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RESULTS OF THE REGION I WORKSHOP ON OIL SPILL ECOLOGICAL DAMAGE ASSESSMENT

AUGUST 28 - 31, 1977

HARTFORD SHERATON HOTEL

HARTFORD, CONNECTICUT

WORKSHOP SPONSORED BY

REGION I AND OFFICE OF RESEARCH AND DEVELOPMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY

REPORT PREPARED BY

METREK DIVISION

THE MITRE CORPORATION

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ACKNOWLEDGMENTS

The Workshop Coordinator expresses sincere thanks to each participant whose dedicated effort made the Region I Workshop an exceptional success. Because the Hartford meeting was the first in a series of Workshops aimed at developing regional response plans for ecological damage assessment, its achievements are particularly noteworthy. The Workshop brough together outstanding experts in relevant scientific and operational disciplines, representing Federal and State agencies, the academic community and private and commercial groups. All participants contributed their expertise and labor voluntarily.

I also wish to thank specifically: Bill Adams, EPA Region I Administrator, for hosting the meeting; the Panel Chairpersons and Executive Committee members, for their contributions above and beyond the call of duty; Carole J. O'Toole, for handling Workshop arrangements; the management and staff of the Hartford Sheraton Hotel, for their helpful cooperation; and Mary Kraus (MITRE Corporation), Robin Lind (EPA Region I) and Sandy Karasuk (EPA, Narragansett ERL) for expertly handling the difficult secretarial burden of the Workshop.

Paul Lefcourt, Ph.D
Workshop Coordinator

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INTRODUCTION

Oil spills pose a recognized threat to natural and cultural features in U.S. coastal ecosystems. Up to now, societal resources have largely been directed towards operations aimed at minimizing the exposure of environmental systems to spilled oil and other hazardous materials. The National Oil and Hazardous Substances Pollution Contingency Plan, for example, establishes a quick response interagency capability for identification, containment, dispersal and restoration operations in the event of accidental discharges. Unfortunately, no such capability exists with respect to the evaluation of the ecological consequences of oil spills.

The Region I Workshop on Ecological Damage Assessment represents an initial attempt to meet this need. The Workshop concept arose from recommendations made to the National Response Team - the body charged with oversight of the National Contingency Plan - by a Task Force on Ecological Damage Assessment. The Task Force noted that existing scientific capabilities are not presently organized to provide effective advisory assistance on ecological matters to operational authorities nor to undertake comprehensive and coordinated scientific projects in a quick-response manner. The Task Force recommended a series of regional workshops as a step in the development of regional and National response plans for ecological damage assessment.

Approximately 135 invited experts participated in the Region I Workshop held at Hartford during the last week of August, 1977. They represented a broad range of scientific and operational expertise from Federal and State agencies, the academic community and the private sector. The program sought and realized a substantial effort by all participants. It was a workshop in the real sense of the term. The results are evident from this report.

The broad aim of the Workshop was to identify scientific needs and resources that might be incorporated in a New England regional response plan for ecological damage assessment. Within this context, the Workshop addressed three principal goals:

(1) Provide highly qualified and coordinated scientific support to Regional Response Teams and On-Scene Coordinators during major spill incidents.

(2) Upgrade our capability to assess environmental damage associated with these spills.

(3) Capitalize on the unique research opportunities that are often afforded by major spills and thus improve our ability to support future clean-up and damage assessment activities.

The main work of the program was entrusted to panels dealing with 10 scientific and technical subject areas. Plenary sessions and meetings of the Workshop Executive Committee provided forums for guidance, interaction, and the development of recommendations to the National Response T eam. Work is proceeding now on the development of a New England Response Plan that will incorporate results of the Hartford program.

The Hartford Workshop dealt specifically with coastal ecosystems. The achievements at Hartford will be followed by workshops in other U.S. coastal regions. They may also serve as a stimulus for addressing ecological damage response needs in freshwater and terrestrial ecosystems.

WORKSHOP SCHEDULE

Sunday, August 28, 1977

8:00 - 11:00 p.m.	Joint Meeting of Panel Chairpersons and Executive Committee

Monday, August 29, 1977

9:00 a.m. - 12:00 p.m.	Plenary Session
9:00 - 9:10 a.m.	Introductions and Welcome Paul Lefcourt, Workshop Chairman
9:10 - 9:20	Welcoming Address Bill Adams, EPA Region I Administrator
9:20 - 9:40	Description of Federal Involvement in Oil Spills Henry VanCleave, EPA, Washington, D.C.
9:40 - 10:00	Background on the National Response Team (NRT) Capt. John Kirkland, USCG, Washington, D.C.
	******************** BREAK ********************
10:20 - 10:40	Description of NOAA/USCG SORT David Kennedy, NOAA-ERL, Boulder, CO
10:40 - 11:00	Socioeconomic and Legal Considerations Jan Praeger, EPA-ERL, Narragansett, RI
11:00 - 11:20	Plan for Workshop - Paul Lefcourt • Charge to panels • Organization • Planned results of Workshop • Future activities
11:20 - noon	Open Discussion - Chaired by Paul Lefcourt • Comments on speakers • Questions • Recommendations: on Workshop performance

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12:00 - 1:00 p.m.	LUNCH

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1:00 - 5:00	Panels Meet in Respective Break-out Rooms
5:00	Panels Terminate for Day
5:00 - 7:00	Panel Chairpersons Write Reports
6:00 - 8:00	Reception - Cash Bar
7:00	Chairpersons Submit Handwritten Copy to Typists
9:00 - 11:00	Executive Committee Meets to Review Panel Reports and Discuss Following Day's Activity

Tuesday, August 30, 1977

9:00 a.m. - 12:00 p.m.	Plenary Session Each Panel Chairperson Reports to General Session
9:00 - 9:15 a.m.	Water Column Biology
9:15 - 9:30	Benthic Biology
9:30 - 9:45	Microbiology/Biodegradation
9:45 - 10:00	Histopathology
10:00 - 10:15	Birds/Marine Mammals
10:15 - 10:30	Laboratory Toxicity Studies
10:30 - 10:45	Chemical Analyses/Fate Studies
10:45 - 11:00	Physical Processes
11:00 - 11:15	Socioeconomic/Legal Considerations
11:15 - 11:30	Facilities
11:30 - noon	Open Discussion

	********************
12:00 - 1:00 p.m.	LUNCH
	********************
1:00 - 5:00	Panels Meet
7:00	Deadline for Panel Chairperson to Submit Copy to Typists
1:00 - 5:00	Executive Committee Meeting

Wednesday, August 31, 1977

9:00 a.m. - 10:00 a.m.	Panel Chairpersons Meet
10:00 - 12:00	Panels Meet
	********************
12:00 - 1:00	LUNCH
	********************
1:00 - 4:00	Panels Meet
2:00 - 4:00	Executive Committee Meeting
4:00 - 6:00	Joint Meeting of Executive Committee and Panel Chairpersons
8:00	Chairpersons Submit Handwritten Copy to Typists

PLENARY SESSIONS

Overview

All participants were invited to attend plenary sessions. These meetings were intended to provide overall guidance on Workshop objectives and procedures, to keep participants abreast of Workshop progress, and to facilitate the exchange of ideas among panels and between panels and the Executive Committee. Two plenary sessions were held, one at the start of the Workshop on the morning of August 29th, and the second on the morning of August 30th. A third session originally scheduled was cancelled to permit participants to devote more time to panel meetings and other Workshop activities.

Summary of Proceedings

The first plenary session (August 28th), included the following presentations:

- Introduction to the Workshop

  Paul Lefcourt (EPA)
  Workshop Chairman

A review of the origins of the Workshop program. The impact of the *Argo Merchant* incident on the recognition of the need for more effective application of scientific capabilities for assessing the ecological consequences of coastal oil spills. The report of the Task Force on Ecological Damage Assessment to the National Response were reviewed including the recommendation for a Workshop program to develop ecological assessment response plans. Changes in Workshop schedule were also announced.

- <u>Welcoming Address</u>

    Bill Adams
    Administrator, EPA Region I

Participants were welcomed. A need was indicated for a national plan to deal with ecological aspects of coastal oil spills that would establish mechanisms for Federal, state and local coordination. Those important issues are: 1) the present Federal inability to rapidly draw on substantial existing scientific resources; 2) the present limited capability for quantifying ecological damage; and 3) the need for effectively matching scientific specialties to the particular characteristics of individual spills. The need for clear federal guidance on responsibilities and authorities for damage assessment, and for resources to support the effort, was emphasized.

- <u>Background on Federal Involvement in Oil Spill Programs</u>

    Henry Van Cleave
    Chief, Spill Prevention and Control Branch
    EPA

A review of the history and authorities of Federal oil spill programs. Section 311 of the Federal Water Pollution Control Act (PL 92-500) addressed notification response, removal and other aspects of oil spills. A National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 1510), published by CEQ, authorized national, regional and subregional operational plans for dealing with oil spills, including the designation of Federal On-Scene Coordinators (OSC). A Federal revolving fund supports clean-up operations and claims may be made against dischargers. Executive Order 11735 gave primary operational responsibility to the U.S. Coast Guard for spills in coastal waters and on the Great Lakes, and to EPA for inland waters. The EPA is responsible for assessing dispersents, and the Office of Spill Prevention and Control is sponsoring damage documentation studies. The operational contingency plans have been generally effective. Scientific support is needed in: 1) developing acceptable methods for measuring ecological damage; 2) clarifying subtle and long-term ecological effects; and 3) developing improved clean-up methods and criteria for terminating clean-up operations. The Workshop effort should eventually lead to augmentation of the National Contingency Plan.

- <u>Background on the National Response Team (NRT)</u>

  Capt. John Kirkland
  Chief, Environmental Protection Division
  U.S.C.G.

Review of NRT organization and functions. The NRT is an interagency standing committee for monitoring oil spill response capabilities. Primary agencies represented are the Departments of Commerce, Defense, Interior, Transportation, and EPA. Advisory agencies are the Energy Research and Development Administration and the Departments of State; Justice; Health, Education, and Welfare; and Housing and Urban Development. The National Contingency Plan deals with ecological damage assessment under 40 CFR 1510.32 - (a), (b), and (c). State involvement and representation, an important aspect of the Plan, are addressed in 1510.34 (c). The present Workshop Executive Committee is an _ad hoc_ body of the NRT. Research activities should not interfere with clean-up operations, which are the principal responsibility of the OSC. The OSC does require expert scientific advice to support operational decisions.

- Description of the NOAA/USCG Spill Oil Research Team (SORT)

David Kennedy
NOAA Environmental Research Laboratory
Boulder, Colorado

The NOAA/USCG SORT is headquartered at Boulder. It deals primarily with physical aspects of spills and is presently refining oil spill trajectory models utilizing field data. The SORT is structured around a group of volunteer teams with facilities located at various points around the country. Spills of opportunity are investigated by the nearest available team utilizing nationally available resources as needed. The concept has been tested at natural oil seeps near Santa Barbara, and SORT served as a primary coordinator for scientific activities carried out in connection with the _Argo Merchant_ incident. SORT is part of the Federal Outer-Continental Shelf program and is funded by BLM.

- Socioeconomic and Legal Considerations

Jan Praeger
EPA Environmental Research Laboratory
Narragansett, Rhode Island

The relevance of economic and legal aspects to ecological damage assessment was summarized. In the context of damage assessment, scientific efforts should be aimed at estimating costs in economic terms and in developing information that can be used as testimony in legal proceedings. The Socioeconomic and Legal Panel will attempt to develop guidelines for scientists on the legal requirements for ecological information. The scientific and technical panels must consider the legal and economic framework in developing recommended scientific programs.

- Plan for the Workshop

  Paul Lefcourt
  Workshop Chairman

Review of Workshop schedule, performance guidelines and goals. Role and membership of the Executive Committee were discussed and Panel Chairpersons were introduced. Mention was also made of pending legislation that would include $200M revolving fund for damage assessment, but which presently does not specify ecological damage appraisals.

The Plenary Session of 30 August involved a review of progress by Panel Chairpersons and notification of changes in Workshop schedule.

PANEL MEETINGS

Overview

The major scientific effort of the Workshop was carried out in panels organized according to the following subject areas:

- Benthic Biology
- Microbiology and Biodegredation
- Birds and Marine Mammals
- Chemical Analysis and Fate
- Physical Processes
- Water Column Biology
- Histopathlology
- Laboratory Toxicity
- Socioeconomic and Legal Aspects
- Facilities and Data Management

The overall charge of the panels was to produce recommendations to the Executive Committee on scientific and technical requirements and resources for application in an oil spill response plan for ecological damage assessment. To the greatest possible extent, each recommended project was described according to a 14-point format that addressed cost, facility and personnel requirements, and feasibility, as well as scientific aspects (see Appendix A).

Panel meetings were chaired by authorities in the respective subject areas (see Appendix B). Panel Chairpersons attended in an orientation meeting held at Narragansett during August. At the Workshop, Chairpersons provided panel members with written guidance on objectives and procedures, attended two joint meetings with the Workshop Executive Committee, and met jointly with the Workshop Chairman. The latter session, held on August 30, addressed several topics including: interactive needs among the various scientific disciplines; lead agency responsibilities for ecological damage assessment; procedures for review of the Workshop report; plans for the development of the regional response plan; and the formation of a national scientific review panel for oversight of ecological damage assessment programs.

Results of the individual panels are presented in following sections.

BENTHIC BIOLOGY PANEL

Participants

D.A. Wolfe, Chairman

A. Carr	J. Hyland
F.R. Cantelmo	G. LaRoche
W.R. Davis	R. McGrath
R. Estabrook	J. Morris
C. Fredette	P.M. Nolan
C. Gifford	S.D. Pratt
G.R. Hampson	A.N. Sastry
E.B. Hatfield	J.M. Teal

BENTHIC BIOLOGY PANEL

General Information and Guidance

- Objectives of Panel
- Issues and Approaches Pertinent to Damage Assessment
- Research Considerations

OBJECTIVES OF PANEL

- To identify and define those studies or projects (in accord with the 14-point "Panel Guidance Format") relevant and useful for ecological damage assessment in reference to benthos.
  - Area of interest extends from high tide line out to shelf break (or reasonable operational depth limit).
  - Damage assessment should consider not only effects of spilled oil *per se*, but also effects of clean-up or mitigation procedures employed.
  - Need to identify expected interfaces with other panels in terms of information and sample needs.
- To specify fundamental research projects which can be conducted under unique spill conditions to improve future damage assessment or spill response capability.
- To identify regional expertise on benthic biomes for potential USCG support.

ISSUES AND APPROACHES PERTINENT TO DAMAGE ASSESSMENT

A. Pre-spill Ecological Characterizations

1. Select sites based on:

   - representativeness of habitats
   - probable vulnerability to spills (analysis of probable sources and trajectories)
   - economic values

2. Focus on key species (commercial/indicator, life stage)

   - standing crop
   - biological productivity
   - catch statistics
   - reproductive cycles
   - feeding relationships/dependencies
   - behavioral parameters
   - disease types and incidence, tumors

There is a need to select key species at the start, based on currently available information, and then to pursue the base line measurements. Ecosystems cannot be studied to determine key species.

3. Determine infaunal community structure

   - relative abundances
   - diversity
   - trophics
   - succession

4. Abiotic factors

   - sediment types/composition
   - current regimes
   - nutrient cycles/flux

5. Death assemblages

   - mollusc shells (population and size frequency)
   - polychaete jaws
   - amphipod eyes

6. Shoreline characteristics

   - salt-marsh distribution, species composition
   - *Zostera*, algal beds
   - erosion/deposition rates

   (potential applicability of satellite imagery)

B. When Spill Occurs

1. Survey Measurements

   a. Need to base final details of study designs on specific characteristics of spill in real time:

- availability of relevant base line measurements
- extent of spill
- timing of spill
- oil type
- how much oil reaches bottom

The Panel emphasized the need for flexibility at prerogative of on-the-scene scientists.

b. Study Parameters

Based on specific characteristics of spill, lead time, availability of relevant base line, measure any or all of parameters outlined in A1 through A6, compared to:

- long-term base line in impact area, if available from literature or recent studies
- instantaneous pre-spill base line in impact area (one or more samples collected immediately before spill impacts the study site)
- simultaneous measurement in adjacent "control" areas

2. Diagnostic Experiments

a. *In-situ* cage experiments for selected key species

- mortality
- growth/respiration
- behavior

b. Microcosm experiments

- invasion/recruitment/succession in sediment trays
- invasion/recruitment/succession in fouling plates

c. Bioassays

- bell jar experiments at unimpacted sites using spill oil
- lab experiments. using spill oil or impacted sediments/key species
- mutagenesis in microorganisms/cell cultures

d. Mollusc shell microstructure and chemical composition

3. Interfaces

- chemical analyses (especially PNAs)
- histopathology
- microbiology

RESEARCH CONSIDERATIONS

A. Research Problems

1. determine effects of cleanup/mitigation alternatives (burning, bulldozing, steam cleaning)

2. determine effects of nutrient additions on biodegradation rates

3. determine effects of dispersants

4. define food chain transport of petroleum

   - study specific known trophic links
   - compare fluxes for different compounds/classes

5. define role of animals in transport of oil into sediments (diagenosis)

In summing up the research needs, the Panel strongly emphasized the continuing need for long-term ecological studies to determine recovery rates and potentials.

B. Habitat Considerations

The Panel decided to structure the ecological damage assessment research around four distinct benthic habitat types, which would require different bases of logistic support or different sampling approaches. These were:

- Rocky Intertidal
- Sand-mud Intertidal (including salt marshes)
- Shallow Subtidal
- Offshore

In many cases, the scientists most qualified to address ecological problems differ from one habitat to the next, and the distinction by habitat would also be useful from a contracting point of view. It should be understood, however, that for a given spill any one or all of the habitats may require study, depending upon the size and location of the accident.

The Panel further decided that the survey approach (see Sections IIA1-IIA6, and IIB1, above) held the greatest promise for damage assessment. The diagnostic approaches (see IIB2) might provide insight on survey design, but none of the diagnostic tools have been developed to a stage of providing a quantitative measure of damage without backup survey information. The contractor selected for the survey work might use any or all of the diagnostic approaches in his final damage assessment.

BENTHIC BIOLOGY PANEL

Recommended Projects

1. Oil spill damage assessment of onshore rocky intertidal environments.

2. Oil spill damage assessment of onshore intertidal environments: sand and soft bottom types.

3. Oil spill damage assessment for the benthic community in shallow subtidal environments.

4. Initial assessment of damage to benthic environment following a medium to large offshore spill.

*5. Effects of petroleum hydrocarbons and/or dispersants on estuarine communities under flow-through laboratory conditions.

*6. Effects of oil pollution on species interactions: caging experiments.

*Projects 5 and 6 were identified in the panel report as Appendices I and II, respectively. Both are considered to be diagnostic approaches for use at the discretion of the benthic survey contractor.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Oil Spill Damage Assessment of Onshore Rocky Intertidal Environments

2. Project Description:

A. Objectives:

(1) Using grid and transect analyses, determine the short-term effect of the oil on the benthic community by comparing the spill area to an unimpacted area and/or base line data. Triplicate samples recommended.

Determine: (a) Biomass

(b) Relative species abundance

(c) Diversity

(2) Determine long-term effects by looking at repopulation of the impacted area.

Look at: (a) Species succession

(b) Settlement and development of larval forms

(3) Detailed visual observations are recorded.

B. A good reference list on the effects of oil on the rocky shore benthos (both plant and animal) should be compiled and made available.

C. See Projects 5 and 6 for possible diagnostic experiments.

(1) See Dale Straughan et al. for many references on Santa Barbara spill.

3. Performing Organization:

A. Limited state and Federal capability

B. Definite capability

(1) Normandeau Associates, Inc.

(2) Woods Hole Oceanographic Institute - Marine Biological Laboratory

C. Possible capability

(1) Dr. Mathieson - Dept. of Botany, University of New Hampshire - macrophyte community

4. <u>Applicable Habitats</u>:

Rocky shoreline - most of shore from northern Maine coast, south to New Hampshire and northern Massachusetts, isolated area from Cape southward including:

A. Exposed rocks

B. Rocky intertidal pools

C. (mussel reefs?)

5. <u>Applicable Conditions</u>:

A. Sufficient oil should reach the rocky shoreline to produce the expected significant petroleum hydrocarbon damage to a viable benthic community.

B. Good base line data is desirable.

C. Uncontaminated control site is desirable.

D. Season/weather must be considered to evaluate effects of winter icing, storm damage, etc., in addition to oil effects.

E. Site should be accessible by land vehicle (or boat for off-shore islands reef).

F. Relative position of impacted area to other pollution sources such as power plant discharge, habor, sewage effluent, etc. should be considered.

G. Presence of commercially harvestable crop (mussels, seaweeds) will affect study.

H. Adequate funding for project completion must be committed to specific research organization prior to project implementation.

6. Applicable Oil Type:

All types.

7. Time Frame:

Intensive study initially with the continued duration and frequency of sampling dependent upon season, weathering of oil, and responses of community structure.

Within 1 year a presentation of the acute impact of the spill will be available.

8. Costs:

Dependent on duration and frequency of sampling and location of spill. Possible scenario:

Field Days -	Daily for 2 weeks	=	10 days
	Weekly for 3 months	=	12 days
	Seasonally for 1 yr	=	3 days
			25 days

5-man team = 5 x 25 = 125 man-days in field
Lab days - 5 lab day/field days = 5 x 125 = 650 man-days in lab
Total man-days = 125 + 650 = 750
Cost - $125/day/scientist = $125 x 750 = $95,000

9. Equipment Needs/Equipment Available:

A. One per field sampling team
   (1) Portable 1 ft^2 grid
   (2) Scraper (putty knife)
   (3) Wash bucket
   (4) Brush
   (5) Sieve
   (6) Dip net
   (7) Spade
   (8) Waders (1 per person)
   (9) Camera

B. Other field equipment

   (1) Bags, jars, formalin - number depends on number of samples taken

(2) Field and lab data cards - number depends on number of samples taken
(3) Glass bottles for hydrocarbon analysis - number depends on number of samples taken
(4) Meter stick
(5) Visible, durable markers to mark sampling site - stakes, fluorescent paint, etc.

C. Lab equipment

(1) Wash bottles, tweezers
(2) Microscope
(3) Dissecting equipment
(4) I. D. keys

Organizations listed in item (3) generally have above equipment available.

10. Facility Needs/Facilities Available:

A. Open boat (16'-20') - trailerable

B. 4-wheel drive land vehicle

C. Helicopter for shoals and islands

D. Living accommodations at sampling site

E. Lab space

11. Personnel Needs/Personnel Available: A list consisting of 3 to 8 people should be compiled of experts in New England.

A. Marine botanist

B. Marine invertebrate taxonomist

C. Invertebrate early larval development specialist

D. Knowledge of physical oceanography in the area

12. Support Services:

A. Hydrocarbon analysis

- tissue analysis
- ambient water concentration analysis
- follow weathering processes

B. Resource analysis - how important is area?

    (1) Commercial fishery
    (2) Harvestable seaweed
    (3) Recreation
    (4) Considered for future development
    (5) Unique species present

C. Histological analysis

D. Spore settlement of algae

E. Chemical (lipid) analysis of tissue

13. <u>Payoff</u>:

    A. Initial mortality and long-term loss in productivity of economic and/or food species will be determined.

    B. Scientific interest - there is scant documentation of effects of oil spill on the rocky coast.

    C. There are harvestable economic resources within the rocky shore; e.g., Irish moss, mussels, etc.

    D. Information will help to manage fisheries forecast and cleanup operation.

14. <u>Limitations</u>:

    A. Manpower - get most out of limited funds and manpower available

    B. Weather

    C. Season

    D. Taxonomic expert availability

PANEL: BENTHIC BIOLOGY
PROJECT NO: 2
PRIORITY RANK:

1. Title: Oil Spill Damage Assessment of Onshore Intertidal Environments: Sand and Soft Bottom Types

2. Project Description:

The impact of an oil spill on the structure and function of benthic communities will be accomplished by a two-phase program composed of a survey effort coupled in the second year to a research program. The first phase will be a short and long-term quantitative and qualitative sampling program to determine the immediate mortality and long-term disruptions of the intertidal system. Special focus will be on the populations and physiological changes of key species which will include economically important organisms. The macrofauna, meiofauna and microfauna will be considered. This survey will result in determining the spacial and temporal extent of oil exposure effects and will serve as a basis for assessment of environmental damage and economic loss.

The second phase, to begin the end of the first year and then run concurrently with the limited survey will utilize both research and experimental techniques. Such research and diagnostic experiments as suggested and outlined in the Appendices (Projects 5 and 6) will deal with productivity, respiration, death assemblage, changes of sediment profiles due to the impact of oil, cage experiments, etc. These would be employed as a useful tool if appropriate in a given habitat to provide further definitive data relating to damage assessment.

References:
a. Sanders et al (West Falmouth oil spill; in manuscript)
b. Krebs and Burn 1977
c. Michaels et al 1975

3. Performing Organization:

Marine Biological Laboratory - Woods Hole

Jackson Estuarine Laboratory - University of New Hampshire

University of Rhode Island

Bigelow Lab - Booth Bay, Maine

EPA Lab, Lexington

EPA Lab, Narragansett

Ira Darling Lab, University of Maine

Marine Research Inc., Falmouth, Massachusetts

Massachusetts State Marine Fisheries, Sandwich, Massachusetts

4. Applicable Habitats:

Onshore intertidal systems: sandy beaches, mud bottom and salt marshes.

5. Applicable Conditions:

This study can be carried out under the most extreme conditions. Sampling techniques and work schedules may be modified to fit the given conditions and circumstances. This project should be put into action whenever a viable benthic community is significantly damaged by oil. Adequate funds for project completion must be committed to the research organization prior to the implementation of the project.

6. Applicable Oil Type:

All types.

7. Time Frame:

The survey phase requires an immediate intense study period of about a month followed by a period of intermediate intensity up to one year duration, and then a study period of low intensity, i.e., seasonal or annual sampling, for as long as the spilled oil is present in the sediments. The second phase, i.e., research and experimental, should commence during the first year and run concurrently for the duration of the project.

A series of times should be established for preliminary reports with a comprehensive presentation of the data at the end of each sampling year.

8. <u>Costs</u>:

A. Sandy intertidal

(1) 1-mile stretch

(a) Survey work

Year 1	$ 50,000
Year 2	30,000
Years 3-6	10,000/yr

(b) Research work

Years 2-6	40,000/yr

(2) 5-mile stretch

(a) Survey work

Year 1	96,000
Year 2	50,000
Years 3-6	20,000

(b) Research work

Years 2-6	60,000/yr

(3) 20-mile stretch

(a) Survey

Year 1	180,000
Year 2	75,000
Years 3-6	37,500/yr

(b) Research

Years 2-6	90,000/yr

B. Muddy intertidal

(1) 1-mile stretch

(a) Survey

Year 1	$ 80,000
Year 2	50,000
Years 3-6	20,000/yr

(b) Research work

Years 2-6	50,000/yr

(2) 5-mile stretch

(a) Survey

Year 1	160,000
Year 2	100,000
Years 3-6	40,000/yr

(b) Research

Years 2-6	70,000/yr

(3) 20-mile stretch

(a) Survey

Year 1	300,000
Year 2	150,000
Years 3-6	75,000/yr

(b) Research work

Years 2-6	100,000/yr

C. Salt marsh

(1) 1 hectare

(a) Survey - excluded meiofauna

Year 1	$ 60,000
Year 2	40,000
Years 3-6	20,000/yr

(b) Research work

Years 2-5	$100,000/yr

(c) Survey to include good meiofauna work

Year 1	120,000
Year 2	100,000
Year 3	80,000
Years 4-6	50,000/yr

(d) Research work

Years 2-5	150,000/yr

9. Equipment Needs/Equipment Available:

Field equipment - cameras, quadrats, corers, dredges, sieves, sample containers, etc., and items commonly used for such studies and readily available in all the above listed laboratories.

Lab equipment - microscopes, identification keys, glassware, sorting trays, etc.

Special items of equipment for the experimental and research phase may include respirometers, spectrophotometers, oxygen probes, light meters, thermometers, etc.

10. Facility Needs/Facilities Available:

Land vehicles, small boat (under 20 feet with trailer), laboratory space and storage space.

11. Personnel Needs/Personnel Available:

Personnel should be knowledgeable of New England intertidal systems and familiar with working and sampling the benthic community. Estimated personnel required would range from 5 to 12 individuals depending on size of oil spill. Individuals must also be willing and able to accept the work on short notice.

Some suggested individuals who might be available and willing:

Howard Sanders George Hampson Fred Grassle John Teal	Woods Hole Oceanographic
George Woodwell John Hobbie Bruce Peterson Cameron Gifford	Marine Biological Lab - Woods Hole
Ivan Valier	MBL - BUMP
George Matthuessen	Falmouth Marine Res. Inst.
Robert Croker	Jackson Estuarine Lab, UNH
Ned Hatfield)	Jackson Estuarine Lab, UNH
Les Watling	Ira Darling Lab

Lee Doggett	Bigelow Lab
Peter Larsen	Bigelow Lab
Joe Graham	State of Mass., Dept. of Marine Res.
Paul Godfrey	Univ. of Mass.
Frank Cantelmo	City College, NY
Allan Michaels	Taxon Inc., Salem, Mass.

12. Support Services:

A. Hydrocarbon analysis

(1) Rapid technique survey, i.e., ultraviolet fluorescence to determine extent of oil in sediments.

(2) Detailed analysis (complete fingerprinting) of spilled oil with a time sequence of weathering of the oil, a vertical and temporal distribution in the sediments and a detailed analysis of hydrocarbons in selected key species.

B. Sediment particle size frequency analysis

C. Chemical analysis

(1) Analysis of the vertical distribution of chemicals in sediments, i.e., organic carbon, nitrogen, phosphorous, etc.

(2) Lipid analysis of selected organism tissues.

D. Histopathological analysis of selected organisms which play a significant role in the structure and function of the community and form the basis of community productivity both biological and economic.

13. Payoff:

This project would determine initial mortality and long-term loss in productivity of economically important species and/or food species in various trophic levels, and should also contribute to our understanding and ability to predict the impact of oil on the structure and function of the intertidal benthic communities. Information generated by this work would also help to manage fin fisheries or shell fisheries which have been impacted and help direct cleanup as well as manage recovery of the site.

14. Limitations:

Availability of competent individuals who are willing to do the work on short notice or do the work at all. For example, there is one person in the Northeast competent to identify soil arthropods from salt marshes. He may not have time or be willing to work on this type of project at the time a spill occurs.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 3
PRIORITY RANK:

1. Title: Oil Spill Damage Assessment for the Benthic Community in Shallow Subtidal Environments

2. Project Description:

The benthos is often considered a prime area of concern when considering the potential impact of petroleum hydrocarbons on aquatic communities. This is based upon 1) documented proof that marine and estuarine bottom sediments provide natural sinks for the accumulation of toxic petroleum hydrocarbons; 2) the potential vulnerability of many benthic communities to oil impact as a result of the broad taxonomic representation of constituent species and in many cases their seemingly apparent longevity, immobility, sensitivity, and ability to concentrate toxic substances; and 3) realization of the significant functional roles that benthic communities play, including recirculation of vital nutrients to pelagic phases and the production of both primary and secondary sources of food that are commercially important to man.

Consequently, it is imperative that we study the effect of oil spills on benthic communities in order to assess the overall impact on the health of coastal marine ecosystems.

In response to a spill, samples will be collected at designated control and impacted sites employing appropriate quantitative sampling methodology and will be processed by standard analytical and data reduction techniques which are generally available. Temporal and spatial changes in species abundance and distribution will provide the data base necessary to properly assess the impact of the spill on benthic community structure.

3. Performing Organization:

Recognized local groups with demonstrated capability in the design and execution of benthic programs include the following:

Bigelow Laboratory, West Boothbay, ME

Normandeau Associates, Manchester, NH

University of New Hampshire, Durham, NH

Taxon, Inc., Salem, MA

Woods Hole Oceanographic Institute, Woods Hole, MA

Marine Biological Lab., Woods Hole, MA

University of Rhode Island, RI

Marine Research Incorporated, Falmouth, MA

National Marine Fisheries Service, Woods Hole, MA

Yale University, New Haven, CN

CUNY, New York, NY

Lamont-Doherty, Palisades, NY

Texas Instruments, Inc., Buchanan, NY

New England Aquarium, Boston, MA

4. Applicable Habitats:

   A. Offshore bottom

   B. Worm-clam flat

5. Applicable Conditions

   Conditions which must be satisfied in order to successfully complete this project include the following:

   A. Base line data or appropriate control sites must be available.

   B. Oil is incorporated into the sediments.

   C. Weather conditions permit sampling - in this case the weather conditions which would preclude sampling are intermediate between those for onshore studies and those for offshore studies.

   D. The presence of a viable benthic community in the potential impact area(s).

   E. Funding adequate to ensure successful completion of the project must be committed prior to its inception.

6. Applicable Oil Type:

All oils and related petrochemicals.

7. Time Frame:

This project requires frequent sampling from day 0 through approximately day 30, although the actual extent of this intensive sampling period will vary for each spill and should be left to the discretion of the study team and OSC. From approximately day 30 to 1 year, the intensity of sampling may be gradually reduced, again at the discretion of the study team. Long-term monitoring on a seasonal basis should be conducted until such time as the oil is no longer present in the sediments or the benthic communities regain a "normal" stability. There is no time frame which may be applied universally.

8. Cost:

A wide variety of site-specific variables preclude an accurate *a priori* assessment of costs for a benthic program. Sample processing times are dependent upon the nature of the sediment can easily vary by over two orders of magnitude. The costs quoted here must be considered as "ballpark" estimates and should be used with caution.

A typical benthic program designed to develop the information needed to assess damage for a moderate spill in a semi-enclosed bay of shallow depth would include approximately 20 to 25 stations. At least three, and preferably five, replicate samples should be taken at each station at each sampling event. Assuming no unusual conditions, such a study, for a period of six years, would cost approximately $600,000 complete with 30% of the costs being incurred in the first year. This estimate is based on an estimated sample volume, after sieving, of two quarts which may be considered typical for inshore samples.

9. Equipment Needs/Equipment Available:

Field equipment for this project includes:

A. Sampling device (Smith-McIntyre, or equivalent) and supporting stand.

B. Assorted buckets, jars, etc.

C. Sieves of appropriate mesh size.

D. Formalin.

E. Various and sundry minor items which are widely obtainable.

10. Facility Needs/Facilities Available:

Facilities required for benthic work are not extensive but include the following:

A. Appropriate vessel - 65' boat appropriate if there is enough depth, otherwise a smaller craft may be adapted.

B. Laboratory with large amount of counter space and storage space which may also be used for staging.

C. Adequate microscopes.

D. Assorted dishes, jars and reference materials.

11. Personnel Needs/Personnel Available:

Proper personnel are critical to the successful completion of this project. Taxonomic specialists are always in demand because there are so few of them. Personnel with proven expertise in benthic studies include the following:

Howard Sanders George Hampson Fred Grassle John Teal	Woods Hole Oceanographic Institute
George Woodwell John Hobbie Bruce Peterson Cameron Gifford	Marine Biological Lab - Woods Hole
Ivan Valier	MBL - BUMP
George Matthiessen	Falmouth Marine Res. Insti.
Robert Croker	Jackson Estuarine Lab, UNH
Ned Hatfield	Jackson Estuarine Lab, UNH
Les Watling	Ira Darling Lab
Lee Doggett	Bigelow Lab
Peter Larsen	Bigelow Lab
Joe Graham	State of Maine, Department of Marine Resources

Paul Godfrey	University of Massachusetts
Frank Cantelmo	City College, NY
Allan Michaels	Taxon Inc., Salem, Mass.

12. Support Services:

Additional data inputs which may be critical value in the interpretation of the faunal data include:

A. Hydrocarbon content of sediment.

B. Sediment grain size.

C. Histopathological analysis of selected species.

13. Payoff:

Important knowledge gained through this type of study includes:

A. Assessment of the ecological damage and economic loss due to impact of spilled oil on a major ecosystem component.

B. Long-term data at control or unimpacted sites will provide presently unavailable information about long-term benthic community variability.

C. The program will provide specimens for potential use by other groups.

D. Accurate information on the status of commercial benthic species will be made available to local agencies.

E. Immediate guidance will be provided to assist in the direction of cleanup efforts.

14. Limitations:

A. Sufficient taxonomic expertise may be unavailable and considerable delay may result.

B. Costs for developing a good statistical study are often prohibitive and the compromise study which results is of limited value.

C. Even with sufficient personnel and funds there is always a lag between collection of samples and availability of data. This is typically longer for benthos than for most other areas.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 4
PRIORITY RANK:

1. Title: Initial Assessment of Damage to Benthic Environment Following a Medium to Large Offshore Spill

2. Project Description:

   To determine the impact of an oil spill on the structure and function of offshore benthic communities, the project will emphasize the initial impact, and is designed to accomplish the following objectives:

   A. Identify dead or moribund organisms.

   B. Take samples for quantitative community analysis.

   C. Map the extent of the impacted area and provide a basis for recognizing spill-caused impact by sampling stations at control sites and spill sites for community characteristics and for death assemblages.

3. Performing Organization:

   A. URI

   B. Coast Guard

   C. Commercial fishing boats

   D. NUS (Naval Underwater Sys. Lab)

   E. WHOI - Densmore

   F. NMFS - Dr. George Kelly

   If ships are to be provided, benthic biologists at several other institutions may be interested in conducting these studies. See the institutional list for shallow-subtidal environments.

4. Applicable Habitats:

   Offshore bottom

5. Applicable Conditions:

   A. Hard funding must be available to the performing organization prior to inception of the study.

   B. Experienced coordinated team must be available and committed to project.

   C. Physical, chemical and biological inventory of site under investigation is rapidly accessible (quantitative baseline is desirable).

6. Applicable Oil Type:

   All types

7. Time Frame:

   Minimum of two trips to define problem and the extent of area affected.

   A. Detection of initial mortality, changes in death assemblage, and oil presence should be done during first 3-4 days.

   B. Survey to determine the limits of area affected and estimate initial impact will require 1-2 weeks.

   If severe impact is indicated by the preliminary cruises, additional sampling may be required to determine the duration of the effects.

8. Cost:

   Note 1 - Consult with WHOI for "Oceanus" costs and URI "Endeavor" The costs for cruises responding to the Argo Merchant spill are a good example.

   Note 2 - Costs do not reflect sample workup or data handling (drafting and computer costs).

3-4 day initial cruise

Ship @ 2-5k/day	=	$ 6,000	-	$ 20,000
Personnel	=	12,500	-	15,000
Standby, etc.		20,000	-	40,000

Second cruise

Ship - 10-14 days	=	20,000	-	70,000
Personnel	=	26,000	-	40,000
Standby, etc.		50,000		120,000

9. <u>Equipment Needs/Equipment Available</u>:

A. Quantitative grabs (4) - 1/25 m^2 area - 2 <u>Smith-MacIntyre</u>

1/25 m^2 area - 2 <u>Van Veen</u>

Openable top for access

Tight seal for covers

B. Box core - quantitative grab

C. Dredges

(1) Epibenthic sled
(2) Modified scallop dredge (with smaller mesh insert removable)
(3) Small rocking chair dredge

D. Gravity corer

Storage depot advisable to store equipment. Mandatory to have person in charge to keep equipment in working order and keep track of same.

E. Sampling and storage containers of various sizes should be available at same location.

F. Formalin and ethyl alcohol, 55 gal drums, plastic bags, containers for approximately 200 samples - 1/2 pts, pts, quarts, gallon jugs, 3 gal jugs.

The research organizations mentioned in Item 3 will have most of these equipment needs on hand.

10. <u>Facility Needs/Facilities Available</u>:

Only involved with medium to large spills.

Ships - A. Should have adequate winches (hydro and main trawl)

B. At least minimum speed of 1 knot capability

C. Requirements and facilities for a minimum of 3 continuous days of operation:

(1) Minimum size 65 feet; preferred size 100 feet plus (North Atlantic)

(2) Adequate storage facilities for gear and specimens alive, i.e., refrigeration, operation pumps.

D. Loran C or satellite navigation. Fathometer, meter wheel.

11. Personnel Needs/Personnel Available:

Availability of personnel dependent on previous commitments and with adequate contingency fund available. Support of two teams would assure availability of a crew within a 3-day preparation time. Suggested sources of staff - Southern New England: WHOI, NMFS (WH), URI, MBL, etc. Northern New England: Taxon, Inc.; Bigelow Lab; University of Maine; UNH; North Eastern UN, etc. (personnel - see inshore benthic personnel list).

12. Support Services:

A. Hydrocarbon analysis (H.V. fluorescent. HCs from our benthic grabs) dissolved and particulate matter, if possible stomach analysis of various marine animals.

B. Mechanical sediment analysis.

C. Histological examination of selected organisms. See Histochemistry Panel Report. Resources will be emphasized in the offshore area and physiology will be deemphasized.

13. Payoff:

Information generated by this project would:

A. Define impacted area.

B. Define initial impact severity.

C. Determine communities and species involved.

D. Determine impact on commercial species and habitat thereof: i.e., destruction of food sources and identification of possible routes of petroleum transfer.

E. Describe physical habitat destruction so as to render changes to natural habitat of selected invertebrates.

14. <u>Limitations</u>:

Weather - icing.

Ship availability.

Availability sampling gear and ship board gear.

Personnel.

This survey defines the impacted area and the impacted species. Complete processing of all samples has not been planned or costed. The design of such work would depend on the results of the survey. Rocky bottom benthos is almost impossible to quantify.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 5
PRIORITY RANK:

1. Title: Effects of Petroleum Hydrocarbons and/or Dispersants on Estuarine Communities under Flow-Through Laboratory Conditions

2. Project Description:

The objective of this project would be to determine the effect of hydrocarbons and/or dispersants on developing macrofauna and meiofauna populations from local estuarine areas. Seawater pumped in from the estuary would be supplied to the control and experimental aquaria. The experimental aquaria would be supplied with metered amounts of the petroleum and hydrocarbons and/or dispersants from a local spill. Each appartus described by Hauser (1974) contains 10 adjacent aquaria 56 cm long, 9 cm long wide and 12 cm high. Aquaria are filled to a depth of 6 cm with autoclaved sand available from the local estuary and water levels are maintained at 3 cm above the surface of the sediment. After a prescribed time period (6-10 weeks), aquaria are harvested for macrofauna and meiofauna. Analysis of the benthic components in these aquaria will yield results regarding the impact of petroleum hydrocarbons on developing estuarine communities. System described by Hauser (1974) is presently being used at EPA - Gulf Breeze, Pensacola, Florida, by S. Tagatz and his associates. The system appears useful for maintaining both macrofauna and meiofauna for 6-10 weeks to evaluate the effects of various pollutants on coastal benthic ecosystems (Cantelmo and Rao 1977a, 1977b; Tagatz et al 1977). An alternate design would be to introduce contaminated sediments with their associated macrofauna and meiofauna into experimental aquaria. Control sediments (not impacted with hydrocarbons from the spill) could also be introduced into the control aquaria. Results of the alternate design would yield results on effects of hydrocarbons on established benthic communities.

3. Performing Organization:

Any organization having flow-through facilities and sufficient laboratory space 20-30' of lab bench space. Persons and/or organizations capable of doing such work include the:

Jackson Estuarine Laboratory (Edward Hatfield)

New England Aquarium, Palisades, NY (F. Cantelmo).

4. Applicable Habitats:

System is best used in sand or sand/mud.

5. Applicable Conditions:

Need sufficient pumping facilities to maintain a flow rate of 200 ml/min to each aquarium. Intake pumping facilities should be located approximately one meter off the bottom. Pumping facilities cannot operate under conditions of severe icing. It would be advantageous to locate the intake in at least 5-10 meters of water.

6. Applicable Oil Type:

Cannot use oil that cannot be readily pumped into the aquaria. This may apply to some crudes and some No. 6 oils.

7. Time Frame:

The entire experiment would require 6-10 weeks and an additional 2-3 months to work up samples and analyze findings.

8. and 9. Cost and Equipment Needs:

Depending on availability, laboratory space would cost a maximum of $6,000/year.

	Total Cost
4 - Metering pumps (2,500 each)	$ 10,000
1 - Compound Microscope	5,000
2 - Dissecting microscope	4,000
Sieves, cores, glass, tubing	1,000
Estimate total cost for equipment to be:	25,000
1 - Full-time technician	10,000
2 - Part-time professionals (30 working days for each experiment - this includes setting up system, identifying organisms, analyzing data)	-

	Total Cost
4 - Part-time technicians (sorters of benthic samples, hired for two months)	6,200
Total cost of personnel and equipment per spill	$50,000 - $60,000

10. Facility Needs/Facilities Available:

Laboratory supplied with flowing seawater system and ample laboratory bench space (20-30').

11. Personnel Needs/Personnel Available:

List of possible workers in benthic ecology available from other infaunal projects.

12. Support Services:

Need adequate amounts of petroleum hydrocarbons to be taken at spill area and transported back to laboratory. For the alternate design sediment has to be secured from grab samples. This way necessitates taking 1 or 2 extra grabs/station.

13. Payoff:

The greatest payoff would be to get a relatively rapid estimation of the effect of hydrocarbons from the spill area on developing and established benthic communities. Studies conducted under controlled laboratory conditions may make it easier to assess or determine the economic costs of damange to commercially important species. In addition, flow-through bioassays of the type described will enable greater cooperation by chemists, biologists and geologists in assessing oil spills. The same system used by the biologist can be monitored by the chemist for hydrocarbon levels, metals, etc., and also analyzed by the geologist for sedimentary parameters.

14. Limitations:

Limitations include icing conditions that would interfere with the seawater pumping facilities as well as the inability to exactly simulate the weathering conditions of oil in the natural environment.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 6
PRIORITY RANK:

1. Title: Effects of Oil Pollution on Species Interactions: Caging Experiments

2. Project Description:

The objectives of these experiments are to analyze cause and effect relationship between spilled oil and the fauna or flora present. The results would allow separation of the effects of oil from those of other factors such as predation and competition on the abundance of fauna and flora.

Experiments would be carried out by enclosing known abundances of organisms in contaminated and uncontaminated sediments in nylon mesh containers. Sediments with different amounts of oil could be used. The effects of the oil on biological interactions, such as predator-prey and competition, could be tested by using the appropriate experimental design. The results of these experiments would indicate numbers of individuals surviving under the different conditions of the experiment. Some references or persons to contact for experimental design are:

Woodin, S.A. 1971, Ecol. Monogr.

Disalvo (75 or 76) Env. Sci. and Tech.

John Lee and John Tietjen - CCNY

Bruce Gull - University of South Carolina

John Gary - Marine Research, Inc.

It might be of particular importance, regarding the problem of availability of personnel to study the effect of oil spills, to note that these experiments would require only a short time to set up and could be performed by persons otherwise involved in their own research.

3. - 6. Performing Organization; Applicable Habitats; Applicable Conditions; and Applicable Oil Type:

These experiments are applicable to all benthic habitats and could be performed by persons present at the institutions listed in other sections of this report. These experiments would vary in design in conjunction with the habitat, season, and animals or plants being studied. The effects of all types of oils could be analyzed in this manner.

7. Time Frame:

Studies of this nature could run over periods of days to months.

8. Cost:

The cost of caging studies would be relatively minor compared to that of survey work, possibly 10-25 percent.

9. Equipment Needs/Equipment Availability:

Equipment required in addition to that of the survey work would be that used in the construction of cages.

10. & 11. Facility Needs and Personnel Needs

See Benthic Projects 1 through 4.

12. Support Services:

Detailed analysis of the amount and kind of oil present in the experimental cages would be necessary.

13. Payoff:

The results of these experiments would provide insight into some aspects of the effect of oil on interactions between species and on the structure and function of benthic communities. It is this insight which is essential to the understanding of the effects of oil on the dynamics of communities and on the relationships between species of particular ecological or economic importance.

14. Limitations:

Experimental field apparatus must not be disturbed by people. Winter ice conditions might prevent the placement of cages in the field and these conditions or storms could cause their destruction.

MICROBIOLOGY AND BIODEGRADATION PANEL

Participants

A. Bourquin, Chairman
C. Carty
C. Fredette
M. Griffin
F. Passman
R. Traxler

MICROBIOLOGY AND BIODEGRADATION PANEL

General Information

BACKGROUND CONSIDERATIONS

A. Areas of Interest

The panel listed research projects which the members considered as important in the study of fate of petroleum in the marine environment. After some discussion of each topic, the panel prioritized and grouped various projects. The summarized priority list in the order of importance or benefit follow:

1. Biodegradation potential studies in surface films and sediments.

    a. water column potential would become important only when dispersants are used.

    b. baseline information is important and should be gathered as much as possible by current projects.

    c. sampling techniques need evaluation or development.

    d. heterotrophic potential - effects on or aid in degradation predation.

    e. biomass determinations are important relative to hydrocarbon degrading microorganisms.

2. Physio-chemical degradation vs. microbial transformation and/or degradation.

    a. methods for determining rates of degradation by physio-chemical or microbial degradation.

    b. determine relationship of the two processes to a given oil in a given environment.

    c. role of photochemical oxidation in further degradation by microorganisms.

d. role each process plays in anaerobic vs. aerobic systems (long-term fate).

3. Use of dispersants.

   a. toxicity to hydrocarbon degrading microorganisms.

   b. increased toxicity to other organisms and decreased degradation in water column.

   c. microbial degradation of dispersants.

4. Increased pathogenicity to other organisms caused by selection of HC-degrading microbes.

   a. HC-degrading microbe is pathogenic.

   b. increased susceptability due to stress on other organisms.

5. Formation of toxic metabolic intermediators.

   a. to HC-degrading microbes.

   b. to other organisms.

B. Other Subject Area

The following areas of research were considered and either rejected for reasons given or reserved for later discussion:

1. "Seeding" of oil slicks is not a feasible method for degrading oil.

   a. range of HC-utilizers in laboratory available for seeding is limited (no "super-but").

   b. cost of nutrient enrichment.

   c. abundance of HC-degrading microbes in most environments.

   d. low viability of freeze-dried populations.

2. Nutrient enrichment of natural populations for HC-degradation.

a. easy-to-degrade fractions are probably gone prior to fertilizing.

b. lower cost of mechanical techniques??

c. nutrients may not be limiting in surface micro-layers or selected environments.

3. Baseline information - not enought information is available for New England in-shore areas.

   a. improve of incorporate into current studies.

   b. develop needed baseline information (micro.) by sampling prior to spill coming ashore in a given area (expanded in topic discussion).

4. Anaerobic metabolism

   - incorporated into other projects.

Discussion on the benefits to assessing ecological damage or predicting the fate within a given environment followed:

C. <u>Relevance of Biodegradation Studies</u>

Biodegradation studies will provide:

- an index for predicting potential for hydrocarbon metabolism in a given environment (sediments and surface films).

- monitoring tool for tracing biodegradation once a spill has occurred (sediments and surface).

- an index for effects on heterotrophic potential (metabolism of amino acids and carbohydrates).

  - predict of toxic hydrocarbons fractions will reach the water column.

  - monitor changes in biogeochmical processes caused by oil intrusion into sediments or surface films.

Biodegradation studies are considered important on the following basis:

1. Microbial degradation is important in the fate of hydrocarbons from oil.

2. Evidence that amino acid degradation potential can be correlated with hydrocarbon degradation whereas other heterotrophic potentials (carbohydrate) do not show this correlation.

3. Rapid analysis and relatively low cost.

4. Most oil fractions will be found in surface films or in sediments with relatively little residence time in water column.

MICROBIOLOGY AND BIODEGRADATION PANEL

Recommended Projects

1. Effect of petroleum hydrocarbons on biodegradation potential and heterotrophic potential of marine and estuarine surface films and sediments.

2. Dispersants toxicity to bacterial population, particularly hydrocarbon degrading bacteria.

3. Degradation in anaerobic sediments.

4. Nutrient enrichment.

PANEL: MICROBIOLOGY AND BIODEGRADATION
PROJECT NO. 1
PRIORITY RANK: 1

1. Project Title: Effect of Petroleum Hydrocarbons on Biodegradation Potential and Heterotrophic Potential of Marine and Estuarine Surface Films and Sediments

2. Project Description:

A. General

Information on the potential for a group of microbes in a given environment to degrade petroleum hydrocarbons could be used to predict the persistance of hydrocarbon films, and the availability of hydrocarbons to the water column and/or sediments. If the oil has a deleterious effect on the physiological functions of the microbial groups found in sediments or in the surface waters, changes in the indices (numbers performing metabolic function, total biomas) can be used to show this effect quantitatively. Additionally, data which correlates some "easy to measure" response in microbial populations to hydrocarbon potential can be used to help in predicting the fate of oil. The objectives of the study are two fold: 1) effect on hydrocarbon degrading potential, and 2) effects on heterotrophic potential. A somewhat detailed approach is included in order to standardize many techniques so that data can be better used in the final analysis.

B. Hydrocarbon-degrading potential

Some measures of the total heterotrophic bacterial population must be made. We suggest total viable counts on Marine agar (1g peptone, 1g yeast ex.) and a back-up method using LPS. In order to obtain an index of potential hydrocarbon degraders to total biomass, selected agar plates (containing 75-200 CFU's) will be replica-plated onto Aged Filtered Sea Water made with washed agar and various HC-substrates added:

1. Synthetic crude oil mixture containing representative aliphatics, aromatics, and cyclics - for total HC degradous.

2. Aromatic HC degraders - methyl-naptholen, + (another aromatic).

3. Cyclic degraders - incorporate a persisting cyclic if possible or t-decalin.

Confirmation of the hydrocarbon degraders and rates of oxidation can be obtained by ^{14}C-HC oxidation studies. Unaltered water and sediment samples are inoculated into:

1. sea water + crude oil (appropriate to spill) + ^{14}C - synthetic crude mixture - effects of crude oil on specific degradation.

2. ^{14}C-synthetic crude mixture + seawater - degradation rates of these three compounds.

Rates of $^{14}CO_2$ evolution from the ^{14}C-HC can be obtained relative to the total biomass showing correlation between two.

Samples should be obtained from surface microlayers (or slicks) by the Nuclepore method (Bourquin) whenever possible or by the alternate screen method if needed because of climatic conditions. Sediment samples should be obtained by aseptically subcoring from a Smith-Macke grab or box core. Care should be taken to reduce the disturbance of the sediment/water interface. (See heterotrophic potential description for sampling time.) These studies will provide a working index of hydrocarbon degrading potential and the changes occurring as oil resides in these environments. Coupled with some information on rates of oxidation, environmental conditions, oil type, and environmental nutrient levels, one should be able to predict with reasonable assurance the length of time a slick may survive or if toxic fractions will persist in surface layers, water column, or sediments.

C. Heterotrophic Potential

1. ^{14}C-labeled substrates
U-^{14}C glutamate, U-^{14}C acetate and either ^{14}C-proline or ^{14}C phenylalanine (labeled in ring position).

2. Substrate mineralization rates will be determined from scintillation data. $^{14}CO_2$ evolved will be trapped and counted. Counts will then be converted to g substrate $C/M^2/h$.

3. Rates of glutamate, proline (or phenylalanine), and acetate mineralization will be compared with:

   a. Mineralization rates for aliphatic, aromatic and cyclic hydrocarbons (determined during hydrocarbon degrading potential project).

b. Total and selective viable counts (determined during H.C. degradation potential project).

c. Bacterial biomass (LPS; determined during HC degradation potential project.

d. Sampling:

1) Surface:

i. calm seas (state $\leq$ 2) - Nuclepone membranes placed on surface from inflatable boat.

ii. rough seas - Niskin bag sampler will be used to obtain new surface water sample.

2) Sediment: Smith-Mackintyre grab sample equipped with shroud to prevent contamination from oil slick at surface.

3) Frequency:

i. Surface:

1. one set of 3 samples before oil intrudes.

2. one set of 3 samples + 2 controls within 24 hours after intrusion.

3. set of 3 samples + 2 controls once each week until slick is no longer visible.

ii. Sediment: 1. and 2. as for surface.

Note: The following points 3-14 deal with heterotrophic potential while point 15 treats aspects of the biodegradation study.

3. <u>Performing Organizations</u>

A. Energy Resources Company, Inc.: Fred Passmand and Tom Novitsky (617/661-3111) capabilities summarized in Items 9 and 10 below.

B. URI - Richard Traxler: capabilities appear on another projects report.

C. UNH - Galen Jones (607/862-2250) probably interested; doesn't have facilities to respond at present.

4. Applicable Habitat:

Project applies to all marine and estuarine habitats.

The study can be modified to include most habitats except rocky or shell sediments. Surface layers and sediments will be the only areas considered because of a high probability for HC-contaminationa and degradation.

5. Applicable Conditions

A. Numerous samples should be taken whenever possible to provide adequate statistical information for correlation with HC fate. The methods and techniques can be modified to meet most conditions and environments, i.e., dip surface samples in rough seas vs. membrane filters in calm seas.

B. Need sufficient notice to get to area for baseline observations before oil intrudes.

C. Heavy seas will obviate surface sampling, but new surface contingency plan is just as useful.

D. Due to elegant simplicity of protocol, experiments can be performed under wide variety of geographical and ecological conditions.

6. Applicable Oil Type

Any type oil except very soluble fractions should be considered.

7. Time Frame

A. Time required to collect complete set of surface and sediment samples 2-4 hours depending on weather conditions and spill area.

B. Processing samples: 24 hours per set.

C. Interpretation: 2 weeks to a month after processing food samples.

D. Total time per spill: sampling - 100 mh
processing - 500 mh
interpretation - 100 mh

(Computer technician/statistician and a microbiologist)

E. Size of spill will not appreciably affect these figures.

F. Additional information for proper correlation is needed whenever a spill occurs and can be assessed to have a high probability to move into a given area. We would need about 24 hours notice if possible.

8. Cost

Does not depend on size of spill; however, it does depend on location of spill as ship time will comprise major fraction of total cost (estimated at \$5000-6000 per day for ship time).

Costs for heterotrophic potential (exclude ship costs):

A. isotopes - \$10,000

B. sampling - \$ 3,000

C. processing - \$8,000 for isotope experiments
\$2,000 for bacterial biomass
\$5,000 for viable plate count of replicate experiments
(labor and supplies)

D. Interpretation and computer time - \$3000

E. Total \$31,000 Note: \$10,000 estimte for radio labled hydrocarbons may be high or low depending on availability of labled substrates.

9. Equipment Needs/Equipment Available:

A. Needs

No major equipment is needed to carry out the project. Radioisotopes can be purchased locally on short notice if not a special synthesis.

A good benthic sampler should be developed which would prevent contamination or disturbance of the sediment/H_2O interface. A messenger shroud for the Smith-Mackintyre grab sampler was proposed to prevent contamination of sediment samples with surface oil.

B. Available

1. complete microbiology laboratory including epifluorescent microscope, scintillation counts, plus all standard laboratory equipment.

2. field capability: inflatable boat equipped with 24 v outboard motor; 2 Smith-MacKintyre grab samplers, a 1 m^3 box corer, 2 dozen Niskin bag samplers.

10. Facility Needs/Facilities Available

An open ocean spill would require ship time and some laboratory time on board ship. Most work would be carried out in analytical labs on land. No special facilities needed.

ERCO's microbiology laboratory is complemented by an organic chemistry laboratory and trace metal laboratory. Gas chromatographs and a mass spectrometer are interfaced into a computer system. ERCO's team includes data management specialists, biostatisticians and computer programmers as well as industrial engineers with in-house capability of designing and manufacturing specialized equipment. The company has ready access to a small airplane, but does not have a sea going platform or mobile laboratory facility. As principle contractor for BLM's George's Bank OCS Benchmark, ERCO is accumulating a broad data base and expeertise on the mid-north Atlantic region.

Facilities needed include: ship to transport investigators to offshore areas and to provide a platform for sediment grabs.

11. Personnel Needs/Personnel Available

Galen Jones - University of New Hampshire

Holger Jannash - Woods Hole Ocean. Inst. (He should be contacted concerning in situ benthic sampling and heterotrophic activities.)

Richard Traxler - University of Rhode Island

Fred Passman - Energy Resources Company, Cambridge, Massachusetts, 02138 617/661-3111

Most people can respond within 24 hours if radioisotopes are available.

12. Support Services

Concurrent HC chemical analysis of sediments and surface films are necessary for good correlation of microbial potential data with HC disappearance.

Physical data on water temperature, wind and current movements and Eh of sediments are required.

Micronutrient levels (N & P) are essential in predicting ultimate degradation levels. Toxicity data on pelagic fauna and in-shore benthic organisms would aid in ultimate predictions of HC entering water or sedimentation.

13. Payoff

This investigation bears the same potential fruits as the H.C. biodegradation project, with two added advantages: 1) radioactively labeled amino acids are considerably less expensive than radioactively labeled hydrocarbons, and 2) incubation periods required for amino acid experiments are on the order of 4 hours as compared with several days for hydrocarbons. Once the correlation between amino acid mineralization and hydrocarbon mineralization has been shown, we will have a tool for rapidly assessing the natural, standing bacterial populations potential for degrading hydrocarbons in the spilled oil.

14. Limitations

The project does not answer the questions of ecological damage assessment directly. However, it does allow the predictions of recovery if enough information is gathered initially. It also helps the OSC in making decisions about clean-up operations because some information on rates and extent of degradation can be obtained within 24 hours after a spill.

15. Biodegradation Potential

(3) Performing Organizations:

University of Rhode Island Oil Spill Research Team supported by an ERDA contract. Dr. Mason Wilson, Jr., Project Leader, Dr. R. W. Traxler, Principal Investigator Biology and Dr. C. Ordzie, Research Associate for macro-biology systems. Dr. Chris Brown, P.I. Chemistry, Dr. T. Kim, droplet size distribution, Dr. Roger Dowdell, wind-wave interactions, Dr. M. Spaulding - modeling P.I.

(4) Applicable Habitat:

Various habitats, salt ponds, clam flats, offshore bottoms. Also spill sites of opportunity as a response function of the existing project.

(5) Applicable Conditions:

(6) Time Frame:

Cruces, No. 6 basic can do any petroleum.

(7) Time Frame:

Projected 3 year period.

(8) Cost:

(9) Equipment Needs/Equipment Available:

BOD capability about 300 determination at any one time with increasing incubation over temperature range 0°C - 100°C. ^{14}C respiration system with air sweep and traps. Capability 24 samples/run. Run times up to 24 hours. Full spectrum of carbohydrate.

Replicate plating capability - genus and predomance estimation capability by photographic means.

Amino acid and representative hydrocarbons by classes. Full capability for detection plate counts and membrance plate counts (up to 300 samples in triplicate, over a 3 log dilution range. MPN for about 300 samples. Limited capability for ATP analysis currently (estimate about 50 determination on a noncontinuing basis).

Sampling gear - in development phase - surface slick by two techniques are under consideration, water column by vacuum bag method. No satisfactory sediment system has been identified. May have to use typical samples.

Currently developing a LN_2 sampling holding system so definitions analysis can be done at base lab rather than ship board.

(10) Facility Needs/Facilities Available

Three tank at meso-scale size with 1 foot interval water column sampling - sediment trap.

Complete micro biology laboratory capability including aerobic and anaerobic systems, T & M and S & M support, general bacterial physiology methods.

Chemistry back up consists of GC-Mass spec. as well as special analysis.

(11) Personnel Needs/Personnel Available:

Full team capability represents 20 people. Contact Dr. Mason Wilson, Jr., 401/792-2330.

Microbiology team 4 persons contact Dr. Richard Traxler 401/792-2481. Biology Principal Investigator.

Biology (macro) Team includes two additional persons. A post-doctoral Research Associate, Dr. C. Ordzie and a technician available October 1, 1977.

(12) Support Services:

Chemical analyses (available)
Histological examination (probably available)
Modeling group (available)
Droplet size distribution (available)
Physical effects group (available)
Wind-wave indicator (available)

(13) Payoff:

This entire project provides biodegradation potential under controlled conditions and *in situ* for oil studies at surface, water column and sediment with various crude oil and petroleum products untreated and also treated with chemical dispersants. Dispersant treatment must respond to all three zones.

Can provide instand response for biodegradation determination by January 1, 1977, at a level of 25 samples - can expand on short notice to 100 sample capability.

14. Limitations:

PANEL: MICROBIOLOGY AND BIODEGRADATION
PROJECT NO. 2
PRIORITY RANK:

1. Project Title: Dispersants toxicity to bacterial population, particularly hydrocarbon degrading bacteria.

2. Project Description:

   A. To determine whether dispersants promote or inhibit biodegradation of hydrocarbons. The project will monitor *in situ* microbial activity and biomass before impact, after impact, before treatment with dispersant, and after treatment. Sampling in an untreated region of the spill will provide control data if possible. Otherwise, data from similar spills for which dispersants were not used will serve as "control."

   B. Parameters to be monitored are:

      1. Heterotrophic potential as determined by mineralization of C-labeled sutstates.

      2. Bacterial biomass as determined by LPS concentration.

      3. Total and hydrocarbonoclastic (viable count as determined by membrane filter and replica plating techniques).

      4. Change in lipid:carbohydrate:protein:nucleic acid (RWA) ratios as function of impacting oil or dispersant.

      5. Presence of exoenzynes or metabolites induced by dispersants.

   C. Sampling:

      1. Surface film

      2. Near surface water column-using Niskin bag samplers

      3. Bottom sediments

   D. More detailed descriptions of methods for monitoring the listed parameters and sampling have been provided in other projects proposed by the group, and are not elaborated on here. Support from organic chemists will be required for parameters 4 and 5.

3. Performing Organizations:

Energy Resources Company - The multi-disciplinary scientific and managerial support team at ERCO is described in another proposal. Key personnel are Fred Passman and Tom Novitsky at (617) 661-3111.

Galin Jones at University of New Hampshore is doing some work on siderochrome production by marine bacteria. This project might be of interest to his group. 607-862-2250

Richard Traxter of University of Rhode Island. His groups capabilities have been described elsewhere.

4. Applicable Habitat:

As with the other microbiology projects, minor modifications in the sampling protocol make the project applicable to all New England aquatic habitats.

5. Applicable Conditions:

Mechanical dispersion of the oil slick by heavy seas would seriously impair the chances of getting meaningful results. If there is no chance of obtaining control data from previous spills or an untreated fraction of the current spill, interpretation of the results would be tenuous at best. Accordingly, Seas ≤ 2; spill area of sufficient size that a region of the spill could be left untreated; and a pure spill period during which laboratory experiments would be performed on candidate dispersants are all important to the success of the investigation.

6. Applicable Oil Types:

Heavier oils, crude oils would be the best suited for this type of study since use of dispersants is probably best justified for such spills.

7. Time Frame:

A. Sampling: 16mh/sample set (6 surface, 6 water column and 6 sediment samples/set).

B. Sample Processing

1.	Radio nucleides experiments	4mh/set	16mh
2.	LPS assay	1mh/set & setup	5mh
3.	Viable count & replicas	18mh/set & prep	80mh
	Total		100mh
4. & 5.	Organic Chemistry Support	?	200mh

C. Interpretation 80mh

D. Summary: Sampling will be completed during the first 2 weeks of the spill/treatment event. Processing will require about 3 months exclusive of the organic chemistry which may take as long as 6 months. Final report should be prepared within 9 months of start of investigation.

8. Cost:

A.	Materials: Isotopes + Media + Membranes + Reagents	$2,000
B.	Processing:	$2,000-5,000
C.	Interpretation & Computer Times:	$2,000-2,500
D.	Transportation, platform costs-depends on location and geography of spill site	$1,000-30,000

9., 10., and 11. Equipment, Facilities, Personnel:

Equipment, facilities, and personnel have been described in detail in Project No. 1 proposal.

12. Support Services:

Biochemical assays described above. Physical data on dynamics of air-ocean interface and slick migration. Data on vertical migration of micelles formed due to treatment is important. Also needed is information from organic chemists on rates of H.C. speciation change in micelles.

13. Payoff:

As with the other microbiology projects, the primary benefit of this study is to provide a means for rationally selecting the optimum technique for minimizing the ecological and socioeconomic impacts of an oil spill. If it can be demonstrated that dispersants enhance biodegradation of oil by increasing surface area, etc., then use of dispersants would be indicated for at least some oil spills. If dispersants are toxic, cause production of toxic metabolites, or cause no enhancemant in biodegradation rates, then other recovery techniques are to be preferred.

In terms of damage assessment, once the initial studies are completed, metabolic rate studies will provide a relatively rapid, inexpensive and statistically significant means of assessing the efficiency of clean up efforts, as well as long-term impact on affected environments.

14. Limitations

The most serious limitations have been alluded to:

A. A background of information from laboratory experiments is needed to ensure success of a field study.

B. Dispersants are not routinely used in the U.S. If dispersants were used to treat an oil spill, some means would have to be devised to preserve an untreated portion of the spill for control studies.

PANEL: MICROBIOLOGY AND BIODEGRADATION
PROJECT NO. 3
PRIORITY RANK:

1. Project Title: Degradation in Anaerobic Sediments

2. Projection Description:

To determine if degradation of hydrocarbon does occur in anaerobic sediments, and if so, at what rates. Using standard petroleum crude oils (API reference Kuwait, South Louisiana and Bunker C) determine which components are degraded. Physical-chemical degradation must be identified as compared to biodegradation. The study should also determine if oils in anaerobic sediments have a negative, positive or no effect on physiological processes in anaerobic sediments such as sulfate reduction or nitrate reduction.

3. Performing Organization:

University of Rhode Island, Department of Plant Pathology - Entomology and Department of Microbiology, Dr. R. W. Traxler in cooperation with Dr. C. Brown of the Department of Chemistry.

4. Applicable Habitats:

Offshore bottoms, sand shores; worm-clam flats; salt ponds.

5. Applicable conditions:

Uncontaminated sediment which can be oiled by standard reference oils. There are no weather or climate conditions which would prevent the study. Oiled sediments from Argo Merchant or other spill sites, with similar unoiled sites for reference. Weather limitation associated with sediment sampling, such as sea state.

6. Applicable Oil Types:

Standard reference oils would be preferred due to existing analyses but any product could be used.

7. Time Frame:

The study would require a 3-year time frame to insure that low degradation rates are not missed in the analysis scheme. Replicate samples would require 1-week testing periods each month for up to 24 months unless rates are established in shorter time frames. Chemical analyses would represent 3 days per month.

8. Cost

In this project there is not a relationship to spill size. Cost would be calculated at personnel, supply, equipment base of about

2-part time personnel	$12,000
Overhead and fringe	6,000
Initial equipment	10,000
Expendable support	4,000
Total	$32,000

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations

PANEL: MICROBIOLOGY AND BIODEGRADATION
PROJECT NO. 4
PRIORITY RANK: 1

1. Project Title: Nutrient Enrichment

2. Project Description:

To determine 1) if nutrient enrichment has a significant stimulatory effect upon hydrocarbon oxidation rate and percentage of hydrocarbon oxidation by microbial populations as compared to nonnutrient-enriched systems, and 2) if nutrient enrichment has potential adverse environmental effects such as over production of microbial or other biomass.

The experiment can be carried out in meso-scale environmental systems utilizing a natural seawater control tank, an oil treated tank and an oil treated tank supplemented with oleophilic nitrogen and phosporus nutrient supplements. Biodegradation potential can be determined using biomass and rate determinations and correlated via chemical analyses for rate of component degradation.

It is anticipated that degradation rates will be increased but that the increase in biomass will result in other problems of environmental significance. More degradation products will appear in the water column thanin nonsupplemented systems.

3. Performing Organizations:

The University of Rhode Island Oil Research Group supported by an ERDA contract to study treated vs. untreated oil spills has the capability to respond to this problem. The MERLE project group at URI/GSO also has the capability from a facility standpoint.

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

8. Cost:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

BIRDS AND MARINE MAMMALS PANEL

Participants

J.L. Dunn, Chairman

B. Baxter	T. Hoehn
B. Blodget	A.M. Julin
J. Cardoza	C.L. Knapp
J. Harris	K. Powers
F. Heppner	J.H. Prescott

R.F. Randall

BIRDS AND MARINE MAMMALS PANEL

General Considerations and Guidelines

- Background Information on Birds
- Preliminary Panel Considerations
- Recommendations to the Workshop Executive Committee
- Laws Concerning Marine Mammals and Birds in EPA Region I
- Recommended Procedures for Processing Specimens
- General Procedures for Assessing Damage to Birds

BACKGROUND INFORMATION ON BIRDS

A. Population and Inventories

Populations of coastal and marine birds in EPA Region I have been addressed in Drury (1973-1974), Nisbet (1973), Brown et al (1975), Brown (1977), and Powers (manuscript being developed for U.S. Fish and Wildlife Service based on an 18-month Georges Bank study by Manomet Bird Observatory). Most of the above work deals with breeding populations on the New England and eastern Canadian seaboard, and to a lesser extent on pelagic distributions. The Fish and Wildlife Service also is presently cataloguing all colonies of coastal and marine birds from Maine to the Carolinas, and developing estimates of total breeding pairs.

Temporal and spatial distributions of species have been described in the above-listed publications.

B. Critical Habitats

Coastal critical habitats are far better understood than critical pelagic habitats. W. Drury (College of The Atlantic), I.C.T. Nisbet (Mass. Audubon Society), Brian Harringon (Manomet Bird Observatory), Michael Erwin (U. of Mass., Coop. Wild Res. Unit) are the authorities on coastal critical habitats in EPA Region I. Kevin Powers (Manomet Bird Observatory) and R.G.B. Brown (Canadian Wildlife Service) are the present authorities on pelagic distributions of marine birds in

EPA Region 1. The previously mentioned publications deal with critical habitats to some extent, but communication with above persons will provide specific unpublished information on certain families of birds and areas in the Region.

C. Facilities, Personnel and Areas of Expertise

Massachusetts Audubon Society - I.C.T. Nisbet (Terns and gulls)

Manomet Bird Observatory - Brian Harrington (Shorebirds)

University of Massachusetts Cooperative Wildlife Research Unit - Michael Erwin (Waders and coastal birds)

College of the Atlantic - William Drury (Gulls and seabirds)

Massachusetts Division of Fish and Wildlife - Brad Blodgett

U.S. Fish and Wildlife Service Regional Office

State Conservtion Agencies in Maine, New Hampshire, Connecticut and Rhode Island

Pelagic birds

Manomet Bird Observatory - Kevin Powers (seabirds)
College of the Atlantic - William Drury (seabirds)
University of Rhode Island - Frank Heppner (Trigom report compiler)

D. Available Impact Information

Substantial information exists on past impact on bird populations of certain spills throughout the world. The most important accidents are summarized in a chapter by W.R.P. Bourne on Seabirds and Pollution in Marine Pollution, ed. R. Johnston, Academic Press (1976). However, most information on ecological impacts deals with abundance and species diversity from birds that have been picked up on "beached bird surveys" of affected coastlines. Quite a bit of information deals with methods of cleaning and rehabilitating oil contaminated plumages. Long-term effects and internal or physiological mechanisms of effects of ingested oil or indirectly ingested oil in contaminated prey items have not been dealt with. Information from the Argo Merchant incident dealing with beached bird surveys and pelagic surveys of oil contaminated birds will be dealt with in a publication by K. Powers (MBO) by January 1978.

Likely effects of future spills on coastal and pelagic birds include:

(1) Direct mortality due physical oiling of plumages.
(2) Indirect mortality by ingestion of oil, either directly or indirectly through food chains.
(3) Effects of external and internal oiling on reproductive success, during applicable seasons
(4) Effects on wintering or breeding habitats of oil reaching shoreline habitats. Breeding, feeding, loafing habitats may be altered.

E. Background Reports

1. A Socio-Economic and Environmental Inventory of the North Atlantic Region (Including the Outer Continental Shelf and Adjacent Waters from Sandy Hook, New Jersey to the Bay of Fundy). Vol. 1, Book 4. Submitted to the Bureau of Land Management, Marine Mammals Division, November, 1974. TRIGOM/PARC, Public Affairs Research Center.

Available From:

TRIGOM
Box 2320
So. Portland, ME

2. Oil Spill Prevention and Response. Report to the Massachusetts Interagency Task Force on Oil Spills. Executive Office of Environmental Affairs, Publication No. 9705-185-30-5-77-CR. April, 1977.

PRELIMINARY PANEL CONSIDERATIONS

A. Critical Habitats and Species Inventories

It became apparent to the panel that time limitations would not permit a cataloging of critical habitats and a species inventory. Panel members were asked to suggest available published reports which would provide this information. Several such reports were on hand and several others were suggested. Of special interest were the Manomet Bird Observatory's Final Report to the U.S. Fish and Wildlife Service on the spatial and temporal distribution of marine birds at Georges Bank and adjacent waters, and a recent Trigon Report which attempted to describe the distribution of marine mammals in New England Outer Continental Shelf. It was the consensus of the panel that identification of habitats critical to birds and marine mammals is one area of baseline information which is sorely lacking. There is a substantial lack of confidence in currently available data. Throughout the panel's discussions, a consistent theme was the lack of baseline data. These gaps in our knowledge cast doubts upon the validity of any studies aimed at assessing the damage to marine mammals and bird populations in the area of oil spills. The panel was unanimous in its recommendation that EPA should undertake major effort to support research designed to fill these gaps. In areas outside its normal purview, EPA should attempt to make certain that appropriate agencies are aware of the requirements for research in such areas. [An area not encompassed by the Workshop is the impact of oil spills on marine and estuarine reptiles. While not of major consequence in the New England area, the panel recommends that this group, which includes species on the List of Threatened and Endangered Wildlife, be considered at workshops in regions where such species are more numerous.]

B. Project Areas

1. Recommended Projects

The panel identified several projects which it feels will aid in assessment of oil damage to marine mammals and bird population in its region. These projects include:

- Survey of birds and marine mammals in the area of an offshore oil spill.
- Near-shore survey of birds and mammals.
- Collection, classification and salvage of suspected oil impacted wildlife. (Includes histopathology, toxicology, physiology, and causes of mortality).
- A study to develop methods to determine actual mortality from post-spill mortality observation.
- Behavioral observations on wildlife in and around an oil impacted area. (Includes observations on both impacted and non-impacted animals.
- Long-term follow up of the impact of an oil spill on birds and marine mammals.
- Determination of the impact of clean-up operations on birds and mammals.
- Development of methods to minimize adverse impact of clean-up operations.

The panel initially considered one project in depth, a survey of birds and marine mammals in the area of an oil spill. After completing this exercise, our initial impression -- that projects involving high cost platforms must be piggybacked with other projects -- was strengthened.

2. Other Subject Areas

Other areas that are not suitable for development as projects but that require further investigation are:

- Identification of federal, state and local agencies which may have jurisdiction over a particular species in order to avoid conflict between these agencies or between these and other agencies.

- Identification of current federal, state or local laws which may delay or prevent execution of required studies.

RECOMMENDATIONS TO THE WORKSHOP EXECUTIVE COMMITTEE

The following formal recommendations are made to the Executive Committee:

1. In a field as esoteric as marine mammology, the numbers of individuals in a given EPA region attending an oil spill workshop may not be adequate to provide the required expertise to produce the information requested of the panel. We feel that EPA should consider funding a national workshop designed to produce the required information. In December there will be a meeting in San Diego dealing with marine mammals. This meeting will be attended by most of the nation's marine mammologists. One additional day at such a meeting could be devoted to assessing oil spill damage in marine mammals. By piggybacking on this meeting, the cost of assembling the required information would be extremely low whereas the information acquired would be maximized.

2. In future workshops birds and marine mammals should not be lumped together. The only common ground between these two groups is the fact that they are homeotherms and may exist in the same areas. Close coordination of projects developed by separate panel is of course highly desirable.

3. The panel suggests the creation of a permanent advisory body to assist the agencies in development of data collection and analysis methods.

4. The requirement for rapid response to an oil spill makes it unlikely that equipment needed for proposed studies will be either immediately available from an institution or immediately available for purchase. For these reasons, the panel suggests the Executive Committee consider the establishment of two or more sites where equipment pertinent to routine oil spill studies can be stored ready for immediate shipment to the scene of a spill. A coordinated nationwide scientific program suggests that certain equipment will be necessary no matter where the spill occurs. Establishment of equipment depots on each coast is a more cost-effective mechanism than funding such equipment purchases for a dozen researchers nationwide.

LAWS CONCERNING MARINE MAMMALS AND BIRDS IN EPA REGION I

A. Massachusetts

Subject to the provisions of existing Federal statutes, the Massachusetts Division of Fisheries and Wildlife of the Department of Fisheries Wildlife (MDFW) and the Department of Recreational Vehicles has jurisdiction over wild birds, mammals, and inland fish within the bounds of the state. In addition to any Federally-required permits, individuals or agencies wishing to conduct investigations involving collection, capture, harassment, marking, etc., of state-protected species are required to obtain a permit for that purpose from: MDFW, Leverett Saltonstall Bldg., Government Center, 100 Cambridge St., Boston, Mass. 02202; 617-727-3151.

The MDFW also has legal authority to conduct investigations on wildlife within the above classes of vertebrates. Whether or not such researches are conducted, and to what extent, is dependent on policy, funding, and training and availability of personnel and equipment.

Statutory authority for the above based on Chapter 131, Sections 5 and 6 of the Massachusetts General Laws, and related laws and regulations.

B. Connecticut

Under state law it is illegal to take birds without permit. Statute 26.60 provides for scientific and educational permits. Statute 26.54 states that it is illegal to possess live birds without a custodian permit. Migratory birds and marine mammals require Federal permits from U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service.

It is recommended that:

1. Researchers work with existing permit holders, e.g., wildlife biologists, universities, etc.

2. Permit requests be addressed to: Connecticut Department of Environmental Protection, Wildlife Unit, State Office Bldg., Hartford, CT. The request should explain species, times, purpose of collection.

C. Federal

Laws governing Federal responsibility for migratory birds include:

- Migratory Bird Treaty of 1918, as amended.

- National Oil and Hazardous Substances Pollution Contingency Plan, issued in the Federal Register by the Council on Environmental Quality on February 10, 1975, as amended in 1976 and 1977.

The Migratory Bird Treaty gives responsibility for managing migratory birds to the U.S. Fish and Wildlife Service and states. This includes issuance of Federal and state collection and possession permits. The regional contact for Federal permits is:

Wayne Sanders
U.S. Fish and Wildlife Service
Newton Corner, Mass.
617-965-5100

Federal permits may be approved by phone for those competent to collect, possess and handle birds.

The "National Contingency Plan" (1510.22) provides that DOI will provide (f) "expertise to OSC and RRT with respect to land, fish, wildlife resources under its jurisdiction"; (m) "making resources available for Federal pollution response operations"; and under 1510.46 (b) "arrange for and coordinate actions of professional and volunteer groups that wish to establish bird collection, cleaning and recovery centers", and "to the extent practicable, identify organizations or institutions that are willing to operate such facilities."

GENERAL PROCEDURE FOR ASSESSING DAMAGE TO BIRDS

A. Immediate Direct Damage to Individual Organisms and Populations

(1) Assess total populations (density estimates) of each species in area of spill and monitor on at least weekly (daily during spring or fall migratory periods) to measure possible movement of specific populations to and from the affected area.

(2) Estimate damage to specific populations by determining percentages of each species that show visible oiling on their plumage and by bleached bird surveys.

(3) Utilizing density estimates in area and percent of specific populations that were contaminated, estimates of immediate direct damage to specific bird populations may be developed.

B. Indirect, Delayed or Chronic Damage to Bird Populations

These assessments require accurate information on the composition and characteristics of the spilled fuel. These needs are discussed under specific recommended projects.

(1) Determine the source or origin (e.g., breeding colony) of contaminated bird species (includes direct and indirect mortality) to enable assessment of population losses at selected breeding locations. Birds from both the Northern and Southern Hemispheres are involved.

RECOMMENDED PROCEDURES FOR PROCESSING SPECIMENS*

1. Dead Animals

a. Advanced autolysis - place animal in freezer

b. Recently dead

- tissue samples in 10% buffered formalin for historical purposes; Vol. of the formalin must exceed 10X vol. of tissue.

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*Specimens should be handled according to EPA chain of custody procedures.

- tissues for hydrocarbon analysis (e.g., blubber, muscle, liver, brain, gut). Sample size depends on precision desired. Tissue must be packaged according to appropriate CF. FR 40(28) Pt.11 pp. 62-97 guidelines - Vol. of tissue should be 100g or better. Err on side of generosity.

c. Frozen specimens, not decomposed

   - handle hydrocarbon analysis as in b above.

2. Moribund Animals

   a. Liver samples - 10g or more should be obtained. If mixed function oxidose levels are desired, must go into liquid nitrogen ASAP.

   b. Blood samples - 5 cc of blood in EDTA and 20cc of blood, no anticoagulant. Refrigerate and centrifuge to separate serum. Remove serum from packed cells. Serum can be frozen for future analysis.

      Make 2 thin smears from EDTA sample; air dry.

   Reference for sampling tissues

   Patuxent Wildlife Research Center, Laurel, MD
   USFW Service National Wildlife Health Labs, Madison, WI

3. Gut Contents - remove for analysis of ingested hydrocarbons, food items, or empty. Many collected specimens may be emaciated and starved.

BIRDS AND MARINE MAMMALS PANEL

Recommended Projects

1. Assessment of immediate impact on bird populations in area of offshore oil spill.

2. Breeding bird population studies.

3. Collection, classification and salvage of suspected oil impacted birds.

4. Effects of oil spills on bird reproduction.

5. Determination of spill associated bird mortality from post-spill body counts.

6. Assessment of the impact of an oil spill on marine mammals.

7. Summary of birds and marine mammals for offshore oil spills.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 1
PRIORITY RANK: 1

1. Project Title: Assessment of Immediate Impact on Bird Populations in Area of Offshore Oil Spill

2. Description of Project:

A. Objective - Determine species composition, density, and distribution of bird populations in area of oil spill, and the proportion of each bird species which is visibly contaminated with oil.

B. Procedure

(1) By aerial surveillance the species composition, density, and distribution of bird populations in the area of the spill will be estimated using a fixed-winged aircraft flown over a pre-selected grid to randomly sample bird populations present on contaminated and adjacent areas. This technique involves using 2 observers and one recorder (in addition to the pilot) in a twin-engine hi-wing aircraft flown at 100 feet above sea level at 100 mph. All birds within a 300m transect will be counted by species for 10-minute periods. Densities (birds/km^2) will be extrapolated using species abundances per area sampled [300m wide x (10 min x air speed)]. This technique is being utilized by the USFWS - OBS/CE, 800 A St., Suite 110, Anchorage, AK 99501 - Project Leader - Calvin Lensink.

(2) Determine percent of each species visibly contaminated with oil from shipboard surveys by using 10-minute counts of total numbers of each bird species within sight of the ship (Brown et al. 1975 - Atlas of eastern Canadian seabirds, and Manomet Bird Observatory unpublished cruise reports). Specific formats for sampling and compilation of data on computerized data sheets are discussed in the references above. Behavioral observations and notes on the degrees (i.e., light, medium, or heavily oiled) of plumage contamination and areas of body affected (i.e. nape of neck, breast, belly, etc.) will be recorded in the 10-minute count format.

(3) Utilizing density estimates determined from aerial surveillance and percents of specific populations visibly contaminated from concurrent shipboard surveys, estimates of immediate direct damage to bird populations can be made.

3. <u>Performing Organization</u>:

A. Offshore spills - Manomet Bird Observatory 617/224-3559 - Kevin Powers or Brian Harrington. This organization presently has the capability and available manpower to perform such a study.

B. Possible performing organizations suggested: College of the Atlantic - 207/288-5015 - William Drury; University of Rhode Island - 401/792-2372 - Frank Heppner.

4. <u>Applicable Habitats</u>:

All offshore habitats in EPA Region I (i.e., Gulf of Maine, Georges Bank, shelf waters South Cape Cod, and Rhode Island, OCS slope waters).

5. <u>Applicable Conditions</u>:

Presence of bird populations in area of spill. The only conditions necessary for completion of study are the use of aircraft and surface vessels able to contend with weather/climate and geographical conditions. Ecological conditions with the bird component of the ecosystem are strictly limited to ocean surface and air strata. An organization like Manomet Bird Observatory can presently supply trained manpower to meet study requirements with internal funds for one week. Equipment such as aircraft and surface vessels must be supplied.

6. <u>Applicable Oil Type</u>:

Any oil type or group of oils.

7. <u>Time Frame</u>:

Inclusive period of short-term assessment requires period from oil spill to one month after spill has visibly dissipated and can no longer be traced by air. Daily to weekly surveillance flights depending on season of year will be necessary. One-week sampling periods per month from shipboard surveys will be necessary. Depending upon size of spill more than one survey ship may be necessary. Sample work-up and data analysis requires an additional 2 months per year. Note: This time frame does not consider any long-term effects.

8. Cost:

A. Aircraft - $100 per day.

B. Surface vessels - range $500 - $3000 per day, 7-10 days on study area per vessel desired.

C. Personnel

(1) Aircraft - 2 observers and 1 recorder per flight.

(2) Surface vessels - 1 observer.

Extra cost of Manomet Bird Observatory observer = $100 per day (includes salary ($12K/year) and 57% overhead) - does not include travel and per diem costs.

D. Equipment - (may sometimes be provided by certain institutions or agencies, but for this project proposal it is assumed that the NRT will provide necessary equipment.

(1) Photographic - $2000 per kit. One kit includes: SLR 35-mm camera with motor drive and data back; 200-400 mm zoom lens with gunstock mount; 10 rolls @ 36 exp Tri-X film; 10 rolls @ 36 exp. Plus-X film. (One kit per aircraft and surface vessel needed).

(2) Cassette tape recorders @ $75 (one recorder per aircraft and surface vessel needed).

(3) Optics - 1 pair 8 x 40 WA binoculars @ $75 (1 pair per observer needed).

(4) Film processing - grossly estimated at $1000.

E. Automatic data processing, if necessary. Key punch and statistician's time grossly estimated at $1500 for a spill of similar size and duration as Argo Merchant incident.

F. Phone, Xerox, etc., costs (if University based study) grossly estimated at $500.

G. Principal investigator - salary range, \$15 - \$25K per year. Mean - \$20K per year. Daily consultant rates based on USFWS scale = $\frac{\text{salary per year}}{260}$ Daily pay rate = \$77 per day.

Based on one month duration spill and three months data analysis and report writing - 4 month with 20 working days per month = 80 days.

\$77 x 80 = \$6160 total P.I. salary.

P.I. at 33% of time for 4 months = \$2033.

9. Equipment Needs/Equipment Available:

A. As this project is largely observation orientated, little equipment will be required beyond optical and recording materials. One kit with the following materials will be required for each crew (aircraft or ship):

(1) single lens reflex camera with data back and motor drive unit

(2) 200-400m 200m lens w/gunstock attachment

(3) cassette tape recorder with tapes

(4) 8X40 binoculars

B. All these materials are potentially available through the appointed institutions, but are not guaranteed to be accessible at the moment of a spill. Therefore, kits should be prepared in advance.

10. Facility Needs/Facilities Available:

Facility needs involve aircraft and ship transport:

A. Aircraft - hi-wing, 2 engine, float equipped preferred, VFR/IFR, deicing, communications, and navigational capability appropriate to pelagic survey, room for two observers, recorder, and pilot.

B. Surface Vessels - from 1-3 vessels of similar design or observational capability, range and construction suitable to open ocean work in poor sea conditions for 10 day minimum (port to port); location electronics equal to Loran A or better; VHF radio with sea-air, sea-sea, sea-land capability;

lifeboat or skiff with capability in cabin to moderate seas; berth for 1-2 observers.

11. Personnel Needs/Personnel Available:

Discussed in parts 3 and 8(C).

The principal investigator and associates chosen from list of performing organizations will delegate staff for the project.

12. Support Services:

A. Relevant long-term and cause-and-effect studies can be associated with and after this study. Base line data necessary for background and more accurate ecological assessments are discussed in part #14 (Limitations).

The following studies should be considered in priority listed:

(1) Recovery, rehabilitation and salvage operations during spill.

(2) Indirect mortality by ingestion of oil, either directly by preening or indirectly through food chain. What are the chances of survival for a lightly oiled bird? Can we assume any bird that ingests oil will die? What are external and internal toxicity levels?

(3) Effects of external and internal oiling on reproductive success (long term and short term).

(4) Effects of habitat degradation or alteration (wintering, breeding, or migratory stopover habitats; whichever is applicable to bird species in question). Habitat aspects to be considered are feeding, loafing, nesting, etc.

13. Payoff:

A. The study will provide capability to clearly respond to public sentiment regarding impact on bird populations. More specifically, it addresses:

(1) estimates of direct mortality per bird species at spill site

(2) probable estimates of indirect mortality due to spill

(3) limitations in estimating long term or more accurate assessments are discussed in part #14 (Limitations).

14. Limitations:

A. Our capability to assess environmental damage to marine bird populations associated with these spills is dependent on necessary base line information.

B. These populations are highly mobile. Even with the best base line data present capabilities can provide, statistically significant measurements ($P < .05$) may not be possible.

C. Weather and sea state may severely disrupt the effectiveness of the project.

D. Initial counts of direct mortality at spill site may be misleading. Oiled birds may die thousands of miles away, may sink before being counted, may float out to sea unobserved (opposed to washing ashore). They also may be more likely to be counted because of behavioral factors (flight and feeding characteristics; spending more time on water). All oiled birds may not be contaminated from same source.

E. Cost predictions listed for this study may not be considered feasible (e.g., aircraft and vessel costs) with available funds. Most of these high-cost facilities necessary, may be dove-tailed with USCG operations and other research groups. However, the quality of data collected may be reduced. To what extent data quality will be impaired is unknown.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Breeding Bird Population Studies to Monitor Population Fluctuation at Breeding Colonies and to Study the Relationship of Such Fluctuations to Oil at Sea

2. Project Description:

This project takes a long-term approach to monitoring changes and trends in sea populations. It provides invaluable base line data, material that ideally should have been generated 20 years ago. Only in seabird rookeries are the populations concentrated in space and time to the extent that accurate and meaningful population estimates can be made. Therefore, this approach should provide a most sensitive measure of population fluctuations--some of which may be attributable to oil spills. The Torrey Canyon disaster demonstrated the value of this approach in the British Isles where considerable surveys of the seabird resources have gone on for many years. Actual percentage drops in the populations could be measured by noting declines at the rookeries. This proposed project would be international in scope and would be quite expensive. Some data are already available (cf. Canadian F. & W. Survey of the Seabirds colonies in eastern Canada; USFWS, Seabird Survey; U. of Maine Coop. Res. Unit and U. of Mass. Coop. Res. Unit, Dr. R. Michael Erwin and Wendell Dodge, P.I.)

3. Performing Organizations:

The enormous scope of this project makes it essential to utilize all available observers and cooperators. These would probably represent various organizations contracting with a lead-coordinating agency - e.g., USFWS or The Seabird Group. Dr. William Drury, College of the Atlantic, Bar Harbor, Maine, has considerable expertise in the Region I seabird population. The only known reference for Canada is the Canadian Wildlife Service.

4. Applicable Habitats:

Offshore islands, sandy beaches and bare cliffs, stacks, ledges, and wherever seabirds are found to be nesting.

5. Applicable Conditions:

Successful completion would depend on availability of necessary manpower, operation platforms and equipment. The hugh scope of the project means that these factors might, in fact, be limiting.

Necessary men and equipment would need to be highly coordinated to correspond/coincide with the seabird meeting chronologies. Accuracy of data generated would be limited by weather, sea conditions, difficulties associated with landing on offshore islands, etc.

6. Applicable Oil Type:

   Not directly applicable.

7. Time Frame:

   A. Total scope of project: minimum 10 years.

   B. Annual scope of project:

      (1) Field Operation May - July.

      (2) Equipment Preparation/Data Processing August - April.

8. Cost*:

   A. Personnel

Principle Investigator (1) @ $250-300/week for 25 weeks	$ 6,875**
Field Observers (12) @ 80-100/week for 12 weeks	13,000**

   B. Operating Platforms

16' Boston Whaler, rented or chartered @ $100/day, boat trailer included, for 8 weeks, fully-equipped	5,600
2 4x4 Scout International Jeeps at $50/day for 12 weeks	4,200

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*For this section, cost estimates are based on survey and observation of all seabird colonies in Massachusetts. Cost for total NE Maritime Region would be expanded Province by Province, with highly variable costs expected due to different colony access problems and requirements. For example, Newfoundland would require large boat and much off-shore work, while in Massachusetts, small boats and vehicle work would be adequate.

**This figure reflects all staffed, agency-filled position and doesn't take into account the probability that some personnel are volunteers or personnel already on the job, e.g., P.I.

C. Equipment

(a) Binoculars (6 pairs) 8x40 Swift @ $120 each — 720

(b) Spotting telescope and tripod @ $200 — 200

D. Contingencies (e.g., telephone calls, beach permits, notebooks, etc.) — 350

$30,570

or $32,000

9. Equipment Needs/Equipment Available:

A. Binoculars, Swift 8x40 or 7x50 (about 6 should be available for use)

B. Telescope, Bausch & Lamb Bolscope Sr. 20 power, 300MM (1)

C. Tripod (1)

10. Facility Needs/Facilities Available:

A. Boat (1) Boston Whaler, 16' fully equipped and C.G. inspected ideal.

B. Trailer for Boat (1)

C. Trucks (2) 4x4 Scout International equipped with 7.50 x 15 tires with psi = 17, low-pressure tire gauge, air-tank (capy 200 lbs.), hydraulic jack, tire iron, several boards, shovel, spare tire, come-along; 25 feet 1/2" nylon rope or equivalent strength cable.

D. Garaging for vehicles assumed to be covered by owning agencies, e.g., MDFW, Wbo. hdqtrs or SE District Office, etc. No additional cost involved.

E. Docking/launching facilities for boat. Arrangements in advance at appropriate points of departure. Possibly some cost involved here not shown in Paragraph 8 above.

11. <u>Personnel Needs/Personnel Available</u>:

A. For Massachusetts, <u>possible</u> Principal Investigators:

Dr. R. M. Erwin, U. MA. Coop Res. Unit, Holdsworth Hall, Amherst, MA 01003 (presently USFEW Coordinator or on MA Coast for Seabird Survey).

Bradford G. Blodget, State Ornithologist, Mass. Div. F. & W., 100 Cambridge Street, Boston, 02202. Tel. (617) 727-3151. Home No: (617) 853-5474 at 74 Hillcroft Ave., Worcester. Currently co-coordinator of Division activity on tern project.

Richard Forster, c/o Mass. Aud. Soc., leader of MA tern project.

B. Current additional observer personnel furnished by other agencies, e.g., Trustees of Res., Parker R. NWR, MAS, Cape Cod Nat. Seashore, Barnstable Conserv. Comm., and volunteers too lengthy a list to give here.

C. Adequate personnel <u>are</u> available on short notice. Names and details available from any of above individuals or agencies listed (for MA only). Personnel would have to be lined up and coordinated state by state or province with a state or provincial coordinator.

12. <u>Support Services</u>:

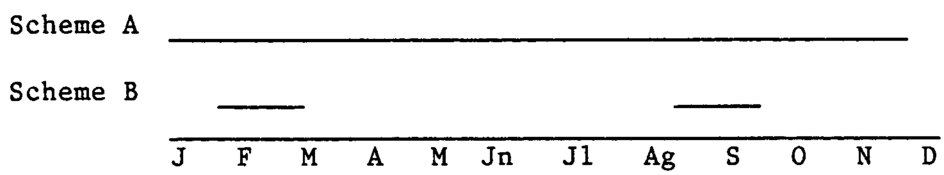
A. Aerial reconnaisance of study area helpful in surveying for locations of colonies to be censused. All actual census work to be carried out from land and water-based platforms. Aerial data are useful only in locating breeding colonies.

B. Studies on census techniques might help refine methods of obtaining accurate numerical estimates.

13. <u>Payoff</u>

Payoff would be in long-range build-up of data to be used as a barometer of change in seabird numbers. Immediate use for determining damage due to spills would be minimal, but the study could yield excellent general population data after sufficient time (probably at least 10 years). Yields current information on sea-bird numbers in total population that cannot be obtained in any other fashion and therefore potentially very useful in assessing long range trends--some trends in part possibly due to oil contamination at sea. The long term oil related mortality in seabirds may be greater than the spectacular one-shot mortality immediately associated with spills.

Figure 1. Two schemes showing seabird mortality due to oil. In Model A, mortality is scattered over a wide area, as birds encounter oil at many small spills, or individual globs of oil and die. In model B, there is spectacular loss at a spill site. However, over the long range, actual mortality under scheme A may be much greater than that associated with B. The proposed project would give a much better assessment of the seabird resource picture at control concentration points, where birds congregate from the oceans of the world. Over time, these two types of mortality might appear thus:



Scheme B takes into account only concentrated, visible oil mortality; scheme A takes into account continuous, non-point oil mortality.

This discussion gives the major payoff, which may be the only long term solution to assessment of damage being done.

14. <u>Limitations</u>:

A. Financial limitations would probably be most severe. Hence, the project could be broken down into state or provincial programs that would capitalize on local experts familiar with their areas to minimize the associated costs.

B. Project does not give a direct cause-effect relationship between oil at sea and impact on seabird numbers. Rather the proposed project shows fluctuation in seabird numbers resulting from a large assemblage of factors.

C. Project has little or no value in short-term assessment of damage at the site of an oil spill. Benefits are entirely based on long-term development.

D. Project may be limited severely in some states or provinces by any or all of the following factors:

(1) difficulty of access to remote colonies,

(2) lack of competent observers, and

(3) impossibility of documenting number of birds in colonies due to difficulties in obaining accurate number estimates.

E. Projects would apply only to colonial nesters (see point 15).

15. Species Affected:

A. The following colonial nesters would be most easily assessed by this project:

(1) Dovekie

(2-3) Murres (2 spp)

(4) Razorbill

(5) Black Guillemot

(6) Gannet

(7) Black-legged Kittiwake

(8) Puffin

(9-10) Cormorants (2 spp)

B. The following species may all be assessed, but may be less critical as they might be more affected by other factors than oil.

(1) Tern spp. (NE and north, 4 spp)

(2) Gulls (NE and north, 6+ spp)

C. The following species are highly colonial, but colonies are geographically very remote from our area:

Cory's Shearwater (Azores, the closest)

Greater Shearwater (Tristan Archipelago)

Sooty Shearwater (sub-Antarctic islands)

Wilson's Storm Petrel (sub-Antarctic islands)

Atlantic Fulmar (Northeast Atlantic)

D. The following pelagic species are non-colonial and would require different censusing techniques:

Oldsquaw, Scoters (3 spp), Eiders (2 spp) Loons (2 spp), Grebes (2 spp).

Addendum to Project No. 2:

The spatial and temporal distribution of the marine bird-populations in OCS New England waters is only superficially understood. Only one 18-month study (USFWS-Manomet Bird Observatory) has examined pelagic distributions of birds in this area. Yearly trends have not been investigated. A viable census technique for counting birds at sea has been developed, and a format for automatic data processing of such information is available. A prototype ADP program is currently being developed and tested by U.S. Fish and Wildlife Service Migratory Bird and Habitat Laboratory at Laurel, Maryland. Data processed in this format was collected at the site of the Argo Merchant spill and will be analyzed by January 1978. We have capitalized on a unique offshore research opportunity. The existence of a spatial and temporal distribution data will allow more accurate estimates of probable import of future spills. The mobility of seabird populations makes this data base necessary for valid damage assessments.

The seabird populations that utilize U.S. Northwest Atlantic OCS waters involves species from Tristan De Cuhna, Antaractic Peninsula, and South Shetland Islands in the Southern Hemisphere; and species from northwest Africa, the Canaries, Azores, Shetland and Faroe Islands, Iceland, Canadian Artic islands, Newfoundland, Nova Scotia, and New England in the northern Hemisphere. A spill may have a devastating effect on a particular breeding population or may involve a small percentage of several breeding populations. We simply do not know this information and therefore cannot really assess the actual damage because it may not be apparent until the birds are thousands of miles away. We can obtain better information with collecting and banding operations on an international scale.

We do not know, but may only conjecture from the literature, what food resources the seabird populations utilize in these waters. Studies in the literature are few and were investigated in other countries mainly during the breeding seasons. Damage (i.e. resource reductions) or contamination of prey items may seriously affect bird populations. A depleted prey species may act as a severe stress on bird populations, or hydrocarbon accumulations in prey species may result in a detrimental build-up of hydrocarbons which may kill individual birds when otherwise stressed; or when toxic tissue levels are reached from contaminated prey items (i.e., fish in Mississippi River drainage resulted in extermination of all breeding populations of this species along coastal Louisinana in the early 1960's).

In conclusion, we may well be able to assess mortality at the site of the spill with a comprehensive effort as stated in this project, at a phenomenal cost, but we cannot make any meaningful statements concerning an ecological assessment of damage until we have a data base with which to compare results obtained during damage assessments studies.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: Collection, Classification and Salvage of Suspected Oil Impacted Birds

2. Project Description:

A. Objectives

(1) Collect distressed and dead birds in an around an oil spill, including adjacent on-shore areas.

(2) Transport collected specimens to a control processing point.

(3) Classify speciments into categories of living vs. dead, oiled vs. non-oiled.

(4) Record appropriate site and specimen data, including species, sex and age, condition, date, time, location.

(5) Coordinate dispostion of specimens for treatment under allied projects.

B. Techniques

(1) Land-based collection: regionalize shoreline and associated inland areas. Assign a regional coordinator (and assistants if necessary) to each region. (Reference: Cardoza, J.E., 1977. Oiled bird recovery program for the "Argo Merchant" Spill. Typescript memorandum to the Director of the Mass. Div. Fisheries and Wildlife. 10pp.). Provide a central coordinator. Regional collectors would be responsible for patrolling their area, collecting the specimens, and transporting them to a central point. Based on Argo Merchant experience, regions may be 3-5 miles in length (depending on numbers of birds involved and accessibility of terrain). Patrolling at least twice a day, but capable of expansion. Nightlighting as applicable.

(2) Water-based collection: regionalize coastal (up to 1/4 mile off-shore) areas. Assign regional coordinator and assistants. Same central coordinator as (i) above. Patrol daily (capable of expansion). Provide at least one off-shore/on-spill collection crew, as necessity requires and conditions permit.

(3) Classification: central coordinator and assistants examine specimens collected by regional crews, make status determination, record applicable data, package specimens for distribution.

(4) Salvage: central coordinator liaisons with allied investigators to provide for transportation and distribution of specimens. Follow recommended EPA chain of custody procedures. Procedures for handling specimens apply.

3. <u>Performing Organizations</u>:

A. Lead: U.S. Fish and Wildlife Service (name & address of coordinator) and state fish and wildlife department(s) of state(s) in area of spill (for Mass., contact Matthew B. Connolly, Jr., Director, Mass. Div. Fish & Wildlife, 100 Cambridge St., Boston, Mass. 02202, 617-727-3151).

B. Secondary: local conservation and humane organizations; local scientific and educational institutions; municipal conservation commissions/civil defense departments.

4. <u>Applicable Habitats</u>:

Pelagic; rocky shore; sandy shore; salt marsh; and salt pond.

5. <u>Applicable Conditions</u>:

A. Physical accessibility of on-shore terrain.

B. Permissible accessibility of area (e.g., bombing ranges, hazardous area).

C. Sea state ≤ 4 ft. for water-based collection.

D. Presence or immediate potential presence of birds in subject area.

E. Availability of collection personnel and associated transport.

F. Requirement for specimen disposition.

6. <u>Applicable Oil Type</u>

All types or groups of oils.

7. <u>Time Frame</u>

Duration of spill, plus period during which capturable/ collectible oiled birds continue to appear.

8. <u>Cost</u>:

A. Equipment:

Vehicle, 4x4	- .20 per mile	Nets	- $5-$8 per net
ATV	- $1.00/hr of operation	Goggles	- $5.00 per pair
		Gloves	- $5.00 per pair
Vessel/boat	- $100 per day	Spotlight	- $10.00 each
Shipping boxes	- $1.75 per box	Scale	- $50.00 each
Burlap bag	- .15 per bag	Expendables	- $50.00 each
Plastic bag	- .20 per bag	Utilities	- $250-$500/mo. for facilities

B. Personnel:

PI-$100/day salary, plus $35 per diem
Others-$75/day, plus $35 per diem.

C. Operating Cost for one Month Operation

1. P.I. Salary + cost (1)	$ 4,050,00	
Other personnel (20)	45,000.00*	
2. Vehicles (based on about 6 vehicles, travelling 5,000 mi. at .20/mi O.C.	1,000.00	
Boats (2) (based on $1.00/da/boat)	6,000.00	7,120
ATV's (1) (based on $1.00/hr of operation, at 4 hrs/day)	120.00	

3. Equipment:

Shipping boxes 500x1.75 e	875.00	
Bags, burlap 500x.15 e	75.00	
Bags, plastic 500x.20 e	100.00	
Nets, 12x$5 or $8	60.00	to 96.00
Goggles, 12x$5	60.00	
Gloves, 25x2 = 50x$5	250.00	
Spotlights (on trik) 6x$10	60.00	
Scale	50.00	
Expendables	100.00	

*Based on assumption all personnel are brought in by agency involved. It is likely the breakdown of personnel would include volunteers.

4.	Utilities (heat, tele., elec.)	200.00 to 500.00*
	Rental of collection center (if necessary)	300.00 to 500.00
		58,500.00

9. Equipment Needs/Equipment Available:

A. Truck or utility vehicle, 1/2 to 3/4 ton, 4x4. One per 3-5 mi. shoreline plus one 2x4 or 4x4 truck for central coordinator.

B. ATV/ACV. One per 3-5 mi. shoreline inaccessible by vehicles in (A) above.

C. Collapsible waxed cardboard pheasant shipping boxes, or equivalent. One per bird.

D. Burlap sacks, new or washed. One per bird.

E. Landing net, 8 ft., nylon bag, wooden or aluminum handle. One per collection crew plus reserve supply.

F. Goggles, work goves, elbow length rubber gloves. One set goggles per collection crew and 2 gloves per man plus reserve supply.

G. Spotlight (narrow beam, candlepower). Vehicle-mounted or hand-held. One per truck.

H. Scale, suspension, dial-reading, with pan, 15Kg capacity. One.

I. Plastic bags, heavyduty, approximately 36x18 in. One per bird.

J. Expendables: labels, markers, writing materials, twine, etc.

10. Facilities Needed:

A. Collection point. Enclosed building, seasonally usable, with adjacent parking area, and ample space for processing and temporary storage of live and dead specimens in warm weather. Land line and CB/RT Commo.

*Variable, due to season.

B. Surface vessels: One per shoreline or sq. mi. surface area. Length 18-25 feet, deck working space, enclosed cabin. Smaller craft (whaler) availability as substitution or supplement for equivalent shoal/shallow water/harbor areas.

11. Personnel:

Principal investigator and associates selected from list of performing organizations (see #3) will delegate staff or requisition volunteers from secondary organizations.

A.	Central coordinator (PI)	1
B.	Assistants	1-3
C.	Regional Coordinators	1 per vehicle/boat
D.	Assistants	1-2 per coordinator

12. Support Services

A. Necropsy, histopathological, chemical analyses of impacted or suspected impacted dead specimens. Includes superficial, ingested, and absorbed contaminants.

B. Rehabilitation of potentially recoverable live specimens.

C. Coordination of collection efforts with on-shore and close in-shore surveys of distressed birds.

D. Coordination of collection efforts with on-shore and close in-shore surveys of distressed birds.

13. Payoff:

A. Distressed birds are one of the most, if not the most, visible indicators of disaster in an oil spill. The resultant surge of emotional public response demands equally visible recovery efforts - despite the frequently questionable biological grounds for such efforts. Public support or resistance for all phases of spill studies may be keyed to the favorable or adverse publicity generated by recovery operations.

B. Collection of impacted specimens will provide a known (albeit minimal) tally of bird losses from a spill.

C. Collection of impacted (and control) specimens will provide samples for initiating determination of the physical and physiological effects of oil on birds.

14. Limitations

A. Weather, sea state, and terrain may limit the effectiveness of collection efforts.

B. Collection of live specimens dependent on mobility of live birds, skill of collectors, terrain accessibility, extent of holding facilities, extent of interference by unsolicited help, and degree of predation on distressed birds.

C. Collection of dead specimens is dependent on at sea flotation time, terrain accessibility, and degree of scavenging by predators.

D. Utility of specimens is dependent on preservation facilities for dead specimens, and holding facilities and transport for live specimens.

E. It should be recognized that this method does not necessarily provide an estimate of total loss, but only a tally of known collected losses.

COMMENT ON PRIORITY

Allied projects will depend on this project for the collection and distribution of specimens, e.g., tissue analysis, blood sample collection, etc. Hence, this should be ranked high. This is not to mention the high public relations importance of this type of project.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: Effects of Accidental Oil Spills on Bird Reproduction

2. Project Description:

Effects of contamination on yolk formation, localized in the ring structure of avian egg yolks, are easily distinguishable from other environmental variables and would provide a good diagnostic index of an oiling effect during egg formation. If this can be taken as an exposure index, other data on ovarian and testicular structure and function, embryonic development, hatchability, clutch size, and subsequent growth and survival of young can be related quantitatively to oil exposure. Yolk variation with respect to oil contamination can be quantified in lab experiments and this information later could be applied to field samples to determine the level of exposure. Field samples of birds and eggs, and other data, will be collected during and after the spill throughout the breeding season.

References:

Grau, C. R. 1975. Ring structure of avian egg yolks. Department of Avian Sciences, University of California, Davis.

Grau, C. R. 1977. Altered egg structure and reduced hatchability of eggs from birds fed single doses of petroleum oils. Science (in press).

3. Performing Organization:

C. R. Grau and T. E. Roudybush
University of California, Davis
Department of Avian Sciences

4. Applicable Habitats:

Depends on species impacted.

5. Applicable Conditions:

A. Oil spills impacting on seabirds, waders, or waterfowl.

B. During breeding season.

6. Applicable Oil Type:

All types.

7. Time Frame:

Two months after the end of the breeding season--roughly 3-8 months.

8. Cost:

Salaries	- $4,600
Travel and Per Diem	- $9,000
Lab and Equipment	- $4,000
Total	$17,600

9. Equipment Needs/Equipment Available:

The majority of the equipment is lab equipment in the UC Davis Lab.

10. Facility Needs/Facilities Available:

Possible fixed wing aircraft or helicopter and quarters for field personnel. These could easily piggy-back with other projects and facilities.

11. Personnel Needs/Personnel Available:

A. Requirements

3 field biologists

1 lab biologists

part time Principal Investigator

B. Persons to Contact

C. R. Grau 916/752-3535 office
916/752-1300 dept.
916/753-4349 home

T. E. Roudybush 916/752-1300 dept.
916/758-2626 home

Alice Berkner
International Bird Rescue Research Center
Aquatic Park
Berkley, California

12. Support Services:

    A. Continued laboratory studies of effects of oil on yolk structure

    B. Baseline data on bird reproduction

13. Payoff:

    A. Quantification of exposure

    B. Impact on reproduction related to exposure.

14. Limitations:

    A. Only few investigators/labs capable of doing this.

    B. Does not in itself yield total effect on a population.

    C. Can be done only during the breeding season.

    D. Proven only on geese and laboratory animals--may not work with wild birds.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: Determination of Spill Associated Bird Mortality from Post-Spill Body Counts

2. Project Description:

For assessment of liability and determination of damages in an offshore spill incident, it will be important to know actual spill associated bird mortality. This information cannot be obtained directly by counting dead birds in the spill area, because some bodies will sink or drift away from the spill area. Knowledge of the fate of dead oiled birds and actuarial techniques based on knowledge of currents could provide a means of predicting actual mortality, if current data were available in the spill area.

A. Project Objectives:

(1) Determine floating times for various seabirds oiled with the major oil types, and;

(2) Develop a model and actuarial tables for calculating the mortality given the time of body count, characteristics of the sampling techniques, and basic oceanographic data.

B. Basic Experimental Design:

(1) Floating times of oiled birds
Mallard ducks will be sacrificed, and their feathers oiled with a standard quantity of each of the test oils. The bodies will be placed in a temperature controlled seawater wave tank and tested under the following conditions:

winter temperature and summer temperature
calm, 1 ft. sea and 2 ft. sea

Observations will be made by photographing the tank every 2 hours. When a bird is 1 ft. below the surface, it will be counted as "sunk" and 10 birds/condition will be used.

(2) The statistician and oceanographer will cooperate in developing a computer model which will predict mortality when the following factors are known:

a. area of spill
b. current
c. tides
d. wind
e. number of live birds counted on transects
f. number of dead birds counted on transects
g. sink rate of dead birds
h. other factors to be determined

(3) Verification of the model and sink times will be provided by taking sacrificed, oiled birds on ships of opportunity placing them in a floating "trap" which will be easily visible, and recording rate of sinking over several days.

3. Performing Organization:

Any organization which has in-house expertise in ornithology, statistics, and machine processing of data, and physical oceanography should be able to handle this project. WHOI, URI-GSO immediately come to mind. Expertise in ornithology is the least important aspect.

4. Applicable Habitat:

Primarily offshore

5. Applicable Conditions:

This is primarily a laboratory simulation, so completion is largely a matter of funding and facilities rather than environmental factors. Verification and validation of the actuarial model can be made on ships of opportunity.

6. Applicable Oil Type:

Each of the common offshore cargoes; Crude, #2, #4, #6, Bunker C, would be tested.

7. Time Fram:

Month	Floater Experiments	Simulation Model
1	organization, construction	1&2 construction of
2	of apparatus, securing of specimens	model
3	start of exp.	3--no work
4	exp.	4--no work
5	exp.	5--no work
6	exp.	6--no work
7	field confirmation of model	7--incorporation of floater data writing
8	exp. field confirmation of model	8--
9	reduction of data	
10	writing	
11	writing	

8. Cost:

This estimate assumes a university contract. Industry will be higher.

A. Personnel

P.I. (20k/year) summer salary	$4,200
Oceanographer-engineer summer salary	$4,200
Statistician-summer	$4,200
Technician (full time 9 mos.)	$7,200
Lab helper (full time 9 mos.)	$5,000
	$24,800
Overhead	$14,000

B. Capital Equipment

tank	$5,000*
"trap"	500
	$5,500

C. Supplies

livestock	$900
chemicals	300
glassware	200
misc.	100
	$1,500

*would not be needed if existing one available

D. Computational Time

$1,500

E. Traver-Per Diem for Ship Trials — $400

F. Publication expenses, secretarial, telephone, postage — $500

TOTAL---------------------------$48,200

9. Equipment Needs/Equipment Available:

The primary piece of equiment is a wave tank. Various university mechanical and ocean engineering departments have such tanks, but their availability depends on time of the year, other projects, etc. A tank could be constructed using standard techniques if none were available at the time of the project. A floating "trap" to hold dead birds for the field trials would have to be constructed. Small amounts of glassware, lab supplies, etc., would be needed.

10. Facility Needs/Facilities Available:

See 9 and 2 above.

11. Personnel Needs/Personnel Available:

P.I. full time summer, 1/4 time for 9 months
Actuary-statistician 1/4 time for 6 months
Ocean engineer-physical oceanographer 1/4 time six months
Technician-full time for 9 months
Lab helper-full time for 9 months

12. Support Services:

This project is in support of other project.

13. Payoff:

This project has an immediate payoff in determining much more accurately than now the possible number of birds killed in a spill. Since it is likely that liability judgements will be based on $/bird, this data will be essential in the adjudication process. From a scientific standpoint, knowledge of the fate of dead birds, and an assessment of mortality will help to determine the short and long term impact on populations.

14. Limitations

Limitations include the fact that not all sea and weather states can or will be simulated in the laboratory. The study also will not include considerations of those birds which ingest oil, fly elsewhere and die. What it will do is narrow the confidence limits of mortality predictions.

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: Assessments of the Impact of an Oil Spill on Marine Mammals

2. Project Description:

A. Data Gathering Techniques

(1) Aerial surveys to identify local populations, distributions and relative abundance of marine mammals in the area of a spill.

(2) Shipboard and/or shore surveys as above to confirm involvement of marine mammals and oil

(3) Collection of obviously fouled marine mammals for necropsy or physiological sampling and debilitated animals for rehabilitation and release.

(4) Tagging of effected but otherwise healthy appearing animals (includes use of radio tags and tracking and photographic identification of individual animals.

B. Cleaning of Oiled Marine Mammals

(1) Initiation of clean-up operations

As oiled marine mammals are identified, efforts should be made to clean affected individuals. As yet, there is no established method for removing oil from various impacted animals. A methodology should be delivered and recommended for implementation in the event of a spill which affects marine mammals populations.

(2) Monitoring of clean-up acitivities

Since clean-up operations have never been conducted on N.E. marine mammal populations in connection with an oil spill, effects of the clean-up operation itself should be carefully monitored. This involves investigating:

(a) the effect of cleaning and no cleaning agent on individuals and;
(b) effect of overall clean-up activities on population and community structure, and

(c) habitat utilization.

With respect to the effects on the individuals, cleaned animals should be tagged so that subsequent monitoring phases can lead to the determination of the apparent success of employed cleaning operations in terms of the survival of cleaned individuals.

In the case of the cleaning operation's effects on the community as a whole, inter and intra-population associations should be observed to investigate any behavioral modifications associated with human intervention.

The redistribution of populations associated with oiled habitat should also be observed and changes in habitat utilization noted.

C. Anticipated Results

(1) Can or do cetaceans avoid spills?

(2) Acute and chronic impact of oil contact and/or ingestion on marine mammals

(3) Behavioral modifications of impacted cetaceans with respect to:

(a) Mother/pup interation
(b) Selection of haul-out sites and rookeries
(c) Are there adverse thermoregulatory effects on neonatal seals?
(d) Demonstrations of physiologic or histologic changes in oil impacted marine mammals.

Without long-term control studies on the effects of oil on marine mammals, oil spills will provide the only source of data on such effects.

3. <u>Performing Organizations</u>:

College of the Atlantic, S. Katona-Census and behavioral Aspects

NEA, Prescott-All Aspects

URI, Winn/Dunn-Physiology, behavior, census, tagging

WHOI, Watkins-Tagging/census

NMFS, Woods Hole, John Nichols

ERCO, Boehm-Hydrocarbon analysis

Univ. of Maine, Gilbert-Census/tagging/behavior

4. Habitats Applicable:

   All but benthic. Because of mobility and species specific behavior temporal requirements must be considered.

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

8. Cost:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

PANEL: BIRDS AND MARINE MAMMALS
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Summary of Birds and Marine Mammals for Offshore Oil Spills

2. Project Description:

Objectives: Attempt to determine species composition, relative abundance, distribution, and proportion of each species of bird and marine mammal that is visibly contaminated with oil in the area of the spill.

A. Birds

(1) Determine species composition, abundance, and distribution of birds in area of spill using a fixed-winged aircraft flown over a pre-selected grid, so as to randomly sample bird populations present on the contaminated and adjacent areas. Technique involves using 2 observers and 1 recorder in a fixed-winged twin engine hi-wing aircraft flown at 100 feet above sea level at 100 mph. All birds within a 300m transect will be counted by species for 10 minutes.

(2) Determine percent of each species that is visibly contaminated with oil, using 10-minute counts of the total number of each species within sight of the ship (Brown et al., 1975-Atlas of eastern Canadian seabirds, and MBO cruise reports-unpublished data). The ship must be moving at least 4 knots and on a fixed course.

(3) Determine by bird species the degrees (i.e., lights medium, or heavily oiled) of plumage oiling and areas of body affected (i.e., nape of neck, breast, belly, etc.)

B. Mammals

(1) Using a fixed-winged aircraft (probably that used for Coast Guard surveillance flights) marine mammal sightings will be made at 500-1000 feet to make species counts (techniques used in Tropical E. Pacific Tuna and Porpoise study of NMFS and California Bight Study by BLM).

(2) Sightings from surface vessels will be made to determine:

(a) evidence of direct contact and coating of oil

(b) interference with normal swimming or feeding behavior

(c) obvious avoidance on attraction to spill area

3. <u>Performing Organization</u>:

A. Birds

(1) Manomet Bird Observatory
Kevin Powers
Brian Harrington
617/224-3559

(2) University of Rhode Island
Dr. Frank Heppner
401/792-2372

(3) College of the Atlantic
Dr. William Drury
207/288-5015

B. Marine Mammals

(1) College of the Atlantic
Dr. Steve Katona
207/288-5015

(2) New England Aquarium
John Prescott
617/742-8830

(3) University of Rhode Island
Dr. Howard Winn
401/792-6251

(4) Woods Hole Oceanographic Institution
William Watkins
617/548-1400

(5) National Marine Fisheries Service (Woods Hole)
John Nicholas
617/548-5123

4. Applicable Habitats:

Offshore only.

5. Applicable Conditions:

A. Aircraft - VFR marine mammals
Sea state $\leq$ 6 ft-birds
- additional base line data helpful (i.e., prior surveys or assessments of species composition and relative abundance in past years within the study area).
- Accessible air space, i.e., not restricted areas
- rapid response before spill, if possible.

B. Surface vessels

- platform availability (i.e., will appropriate vessels be available)
- oil detectable from air or will be if uncontained

6. Applicable Oil Type:

All oils or groups of oils.

7. Time Frame:

A. Duration of spill, plus 2 weeks after spill is no longer detectable by aircraft.

B. Data analysis within 3 months.

8. Cost:

A. Aircraft-Marine mammals - may be USCG aircraft
Birds-$1000 per day (based on 10 hour day and 1 day needed to cover study area)
1 surveillance flight per week desired

B. Surface Vessels - range $500-$3000 per day
mean-$1750 per day
(10 days on study area per month desired)

C. Personnel

(1) Aircraft-marine mammals - 2 observers per flight
birds - 2 observers and 1 recorder per flight

(2) Surface vessels-marine mammals and bird observers should equal 2 people per ship.
(3) Exact cost of Manomet Bird Observatory observer=$100 per day (includes salary, ($12k/yr) and 57% overhead) - does not include travel expenses, food, per diem, etc.

D. Equipment (may sometimes be provided by certain institutions or agencies, but for this project proposal it is assumed that the NRT will provide necessary equipment).

(1) Photographic - $2000 per kit
1 kit includes: SLR 35-mm camera with motor drive and data back; 200-400mm zoom lens with gunstock attachment; 10 rolls @ 36-exp Tri-X film; 10 rolls p 36-exp Plus-X film)
(one kit needed per aircraft and surface vessel)
(2) Tape recorders-cassette @ $75
(3) Optics-1 pair 8x40 Swift W.A. binoculars or comparable item per observer.
(4) Expendables-$1000 for film processing

E. Automatic Data Processing of Bird Information

(1) Key punch and statistician's time grossly estimated at $1500

F. Phone, Xerox, etc. (if University based study) costs grossly estimated at $500.

G. Principal Investigator

Salary range: $15,000-$25,000 per year, Mean: $20,000 per year

Consulting rates based on USFWS Scale = $\frac{\text{salary per annum}}{260}$ = $77.00 per day

Based on one month duration oil spill and three months data analysis and report writing--4 months (20 working days per month) x $77.00 = $1,540 + P.I. at 25% of time for 3 additional months = $1,155.00.

Total Principal Investigator Cost: $2,695 per spill

9. Equipment Needs/Equipment Available:

As this project is largely observation oriented, little equipment will be required beyond optical and recording materials. One kit with the following materials will be required for each crew (aircraft or ship):

- single lens reflex camera back w/motor drive
- 200-400mm zoom lens w/gunstock attachment
- cassette tape recorder w/tapes
- 8 x 40 wide angle binoculars.

All these materials are potentially available through the appointed institutions, but are not guaranteed to be accessible at the moment of a spill. Kits should therefore be prepared in advance.

10. Facility Needs/Facilities Available:

Facility needs amount to aircraft and ship transport. The marine mammals aerial survey may dovetail with Coast Guard overflights and IR studies of the spill or operate on a timesharing basis with the bird surveys.

A. Aircraft- (1) highwing, $\overline{>}$ 2 engines, auxphilions preferred, VFR/IFR, deicing, communications, and navigational capability appropriate to pelogic survey, room for two observers, recorder, and pilot.

B. Surface Vessels - (3) ships of similar design or observational capability, range and construction suitable to open ocean work in poor sea conditions for 10 day minimum, hoists and nets for salvage and tagging capability, berths for at least two observers.

11. Personnel Needs/Personnel Available:

The principle investigator(s) and associates chosen from the list of performing organizations (See 3) will delegate staff for the project.

12. Support Services:

Relevant studies would include tagging programs, additional base line population research and any work petaining to clarification of impacts on lower units of food chain supporting these top carnivores. These studies could be undertaken concurrently and/or outside the time frame of the spill.

13. Payoff:

This study provides the capability to clearly respond to public sentiment regarding impacts on wildlife. More specifically it addresses:

A. Short-term impact on wildlife at the spill site.

B. Behavioral alteration of a gross nature, i.e., avoidance of or attraction to a slick, flight or swimming difficulties as a result of fouling.

C. Valuable supplement to the available population assessments--collect specimens under stress conditions.

14. Limitations:

A. Lack of baseline date. The strongest recommendation made by this panel is for more hard data on the 'normal' populations in the U.S. Northeast Atlantic. This requires expensive and long-term studies.

B. These populations are highly mobile. Even with the best base line data in hand, a reduced population cannot be regarded as a certain response to stress.

C. Weather and sea state may severely disrupt the effectiveness of the project.

D. The extrapolation of observed species counts (or numbers of animals impacted) to population estimates may be inadvisable in some cases--especially with regard to population of great whales for which diving times and repeat sightings still constitute difficult statistical complications.

E. Initial counts of impacted birds may be extremely misleading. Oiled birds may die and sink before being counted or may retreat from the area following fouling or infection only to die outside the observation area (note Project No. 5, Birds and Marine Mammals).

Cost predictions for this project should be considered unreliable in light of the fact that most if not all of the equipment and facilities required can be "piggybacked" with other work by Coast Guard and research groups.

CHEMICAL ANALYSIS AND FATE PANEL

Participants

W.D. McLeod, Jr., Chairman

W. Andrade	E.J. Hoffman
P. Boehm	G. Keineberg
R. Ceurvels	J. Lakes
P. Gearing	G. McLeod
R. Hiltabrand	P. Rogerson

M. Wilson

CHEMICAL ANALYSIS AND FATE PANEL

General Considerations and Recommendations

- General Discussions
- Panel Results
- References

GENERAL DISCUSSIONS

A. Findings

The Panel made the following initial findings and recommendations:

1. The panel accepted the current analytical chemical methodology as practiced throughout New England.

2. Sufficient laboratory capabilities are available throughout New England to meet the needs of any likely combination of oil spill damage assessments. ERCO (Cambridge, MA) appears to be in the best position to offer prompt large sample processing capacity (100's). Others such as EPA and U.R.I. (Narragansett, RI) and NOAA's National Analytical Facility (Seattle, WA) may be able to respond similarly depending on the circumstances, whereas the EPA (Lexington, MA) and New England Aquarium (Boston, MA) probably could handle only 10-20 samples. The Coast Guard Center (Groton, CT) may be too occupied with their own chemical analyses to participate except in an advisory role.

3. Initial chemical analytical surveying of the oil spill affected area should be done, if possible, by the Coast Guard's UV fluorescence method. The panel recommends that a mobile field analysis capability (lab-van, research vessel) be established and maintained in New England for rapid response to oil spills.

4. Preliminary sample analysis cost estimates:

   a) UV fluorescent screening: $50/sample

   b) Extraction, chromatography, gas chromatographic analysis, GC/MS backup: $350-500

5. Recommend establishment of a committee of regional oil spill chemists who can be immediately consulted in the event of an oil spill. One committee member should represent these chemists on an inter-disciplinary Technical Advisory Committee to the RRT/OSC. This chemist/representative should be accessible to the RRT/OSC to assist in immediate judgments on initial actions following an oil spill.

A significant point remained largely unresolved throughout our proceedings: the concept that during this workhop, realistic cost-effective, detailed chemical analysis projects could be devised collectively to assess ecological damages resulting from oil spills according to size, oil type, habitat, weather, season, climate, etc. [Only one panel member attempted to address this issue.] Instead, this panel has devoted its efforts to elaborating information on the capabilities of key analytical laboratories, the prompt availability of chemical consultants, the preferred analytical methodology, and some general advance preparations to be made, such as acquisition of field analysis and sampling equipment. Additional information and specifications can be introduced during review of the draft report. Successful synthesis of these materials into an overall program will be a most important factor.

B. Assignments

The following individual assignments were made to individual panel members for further development at the workshop:

1. Preliminary assessment of chemical analyses needed by other panels.

2. Special research opportunities afforded by oil spills.

3. Delineation of likely demands on chemical analyses with regard to:

   a) immediate emergency response to determine initial nature and extent of spill

   b) environmental damage assessment, intermediate and long term.

4. Elaboration of the role of a proposed "on-scene chemist," as part of an interdisciplinary Technical Advisory Committee available to the OSC.

5. Description of sample preservation and distribution procedures.

6. Design questionnaire to inventory chemical analysis and research capability applicable to New England oil spills.

7. Description of limitations to chemical analyses, i.e., what consequences could be expected of chemical analyses, what should not be expected; discuss some aspects of sampling strategy.

RESULTS

A. Chemical Analysis Needs of Other Panels

Table 2 gives the results of needed chemical analytical capabilities of other disciplines represented at the Hartford Workshop.

B. Identification of Existing Capabilities

An inventory of all organizations having equipment and personnel capable of petroleum hydrocarbon analyses will be made and oil spill research teams and ongoing oil-spill research of these organizations will be identified. This survey will be conducted by Dr. Mason P. Wilson of U.R.I. As example of an applicable questionnaire is shown in Table 3.

It is recommended that an advisory panel consisting of representatives from major oil-spill research teams and organizations in Region I be formed. This team will help coordinate the scientific investigation of the spill and serve as an advisory panel at the request of the OSC. It is important to use Regional personnel whenever possible because of their expertise of the area. Compensations and per diem could be used as an incentive for continued participation of individuals not in the federal government employ.

C. Recommended On-Scene and Advisory Support

1. Interdisciplinary On-Scene Committee

These are scientists who respond immediately to a spill. They are "on call" and respond when someone in authority activates the plan. As a minimum a chemist and a biologist might be called, but for a large spill more disciplines should be involved. These people are there to help the on-scene coordinator and to coordinate and integrate any of

TABLE 2

ANALYTICAL CHEMISTRY NEEDED IN SUPPORT OF
AND
BIOLOGY PHYSICAL PROGRAMS

Requested task (UV-fluorescence)	Panel requesting this analysis	Estimated number of analyses*
Determination of areal extent of sediment contamination through screening (UV fluorescence) of sediments collected in potentially impacted areas	Benthic biology Lab toxicity Microbiology	200†
Determination of concentration of HC's in the water column as a function of depth location and time by screening (UV-fluorescence)	Water column Lab toxicity	2000†† (50†)
Determination of concentrations of HC's in tissue samples by screening (UV-fluorescence)	Water column	1000†† (100†)
UV fluorescence or I.R. monitoring of HC levels in tanks used in lab toxicity experiments (UV-fluorescence or IR)	Lab toxicity	50†/tank (est † = 5 tanks)

*This obviously depends highly upon habitat, size of spill, etc.

†Chemist estimate.

††Biologist estimate.

TABLE 2 (Continued)

Requested task (G.C. and M.S.)	Panel requesting this analysis	Estimated number of analyses
Changes of oil chemistry as a function of time in the sediment	Microbiology Benthic biology	50†
Vertical distribution of oil in the sediments - chemical variations with depth	Benthic biology	50†
HC composition (quant. & qual.) in tissues of selected key organisms	Benthic biology Lab toxicity Histopathology Water column Marine mammals	20† 20† 20† 100†† (20†) 20†
Polynuclear aromatics in water column esp. if spill in subtidal area	Benthic biology	5-10†
HC composition of oil in gut contents and on feathers of oiled birds	Marine mammals and birds	400††(20†)
HC levels in bird tissues	Marine mammals and birds	20†
G.C. monitoring of HC composition in lab toxicity expts.	Lab toxicity	5†/tank (est† = 5 tanks
HC levels in tissues of lab experiment organisms	Lab toxicity	100†
HC compositional changes as a function of time in sea slicks	Microbiology	20†
HC compositional changes as a function of time in benthic infauna	Microbiology	50†
Cargo oil complete analysis	All	5†

TABLE 2 (Concluded)

Requested task (G.C. and M.S.)	Panel requesting this analysis	Estimated number of analyses
Dissolved O_2, S $^o/oo$ nutrients	Water column	50†each
Mixed function oxidases	Bird and mammal	20†
Blood chemistry parameters	Bird and mammal	20
Cargo oil	Physical group	
pour point		2†
density as function of weathering		10†
surface tensions		20†
composition of emulsion forming oils versus non-emulsion forming oils		5†
Compositional changes of slick - water column during use of dispersants	Physical group	20†
Quality assurance analyses	All	20†
Blanks		10% of total†

TOTALS

	Chemist estimate	Biologist estimate (when not specifically given the chemist est is used).
UV-fluorescence	350	3200
i:r	250	250
G.C.	430	910
G.C. - M.S. (10% of G.C.)	40	90
Other	370	370
Blanks	50	50
Grand Total	1490	4870

TABLE 3

CHEMICAL/FATE QUESTIONNAIRE

Name *Dr. Wm. D. MacLeod* Alternate *Donald W. Brown*

Address & Organization:
NOAA National Analytical Facility
2725 Montlake Blvd., East
Seattle, WA 98112

Address & Organization:
same

Bus. Phone (206) 442-4240 Bus. Phone ( ) *same*

Sponsoring Agencies: *NOAA/National Marine Fisheries Service; also EPA, BLM etc.*

Analytical Equipment: If more than one insert number

Infrared *1*

Gas Chromatographs
packed column *1* glass capill. *3*
mass spec. *2*

UV Fluorescence *1*
Type *dual offset scan, fully corrected*

Micro-balance *2*

General Description of Extraction Techniques
See Appendix A of NOAA Technical Memorandum ERL MESA-8 forwarded separately.

Type of Samples Analyzed: Sediment *yes* Tissue *yes*
Seawater *yes* Tar balls *yes*
Cargo *yes* Other (specify) ______

Other Lab Capabilities: Ecosystem tanks, weathering, etc.
High performance liquid chromatography: 2 instruments, one automated UV fluorescence HPLC detector

TABLE 3 (Concluded)

Field Work Capabilities (sediment, water column, surface, etc.)

Can place 1-2 experienced field chemists at the oiled site within a few days.

Response Capabilities:

(1) How many people can you muster in 24 hours?

a) to obtain samples: *Possibly 1-2 New England NMFS chemists or biologists*

b) to analyze samples: *4 chemists*

(2) Do you need sponsoring agency approval?

X Yes * ____ No * *Also require authorized funds*

(3) Are you part of an oil spill research team?

X Yes ____ No

(4) If so, can the whole team respond?

____ Yes *x* No

(5) What is the expertise of the team?

State of the Art analyses of marine environmental samples for trace contamination by oil. Employ glass capillary GC, GC/MS, HPLC and UV.

(6) Are there other people or laboratories in your organization that can respond? *Yes, Robert C. Clark, Chemical Oceanographer, NMFS/Seattle*

____ Yes ____ No Please Identify:

(7) Under what conditions can you respond? (or cannot respond)

We can and will respond to all U.S. jurisdictional major oil spills, unless the NOAA NAF staff is fully committed to other projects.

the specific scientific studies that become activated. There should be a mobile laboratory (the old EPA trailer?) stocked with sampling gear, containers and the other stuff necessary for the field support effort. It should also be equipped with enough instrumentation like UV-fluorescence and/or IR so that samples could be analyzed in the field. This will give the on-scene coordinator and the biologists the knowledge of where the oil is and where it is not.

2. Advisory Groups

On support of each discipline activated in the on-scene committee, there should be a regional group of experts on whom the committee members could call on for help and advise. For example, the hydrocarbon chemists in New England would organize into a committee which would meet periodically. They would be available to the responding chemist to hlep him with whatever problems come up. This same mechanism can be set up for the biologists, physical process people, and whomever else it would be appropriate for. This gives a mechanism whereby almost everyone in the area working with oil could be called into a spill if needed.

D. Sampling Considerations

The sample strategy to be utilized for sampling oil-impacted environments is adequately covered in "An Oil Spill Sampling Strategy" by Woollcott Smith. While that note outlined the best procedure to be utilized in an oil-spill event, several comments on its content arose our panel discussions. The group appears to be in general agreement with Smith's conclusions that a grid pattern of sampling covering the entire area is best, that ancillary information should be obtained, and that the size of the grid survey should be determined by the cost and manpower available rather than by the cost of analyzing the samples. However, several considerations were not addressed by Smith and he raises several interesting questions which seem best handled by pragmatic decisions by an on-scene chemist:

1. If numerous samples are taken, how will they be transported and where will they be stored to avoid decomposition and/or degradation?

2. Smith's last paragraph speaks to the inability of oil-spill surveys to assign a direct or indirect causal relationship between the oil spill and differences observed in the survey. He then states that "One must turn to scientific results from controlled experiments on the effects of oil to show the probable relationship between the impact of oil on the survey area and the

results of the survey analysis." It seems, then, that without the necessary back-up of data from controlled laboratory tests on effects of oil on organisms (which do not presently exist) that oil-spill surveys have very limited value.

3. Experience in oil-spill situations has shown that oil often distributes in a patchy manner; large differences in the concentration of oil are seen on both the large scale and the small scale. It seems that to survey the extent and concentration ranges of an oil-spill-impacted environment that tremendous numbers of samples (a far finer grid sampling pattern) must be taken, stored, and analyzed.

4. Smith states that "the control area should include sediment and water depths similar to the affected area." Oil spills may be extensive and it may be difficult to find suitable control areas within many miles (e.g., Chesapeake Bay Spill). Do the control areas then, contain similar sediment and environmental characteristics as the impacted areas?

These are four points that emphasize the need to preserve the freedom of action of the on-scene chemist to direct the field sampling operation. Unfortunately, this may mean that a statistically valid program is not possible. However, it is apparent that legal action must commence without the necessary back-up of a direct or indirect causal relationship between the oil spill and differences observed in the survey. Therefore, our best and most practical effort (as directed by the on-scene chemist) to survey oil-impacted areas must suffice.

E. Sample Preparation and Chain Custody

Sediment, biological, and water samples collected at a spill site should be distributed by a central regional laboratory and the transfer of these samples should be accompanied by a chain of custody record similar to the one recommended by the Coast Guard.

Preparations should be made in advance to store sampling equipment where it can readily be available during an emergency. All samples collected should be preserved or extracted immediately upon collection. Mobile facilities should be available for this.

REFERENCES

The following reports were submitted with the panel report or otherwise identified:

1. Research by NOAA National Analytical Facility, Environmental Conservation Division, Northwest and Alaska Fisheries Center.

2. A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Riget Sound and Strait of Juan de Fuca. W.D. Macleod, D.W. Brown, R.G. Jenkins, L.S. Ramos and V.D. Henry. NOAA Technical Memorandum ERL MESA-8. November 1977.

3. Energy Resources Company, Inc. Oil Spill Response Capabilities. ERCO, Cambridge, MA.

4. Bowdoin College Hydrocarbon Contamination Research Center.

5. Techniques and Proposals/USGS Contributions to Overall Ecological Damage Assessment. Compiled by F.T. Manheim. August 1977.

6. U.S. Coast Guard Oil Spill Identification System. NTIS publication (available in near future). Documents also may be available on: "Sampling, Sample Handling and Chain of Custody Procedures" (as soon as published). Manuals on "Field Thin-Layer Chromatography Method for Oil Identification" and "Field UV Fluorescence Spectroscopy Method for Oil Identification" can be made available, from: U.S. Coast Guard R&D Center, Groton, CT.

CHEMICAL ANALYSIS AND FATE PANEL

Recommended Projects

1. The physical-chemical weathering of oil at sea.
2. The physical-chemical weathering of beached or stranded oil.
3. The chemical fate of biologically assimilated oil.
4. The monitoring of aryl hydrocarbon hydroxylase enzyme system in sessile teleost fish and selected benthic infauna.

PANEL: CHEMICAL ANALYSIS AND FATE
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: The Physical and Chemical Weathering of Oil at Sea

2. Project Description:

   To study the changes in hydrocarbon and non-hydrocarbon (NSO compounds) composition of (1) the spilled oil, (2) of the adjacent water, and (3) of the air mass.

   We do not know how spilled oils partition and are altered immediately following a spill. Weathering studies have never addressed the combined questions relating to hydrocarbon as well as metabolite (i.e., phthalates, fatty acids, phenols) chemistry. The bacterial metabolites and photo-oxidation products are more soluble and potentially more toxic than are the hydrocarbon compounds.

   The study to be carried out by continually sampling a given patch of oil, monitoring the water below and air above the patch, thereby establishing a realistic mass balance.

   This information, in addition to being fundamental to our chemical understanding of oil spills, is essential for toxicological investigations and links to microbiological degradation studies and physical processes.

3. Performing Organizations:

   Woods Hole
   U.R.I.
   ERCO

   Probably these three groups will have to interact closely. All three have seagoing oceanographers and sampling capability. ERCO seems well equipped to handle large sample numbers. However, U.R.I. probably has more experience in air sampling (C. Brown, J. Quinn).

4. Applicable Habitats:

   Pelagic, salt pond, estuarine

5. Applicable Conditions:

   A. All spilled oil containers.

   B. Weather conditions must permit accurate sampling as far as depth under oil slick.

6. Applicable Oil Type:

   All, although fuel oils and light crudes are more apt to results in good data sets due to more rapid dissolution and evaporation rates.

7. Time Frame:

   Start immediately and continue as long as oil mass can be traced; probably on the order of a week to several weeks. Sample every hour, perhaps.

8. Cost:

   Analytical ≅ 25,000

   Ship Time ≅ 15,000 (time shared with other groups)

   Total Cost ≅ 50,000 (open ocean)

   ≅ 30,000 (near shore)

9. Equipment Needs/Equipment Available:

   A. Sampling bottles (Bodmans, Niskens)

   B. Air sampling gear

   C. On-board sample extraction capability

   D. Sample containers

   E. GC and GC/MS; IR capability

10. Facility Needs/Facilities Available:

   A. Ship or small boat

   B. Analytical lab

11. Personnel Needs/Personnel Available:

A. Presently available to ERCO, URI, WHOI

B. Immediate response needed

ERCO can respond immediately, others later

12. Support Services:

Physical process group must interact.

13. Payoff:

Our knowledge of chemical alterations of spilled oil is meager. This knowledge is fundamental to any ecological assessment.

14. Limitations:

A. Good sampling weather is needed.

B. Good analytical schemes in identifying especially non-hydrocarbon secondary products is essential.

PANEL: CHEMICAL ANALYSIS AND FATE
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: The Physical-Chemical Weathering of Beached or Stranded Oil

2. Project Description:

An immediate and long-term study following the chemical changes in stranded oil and the chemical recovery of a given environment.

It is carried out by sampling polluted shoreline substrate as well as tarry residues from beached oil. Also, short cores should be taken.

This includes hydrocarbon as well as NSO compounds.

Ref: Blumer: The Environmental Fate of Stranded Crude Oil (Deep Sea Research?)

3. Performing Organizations:

ERCO
WHOI
URI
Bowdoin
EPA/Narragansett
NOAA NAF

4. Applicable Habitats:

Applies to any habitat where oil has reached the bottom or shoreline, excludes pelagic habitats.

5. Applicable Conditions:

All conditions applicable although offshore bottom would pose problems in rough weather.

6. Applicable Oil Type:

Any oil type applicable.

7. Time Frame:

Start immediately. Sample daily for 2 weeks; then weekly for 6 months; then monthly for 5 years.

8. Cost:

$\cong$ 100 samples x \$500 = 50,000

onshore sampling = 5,000

offshore sampling = 50,000

Total = 55,000 - 100,000

9. Equipment Needs/Equipment Available:

- GC, GC/MS
- Grab sampler on hand-held beach corers
- Available soon after spill; however, immediate analyses not needed
- Jars needed

10. Facility Needs/Facilities Available:

A. Onshore: sampling and analytical equipment and instrumentation

B. Offshore: small or large boat depending on distance offshore

C. Facilities are available on short notice

11. Personnel Needs/Personnel Available:

Personnel are available on short notice from universities, from private contractors (ERCO) and NOAA NAF.

12. Support Services:

Must interface with microbiology program and benthic biologists.

13. Payoff:

A. Short and long-term weathering of stranded oil, from both the hydrocarbon and non-hydrocarbon perspective, is sorely needed using glass capillary GC.

B. Can relate chemical changes directly to changes in microbial and faunal populations.

14. Limitations:

Must carefully select sampling areas and preserve them from disturbance (i.e., cleanup operations).

Offshore station revisitation may be tricky and sediment resuspension and physical disruption of study may occur.

PANEL: CHEMICAL ANALYSIS AND FATE
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: The Chemical Fate of Biological Assimilated Oil

2. Project Description:

This project is designed to trace the chemical changes that occur in biological assimilated oil over a long period of time. Clean organisms, shellfish (Mytilus or Mercenaria), are kept in a controlled area (lab or field) and are completely characterized chemically. After a spill, and as oil approaches land, these organisms are either marked or are put in cages and deployed near shore before the oil's landfill.

The initial chemical uptake of oil is monitored by sampling this deployed population; subsequent samples reveal further uptake, degradation or depuration for the months following the landfill or oil. Individual tissues should be monitored chemically and histopathologically throughout the study.

Ref: D. Salvo et al: Environmental Science and Technology (1975?)

3. Performing Organizations:

A. Biological Deployment

MBL
Taxon
URI

B. Chemical Analysis

ERCO and/or NOAA NAF
URI

4. Applicable Habitats:

oyster-mussel reef
rocky shore
salt marsh
salt pond
clam flat

5. Applicable Conditions:

A. All conditions applicable. In fact, this experiment is designed for massive dosing (direct) or indirect via the water column.

B. Need controlled, chemically-characterized organisms.

6. Applicable Oil Types:

All types of oil could be studied.

7. Time Frame:

Starts immediately before landfall and can continue for several years. Should sample immediately and continue weekly for 2 months, then monthly for 5 years.

8. Cost:

A. Modest total cost = $50,000 - 75,000

B. Analyses, deployment and maintenance of test animals

Analyses	= 50,000
Maintenance deployment	= 10,000
Test animal maintenance	= 10,000

9., 10., and 11. Equipment, Facility, Personnel Needs/Availability

A. Need facility for storing animals prior to deployment; flow-through tanks, etc. (N.E. Aquarium; URI). Personnel for deployment (URI); perhaps small boat for deployment (URI);

B. Analytical equipment (GC, GC/MS) and large facility (ERCO, URI, Bowdoin).

12. Support Services:

Must interface with histopathologists. Individual tissue analyses essential.

13. Payoff:

This is a very critical type of study. Chemical impacts and histopathological studies for the first time can be interfaced and cause-and-effect relationships established under careful monitoring of these deployed animals. Behavioral and biochemical responses of adjacent communities then can be more fully understood.

14. Limitations:

Animals may not react naturally in cages; therefore, marking organisms and deploying them in a marked area may be necessary.

PANEL: CHEMICAL ANALYSIS AND FATE
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: The Monitoring of Aryl Hydrocarbon Hydroxylase Enzyme System in Sessile Teleost Fish and Selected Benthic Infauna (e.g., *Nephtys*)

2. Project Description:

The AHH system has been studied recently by Gruger et al (Bull. of Environ. Cont. and Toxicol.) and Payne (Science, 1977). AHH activity is induced by exposure to polynuclear aromatic hydrocarbons. Assaying for this enzyme can be of great importance in assessing subtle impacts of spilled oil and may precede more important and obvious effects.

3. Performing Organizations:

   A. Chemical Analysis: Environmental Conservation Division, NMFS/Seattle

   B. Sampling: NMFS/Woods Hole

4. Applicable Habitats:

All habitats where appropriate species are available.

5. Applicable Conditions:

All conditions; this may be a good indication of oil dispersion and the extent of impact of a certain spill event.

6. Applicable Oil Type:

Better for large quantities of aromatic hydrocarbons (e.g., fuel oil, Venezuelan crude), but can apply to all spill events.

7. Time Frame:

Days to several weeks; the exact time frame is unkown. Research has not yet indicated the response lag of the enzyme system to PNA stress.

8. Cost:

$25,000 - 30,000 (80-100 assays at $300 apiece)

9. and 10. Equipment, Facility Needs/Availability:

A. Needs:

Trawling and dredging for fish and invertebrates

Ship for trawl/dredge operations

Analytical facilities - enzyme assay system

B. Facilities that may assist:

NOAA/Seattle - E. Gruger

ERCO - P. Boehm

EPA/Narragansett - G. Jackem

11. Personnel Needs/Personnel Availability:

Shipboard for sampling and lab technician. Should be readily available.

12. Support:

Should correlate with chemical analyses of PNA and histopathology.

13. Payoff:

May be the pollution monitoring mechanism that we need to spot early biochemical changes in marine systems exposed to oil (PNA).

14. Limitations:

Enzyme may be activated by PCB and other aromatic compounds as well. More lab research is needed to complement field studies.

PHYSICAL PROCESSES PANEL

Participants

J.A. Galt, Chairman

R. Beauchamp
P. Cornillon
W. Grant
C. Griscom
Capt. K.M. Palfrey
C.E. Parker
A. Pollack
J. Ripp
M. Spaulding
R. Wright

PHYSICAL PROCESSES PANEL

General Information

- Background Considerations
- Specific Subjects Areas

BACKGROUND CONSIDERATIONS

A. Role of Physical Processes Research

Initial discussion centered on the role of physical processes studies in the general assessment problem and for the tatical support of the on-scene-coordinator. It was agreed that physical processes studies should be thought of as supportive and carried out as a sequence, passing on distribution data to aid in cleanup, operational planning, and selection of sites for detailed biological study.

Spill Description

Physical movement and dispersion

Populations at risk — Tactical support to OSC

Effects and damage

Cost and evaluation of alternatives

B. Products of Physical Processes Research

Information needed as products from the physical processes studies will be descriptions of the oil distribution in time and space including: 1) form the oil is in, 2) composition of the oil, and 3) concentrations. These data will establish appropriate areas to study impact as well as control sites. They should also result in environmental forecasts and estimates of the effects on distributions of possible clean-up actions (burning, emulsification, etc.). A question was raised with regard to physical forecasts for models of biological distributions (mixed layer depth and compensation depths for example?)

C. Pertinent Physical Processes

Dominant physical processes were discussed in terms of four general areas:

1. Advection

   - geostrophic flow
   - Ekman flow
   - wind drift/wave drift
   - tides
   - shelf waves/eddies
   - longshore drift
   - sediment transport by waves
   - estuarine flow
   - river flow

2. Mixing

   - spreading
   - mixed layer dynamics

     - wave compression
     - Langmuire cells
     - turbulence

   - waves
   - chemical dispersion

3. Sources and Sinks

   - spill definition
   - evaporation
   - sinking
   - incorporation with sediments
   - oxidation

     - burning
     - photo
     - biological

   - clean-up
   - ice
   - biological transport

4. Oil Associated With Sediment

   - residence times and transport descriptions
   - sediment fluxes and oil particle interactions
   - bioturbation
   - biodegradation

It was agreed that these processes largely covered the subject and that for any particular area and source, a fraction of these may be dominant. Basically these represent the framework in which the projects can be developed.

D. Initial Project Areas

An initial list of projects to be considered was as follows:

(1) meteorological observations
(2) mapping of oil spills
(3) trajectory forecasting/hindcasting
(4) thickness, distribution and form forecasting
(5) vertical distribution and accommodation description
(6) particle and oil interactions
(7) biological interactions
(8) Lagrandian measurements
(9) Current meter mooring experiments
(10) bottom boundary layer studies
(11) characterization of oil in sediment resident times

SPECIFIC SUBJECT AREAS

A. Catalogue of Embayments and Development of Current Algorithms

Particular publications have been, or are near completion which address a catalogue of embayments. The following publications specifically address the Atlantic Outer Continental Shelf and the associated near-shore areas. Funds for these literature summaries have been provided by BLM.

Update of the Institute of the Gulf of Maine's (TRIGOM) report on environmental information from the U.S./Canadian Border to Cape Hateras, N.C. The study is being conducted by the Center for Natural Areas (CNA) presently located in Washington, D.C. Principal contact for this study is Mr. Ned Sherston. Expected completion date is October 1977. Approximately 50 copies of the report will be available at the BLM New York OCS Office at the World Trade Center, New York City. BLM contact is Dr. Arthur Horowitz (212/264-2401).

The Institute of the Gulf of Maine (TRIGOM) completed a Socio-economic and Environmental study from the U.S./Canadian Border to Sandy Hook, New Jersey, in June 1974. This 8 volume report is also available at the BLM New York OCS Office. BLM contact is the same as above.

B. Development of Regional Reference Document

In addition to the studies described above, the following BLM sponsored study programs will also have input to the development of a regional reference document:

- U.S. Geological Survey ongoing program dealing with chatterer sediment mobility and suspended sediment flux on the Georges Bank region. This program also includes water column hydrography (surface, subsurface and bottom current studies). Report is expected to be completed in April 1978. Principal contact is Dr. David Folges of USGS, Woods Hole, Massachusetts (FTS-837-4155).

- Raytheon Company of Portsmouth, Rhode Island, and EG&G of Waltham, Massachusetts, are conducting a physical oceanography program for BLM on Georges Bank.

  Specific inputs to this physical oceanography study will include Lagrangien measurements, Eulerian measurements (surface and subsurface current meter moorings) and support hydrography. Principal objective is trajectory forecasting.

  A report of the first year program will be available in August 1978. An additional 2 years of dates collection and interpretation is planned. Specific contact is Dr. Richard Scarlett of EG&G and Dr. David Cook of Raytheon Co. BLM contact is Mr. Ken Berger of the New York OSC Office.

- At the present time, BLM and EDS/NOAA are discussing advantages of having a historical summerization and interpretation of meteorological and physical oceanographic information for the Georges Bank region. A study could begin by December 1977, and expected time of completion would be April 1979. BLM contact on progress of this possible study is Mr. Ken Berger - New York OCS Office.

C. Additional Needs

The following additional needs for ecological damage assessment were identified:

1. An inventory to include:

   - selected bibliography
   - names, addresses, phone numbers
   - facilities (including charter)
   - equipment, large and small, including sources of rental items (like ENDECO current meters)

2. Simple, unambiguous, clear and complete instructions for field observers and collectors, to include "chain of custody" requirements as well as sampling techniques.

3. Reliable, accessible, informed Public Information Officer to get accurate information out as fast as possible and to reduce the pressure on those doing the work.

4. Provision of SOR Team training to selected local individuals or groups and of SOR Team equipment kits on hand - especially hard to get stuff like Hexane.

5. Arrangements with NSF to free academic types of oil spill work (no-cost extension, etc.).

6. Quick way to put people on Federal payroll for short-term emergency.

7. Assurance that costs incurred by non-Federal organization will be promptly reimbursed.

8. Compilation of existing information on what happens when oil hits the shoreline.

9. Appropriate descriptors for oil, i.e., what should be the basic independent variables used as environmental descriptors for oil or, more generally, hydrocarbons?

D. <u>Equipment Requirements</u>

The following equipment was recommended for stockpiling by the OSC or otherwise immediately available:

1. Satellite tracked drogues

2. 1000 bottom drifters and 1000 surface drift cards, appropriately labeled and ready for deployment (total cost $5K)

3. Minirangers for accurate navigation

4. Chart library

5. Typewriters, Xeroxes, CB radios

PHYSICAL PROCESSES PANEL

Recommended Projects*

1. Meteorological observations and analysis

2. Surface mapping

3. Trajectory forecasting/hindcasting

4.

5. Bottom boundary layer and sediment (oil) residence time

6.

7. Longshore and rip current dynamics

8. Coastal current studies

*Not all projects were submitted at the time of this report.

PANEL: PHYSICAL PROCESSES
PROJECT: 1
PRIORITY RANK: 1

1. Project Title: Meteorological Observations and Analysis

2. Project Description:

   A. Objective - To provide accurate observations and useful forecasts of wind speed and direction, sea state, precipitation, visibility and other weather conditions that could affect cleanup efforts and be entered into trajectory predictions.

   B. Method - Establishment of an on-scene meteorological office with equipment and personnel dedicated to the job of producing local forecasts at least four times daily based on all available data.

   C. Results - Basic data for tactical decisions by on-scene coordinator; basic data for trajectory models and predicitions of areas likely to be affected by oil or suitable for controls; and data base for after the fact verification of models and development of new hypotheses.

3. Performing Organization:

   Principally National Weather Service, with help from ships on the scene and satellite observations.

4. Applicable Habitats:

   All

5. Applicable Conditions:

   All

6. Applicable Oil Type:

   All

7. Time Frame:

   As long as the on-scene coordinator is responsible for the spill -- probably several days to a few weeks.

8. Cost:

$20-$30 k

(Equipment approximately $15 to 20 k for weatherfare, radio, teletype, etc.)

(Personnel approximately $10-$15 k for three meteorologists, wages and living expenses for up to 3 weeks).

9. Equipment Needs:

Van or office with desk, weatherfare, radio, teletype, telephone, and typewriter. NWS should be responsible for having portable equipment available.

10. Facility Needs:

No special needs other than described in item (9) for small near-shore spill. The layer, offshore spill, ships on the scene can provide information and a weather data buoy may be useful. Satellite observations should be obtained routinely, as well as small-scale weather phenomenon and local weather from existing weather radar facilities.

11. Personnel Needs:

We understand NSW is training a group of marine meteorologists. Arrangements should be made to make two or three of these available as needed. Alternatively, Joseph Chase of Falmouth, a retired WHOI Meteorologist/Oceanographer, could be retained as consultant.

12. Support Services:

Good communication for rapid reporting of data and dissemination of forecasts.

13. Payoff:

A. Principally, the On-Scene Coordinator (OSC) decides where, how and when to deploy his resources.

B. Provide input for trajectory modelers, both for direct use by OSC and to identify sites of probable impact and potential control areas where experiments should be conducted.

C. Improve ability to forecast distribution of oil if substantial quantities become airborne as a result of evaporation or either accidental or deliberate burning.

D. Provide data for after-the-fact studies of oil weathering, interaction with biological communities, mixing in water column, etc.

14. Limitations:

New England weather is difficult to predict. Wind speed error of 5 knots and direction error of 30° are considered excellent (Argo report). Shortage of offshore data will be a problem for some spills.

PANEL: PHYSICAL PROCESSES
PROJECT: 2
PRIORITY RANK: 1

1. Project Title: Surface Mapping

2. Project Description:

The objective of this project is to provide accurate surface maps at meaningful intervals of the progress and extent of an oil spill to the Regional Response Team and the On-Scene Coordinator (OSC).

The time interval between maps will be primarily dictated by the strength of the tide in the area. Near-shore and energetic areas require one map each 3 hours; while in off-shore areas of low tidal action, one each day is sufficient.

Observations less than about 5 miles from shore will be taken from locally leased light aircraft and boats. Farther off-shore, longer ranged (usually Federally operated) aircraft capable of safer overwater operation with a heavier payload should be used. Both types of aircraft should be capable of accurate navigation (min-rangers for light aircraft) photographic and deice recording of observations supplemented by sea surface temperatures (infrared thermometer) to show the presence of thermal fronts, eddies, shoals and major currents that may affect the oil movement. Local flight weather conditions are also noted.

All data gathered for the time period should be incorporated in schematic form on a single chart accompanied by a brief description of the results and received by the OSC within 1 to 3 hours after the flight.

In addition to the observational aspects of this program, a research component is needed. The facet of the program will be directed at obtaining remote sensing techniques that can accurately detect and map oil on to ocean surface under all weather conditions. This capability is a long range and continuing need for aspects of both operational and assessment oil activities.

Reference: The Argo Report and SORE Team

3. Performing Organizations:

SOR Teams ERDA,
Coast Guard and nongovernmental labs such as Woods Hole Oceanographic

University of Rhode Island
Chesapeake Bay Institute

4. Applicable Habitats:

   All

5. Applicable Conditions:

   Mapping efforts are weather limited, but conditions and procedures for safe operation of aircraft are well documented. Conditions not covered are those encountered when making aerial observations of oil in ice fields, fog and snow. These areas need special research to develop new techniques. The important fact is that marine disasters often occur under these conditions.

6. Applicable Oil Type:

   All except gasoline whose half-life is too short usually to mount an aerial program for more than a day.

7. Time Frame:

   Mapping should continue until the oil either goes ashore and stays there or moves out to sea and is either operationally difficult to follow or is lost.

8. Cost:

AC time, 2 weeks, 3 to 4 hours/day	$20,000
6 people, time, expenses, travel,	28,000
equipment, 2 satellite buoys	10,000
Navigator	10,000
Support services (photo, etc.)	5,000
Communications	2,000
	$75,000
R&D contracts for remote sensing techniques	$75,000

9. Equipment Needs:

   1) Mini-rangers for light a.c. navigation

   2) Infra-red radiation thermometers

3) Cameras, 2/a.c., film: color and infra-red light meters

4) Binoculars

5) Smoke bombs or other wind indicators

6) At leas one satellite tracked buoy/spill

7) Charts and drafting equipment

8) Telefax - Xerox machine

9) Radio

Stock Pile items at Coast Guard base with Marine Safety Officer.

10. Facility Needs:

a. Coastal near-shore with a small spill requires < 20 ft. boats, small aircraft or 4-wheel drive vehicles for beach work. Radio type communication, small building or shop with drafting space and telecommunication available.

b. Off-shore large spills require the use of major dockside facilities for large ships and equipment.

11. Personnel Needs:

It is suggested that a SOR type educational program be started a cadre of regional people to familiarize them with the methods, practices and players in order to enhance a rapid response capability.

12. Support Services:

Access to: photolab with quick turn around drafting equipment, teleprinter or fax machine, Xerox, and typewriters: stock pile of charts of the area.

13. Payoff:

Information to OSC
Information to sampling teams
Information to assessment of damage (legal)

14. Limitations:

a. Surface mapping from aircraft is nonqualitative

b. Coordination with other disciplines is poor.

c. Adverse weather severly limits effectiveness.

d. Data gathered is not precise enough to advance modeling techniques for forecasts.

e. Coast Guard in-house capabilies should be improved to provide an operational system to be used with others.

PANEL: PHYSICAL PROCESSES
PROJECT: 3
PRIORITY RANK: HIGH

1. Project Title: Trajectory Forecasting/Hindcasting

2. Project Description:

Trajectory models to describe the distribution of spilled hydrocarbons will be developed and exercised. This will include time and space dependent estimates of where the oil is, where it will go and in some cases where it has come from. It will be necessary to provide information products that describe the form of the oil (pancakes, windrows, etc.) and its distribution throughout the water column. This project will have both observational facets supported by field studies and theoretical components.

Oil movement forecasting techniques have been developed to the point where the general movement of a surface slick can be predicted, providing adequate supporting environmental background data is available. Unfortunately, little more than the center of mass of the slick can now be provided reliably using state-of-the-art methods. Key questions that still cannot be answered, and which must be supported with additional research, relate to what form the oil is in, i.e., patch spreading, thickness distribution and extent of mixing within the water column. It is clear from a study of the assessment problem that virtually all the environmental interactions with oil (biological uptake, flocculation, photo-oxidation, etc.) and most cleanup activity will be more dependent on the surface area and form of the oil than its actual mass. Such forecasts and predictors then must be developed and made available during oil spill incidents for support of cleanup and assessment activities.

3. Performing Organizations:

Major responsibility for forecasting should go to NOAA (NWS-Dr. Celso Barrientos-ERL Dr. J. A. Galt) with research support from academic institutions, USGS and states.

4. Applicable Habitat:

All

5. Applicable Conditions:

Any time the oil is spilled into an active circulation system. In the absence of supporting environmental data that already has supplied sufficient information to develop the needed trajectory algorithms, the studies should be initiated.

6. Applicable Oil Type:

All types of oils with a sufficient observation base are established to permit reliable forecasting.

7. Time Frame:

These observational studies and tactical support of OSC should be continued while oil forecasts are needed in cleanup activity.

8. Cost:

On-scene support (per spill)

Small spill $10km^2$	1 man-month \$4k
Medium spill $50km^2$	2 man-months \$8k
Big spill $100km^2$	6 man-months \$24k
Computer development \$3 to \$6k and support per spill	

Research/analysis of spill data (not dependent on number of spills)

Computer software development	\$30k
Algorithm research	\$50k per year for 3 years
	ΣDepends on scope

9. Equipment Needs:

a. Phone lines

b. Telefax

c. Computer terminals

d. Access to computing facilities

e. Drafting equipment

10. Facility Needs:

On-scene room, typically a motel room, could be a van or camper with communication hook-up.

11. Personnel Needs:

Trained oil trajectory forecasters on-scene - (NWS-Marine Services Program -- NSW-Tech. Dev. Lab. Dr. Celso Barrientos; ERl-PMEL Dr. Jerry Galt).

12. Support Services:

Mapping of oil.

SOR team measurements of differential oil/water movement.

Detailed weather forecasts.

Local circulation data for currents.

13. Payoff:

Forecasts and hindcasts of oil movement and concentrations will be the payoffs of this project.

14. Limitations:

To work, this project will need appropriate background environmental data (currents, weather, etc.) plus an access to observational data as would be obtained from a mapping and SOR team type project.

To fully support assessment studies additional research will have to be carried out to develop algorithms to describe oil thickness distributions and large scale spreading.

PANEL: PHYSICAL PROCESSES
PROJECT: 5
PRIORITY RANK:

1. Project Title: Bottom Boundary Layer and Sediment (Oil) Residence Time

2. Project Description:

Sediment residence time provides information on:

a. Duration of oil impact, e.g., oil impregnation of bottom sediment, which is a multiplier for damage evaluation.

b. Direction and dynamics of movement of oil and sediments along bottom. This subject should be identified as a future research project.

The investigation incorporates detailed mapping of shallow structure, e.g., by high-resolution seismic, backed by sediment coring, coupled with bottom instrument packages capable of continuous measuring of dynamic properties, includes both waves and currents measurements, such as currents, temperature, turbidity and pressure (interpretation of bottom shear should be achievable from presently available models). The studies should yield maps of sediment (potential oil) residence time, plus a realistic assessment of conditions affecting transport of oil or treatment materials.

3. Performing Organizations:

a. USGS Atlantic-Gulf of Mexico Branch. Office of Marine Geology* offers immediate response on completion of new coastal workboat (anticipated Spring 1978), or partial assistance prior to that time. Assistance includes bottom instrument emplacement. See draft proposal submitted to workshop. Background (pre-spill) study highly recommended.

b. WHOI Oceanographic Engineering Sediment Transport under combined waves and currents. W. D. Grant**

c. NOAA sediment dynamics group has expertise, especially in N.Y. Bight area.***

*Woods Hole Mass: D. Folger 837-4155.
**Developed bottom shear model for AOML Project INSTEP.
***D. J. Swift, NOAA-AOML-Miami.

d. MIT - Orof. Ole Madsen - Civil Engineering.*

e. Corps of Engineers has extensive basic data (cores, seismic profiles).

f. Partial data in Massachusetts Bay available as a result of preliminary experiments in NOMES program. ERL-BOUDER-Witless.

4. Applicable Habitats:

Off-shore bottoms.

5. Applicable Conditions:

Can (should) be determined as baseline study in High Risk, Marine Traffic Corridors before spill; pinpointing afterward. (See p. 16-17; Fig. 2 in USGS proposal for key profiles).

6. Applicable Oil Type:

Any oil type.

7. Time Frame:

Key coastal areas should be systematically mapped and reinvestigated at multiple yearly intervals until a comprehensive inventory is obtained. Each investigation of a given interval requires about 1 month field survey time. Bottom instrument packages may be retained longer in given spill site if necessary. Sample workshop requires additional 1 month workup time for each field survey (preliminary study). Some data available to OSC immediately on return of field gear.

8. Cost:

Per one month, area investigation for field deployment, including personnel; not including data workup: $30k.

One bottom instrument package can be supplied at present for emergency use without personnel or equipment changes.

Bare Boat with operator - $177/day.

*Developed bottom shear model for AMOL Project INSTEP.

Additional cost for transport, truck rental, three support personnel, expendables as indicated in "Yellow boat project" report obtainable from R. Would, USGS Woods Hole, 02536.

9. Equipment Needs:

Coring equipment, high resolution seismic equipment, bottom instrument package (e.g., USGS "TRIPODS" for long-term deployment. Location equipment.

10. Facility Needs:

Coastal work boat, truck rental, normal temporary coastal accommodations, computer facilities for seismic data manipulation and interpretation.

11. Personnel Needs/Personnel Available:

WHOI - W. D. Grant

USGS - Yes: immediate response

After Spring 1978

Present - bottom instrument only

See R. Wold or D. Folger 837-4155, FTS, USGS Woods Hole

12. Support Services:

Background (sequential) on bottom sediment.

Configuration and Dynamic Properties, highly desirable.

13. Payoff:

Map of Bottom Dynamic conditions of immediate use to OSC; useful to predict oil impact duration and "multiplier effect" on damage assessment (residence time). Aids estimate of time involved in bottom movement, discrimination of highest priority areas in event of limited cleanup or deterrence capacity. Prediction of particle erosion of bottoms and presence in water column.

14. Limitations:

The project is most useful in in-shore areas having high risk potential and where sedimentation-erosion patterns show reasonable continuity. The effect of extreme events such as storms and hurricanes not well predicted by bottom instrument packages emplaced under normal conditions; this area is partly covered by acoustic surveying-coring. Also predictive models for sediment transport and bottom shear stress under waves and currents. All three elements, geophysical profiling, coring and dynamic measurement, are needed for maximum effectiveness. Even though areas of potential sediment transport are identified, our present knowledge is not adequate to give quantitative numbers except under very specialized conditions.

PANEL: PHYSICAL PROCESSES
PROJECT: 7
PRIORITY RANK:

1. Project Title: Longshore and Rip Current Dynamics

2. Project Description:

   A. Objectives:

      (1) Prediction of magnitudes and directions of longshore currents and rip currents.

      (2) Identification of research needs for the development of adequate models of longshore currents and rip current models.

   B. Procedure:

      (1) Information to modelers and on-site coordinators provided by:

         (a) Empirical current and wave measurements - current meters, wave sensors, sediment size

         (b) Regional reference document

         (c) Simple analytical models.

   C. Anticipated Results

      (1) Longshore currents in the surf zone and immediate vicinity.

      (2) Description of rip currents and coastal cells.

3. Performing Organization:

   A. Organization with Capability

      (1) Woods Hole Oceanographic Institution - Dr. William D. Grant, Ocean Engineering

      (2) Massachusetts Institute of Technology - Dr. Ole S. Madsen, Civil Engineering

      (3) University of Massachusetts - Dr. Allen Nesderoda

B. Possible Performing Organizations

All of the above.

4. Available Habitat:

New England - surf zone

5. Applicable Conditions:

Spill heading toward coastline

6. Applicable Oil Type:

All

7. Time Frame:

a. Predictions needed over tidal cycles to get directions.

b. Empirical measurements will provide immediate results.

c. Longer term research is needed into Longshore current models -- possibly provided by national Sediment Transport Study.

8. Cost:

$10k (seems low).

9. Equipment Needs/Equipment Available:

a. Current meters capable of resolving both wave and current flows.

(1) E/M current meters

(2) Acoustic current meters

(3) Wave measuring devices

(4) Sediment sampling.

b. Woods Hole Oceanographic Institution

MIT

University of Massachusetts

10. Facility Needs/Facilities Available:

a. Small boats available
Computer to our current models
Four-wheel drive vehicles

b. Woods Hole Oceanographic Institution
MIT
University of Massachusetts

11. Personnel Needs/Personnel Available:

a. See item 3a.

b. Volunteers to make beach observations.

12. Support Services:

a. Mapping of spill

b. Meteorological data

c. Beach observations - beach slope, wave direction, tides, winds, breaker type, water depth, wave height, and wave period.

13. Payoff:

a. Contribution to assessment of Ecological Impact:

(1) Trajectory of oil down coast to try to determine where to center cleanup.

(2) Support service to determine ultimate fate of spill.

(3) Major consideration is that once oil is inside surf zone it is too late to prevent spill damage on shore. Thus, it is necessary to make the current predictions a significant period of time ahead.

b. Scientific Interest:

(1) Forcing function contributing to longshore current (currently under study).

(2) Longshore current distribution.

14. Limitations:

a. Availability of equipment

b. Weather conditions

c. Present model of wind devices, longshore currents, etc.

PANEL: PHYSICAL PROCESSES
PROJECT: 8
PRIORITY RANK:

1. Project Title: Coastal Current Studies

2. Project Description:

   A. Objectives:

      (1) Prediction of magnitudes and directions of coastal currents throughout water column to assist trajectory modeling predictions and on-site coordinator.

      (2) Identification of research needs for the development of adequate models of coastal currents and baseline current data.

   B. Procedure:

      (1) Information to modelers and on-site coordinator provided by

         (a) Emperical current measurements - current meter array, bottom observations (topography) and drifters.

         (b) Regional reference document.

         (c) Simple analytical current models and for tabulated current tables.

   C. Anticipated Result: Surface, mid-depth and bottom velocities due to:

         (a) Tide

         (b) Wind driven currents

         (c) Density currents

         (d) Wave-current interaction.

3. Performing Organization:

A. Organization with capability:

(1) Woods Hole Oceanographic Institution

(a) Dr. William D. Grant, Ocean Engineering

(b) Dr. Robert Beardsly, Physical Oceanography

(2) Massachusetts Institute of Technology - Dr. Ole S. Madsen, Civil Engineering.

(3) USGA-Woods Hole - Dr. Brad Butman.

B. Possible performing organization - all of the above.

4. Applicable Habitat:

Coastal Zone, i.e., region where frictional influence of bottom is felt through water column. 30 to 40m depth contour.

5. Applicable Conditions:

a. Oil spill occurs in shallow coastal region.

b. Trajectory predictions show likely impingement in coastal region.

6. Applicable Oil Type:

All

7. Time Frame:

a. Predictions for on-site use could be provided almost immediately by empirical methods.

b. Longer term research is needed to develop adequate models of wind-driven currents, wave-current interaction models, and adequate descriptions of the forcing involved.

c. In the event that oil reaches bottom sediments, longer term monitoring of the currents will be needed to determine direction of potential oil laden sediment transport.

8. Cost:

$10k.

9. Equipment Needs/Equipment Available:

a. Current meters capable of resolving both wave and current flows:

(1) E/M Current Meter

(2) Aeocestic Current Meters

(3) CTD measurements

(4) Bottom observations, i.e., bottom camera or divers.

b. Woods Hole Oceanographic Institution, if available

University of Rhode Island (possibly)

Massachusetts Institute of Technology.

10. Facility Needs/Facilities Available:

a. Ships to deplay current meters; computer to run simple current models.

b. Woods Hole Oceanographic Institution (ship & comp.)
Massachusetts Institute of Technology (ship & comp.)
URI.

11. Personnel Needs/Personnel Available:

See item 3a.

12. Support Services:

a. Mapping of spill.

b. Meteorological data.

13. Payoff:

a. Contribution of assessment of ecological impact:

(1) Necessary input to trajectory model

(2) Support service to determine ultimate fate of spill.

b. Scientific Interest:

Research into: wind-driven currents, wave-current interaction, and partitioning of wind stress into currents/waves. These topics are of interest for a wide range of pollution studies besides oil.

14. Limitations:

a. Availability of current meters

b. Weather conditions for deployment

c. Present models of wind-driven currents and wave-current interactions are crude but possibly adequate for initial trajectory predictions when backed up by empirical measurements. Future predictions over longer time period require a better knowledge of these; i.e., depth average current models are not adequate.

WATER COLUMN BIOLOGY PANEL

Participants

F.G. Lowman, Chairman

O.T. Edstrom	H. Mulligan
R. Gerber	C.L. Rogers
P.E. Hargraves	C. Ross
D.L. Harvey	J. Snider
G. LaRoche	G.A. Vargo

WATER COLUMN BIOLOGY PANEL

Recommended Projects

1. Possible responses to oil spills: analysis of plankton.

2. Effects of oil spills on resident fish communities.

3. The effects of oil spills on icthyoplankton: eggs and larval stages.

Addendum: General Methodology Considerations

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Possible Responses to Oil Spills: Analysis of Plankton

2. Project Description:

Objective: Determination of short-term effects of oil spills on plankton populations.

A. Unquestionable need for a data base - centralization of existing literature and the means to acquire and update additional data.

B. Interactions and coordinations with laboratory experimentation; standardization of experimental techniques, e.g., bioassay studies - standardization of simple rapid bioassay test which can be performed (initiated?) in the field and duplicated (continued?) in the lab.

C. Groups to be examined

(1) Phytoplankton. For species composition, measurement of productivity, and community dynamics, fractionation into net and nanoplankton is essential. Measurements should include C, N, and ATP analyses, along with other analyses such as total biomass and chorophyll.

(2) Heterotrophic microplankton. Species composition and abundance of such groups as protozoa (tintinnids, other ciliates, amoebae, flagellates) and larvae stages of planktonic invertebrates. A physiological measurement such as respiration is desirable but methodology is not perfected.

(3) Other zooplankton (pelagic crustaceans and others). Species composition and abundance. Respiration, ingestion, and excretion measurements are desirable.

(4) Particulate organic matter. Estimates of abundance and total C contribution.

(5) Bacterioplankton. Marginally understood, but should be considered.

D. Measurements of hydrocarbons necessary in all size categories: with larger sizes, separation at trophic level should be possible (e.g., carnivores vs. herbivores). At smaller size levels, trophic separation is probably not feasible.

3. Performing Organization:

See Project No. 3 on eggs and larvae.

4. Applicable Habitats:

Habitats are all coastal areas to the limits of the continental shelf where significant economic or aesthetic impact could occur.

5. Applicable Oil Types:

The project applies to all types of oil. The experimental format should be flexible according to oil type.

6. Time Frame:

The time required for on-site investigations is dictated by the duration of analysis and the finalized experimental design. This will vary with the scope of the investigation, nature and size of the spill, etc. In all cases a maximum flexibility in response should be maintained.

7. Cost:

A supply of capital equipment should be maintained sufficient to support all planned projects. A fund of readily available money should be maintained in order to insure and promote rapid and intensive responses to any spill. Such a fund should include guaranteed expenses plus, in the case of state and university commitments, overhead costs. For details see projects entitled Effects of Oil Spills on Resident Fish Communities and Effects of Oil Spills on Icthyoplankton.

8. Equipment Needs:

All equipment should be standardized and readily accessible. Samplers should be those that do not damage the organisms sampled (e.g., large volume water samplers).

9. Facility Needs:

Depending on the size of the spill, investigations should be coordinated at local levels (small spills) or regional levels (large spills). For more sophisticated experiments, a centralized laboratory should be available and designated. Availability of vessels and aircraft should be designated, as well as an organized local liaison center. All experiments relating to spills should be coordinated from a central facility, such as EPA-Narragansett or NMFS-Woods Hole.

10. Personnel Needs:

A centralized listing of personnel in the areas named in category #2 should be maintained and widely distributed. Since many of these projects involve considerable time and expense, a regional or national fund guaranteeing support should be available for dispensation of seed funds at short notice.

Addenda:

At this stage of organization it is premature to be overly specific in design and analysis of experiments and specific methodology. Each project has different requirements and each oil spill requires a different response.

Investigators should not have preconceived expectations of results. The complexity of marine food webs is such that adequate answers can come only from carefully considered experimentation and analysis.

11. Support Services:

- Horizontal and vertical distribution of pollutant with time
- Oil analysis support
- Communications (field)
- Freezer space and shipping support
- Interaction with other activities and disciplines associated with oil spill
- Medical support and facilities

12. Payoff:

Estimates of the degree of petroleum contamination should be made for the first two trophic levels of the food web, the phytoplankton and the zooplankton, to determine the impact of contamination on the species composition and abundance of the phytoplankton and zooplankton.

13. <u>Limitations</u>:

Due to the effects of rapid recruitment, high reproductive rate and natural patchiness of plankton, it may be difficult to definitely attribute detectable alterations to the plankton populations.

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Effects of Oil Spills on Resident Fish Communities

2. Project Description:

   A. Determine hydrocarbon in resident species in and near site of spill.

   B. Determine impacts of the spill on the resident species.

      - Short-term possible studies include:

        - Instant mortality
        - Depuration rates(?)
        - Enzyme activity
        - Histopathology
        - Behavior analysis
        - Stamina testing and respiration rates
        - Tainting

      - Long-term possible studies include:

        - Fecundity (eggs/gm/gravid female)
        - Behavior (avoidance included)
        - Stamina testing
        - Histopathology
        - Recruitment (sex ratios)
        - Condition coefficient gut analysis - respiration rates
        - Tainting

3. Performing Organization:

   See project entitled: Effects of Oil Spills on Icthyoplankton.

4. Applicable Habitats:

   Pelagic and benthic resident fishes to the continental shelf.

5. Applicable Conditions:

   Major spills per lead agency definition and safe sampling conditions.

6. Applicable Oil Type:

Any oil type except those of low flash points that would subject field crew to unnecessary hazards from inhalation or fire.

7. Time Frame:

Duration of the study depends on the conditions, type of oil, area of the spill and the monies available.

8. Cost:

For all H_2O species (including plankton and finfish) including cost of gear, ship time, screening analysis (3000 samples); 10 investigators ($30K) $150K; ship time (inshore $20K, 30 days) includes gear and operating expense (offshore $320K, 30 days); total estimate $200K inshore; total estimate $500K offshore; plus 100 detailed analyses ($50,000).

9. Equipment Needs:*

Fisheries	Estimated Value
A. Hook and line (D) complete	$ 500.00
B. Gill nets (D) 15 @ $200 apiece	3,000.00
C. Shrimp trynets (D) including boards	3,000.00
D. Trawls (bottom and midwater) (D) 5 replacement nets	4,000.00
E. Explosives (D)	500.00
F. Vessels (minor maintenance)	1,000.00
G. Disposable sampling equipment (D) bottles, plastic bags, aluminum foil, ice, ice chests, etc.	4,000.00

10. Facility Needs:

A. Docking launching facility

*(D) = disposable

B. Vessels and laboratory to perform services. If needed, helicopter time is \$200/hr. - 20 hrs. The availability of local State and Federal military aircraft should be checked. Lodging, etc., should be handled by executive director.

11. <u>Personnel Needs</u>:

See #3 for agencies and organization.

12. <u>Support Services</u>:

A. Horizontal and vertical distribution of oil.

B. Oil analysis support.

C. Communications (mobile).

D. Freezer and shipping support.

E. Interaction with other activities and disciplines associated with that oil spill.

F. Medical facilities and support.

13. <u>Payoff</u>:

With a well-coordinated interdisciplinary program, this project could assess the total impact of an oil spill on resident fish populations. Loss of resident fish populations may affect distribution and availability of migratory species. Total factors could have adverse local economic impacts.

14. <u>Limitations</u>:

It is difficult to determine whether detectable alterations to fish populations in the vicinity of an oil spill are related directly to that event.

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: The Effects of Oil Spills on Ichthyoplankton: Eggs and Larval Stages

2. Project Description:

Standardized plankton and neuston tows will be made at the periphery of the oil spill (this can also include treated areas (i.e., dispersants) and in an area well outside the spill. These sampling techniques can be used anywhere--coastal, shelf, slope waters.

3. Performing Organization:

- Rhode Island

  State Department of Natural Resources Ocean Division

  State Department of Health

  University of Rhode Island

  Environmental Research Laboratory, EPA, Narragansett, RI

  NOAA/NMFS Laboratory, Narragansett, RI

  U.S. Coast Guard, Newport

- Connecticut

  State Department of Environmental Protection Division of Conservation and Preservation

  Wesleyen University

  University of Connecticut

  State Department of Health

  NOAA/NMFS Laboratory, Milford

  Essex Marine Laboratory

  U.S. Coast Guard

- Massachusetts

  Executive Office of Environmental Affairs

    Division of Environmental Quality

    Division of Marine Fisheries

  Woods Hole Institute of Oceanography

  NOAA/NMFS Laboratory, Woods Hole, MA

  U.S. Coast Guard

  Edgerton, Gemershusen & Grier Bionomics, Wareham, MA

  Edgerton, Gemershusen & Grier Env. Consultants, Waltham, MA

  Northeastern University Marine Lab - Nahaut, MA

  University of Masschusetts Marine Lab, Rockport, MA

- New Hampshire

  New Hampshire Department of Fish & Game, Concord, NH

  New Hampshire Water Supply & Pollution Control Comm., Concord, NH

  University of New Hampshire, Office of Marine Research, Durham, NH

  State Department of Health

- Maine

  Department of Inland Fisheries, Bangor, ME

  Department of Marine Fisheries, Hanlon, ME

  Bigelow Marine Laboratory, Boothbay Harbor, ME

  University of Maine Darling Center, Walpole, ME

  State Department of Health Marine Research Laboratory

  Bowdoin College, Brunswick, ME

• Other

NOAA/NMFS Laboratory Sandy Hook, NJ

______________________ Oxford, Md

4. Applicable Habitats:

5&6. Applicable Conditions and Oil Type:

A major spill of any petroleum oil type except those with low flashpoints that would subject the field crew to unnecessary hazards from inhalation or fire. The assumption is made that with either a surface application or offshore rig blowout, the pollutant will occur in the water column.

7. Time Frame:

The time required will be determined by the financial support available and the urgency of subsequent spills.

8. Cost:

The cost is for sampling of all water column species for 30 days.

• Inshore (includes projects dealing with phytoplankton and zooplankton, eggs and larvae, and resident fish.

Investigations	$ 30,000
Screening	150,000 (3000 samples)
100 detailed analyses	50,000
Inshore boat time and gear	30,000
Living Accommodations	________
	$250,000

• Offshore

Investigations	$ 30,000 (salines and fringe benefits)
Screening	150,000
100 detailed analyses	50,000
Offshore ship	320,000
	$550,000

9. Equipment Needs:

A. Ship or boat suitable for the spill area with winch 61 and 20 cm paired bongo frames.

B. 0.5 X 1.0 m frame (neuston)

C. Nets - plankton 0.333, 0.505, 0.253, 0.165, neuston 0.505, clips, rope, wire depressors, jars, formalin, sieves, buckets, labels, submersible pumps.

D. Microscopes, sorting dishes, vials, labels, jars, air stones, droppers, chemicals, stains, histological equipment, gilson respirometer, Nisvin or Nansen bottles, glassware.

E. Centrifuge.

10. Facility Needs:

A. Vessel

B. Helicopters

C. Laboratory

11. Personnel Needs

See Item 3 for agencies and organizations.

12. Support Services:

A. Horizontal and vertical distribution of pollutant with time

B. Oil analysis support

C. Communications (field)

D. Freezer space and shipping support

E. Interaction with other activities and disciplines associated with that oil spill

F. Medical support and facilities

13. Limitations:

Estimate of the degree of petroleum contamination of eggs and larvae would be made. An estimate of the effects on future marine stocks may not be possible.

14. Limitations:

It is improbable that detectable changes in biota following an oil spill could be related exclusively to the incident under study.

WATER COLUMN BIOLOGY PANEL
ADDENDUM

General Methodology Considerations

The three recommended projects are considered short-term. Continued sampling and bioassay work would provide base line information and would indicate the return of the populations to normal.

The following are considerations pertaining to sampling and study methods for particular areas of study.

A. Neuston:

Neuston samples (0.5 X 1.0 m frame 0.505 mm net 10 min surface tow 1.5 km) and plankton samples (61 and 20 cm parsied bongos, each w/a flowmeter 0.505, 0.333, 0.253, 0.165 mm mesh. direct oblique tow 1.5 km, - standard MARMAP techniques) will be collected at regular intervals following a spill. Samples will be preserved in 4 percent formalin. Contents of the 0.505 plankton and neuston will be sorted for ichthyoplankton. The species composition and numbers of eggs and larvae will be calculated for 100 m^3 water filtered. (The other samples can be used for other zooplankton analyses.) Direct observations of the condition of the eggs and larvae can be made (i.e., oil on egg morbidity) of abundance, species composition, and distribution of fish eggs and larvae can be made during the sampling period, and can be compared with historical data from previous years to give an estimate of impact.

RNA/DNA ratios, protein synthesis, growth and yolk utilization can be used to determine the effects of hydrocarbons on the larvae. In addition, histopathological studies can also be carried out on preserved specimens.

B. Genetics (field):

Preserved eggs from plankton and neuston tows should be sorted by species and stage. They can then be examined for genetic damage. Using the methods of Longwell (1976) the extent (%) of damage can be estimated, i.e., morbidity, moribundity, abnormal embryos, chromosome damage, for that sample (see Argo Merchant ICES Report). The results can be compared for samples from clean and impacted areas and for historical data.

C. Bioassay Studies (field and laboratory)*

Bioassays can be carried out for both egg and larval stages. Laboratory produced embryos will be brought out to sea and exposed to water pumped from areas beneath the slick, at the periphery of the slick and in "clean" areas. Water samples will also be collected and analyzed for petroleum hydrocarbons. Samples will also be collected for DO and salinity determinations. Embryos will be exposed at different stages of development, and subsamples will be preserved at regular intervals for later genetic studies. Observations of the developing embryos will be made including heartbeat, sinking (due to osmoregulation difficulties) respiration, yolk utilization. Similar studies will be conducted under laboratory conditions using known concentrations of fuel oil types (e.g., crude, nos. 6, 4, 2) and the water soluble fractions (Kuhnhold).

The same procedures, both field and laboratory (excepting genetics studies) can be carried out for larvae. When larvae are used, feeding initiation, feeding, swimming behavior, respiration, RNA/DNA ratios, protein synthesis, growth and yolk utilization can be used to determine the effects of hydrocarbons on the larvae. In addition, histopathological studies can be carried out on preserved specimens.

*These studies should be carried out at regular intervals from beginning of the spill. Nonetheless, if weather conditions do not permit, sampling should proceed whenever conditions are suitable.

Sampling Observations
Numbers/100m^3
Species

II. Genetics

Eggs

Sampling
Identification
Species
Stage
Examination (Longwell, 1976)
Results % morbid, moribund
abnormal embryos
Chromosome damage

III. Bioassay Laboratory + Field

Eggs + Larvae

Direct observations genetics Physiology
heartbeat
sinking-osmoregulation
yolk utilization
larvae respiration
feeding (exposed & unexposed organisms)
DNA/RNA
Growth
yolk utilization
protein synthesis

Histopathology

HISTOPATHOLOGY PANEL

Participants

P.P. Yevich, Chairman
R.S. Brown
C.A. Farley
G. Gardner
J.W. Hurst, Jr.

HISTOPATHOLOGY PANEL

General Considerations

BACKGROUND INFORMATION

A. Objectives:

The panel outlined the following objectives for histopathology studies:

1. To determine whether or not the cell tissues of animals which have been collected from the oil spill sites show any morphologic or histochemical changes which can be attributed to the action of the oil.

2. However, some of the difficulties in arriving at this ability is our lack of knowledge as to what constitutes normal for the area from which the animals are collected. We have need at physiological, seasonal, and cyclic morphologic baseline data of the majority of marine species.

3. Information is now becoming available as to what constitutes norm in many of the commercially important marine species (oysters, mussels, blue crabs, quahogs, soft shells, and scallops). This information is being prepared for publication in Atlas forms by EPA & NOAA, and possibly the BLM program.

B. Recommendations:

1. Histopathologic studies must be correlated with analytical studies.

2. We will collect whatever species are available at the spill. However, the selection of the species will be left up to the discretion of the histopathologic investigator who may not be looking for the most sensitive species but for an indicator species.

3. Histopathology expertise should be invited to all spills. However, what animals are to be collected should be left to the discretion of the histopathologic investigator.

4. Where and how animals are to be necropsied is left up to the discretion of the investigator.

5. Fixation, trimming, and slide preparation is left up to the discretion of the investigator.

6. The number of collections per oil spill site shall be determined by the histopathologic investigator and the circumstances of the oil spill. Of greatest interest are the chronic histopathologic effects of the oil spill.

7. Close coordination should be maintained with the Laboratory Toxicity Testing group as to the histopathologic findings in the field animals. For histopathology efforts to be at any value to the Socio-Legal group, we have a need to show the cause-effect relationship.

8. There is a lack of funds and trained people in marine histopathology in the U.S. and ways were discussed for training of these people.

C. <u>Recommended Reference</u>:

Yevich, P.P. and C.A. Barszcz, 1977. Preparation of Aquatic Animals for Histopathological Examination. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. 20 pp. (Preliminary - Subject to Revision)

HISTOPATHOLOGY PANEL

Recommended Projects

1. To determine the histopathologic effects of an oil spill on marine organisms.

PANEL: HISTOPATHOLOGY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: To Determine the Histopathologic Effects of an Oil Spill on Marine Organisms

2. Project Description:

Morphologic study of cells and tissues from oil exposed and control animals will be studied via the light and electron microscopes. Histochemical methods will also be utilized to determine any chemical changes which may be taking place in the cells and tissues. Utilization of these tools should give us some concepts as to whether or not any tissue changes are taking place in the exposed animals. Comparison of cells and tissues of the control animals using the same methods and baseline data will give us some indication as to whether or not these changes are due to the oil.

The methods and techniques employed are the same as those used by animal, (experimental), and human pathologists during the past 50-100 years.

3. Performing Organizations:

Paul P. Yevich
Histopathology Unit
ERL - Narragansett

Austi Forley
Pathology Br.
NMFS - NOAA
Oxford, Maryland

Dr. Robert Brown
Marine Pathology Laboratory
University of Rhode Island
Kingston, R.I.

4. Applicable Habitats:

Most of the habitats listed in the New England list would be applicable.

5. Applicable Conditions:

Studies should be limited to major oil spills which have impacted large populations and organisms which can be identified by location.

6. Applicable Oil Type:

All types of oil spills should be studied.

7. Time Frame:

Studies will commence with controls and become more significant after 2 weeks and continue until no effects are seen histopathologically. Species should be selected on the basis of availability at the site and with comparable controls. Samples should include at least 30 animals and be collected weekly for the first month, monthly for the next 5 months, and then quarterly for 2 years. Other sample collections should be made available to the investigator for a period of up to 10 years. Birds, mammals and other various organisms should be examined when requested or when gross pathology is evident. Samples of oil species should be at least fixed and archived.

8. Cost:

Slide preparation and histopathologic analysis of the slide runs anywhere from $12.00 to $15.00/slide. It will cost $12,000 per species for a 2-year study, $5,000/species for a 6-month study.

Travel and preparation of reports - $50,000.

9. Equipment Needs/Equipment Available:

A field model kit containing fixatives, alcohol for storage of specimens, bags, shucking knives, etc. has been constructed by the Histopathology Unit of ERL-N. Some improvements will be made and it is hoped that these kits will then be made available for histopathologists who respond to oil spills.

A manual for the preparation of aquatic animals for histopathologic examination has been prepared by the Histopathology Unit of ERL-N and will be distributed throughout the country to interested people.

A histopathologic technique manual prepared by the Pathology Br. of the NMFS. NOAA Labs, Oxford, Md. will soon be available to interested people.

Necessary equipment for the preparation and analysis of microscopic slides is available at the institutions listed in #3.

10. Facility Needs/Facilities Available:

See list in #3.

11. Personnel Needs/Personnel Available:

See list in #3. However, there is need of more people and organizations to get involved in marine histopathology. There is a great shortage of marine histopathologists and means should be provided for training them.

12. Support Services:

In order for this project to function properly the histopathologist should be informed as to the possible oil spill impact, etc. by the on-scene coordinator. Also close coordination should be maintained with the analytical chemists who will be doing hydrocarbon determinations of the animals. In fact, when specimens are collected, they should be collected from the same time, area, species, etc. as those collected for the analytical chemists.

13. Payoff:

We have little knowledge as to histopathology effects of oil on marine life, we thus would be making contributions in this area.

Causes of death to the animals especially in chronic studies (5 to 10 years) in which we have a slow depletion of a population of animals once the oil spill site has been cleared.

Correlated with laboratory toxicity studies - a cause and effect relationship.

Possible carcinogenic potentials of petro-chemicals.

14. Limitations:

Histopathology would be of use only on animals which have come into contact with the oil in some form or manner.

LABORATORY TOXICITY PANEL

Participants

J. Gentile, Chairman

J. Atema	J. Kineman
C. Deacutis	P. Lefcourt
R. Eisler	S.M. Lord
D. Everich	B.D. Melzian
R. Gerber	D.C. Miller
S. Jacobson	S.R. Petrocelli
E. Jackim	C. Ross
E.B. Karnofsky	A.N. Sastry

K. Simon

LABORATORY TOXICITY PANEL

General Information and Guidance

- Initial Considerations
- Specific Research Considerations
- Miscellaneous Information

INITIAL CONSIDERATION

A. Research Thrusts

The Panel reviewed the action plan and focused on three factors in guiding lab studies:

1. Studies that assist and support the on-scene coordination functions and decision making.
2. Post-spill damage assessment and dollar impact.
3. The utilization of a spill as a research opportunity.

The Panel produced the 15 research areas enumerated below in order of presentation.

1. Time dilution bioassay studies using field verified dosing regimes to plankton and meroplankton.
2. Test effects of long-term exposure on normal development and reproduction for selected commercially important species.
3. Field exposed organisms returned to lab and a variety of response parameters measured and recovery evaluated. These studies potentially involve repeated field collections of infaunal benthos to assess long-term effects.
4. Effects of tainting on predator-prey relationships.
5. Effects of oil contaminated sediment upon the reproductive potential of benthic fish.
6. Long-term physiological and behavioral adaptations.

7. Comparative toxicity of petroleum and dispersant mixtures.

8. Comparative toxicity of various types of oils.

9. Chronic oil exposure to commercial infauna.

10. Effects of seasonality on toxicity.

11. Effects of oil pollution on species distribution and structure in microcosms: planktonic and soft body benthic.

12. Large scale controlled lab studies on structured assemblages.

13. Research on bioaccumulation of petroleum hydrocarbons in commercial species and human health hazards from consumption of these species.

14. Standardization of bioassay methods.

15. Intertidal modeling of benthos to simulate natural exposure. Looking at tumor induction fish disease and parasitism.

The panel summarized this diverse list into the following categories:

- Time-Dilution Models for Plankton/Meroplankton
- Field Exposed - Laboratory Assessed Studies
- Standardization and Testing of Major Petroleum Hydrocarbon Types Singly and in Combination with Available Dispersants
- Microcosm Research
- Health Effects
- Large Scale Structural Assemblages.

The panel decided they could not rank these categories as to importance because spill situations can be so variable. It was generally concluded that the potential long-term effects were in the benthos for near-shore spills. In terms of research that should be implemented now, the third category (hydrocarbon testing) was highlighted. These data would be invaluable to the on-scene coordinator.

B. Recommendations to the Workshop Executive Committee

Two problem areas were highlighted for further consideration by the Executive Committee:

1. Clarification of funding to on-going research efforts. Is funding added to existing programs and the commitments delayed?

2. The subject of dollar value for liability.

It was recommended that population models and catch data for regionally important species be centrally available and that specialists in this area be used to project impacts. Also resource economists should be retained to calculate the possible ramifications.

C. Corporate Capabilities

The panel discussed with its corporate members their capabilities and contributions. There appears to be substantial laboratory bioassay expertise in this geographical area. The role of state support in laboratory toxicity studies was not dealth with initially.

SPECIFIC RESEARCH CONSIDERATIONS

A. Species and Parameters

The panel decided that to recommend a list of test species would not be appropriate. We recommend the following criteria be used as guidance for species selection:

- Select species representing pertinent feeding types that reflect the major routes of pollutant entry to the biota.

- Select indigenous and/or representative species from the following phyla: fish, crustacean, molluscs, polychaetes, echinoderms, and macroalgae.

- Other factors that must be considered on a spill basis are ecological or commercial significance, suitable life stage, appropriately sensitive species, availability of species from field or culture.

Parameters to be included in laboratory assessments are quite numerous and specific to the research design. Generally, short-term measures of stress such as biochemical, physiological, behavioral, and histological, should be correlated with growth and reproduction and tissue residues whenever possible. Measures of stress for microcosms and community assays should include both functional and structural components whenever possible.

B. Role of Analytical Support

The role of Analytical Support was discussed with emphasis upon realistic assessment of water, tissue, and sediment analysis for each experimental design. We emphasize the careful deliberation on how the data is to be used and how the application affects choice and sophistication of analysis. Total hydrocarbon may frequently be sufficient to establish a casual relationship.

A second order Analytical problem involves quality assurance. There must be a coordinated Chemistry Section effort to assist the biologist in selecting a contractor and to assure the quality of the data.

Several questions were raised regarding site coordination problems. The panel feels that a specific hierarchy be established that includes an on the scene coordinating biologist and chemist to direct activities in these areas. The OSC can't cope with all the factors. The biologist will also make a list of participating institutions and researchers that can be mobilized rapidly.

Another useful approach that was recommended is to train state wildlife and pollution personnel to handle many of the collection functions.

C. Microcosm Research

The applicability of microcosms in spill assessment research was discussed. It was concluded that microcosms are at present best utilized to study basic research needs and have limited applicability in frequent spill assessment.

D. Testing for Health Hazards in Seafood

In any assessment of oil spill impact, the health hazards to man must be considered, especially when it involves closing down a fishery. The major questions in this regard are the following.

1. How is it determined when a fishery could be closed because of a health hazard?

2. How extensive is the area to be closed?

3. How long should an area remain off limits?

health impact have to be conducted along with more research. These tests should include organoleptic tests for tainting and relating the results to specific hydrocarbon levels. It appears that U.S. Food and Drug Administration may set recommendations for safe levels of PNA's and other carcinogens in seafood in the near future. Consequently, fish from oil spill areas should be evaluated for specific PNA's. Furthermore, seafood extracts should be assayed for carcinogens by tests such as the Ames test, DNA repair or cell transformation. Chromosome breakage in field or lab exposed animals might also be indicative of the presence of carcinogens and mutagens. This is of practical interest because it has been shown that concentrates of polluted shellfish have produced cancers in test animals.

MISCELLANEOUS INFORMATION

A. Problems Related to the Role of the On-Scene Coordinator

The following were raised as relevant problems faced by the OSC:

1. Toxicity of oil of all types to species in impact area (e.g., shellfish, fish, etc.).

2. Identification and comparison of oil spilled for enforcement action and damage assessment, especially in the case of weathered oil.

3. Species collection and preservation in impact area for short-term effect of spilled oil.

4. Health Data to establish minimum criteria for shellfish, finfish, etc., in impacted areas. Total Hydrocarbons should be used as criteria or fractions thereof.

B. Massachusetts Information

The following information was provided on Massachusetts State facilities:

1. Lawrence Laboratory

   - 3 Gas chromatographs/minicomputers
   - 1 UV Fluorescence Spectrophotometer

2. Cat Cove Laboratory

- 1 Gas chromatograph
- 1 UV Fluorescence Spectrophotometer

During the Argo Merchant and Bouchard 65 incidents, both labs combined forces and could run 5 GC samples/day. Cat Cove prepared samples and Lawrence ran the samples.

LABORATORY TOXICITY PANEL

Recommended Projects

1. Parallel benthic bioassay for single species or natural benthic assemblage (box core).

2. Standardized toxicity testing of petroleum and oil-dispersant mixture to marine biota.

3. Damage effects of oil-dispersant mixtures under simulated field conditions: use of large assay containers.

4. *In situ* acute toxicity tests.

5. Time dilution bioassay on holoplankton and meroplankton.

6. Sublethal effects of chronic exposure to low levels of petroleum hydrocarbons in zooplankton.

7. Effects of oil tainting of prey on food selectivity and feeding behavior of two predatory fish species.

8. Effects of oil-spill contaminated sediment on reproduction of winter flounder, *Pseudopleuronectes americanus* (Walbum).

9. Effects of chronic exposure to oil on representative marine animals.

PANEL: LABORATORY TOXICITY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Parallel Benthic Bioassay for Single Species or Natural Benthic Assemblage (Box Core)

2. Project Description:

The general philosophy of this research approach is to periodically remove either single species or a natural benthic assemblage that was impacted by a spill, transport to a mobile or fixed laboratory and assess physiological, behavioral, shell microstructure, biochemical, histological, integrative or conservative biological parameters, and tissue and sediment residues. Determine lab recovery patterns with those from occurring in the field as well as new recruitment in the field. The critical aspect of this study is that the dosing is natural and integrative. There is a general feeling of inadequacy about lab dosing benthic systems. This approach is concerned with natural dosing of benthic communities.

Such a research design will correlate a variety of stress measures with recovery time under natural conditions giving a true assessment of damage. This approach eliminates the problem of projecting field results from purely lab studies since they are being run concurrently. Sessile infaunal and epifaunal communities are especially well suited for these types of studies as are commercially important shell fisheries.

3. Performing Organizations:

University laboratories with sources of running seawater and marine labs (i.e., URI, U-Mass. @ Gloucester, U. of Maine, U. of New Hampshire @ Jackson Lab). EPA/NOAA labs and private consultants located in New England area.

4. Applicable Habitats:

Clam/mud flats; offshore bottom; oyster-mussel reef.

5. Applicable Conditions:

A. Demonstration of oil impact on community.

B. Large impacted area of simlar community structure to allow repetitive temporal sampling.

C. Accessibility to divers and/or sampling ($\leq$ 30 meters).

6. Applicable Oil Type:

   Any oil type would be applicable.

7. Time Frame:

   Such studies should have a minimum duration of one year to cover reproductive, growth, and recruitment parameters. Also, rates of biological uptake and/or depuration can be seasonally assessed. Field sampling should be once monthly at a minimum. If possible, sampling could be as frequent as every other week during spring and summer.

   Follow-up studies with less intensive sampling (seasonally) schedules could continue for up to three years depending on habitat significance (liability) and data base.

8. Cost:

   Such a study would require from $100K to 200K/year depending on sampling frequency, vessel expense, analytical chemistry needed and number of parameters measured.

9. Equipment Needs/Equipment Available:

   Benthic samplers (Peterson Grabs). Box Core samplers, tanks for transporting organisms. The necessary analytical chemistry support and instrumentation (unless contracted). Lab requirements include flowing seawater, troughs and tanks, and depending on measured parameters any number of things. For example, feeding studies require algal culturing and counting equipment; respiratory studies require D.O. measuring devices; shell microstructure studies require = $30K in scopes, grinding equipment and accessories.

10. Facility Needs/Facilities Available: Cruise time, analytical lab and wet lab for any applicable habitat. Diving capability and support.

11. Personnel Needs/Personnel Available:

    Need benthic biologist with expertise in molluscan biology and benthic community ecology. Support personnel needed for lab studies include experienced technician. Divers also need sample collection as well as analytical capability. Currently such assessment techniques are not routinely available. EPA-Narragansett staff will have most capabilities by January 1978. Having settled on design details for such studies a training program and/or identification of other experts could be forthcoming.

12. Support Services:

A. Total areal impact of spill on benthos.

B. Analytical support for tissue and sediments.

C. Shell microstructure contract (Yale U.).

13. Payoff:

The principal output would be a real world assessment of initial damage, latent effects and degree of recovery with time. Further one can correlate lab measures of stress with actual field impact. By monitoring the indigenous populations temporally, one obtains a meaningful measure of duration of impact. With reliable areal information both duration and extent can be realistically measured. The cost/liability estimates would have a meaningful base.

14. Limitations:

The field sampling limitations involve patchiness of exposed habitat and selection of a similar but unimpacted control population. Further direct casual relationship may be difficult to verify and may only be inferred since populations in exposed and control areas may have different histories, etc.

PANEL: LABORATORY TOXICITY
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Standardized Toxicity Testing of Petroleum and Oil-Dispersant Mixtures to Marine Biota

2. Project Description:

To conduct static acute toxicity bioassays with petroleum, chemical oil dispersants, and oil-dispersant mixtures using selected marine indicator species. Methodology is as outlined in Annex X of the Federal Register. Results are essential for use of on-scene coordinator in dispersant application recommendations. Methodology and some results reported in detail in La Roche et al., 1970 JWPCFed 42:1982-1989.

3. Performance Organizations:

   A. EPA ERL-Narragansett

   B. RFP for industrial contract

   C. Manufacturer's responsibility as outlined in Annex X--although none have complied to date.

4. Applicable Habitats:

Salt marsh, shallow salt pond, rocky shore, sand shore.

5. Applicable Conditions:

As outlined in Annex X; mixtures should reflect manufacturer's recommended application dosages.

6. Applicable Oil Type:

All types of oils-preferably restricted to products transported via VLCC in excess of 100,000 tons annually in local waters.

7. Time Frame:

Four man-years -- continuous bioassay testing of 96 hour duration, approximately 5 dispersants tested weekly vs 6 oils. This should cover all dispersants now sold commercially.

8. Cost:

$120k ($30k/man-year)

9. Equipment Needs/Equipment Available:

As specified in Annex X.

10. Facility Needs/Facilities Available:

As specified in Annex X.

11. Personnel Needs/Personnel Available:

Ron Eisler available for providing instruction at ERL-Narragansett in oil-dispersant testing. Four GS-5 level personnel can be trained in 2 weeks, but assays must be conducted under senior biologist supervision.

12. Support Services:

As indicated in Annex X.

13. Payoff:

Recommendations by OSC to apply dispersants and other oil-counteractants are dependent on a solid data base. This data base is nonexistent at present--at least for the several hundred chemical oil dispersants now in use.

14. Limitations:

As outlined in Annex X; especially tests of dispersant chemical effectiveness.

PANEL: LABORATORY TOXICITY
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: Damage Effects of Oil-Dispersant Mixtures Under Simulated Field Conditions: Use of Large Assay Containers

2. Project Description:

Current oil-dispersant toxicity evaluations are conducted under static conditions in small jars using comparatively small indicator species. Failure to consider known depth protective effects in large, deep flow through systems (Eisler, 1975 API Proceedings, San Francisco 535-540) lowers credibility to OSC of data derived from standardized (i.e., Annex X) toxicity tests.

Tests proposed herein would be conducted in large, deep, flow-through systems using adults of economically important coastal and offshore species, and others where appropriate. Primary emphasis would be on survival and whole body residues during exposure and afterwards, sublethal and latent effects including biochemical, physiological behavioral, and histological data could also be collected. Results of these studies would be useful in (1) assessing ecological damage effects of petroleum and oil-dispersant mixtures (2) establishment of hydrocarbon residues in marine products of commerce which are (a) not harmful to human health and (b) do not significantly affect integrity of brood populations.

3. Performing Organizations:

EPA - Edison, NJ

EPA - Narragansett, RI

U.S. Army Corps of Engineers

RFP

4. Applicable Habitats:

All

5. Applicable Conditions:

Mixing energy for oil-dispersant combinations must be calibrated; sediment types and amounts should be established; distance from surface variation should be determined; HC levels in water column known.

6. Applicable Oil Time:

Applicable to all crude oils; and oil-dispersant combinations at manufacturers recommended dosages (use of dispersants contra-indicated in spills of gasoline and other highly refined products).

7. Time Frame:

First year (reevaluation afterwards): screening of the five most promising dispersants (derived from Annex X data) together with appropriate target oils. A typical study would last 2 to 3 months with a total of 48 to 72 separate studies planned during this interval (see equipment section). This is a multidisciplinary approach recycling heavily on aquatic toxicologists, and analytical chemists. A minimum of 5 man-years is necessary. This can be expanded to 10 man-years if supplemental data on biochemical, physiological and other stress profiles are acquired (strongly recommended).

8. Cost:

At \$30K/man-year, minimum personnel costs would be \$150K, maximum 300K. Construction costs would approximate \$125K.

9. Equipment Needs/Equipment Available:

A minimum of six large tanks are required, each of approximately 20 meters in length 4 meters by 4 meters. Tanks should be continually supplied with raw seawater and bottom exit drains and equipped with cage-like compartments at discrete intervals surface to bottom. These tanks do not exist at present. Conventional glassware and other equipment are available at ERL-Narragansett for organisms.

10. Facility Needs/Facilities Available:

Needs: (1) holding facilities (2) analytical capability (GC-MS9; water chemistry analysis); histology and biochemical facilities. These are all available at ERL-Narragansett.

11. Personnel Needs/Personnel Available:

Availability of personnel unknown. Disciplines required include aquatic toxicology, marine biochemistry, analytical petroleum chemistry, histology, marine behavior, and aquatic physiology.

12. Support Services:

Dispersant effectiveness must be established under these conditions. Degradation of petroleum and levels in water column and sediments should be monitored. Quality control of indicator species.

13. Payoff:

A. Establishment of HC residue levels for protection of aquatic life and human health.

B. Establishes link between Annex X data and field testing of oil counteractants.

C. Unique scientific contribution on basis of test facility and multidisciplinary approach.

D. Provides OSC with decision making capability.

E. Provides data for predictive model capability for assessing economic damage of large scale spills and selected oil dispersant counteractants.

14. Limitations:

Contingency on (a) construction of test facility, (b) availability of technical expertise (some could be fixed on a one-year temporary basis) and (c) needs validation with field testing.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 3
PRIORITY RANK:

1. Project Title: In situ Acute Toxicity Tests

2. Project Description:

Mobile lab aboard work boat at spill site.

Indigenous species representing several major groups (molluscs, polychaetes, crustacean, fish) collected from a field control site are exposed to (a) oil-contaminated water from spill site in dynamic (flowing) water systems to determine toxicity under field conditions (i.e., in the presence of physical, chemical, microbial, etc. factors present at site). (b) Samples of water to be collected for chemical analyses by appropriate techniques (e.g., GC/MS, LC, etc). (c) Dispersants can be mixed with incoming oil-contaminated seawater to determine effects of dispersants on toxicity of oil-dispersant mixtures under field conditions. On the basis of this test, the least harmful dispersant could be selected for clean-up (presumably only dispersants considered to be effective in dispersing the oil in question would be tested as to effects on toxicology).

3. Performing Organizations:

EPA

EG&G Bionomics

4. Applicable Habitats:

Study could be performed (a) near shore with mobile lab located on-shore and pumping systems conducting oil-seawater to lab. (b) offshore with mobile lab on work boat.

5. Applicable Conditions:

Weather conditions would have greatest impact on ability to perform study of this type. Tests would be difficult under heavy weather conditions with the lab on work boat. Self-contained mobile lab could be rapidly transported to site of nearly any spill.

6. Applicable Oil Type:

Study would be appropriate for any type of oil spill.

7. Time Frame:

Standard acute toxicity test would require a 96-hour exposure period (i.e., to estimate the 96-h LC50 for the oil and the oil-dispersant mixtures). However, since the time will be critical it may be necessary to shorten exposure to 24 or 48 hours.

8. Cost:

Costs would not be related to spill size but would be determined by number of days lab and ship are on site. Costs for lab and personnel on site for 1 week could approach $10K exclusive of cost of ship time and collecting operations which could be shared with the research projects of other investigators.

9. Equipment Needs/Equipment Available:

Equipment needed would include: mobile lab with the appropriate exposure aquaria, diluters, pumps, and ancillary equipment normally required for bioassays (pH meters, dissolved oxygen meters, etc.). Bionomics currently operates mobile laboratory facilities which contain all the necessary equipment. Also required is test animal collecting gear such as trawl nets and water samplers.

10. Facility Needs/Facilities Available:

Facilities include mobile lab described above and work boat of appropriate size to transport lab.

11. Personnel Needs/Personnel Available:

Personnel required would include investigators familiar with the performance of on-site toxicity tests. Bionomics has personnel available with the relevant field and lab experience. Contact is S.R. Petrocelli 617/295-2550.

12. Support Services:

Support would include collection of test organisms and chemical analyses of water and animal tissues.

13. Payoff:

Results of study would (a) determine acute toxicity of the oil under field conditions to natural indigenous species; (b) give the OSC information regarding the selection of dispersant to be used in clean-up or allow the OSC to determine that a dispersant should not be used; and (c) using mortality as the criterion of effect, the economic loss associated with the death of a certain percentage of the species of interest could be determined.

14. <u>Limitations</u>:

Study would be difficult under conditions of heavy seas, strong winds, heavy ice conditions. Need to locate appropriate control areas from which to collect test animals. Test would probably be shortened in time and scope due to need for immediate information for the OSC to make decisions.

15. Other--study will allow investigator to (a) determine impact on test animals of environmentally realistic oil concentrations; and (b) alter systems as required by the particular spill. That is, test under continuous exposure to oil as occurs during continuous release of oil from grounded tanker or test under pulse-dosing conditions as occurs if oil spill is intermittent. Also allows the study of under time-dilution conditions which occur once the input of oil into the sea is ended and the oil disperses with time.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 5
PRIORITY RANK:

1. Project Title: Time Dilution Bioassay on Holoplankton and Meroplankton

2. Project Description:

Objective of this study is to utilize actual spill dispersion information to assess the acute, latent and chronic impact upon selected species of marine holoplankton and meroplankton. Actual time series of chemical analysis from the spill site will be used to develop a dispersion model for continuous flow dosing system. Laboratory spawned or cultured organisms will be exposed using a design that will permit assessment of acute, latent and sublethal effects. Parameters could include embryological development, viable hatch, survival, and swimming behavior. For chronic studies growth, reproduction, brood size and subsequent F_1 survival, this study will permit a realistic assessment of impact to the water column environment. Applications should be carefully chosen.

3. Performing Organizations:

Would include EPA-Narragansett, EG&G, Marine Research Associates.

4. Applicable Habitats:

This assay is applicable to pelagic habitats either nearshore or offshore.

5. Applicable Conditions:

Conditions for the success of this study include:

A. Detailed field analytical data and time dispersion model

B. Detailed lab analytical data to verify lab dosing systems

C. Application of assay in situations of known high potential impact. Spawning areas for ichthioplankton species, important meroplanktons, etc.

D. Deep offshore habitats where benthic impact is not expected.

6. Applicable Oil Type:

Oil type most applicable is one with high dispersability and potentially high WAF:No. 2, gasoline, No. 4.

7. Time Frame:

Acute and latent studies relate to temperatures and developmental periods of appropriate species, generally, 10 to 30 days. Chronic studies could extend to 60 days.

8. Cost:

Cost per assay: Acute with latent 100 to $200/assay; chronic $5 to $10K.

9. Equipment Needs/Equipment Available:

Dosing system ready to go with little advance notice.

10. Facility Needs/Facilities Available:

Facilities include analytical laboratory and bioassay facilities including flowing seawater, air and seawater temperature control, model ship for dosing system fabrication.

11. Personnel Needs/Personnel Available:

Reputable contractors available and federal research facilities.

12. Support Services:

Support services include analytical chemistry, culture of test species, field collection of indigenous adult spawning stock, biogeographical and seasonal information for proper species selection.

13. Payoff:

Produces hard scientific data based upon field observations and predictability for acute, chronic and latent effects. Verified (?) by field studies. Economic liability can only be assessed if data is model with historical catch, fecundity and year class data if available.

14. Limitations:

Limitations are that the plankton may constitute a minor problem due to patchiness, immigration and high reproductive potential.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 6
PRIORITY RANK:

1. Project Title: Sublethal Effects of Chronic Exposure to Low Levels of Petroleum Hydrocarbons in Zooplankton (Coastal, Offshore, etc.). "This Work Could Also be Extended to Fish (Herring) or Other Crustaceans."

2. Project Description:

   A. Objectives: to determine the long-term effects of realistic, sublethal concentrations of petroleum oils on

      (1) rates of uptake and retention of H-C by above organisms.

      (2) rates of biodeposition of oil residues in fecal pellets.

      (3) rates of ingestion, assimulation and respiration.

      (4) energy available for growth, growth rates and fecundity.

      (5) interpretation in terms of their usefulness in predicting ecological influences of oil.

   B. How carried out?

      (1) populations of marine organisms will be held in 5700L tanks into which a continuous supply of seawater, food and oil is maintained.

      (2) physiological measurements will be done using organisms from the experimental (oiled-WSF) tanks and compared to control (unoiled).

      (3) possible results-reduction in carbon flow (Gilfillan, 1976), increased sensitivity to environmental stress, reduced fecundity.

3. Performing Organizations:

Bowdoin College Marine Research Laboratory and Bowdoin College Dept. of Chemistry. Personnel: Drs. Dana Mayo, Davie Page, Edward Gilfillan, Ray Gerber, all at B.C.

Address: Bowdoin College Marine Research Laboratory
Brunswick, Maine 04011 207/725-8731 Ext. 604

4. Applicable Habitats:

Coastal, Inshore, and Offshore waters of the Gulf of Maine.

5. Applicable Conditions:

Conditions for the study will be created and maintained using the flow-through dosing apparatus. Once the system is set up work can begin immediately.

6. Applicable Oil Type:

All oils can be used but should be limited to the most detrimental types.

7. Time Frame:

This is a long term study and the period reflects the length of the life cycle of the organisms and the seasonal cycle of food supply. We envision at least one full year studies, sampling once a week for nutrients, etc., bi-weekly for physiological studies, etc.

8. Cost:

1st year is $126K (includes cost of apparatus)
2nd year is $80K (salary and maintenance--H-C sample analysis)

9. Equipment Needs/Equipment Available:

A. flow through apparatus - to be constructed

B. H-C equipment available at Bowdoin College (see xerox of H-C Research Center)

C. physiological equipment--mostly available: respirometers, feeding apparatus, glassware, balances, etc.

D. CHN analyses--not available at Bowdoin College but from Bigelow Laboratories, Boothbay Harbor, Maine.

10. Facility Needs/Facilities Available:

A. We have no facility needs except for the building of the flow-through apparatus.

B. Chemistry Dept., Marine Research Laboratory at Bowdoin College has adequate space at the Main Campus and the marine laboratory at Bethal Point.

C. Boats available for collecting and computer, library facilities excellent.

11. <u>Personnel Needs/Personnel Available</u>:

A. Chemistry group--Drs. Dana Mayo, David Page

B. Marine Research Group--Drs. Edward Gilfillan, Ray Gerber.

These personnel have had extensive experience in their respective fields.

C. Two technicians--S. Hansen and J. Cooley; both senior technicians.

12. <u>Support Services</u>:

A. Nutrient samples and particulate carbon and nitrogen samples can be processed at the Bigelow Laboratories (they have approved this work).

B. No other support services necessary.

13. <u>Payoff</u>:

A. This work will determine the long-term effects (physiological) of sublethal concentrations of petroleum H-C on marine organisms using a flow-through in situ system.

B. We are concerned with nutritional physiology and energy flux which ultimately effects the production of these populations.

C. Provide insite into H-C uptake, rate of retension and ultimately the concentration and movements of these H-Cs up the food chain...even to man.

D. Any reduction in the production at one level (e.g., zooplankton) could affect abundances by reducing consumer populations (herring, etc.).

E. Since these experiments will be conducted throughout the year, valuable information on temperature and food effects on the organisms' ability to resist oil pollution will be obtained.

F. The flow-through apparatus will provide more realistic conditions compared to static systems and could be used in other similar dosing studies.

G. Economic payoff would be directly related to possible reduction in the growth and production of economically important species.

14. Limitations:

A. The experiments have to be long-term and require considerable manpower, thus would be costly and time consuming.

B. Each apparatus ($25K each) can only work with one oil type at a time.

C. Results from these studies will not be directly comparable to studies from "static systems."

D. The complexity of the apparatus will no doubt create operational problems, which should be overcome after the first year of operations.

E. The system may have to be closed down (December-February) because of severe weather conditions in Maine.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 7
PRIORITY RANK:

1. Project Title: Effects of Oil Tainting of Prey on Food Selectivity and Feeding Behavior of Two Predatory Fish Species

2. Project Description:

A. Objectives

(1) Determine behavior effects on an inshore oil spill on normal feeding behavior of two predatory fish species in terms of alteration of prey palatability.

(2) Increase knowledge in defining biologically adequate stimuli used for optimal prey selection in fish, and observe how these stimuli are altered by oil tainting.

(3) Determine the "rejection strength" of oil-tainted prey in relation to feeding motivation changes due to satiation.

B. Materials and Methods

Predator and prey species will be chosen with careful consideration of constraints involved in a laboratory study, i.e., predator and prey species suitability for laboratory holding facilities; availability of normal prey in a spill site, etc. Feeding behavior studies indicate two preliminary predator species as plausible candidates. Olla et. al. (1975) found juvenile Tautoga onitus to feed primarily on Mytilus edulis. Olla et al. (1969) indicated adult winter flounder (Pseudopleuronectes americanus) to feed mainly on bivalve moluscs and gastropods. Juvenile winter flounder will be used, as Werner (1974) has predicted greater selectivity in juvenile fish due to restrictions of a smaller mouth gape. It is proposed here that these two predators, being important sport and commercial fish species, be utilized in behavior bioassays to determine effects of oil tainting on feeding response to normal prey (Mytilus edulis). Predators will be obtained from a clean site and held in the lab. Contaminated prey (Mytilus edulis) will be obtained from a spill area, and control prey from a "clean," uncontaminated area. Experiments will take place in sea water tables 1.5m^2 x 10cm deep. Predators will be presented with a choice situation of oil-tainted and uncontaminated prey simultaneously. Probability of eating prey items and response to the prey will be recorded. Data will be categorized into different motivation (satiation) levels and analyzed for differences between tainted and "clean" prey. This methodology has been used in behavior experiments by Kislalioglu (1976) to analyze stimulus cue strength of prey in fish feeding studies.

3. Performing Organizations:

EPA Environmental Research Lab In-House project.

4. Applicable Habitats:

Rocky shore and possibly offshore bottom (flounder).

5. Applicable Conditions:

Oil impact on a rocky intertidal area with adequate mussel beds impacted.

6. Applicable Oil Type:

Any heavy oil which would fulfill the above requirement.

7. Time Frame:

The study requires a 2 year period, consisting of review of gut analysis data in the literature; baseline feeding studies to define the relationship of satiation to feeding behavior in the species used and to define normal feeding responses; and oil studies to observe any changes in normal feeding response. Because of the dependence upon a spill of opportunity, baseline studies will proceed until a spill of the specified type occurs in the Region I coastal area, at which time emphasis will be shifted to oil studies, with return to baseline studies necessary for comparison of behavioral feeding responses.

8. Cost:

In-House Project	\$15K/man-years x 2 = \$30K
1040 App't.	(includes use of EPA facilities and
EPA ERL-Narragansett	equipment)

9. Equipment Needs/Equipment Available:

Will be supplied by EPA ERL-Narragansett.

10. Facility Needs/Facilities Available:

Supplied by EPA ERL-Narragansett.

11. Personnel Needs/Personnel Available:

Christopher Deacutis, University of Rhode Island.

12. Support Services:

Body burden analysis of pooled oil-tainted prey.

13. Payoff:

A. Examines the effect of oil on normal predatory-prey relationships. Depending upon predatory species utilized, the project may offer some predictive abilities as to impact strength on generalist vs. more specialized predators. It is expected that those fish species which rely on chemosensory cues in any behavioral components of normal feeding behavior will be most likely to alter normal feeding behavior, and possibly result in "area avoidance searching" (Thomas, 1975). If a large area is impacted by the oil, extensive localized migration and avoidance of the impacted area may take place. Thus:

B. Contributes to long-term assessment of oil spill ecological damage in terms of loss of contaminated areas as adequate feeding grounds for commercially valuable fish species.

14. Limitations:

Prey should be obtained after clean-up if possible. A spring or summer spill is desired since most fish species depress feeding behavior to very low levels in winter months. If mussels are in offshore areas, diving services may be required.

REFERENCES

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Werner, E.E., 1974. J. Fish. Res. Bd. Can., 31: 1531-1536.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 8
PRIORITY RANK:

1. <u>Project Title</u>: Effects of Oil-Spill Contaminated Sediment on Reproduction of Winter Flounder, *Pseudopleuronectes americanus* (Walbaum)

2. <u>Project Description</u>:

   Objectives of the project would be:

   A. To assess the impact of oil contaminated sediment on the reproductive success of winter flounder, as measured by larval survival after parental exposure during gonad maturation.

   B. To investigate whether a similar response occurs in the field at an oil spill site by collecting gravid flounders from the site, obtaining gametes, and measuring larval survival.

3. <u>Performing Organizations</u>:

   Environmental Research Lab. - Narragansett (EPA)

4. <u>Applicable Habitat</u>:

   Shallow salt pond; worm-clam flat; shallow estuary or embayment.

5. <u>Applicable Conditions</u>:

   A. Persistent incorporation of oil into the sediment

   B. Existence of a suitable control site

   C. Impact in an area where a spawning population of winter flounder resides.

6. <u>Applicable Oil Type</u>:

   Any frequently transported oil which has potential for incorporation into sediment (preferably No. 2 fuel oil for comparison with previous studies).

7. Time Frame

One to two years although follow-up studies may extend this to five years.

8. Cost:

$20K-$30K (?)

9. Equipment Needs/Equipment Available:

- large tanks for adult exposure
- 10 gallon aquaria with temperature control
- sediment collection equipment
- 2 otter trawls
- plankton nets or a supply of plankton for larval food
- microscope.

10. Facility Needs/Facilities Available:

Analytical (GC) sediment and tissue analysis boat equipped for handling an otter trawl and willing to trawl in an oil contaminated area.

11. Personnel Needs/Personnel Available:

Diane Everich - Research Aquatic Biologist, EPA-ERL, Narragansett

One technician - half-time.

12. Support Services:

Completed sediment contamination surveys of spill area.

13. Payoff:

A. Study will indicate impact of an oil spill on winter flounder reproductive success.

B. Catch statistics plus fecundity information in literature may be combined with results from this study to produce a rough estimate of damage cost to winter flounder fishery.

14. Limitations:

A. Collection of sediment from spill site for laboratory exposures may be difficult due to patchy distribution of oil and disturbance of oil gradient in sediment during collection. This problem may be avoided by artificial contamination of sediment in the lab using the same oil which was spilled.

B. It may happen that flounders avoid the spill site, in which case the spill is not a problem -- an interesting result in itself.

PANEL: LABORATORY TOXICITY
PROJECT NO.: 9
PRIORITY RANK:

1. Project Title: Effects of Chronic Exposure to Oil on Representative Marine Animals

2. Project Description:

Exposure of marine animals to oil even for limited periods of time may result in significant deleterious effects on the subsequent growth, development and reproduction of these animals. Since it is difficult to determine the exposure history of animals collected in the field, laboratory populations of fish, crustaceans and/or molluscs could be exposed in the lab in a dynamic (flowing) water system to a range of concentrations representing different size oil spills in different water masses representative of open ocean versus coastal embayment, etc. Following exposure to the whole oils for a period of time approximating an oil spill (days, weeks or months) the oil source would be ended and the growth and development of the animals measured in terms of length and weight measurements; fecundity of animals exposed to oil at the various concentrations could be compared with each other and with the controls to determine a dose-response relationship and the subsequent hatching of eggs and development of larvae could be determined. During this time observations of behavior and physical anomalies could be made; subsamples would be removed for histopathological examination as well. This study would yield information concerning the long-term effects on marine animals of exposure to an oil spill in the field in a manner which would permit an evaluation of the potential decrease in populations of these species as a direct result of the exposure.

3. Performing Organizations:

EPA
Bionomics
EG&G

4. Applicable Habitats:

Any habitat could be considered.

5. Applicable Conditions:

It is necessary (a) to work with species which can be successfully cultured in the lab and (b) to determine prior to commencement of the study, the duration of exposure and oil concentrations to be representative of an actual oil spill.

6. Applicable Oil Type:

Any type of oil could be tested.

7. Time Frame:

Time frame depends on the duration of the life cycle of the animal being tested and could range from 17-20 days for the calanoid copepod Scartia tonsa, to weeks for the mysid shrimp Cyprinodon vainegatus.

8. Cost:

Size of spill does not affect cost. Cost determined by duration of life cycle (i.e., amount of time populations are to be maintained in lab following exposure). Costs may approach $75K for 7 months sheepshead minnow study.

9. Equipment Needs/Equipment Available:

Appropriate exposure aquaria, water quality measurement apparatus (pH and dissolved oxygen meters, GC, etc.).

10. Facility Needs/Facilities Available:

Facilities required would include a laboratory with flowing good quality seawater, water tempering equipment, analytical laboratories.

11. Personnel Needs/Personnel Available:

Investigators with familiarity with the general biology and culturing of the test species are preferred. Bionomics currently employs persons with the necessary qualifications. Contact S.R. Petrocelli 617-295-2550.

12. Support Services:

Analytical chemistry is most important ancillary service required.

13. Payoff:

Results of study would define the long term effects of oil spills on marine animals and perhaps permit an evaluation of the changes in numbers of individuals surviving and reproducing in natural populations.

14. Limitations:

By necessity, only one species could be tested in any study. Separate studies must be conducted with each of several significant species. It would be difficult to determine the overall ecological effects but does give good information for the selected species (which should be selected on the basis of commercial, ecological and human health significance).

SOCIOECONOMIC AND LEGAL ASPECTS PANEL

Participants

J. Praeger, Chairman
P. Fricke, Co-Chairman

C. C. Bates	W. Marhoffer
S. Carroll	J. Marotta
C. Carty	B. Melzian
P. Cavicchi	F. C. Monastero
R. Ceurvels	D. G. Neal
F. R. Disheroon	S. Peterson
J. Fiske	R. Rehfus
D. Forcella	R. Robinson
J. Gentile	L. Slaski
C. Hall	W. Smith
J. W. Hurst	J. Snider
J. F. Kirkland	J. Valenti
S. M. Lord	H. D. VanCleave

Judge T. Yost

SOCIOECONOMIC AND LEGAL ASPECTS PANEL*

General Information and Guidance

- Initial Considerations
- Follow-Up Panel Activities

INITIAL CONSIDERATIONS

A. Formation of Socioeconomic Subpanel

The initial act of this panel was to recognize that the social sciences should contribute project proposals in their own disciplines to the Executive Committee. Consequently, a separate subpanel on assessment of socioeconomic impacts of an oil spill was created under the Chairmanship of Peter Fricke.

B. Legal Framework for Damage Assessment

1. Pending Legislation

The panel addressed applicable law and decided that the wisest course of action to offer guidance based upon anticipated passage of one of the three laws dealing with oil spills that now are before Congress. This is possible because none of the three affect the nature or amount of scientific contribution to ecological damage assessment. All deal with traditional concepts of damage assessment, such as oil removal costs, losses of use, losses of profits, losses of tax revenues, etc. Only "loss or injury to natural resources" is a new feature of the law. This will need to be developed through the evolution of case law -- but is a major concern of this workshop.

2. The Three Questions

The basic questions that must be answered in a case in which damage to natural resources is claimed:

1) What was damaged?

2) How much was it damaged?

3) How was it damaged?

*Some material produced by the panel was not available for inclusion in this draft. That material will be incorporated into the final workshop report.

Discussions of these questions ellicited a recurring theme of baselines or controls. The panel concluded that although baseline or control information is highly desirable, it is not always available. Therefore, studies of damage must be prepared to proceed in the absence of prior or control data. Scientists must be prepared to determine what is measurable in the absence of a baseline -- and how this may be used in a forensic sense to establish answers to what was damaged, how much it was damaged, and by what means it was damaged.

3. Scientific vs Legal Requirements

Whereas science would like to be at least 95 percent sure of it's ground before venturing an opinion, the courts are satisfied with 51 percent surety. Expert opinion is quite acceptable -- and the weight or preponderence of evidence sways the courts decision. Thus, narrative description of observable phenomina is adequate and acceptable if nothing more substantial can be developed as evidence.

FOLLOW-UP PANEL ACTIVITIES

A. Development of Legal Guidance for Scientists

The panel agreed that as an exercise, it would define the elements of an ideal case, and then determine just how far from the ideal one could stray for each element before the study could be deemed useless. An ideal case of ecological damage assessment was defined as one in which:

1) All parties were defined.

2) A scientific baseline was available.

3) Damage was to a commercial crop.

4) Cause and effect of the spill was clearly demonstrable.

5) Economic losses were measurable.

6) Means of measurement were known, verified, and agreed upon.

7) Predictable losses of resources and their economic values were agreed upon.

Clearly this set of criteria never will be fully met. What then, can scientists contribute to the adjudication of these seven points?

Identification of the parties is not in the scientific realm. The parties will be determined by the courts. The remaining 6 criteria are fair game for the scientific community. The guidance to be developed by the panel will deal with such questions as:

- Do conditions under which samples are taken affect stringency of proof required?
- Can index species be used to presume baseline conditions?
- Must an effect on man be proven to demonstrate damage?
- Can scientific findings be prioritized in the legal arena?
- Must cause and effect be provable in every case?
- How much money is a dead barnacle really worth?

B. Specific Projects

The projects recommended by the panel represent broad brush, but not exhaustive proposals to gather information which would be useful in assessing socioeconomic impacts of oil pollution. It should be noted that any person or corporate entity earning more than 25 percent of his yearly income from marine related activities in entitled to redress if he can prove damage under proposed legislation (HR-6803). Thus, in addition to providing the OSC with information which would assist in the choice of clean-up methods, the socioeconomic studies are seen as providing yard sticks against which compensation for given incidents may be measured.

The suggested studies fall into two groups. Baseline studies are seen as providing basic information about socioeconomic activities which will probably be impacted by any spill. These studies would require periodic up-dating. The second group of studies provide specific information useful in impact assessment, but would not need to be updated. The actual impact studies after a polluting event would draw upon the two groups of research studies and would ascertain the impact in socioeconomic terms.

SOCIOECONOMIC AND LEGAL ASPECTS PANEL

Recommended Projects*

1. Overview of the maritime socioeconomic activities of the region by sub-region.
2. Baseline study of commercial fisheries processing industry by sub-region.
3. Baseline study of the fish processing industry by sub-region.
4. Baseline study of the fish trucking by regions and sub-regions.
5. Baseline study of fish retailing dependent upon locally caught fish by sub-region and region.
6. Baseline study of the recreational boating industry and of boat ownership and use.
7. Baseline study of sports fishing by sub-region.
8. Baseline study of recreational use of the shoreline.
9. Analysis of effectiveness of baseline research as a basis for assessing legal damage.
10. Analysis of the cost-effectiveness of oil spill cleanup operations.
11. Study of the socioeconomic factors involved in locating oil pollution response equipment stores and the designation of areas for beaching or off-loading damaged vessels.
12. Analysis of oil transportation patterns for the region by sub-region.
13. Development of models for the assessment of socioeconomic damage following spills.

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*Projects 1-8 are considered baseline studies providing basic socio-economic information which would require periodic updating. Projects 9-14 provide specific information useful in impact assessment which would not require updating.

14. Assignment of socioeconomic priorities for protection of areas vulnerable to oil spills by sub-region.

15. Preliminary descriptions of additional projects.

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Overview of the Maritime Socioeconomic Activities of the Region by Sub-Region. (A sub-region is defined as one bounded by natural features of the marine environment, e.g., Narragansett Bay or Vineyard Sound.)

2. Project Description:

   Goals of the project would be:

   A. Ascertain population size, demographic characteristics, and distribution by season;

   B. Provide a general description of the use of, and economic value to, the marine environment by the population, and the hinterlands served by region and sub-region;

   C. Provide a full description of the industrial uses of the marine environment (e.g., sand and gravel extraction, shore line industrial sites, ports and terminals);

   D. Identify the fisheries and their socioeconomic values;

   E. Identify other uses of the marine environment and their socioeconomic values;

   F. Identification of areas and uses particularly vulnerable to oil pollution;

   G. Provide a comprehensive reference to previous experience in coping with oil spills and clean-up.

3. Performing Organizations:

   State Coastal Zone Management (CZM) Offices; or the University of Massachusetts; University of Maine; University of Rhode Island (URI); Southeastern Massachusetts University (SMU); M.I.T.; Woods Hole Oceanographic Institution (W.H.O.I.).

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   1 year; updated quinquennially.

8. Cost:

   $80,000 initially; $20,000 for updates.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

    The study will provide an overview of socioeconomic activities in the region and will pinpoint areas of particular impact for later studies.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Baseline Study of Commercial Fisheries by Sub-Region

2. Project Description:

   Goals of the project would be:

   A. Collate catch statistics by species, by location of catch, by value on landing at the dock.

   B. Provide data on the number of vessels and fisherman using the sub-region as

      (1) a base for operations

      (2) regular fishing activity

   C. Examine structure of industry (e.g., company or family ownership of vessels; part or full-time fishing activities; whether subsistence or purely commercial fisheries).

   D. Investigate capital employed in the industry (value, age and size of vessels, gear, etc.).

3. Performing Organizations:

   NOAA/NMFS; New England Fishery Management Council (NEFMC); WHOI (Dr. Peterson and Dr. Smith); URI (Drs. Poggie and Norton); University of Maine (Dr. J. Atcheson). (N.B. Dr. Peterson is completing a baseline study for the NEFMC; Drs. Poggie and Atcheson have a newly awarded contract from NSF for a regional study.)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   2 year initial study; 1 month annual updates.

8. Cost:

$300,000 initially; $12,000 annually.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Full assessment of probable socioeconomic impacts on the fishing industry.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: Baseline Study of the Fish Processing Industry by Sub-Region

2. Project Description:

   Goals of the project would be:

   A. Provide fish product statistics by species, source and value;

   B. Indicate the number of plants and employees, and the size and value of the operations;

   C. Indicate the structure of the industry for each sub-region (e.g., whether frozen or fresh fish are used; degree of vertical integration with associated industries; company or family plant-ownership; whether seasonal, part or full-time operation in normal practice);

   D. Capital structure of the industry (age, value and type of equipment, etc.);

3. Performing Organizations:

   W.H.O.I (Dr. Peterson and Dr. Smith); U.R.I. (Dr. Norton); S.M.U. (Dr. Giorgioni); University of Maine (Dr. Wilson); University of Massachusetts-Amherst (Dr. Storey). (N.B. Drs. Peterson and Smith are currently working on a similar study.)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

   1 year initially; 2 weeks annual up-date.

8. Cost:

   $40,000 initially; $6,000 annually.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

    Indication of the probable impacts of oil pollution on the fish processing industry.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: Baseline Study of Fish Trucking by Regions and Sub-Regions

2. Project Description:

   Goals of the project would be:

   A. Mapping of fish distribution networks;

   B. Detail the numbers of trucks and persons solely involved in the transportation of fish;

   C. Show the structure of the industry (e.g., whether company or individually owned trucks; the degree of vertical integration, etc.);

   D. An analysis of the capitalization of the fish truckings (e.g., value, age and type of trucks; whether owned or leased, etc.).

3. Performing Organizations:

   University of Massachusetts (Storey)
   WHOI (Peterson and Smith)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   Three months initially; update 1 week annually (this could be associated with the update of fish processing).

8. Cost:

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoffs:

Provide an estimate of an industry which would be affected if oil pollution caused a shift in fishing grounds and landing ports.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: Baseline Study of Fish Retailing Dependent Upon Locally Caught Fish by Sub-Region and Region

2. Project Description:

Goals of the project would be:

A. Provide an analysis of the sources of fish supplied, their quantity and value, and the local market area served;

B. A mapping of the number of markets/stores and persons engaged in the industry by season;

C. An analysis of the structure of the industry (e.g., degree of vertical integration with other aspects of the fishing industry; whether company or family owned, etc.);

D. Capital structure of the retail system (e.g., value, age, and type of store, equipment, etc.).

3. Performing Organizations:

University of Massachusetts-Amherst (Storey)
URI
WHOI (Peterson and Smith)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

Four months initially; quinquennially update of 2 weeks.

8. Cost:

$20,000 initially; $2,500 for updates.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

An assessment of the structure of a local industry which would be quickly affected of local supplies if fish were tainted or fishing grounds closed.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: Baseline Study of the Recreational Boating Industry and of Boat Ownership and Use

2. Project Description:

Objectives of the project would be:

A. Description of the size, numbers and location of recreational boating facilities-marinas, boatyards, boat ramps -- both public and private, their degree of use and spatial distribution;

B. Values, numbers and types of boats by region and sub-region;

C. Socioeconomic profiles of boat owners and their patterns of use of their craft;

D. Capital structure of marinas (e.g., ownership patterns; value and size of facilities, equipment, etc.);

E. Capital structure of boatyards (e.g., ownership patterns; value and size of facilities, equipment, etc.).

3. Performing Organizations:

State CZM Offices
URI (Dr. Rorholm)
M.I.T. (Dr. Devanney)
WHOI (Peterson and Smith)
SMU
University of Maine

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

9 months.

8. Cost:

$30,000.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Identification of patterns of use of recreational boating facilities for use by the OSC in his planning, and the impact of oil pollution in sub-regions.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Baseline Study of Sports Fishing by Sub-Region

2. Project Description:

Objectives of the project would be:

A. Description of size and location of fishing areas, their degree of use and the species sought;

B. Description of the numbers of fisherman engaged in off-shore, near-shore and on-shore sport fishing; a demographic profile of sports fisherman, and a socioeconomic appraisal of the number, size and types of boats and gear used;

C. Size, location and extent of charter-boat operations, bait shops and services provided in local communities;

D. Capital structure of service sector.

3. Performing Organizations:

NOAA/NMFS
State CZM Offices
URI (Dr. Rorholm)
UHOI (Drs. Peterson and Smith)

(N.B. NOAA/NMFS already conducts a survey of sports fishing which could easily be expanded to meet the needs of the baseline study.)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

1 year; updated quinquennially.

8. Cost:

Initially $60,000; updates $60,000

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Provides a basis for the assessment of damage to sports fishing.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 8
PRIORITY RANK:

1. Project Title: Baseline Study of Recreational Use of the Shoreline

2. Project Description:

Objective of the project would be:

A. Ascertain size and location of shoreline amenity areas (e.g. beaches, salt water ponds, marshes, coastal trails, town wetland areas) and size of population served;

B. Determine types of use and social profiles of users;

C. Determine types of facilities, whether public or private, and the type and value of equipment provided.

3. Performing Organizations:

State CZM Office
University of Massachusetts-Amherst (Storey)
U.R.I. (Rorholm)
WHOI
SMU
University of Maine
University of New Hampshire

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

6 months initially; one month quinquennial update.

8. Cost:

$30,000 initially; $6,000 for updating.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Assessment of value to user population.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 9
PRIORITY RANK:

1. Project Title: Analysis of Effectiveness of Baseline Research as a Basis for Assessing Legal Damage

2. Project Description:

   Objectives of the project would be:

   A. To compare the costs of baseline and post-spill research with assessment of damages awarded by courts.

   B. To ascertain the usefulness of information generated in research projects in the assessment of damages.

3. Performing Organizations:

   University of Massachusetts
   U.R.I.
   S.M.U.
   WHOI

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   3 months duration after legal proceeding completed. (The frequency of such studies would be determined by the RRT).

8. Cost:

   $20,000

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Needs:

13. Payoff:

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 10
PRIORITY RANK:

1. Project Title: Analysis of the Cost-Effectiveness of Oil Spill Cleanup Operations

2. Project Description:

   Objectives of the research would be:

   A. Analysis of the cost components of cleanup operations and the effectivenss of these operations.

   B. Identify the cost benefit of cleanup operations required under the National Contingency Plan.

   C. Review these costs and cost benefits in relation to socio-economic impacts observed.

3. Performaing Organizations:

   USCG
   EPA
   State CZM Offices
   University of Maine
   University of Massachusetts
   U.R.I.
   S.M.U.
   WHOI

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   3 months

8. Cost:

   $30,000

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

    Input to the review of the national and regional plans.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 11
PRIORITY RANK:

1. <u>Project Title</u>: Study of the Socioeconomic Factors Involved in Locating Oil Pollution Response Equipment Stores and the Designation of Areas for Beaching or Off-Loading Damaged Vessels

2. <u>Project Description</u>:

Objectives of the project would be:

A. Establish criteria for the designation of "refuse" areas including public and private use, economic and social values of the areas.

B. Assess alternative sites proposed by USCG.

3. <u>Performing Organizations</u>:

State CZM Offices
University of Maine
University of Massachusetts
URI
WHOI

4. <u>Applicable Habitat</u>:

5. <u>Applicable Conditions</u>:

6. <u>Applicable Oil Type</u>:

7. <u>Time Frame</u>:

3 months.

8. <u>Cost</u>:

$25,000

9. <u>Equipment Needs/Availability</u>:

10. <u>Facility Needs/Availability</u>:

11. <u>Personnel Needs/Availability</u>:

12. Support Services:

13. Payoff:

Avoidance of additional socioeconomic impact the handling of spills.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 12
PRIORITY RANK:

1. Project Title: Analysis of Oil Transportation Patterns for the Region by Sub-Region

2. Project Description:

   Objective of the project would be:

   A. Review movement of oil to and from regional ports, and through the seaways of the region, by type and quantity of oil carried and the type and size of vessel;

   B. Identify areas of greatest density of oil movements.

3. Performing Organizations:

   USCG
   NOAA
   State CZM Offices
   University of Maine
   University of Massachusetts
   U.R.I.
   WHOI

(N.B. A study of traffic off Maine, New Hampshire, Massachusetts and Rhode Island has been sponsored by NOAA and is being completed by WHOI.)

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   3 months.

8. Cost:

   $25,000

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Identification of vulnerable areas and types of threat to the environment.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 13
PRIORITY RANK:

1. Project Title: Development of Models for the Assessment of Socioeconomic Damage Following Spills

2. Project Description:

   Objectives of the project would be to:

   A. From the overview and baseline studies develop critiera to be used to assess damage;

   B. Develop an assessment plan for application to specific spills.

3. Performing Organizations:

   EPA
   NOAA
   State CZM Offices
   University of Maine
   University of Massachusetts
   URI
   WHOI

4. Applicable Habit:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   3 months; update after experience of use of the request of RRT.

8. Cost:

   $25,000 initially.

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13. Payoff:

Standardization of assessment procedures.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS
PROJECT NO: 14
PRIORITY RANK:

1. Project Title: Assignment of Socioeconomic Priorities for Protection of Areas Vulnerable to Oil Spills by Sub-Regions

2. Project Description:

   Objective of the project would be:

   A. Develop socioeconomic criteria for protection of specific sites;

   B. Develop, in conjunction with State and local governments, designations of priority in each sub-region.

3. Performing Organizations:

   State CZM Offices
   Regional University and Institutions

4. Applicable Habitat:

5. Applicable Conditions:

6. Applicable Oil Type:

7. Time Frame:

   3 months.

8. Cost:

   $25,000

9. Equipment Needs/Availability:

10. Facility Needs/Availability:

11. Personnel Needs/Availability:

12. Support Services:

13: Payoff:

Advice to OSC and States on protection of sites to be used in specific subregions.

14. Limitations:

PANEL: SOCIOECONOMIC AND LEGAL ASPECTS

Preliminary Descriptions of Additional Projects*

1. Analysis of the costs of Federally authorized cleanups (FWCTA Act of 1970).

   Description of research tasks:

   a) Size of spill and nature of oil;
   b) Size of clean-up area;
   c) Duration of clean-up;
   d) Extent of personal property affected;
   e) Cost of cleanup of various types of property;
   f) Degree of success of cleanup.

2. A study of the nature of commercial insurance adjusters manuals for determining injury to, destruction of, or loss of use of:

   a) real property;
   b) personal property;
   c) natural resources;
   d) income/earnings.

Research Objective: Develop a similar set of predictions for use by assessors in oil spill cases.

3. A national compendium of insurance and legal specialists experienced in oil spill litigation.

   Description of research objective:

   Establish, for the benefit of the public, the damage assessment panels and administrative judges, a roll of those with particular experience in oil spill litigation and the assessment of property damage and economic loss rising therefrom.

4. A summary of the operation of the international TOVALOP and CRISTAL funds in paying for oil spill damages.

5. A study of international practices in assessing cleanup and damage costs for oil spills, and in providing reimbursements.

---

*These projects were proposed but full discussion of them was not accomplished.

Description of research objectives:

Develop comparative case studies of the methods used in oil pollution cases in Japan, Norway, France and the United Kingdom for possible use in standard setting.

6. Compilation of a digest or handbook on the variability in natural resources, particularly those of commercial value, and their use and the causes of such variability.

Description of research objectives:

Provide a guide to lawyers, panels of assessors and administrative judges in interpreting standard regulations and assessment.

FACILITIES AND DATA MANAGEMENT PANEL

Participants

C.L. Eidam, Chairman

R. Boynton	M. Lockwood
C. Buehrens	W.J. Marhoffer
P.J. Cavicchi	Lt. Cmdr. J. Marotta
A.R. Ceurvels	J. Ripp
J. Fiske	Lt. D. Sande
J. Griffin	M.D. Schuldt
G.F. Kelly	L. Smith
D. Kennedy	W.H.B. Smith

Cdr. J. Valenti

FACILITIES AND DATA MANAGEMENT PANEL

- Guidelines and Criteria for Facilities
- Data Management Aspects
- Research Vessels in EPA Region I
- EPA Region I Chain of Custody Procedures

GUIDELINES AND CRITERIA FOR FACILITIES

A. Reporting Format for Facilities

Initial order of business centered around a review of the guidance prepared for the panel by the Chairman and deciding on a course of action which the panel would follow to fulfill its objectives. After a fairly lengthy review, it was accepted by the panel as a workable document. The panel then focused on the specific criteria which would be used to fulfill the guidance document. The remainder of the session spent defining these criteria into a workable reporting format for inclusion in the workshop report.

In developing this reporting format, the panel considered two basic scenarios: (1) emergency scientific support to the On-scene Coordinator (OSC) and (2) longer term (or after-the-fact) environmental assessment studies. The reason for this delineation centered mainly around the availability of funding for emergency OSC support through the Federal revolving fund, and the present lack of dedicated funds for longer term studies. The first topic covered was fixed and mobile laboratory facilities. The panel initially separated this topic into two groups, but after considerable discussion, the panel felt that mobile laboratories are essentially a support function of fixed laboratory facilities and, therefore, decided to identify mobile labs as a support category under fixed laboratories.

The following is an outline of the reporting format which was agreed on by the panel to describe fixed laboratories facilities in accordance with the guidance document.

1. Fixed Laboratories

   a. Location

b. Operating Organization

c. Contact Person: Name, Bus. tel., 24-hour tel.
   Alternate: Name, Bus. tel., 24-hour tel.

d. Capabilities

   (1) Physical Oceanography

   (2) Biological Oceanography

   (3) Chemical Oceanography

   (4) Geological Oceanography

   (5) Current Research/Operational Activities

   (6) Maximum Sample Output (1 day, 1 week, etc.) by category of hydrocarbon analysis, oil identification, etc.

   (7) Mobile Laboratory

e. Availability

   (1) Emergency Support - categorize high or low

   (2) Longer Term Studies - categorize high or low

A number of issues were discussed in arriving at this reporting format. Most notably, the issue of funding and analytical costs was at question. It was the concensus of the panel, based on advise from Coast Guard representatives, that funding of emergency support services to the OSC was available through the Pollution Revolving Fund, and, therefore, was not a constraint. While this is true if the fund is activated, there will be a number of incidents in which the responsible party will be taking proper cleanup actions, thus not allowing use of the fund at times during which the OSC might still need scientific support. In these cases, the considerations pertinent to longer term studies will apply.

This panel recognized that the availability of laboratories for longer term studies would be dependent on a number of factors. Federal laboratories, for example, might be willing to undertake longer term studies if they fell within the criteria of already funded research activities. The availability of private laboratories, however, would probably be based on the results of bid invitations and the acceptance of some form of basic ordering agreements (BOA) for the specific projects required.

2. Command/Coordination Centers

The NOAA-SOR Team has established operating guidance which includes criteria for command/coordination centers. This document was made available to the panel by the SOR Team director. If possible, identical or similar criteria will be used by the panel to ensure maximum compatability.

3. Fixed Wing Aircraft

The following criteria were established by the panel to describe fixed wing aircraft.

a. Aircraft Type

b. Operating Organization

c. Contact Person: Name, Bus. tel., 24-hour tel.

d. Alternate: Name, Bus. tel., 24-hour tel.

e. Remote Sensing Capability

f. Range

g. Load and Passenger Capacity

h. Navigation Capability

i. Operating Costs

j. Other Capabilities: e.g., over water, water landing capability

4. Rotary Wing Aircraft

The same criteria as applied to fixed wing aircraft apply to rotary wing aircraft.

5. Nearshore Oceanographic Vessels

These were subdivided by the panel into short endurance work platforms (i.e., no overnight capabilities) and longer endurance nearshore craft. The following criteria will be used to describe these vessels.

a. Aircraft Type

b. Operating Organization

c. Contact Person: Name, Bus. tel., 24-hour tel.

d. Alternate: Name, Bus. tel., 24-hour tel.

e. Range

f. Endurance

g. Sampling Capabilities - Including fish and plankton travels, benthic sampling (both geological and biological) water column sampling, instrument emplacement and meteorological capabilities.

h. Scientific Party Capacity

i. Draft

j. Navigation Capability

6. Offshore Oceanographic Vessels

Same as a-j above. Other capabilities - include satellite support (i.e., work boats, helo landing and refueling capabilities, etc.).

7. Radio Communications

a. Operating organization

b. Location

c. Contact Person: Name, Bus. tel., 24-hr tel.

Alternate: Name, Bus. tel., 24-hr tel.

d. Frequency assignments - other frequencies available.

e. Types of Equipment: Base, mobile, hand held

f. Range

(1) Base - mobile

(2) Base - hand held

(3) Mobile - hand held

g. Equipment Available

(1) Base

(2) Mobile

(3) Hand held

h. Availability

i. Daily Time of Operation

j. Mobile Operator Interface - yes, no

Land line communications, including telephone and TWX/TELEX capability will also have to be inventoried for all participating organizations.

8. <u>Submersible Criteria</u>

The following criteria were established for submersibles:

1) Vessel Name

2) Operating organization

3) Location

4) Contact person: Name, bus. tel, 24-hr tel.

Alternate: Name, bus. tel, 24-hr tel.

5) Depth capability

6) Sensing/sampling capability

7) Speed

8) Endurance

9) Surface Support Requirements

10) Transportability

11) Scientific compliment

12) Lock-out capabilities

13) Operating Costs

14) Availability

15) Communications

16) Navigation capability

17) Safety equipment

B. Funding for Facilities

The panel discussed various alternative mechanisms which might be utilized to fund the use of facilities. It was recognized that the normal contracting procedures used by the Federal Government are much too lengthy to be effectively utilized to fund private sector response. The panel, therefore, recommends that the following mechanism be investigated by the executive committee as possible funding means:

- Basic ordering agreements (BOA'S)
- Letter contracts
- Procedures used by the Coast Guard for funding cleanup contractor emergency response.

The use of interagency agreements was felt to be a viable method of transferring funds among Federal agencies for reimbursement of facility costs, if needed. It was recognized, however, that all Federal agencies have statutory responsibility for oil spills, and, therefore, should be encouraged to commit their own resources to this problem.

C. Follow-up Work on Facilities

The panel agreed that it could go no further in its work until specific information is obtained from all participating organization. The Chairman, therefore, relieved the panel of any further responsibilities. The Chairman will now begin to gather specific information required to complete our work. To data, the following organizations have submitted facilities date: University of Rhode Island, EG&G, Jackson Estuarine Lab (UNH), USGS, USCG, ERCO, NOAA-SOR.

DATA MANAGEMENT ASPECTS

A. General Considerations

The success or failure of any scientific endavor can only be assessed by the quality of the data gathered and the mechanism by which the integrity of these data is maintained throughout the time period required for initial assessment of the problem until the data is deposited in a national archive. Data quickly can be assured by adapting valid procedures, utilizing proper techniques, etc. Data integrity can only be assured through an adequate data management system. This system can be as simple as using a set of 3 x 5 cards to track the data from the time it is collected until it reaches its final "resting place," or it could be a sophisticated computerized system as is currently being used for the NOAA/BLM OCSEAP program in Alaska.

B. Data Management and Chain of Custody

This plan shall be an integral part of the proposed organization of the scientific response program and, as such, shall include within its framework the necessary elements of its "chain of custody" procedure to insure legal sufficiency of data collected.

As proposed, a data management plan at a minimum should include the following elements:

1. A predesignated data coordinator. This could be the EPA or NOAA scientific coordinator (be it nearshore or offshore) or an assistant at that level. This individual will:

    a. Respond immediately in support of the response team to regional spills for the purpose of implementing the data tracking an chain of custody procedures.

    b. Interact with all NOAA components and contractors to ensure that data tracking and necessary chain of custody procedures are carried out.

    c. Act as a sample transfer mechanism when ship returns from cruise. This will insure consistency in chain of custody procedures as well as insuring integrity of collected data.

d. Act as a training officer to brief staff and contract personnel on the necessity of chain of custody and data handling procedures and will be a local source of chain of custody materials.

2. Adopticn of an existing data tracking system as well as archival formats for all oil spill environmental investigations. As an initial proposal, the tracking system and its archive formats develop for the BLM/OCSEAP. It appears that the data management approach taken for OCS investigation could be satisfactory for this purpose.

3. Designation of a national repository to store and disseminate the data upon completion of its field project.

These are four main points to emphasize in this plan:

- A data/chain of custody coordination must be identified prior to a spill.
- Adoption of a data tracking system
- Predesignation (if available) of formats for which data shall be reported.
- Designation of a national repository.

The Environmental Data Service (EDS) of NOAA has a field liaison officer at Region I (Woods Hole) with extensive knowledge, contacts and experience in data management as well as chain of custody procedures. This individual could be called upon to act as local data/chain of custody official during a spill situation.

In addition, this office is prepared to supply to its scientific support team information on the availability of necessary baseline enviornmental information (data/literature) in the area of the spill. Other services available through this office are access to the Environmental Data Base Director which will identify other types of data which has been collected in the area of the spill.

RESEARCH VESSELS IN EPA REGION I

The following pages identify research vessels available in the New England Region categorized in three groups; offshore vessels, near-shore long endurance vessels (e.g., remain at sea more than one day), and nearshore short endurance vessels. The listing is based on a 1974 UNOLS inventory and the oceanographic vessel listing in the 1976 Sea Technology Handbook, supplemented by information submitted at the Hartford Workshop. Some information may be outdated or incorrect. Therefore, appropriate persons are requested to verify and complete information on those vessels listed and to identify vessels not listed by using the blank forms at the end of each vessel grouping.

OFFSHORE VESSELS

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ALBATROSS IV (1962) Home Port WOODS HOLE, MA

Operating Institution:
NOAA/NMFS
WOODS HOLE, MA

Name & Address of Contact:

Tel. No. (Bus./After hrs.)

LOA 187' Beam 33' Draft 16'

Displ. Tons 1,089 Cruising Speed 11

Machinery DIESEL H.P. 1,000

Type Hull/Material

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	23	13
Ext. Cruise	23	13

Endurance:

Days Miles 9,000

Usual Areas of Operation:

Lab Spaces (Describe) CHEMICAL, HYDROGRAPHIC, ELECTRONIC, BIOLOGICAL (2)

Electric Power:

K.W. 150, 60 Volts 120/240 AC/DC

Winches: TRAWL (2) DREDGE HYDRO (2)

Wire Size

Length

H. P.

Booms/Cranes:

Type Cap

"A"-Frame

Echo Sounder Precision Recorder

Nav. Equipment

Describe any special vessel capabilities ELECTRIC BOW THRUSTER

Vessel available for outside use? What Basis?

Cost: Per day Per week Other

Areal limits of operation

Other comments

05

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) R/V ATLANTIC TWIN (1965) Home Port STATEN ISLAND, N.Y.

Operating Institution:	Name & Address of Contact:
OCEAN/SEISMIC/SURVEY OAK STREET NORWOOD, NEW JERSEY 07648	Tel. No. (Bus./After hrs.)

LOA 90' Beam 28' Draft 6' 6"

Displ. Tons 103 Cruising Speed 10 KTS

Machinery DIESEL (2) H.P. 456

Type Hull/Material CATAMARAN/STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	4	10
Ext. Cruise	4	10

Endurance:

Days 20 Miles 4000

Usual Areas of Operation:

Lab Spaces (Describe) 10' X 18' IN DECK HOUSE - FRESH/SALT WATER, 115 AND 208 VOLT OUTLETS, FREEZER

Electric Power:

K.W. 30/40 Volts 115/208 AC/DC

Winches:	TRAWL (DBLE DRUM)	BT (2)	OCEAN
Wire Size	1/2"		1/4" 3/32"
Length	4,000'		3,300' 27,000'
H. P.			

Booms/Cranes:

Type HYDRAULIC Cap 5,000 LBS.

"A"-Frame YES

Echo Sounder Bendix DR-90 (600'), SIMRAD (400F) Precision Recorder

Nav. Equipment LORAN A, C, 24/32 MILE RADAR, COMPASS to AUTOPILOT

Describe any special vessel capabilities CAN MOUNT 8' X 15' WET CHEMISTRY LAB ON AFT DECK

Vessel available for outside use? YES What Basis?

Cost: Per day Per week Other

Areal limits of operation

Other comments

OS

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ATLANTIS II (1963) Home Port WOODS HOLE, MA

Operating Institution:	Name & Address of Contact:
WOODS HOLE OCEANOGRAPHIC INSTITUTE WOODS HOLE, MA	Tel. No. (Bus./After hrs.)

LOA 210' Beam 44' Draft 16'

Displ. Tons 2,300 Cruising Speed 12

Machinery STEAM H.P. 1,400

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	31	25
Ext. Cruise	31	25

Endurance:

Days ________ Miles 8,000

Usual Areas of Operation: ________

Lab Spaces (Describe) 4 LABS, SHIPBOARD COMPUTER, UNDERWATER OBSERVATION PORTS

Electric Power: ________

K.W. ________ Volts ________ AC/DC

Winches: 6 WINCHES

Wire Size

Length

H. P.

Booms/Cranes:

Type ________ Cap ________

"A"-Frame ________

Echo Sounder YES Precision Recorder ________

Nav. Equipment LORAN, ADF, OMEGA, SATELLITE

Describe any special vessel capabilities ________

Vessel available for outside use? ________ What Basis? ________

Cost: Per day ________ Per week ________ Other ________

Areal limits of operation ________

Other comments ________

CS

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) DELAWARE II (1968) Home Port GLOUCESTER, MA

Operating Institution:
NOAA/NMFS
GLOUCESTER, MA

Name & Address of Contact:

Tel. No. (Bus./After hrs.)

LOA 155' Beam 30' Draft 11'

Displ. Tons 680 Cruising Speed ____

Machinery DIESEL H.P. 1,000

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise	___	___
Overnight	15	8
Ext. Cruise	15	8

Endurance:

Days ____ Miles 8,000

Usual Areas of Operation: ____

Lab Spaces (Describe) 250 FT^2 WET LAB

Electric Power:

K.W. 300 Volts 450/3 phse, 115/1 phse AC/DC

Winches: DRUM TRAWLS (2) HYDRO

Wire Size

Length

H. P.

Booms/Cranes:

Type ____ Cap ____

"A"-Frame ____

Echo Sounder THREE Precision Recorder ____

Nav. Equipment LORAN A (3), GYRO, MAG COMPASS III AUTOPILOT, 2 RADARS

Describe any special vessel capabilities ____

Vessel available for outside use? ____ What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ENDEAVOR (1976) Home Port NARRAGANSETT, RI

Operating Institution:
UNIVERSITY OF Rhode Island
GRADUATE SCHOOL OF OCEANOGRAPHY
KINGSTON, RI

Name & Address of Contact:

Tel. No. (Bus./After hrs.)

LOA 177 Beam 33 Draft 17'6"

Displ. Tons ______ Cruising Speed 13.5

Machinery DIESEL H.P. 2800

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	13	14
Ext. Cruise	13	14

Endurance:

Days 30 Miles 7000

Usual Areas of Operation: ______

Lab Spaces (Describe) YES

Electric Power:

K.W. 2(300) 1(200) Volts 440 AC/DC

Winches: GENERAL STD HYDRO BT

Wire Size

Length

H. P.

Booms/Cranes:

Type ______ Cap ______

"A"-Frame ______

Echo Sounder YES - 2 Precision Recorder ______

Nav. Equipment LORAN A (2), C, SATELLITE, GYRO, MAG, RADAR, DOPPLER

Describe any special vessel capabilities ______

Vessel available for outside use? ______ What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) EVERGREEN (1943) Home Port GROTON, CONN

Operating Institution:	Name & Address of Contact:
U.S. COAST GUARD R&D CENTER AVERY POINT GROTON, CONN	Tel. No. (Bus./After hrs.)

LOA 180' Beam 37' Draft 13'

Displ. Tons 1,025 Cruising Speed 12

Machinery DIESEL H.P. 1,200

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	45	7
Ext. Cruise	45	7

Endurance:

Days 45 Miles 19,000

Usual Areas of Operation:

Lab Spaces (Describe) ONE OCEANOGRAPHIC LAB

Electric Power:

K.W. Volts 120/240 AC DC

Winches:	OCEAN (2) BT	SORE, TOW
Wire Size	5/32"	5/8"
Length	20,000	600'
H. P.		

Booms/Cranes:

Type BUOY HANDLING Cap 20 TONS

"A"-Frame

Echo Sounder AN-C EDO (6,000 Fms) Precision Recorder

Nav. Equipment LORAN A, C, RADAR, GYRO, RDF, PATENT LOG

Describe any special vessel capabilities

Vessel available for outside use? What Basis?

Cost: Per day Per week Other

Areal limits of operation

Other comments

OS

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) GULF MARINER (1955) Home Port New London, CT

Operating Institution:	Name & Address of Contact:
TUG LEASING CORP. SPARYARD STREET P.O. BOX 968 NEW LONDON, CT. 06320	(203) 442-0293 Tel. No. (Bus./After hrs.)

LOA 132' Beam 32' Draft 12'

Displ. Tons ______ Cruising Speed 10 KNTS

Machinery DIESEL H.P. 1,000

Type Hull/Material Supply vessel/STEEL

Accommodations:

	Crew	Scientists
Day Cruise	3	-
Overnight	5	10
Ext. Cruise	5	10

Endurance:

Days 30 Miles 3,000

Usual Areas of Operation: UNLIMITED

Lab Spaces (Describe) NONE

Electric Power: 60 CYCLE GENERATORS

K.W. 30 Volts 110/220 3 phse AC/DC

Winches: AS REQUIRED

Wire Size

Length

H. P.

Booms/Cranes:

Type ARTICULATED HYDRAULIC Cap 5 TONS

"A"-Frame

Echo Sounder ______ Precision Recorder ______

Nav. Equipment ______

Describe any special vessel capabilities Complete Diving capability including SCUBA and surface ~~air~~ supply AIR

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation NONE

Other comments ______

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) KNORR (1970) Home Port WOODS HOLE, MA

Operating Institution:	Name & Address of Contact:
WOODS HOLE OCEANOGRAPHIC INSTITUTE WOODS HOLE, MA	Tel. No. (Bus./After hrs.)

LOA 245' Beam 46' Draft 16'

Displ. Tons ______ Cruising Speed 10

Machinery DIESEL H.P. 2,500

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	25	25
Ext. Cruise	25	25

Endurance:

Days ______ Miles 10,000

Usual Areas of Operation: ______

Lab Spaces (Describe) YES

Electric Power: ______

K.W. ______ Volts ______ AC/DC

Winches: HYDRO (2) TRAWL (1)

Wire Size

Length

H. P.

Booms/Cranes:

Type ______ Cap ______

"A"-Frame ______

Echo Sounder YES Precision Recorder YES

Nav. Equipment LORAN (2), GYRO, SATELLITE, OMEGA

Describe any special vessel capabilities ______

Vessel available for outside use? ______ What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

CS

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) OCEANUS (1975) Home Port WOODS HOLE, MA

Operating Institution:
WOODS HOLE OCEANOGRAPHIC INSTITUTE
WOODS HOLE, MA

Name & Address of Contact:

Tel. No. (Bus./After hrs.)

LOA 177' Beam 30' Draft 16' 6"

Displ. Tons ____ Cruising Speed ____

Machinery DIESEL H.P. ____

Type Hull/Material STEEL

Accommodations:

	Crew	Scientists
Day Cruise		
Overnight	12	12
Ext. Cruise	12	12

Endurance:

Days ____ Miles 10,000

Usual Areas of Operation: ____

Lab Spaces (Describe) YES

Electric Power: ____

K.W. 600 Volts 440 $\boxed{\text{AC}}$/DC

Winches: TRAWL HYDRO

Wire Size

Length

H. P.

Booms/Cranes:

Type ____ Cap ____

"A"-Frame ____

Echo Sounder YES Precision Recorder YES

Nav. Equipment LORAN A, C, GYRO, RADAR, SATELLITE

Describe any special vessel capabilities ____

Vessel available for outside use? ____ What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) VAST EXPLORER III (1968) Home Port So. Bristol, Maine

Operating Institution:
VAST INC.
Air/Maritime Services Division
Box 384
Newcastle, Maine 04553

Name & Address of Contact:
Charles L. Wyman, Director

(207) 563-3193
Tel. No. (Bus./After hrs.)

LOA 85' Beam 24' Draft 9'

Displ. Tons ____ Cruising Speed ____

Machinery DIESEL (2) H.P. 440

Type Hull/Material Chine-hull/steel

Accommodations:

	Crew	Scientists
Day Cruise	4	14
Overnight	5	11-13
Ext. Cruise	6	10-12

Endurance:

Days 12 Miles 3,000

Usual Areas of Operation:
Caribbean/Atlantic/Gulf of Maine

Lab Spaces (Describe) 220 FT^2 air-conditioned electronics lab; wet lab added as required

Electric Power: 3 generators

K.W. 20/40/55 Volts 115/220 $\boxed{AC}$/DC

Winches: 400 lb.

Wire Size 3/32"

Length 3,000'

H. P. 5

Booms/Cranes:

Type ____ Cap ____

"A"-Frame Add-on

Echo Sounder Simrad - 600 Fathom Precision Recorder Simrad

Nav. Equipment Loran, Radar

Describe any special vessel capabilities ____

Vessel available for outside use? YES What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) R/V WESTWARD (1961) Home Port BOSTON, MASS

Operating Institution:	Name & Address of Contact:
Sea Education Association 3 School Street Boston, MA 02108	Corwith Cramer, JR (617) 742-4246 Tel. No. (Bus./After hrs.)

LOA 100' Beam 22' Draft 12' 6"

Displ. Tons 220 Cruising Speed 8 kts

Machinery DIESEL H.P. 350

Type Hull/Material YACHT / STEEL

Accommodations:

	Crew	Scientists
Day Cruise	7	2-4
Overnight	7	2-4
Ext. Cruise	7	2-4

Endurance:

Days 50 Miles 5,000

Usual Areas of Operation: EASTERN U.S. & CANADA, EUROPE, CARIBBEAN

Lab Spaces (Describe) 100 FT² Lab, additional 150 FT² on deck

Electric Power:

K.W. 10 Volts 120 AC/DC

Winches:	HYDRO	BT
Wire Size	3/16"	STD.
Length	20,000'	6,000'
H. P.	5	½

Booms/Cranes:

Type Non-Telescoping Cap 1,000 LBS

"A"-Frame

Echo Sounder ATLAS Echograph, Monograph Precision Recorder

Nav. Equipment LORAN, Decca Radar, Raytheon RDF

Describe any special vessel capabilities Capable of silent operation under sail; photo lab

Vessel available for outside use? YES What Basis?

Cost: Per day Per week Other

Areal limits of operation

Other comments Crew requirements supplemented by 15-20 students

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ____________________ Home Port ____________________

Operating Institution:

Name & Address of Contact:

Tel. No. (Bus./After hrs.)

LOA ________ Beam ________ Draft ________

Displ. Tons ________ Cruising Speed ________

Machinery ____________ H.P. ________

Type Hull/Material ____________

Accommodations:

	Crew	Scientists
Day Cruise	____	____
Overnight	____	____
Ext. Cruise	____	____

Endurance:

Days ________ Miles ________

Usual Areas of Operation: ____________

Lab Spaces (Describe) ____________

Electric Power: ____________

K.W. ________ Volts ________ AC/DC

Winches: ____________

Wire Size

Length

H. P.

Booms/Cranes:

Type ________ Cap ________

"A"-Frame ____________

Echo Sounder ____________ Precision Recorder ____________

Nav. Equipment ____________

Describe any special vessel capabilities ____________

Vessel available for outside use? ________ What Basis? ____________

Cost: Per day ________ Per week ________ Other ________

Areal limits of operation ____________

Other comments ____________

NEARSHORE VESSELS - SHORT ENDURANCE

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) DULCINEA (1944) Home Port JERUSALEM, RI

Operating Institution:
UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY
KINGSTON, RI 02881

Name & Address of Contact:
C. A. Buehrens Marine Superintendent
Tel. No. (Bus./After hrs.) (401) 792-6203

LOA 40' Beam 12' Draft 4'

Displ. Tons ______ Cruising Speed 10 KTS

Machinery DIESEL H.P. 165

Type Hull/Material NAVY UTILITY / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	5
Overnight	-	-
Ext. Cruise	-	-

Endurance:

Days ______ Miles ______

Usual Areas of Operation: ______

Lab Spaces (Describe) NONE

Electric Power: ______

K.W. ______ Volts ______ AC/DC

Winches: ______

Wire Size COMMON TYPE

Length FISHING TRAWL WINCH

H. P.

Booms/Cranes:

Type MAST & BOOM Cap ______

"A"-Frame ______

Echo Sounder ______ Precision Recorder ______

Nav. Equipment ______

Describe any special vessel capabilities Rigged for EXPERIMENTAL Fishing

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) F.C. WILBOUR (1964) Home Port BOSTON, MA (berthed in Sandwich)

Operating Institution:	Name & Address of Contact:
MASS. DIVISION OF MARINE FISHERIES 100 CAMBRIDGE STREET BOSTON, MA 02202	Philip Coates (617) 727-3193 Tel. No. (Bus./After hrs.)

LOA 50' Beam 16' Draft 4'6"

Displ. Tons ____ Cruising Speed 10 KTS

Machinery DIESEL H.P. 150

Type Hull/Material F/V / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	2	4
Overnight	2	
Ext. Cruise	-	-

Endurance:

Days ____ Miles 370

Usual Areas of Operation:

Coastal waters of Massachusetts

Lab Spaces (Describe) NONE

Electric Power:

K.W. 50 Amp ALT. Volts 12 AC/DC

Winches: HANCOCK Double Drum

Wire Size 7/16" Hydraulic 21" Drums

Length 600' 6X19 wire

H. P. 24

Booms/Cranes:

Type 4" Pipe Cap 1 TON

"A"-Frame ____

Echo Sounder Raytheon Flasher Precision Recorder Furuno F.M.22

Nav. Equipment MAG. compass

Describe any special vessel capabilities ____

Vessel available for outside use? ____ What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation COASTAL waters

Other comments ____

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) LEE (1975) Home Port ____

Operating Institution:	Name & Address of Contact:
IRA C. DARLING CENTER UNIVERSITY OF MAINE WALPOLE, ME 04573	Tel. No. (Bus./After hrs.)

LOA 34' Beam 10'6" Draft 3'6"

Displ. Tons 10 Cruising Speed ____

Machinery DIESEL H.P. 210

Type Hull/Material ____

Accommodations:

	Crew	Scientists
Day Cruise	1	
Overnight		
Ext. Cruise		

Endurance:

Days ____ Miles ____

Usual Areas of Operation: ____

Lab Spaces (Describe) NONE

Electric Power: ____

K.W. ____ Volts ____ AC/DC

Winches: ____

Wire Size

Length 5,000'

H. P.

Booms/Cranes:

Type ____ Cap ____

"A"-Frame ____

Echo Sounder ____ Precision Recorder ____

Nav. Equipment RADAR, MAG COMPASS

Describe any special vessel capabilities ____

Vessel available for outside use? ____ What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) MICMAC Home Port PORT JEFFERSON, N.Y.

Operating Institution:	Name & Address of Contact:
MARINE SCIENCES RESEARCH CENTER STATE UNIVERSITY OF NEW YORK STONY BROOK, NEW YORK 11790	FREDERICK G. ROBERTS, ASSOC. DIRECTOR MARINE SCIENCES RESEARCH CENTER Tel. No. (Bus./After hrs.)

LOA 39' 11" Beam ____ Draft 4'

Displ. Tons ____ Cruising Speed 10 KTS

Machinery DIESEL H.P. 165

Type Hull/Material NOVA SCOTIA / WOOD

Accommodations:

	Crew	Scientists
Day Cruise		10
Overnight	-	-
Ext. Cruise	-	-

Endurance:

Days 15 HRS Miles 150

Usual Areas of Operation: L.I. SOUND, NY HARBOR, GREAT BAY SOUTH

Lab Spaces (Describe) Equivalent 20 FT²; bench space in cabin; 75 FT² deck space

Electric Power: ONAN GENERATOR

K.W. 3 Volts 110 AC/DC

Winches: Single drum Hand

Wire Size 3/16"

Length 400'

H. P.

Booms/Cranes:

Type GIN POLLS Cap 600 LBS

"A"-Frame ____

Echo Sounder RAYTHEON 77 Precision Recorder ELAC

Nav. Equipment RADAR, AUTO PILOT

Describe any special vessel capabilities ____

Vessel available for outside use? YES What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) MISS BESS (1967) Home Port ______

Operating Institution:	Name & Address of Contact:
IRA C. DARLING CENTER UNIVERSITY OF MAINE WALPOLE, ME 04573	 Tel. No. (Bus./After hrs.)

LOA 34' Beam 10'6" Draft 4'

Displ. Tons 12 Cruising Speed 9

Machinery DIESEL H.P. 118

Type Hull/Material ______

Accommodations:

	Crew	Scientists
Day Cruise	1	3
Overnight		
Ext. Cruise		

Endurance:

Days ______ Miles 400

Usual Areas of Operation: ______

Lab Spaces (Describe) NONE

Electric Power: ______

K.W. ______ Volts ______ AC/DC

Winches: POT HAULER

Wire Size

Length

H. P.

Booms/Cranes:

Type ______ Cap ______

"A"-Frame ______

Echo Sounder ______ Precision Recorder ______

Nav. Equipment ______

Describe any special vessel capabilities ______

Vessel available for outside use? ______ What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) SARSIA (1949) Home Port NAHANT, MA

Operating Institution:	Name & Address of Contact:
NORTHEASTERN UNIVERSITY MARINE SCIENCE INSTITUTE EAST POINT NAHANT, MASS. 01908	DR. NATHAN W. RISER, DIRECTOR Tel. No. (Bus./After hrs.) (617) 581-1170

LOA 40' Beam ___ Draft 4'

Displ. Tons ___ Cruising Speed ___

Machinery GRAY MARINE H.P. 150

Type Hull/Material NOVA SCOTIA/WOOD

Accommodations:

	Crew	Scientists
Day Cruise	-	8
Overnight	-	-
Ext. Cruise	-	-

Endurance:

Days day only Miles ___

Usual Areas of Operation: MASS. BAY

Lab Spaces (Describe) ___

Electric Power: ___

K.W. ___ Volts ___ AC/DC

Winches: HAND

Wire Size 3/8"

Length 500'

H. P.

Booms/Cranes:

Type davit Cap ___

"A"-Frame ___

Echo Sounder ___ Precision Recorder ___

Nav. Equipment ___

Describe any special vessel capabilities ___

Vessel available for outside use? YES What Basis? ___

Cost: Per day ___ Per week ___ Other ___

Areal limits of operation ___

Other comments ___

NE - NJ

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) SCHROCK (1965) Home Port BOSTON, MA

Operating Institution:
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS. 02138

Name & Address of Contact:
PROFESSOR ERIK MOLLO-CHRISTENSEN
(617) 253-7910
Tel. No. (Bus./After hrs.)

LOA 50' Beam ____ Draft 3'

Displ. Tons ____ Cruising Speed 10 KTS

Machinery DIESEL H.P. 280

Type Hull/Material NAVY LAUNCH / WOOD

Accommodations:

	Crew	Scientists
Day Cruise		6
Overnight		–
Ext. Cruise		–

Endurance:

Days ____ Miles ____

Usual Areas of Operation:
MASSACHUSETTS BAY, BUZZARDS BAY

Lab Spaces (Describe) 10' X 12', SINK
3 ELECTRONICS RACKS

Electric Power:

K.W. 12 Volts 110 AC/DC

Winches: HOISTING

Wire Size 1/4"

Length 400'

H. P.

Booms/Cranes:

Type ____ Cap 2,000 LBS

"A"-Frame YES

Echo Sounder RAYTHEON Precision Recorder ____

Nav. Equipment LORAN, RADAR

Describe any special vessel capabilities ____

Vessel available for outside use? YES What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

NS-N

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) WRACK (1969) Home Port Appledore Island, ME.

Operating Institution:	Name & Address of Contact:
SHOALS MARINE LABORATORY	J. M. KINGSBURY, DIRECTOR
WINTER: 202 PLANT SCIENCE Bldg, CORNELL UNIVERSITY, ITHACA, NY 14850	
SUMMER: PO BOX 178, PORTSMOUTH, N.H. 03801	Tel. No. (Bus./After hrs.)

LOA 33' 8" Beam 11' 6" Draft 3'

Displ. Tons ____ Cruising Speed 10 KTS

Machinery DIESEL H.P. 133

Type Hull/Material F/U / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	3-4
Overnight	1	1
Ext. Cruise	-	-

Endurance:

Days 1 Miles 120

Usual Areas of Operation: WITHIN 20 MILES OF THE ISLES OF SHOALS

Lab Spaces (Describe) NONE

Electric Power:

K.W. ____ Volts 12/24 AC/DC

Winches:	1	2
Wire Size	3/8"	3/8"
Length	1000'	1000'
H. P.		

Booms/Cranes:

Type SPAR BOOM Cap 1000 Lbs

"A"-Frame NO

Echo Sounder BENMAR Precision Recorder ____

Nav. Equipment RADAR

Describe any special vessel capabilities ____

Vessel available for outside use? YES What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation WITHIN 40 MILES OF THE ISLES OF SHOALS

Other comments ____

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built)______________ Home Port ______________

Operating Institution:	Name & Address of Contact: Tel. No. (Bus./After hrs.)

LOA ________ Beam ______ Draft ______

Displ. Tons ________ Cruising Speed ______

Machinery ______________ H.P. ______

Type Hull/Material ______________

Accommodations:

	Crew	Scientists
Day Cruise	___	___
Overnight	___	___
Ext. Cruise	___	___

Endurance:

Days ________ Miles ________

Usual Areas of Operation: ______________

Lab Spaces (Describe) ______________

Electric Power: ______________

K.W. ________ Volts ________ AC/DC

Winches: ______________

Wire Size

Length

H. P.

Booms/Cranes:

Type ________ Cap ________

"A"-Frame ______________

Echo Sounder ______________ Precision Recorder ______________

Nav. Equipment ______________

Describe any special vessel capabilities ______________

Vessel available for outside use? ________ What Basis? ______________

Cost: Per day ________ Per week ________ Other ________

Areal limits of operation ______________

Other comments ______________

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ______________________ Home Port ______________

Operating Institution:	Name & Address of Contact: Tel. No. (Bus./After hrs.)

LOA __________ Beam ______ Draft ______

Displ. Tons ________ Cruising Speed ______

Machinery ______________ H.P. ______

Type Hull/Material ________________

Accommodations:

	Crew	Scientists
Day Cruise	____	____
Overnight	____	____
Ext. Cruise	____	____

Endurance:

Days ________ Miles ________

Usual Areas of Operation: ____________

____

Lab Spaces (Describe) ______________

____

____

Electric Power: ________________

K.W. ________ Volts ________ AC/DC

Winches: ________________

Wire Size

Length

H. P.

Booms/Cranes:

Type ________ Cap ________

"A"-Frame ________________

Echo Sounder ______________________ Precision Recorder ____________

Nav. Equipment ____

Describe any special vessel capabilities ______________________

____

Vessel available for outside use? ________ What Basis? ______________

Cost: Per day ____________ Per week ____________ Other ____________

Areal limits of operation ________________________________

Other comments ____

____

NEARSHORE VESSELS - LONG ENDURANCE

N-J

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) A.E. VERRILL (1966) Home Port WOODS HOLE, MA

Operating Institution:
MARINE BIOLOGICAL LABORATORY
Woods Hole, Mass. 02543

Name & Address of Contact:
John J. Valois, Mgr.
Supply Dept
(617) 548-3705 x 325
Tel. No. (Bus./After hrs.)

LOA 65' Beam 18' Draft 6'6"
Displ. Tons ____ Cruising Speed 9.5 KTS
Machinery DIESEL H.P. 235
Type Hull/Material R/V / STEEL
Accommodations:

	Crew	Scientists
Day Cruise	2	10
Overnight	2	5
Ext. Cruise	2	5

Endurance:
Days 7 Miles 1,000
Usual Areas of Operation: MAINE TO N.Y.

Lab Spaces (Describe) 170 FT^2, NON-TOXIC SEA WATER, hot & cold FRESH WATER, SORTING Table, benches
Electric Power: ____
K.W. 15 Volts 110/220 $\boxed{AC}$/DC
Winches: DBL. TRAWL BT
Wire Size 3/8" 1/8"
Length 750 M 300 m
H. P.
Booms/Cranes:
Type 20' BOOM Cap 2000 LBS
"A"-Frame HYDRAULIC - 4,000 LBS

Echo Sounder Recording Precision Recorder ____
Nav. Equipment LORAN A, C - DUAL TRACKING, RADAR, AUTO PILOT
Describe any special vessel capabilities C P PROPELLOR, QUARTZ FLOOD LIGHTS, 80 FT^2 WORK SHOP, 16 FT^3 FREEZER, ALL COMPARTMENTS HEATED
Vessel available for outside use? YES What Basis? ____
Cost: Per day ____ Per week ____ Other ____
Areal limits of operation CONTINENTAL SHELF
Other comments ____

NS-0

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) AQUALAB III (1957) Home Port S. PORTLAND

Operating Institution:
DEPT. OF MARINE SCIENCE & TECHNOLOGY
SOUTHERN MAINE VOCATIONAL TECHNICAL INST.
FORT ROAD
SOUTH PORTLAND, MAINE 04106

Name & Address of Contact:
Tapan Banerjee
CHAIRMAN, Dept of Marine Science & Technology
(207) 799-7303 x 67
Tel. No. (Bus./After hrs.)

LOA 144 Beam ______ Draft 8'6"

Displ. Tons 350 Cruising Speed 12 KTS

Machinery DIESEL H.P. 600

Type Hull/Material MINE SWEEPER/WOOD

Accommodations:

	Crew	Scientists
Day Cruise	4	76
Overnight	7	42
Ext. Cruise	7	42

Endurance:

Days 4 1/2 Miles 1,100

Usual Areas of Operation:
CASCO BAY / GULF OF MAINE

Lab Spaces (Describe) ______

Electric Power: ______

K.W. ______ Volts 440 AC/DC

Winches: STERN

Wire Size 1/4"

Length 2 WIRES OF 50 FATHOMS each ON SEPARATE DRUMS

H. P.

Booms/Cranes:

Type NONE Cap ______

"A"-Frame ______

Echo Sounder YES Precision Recorder ______

Nav. Equipment LORAN, RADAR, GYRO, MAG. COMPASS, VHF, MF

Describe any special vessel capabilities Hydro winch, BT winch, dry lab

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation COASTWIDE OPERATIONS - NOT MORE THAN 20 MILES OFFSHORE

Other comments ______

NS-0

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) ASTERIAS (1931) Home Port WOODS HOLE, MASS

Operating Institution:
Woods Hole Oceanographic Institute
Woods Hole, Mass. 02543

Name & Address of Contact:
MR. R.S. Edwards
Marine Superintendent
Tel. No. (Bus./After hrs.) (617) 548-1400 X247

LOA 41' Beam 13' Draft 4'

Displ. Tons 15 Cruising Speed 8 KTS

Machinery DIESEL H.P. 68

Type Hull/Material DRAGGER / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	12
Overnight	1	3
Ext. Cruise	2	2

Endurance:

Days 3 Miles 525

Usual Areas of Operation:
LOCAL CAPE COD

Lab Spaces (Describe)
ONE DECK LAB 8' X 10'

Electric Power:

K.W. 7.5 Volts 110 AC/DC

Winches:	#1	#2
Wire Size	3/8"	3/16"
Length	200'	600'
H. P.		

Booms/Cranes: NONE

Type ______ Cap ______

"A"-Frame NO

Echo Sounder Raytheon Fathometer Junior Precision Recorder optional

Nav. Equipment LORAN A, 101 RADAR

Describe any special vessel capabilities

Vessel available for outside use? YES What Basis?

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation

Other comments

NS-C

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) BIGELOW (1950) Home Port WEST BOOTH BAY HARBOR,

Operating Institution:
BIGELOW LABORATORY FOR OCEAN SCIENCE
McKNOWN POINT
WEST BOOTH BAY HARBOR, ME
04575

Name & Address of Contact:
MR. JACK LAIRD

Tel. No. (Bus./After hrs.)

LOA 47' Beam ____ Draft 4'
Displ. Tons ____ Cruising Speed ____
Machinery DIESEL H.P. 270
Type Hull/Material FISHING / WOOD
Accommodations:

	Crew	Scientists
Day Cruise		20
Overnight	2	2
Ext. Cruise	-	-

Endurance:
Days 3 Miles 500
Usual Areas of Operation:
GULF OF MAINE

Lab Spaces (Describe)
8'X12' WORKING LAB
10'X20' deck space
Electric Power:
K.W. 7.5 Volts 110/220 AC/DC
Winches:
Wire Size 7/16"
Length 500 m
H. P.
Booms/Cranes:
Type ____ Cap ____
"A"-Frame YES

Echo Sounder YES (2) Precision Recorder YES
Nav. Equipment LORAN
Describe any special vessel capabilities

Vessel available for outside use? YES What Basis? IF AVAILABLE, COST REIMBURS.
Cost: Per day ____ Per week ____ Other ____
Areal limits of operation GULF OF MAINE
Other comments

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) CORSAIR Home Port FAIRHAVEN, MA.

Operating Institution:
SouThEasTERN MASSAchusETTS UNIV.
NORTH DARTMOUTH, MASS. 02747

Name & Address of Contact:
MR. GILBERT FAIN
ASSOC. PROF. OF ELECTRICAL ENGINEERING
Tel. No. (Bus./After hrs.) (617) 997-9321 x 357

LOA 65' Beam ____ Draft 5'

Displ. Tons ____ Cruising Speed 11 KTS

Machinery DIESEL (2) H.P. 180

Type Hull/Material MOTOR / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	2	12
Overnight	2	2
Ext. Cruise	2	2

Endurance:

Days 3 Miles 360

Usual Areas of Operation: BUZZARDS BAY

Lab Spaces (Describe)
1 WET LAB
1 DRY LAB

Electric Power:

K.W. 25 Volts 120/220 3ph AC/DC

Winches: HAND DBLE DRM HYDRAULIC

Wire Size

Length

H. P.

Booms/Cranes:

Type ____ Cap 3000 Lbs

"A"-Frame STERN - 3 TON

Echo Sounder ____ Precision Recorder YES

Nav. Equipment LORAN, RADAR

Describe any special vessel capabilities ____

Vessel available for outside use? YES What Basis? ____

Cost: Per day ____ Per week ____ Other ____

Areal limits of operation ____

Other comments ____

NS-C

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) R/V CROWS NEST VI (1962) Home Port JAMESTOWN, R.I.

Operating Institution:	Name & Address of Contact:
UNIVERSITY OF Rhode Island OCEAN ENGINEERING DEPT. KINGSTON, RI 02881	C. A. BUEHRENS, MARINE SUPERINTENDENT (401) 792-6203 Tel. No. (Bus./After hrs.)

LOA 45' Beam 13' Draft 3'6"

Displ. Tons ______ Cruising Speed 12 KTS

Machinery DIESEL (2) H.P. 175

Type Hull/Material CRUISER/WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	7
Overnight	3	3
Ext. Cruise	-	-

Endurance:

Days 4 Miles 506

Usual Areas of Operation:

NARRAGANSETT BAY

Lab Spaces (Describe) AFTER CABIN LAB

Electric Power:

K.W. 2.5 Volts 110 $\boxed{\text{AC}}$/DC

Winches:

Wire Size

Length NONE

H. P.

Booms/Cranes:

Type ______ Cap ______

"A"-Frame ______

Echo Sounder SIDE SCAN SONAR Precision Recorder ______

Nav. Equipment ______

Describe any special vessel capabilities ______

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation NARRAGANSETT BAY

Other comments ______

NS-C

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) F/V GAIL ANN (1965) Home Port WICKFORD, RI

Operating Institution:	Name & Address of Contact:
UNIVERSITY OF Rhode Island School of fisheries & MARINE Technology KINGSTON, RI 02881	C.A. Buchrens, MARINE Superintendent (401) 792-6203 Tel. No. (Bus./After hrs.)

LOA 47' Beam 13' Draft 6'

Displ. Tons ______ Cruising Speed 9 KTS

Machinery DIESEL H.P. 140

Type Hull/Material F/V / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	11
Overnight	1	2
Ext. Cruise	-	-

Endurance:

Days 3 Miles 350

Usual Areas of Operation: NARRAGANSETT BAY & RI SOUND

Lab Spaces (Describe) OPEN DECK

Electric Power:

K.W. 6/5 Volts 110 AC/DC

Winches: TRAWL

Wire Size 3/16"

Length 800'

H. P.

Booms/Cranes:

Type TRAWL BOOM Cap 1 TON

"A"-Frame NO

Echo Sounder Side Scanning Precision Recorder ______

Nav. Equipment ______

Describe any special vessel capabilities ______

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation NARRAGANSETT BAY & RI SOUND

Other comments ______

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) R/V JERE A. CHASE (1964) Home Port DURHAM, New Hampshire

Operating Institution:
JACKSON ESTUARINE LABORATORY
RFD #1 ADAMS POINT
DURHAM, New Hampshire 03824

Name & Address of Contact:
DR ARTHUR C. MATHIESON, DIRECTOR

Tel. No. (Bus./After hrs.) (603) 862-2175

LOA 45' Beam 13' Draft 4'

Displ. Tons 22 Cruising Speed 10 KTS

Machinery DIESEL H.P. 130

Type Hull/Material TRAWLER / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	1	10
Overnight	2	4
Ext. Cruise	2	4

Endurance:

Days 14 Miles 1000

Usual Areas of Operation: COASTAL WATERS

Lab Spaces (Describe) 6'X9' WITH COUNTERS, SHELVES, drying RACKS

Electric Power:

K.W. 3 Volts 12DC, 24DC, 120 AC/DC

Winches:	#1	#2
Wire Size	1/8"	1/4"
Length	1000'	1000'
H. P.	5	5

Booms/Cranes:

Type 1 BOOM Cap 800 Lbs

"A"-Frame YES - 1000 Lbs cap.

Echo Sounder #1 - 200' #2 - 800' Precision Recorder DECCA RANGE MARKER

Nav. Equipment LORAN A, VHF-FM TRANSCEIVER

Describe any special vessel capabilities ZODIAC AND DIVING PLATFORM FOR SCUBA DIVING

Vessel available for outside use? YES What Basis?

Cost: Per day Per week Other

Areal limits of operation GULF OF MAINE

Other comments

NS-C

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) KYMA (1952) Home Port MONTAUK, N.Y.

Operating Institution:
NEW YORK OCEAN SCIENCE LABORATORY
Operated by Affiliated Colleges & Universities, Inc.
Drawer EE
Montauk, New York 11954

Name & Address of Contact:
DR. RUDOLPH HOLLMAN
Research Scientist
(516)-668-5800
Tel. No. (Bus./After hrs.)

LOA 65' Beam 20' Draft 7.5'
Displ. Tons ______ Cruising Speed 9 KTS
Machinery DIESEL H.P. 275
Type Hull/Material TUG / STEEL

Accommodations:

	Crew	Scientists
Day Cruise	2	14
Overnight	3	6
Ext. Cruise	4	5

Endurance:
Days 6 Miles 1200

Usual Areas of Operation: Long Island & Block Island Sounds, N.Y. Bight

Lab Spaces (Describe) Converted cargo hold - 300 sq. FT. with Lab benches, sinks, etc.

Electric Power: ______

K.W. 20 Volts 110 AC/DC

Winches: Hydraulic BT

Wire Size 3/8"

Length 20,000'

H. P.

Booms/Cranes:
Type Cargo Davit Cap 2,500 Lbs.
"A"-Frame 10'

Echo Sounder Raytheon, Model DE714/715 Precision Recorder ______

Nav. Equipment LORAN A & C, DECCA RADAR

Describe any special vessel capabilities ______

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

MS - 2

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) SHAWNA IV (1948) Home Port SouThampTon

Operating Institution:
MARINE SCIENCE CENTER
SouThampTon College
SouThampTon, L.I., New York

Name & Address of Contact:
J.R. WeLKer, Director
Marine OperaTions and Research
Tel. No. (516) 283-4000 x 228 (Bus./After hrs.)

LOA 38' Beam 12'8" Draft 4'

Displ. Tons 12 Cruising Speed 10 KTS

Machinery DIESEL (2) H.P. 280

Type Hull/Material TRAWLER / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	2	4-6
Overnight	2	2-3
Ext. Cruise	2	2-3

Endurance:

Days 7 Miles 400

Usual Areas of Operation: ATLANTIC SHELF OF E.L.I., BLOCK ISLAND SOUND

Lab Spaces (Describe) SMALL WET LAB

Electric Power: 5 KW GENERATOR AVAILABLE

K.W. ______ Volts ______ AC/DC

Winches:

Wire Size 5/32"

Length 500'

H. P. 2

Booms/Cranes:

Type 12' Cap 1000 LBS

"A"-Frame

Echo Sounder RAYTHEON 260' Precision Recorder YES

Nav. Equipment RADAR

Describe any special vessel capabilities

Vessel available for outside use? YES What Basis?

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation COASTAL WATERS

Other comments

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) M.V. SUB SIG (1971) Home Port NEWPORT, RI

Operating Institution:	Name & Address of Contact:
RAYTHEON COMPANY BOX 360 PORTSMOUTH, Rhode Island 02871	CAPT. Robert BROWN, MGR. MARINE TEST FACILITIES (401) 847-8000 X 2533 Tel. No. (Bus./After hrs.)

LOA 83' Beam 24' Draft 8'

Displ. Tons 114 Cruising Speed 12 KTS

Machinery DIESEL (2) H.P. 750

Type Hull/Material R/V / STEEL

Accommodations:

	Crew	Scientists
Day Cruise	4	6
Overnight	4	6
Ext. Cruise	4	6

Endurance:

Days 30 Miles 2900

Usual Areas of Operation: U.S. EAST COAST

Lab Spaces (Describe) 480 FT^2 LAB

40 FT BENCH SPACE

36" DIA. SEACHEST

Electric Power:

K.W. 60 Volts 110/220/440 AC/DC 12/32 DC

Winches:	1000#	10,000#
Wire Size	1/4"	1/2"
Length	1000'	800'
H. P.	17	4

Booms/Cranes:

Type Scott-Midland Cap 5 TON

"A"-Frame NO

Echo Sounder 11 ON BOARD Precision Recorder AVAILABLE

Nav. Equipment LORAN A & C, OMEGA

Describe any special vessel capabilities

Vessel available for outside use? YES What Basis?

Cost: Per day Per week Other

Areal limits of operation 100 MILES FROM SHORE

Other comments

NS-0

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) T-441 (1953) Home Port NOANK, CT

Operating Institution:
MARINE SCIENCES INSTITUTE
UNIVERSITY OF CONNECTICUT
SE BRANCH, AVERY POINT
GROTON, CT 06340

Name & Address of Contact:
DR. PETER DEHLINGER

203-446-1020 x 211
Tel. No. (Bus./After hrs.)

LOA 65' Beam 16' Draft 8'

Displ. Tons ______ Cruising Speed 10 KTS

Machinery DIESEL H.P. 275

Type Hull/Material PASS. VESSEL / STEEL

Accommodations:

	Crew	Scientists
Day Cruise	3	18
Overnight	5	5
Ext. Cruise	5	5

Endurance:

Days 7 Miles 1680

Usual Areas of Operation: ______

Lab Spaces (Describe) MAIN DECK 12' x 15'

Electric Power: ______

K.W. — Volts 120 AC/DC

Winches:	OCEAN.	BT
Wire Size	1/4"	3/32"
Length	900'	500'
H. P.		

Booms/Cranes:

Type 50' 1/4" CABLES Cap 4200 LBS

"A"-Frame NO

Echo Sounder YES Precision Recorder YES

Nav. Equipment RADAR

Describe any special vessel capabilities ______

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation ______

Other comments ______

NE-C

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) R/V UCONN (1943) Home Port NOANK, CT

Operating Institution:
MARINE SCIENCES INSTITUTE
UNIVERSITY OF CONNECTICUT
SE BRANCH, AVERY POINT
GROTON, CT 06340

Name & Address of Contact:
DR. PETER DEHLINGER

203-446-1020 X211
Tel. No. (Bus./After hrs.)

LOA 65' Beam 16' Draft 7'4"

Displ. Tons ______ Cruising Speed 10 KTS

Machinery DIESEL H.P. 180

Type Hull/Material PASS. VESSEL / WOOD

Accommodations:

	Crew	Scientists
Day Cruise	3	18
Overnight	5	5
Ext. Cruise	5	5

Endurance:

Days 5 Miles 1200

Usual Areas of Operation: BLOCK ISLAND, LONG ISLAND & FISHERS ISLAND SOUND

Lab Spaces (Describe) MAIN DECK 8' x 8'

Electric Power:

K.W. ______ Volts 120 $\boxed{AC}$/DC

Winches:	DB. DRUM	Reebe	BT
Wire Size	3/8"	1/4"	1/8"
Length	600'	400'	600'
H. P.			

Booms/Cranes:

Type General Purpose Cap 2000 lbs

"A"-Frame ______

Echo Sounder YES Precision Recorder YES

Nav. Equipment Radar

Describe any special vessel capabilities ______

Vessel available for outside use? YES What Basis? ______

Cost: Per day ______ Per week ______ Other ______

Areal limits of operation BLOCK ISLAND, LONG ISLAND & FISHER'S ISLAND SOUND

Other comments ______

NS-O

U. S. ENVIRONMENTAL PROTECTION AGENCY

Region I - Research Vessel Inventory

Vessel Name (yr. built) WHITEFOOT (1970) Home Port VINEYARD HAVEN, MASS.

Operating Institution:	Name & Address of Contact:
WHITEFOOT TOWING & SALVAGE, INC. RFD VINEYARD HAVEN, MASS. 02568	L. B. CALDWELL, Business Manager Tel. No. (Bus./After hrs.) (617)-693-1055

LOA 65' Beam 22' Draft 7'

Displ. Tons 41 Cruising Speed 10 KTS

Machinery DIESEL (2) H.P. 500

Type Hull/Material SUPPLY-TUG / STEEL

Accommodations:

	Crew	Scientists
Day Cruise	2	15
Overnight	2	4
Ext. Cruise	2	4

Endurance:

Days 13 Miles 1500

Usual Areas of Operation:

ENTIRE EAST COAST area

Lab Spaces (Describe)

432 FT^2 CLEAR DECK SPACE

65 FT^2 INTERIOR SPACE

Electric Power:

K.W. 20 Volts 110/240 AC/DC

Winches:

Wire Size

Length

H. P.

Booms/Cranes:

Type NATIONAL Cap 8 TONS

"A"-Frame AVAILABLE

Echo Sounder Precision Recorder

Nav. Equipment LORAN, DECCA 303, BENDIX RECORDER

Describe any special vessel capabilities

Vessel available for outside use? YES What Basis?

Cost: Per day Per week Other

Areal limits of operation ENTIRE EASTERN SEABOARD, up To 200 miles offshore

Other comments

EPA REGION I CHAIN OF CUSTODY PROCEDURES

The following are the procedures developed jointly by the Surveillance and Analysis and Enforcement Divisions of Region I which prescribe the chain of custody procedures to be followed in the collection and analysis of water samples during water quality and liquid waste surveys. Such procedures must be adhered to in order to ensure that data which has been collected can be introduced in evidence during the trial of a case. They are presented verbatim from a July 5, 1973 memo to the Region I EPA Administrator.

THE PROCEDURES THAT ARE DESCRIBED BELOW ARE TO BE STRICTLY ADHERED TO IN THE CONDUCT OF ALL WATER QUALITY AND LIQUID WASTE SURVEYS REQUESTED BY THE ENFORCEMENT DIVISION UNLESS WRITTEN PERMISSION TO THE CONTRARY IS OBTAINED FROM THE DIRECTOR OF THE ENFORCEMENT DIVISION:

1. Terms used herein shall have the following definitions:

   a. "chief of the sampling crew" means the senior ranking member of the sampling crew of the person designated a chief by the Director of the Surveillance and Analysis Division.

   b. "composite sample" means a sample collected manually or by automatic sampling device in increments taken at set intervals (or continuously) over a period of time and placed in a single sample container.

   c. "Director, Enforcement Divison" means the Director of the Enforcement Division of Region I, EPA, or his designees.

   d. "Director, Survillance & Analysis Division" means the Director of the Surveillance & Analysis Division of Region I, EPA, or his designees.

   e. "EPA personnel" means persons employed by or assigned to the United States Environmental Protection Agency.

   f. "field data card" means the form attached hereto and marked "A".

   g. "field log books" means the log books used in the field by survey personnel to record data, observations, and comments regarding the collection and custody of samples.

h. "laboratory number" means the number assigned by the field data card to all samples (and parts thereof) collected at the same station, at the same depth, on the same date(s), and at the same time (or within a specified time frame in the case of a composite sample).

i. "laboratory bench books" means the books used to record the result of scientific analyses of samples.

j. "laboratory sample log books" means the log books maintained at the field laboratories and the New England Regional Laboratory to record the receipt of samples for scientific analysis, the format of which is attached hereto and marked "B".

k. "field laboratory" means any temporary or mobile laboratory operated by the Surveillance and Analysis Division of Region I, EPA.

l. "New England Regional Laboratory" [N.E.R.L.] means the New England Regional Laboratory of the United States Environmental Protection Agency.

m. "sample" means the whole or part of a substance which is collected for scientific examination or analysis.

n. "sample container" means the immediate container used to hold a sample.

o. "sample label" means the label attached to each sample that is collected, the format of which is attached hereto and marked "C".

p. "sampling crew" means those persons collecting or participating in the collection of samples at a particular station, on a particular date(s), and at a particular time (or within a specified time frame in the case of a composite sample).

q. "appropriate seal" means the material placed on a container to indicate operning of or tampering with the container or its contents and includes:

(1) EPA Form 7500-2 tape on cardboard boxes, paper or polyethylene bags;

(2) wire or lead seals on metal containers or wooden boxes with hinges;

(3) plastic seals on hinged and unhinged boxes.

r. "shipment sample log" means the form attached hereto and marked "D".

s. "State personnel" means persons employed by an agency or department of State government.

t. "station" means the location at which one or more samples are collected.

u. "subnumber" means the number or numbers assigned to a sample container and its contents in addition to the laboratory number.

2. Each time a station is sampled a field data card must be completely filled out by one or more members of the sampling crew.

3. All members of the sampling crew must sign their full names, as well as their initials, in the space labeled "Collector" on the field card.

4. For each sample container that is used, a sample label must be completely filled out by one or more members of the sampling crew.

5. Except in the case of a composite sample, the person actually collecting the sample must sign his full name (including middle initial) in the space labeled "Sampling Crew" on the sample label. All other members of the sampling crew must sign their initials.

6. In the case of a composite sample, the chief of the sampling crew collecting the sample must sign his full name (including middle initial) in the space labeled "Sampling Crew." All other members of the sampling crew must sign their initials.

7. Each sample label must be securely attached to the sample container immediately after collection.

8. Each member of the sampling crew must check over each sample label as soon as after collection as possible to see if it is accurate.

9. Where more than one sample label contains the same laboratory number, a different subnumber must be added to each such label at the time of sample collection (e.g., 10235-1, 10235-2, etc.).

10. If the contents of a sample container are to be subdivided into several containers in the field prior to analysis, there are two permissible course of action:

a. Sample labels for all the containers to be used may be filled out when the sample is first collected (using subnumbers), attached to the original sample container, and later attached to the containers into which the sample is divided; or

b. One sample label may be filled out for the original sample container. In this case, when the sample is subdivided, sample labels must be filled out in the same manner as the original label was filled out and attached to each container to be used. A set of subnumbers, or, if necessary, a second set of subnumbers, must be used to insure that no two labels have the same numerical identification. A circle must be drawn around the laboratory number on the original sample label in order to allow future identification of that label.

11. Whenever a photograph is taken in the field, the following information must be recorded on the back of the picture or in a field log book: the date and time of the photograph, the subject, the direction of the photograph, the photographer's signature, and the signature of a witness (if available).

12. Only members of the sampling crew that collects a particular sample should perform any of the operations related to such collection, including: placing the sample in the sample container, filling out the sample label, attaching the label to the sample container, adding the preservative to the sample, placing the top on the sample container, subdividing the sample into several containers. If anyone other than a member of the sampling crew that collects the sample performs any of such field operations, he must sign his full name (including middle initial) in the space labeled "Remarks" on the back of the sample label and note what operation he performed and the date on which he performed it.

13. During the collection of a composite sample, the automatic sampling device (if used) and the sample container must at all times be in view of a member of the sampling crew or in a location accessible only to the sampling crew.

14. Unless a sample remains in the possession of the members of the sampling crew (that is, in their sight or locked in the motor vehicle used by them), the sample container or any shipping container holding the sample container must be sealed with an appropriate seal and must remain unopened until it arrives at the laboratory where analysis of the sample is to be conducted.

15. At the time the sample container or other shipping container is sealed, the following information must be recorded in a field log book: the fact that the container was sealed; the date and time of the sealing; the laboratory number (and, if appropriate, the subnumber) of the sample; the name (or initals) of the person sealing the container; and the name (or initials) of the person recording the above information.

16. Any time a sample arrives at the laboratory where the analysis of it is to be conducted, the following information must be recorded in the laboratory sample log book: the date and time of arrival of the sample; the condition of the seal (in fact, broken, none) or acknowledgement that the sample remained in the possession of the members of the sampling crew (that is, in their sight or locked in the motor vehicle used by them) from its collection until delivery to the laboratory; the laboratory number (and, if appropriate, the subnumber) of the sample, and the names (or initials) of the persons delivering the sample, receiving the sample, and recording the above information

17. The field laboratories and the N.E.R.L. must be securely locked during non-working hours. Public access to areas where samples are stored and analyzed must be strictly limited at all times. While in the field laboratory or the N.E.R.L., all samples (including portions thereof under-going analysis) must at all times be attended by EPA personnel or stored in rooms, refrigerators, or other receptacles that are locked and accessible only to EPA personnel.

18. All persons collecting, handling, transporting, or attending samples must be continually alert for evidence of contamination of and tampering with the samples.

19. Any indication that contamination or tampering may have occurred must be noted on the sample label in the space labeled "Remarks" or on a sheet securely attached to the sample shipping container, together with the full name (including middle initial) of the person making the notation and the date of the notation. A description of the evidence of contamination and tampering must be noted in a field log book or laboratory sample log book and must

include the date and time of discovery, the laboratory numbers (and, if appropriate, the subnumbers) of the affected samples, the date of the notation, together with the names of the person(s) making the discovery and the notation in the log book.

20. As few people as possible should handle a sample between its collection and analysis. Except when samples are in the possession of a common carrier, all of the persons handling them must be EPA personnel or personnel of State governments who are designated in writing by the Director of the Surveillance and Analysis Division as authorized to handle samples.

21. When samples are shipped by United States Mail or by comon carrier, the immediate shipping containers must be sealed with an appropriate seal and packaged so that the seal will not be disturbed by handling during transit. (Mailed packages must be registered with return receipt requested.) A shipment sample log must be filled out by the person arranging for the shipment. His name (or initials) must appear in the space labeled "Sent by" on the shipment log. The destination of the shipment, the laboratory numbers (and, if appropriate, the subnumbers) fell samples shipped, and any identifying number found on the shipping receipts must be noted on the shipment sample log. The log must be filled out as soon as possible after shipment. All registry receipts and shipping documents must be saved.

22. Unless the contrary is indicated by the Director of the Enforcement Division, a portion of the official sample may be furnished to a prospective defendant if he requires it and if this is feasible.

23. Used seals, used sample containers, and remnants of samples may be disposed of unless there is a written or oral request to the contrary by the Director of the Enforcement Division.

24. Field data cards, sample labels, log books, laboratory bench books, shipment sample logs, shipping documents, registry receipts, and all other records relative to the collection, custody, and analysis of samples, including any photographs that are taken, must be saved for seven years unless the Director of the Enforcement Division gives written approval to the contrary.

25. Every test result or observation recorded in log books, laboratory bench books, on field data cards, on the back of sample labels, on shipment sample logs, and in any other record that is maintained must be identified by the signature or initals (except in

the case of the back of sample labels where the full name is required) of the person or persons conducting the test or making the observation and must dated (if this information is not otherwise apparent from the face of the record). As much as possible of the field data cards and sample labels may be filled out before sampling. However, in the case of the other documents listed above, they must be filled in contemporaneously with or as soon as possible after the events they record. All records that are maintained (including any photographs that are taken) must at all times remain in the possession of EPA personnel or uneer lock and key and accessible only to EPA personnel

26. The results of laboratory analysis of samples must be recorded in laboratory bench books under laboratory numbers and subnumbers.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 1

PROJECT: ______________ St. ______

COLLECTOR: ______________

WEATHER OBSERVATIONS:

WIND DIRECTION N, NE, E, SE, S, SW, W, NW		WIND SPEED m.p.h.	
CLOUD COVER %		PRECIPITATION Rain, Snow, Fog, None	
AIR TEMP. °C		TIDE High, Ebb, Low, Flood	

TYPE OF SAMPLES (check appropriate)

BACTI	☐	DO	☐	Hg	☐	
BOD	☐	A&A	☐	MET.	☐	
COD	☐	O&G	☐	SED.	☐	
TOC	☐	TRS	☐	OIL	☐	
NO--	☐	NFRS	☐	PCB	☐	
NH3	☐	TURB	☐			
TKN	☐	T-P	☐			

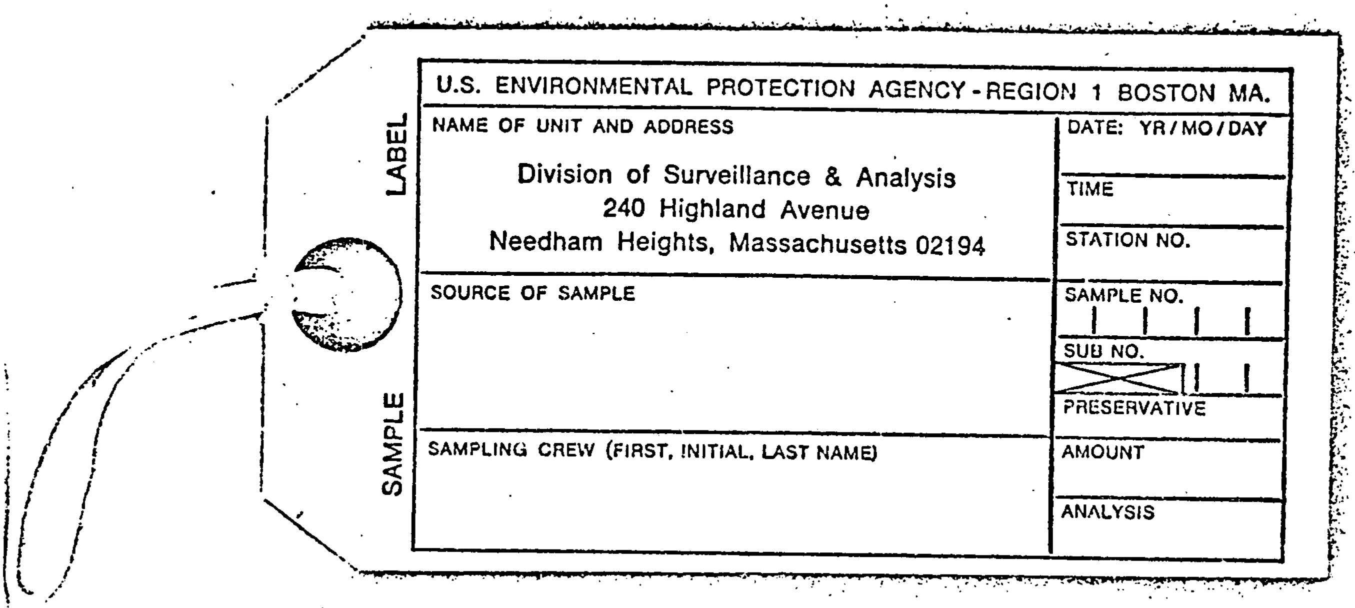
LAB CODE	No. 38567
STATION NO.	
	Y Y M M D D
DATE	
COLLECTION TIME	
SAMPLING DEPTH (ft.)	
SAMPLE TEMP. (°C)	
CONDUCTIVITY (milli mhos/cm)	
SALINITY (0/00)	
PROBE-D.O. (mg/1)	
pH-SU	
Cl_2 RESIDUAL	
TOTAL WATER DEPTH (ft.)	

(over)--------

ATTACHMENT "A"

ATTACHMENT B

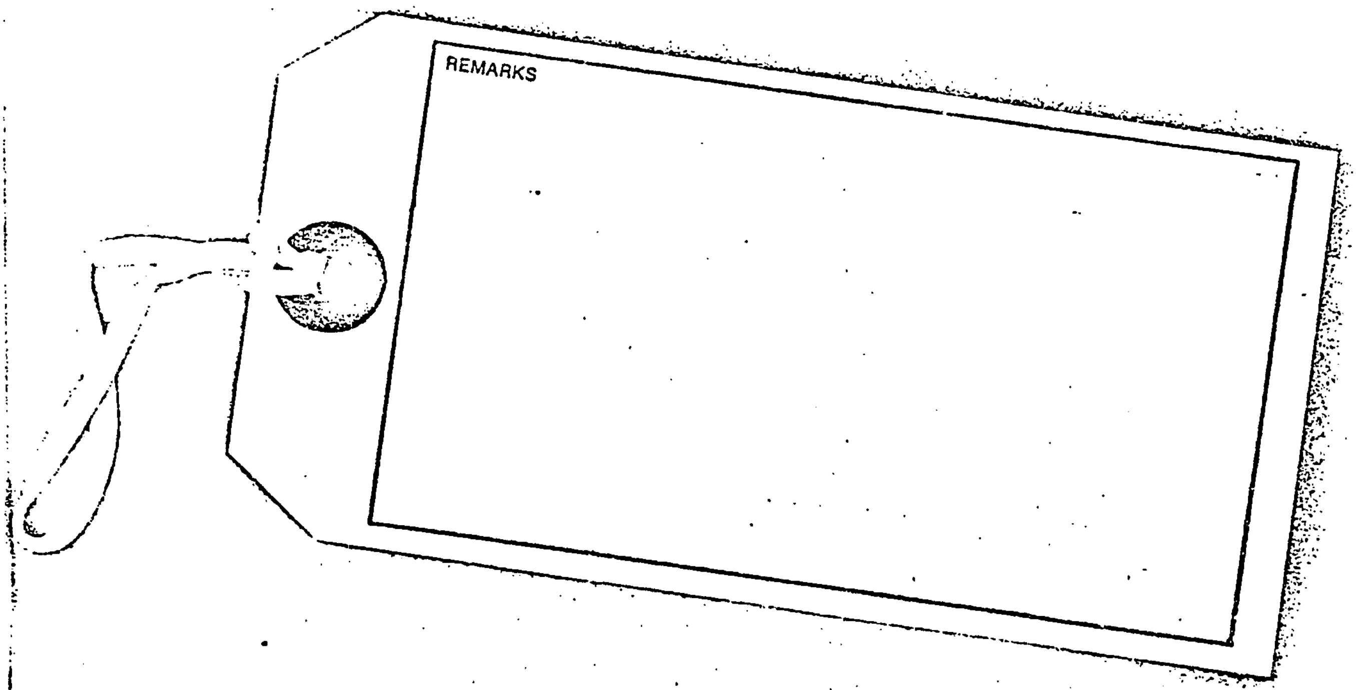
Date & Time	Laboratory numbers & subnumbers:	Delivered by (initials of person delivering sample):	Received by (initials of person receiving sample):	Condition of seal Intact (I); Broken (B); None (N) :	Acknowledgement of custody (initials of chief of sampling crew):



SAMPLE LABEL

U.S. ENVIRONMENTAL PROTECTION AGENCY - REGION 1 BOSTON MA.

NAME OF UNIT AND ADDRESS Division of Surveillance & Analysis 240 Highland Avenue Needham Heights, Massachusetts 02194	DATE: YR / MO / DAY
	TIME
	STATION NO.
SOURCE OF SAMPLE	SAMPLE NO.
	SUB NO.
	PRESERVATIVE
SAMPLING CREW (FIRST, INITIAL, LAST NAME)	AMOUNT
	ANALYSIS



REMARKS

ATTACHMENT "C"

SHIPMENT SAMPLE LOG

Sample Source:	Date Sent:	Laboratory Numbers & Subnumbers:
Sent by (initials):	Shipped From:	Method of Shipment: ☐ Air Freight Airline & Flight: ☐ REA ☐ Parcel Post ☐ U.S. Mail ☐ Other:
Destination:	Shipping Receipt No.:	

Description of Shipment:

No. of shipping containers: ☐ Iced ☐ Dry Ice

Shipping containers sealed by (initials):

Type of sample container:

Sample preservative:

Analyses requested:

Remarks:

Attachment D

EXECUTIVE COMMITTEE MEETINGS

Overview

An Executive Committee was established for overall guidance of Workshop and response plan activities to translate the results of the Workshop into recommended action items for consideration by the National Response Team. The specific objectives of the Executive Committee were to:

(1) Develop an organizational mechanism for activating the national and local components of the Regional Plan.

(2) Develop a mechanism for review, analysis, and decision making dealing with the degree of field/laboratory studies on any specific spill impact assessment.

(3) Develop an organizational framework and mechanisms for review, critique and modification of the Regional Plan.

(4) Determine the existing resources (Federal, State, Local agencies and private sector) in manpower, funds, equipment and facilities to be applied to any specific spill situation.

(5) Develop specific proposals for obtaining required funding of the Regional Plan.

(6) Provide mechanisms for assisting the On-scene Coordinator.

The Executive Committee was comprised of responsible Federal and state officials who could potentially contribute to implementation of an ecological damage assessment response plan, and authoritatively consider matters of policy and resources. Members of the Committee are identified in Appendix C.

During the Hartford Workshop, the Executive Committee held five meetings, including two joint sessions with Panel Chairpersons.

Summary Review

An initial joint meeting of the Executive Committee and Panel Chairpersons was held on August 28th, at the eve of the Workshop. It served as a forum for reviewing the Workshop schedule and clarifying Workshop and Executive Committee objectives. Major items of discussion included: the role of various Federal agencies and the states in ecological assessment activities; plans for the development of a New England response plan; operational and scientific aspects of proposed ecological assessment; and the present need for *ad hoc* scientific assistance to the OSC.

The Executive Committee meeting of August 29th reviewed the days proceedings, discussed schedule and meeting room changes, and addressed paper work and secretarial needs. Some substantive issues were discussed including the role of university support. The next Executive Committee meeting was scheduled to deal with specific Committee objectives.

An Executive Committee meeting of August 30th was divided into two groups. One, chaired by Henry Van Cleave (EPA) dealt with Executive Committee objectives (1), (2) and (3); the other, chaired by Cmdr. Joseph Valenti (USCG), addressed objectives (4), (5) and (6). Following the work of the two subgroups, the Committee met jointly to discuss and summarize Executive Committee recommendations in regard to each objective.

An Executive Committee meeting on August 31st addressed several substantive issues. These included: anticipated timeframe for development of the New England Regional response plan for ecological damage assessment; anticipated review of the draft response plan by the Executive Committee; establishment of a scientific advisory panel to assistant in development of the plan; the MITRE role in plan development; the funding scope of the plan; incorporation of ecological damage assessment plans in the National Contingency Plan; Plans for the Alaska Workshop and the role of NOAA thereto; lead agency responsibilities for ecological damage assessment activities; future scope and objectives of the Workshop program; and the interface of scientific and operational needs.

A joint meeting of the Executive Committee and Panel Chairman discussed progress of the Workshop in meeting overall Workshop goals (p.) and the specific objectives of the Executive Committee (p.). Progress was summarized as follows:

- Workshop Goal 1. The proposed organization outlined in the "Report to the National Response Team on Interagency Scientific Capability to Respond to Major Oil Spills" prepared by the Task Force on Ecological Damage Assessment was accepted as the framework for the regional plan. It was recommended that the Immediate Response Coordinator for scientific support be a member of the Regional Response Team. The proposed chain of notification of an oil spill leading to notification of the Immediate Response Coordinator for scientific support is shown in Figure 1. The Immediate Response Coordinator is responsible for all support to the Coast Guard On-scene Coordinator (OSC) and the decisions as to the need for additional scientific support personnel required on-scene.

- Workshop Goal 2. The Workshop Panels prepared descriptions of projects that may be undertaken to attain this goal. These descriptions are included in the Workshop Report.
- Workshop Goal 3. The project descriptions prepared by the Workshop Panels meet this goal.
- Executive Committee Objective 1. This objective has been met as described above under Workshop Goal 1.
- Executive Committee Objective 2. These decisions will be made jointly by the Immediate Response Coordinator and the National Scientific Support Team Leader. A National Science Review Panel is proposed to establish and review the overall national assessment program, determine needs for longer-term research projects, and to review research needs at specific oil spills. This committee would meet once or twice a year, and will assist in the development of regional and National Ecological Damage Assessment Response Plans.
- Executive Committee Objective 3. The regular review procedure for amending the National Contingency Plan will be applied to the regional plan for scientific support.

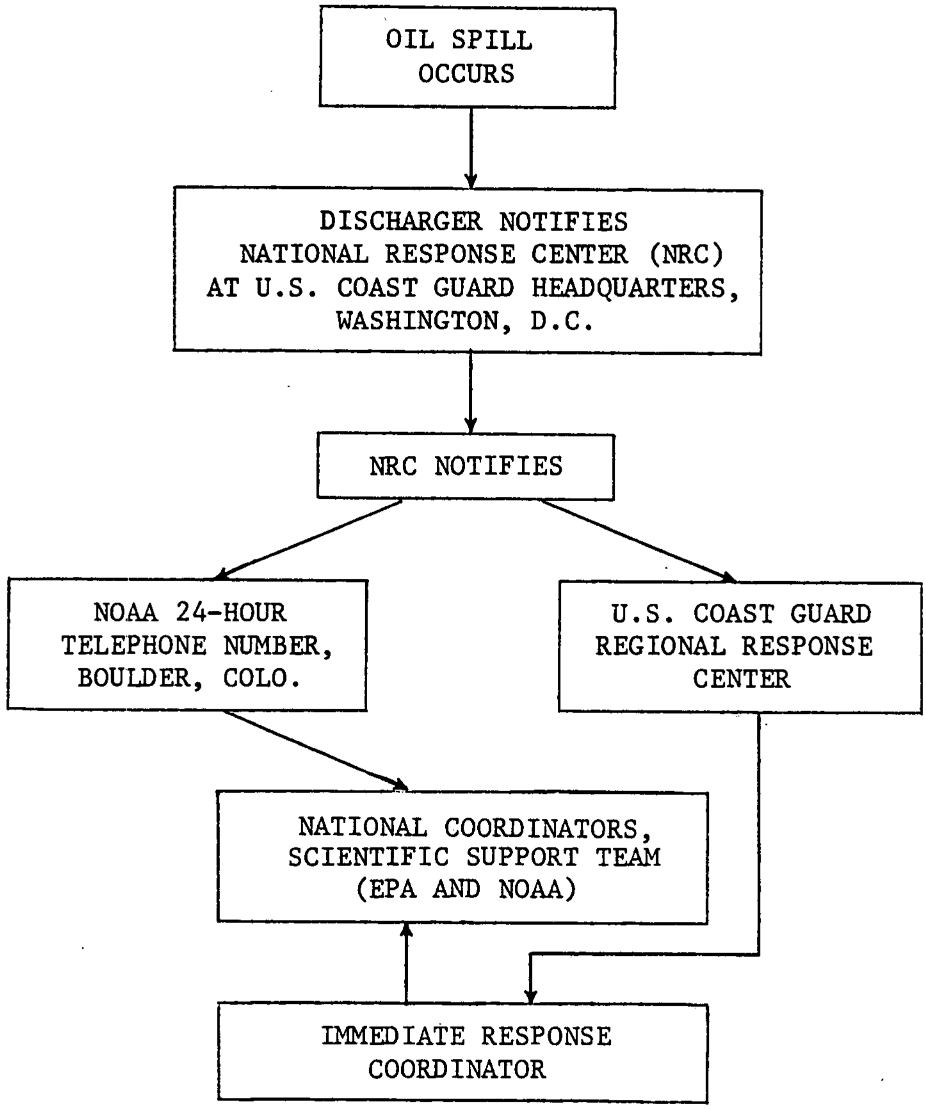


FIGURE 1

PROCEDURE FOR NOTIFYING THE IMMEDIATE RESPONSE COORDINATOR FOR SCIENTIFIC SUPPORT IN THE EVENT OF A MAJOR OIL SPILL

- Executive Committee Objective 4. Some of these needs have been identified by Workshop Panels. The Immediate Response Coordinator will be responsible for knowledge of both regional and national resources available and required. This effort will be undertaken in close cooperation with local EPA and NOAA offices.
- Executive Committee Objective 5. Projects outlined by working panels will be reviewed to determine those that can be funded by existing programs. In addition, a more comprehensive regional assessment program will be identified based for planning purposes on an assumed $1 million budget above existing resources.
- Executive Committee Objective 6. The Immediate Response Coordinator is responsible for providing assistance to the On-scene Coordinator

It was also recommended that the Workshop Chairman prepare a letter report to the National Response Team on results of the Workshop.

Recommendations to the NRT

The Workshop Coordinator reviewed results of the Region I Workshop with the National Response Team on September 8 , 1977. Based on Executive Committee discussions he recommended the following action items for consideration by the NRT:

- Modification of the National Contingency Plan to incorporate an ecological damage assessment program as specified in the report to the NRT by the Task Force on Ecological Damage Assessment (dated June 1977) and the recommendations of the Executive Committee at the Hartford Workshop.
- Resolution of lead agency jurisdiction between EPA and NOAA for ecological damage assessment activities. It is recommended that EPA assume lead responsibility for all spills originating within the baseline from which the territorial sea is measured ("near-shore" spills) and the NOAA assume lead responsibility for spills originating beyond this line ("off-shore" spills).
- Formalize the development and implementation of ecological assessment activities in consideration of the Draft National Plan and the recommendations of the Hartford Workshop. Specifically, it is important that each primary agency appoint a full-time representative to continue development and implementation of the ecological damage assessment effort.
- Approval of the entire series of Regional Workshops and the development of regional and national plans for ecological damage assessment.
- Notification of all EPA Regions and USCG Districts of the draft National Plan and the Workshop program.

- Establishment of a National Scientific Advisory Panel to assist in the development and scientific oversight of Ecological Damage Assessment Response Plans.
- Survey of resources of agencies represented on the NRT to support implementation of Ecological Damage Assessment Response Plans.
- Designation of a lead agency to seek additional funding support for implementing the response plans.
- Seeking allocation of a portion of the proposed $200M "superfund" to support the ecological damage assessment effort.
- Investigation of other potential funding sources for the ecological damage assessment program, including the National Science Foundation, American Petroleum Institute, and the Smithsonian Institute.

APPENDIX A

PROJECT REPORT FORMAT

Panel ____________________

Project #________________

Priority Rank ____________

PANEL GUIDANCE FORMAT

1. Proposed Title of Project

2. Description of Project
   - Be brief! Outline the objectives of the study, how it is carried out, and anticipated results.
   - Give references if possible.

3. Performing Organization
   - Indicate the organization(s) the panel is certain has the capability to perform the study. Give names if possible.
   - Suggest possible performing organizations.

4. Habitats Applicable
   - Identify one or more from listing of New England habitats.

5. Conditions Applicable
   - Consider all possible conditions required for successful completion of study. For example, in a study of impact on benthic fauna some conditions are:
     - oil is incorporated in sediment
     - benthos at control site(s) is uncontaminated

   - Consider what weather/climate, geographical, ecological, economic or other condition(s) are necessary before putting this study into effect.

6. Oil Type Applicable
   - Specify what oils or groups of oils (e.g., crude, no. 6, no. 4, no. 2, gasoline, etc.) project applies.

7. Time Frame
   - Identify the total inclusive period of the study and the actual required work periods, e.g.:

     "The study requires a minimum five-year period consisting of four one-week sampling periods at one field sampling per season. Sample work-up and data analysis requires an additional 8 weeks/year for a spill of ________ size."

8. Cost
   - Estimate the intensive cost of the project, i.e., give a sliding cost based on the size of spill and area of impact, e.g.:

Area (Km^2)	Cost $
10	100,000
50	800,000
100	1,500,000

- Show how you arrived at your figures.

9. <u>Equipment Needs/Equipment Available</u>
   - Be specific! What kind and how much?
   - Available equipment means it can be used for the project with little advance notice.
   - Equipment means sampling gear, sample containers, field and laboratory instrumentation, glassware, communication equipment and various kinds of hardware.

10. <u>Facility Needs/Facilities Available</u>
   - Be specific by habitat and kind and size of spill.
   - Facilities means analytical laboratories, ships, boats, aircraft, land vehicles, living accommodations for lodging, staging and action center, etc.

11. <u>Personnel Needs/Personnel Available</u>
   - Identify if proper personnel are currently available. What response time is needed? Could they respond within the stated time frame?
   - Give names, addresses, tel. no. if possible.
   - If personnel are not available give indication of what disciplines, number are necessary. Suggest possible workers!

12. <u>Support Services (Concurrent or Associated Studies)</u>
   - Indicate the kinds of projects that must be performed to provide data essential for the proper functioning of this project.
   - For example, if project dealt with determining alterations in benthic community diversity a study mapping the distribution of oil in sediments would likely be desirable.
   - Another example might be the need for histological examination of selected organisms.

13. <u>Payoff</u>
   - Describe in adequate detail what the results of such a study would be in contributing to determining the overall ecological impact.
   - Consider the possible results from the perspective of: (1) scientific interest, i.e., how much of a unique contribution does the study make to our understanding of oil pollution impact on marine ecosystems and (2) how does the study lend itself to determining the economic ($) costs of damage to "natural resources"?

14. <u>Limitations</u>
   - This is a very broad category. Considerations of feasibility, utility and operational problems come to bear. Environmental factors, weather, location, ongoing clean-up operations, nature of oil, habitat type, season, etc. all play a role in determining the limitations.
   - Ask if the project answers all questions dealing with assessing ecological impact under all possible scenaries and conditions. Of course not! O.K., then what are the major flaw?

APPENDIX B

PANEL CHAIRPERSONS

BENTHIC BIOLOGY

Dr. Doug Wolfe
Deputy Director - OCSEAP
NOAA/ERL
Boulder, CO 80302

MICROBIOLOGY/BIODEGRATION

Dr. Al Bourquin
EPA
Environmental Research Laboratory
Sabine Island
Gulf Breeze, FL 32561

BIRDS/MARINE MAMMALS

Dr. J. Lawrence Dunn
233 Woodward Hall
University of Rhode Island
Kingston, RI 02881

CHEMICAL ANALYSIS/FATE

Dr. Bill McLeod
N. W. and Alaska Fisheries Center
2725 Montlake Boulevard, East
Seattle, WA 98112

PHYSICAL PROCESSES

Dr. Jerry Galt
NOAA/ERL/PMEL
Pacific Northwest Fisheries Center
3711 15th Avenue, N.E.
Seattle, WA 98105

WATER COLUMN BIOLOGY

Dr. Frank G. Lowman
Deputy Director
Environmental Research Laboratory
EPA
So. Ferry Road
Narragansett, RI 02882

HISTOPATHOLOGY

Mr. Paul P. Yevich
EPA
Environmental Research Laboratory
So. Ferry Road
Narragansett, RI 02882

LABORATORY TOXICITY

Dr. John H. Gentile
EPA
Environmental Research Laboratory
So. Ferry Road
Narragansett, RI 02882

SOCIOECONOMIC/LEGAL

Dr. Jan C. Prager
EPA
Environmental Research Laboratory
So. Ferry Road
Narragansett, RI 02882

FACILITIES/DATA MANAGEMENT

Mr. Carl Eidam
EPA
Region I
60 Westview Street
Lexington, MA 02173

APPENDIX C

MEMBERS OF THE EXECUTIVE COMMITTEE
REGION I WORKSHOP

Dr. Norman Richards (not in attendance)
Environmental Research Laboratory
Environmental Protection Agency
Sabine Island
Gulf Breeze, FL 32561

Mr. Mark Schuldt (for Don Baumgartner)
Environmental Research Laboratory
Environmental Protection Agency
200 S.W. 35th Street
Corvallis, OR 97330

Dr. John Robinson
MESA, Rx 5
NOAA/ERL
Boulder, CO 80302

Mr. David Kennedy
Project Manager - SOR
NOAA/ERL
Boulder, CO 80302

Dr. Doug Wolfe
Deputy Director - OCSEAP
NOAA/ERL
Boulder, CO 80302

Dr. Charles C. Bates
Science Advisor to Commandant
U.S. Coast Guard
(G-DS/62)
Washington, DC 20024

Mr. Henry Van Cleave (for Ken Biglane)
Oil & Special Materials Control Div.
Environmental Protection Agency
401 M St., SW
Washington, DC 20024

Ms. Carolyn Rogers (for Ken Sherman)
Northeast Fisheries Center Narra. Lab.
NOAA - NMFS
South Ferry Road
Narragansett, RI 02882

Dr. Frank Monastero
U.S. Department of the Interior
Bureau of Land Management
C Street between 18th & 19th, NW
Washington, DC 20006

Mr. Richard Robinson (for Nelson
Dept. of the Interior Kverno)
Fish & Wildlife Service
18th & C St., NW
Washington, DC 20240

Dr. Cal Ross
Environmental Emergency Branch
E.P. Service
Ottawa, Ontario K1A OH3
Canada

Capt. J. R. Kirkland
U.S. Coast Guard
400 7th St., SW
Washington, DC 20590

Lt. Cmdr. Joseph Marotta (for
Rear Adm. First U.S. Coast Guard
District Schwob)
150 Causeway St.
Boston, MA 02114

Capt. Milton Suzich (not in attendance)
U.S. Coast Guard R&D Center
Avery Point
Groton, CT 08340

Mr. Les Smith (for Evelyn Murphy)
Executive Office of Environmental Affairs)
100 Cambridge St.
Boston, MA 02114

Ms. Sara Carroll (for Evelyn Murphy)
Executive Office of Environmental Affairs
100 Cambridge St.
Boston, MA 02114

Ruth Rehfus (for William Gordon)
Regional Director
National Marine Fisheries Service
14 Elm Street
Gloucester, MA 01930

Mr. Domenic Forcella (for Stanley Pack)
Conn. Dept. of Environmental Protection
State Office Bldg.
Hartford, CT 06115

Mr. Bob Randall (for George Gormley)
Maine Department of Environmental Protection
State House
Augusta, ME 04330

Mr. Carlton Maine (not in attendance)
RI Dept. of Health
Davis St.
Providence, RI 02908

Mr. Paul Caviechi (for William Healy)
NH Water Supply & Pollution Control Commission
Concord, NH 03301

Mr. Bernard Corson (not in attendance)
NH Fish & Game Dept.
Concord, NH 03301

Mr. Clinton Hall
EPA (RD-621)
401 M St., SW
Washington, DC 20460

Dr. Paul Lefcourt, Chairman
EPA/ERL
Narragansett, RI 02882

Mr. Carl Eidam
EPA
60 Westview St.
Lexington, MA 02172

Dr. Frank Manheim
U.S. Geological Survey
Woods Hole, MA 02543

APPENDIX D

LIST OF PARTICIPANTS

Dr. Philip U. Alkon
METREK Division
MITRE Corporation
Westgate Research Park
McLean, Va. 22101

Dr. William Andrade
Environmental Protection Agency
60 Westview Street
Lexington, MA 02172

Dr. Charles C. Bates (G-DS/62)
U. S. Coast Guard
Washington, DC

Mr. Benjamin Baxter
Research Scientist
Science Applications, Inc.
745 Main Street
Newington, Connecticut

Mr. Robert Beauchamp
U. S. Department of Interior
Bureau of Land Management
C. St. Between 18th & 19th, N.W.
Washington, DC 20006

Mr. Bradford Blodget
State Ornithologist
Massachusetts Division of Fish & Wildlife
74 Hillcroft Avenue
Worcester, MA 01606

Mr. Paul Boehm
Energy Resource Company
185 Alewife Brook Parkway
Cambridge, MA 02138

Dr. Al Bourquin
Environmental Protection Agency
Environmental Research Laboratory
Sabine Island
Gulf Breeze, FL 32561

Mr. Patrick Bowe
452 Laughlin Road
Stratford, CT 06497

Mr. Richard C. Boynton
Research Representative
Environmental Protection Agency
JFK Federal Building
Boston, MA 02203

Dr. Robert S. Brown
233 Woodward Hall
University of Rhode Island
Kingston, RI 02881

Dr. Clifford Buehrens
Graduate School of Oceanography
University of Rhode Island
494 Annaquatucket Road
North Kingston, Rhode Island

Dr. Frank Cantelmo
City College of New York
New York, New York

Mr. James Cardoza
Massachusetts Division of Fish & Wildlife
Westboro, MA 01581

Mr. Arnold Carr
Massachusets Dept. of Fisheries & Wildlife
Division of Marine Fisheries
18 Heritage Professional Building, Rte. 6A R
Sandwich, MA 02553

Ms. Sara Carroll
Massachusetts Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Dr. Chris Carty
MESA/RX5
NOAA/ERL
Boulder, CO 80302

Mr. Paul Caviechi
New Hampshire Water Supply & Pollution Control
Prescott Park
105 Loudon Road
Concord, NH 03301

John F. Conlon
Chief, Oil & Hazardous Materials Section
Environmental Protection Agency/NERL
60 Westview Street
Lexington, MA 02173

Mr. Peter Cornillon
208 Lippitt Hall
University of Rhode Island
Kingston, RI 02881

Mr. Russell Cuervels
Massachusetts Division of Marine Fisheries
92 Front Avenue
Salem, Massachusetts

Dr. Wayne Davis
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Chris Deacutis
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Mr. Fred Disheroon
Attorney, U. S. Department of Justice
10th & Penn. Avenue
Washington, DC 20530

Dr. J. Lawrence Dunn
233 Woodward Hall
University of Rhode Island
Kingston, RI 02881

Carl L. Eidam
Oceanographer, Oil & Hazardous Materials Section
Environmental Protection Agency/NERL
60 Westview Street
Lexington, MA 02173

Dr. Ronald Eisler
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Mr. Robert Estabrook
New Hampshire Water Supply & Pollution Control
Prescott Park
105 Loudon Road
Concord, NH 03301

Dr. Dianne Everich
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Austin Farley
National Oceanographic Atmospheric Administration
Oxford, Maryland

Mr. John Fiske
Massachusetts Division of Marine Fisheries
105 Clark Road
Sandwich Beach, Massachusetts

Mr. Domenic Forcella
Connecticut Department of Environmental Protection
State Office Building
Room 161
Hartford, CT 06115

Mr. Charles Fredette
Water Compliance Unit
Connecticut Department of Environmental Protection
State Office Building
Hartford, CT 06115

Dr. Peter H. Fricke
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. Jerry Galt
NOAA/ERL/PMEL
Pacific Northwest Fisheries Center
3711 15th Avenue, N.E.
Seattle, WA 98105

Dr. George Gardner
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Patrick Gearing
MERL
Narragansett Bay Campus
University of Rhode Island
Narragansett, RI 02882

Dr. John Gentile
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Mr. Ray Gerber
Bowdoin College
Marine Research Laboratory
Middle Bay Road
Brunswick, Maine

Dr. Cameron Gifford
Marine Biological Laboratory
Woods Hole, MA 02543

Dr. William Grant
Assistant Scientist
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. James Griffen
Director of Technical Services
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Dr. Michael Griffin
101 Woodward Hall
University of Rhode Island
Kingston, RI 02881

Mr. R. A. Griffths
First U. S. Coast Guard District
150 Causeway Street
Boston, MA 02114

Dr. Clement Griscom
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Mr. Clint Hall
Environmental Protection Agency (RD-681)
401 M Street, S.W.
Washington, DC 20460

Mr. George Hampson
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. Paul Hargraves
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Ms. Janie Harris
Energy Resource Company
185 Alewife Brook Parkway
Cambridge, MA 02138

Dr. Diane Harvey
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Dr. Edward Hatfield
Jackson Estuarine Laboratory
Durham, New Hampshire

Dr. Frank Hepner
Department of Zoology
University of Rhode Island
Kingston, RI 02881

Mr. Robert Hiltabrand
U. S. Coast Guard R & D
Avery Point
Groton, CT 06340

Mr. Thomas Hoehn
Connecticut Department of Environmental Protection
Marine Region Director
P.O. Box 248
Waterford, CT 06385

Dr. Eva Hoffman
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Mr. Jon Hurst
Maine Department of Marine Resources
West Boothbay Harbor, ME 04575

Dr. Jeffrey Hyland
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Gene Jackim
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Arnold Julin
Office of Biological Sciences
U. S. Fish & Wildlife Service
One Gateway Center
Newton Corner, MA 02158

Ms. Elisa B. Karnofsky
BUMP/MBL
Woods Hole, MA 02543

Dr. George Kelly
National Marine Fisheries Service
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Mr. David Kennedy
Project Manager-SOR
NOAA/ERL
Boulder, CO 80302

Dr. John Kinneman
U. S. Department of Commerce
NOAA/ERL
Boulder, CO 80302

Captain J. R. Kirkland
U. S. Coast Guard
400 7th Street, S.W.
Washington, DC 20590

Dr. Constance Knapp
Department of Ocean Engineering
Lippitt Hall
University of Rhode Island
Kingston, RI 02881

Dr. Giles LaRoche
Marine Science Center
McGill University
Montreal, Canada

Dr. James Lake
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Paul Lefcourt
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

CDR J. T. Leigh
G-DOE-1
U. S. Coast Guard
Washington, DC 20590

Mr. Millington Lockwood
EDS/NOAA
Pacific Northwest Fisheries Center
3300 Whitehaven Street, N.W.
Washington, DC 20460

Mr. Sabin Lord
Division of Water Pollution Control
Massachusetts Department of Environmental Quality Engineering
110 Tremont Street
Boston, MA 02108

Dr. Frank Lowman
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Frank Manheim
U. S. Geological Survey
Woods Hole, MA 02543

Ms. Janie Harris
Energy Resource Company
185 Alewife Brook Parkway
Cambridge, MA 02138

Dr. Diane Harvey
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Dr. Edward Hatfield
Jackson Estuarine Laboratory
Durham, New Hampshire

Dr. Frank Hepner
Department of Zoology
University of Rhode Island
Kingston, RI 02881

Mr. Robert Hiltabrand
U. S. Coast Guard R & D
Avery Point
Groton, CT 06340

Mr. Thomas Hoehn
Connecticut Department of Environmental Protection
Marine Region Director
P.O. Box 248
Waterford, CT 06385

Dr. Eva Hoffman
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Mr. Jon Hurst
Maine Department of Marine Resources
West Boothbay Harbor, ME 04575

Dr. Jeffrey Hyland
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Gene Jackim
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Arnold Julin
Office of Biological Sciences
U. S. Fish & Wildlife Service
One Gateway Center
Newton Corner, MA 02158

Ms. Elisa B. Karnofsky
BUMP/MBL
Woods Hole, MA 02543

Dr. George Kelly
National Marine Fisheries Service
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Mr. David Kennedy
Project Manager-SOR
NOAA/ERL
Boulder, CO 80302

Dr. John Kinneman
U. S. Department of Commerce
NOAA/ERL
Boulder, CO 80302

Captain J. R. Kirkland
U. S. Coast Guard
400 7th Street, S.W.
Washington, DC 20590

Dr. Constance Knapp
Department of Ocean Engineering
Lippitt Hall
University of Rhode Island
Kingston, RI 02881

Dr. Giles LaRoche
Marine Science Center
McGill University
Montreal, Canada

Dr. James Lake
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Paul Lefcourt
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

CDR J. T. Leigh
G-DOE-1
U. S. Coast Guard
Washington, DC 20590

Mr. Millington Lockwood
EDS/NOAA
Pacific Northwest Fisheries Center
3300 Whitehaven Street, N.W.
Washington, DC 20460

Mr. Sabin Lord
Division of Water Pollution Control
Massachusetts Department of Environmental Quality Engineering
110 Tremont Street
Boston, MA 02108

Dr. Frank Lowman
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Frank Manheim
U. S. Geological Survey
Woods Hole, MA 02543

Mr. William Marhoffer
Division of Water Pollution Control
Massachusetts Department of Environmental
Quality Engineering
P.O. Box 537
North Pembroke, MA 02358

LCDR Joseph Marotta
Chief (mep)
U. S. Coast Guard - First District
150 Causeway Street
Boston, MA 02114

Mr. Richard McGrath
Taxon, Inc.
50 Grove Street
Salem, Massachusetts

Mr. Guy McLeod
Southern Massachusetts University
Dartmouth, MA 02714

Dr. William McLeod
N. W. & Alaska Fisheries Center
2725 Montlake Blvd., East
Seattle, WA 98112

Dr. Brian Melzian
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Donald Miller
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Dr. Frank Monastero
Department of Interior
Bureau of Land Management
Washington, DC

Mr. Jeffrey Morris
Connecticut Department of Environmental
Protection
Marine Region
Waterford, Connecticut

Dr. Hugh Mulligan
Manager, Biological Sciences Staff
EG & G Environmental Consultants
151 Bear Hill Road
Waltham, MA 02154

Mr. David G. Neal
P.O. Box 30
Buzzards Bay, Massachusetts

Mr. Peter Nolan
Environmental Protection Agency
60 Westview Street
Lexington, MA 02173

Ms. Carole O'Toole
c/o MESA/RX5
NOAA/ERL
Boulder, CO 80302

Captain K. M. Palerey
First U. S. Coast Guard District
150 Causeway Street
Boston, MA 02114

Mr. Charles Parker
Bigelow Laboratories for Ocean Science
West Boothbay Harbor, ME 04575

Mr. Fred Passman
Energy Resource Company
185 Alewife Brook Parkway
Cambridge, ME 02138

Dr. Susan Peterson
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. Samuel R. Petrocelli
EG & G
790 Main Street
Wareham, MA 02571

Dr. Andrew Pollack
Massachusetts Institute of
Technology (48-320)
Department of Civil Engineering
77 Massachusetts Avenue
Cambridge, MA 02138

Dr. Kevin Powers
Manomet Bird Observatory
P.O. Box 0
Manomet, MA 02345

Dr. Sheldon Pratt
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Dr. John H. Prescott, Director
New England Aquarium
Central Wharf
Boston, MA 02110

Mr. Robert Randall
Environmental Services Specialist II
Maine Department of Environmental
Protection
32 Coombs Street
Bangor, Maine

Ms. Ruth Rehfus
Assistant Branch Chief
Environmental Assessment Branch
National Marine Fisheries Service
191 Main Street
Gloucester, Massachusetts

Mr. John Ripp
Assistant Project Engineer
The Research Corporation
125 Silas Dean Highway
Wethersfield, CT 06109

Dr. John Robinson
MESA, RX5
NOAA/ERL
Boulder, CO 80302

Mr. Richard Robinson
Deputy Chief, Division of Ecological Services
U. S. Fish & Wildlife Service
Interior Building 4
Washington, DC 20240

Ms. Carolyn Rogers
NOAA/NMFS
South Ferry Road
Narragansett, RI 02882

Dr. Peter Rogerson
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Mr. Cal Ross
Environmental Emergency Branch
Environmental Protection Service
Place Vincent Massey
Ottawa, Ontario K1A 1C8
Canada

Mr. Dennis A. Sande
Pollution Control Officer
Quarters 12-H--6
U. S. Coast Guard
Governors Island, NY 10004

Dr. Akella Sastry
Graduate School of Oceanography
University of Rhode Island
11 Butler Building
Kingston, RI 02881

Dr. Mark Schuldt
Environmental Research Laboratory
200 So. 35th Street
Corvallis, OR 97330

Mr. Kenneth Simon
Normandeau Associates
Nashua Road
Bedford, New Hampshire

Mr. Lawrence J. Slaski
Economist for U.S. Fish & Wildlife Service
12511 Atherton Drive
Wheaton, MD 20906

Mr. Lester B. Smith, Jr.
Massachusetts Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Dr. Wade H. B. Smith
METREK Division
MITRE Corporation
Westgate Research Park
McLean, Va. 22101

Dr. Jean Snider
Marine Environmental Protection Office
MRS - NOAA
6010 Executive Blvd.
Rockville, MD 20852

Dr. Malcolm Spaulding
208 Lippitt Hall
University of Rhode Island
Kingston, RI 02881

Dr. Thomas Spittler
Environmental Protection Agency
60 Westview Street
Lexington, MA 02173

Dr. John Teal
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. Richard Traxler
101 Woodward Hall
University of Rhode Island
Kingston, RI 02881

Mr. Joseph Vallenti
Chief, Pollution Response Branch
Coast Guard Headquarters
Washington, DC

Mr. Henry VanCleave
Oil & Special Materials Control Division (WH-548)
Environmental Protection Agency
Washington, DC 20460

Dr. Gabriel Vargo
Bunker C
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881

Dr. G. W. Wadley
Technical Manager
Nalco Environmental Sciences
1500 Frontage Road
Northbrook, IL 60062

Dr. Mason Wilson, Jr.
101 Wales Hall
University of Rhode Island
Kingston, RI 02881

Dr. Douglas Wolfe
Deputy Director - OCSEAP
NOAA/ERL
Boulder, CO 80302

Dr. Red Wright
National Marine Fisheries Service
Woods Hole Oceanographic Institute
Woods Hole, MA 02543

Dr. Paul Yevich
Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Honorable Thomas Yost
Environmental Protection Agency - Region IV
345 Courtland Street, N.E.
Atlanta, GA 30308

APPENDIX E

SUPPLEMENTARY INFORMATION

U.S. FISH AND WILDLIFE SERVICE

Region 5 (Northeastern States)

Regional Oil Spill Coordinator
Arnold M. Julin, ECE, Newton Corner, MA
FTS: 829-9217
Comm: 617-965-5100 ext. 217
Home: 603-893-9348

Alternate Regional Oil Spill Coordinator
Curtis Laffin, OBS, Newton Corner, MA
FTS: 829-9217
Comm: 617-965-5100 ext. 217
Home: 603-339-4643

Area III (ME, NH, VT, MA, RI, CONN)

Area Manager, Concord, NH
Charles Maloy
FTS: 8-834-471/4718
Comm: 603-224-9558/9559
Home: 603-224-5176

Field Coordinators

Maine Coast

Michael Hendrix, Hatchery Manager, Craig Brook NFH, East Orland, ME
FTS: None
Comm: 207-469-2803
Home: 207-469-7253

Maine, NH, Mass Coast to Buzzards Bay

George Gavutis, Refuse Manager, Parker River NWR, Newburyport, MA
FTS: None
Comm: 617-465-5753 (Thru FTS 223-2100)
Home: 603-394-7874

Mass, RI, Conn Coast South of Cape Cod

Refuse Manager, Ninigret NWR, Charlestown, RI
FTS: None
Comm: 401-364-3106 (Thru FTS 838-1000)
Home:

Lake Champlain, VT

John Gersmehl, FA, Montpelier, VT
FTS: 8-832-4438
Comm: 802-223-5900, 802-229-9476
Home:

Alternate for New England Area
Bob Currie, ES, Concord, NH
FTS: 8-834-4726/4762
Comm: 603-224-2585/2586
Home: 603-648-2257

MASSACHUSETTS INFORMATION

Critical Areas

References:

Massachusetts, Executive Office of Environmental Affairs, 1977. Oil Spill Prevention and Response. Report of the Massachusetts Interagency Task Force on Oil Spills. Mass. EOEA, Boston. Chapters paged separately. (Map 1, page 11-14, shows locations of coastal wildlife areas potentially impacted by oil spills.)

Persons to Contact:

1. Bradford Blodget, State Ornithologist, Mass. Division of Fish and Wildlife, 100 Cambridge Street, Boston, MA 02202
   Sensitive, uncommon, unusual birds and their habitats.

2. H. W. Heusmann, Waterfowl Biologist, Mass. Division of Fisheries and Wildlife, Field Headquarters, Westboro, MA 01581
   Waterfowl distribution.

3. Richard Forster, Natural History Specialist, Mass. Audubon Society, South Great Road, Lincoln, MA
   Localized bird populations and their habitats.

4. Manomet Bird Observatory, Box. 0, Manomet, MA 02345
   Staff (U. Powers, R. Veit, B. Harrington).
   Critical offshore areas.

Surveys

References:

1. Massachusetts Breeding Bird Atlas. Five year project (1974-1978) to determine distribution of breeding birds in Massachusetts. Joint project of Mass. Audubon Society and Mass. Division of Fisheries and Wildlife. In preparation for eventual publication.
   Contact: B. Blodget (MDFW), R. Forster (Mass. Audubon).

Surveys (Continued)

2. U.S. Fish and Wildlife Colonial Seabird Nesting Survey. Three year project (1975-1977) to furnish baseline data on colony occupancy and distribution in Coastal North America. To be published.
   Contact: Dr. Wendell E. Dodge and R. Michael Erwin, Mass. Coop. Wildlife Research Unit, 204 Holdsworth Hall, University of Mass., Amherst, MA 01003

3. Winter Waterfowl Surveys (for Massachusetts). Job progress reports published under Pittman-Robertson Projects W-35-R, W-42-R, and other State and PR projects. Coverage-ca. 1950 to date.
   Contact: H. W. Heusmann, Mass. Division of Fish and Wildlife, Field Headquarters, Westboro, MA 01581
   Regional compilation by U.S. Fish and Wildlife Service.

4. Nisbet, I.C.T., 1973. Terns in Massachusetts: Present numbers and historical changes. Bird-Banding (vol. + pagination?). Documents colony locations.

5. Drury, W., 1973-74. Historic Changes in New England Seabird Populations. Bird-Banding (2 parts, vol. + pagination?). Documents populations, distributions, and numbers (including maps) of seabird areas.

Wildlife Inventories

Birds:

1. Griscom, L. and D. E. Snyder, 1955. Birds of Massachusetts. Peabody Museum, Salem, Mass. Discussion of history and annotated list of species.

2. Barley, W., 1955. Birds in Massachusetts. PP for Mass. Audubon Society.

3. Barley, W., 1968. Birds of Cape Cod National Seashore. Mass. Audubon Society. Annotated list.

4. Hill, N. P., 1965. Birds of Cape Cod. W. Morrow and Co.

5. Griscom, L. and E. V. Floger, 1948. Birds of Nantucket. Harvard University Press. Information local, but largely dated.

Wildlife Inventories (Continued)

6. Griscom, L. and G. Emerson, 1959. Birds and Martha's Vineyard.
PP Martha's Vineyard, MA
Information local but largely dated.

7. Blodget, B. Annotated list of birds of Massachusetts. With Seasonal Abundance and Distribution. In prep.

8. Resource Management Plan. Phase 1 RB1. For Cape Cod National Seashore (1976).
Contact: P. Godfrey, Dept. of Botany, Morrill Hall, University of Massachusetts, Amherst, MA 01003

Mammals:

1. Cardoza, James E., 1976. Preliminary List of Mammals of Massachusetts. Mass. Division of Fish and Wildlife. Mimeo. Unannotated list of mammals of the state. Distribution and abundance of land mammals.

2. Godin, A. J., 1977. The Mammals of New England. Johns Hopkins Press. Detailed discussion, by species, of distribution, abundance, and some history of regional mammals.

3. NOAA - Marine Mammals of Western Atlantic.

Reptiles:

1. Lazell, J. D., Jr., 1975. Reptiles and Amphibians of Massachusetts, 2nd Ed. Mass. Audubon Society. Annotated with brief comments on distribution and abundance.

2. Lazell, J. D., Jr., 1976. This Broken Archipelogo. Quadrangle Press, New York. Distribution, abundance and history of reptiles and amphibians in Barnstable, Dunes, and Nantucket Counties, Mass.