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FOIA MARKER

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Record Group/Collection: George H.W. Bush Presidential Records
Collection/Office of Origin: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: Correspondence Files

OA/ID Number: 62009
Folder ID Number: 62009-003

Folder Title:
Invitations: General (3) [2 of 7] [1991]

Stack:

Row:

Section:

Shelf:

Position:

0

0

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"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION-ROUNDTABLE

DOCUMENT NUMBER: 9123548

SPEECH: YES NO

FROM: BORNER, Alan John: ENVIRONMENTAL HAZARDS
MANAGEMENT INSTITUTE

DATE OF EVENT: 10/30/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: INVITATION TO PARTICIPATE IN THE QUORUM ON RISK.

RSVP: 09/04/91

CONTACT PERSON:

CONTACT NUMBER: 603/868-1496

INVITATION ACCEPTED?

~~YES~~

NO

COPIES TO: ENVIRONMENT
LIFE SCIENCES

REMARKS:

CLOSED

DATE OF LETTER: 08/13/91

DATE RECEIVED: 08/21/91

FILE: P-INVITATION



10 NEWMARKET ROAD
P.O. BOX 932
DURHAM, NH 03824
603-868-1496
FAX: 603-868-1547

RECEIVED

91 AUG 21 A10:30

OFFICE OF THE
DIRECTOR

August 13, 1991

Honorable D. Allan Bromley
Asst. for Science & Technology
Old Executive Office Building
17th and Pennsylvania Ave, NW
Washington, DC 20500

Dear Honorable Bromley:

Following months of discussion and consideration, I have decided to convene a very special gathering whose focus will be **risk**, the assessment and prioritization of which, I believe, will become central to the future of all environmental planning.

To that end, I have asked you, and a number of other motivated and concerned stakeholders in the environment, to convene with me **The Quorum on Risk** October 3-4 in Newport, Rhode Island. Many of us have long worked toward the chance to affect our environmental future. Never has that time been closer at hand.

The environmental agenda in this country and beyond is in flux. "Knee-jerk" responses and "end-of-the-pipe" solutions have been exposed for what they are -- too little too late. It is time for a new agenda.

Your participation in **The Quorum on Risk** will be active, rather than passive. We will anticipate that your expertise, opinions, and observations will become part of the raw material which we will shape into ideas for new initiatives. We will seek from you creative possibilities for constructive change.

This letter, then, is a call to action. As you read through the enclosed brochure describing the **Quorum**, please consider your possible participation in light of your desire to change the course of environmental "business as usual".

Feel free to call me at the *Environmental Hazards Management Institute* (EHMI) in Durham, New Hampshire at 1-603-868-1496 with any questions. I hope sincerely that you will be able to take your place at the **Quorum** roundtable alongside lay leaders, top government officials, captains of industry, concerned members of the public, the press, and the academy.

The time is right for **The Quorum on Risk**. Will you join us?

Sincerely,

Alan John Borner
Executive Director



presents



Windows On the EnvironmentSM Series

Quorum on Risk: Broadening the Dialogue and

WORKSHOP

● October 3 - 4, 1991 ●
Newport Marriot
Newport, Rhode Island

*Environmental Hazards Management Institute
EHMI...10 Newmarket Road...P.O. Box 932
Durham...NH 03824 (603) 868-1496*

printed on recycled paper...completing the cycle of responsibility

A

bout Newport, RI...

Newport...the "City by the Sea" is renowned for its sailing regattas and opulent estates. The charming shoplined cobblestone streets belie a vibrant city deeply rooted in New England tradition, with an abundance of historical attractions.

Yet...this colonial seaport boasts some of the finest dining and nightlife in the Northeast.

And for the "leaf-peepers" ...you can't beat Fall in New England!

HOTEL ACCOMODATIONS

The Newport Marriott is particularly lovely...overlooking Narragansett Bay.

Truly a meeting destination as conducive to work as it is to relaxation.

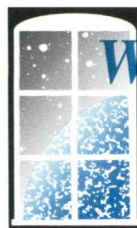
● Room blocks have been reserved at the Newport Marriott at the group rate of \$120.00/night.

To receive this group rate, reservations must be made prior to September 9, 1991.

Please make your reservations by contacting the Newport Marriott at (401)849-1000.

ENVIRONMENTAL HAZARDS MANAGEMENT INSTITUTE

is pleased to present
the first of the
**Windows on
the Environment**SM
Series:



Quorum on Risk: Broadening the Dialogue

October 3-4, 1991
Newport Marriott,
Newport, Rhode Island

Featuring:

● A

presented by the Law offices of
Jaffe, Trunanich, Scatena & Blum,
Los Angeles, CA.

●

A Field Technology
Demonstration sponsored by GZA,
GeoEnvironmental, Newton, MA.

●

A Quorum Round Table
Discussion, facilitated by Profes-
sor Arthur Miller*, Harvard Law
School.



A

bout EHMI...

For more than 10 years, EHMI, under the direction of founder Alan John Borner, has catalyzed action, enhanced understanding, and pioneered new products and services within an embryonic environmental field of extremely diverse constituencies and disciplines. Conferences chaired by EHMI each attract over 13,000 professionals throughout North America each year. Interactive environmental educational tools developed by EHMI are now in the hands of close to two million students, consumers, employees and environmental activists. An environmental business and technology magazine which Mr. Borner conceived and co-founded four years ago is now read by more than 130,000 executives and managers in the U.S. and abroad.

EHMI, a veteran in the industry, is a self-supporting, non-profit educational institute which reaches across even the most adversarial boundaries to promote awareness, understanding and cooperation in countless environmental efforts. ▼

The Quorum on Risk: Broadening the Dialogue

October 3 - 4, 1991
Newport Marriott Hotel,
Newport, RI

REGISTRATION

Name: _____

Title: _____

Affiliation/Company _____

Name: _____

Address: _____

Telephone: _____

Fax: _____

- If you would like to be considered for the Quorum Round Table panel, please indicate your interest here. What are some of your experiences that can contribute to the Quorum agenda?

- Request for Scholarship - Please indicate need:

FEES: Registration Fee: \$795.00/person
\$395.00/person - Non-profit and
Government agencies

Checks may be made payable to EHMI,
P.O. Box 932, Durham, NH 03824 and
received by September 16, 1991. Please
Note: After September 16, 1991, register
on-site at the Newport Marriott.

- Should you wish to stay in Newport through Saturday, October 5, there will be a sailing excursion and clambake scheduled (at an additional cost). Detailed information will be announced at a later date. Please indicate your interest here. _____ Yes I am interested!

***For further information, please contact
Amy A. Gendron at (603) 868-1496.***



12:00 -1:00pm **Lunch - Keynote Address:**
William K. Reilly - Administrator, USEPA (invited) or
Henry Habicht - Deputy Administrator, USEPA (in-
vited)

1:00 -4:00pm **Quorum Round Table:**
Featuring *Professor Arthur Miller, Esq.*, Harvard
Law School. Mr. Miller has an active law practice. He is Legal
Editor for ABC's "Good Morning America" and for eight
years hosted the television program, "Miller's Court."

In a deliberate departure from the structure of
other, more homogeneous gatherings, the Quorum will
bring together a select, representative sampling of
concerned constituencies. The Quorum round table
will be shared by individuals on all sides of the
environmental debate. It is within this discussion group
that we will address the following questions:

ONE Can risk-prioritization be a central strategy for
setting this country's environmental policy agenda, given a
set of laws that seem to "hamstring" such an approach?

TWO Do the sorts of relationships that exist between the
various players in the environmental community put the
"prize" of Environmental Improvement at risk? What sorts of
communication processes will foster collaboration and nego-
tiation among the many environmental stakeholders without
stifling their vigorous dialogue?

● An interactive discussion facilitated by Arthur Miller
will include a distinguished panel of guests, expressing
their own perspectives as environmental stakeholders.
The panel will consist of policy-makers, environmental
advocates, environmental victims of excess and abuse,
corporate leaders, academicians, scientists, lay activists,
municipal leaders, the media and concerned citizenry.

4:00 -5:00pm **Wrap up** Facilitated by New Context
Consulting and McGonagill & Associates.

Reflections for Action:

*What can you, your company, your practice, your community
or organization do to effect change?*

▲ *page four*

Introduction

▲ *page six*

**Quorum Agenda:
Thursday, October 3rd**

▲ *page eight*

**Quorum Agenda:
Friday, October 4th**

Mock Trial Scenario

▲ *page eleven*

Registration Information

▲ *page twelve*

**Newport, RI
Hotel Information**

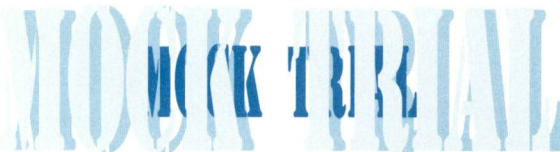


Quorum on Risk: Broadening the Dialogue

The "Quorum on Risk" is the first of a unique series of gatherings to provide a focused exploration or "window" into a variety of global environmental issues. This series was created to bridge the data and communication gaps that separate the disparate groups concerned with environmental improvement. We will look to the expertise of each participant, not solely the contributions of the "experts" that have been included in the program. Throughout the two days, we will build in facilitated, interactive opportunities for all participants to express their views on the questions at issue in the Quorum. ▼

Friday, October 4

8:30 - 11:30am



The Law Offices of Jaffe, Trutanich, Scatena & Blum in conjunction with Trial Behavior Consulting, Inc. will orchestrate a Mock Trial, based on a case involving a disposal facility charged with a declaration of nuisance by the nearby residential community.

THE TRIAL SCENARIO:

- A hazardous waste disposal site has legally existed at its present location for more than ten years. Hazardous wastes, such as PCB's, solvents and heavy metals are legally disposed of there. The facility is Part B permitted. When the disposal site was originally built, there were no residential neighbors within the immediate area. The disposal site's safety record is relatively clean; but five years ago there was a spill that caused the contamination of drinking water wells with cancer causing agents and the death of numerous farm animals. Since that time the persons responsible for the spill have been fired and new owners have instituted measures to insure that such a spill cannot happen again.
- In the last four years, residential sprawl has caused residences to encroach into the area in which the disposal site is situated. A school is situated within 200 yards of the site and a playground is located across the street. As a result, the home owners association has brought an action in state court asking the court to declare the disposal site a public or private nuisance* and to shut it down. This is the only facility of its kind in all of EPA Region I and it cannot be economically relocated. Closure costs alone would be prohibitive.

*Nuisance: Injurious to health or is indecent or offensive to the senses; an obstruction to the free use of property so as to interfere with the comfortable enjoyment of life and property; Public nuisance affects, at the same time, an entire community or neighborhood.



of risk, and having heard from renowned experts on the theories and broad policy of risk, the Quorum on Risk will lead you into the field to experience first-hand some of the critical issues that are decided as a direct result of field work. We will examine some of the state-of-the-art technologies being used to clean up dirty sites.

The technologies involved in risk management are many and varied. Where samples should be taken, how many should be taken, what the lab should test for, what computer models should be created, what clean-up methods should be used, and how long clean-up efforts should last are all largely, if not solely, based on field information.

Quorum attendees will be presented with an opportunity to examine some of these technologies at work on sites around the nation:

- A geostatistical method of predicting contaminant flow through a site
- EPA's soil gas survey technologies
- Groundwater treatment systems
- Wellbore analysis capabilities
- Well installation techniques

Your time spent in the field will form a critical link in your understanding of risk and what information goes into decisions made by consultants, regulators, community members, attorneys and others.

6:30pm **Reception**

7:15pm **Dinner - Keynote Address: *Mr. E.S. Woolard, Jr.* C.E.O. DuPont (expected).**

The first Quorum on Risk addresses two pressing and interrelated questions confronting the environmental community:

O Can risk-prioritization be a central strategy for setting this country's environmental policy agenda, given a set of laws that seem to preclude such an approach



Do the sorts of relationships that exist between the various players in the environmental community put the "prize" of Environmental Improvement at risk? What sorts of communication processes will foster collaboration and negotiation among the many environmental stakeholders without stifling their vigorous dialogue

**T
W
O**



Thursday, October 3

7:00am **Registration**

8:00am **Introduction:**

Alan John Borner, *Executive Director, Environmental Hazards Management Institute, Durham, New Hampshire.*

Reaching a Common Understanding

This session is intended to get the "Quorum on Risk" off on a foundation of understanding of commonly used terminology, commonly misunderstood concepts and where the Quorum is expected to take us.

Special addresses will be given by:

Dr. Peter Sandman...The mere mention of Peter Sandman's name elicits a smile of anticipation before every one of his appearances, though his keen insights into the behaviors and perceptions of all stakeholders invariably make the targets of his insights squirm in their seats.

Dr. Sandman is the Director of the Environmental Communication Research Program at Rutgers University. He is also Professor of Journalism at Rutgers and Professor of Environmental and Community Medicine at the Robert Wood Johnson Medical School. He is the author of 24 books and dozens of articles in both professional journals and popular magazines.

Mr. Frank Kaler...Few people have experienced more pain and anguish with regard to inappropriate hazardous waste management than Frank Kaler and his wife Rita. Their story, articulately and inspirationally told, would be reason enough for our Quorum "retreat", for our attempt to find another way, were it not for the fact that it has recurred in countless communities in countless variations. Science, the law and the environmental protection "system" failed

miserably here and we need to know why and how to prevent it from happening again.

Reflections for Action:

- Facilitated by New Context Consultants and McGonagill & Associates

Dr. Dennis Paustenbach: "A Critical Examination of National Environmental Policy on Risk with Some Clear Recommendations". Dr. Paustenbach brings uncommon wisdom and experience to our Quorum on Risk. Dr. Paustenbach founded one of the most respected risk assessment consulting groups in the United States. As one who, each day, manages 80 health professionals who evaluate, characterize and solve environmental problems using risk assessment methodologies, he has a wealth of experience. He knows why risk assessment has often been poorly accepted by the public, environmental groups and regulators. He is intimately aware of the problems that have occurred because America has tackled environmental issues based on emotion or political pressure, rather than through the use of risk-based priorities.

Reflections for Action: with Mr. Paustenbach

12:15pm **Luncheon Presentation:**

Governor James Florio... Jim Florio was an early pioneer and architect of foundational environmental legislation as a Congressman from New Jersey. Now Governor Florio's environmental steel is being tested in the face of brutal economic realities. Both his historical perspective and his current efforts are expected to add considerable value to our deliberations.

1:30pm **Technologies in the Field: A Critical Link** - Sponsored by GZA GeoEnvironmental, Newton, Massachusetts.

● Following your morning introduction to the elements



"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123557

SPEECH: YES NO

FROM: DECKER, Gilbert: AMERICAN ELECTRONIC ASSOCIATION

DATE OF EVENT: 11/14/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: INVITATION TO MEET WITH THE AEA SCIENCE AND
TECHNOLOGY COMMITTEE 11/14 OR 11/15.

RSVP: 08/26/91

CONTACT PERSON: DENISE MICHEL

CONTACT NUMBER: 202/682-9110

INVITATION ACCEPTED?

~~YES~~

NO

COPIES TO: D. Allan Bromley
INDUSTRIAL

REMARKS: 9/4/91 - Regretted for DAB + suggested she call EW!
m n

CLOSED

DATE OF LETTER: 08/12/91

DATE RECEIVED: 08/21/91

FILE: P-INVITATION

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123557

SPEECH: YES NO

FROM: DECKER, Gilbert: AMERICAN ELECTRONIC ASSOCIATION

DATE OF EVENT: 11/14/91

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RSVP: 08/26/91

CONTACT PERSON: DENISE MICHEL

CONTACT NUMBER: 202/682-9110

INVITATION ACCEPTED? YES NO

COPIES TO: D. Allan Bromley
INDUSTRIAL

REMARKS:

DATE OF LETTER: 08/12/91

DATE RECEIVED: 08/21/91

FILE: P-INVITATION

9/3

Jurson
again

Gene Wong
should do this
DB

American Electronics Association

3557
AEA

5201 Great America Parkway, Santa Clara, California 95054, Telephone: (408) 987-4200
1225 Eye Street, N.W., Suite 950, Washington, D.C. 20005, Telephone: (202) 682-9110

August 12, 1991

91 AUG 21 P 2: 55

The Honorable D. Allan Bromley
Assistant to the President
for Science and Technology
Old Executive Office Building
17th Street & Pennsylvania Avenue, N.W.
Washington, D.C. 20506

OFFICE OF THE
DIRECTOR

Dear Dr. Bromley:

On behalf of the American Electronics Association, I invite you to meet with the AEA Science and Technology Committee on Thursday, November 14 or Friday, November 15 in Washington, D.C.

The Committee, which is comprised of chief scientists and technologists from key electronics industry product areas, is eager to meet with you before proceeding with decisions on AEA's future science, technology, and manufacturing agenda. We were disappointed that you were unable to accept our invitations to meet on May 7 and on July 26.

Members of the Science and Technology Committee believe industry/government interaction on these issues is vital, and we are willing to change the location of our November meeting from California to Washington, based on your availability. The Committee is interested in learning of your plans for coordinating and building upon the Administration's science and technology policy. We would like to discuss ways in which AEA can support OSTP's efforts and work with the Administration to advance U.S. technology and manufacturing global leadership.

The Committee would like to meet with you for approximately one hour on November 14 or 15 (we will arrange our meeting to accommodate your schedule). **Please have your staff notify Denise Michel at AEA (202-682-9110) of your availability by August 26 to enable us to make travel and other arrangements.**

We look forward to meeting you.

Sincerely,


Gilbert F. Decker

Chairman

AEA Science and Technology Committee

cc: J. Richard Iverson, President & CEO, AEA

AEA Science and Technology Committee:

David Beecham, Director, AT&T Microelectronics
Richard C. Berry, Vice President, Rogers Corporation
William V. Braun, Senior Vice President, Motorola Inc.
John Carruthers, Manager, Intel Corporation
Loney R. Duncan, Vice President, Rockwell International Corp.
Thomas F. Gannon, Director, Digital Equipment Corporation
Paul Kruse, Chief Research Fellow, Honeywell, Inc.
Tom Long, Vice President & General Manager, Tektronix, Inc.
Hugh Lynch, Senior Vice President, Unisys/Convergent
Mark Myers, Vice President, Xerox Corporation
David Nagel, Vice President, Apple Computer
Paul Sandland, Vice President, KLA Instruments Corporation
Steve Swerling, Vice President, Mentor Graphics Corporation

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123576

SPEECH: YES NO

FROM: BRISTOL-MYER SQUIBB/MEAD JOHNSON

DATE OF EVENT: 10/17/91

LOCATION OF EVENT:

TIME OF EVENT: 7:00PM

SUBJECT: INVITATION TO THE PRESENTATION OF THE ELEVENTH
ANNUAL BRISTOL-MYERS SQUIBB/MEAD JOHNSON AWARD FOR
DISTINGUISHED ACHIEVEMENT IN NUTRITIONAL RESEARCH TO
KURT J. ISSELBACHER.

RSVP: 09/05/91

CONTACT PERSON: MS. FRANCINE GINGRAS

CONTACT NUMBER:

INVITATION ACCEPTED?

YES

NO

COPIES TO: LIFE SCIENCES

REMARKS:

CLOSED

DATE OF LETTER: 08/12/91

DATE RECEIVED: 08/23/91

FILE: P-INVITATION



YOU ARE CORDIALLY INVITED
TO THE PRESENTATION OF THE
ELEVENTH ANNUAL
BRISTOL-MYERS SQUIBB/MEAD JOHNSON
AWARD FOR DISTINGUISHED
ACHIEVEMENT IN NUTRITION RESEARCH

TO
KURT J. ISSELBACHER, M.D.
MASSACHUSETTS GENERAL HOSPITAL
CANCER CENTER
DEPARTMENT OF MEDICINE
HARVARD MEDICAL SCHOOL
BOSTON, MASSACHUSETTS

ON
THURSDAY, OCTOBER 17TH
AT SEVEN O'CLOCK
PARK HYATT HOTEL
WASHINGTON, D.C.

DINNER WILL BE SERVED

RECEIVED

23 AUG 15

LEADING
DIRECTOR



Dr. D. Allan Bromley
Assistant to the President and Director
Office of Science and Technology Policy
Main Building, Room 360
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

257



SUITE 4100

345 PARK AVENUE

NEW YORK, NY 10154-0037

PLEASE RESPOND ON OR BEFORE

SEPTEMBER 16, 1991

The Honorable D. Allan Bromley

(NAME-PLEASE PRINT)

The Assistant to the President
for Science & Technology

(AFFILIATION)

☒ WILL ATTEND

☐ WILL NOT ATTEND

"CORRESPONDENCE TRACKING"

TYPE: ACTION DOCUMENT NUMBER: 9123443
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: BARR, John R.: MOTOROLA INC.

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 08/06/91

SUBJECT: REQUEST TO ASSIST IN THEIR REQUEST TO HAVE PRESIDENT
BUSH AS THE KEYNOTE SPEAKER FOR THE 1992 IEEE
COMPCON CONFERENCE.

DIRECTORATE STAFF
ASSIGNED: D. Allan Bromley ASSIGNED:

ACTION STAFF
REQUIRED: IF APPROPRIATE ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 08/26/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: PHYSICAL SCIENCES

WHITE HOUSE TRACKING #: CONTACT PERSON:
REMARKS: PHONE: EXT:

*This is not an appropriate occasion for the
President to speak.*

James Wang

OSTP RECEIVED: 08/12/91
DEPT RECEIVED:

FILE: P-INVITATION

THE WHITE HOUSE
WASHINGTON

September 20, 1991

Dear Dr. Barr:

Thank you for your letter of August 6 which arrived while I was out of the country. In it you tell me of your invitation to President Bush to speak at your conference next year scheduled to take place in San Francisco, February 25-27.

The scheduling is such that, although the invitation will be in the scheduling mill, you will not receive any concrete answer until between six weeks and two months prior to the event. I will, however, be happy to talk with the individual who is in charge of scheduling such Presidential appearances and add my suggestion that this would be an excellent occasion to speak concerning the Presidential initiative on high performance computing and communication.

With all best wishes,

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley", with a large, stylized flourish at the end.

D. Allan Bromley
The Assistant to the President
for
Science and Technology

Dr. John R. Barr
Manager
Software Systems Research Laboratory
Motorola, Incorporated
3701 East Algonquin Road, Suite 601
Rolling Meadows, Illinois 60008



MOTOROLA INC.

3443

RECEIVED

91 AUG 12 AIO: 43

OFFICE OF THE
DIRECTOR

August 6, 1991

Honorable D. Allan Bromley
Assistant to the President for Science and Technology
Office of Science and Technology Policy
Room 326, Old Executive Office
17th & Pennsylvania Avenue
Washington, D.C. 20506

Dear Dr. Bromley:

As the chairman of the 1992 IEEE COMPCON Conference Technical Program Committee, I have asked President Bush if he would consider being a keynote speaker for the conference. As the President's science advisor, I would like to ask your help with our request.

As stated in our letter to the President and as you may know, COMPCON is the IEEE Computer Society's annual conference and it draws a good mix of computer scientists from both industry and academia with considerable international attendance. We have had special sessions on the High Performance Computing Initiative in the past, and will have a session this year concerning the Grand Challenges and the Federal High Performance Computing and Communications program led by Dr. Paul Huray from the University of South Carolina.

It would be of great benefit for the IEEE Computer Society to have President Bush as a keynote speaker at next years conference. The IEEE Computer Society is a supporter of HPCC and many of the presenters and attendees will be members of the industrial and research community associated with high performance computing and communications. I have been told that you have participated in past COMPCON conferences. Your support this year will be appreciated

Please have someone contact me if you have any questions regarding the conference. My electronic mail address is barr@mot.com if that is more convenient.

Sincerely yours,

John R. Barr, Ph.D.
Manager, Software Systems Research Laboratory
(708) 576-8706

cc: Dr. Paul Huray



MOTOROLA INC.

August 6, 1991

Honorable George Bush
President, United States of America
1600 Pennsylvania Avenue
Washington, D.C. 20506

Dear Mr. President:

On behalf of the IEEE COMPCON '92 program committee I would like to invite you to be a special keynote speaker at next years conference which is scheduled to take place in San Francisco, California, Feb. 25 - 27, 1992. Should you accept, your keynote address can be scheduled for any day of the conference. Given the demands on your schedule, we would be flexible with the time of your presentation.

Our keynote speeches are normally one hour in duration in a morning session from 8:30 - 10:30 AM. On Wednesday mornings, we only have one keynote speaker followed by an IEEE Computer Society Awards Ceremony honoring key contributors and pioneers of the IEEE Computer Society. These awards are presented by the president of the IEEE Computer Society.

COMPCON is the IEEE Computer Society's annual conference and it draws a good mix of computer scientists from both industry and academia with considerable international attendance. It is a technical conference, not an exhibit. Attendance varies from 800-1200 people. Topics will include high-performance computing systems, multi-media systems, and the latest technological advances in microprocessors and workstations.

We are open to hear you speak on any topic you choose. We are interested in your reflections on learning how to utilize a computer or your view of the impact of the "Federal High Performance Computing and Communications (HPCC) Program on the United States' research and industrial communities as well as on education.

Please have someone contact me if you have any questions regarding the conference. My electronic mail address is barr@mot.com if that is more convenient.

Sincerely yours,

John R. Barr, Ph.D.
Manager, Software Systems Research Laboratory
(708) 576-8706

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123449

SPEECH: YES NO

FROM: AURORA FLIGHT SCIENCES CORPORATION

DATE OF EVENT: 08/23/91

LOCATION OF EVENT:

TIME OF EVENT: 2:00PM

SUBJECT: INVITATION TO CELEBRATE THE OPENING OF THEIR NEW
MANASSAS FACILITY.

RSVP: 08/16/91

CONTACT PERSON:

CONTACT NUMBER: 703/369-3633

INVITATION ACCEPTED?

YES

NO

COPIES TO: NATIONAL SECURITY
PHYSICAL SCIENCES

REMARKS:

8/16/91 - Regretted.
mr

CLOSED

DATE OF LETTER: 08/12/91

DATE RECEIVED: 08/13/91

FILE: P-INVITATION



RECEIVED

Aurora Flight Sciences Corporation

cordially invites you to:

91 AUG 13 A 9:50

- *Celebrate the opening of our new Manassas Facility*
- *Inspect the completed prototype of the Perseus remotely piloted high-altitude research aircraft*
- *Join us in a sendoff for the Aurora Flight Team as they leave for flight testing in California*

OFFICE OF THE
DIRECTOR

Friday, August 23, 1991

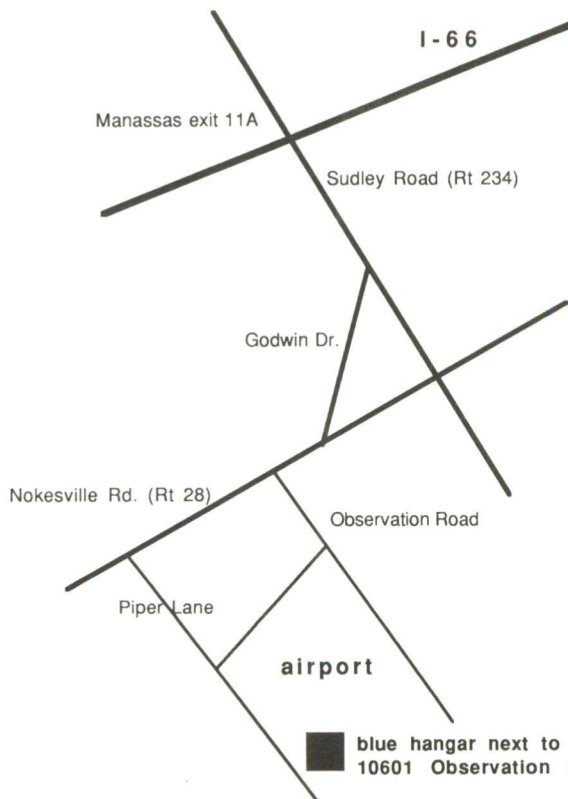
2-5 p.m.

*Aurora Flight Sciences
10601 Observation Road
Manassas Municipal Airport
Manassas, Virginia 22110
RSVP (703) 369-3633*

(map on back)

**Directions to
AURORA FLIGHT SCIENCES**

to Washington



- West 66 to exit 11A
- south on Sudley (234) to Godwin
- west (right) on Godwin to Rt. 28
- Rt 28 to airport, left on
Observation or Piper
- big blue hangar next to tower
- (703) 369-3633

airport



**blue hangar next to tower
10601 Observation Rd.**



Mr. Alan Bromley
Science Advisor to the President and Director
Old Executive Building
Washington, D.C. 20506

A U R O R A
FLIGHT SCIENCES CORPORATION
10601 OBSERVATION ROAD • MANASSAS MUNICIPAL AIRPORT
MANASSAS, VIRGINIA 22110 U.S.A.

3449

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123493

SPEECH: YES NO

FROM: SOBERON, Guillermo: CONSEJO CONSULTATIVO DE
CIENCIAS

DATE OF EVENT: 11/14/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: INVITATION TO ATTEND AN UNOFFICIAL AND INFORMAL
MEETING OF SCIENCE AND TECHNOLOGY ADVISORS TO HEADS
OF GOVERNMENT.

RSVP: 08/29/91

CONTACT PERSON:

CONTACT NUMBER:

INVITATION ACCEPTED? YES NO

COPIES TO:

INTERNATIONAL/POL

REMARKS:

CLOSED

DATE OF LETTER: 08/10/91

DATE RECEIVED: 08/15/91

FILE: P-~~INTERNATIONAL~~

invitation

THE WHITE HOUSE
WASHINGTON

September 3, 1991

Dear Dr. Soberón:

As you know from my letter of August 2, 1991, I am pleased to accept your kind invitation to attend the unofficial and informal meeting of Science and Technology Advisors in the Western Hemisphere. The Consejo Consultivo de Ciencias is to be commended for convening this meeting. I expect to participate beginning on the evening of November 15. Prior obligations will delay my departure, and I regret that I must miss the first two days.

My experience at the Carnegie Commission-sponsored meeting last February was very positive, and I believe that under your leadership the Western Hemisphere meeting will be equally successful. Much of the success of the February meeting was due to the informal nature of our discussions and agreement by all participants not to publicize the event. I am sure you will set similar guidelines for your meeting.

Your preliminary list of topics for discussion seems quite comprehensive and worthwhile. I suggest that we may also wish to discuss north-south cooperation in science and technology and in mathematics and science education to ensure that our next generation of scientific and engineering talent is all we could want it to be.

I look forward to seeing you in November, if not before.

Sincerely,



D. Allan Bromley
The Assistant to the President
for
Science and Technology

Dr. Guillermo Soberón
Coordinator General
Consejo Consultivo de Ciencias
Presidencia de la República
Félix Cuevas No. 301, 4 Piso
Col. del Valle
Delegación Benito Juárez
03100, México, D.F.

OSTP STAFFING SHEET

SUBJECT: Letter to Soberon

ORIGINATOR: Sara Bowden / Roseel PHONE: x4626

DATE ORIGINATED: 8/26 DATE DUE: _____ CORR TRACKING NO.: _____

EXTERNAL COORDINATION: None

	COMMENTS	DATE
5 DIRECTOR		
4 CHIEF OF STAFF		
3 GENERAL COUNSEL		
2 EXEC. ASST.		

ACTION REQUESTED: Return to Bonne for mailing.

[illegible]



COORDINACION GENERAL

CCC/CG/059/91

PRESIDENCIA DE LA REPUBLICA

CONSEJO CONSULTIVO
DE CIENCIAS

México D.F., 1o. de agosto de 1991.

DR. ALLAN BROMLEY
Assistant to the President
for Science and Technology
United States of America

Dear Dr. Bromley:

I am writing on behalf of the Consejo Consultivo de Ciencias to the President of Mexico (Science Advisory Council) to invite you to attend an unofficial and informal meeting of Science and Technology Advisers to Heads of Government. The purposes of the meeting are to develop a closer relationship among science advisers in different countries, to increase their understanding of various national perspectives, and to exchange views on science issues.

The Consejo Consultivo de Ciencias' decision to organize the meeting was inspired in the efforts undertaken by the Carnegie Commission on Science, Technology and Government and the United States Government which, based on the positive response to the idea from over thirty scientific leaders world-wide, held a meeting in New York City on February 1991 of science advisers to the highest levels of government. Representatives of six countries attended this meeting, the United States and the Soviet Union included.

We are extending invitations to Science and Technology Advisers from some of the Latin American and Caribbean countries, in which the advisory activities have had some development, as well as from the United States, Canada, Spain, and Portugal.

During the meeting, focused on the processes of scientific and technological advising, it is expected that the following issues will be addressed: science and technology in a dynamic world; functions and methods of scientific and technological advising at the highest level; global changes and scientific and technological prospects; international cooperation; role of the science and technology advisory bodies in the formulation of public policies for modernization and sustained development; modalities of the application and follow up of the results of the meeting.



PRESIDENCIA DE LA REPUBLICA

CONSEJO CONSULTIVO
DE CIENCIAS

Please let us know at your earliest convenience whether you will be able to attend the meeting, and send us your suggestions for subjects you would like to see included in the agenda. These suggestions will be tentative guidelines for the participants discussions, with freedom to undertake topics that are of interest to them which will be off the record if the participants desire.

We are expecting that in all cases, the actual Science Advisors or heads of the Scientific Advisory Bodies, will participate personally.

The meeting will be held this November 14, 15 and 16 at Ixtapa - Zihuatanejo, Mexico.

The organizers will cover room and board expenses during your stay in Mexico. The airfare and transportation expenses should be covered by the participants themselves.

We believe that this meeting is necessary due to the increasing scientific interdependence and the importance of international consultation on science policies. We are confident that the meeting will be productive and of lasting value.

SINCERELY,

GUILLERMO SOBERON, M.D., Ph.D
COORDINATOR GENERAL

Please send information to:

Graciela Rodriguez, Ph.D.
Executive Secretary
Consejo Consultivo de Ciencias
Presidencia de la República
Félix Cuevas No. 301, 4º Piso
Col. del Valle
Delegación Benito Juárez
03100, México, D.F.
Tel. (01152) 5 34 86 12
Fax: (01152) 5 24 69 20

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123253

SPEECH: YES NO

FROM: TRULL, Frankie L.:FOUNDATION FOR MEDICAL RESEARCH

DATE OF EVENT: 10/09/91

LOCATION OF EVENT:

TIME OF EVENT: 7:00PM

SUBJECT: INVITATION TO THE PRESENTATION OF THE 1991 LIFETIME
ACHIEVEMENT AWARD TO MICHAEL E. DEBAKEY, M.D.

RSVP: 08/19/91

CONTACT PERSON:

CONTACT NUMBER:

INVITATION ACCEPTED?

~~YES~~

☒ NO

COPIES TO:

REMARKS: A formal invitation will follow.

CLOSED

DATE OF LETTER: 08/02/91

DATE RECEIVED: 08/05/91

FILE: P-INVITATION

3253

FOUNDATION FOR
BIOMEDICAL RESEARCH

RECEIVED

OFFICERS

Michael E. DeBakey, M.D.
Chairman

Peter Barton Hutt, Esq.
Vice-Chairman

Frankie L. Trull
President

August 2, 1991 01 AUG 5 P12:40

OFFICE OF THE
DIRECTOR

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Lewis Thomas, M.D.
George W. Thorn, M.D.
James S. Todd, M.D.
Edwin C. Whitehead
Torsten N. Wiesel, M.D., F.R.S.
James Wyngaarden, M.D.

D. Allan Bromley, Ph.D.
Assistant to the President
Office of Science and Technology Policy
Room 360
Old Executive Office Building
Seventeenth and Pennsylvania Avenue, N.W.
Washington, D.C. 20506

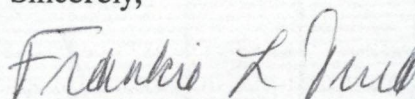
Dear Dr. Bromley:

On October 9, 1991 the Foundation for Biomedical Research will award the *1991 Lifetime Achievement Award* to one of the most distinguished members of the medical community, Michael E. DeBakey, M.D. As you are undoubtedly aware, Dr. DeBakey is one of the world's leading heart surgeons and cardiovascular researchers, and in his capacity as Chancellor of Baylor College of Medicine, a leading educator.

The presentation of this award will take place at the National Building Museum in Washington, D.C. A cocktail reception will begin at seven o'clock, followed by the dinner, the awards ceremony and dancing. Many of your colleagues from the public service arena as well as the scientific and medical communities will be gathered to honor Dr. DeBakey. I would like to extend to you, on behalf of the Board of Directors of the Foundation for Biomedical Research, an invitation to join Wayne Newton, Al Hirt and a host of others at this gala event.

A formal invitation will be sent to you at a later date, but we wished to inform you of the event at this time realizing how hectic your schedule can become. I certainly hope that you will be able to join us on October 9, and if you have any questions please do not hesitate to contact me.

Sincerely,



Frankie L. Trull
President

FLT:pl

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9123217

SPEECH: YES NO

FROM: INTERMAGNETICS GENERAL CORPORATION

DATE OF EVENT: 08/22/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: A RECEPTION AND SYMPOSIUM IN CELEBRATION OF THEIR
20TH ANNIVERSARY, (RECEPTION -- 7PM-10PM 08/22/91
AND SYMPOSIUM -- 9AM-2PM)

RSVP: 08/12/91

CONTACT PERSON:

CONTACT NUMBER:

INVITATION ACCEPTED?

~~YES~~

NO

COPIES TO:

REMARKS:

CLOSED

DATE OF LETTER: 07/31/91

DATE RECEIVED: 08/05/91

FILE: P-INVITATION

C.H. Rosner
President



**Intermagnetics General Corporation is sponsoring a symposium
in celebration of our 20th Anniversary**

You are cordially invited to attend.

Dates: August 22, 1991
Reception — 7 p.m.-10 p.m.

August 23, 1991
Symposium — 9 a.m.-2 p.m.

Where: The Gideon Putnam Hotel and Conference Center
Saratoga Springs, New York, USA

RSVP by August 12, 1991

3217

ALBANY, NY 122
PM
JUL 31 1991

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DR. D. ALLAN BROMLEY
SCIENCE ADVISOR TO
PRESIDENT BUSH
OLD EXECUTIVE OFFICE BLDG.
WASHINGTON, DC 20506
USA

ALB NY 322 PM 07/31/91 DCR#13

Intermagnetics General Corporation

P.O. Box 566

Guilderland, New York 12084

RECEIVED

9:31

OFFICE OF THE
DIRECTOR

DIRECTOR

91 AUG 5 9:31

RECEIVED

C.H. Rosner
President



RSVP by August 12, 1991

Name(s) _____

- ☐ I will attend Reception on August 22, 1991
- ☐ I will attend Symposium on August 23, 1991

Number attending _____



Intermagnetics General Corporation

Attn: Michelle Kepner

P.O. Box 566

Guilderland, New York 12084

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9122668

SPEECH: YES NO

FROM: CALABRESI, Steven G. and David M. McIntosh: THE
FEDERALIST SOCIETY

DATE OF EVENT: 09/13/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: INVITATION TO ATTEND THE FIFTH ANNUAL LAWYERS
CONVENTION ON THE TOPIC OF "INDIVIDUAL
RESPONSIBILITY AND THE LAW", AS THE SOCIETY'S GUEST.

RSVP:

CONTACT PERSON:

CONTACT NUMBER:

INVITATION ACCEPTED?

~~YES~~

NO

COPIES TO: D. Allan Bromley
Michelle Van Clea

REMARKS:

7/29 - Regretted to Christine!
mx

CLOSED

DATE OF LETTER: 07/18/91

DATE RECEIVED: 07/24/91

FILE: P-INVITATION

2668

THE FEDERALIST SOCIETY FOR LAW & PUBLIC POLICY STUDIES

1700 K STREET, N.W.
SUITE 901
WASHINGTON, D.C. 20006
202-822-8138

RECEIVED

91 JUL 24 A 9: 54

July 18, 1991

OFFICE OF THE
DIRECTOR

Dr. D. Allan Bromley
Asst. to the President
Science & Technology Policy
Old Executive Office Bldg., NW
Washington, DC 20506

Dear Dr. Bromley,

On September 13-14, 1991, the Federalist Society will hold its Fifth Annual Lawyers Convention in Washington, D.C. on the topic "Individual Responsibility and the Law." As National Co-Chairmen, we would like to invite you to attend the conference as the Society's guest.

The American experiment in self-government requires for its success both a free and a responsible citizenry. The formal structure of our government and the rhetorical self-image of the country both re-enforce the role--unique among nations--of the individual in American life. On the constitutional side, the Bill of Rights is well recognized as a concrete protection of the individual against government, but the structural constraints of separation of powers and federalism also have as their end the safeguarding of the individual. On the rhetorical side, such famous slogans as "one man, one vote," and "forty acres and a mule" invoke a tradition in which the individual is paramount--and responsible. This conference will explore ways in which developments in the law affect the degree of responsibility individual citizens shoulder for their actions, as well as the social and moral repercussions on the polity as a result. Panels will examine these trends in relation to major areas of the law.

A few of the many participants already confirmed include Judges Robert Bork, Edith Jones and Frank Easterbrook, ACLU President Nadine Strossen, Senator Orrin Hatch, former Assistant Attorney General William Bradford Reynolds and Professors Norval Morris of the University of Chicago Law School and Elizabeth Warren of the University of Pennsylvania Law School. To further acquaint you with the program and the participants, we have enclosed a brochure outlining the conference activities as well as a reply envelope for registration. For our records, we would appreciate your writing "guest" on the envelope.

The conference will be at the Mayflower Hotel, 1127 Connecticut Avenue, N.W., Washington, DC 20006. We are sure you will agree the subject of this event is of great national importance. We hope you will join us.

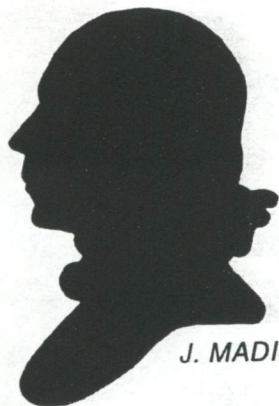
Steven G. Calabresi

Steven G. Calabresi
National Co-Chairman

Sincerely,

David M. McIntosh

David M. McIntosh
National Co-Chairman



J. MADISON

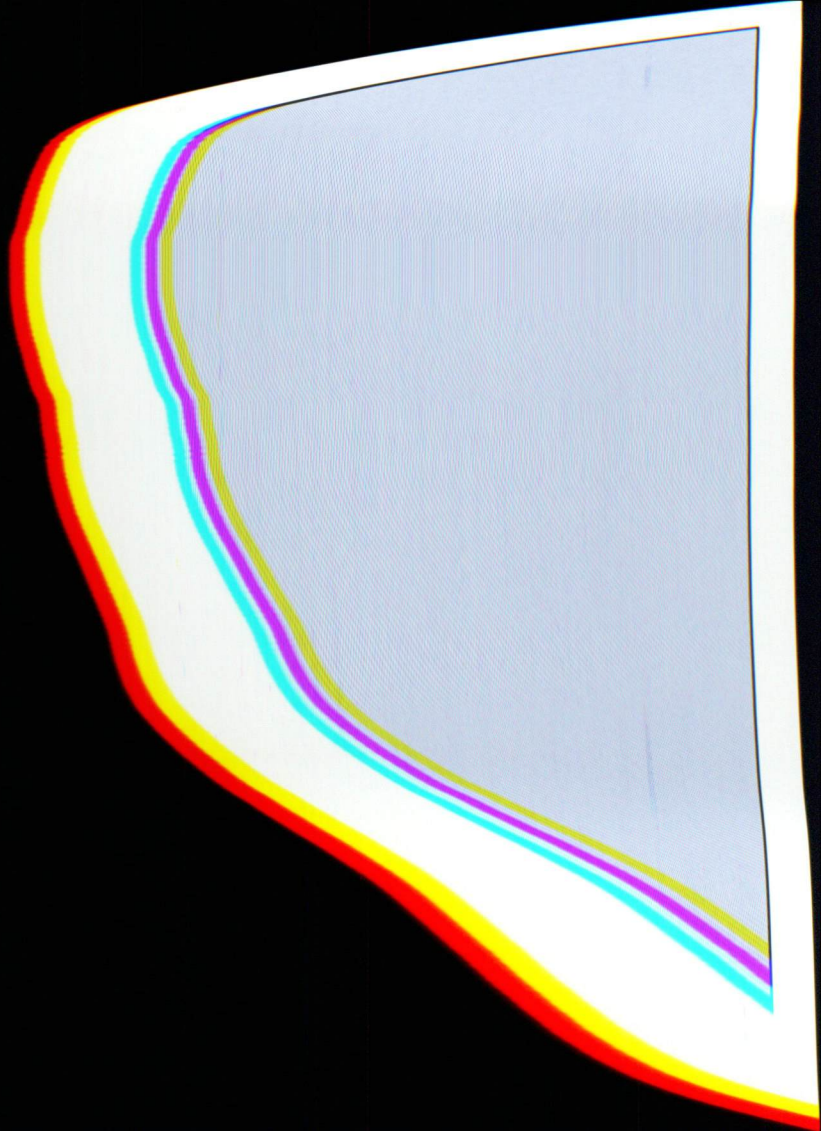
THE FEDERALIST SOCIETY

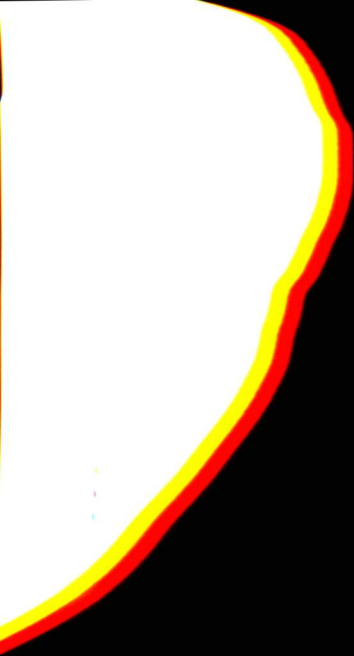
presents

INDIVIDUAL
RESPONSIBILITY
AND THE LAW

*FIFTH ANNUAL
LAWYERS CONVENTION*

September 13 and 14, 1991
The Mayflower Hotel
Washington, D.C.





Questions

Is the displacement of contract principles by tort law as profound and significant as is sometimes suggested, and what are the consequences of this development?

What is the role of bankruptcy law and policy in a free and responsible society? In particular, do financial markets require a different set of rules?

What role does and should personal responsibility play in the criminal law?

Do entitlements offer necessary empowerment, or do they weaken individuals by fostering a culture of dependence?

How does mandating the private provision of benefits advance or hamper the liberties of those who must provide them and their intended beneficiaries?

What can and should be the role of the law in administering the family relations of free and responsible individuals?



"You (the Federalist Society) have already, made, in your rather short life, a considerable and indispensable contribution to the dialogue about the rule of law which lies at the heart of the great freedoms that I am convinced many of us take for granted."

The Honorable George Bush

"How far we have come these last eight years, not only in transforming the operations of government . . . but also in changing the terms of national debate. And nowhere is that change more evident than in the rise of the Federalist Society . . ."

The Honorable Ronald Reagan

" . . . The convention of the Federalist Society was a show of intellectual firepower and numerical forces by conservatives who have already begun to change the terms of legal debate and to revive legal doctrines that were for decades dismissed as historical curiosities."

The New York Times

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J. MADISON

THE FEDERALIST SOCIETY

presents

INDIVIDUAL RESPONSIBILITY AND THE LAW

FIFTH ANNUAL LAWYERS CONVENTION

September 13 and 14, 1991
The Mayflower Hotel
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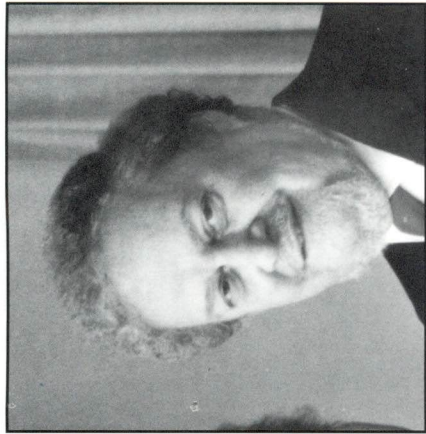
*Judge Edith Jones
U.S. Court of Appeals for the Fifth Circuit*



*Honorable Orrin Hatch
U.S. Senate*



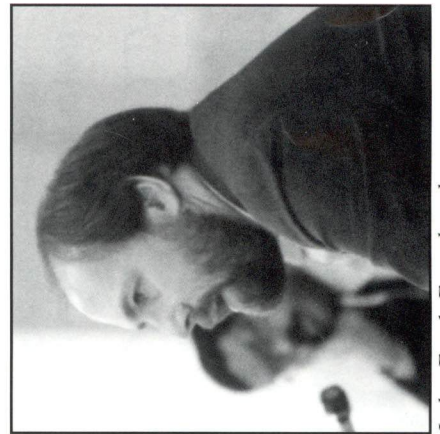
*Mrs. Phyllis Schlafly
Eagle Forum*



*Judge Robert H. Bork
American Enterprise Institute*



*Professor Nadine Strossen
President, American Civil Liberties Union*



*Judge Frank Easterbrook
U.S. Court of Appeals for the Seventh Circuit*

About the Federalist Society

The Federalist Society for Law and Public Policy Studies is a non-profit organization comprised of conservatives and libertarians interested in the current state of the legal order. It is founded on the principles that the state exists to preserve freedom, that the separation of powers is central to our Constitution, and that it is emphatically the province of the judiciary to say what the law is, not what it should be. Through its activities, the Society seeks both to promote an awareness of these principles and to further their application.

The Society's Lawyers Division currently has thirty-five chapters in cities across the country, as well as groups organizing chapters in several other cities. The chapters sponsor meetings where members of the bar and others interested in the ideals of the Society can meet one another and attend speeches and debates involving prominent scholars, judges and practitioners discussing current issues in the law. The chapters convene at the Annual National Lawyers Convention.

Additionally, the Society's Student Division includes Chapters at 110 law school campuses around the country.

About the Convention Topic

The American experiment in self-government requires for its success both a free and a responsible citizenry. The formal structure of our government and the rhetorical self-image of the country both re-enforce the role—unique among nations—of the individual in American life. On the constitutional side, the Bill of Rights is well recognized as a concrete protection of the individual against government, but the structural constraints of separation of powers and federalism also have as their end the safeguarding of the individual. On the rhetorical side, such famous slogans as "one man, one vote," and "forty acres and a mule" invoke a tradition in which the individual is paramount—and responsible.

In the twentieth century, the growing wealth of the nation and the widespread emergence of philosophical theories questioning the meaningfulness and scope of individual responsibility led to suggestions that the system was unsuited to current conditions—that laissez-faire promoted only a formalistic individualism at the expense of "real" freedom. These ideas have greatly influenced legal developments, as the law increasingly seeks to protect individuals from their own mistakes and misfortunes. In recent years, however, our society is increasingly regaining an appreciation of the benefits of individual action and responsibility in the traditional sense.

The conference will examine how major legal developments affect individual responsibility. It will focus on key areas in which legal change has affected the accountability that individuals expect and accept for their actions—in particular, the law of contracts, torts, bankruptcy, crime, and the family. The conference is especially timely in view of the suggestion increasingly heard in public policy debates that cultural decay has produced individuals who are less responsible and civic-minded in their conduct.

THE FEDERALIST SOCIETY

invites you to a conference on:

INDIVIDUAL RESPONSIBILITY AND THE LAW

September 13 and 14, 1991

The Mayflower Hotel
Washington, D.C.

Speakers

Professor Randy E. Barnett
Chicago-Kent College of Law,
Illinois Institute of Technology

Hon. William P. Barr
Deputy Attorney General of the U.S.

Judge Robert H. Bork
American Enterprise Institute

Judge Frank Easterbrook
U.S. Court of Appeals, Seventh Circuit

Mr. Alexander Forger
Milbank Tweed Hadley & McCloy

Professor Elizabeth Fox-Genovese
Emory University

Hon. Orrin G. Hatch
U.S. Senate

Mr. Peter Huber
The Manhattan Institute
Author of *Liability*

Judge Edith Jones
U.S. Court of Appeals, Fifth Circuit

Professor Norval Morris
University of Chicago Law School

Mr. Walter K. Olson
The Manhattan Institute
Author of *The Litigation Explosion*

Hon. Wm. Bradford Reynolds

Panel Descriptions

The Death of Contract and the Rise of Tort. The role of contract in the law has evolved dramatically over the last thirty years. In many areas of the law, contract principles have been displaced by tort law, which has become a major tool not only of rectificatory justice but also of redistribution throughout society of the costs of accidents and other misfortunes. Some say these changes have made businesses and the powerful more responsible and less able to run roughshod over the disadvantaged elements of society. Others see the trend away from contract reducing individual responsibility, protecting the careless, and destroying predictability in law and life. Are these legal changes as profound and significant as their proponents and opponents sometimes suggest? If so, who is right about their consequences, and how does society deal with them?

Socialization of Risk: Bankruptcy Law and Financial Institutions. In an unregulated market, businesses will sometimes fail. As recent events involving financial institutions illustrate, however, modern markets are not unregulated. The law often intervenes, both systematically and episodically, to affect the course of business failures, sometimes by "bailing out" businesses that are on (or over) the brink of bankruptcy. Some say that softening penalties for failure, particularly in the banking arena, avoids sharp distortions and possibly undeserved personal ruin, can protect innocent investors from financial disaster, and can enhance the stability of the financial system. Others suggest that a world in which failure is subsidized and success taxed will be a world with less success and more failure. Excess reliance on government, they urge, undercuts private initiative, induces excessive risk-taking, and can stifle the development of effective market mechanisms for addressing these problems. What is the role of bankruptcy law and policy in a free and responsible society? In particular, do financial markets warrant or require a different set of rules?

Personal Responsibility in Criminal Law. Perhaps no issue affects American life more deeply than crime. And perhaps no issue generates deeper disagreements, ranging from the philosophical (is society's goal in punishing criminals revenge, rehabilitation, deterrence, or all three?) to the practical (what will work to achieve the long term goal of reducing crime?). What role does and should personal responsibility play in this dialogue? When, if ever, are conditions such that individuals are no longer meaningfully responsible for their actions? Do deprived backgrounds, poor role models, drug infested neighborhoods, and lack of education make "personal responsibility" an empty phrase? Will current efforts to stress a "search for truth" in the courtroom help make individuals more responsible for their actions?

Entitlements, Empowerment and Victimization. Entitlements take many forms, from cash and in-kind benefits to guarantees of certain treatment by others. Some suggest that entitlements, and their concomitant treatment of people as victims, weakens people's character, damages their individual initiative, and prepares them for a life of dependency. Far from being empowered, they lose the entrepreneurial spirit needed in a robust society. Others suggest that entitlements are necessary to make freedom and citizenship meaningful for many people. Some people are rendered powerless, it is said, not only by the weight of past discrimination but by subtle (or not so subtle) present discrimination as well. Do our laws and entitlements protect our citizens against discrimination, correct past injustices, and offer necessary empowerment? Or do they weaken individuals by treating them as parts of groups, fostering self-images of powerlessness, and affronting the individuals who must provide the entitlements?

Regulating for the Public Good and In-kind Transfers. Taxation and centralized government-run programs are no longer the

Ross & Hardies
Mrs. Phyllis Schlafly
Eagle Forum
Professor Nadine Strossen
President, American Civil Liberties Union
Professor Elizabeth Warren
University of Pennsylvania Law School
... and many others.

Family Law and Individual Responsibility. "Till death do us part—or until I don't feel like it anymore." The rise to dominance of no-fault divorce regimes and single parent families has undermined the marriage relationship, and has radically altered the consequences that flow from agreeing to a marriage relationship. As a result, over one quarter of all children under the age of 18 now live in single parent families compared with only 5% in 1960. Other changes in what can broadly be called family law, including the rise of the children's rights movement, the creation of new legal rules making it harder to collect child support, and the liberalization of abortion laws that was well underway even before the Supreme Court's 1973 decision in *Roe v. Wade*, have similarly caused major changes in American life. How have these changes affected individual responsibility? Have they allowed ever larger groups of people to take control of their own destinies, or have they contributed to a growing culture of irresponsibility? What can and should be the role of the law in administering the family relations of free and responsible individuals?

Registration Fees

	Before 8/20	After 8/20
Registration:		
Member	\$30.00	\$40.00
Non-member	\$50.00	\$60.00
Friday Banquet	\$40.00	\$40.00
Saturday Lunch	\$20.00	\$20.00

To reserve overnight accommodations, please contact the Mayflower Hotel directly. Be sure to inquire about the special rate available for those attending the conference.

The Mayflower Hotel
1127 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 347-3000

To register or receive more information about the Federalist Society, return the enclosed envelope to:

FIFTH ANNUAL LAWYERS
CONVENTION
The Federalist Society
1700 K Street, N.W.
Suite 901
Washington, D.C. 20006
(202) 822-8138

Schedule

Friday, September 13

Registration Noon-5:00 p.m.
Opening Remarks 1:00-1:15 p.m.
Keynote Address 1:15-2:00 p.m.
Panel I 2:15-4:00 p.m.
Panel II 4:15-6:00 p.m.
Reception 6:00-7:00 p.m.
Banquet 7:00-9:30 p.m.

Saturday, September 14

Panel III 9:00-10:30 a.m.
Panel IV 10:45-12:30 p.m.
Lunch 12:30-2:15 p.m.
Panel V 2:15-4:00 p.m.
Panel VI 4:15-6:00 p.m.
Closing Reception 6:00-8:00 p.m.

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TYPE: INVITATION DOCUMENT NUMBER: 9122959
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: RAYMOND, L.R.: EXON

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/25/91

SUBJECT: INVITATION TO TOUR PRINCE WILLIAM SOUND VIA
HELICOPTER.

DIRECTORATE STAFF
ASSIGNED: D. Allan Bromley ASSIGNED:

ACTION STAFF
REQUIRED: RSVP ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 08/12/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: ENVIRONMENT

WHITE HOUSE TRACKING #: CONTACT PERSON: JIM SHEERAN
PHONE: 713/656-3548 EXT:
REMARKS:

OSTP RECEIVED: 07/29/91
DEPT RECEIVED:

FILE: P INVITATION

THE WHITE HOUSE
WASHINGTON

September 9, 1991

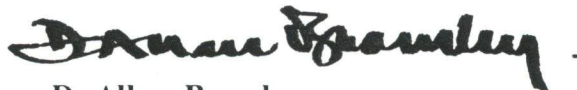
Dear Mr. Raymond:

Thank you for your letter of July 25. I apologize for the delay in responding but I was out of the country much of August and did not receive your invitation until early September.

As much as I would have enjoyed the opportunity for a bird's eye view of Prince William Sound, in my current position in the Administration, it would not have been appropriate for me to accompany you. From the agenda and enclosed brochures, it looks as though it was a most interesting trip.

I do, however, appreciate your thinking of me.

Sincerely,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley", with a small horizontal line at the end.

D. Allan Bromley
The Assistant to the President
for
Science and Technology

Mr. R. L. Raymond
President
Exxon Corporation
225 East John W. Carpenter Freeway
Irving, TX 75062-2298

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

August 13, 1991

*Thanks!
just as I
suspected
DAB.*

MEMORANDUM FOR D. ALLAN BROMLEY

FROM: MICHELLE K. VAN CLEAVE *mkv*
SUBJECT: INVITATION TO TOUR PRINCE WILLIAM SOUND VIA
HELICOPTER

You have asked whether you might accept an invitation from EXXON to tour Prince William Sound. They have offered to provide the helicopter tour, as well as round-trip transportation to and from Alaska, and lodging and meals.

As I read applicable guidelines (explained below), it is my opinion that you may not accept this invitation (as you suspected). However, should you wish to accept, you may want to get an independent ruling from White House Counsel.

Under new (March 1991) OGE guidelines, agencies may accept payments from non-Federal sources in connection with the funding of certain official travel (31 U.S.C. Sec. 1353). The requirements are that payment be:

1. For attendance at a meeting or similar function, defined as "a conference, seminar, speaking engagement, training course or similar event." The definition specifically excludes events required to carry out an agency's statutory and regulatory functions, such as investigations, inspections, audits, or site visits.
2. For travel related to an employee's official duties.
3. From a non-Federal source that is not disqualified on conflict of interest grounds (i.e., a source which "has interests that may be substantially affected by the performance or nonperformance of the employee's duties"). This requirement can be met upon a determination that the agency's interest in the employee's attendance at, or participation in, the event outweighs concern that acceptance of the payment may or may reasonably appear to influence improperly the employee in the performance of his/her official duties.

In the case of EXXON's invitation, I would interpret these requirements as follows:

1. As currently contemplated, the proposed travel is not associated with any "function" within the meaning of 31 U.S.C. Sec. 1353, but would appear to fall within the definition of a site visit, for which payment may not be accepted.
2. The travel is related to your official duties.
3. EXXON may be a prohibited source, especially given the extensive litigation and liabilities it has incurred from the oil spill, which may be adversarial to the government's interests. And, given your position in the White House, the perception of improper influence would remain a concern.

2959

EXXON
RECEIVED

L. R. RAYMOND
President

91 JUL 29 P 3: 55

July 25, 1991

OFFICE OF THE
DIRECTOR

Dr. D. Allan Bromley
Executive Office of the President
Office of Science & Technology Policy
Old Executive Office Bldg.
Room 360
17th and Pennsylvania Avenue NW
Washington, D.C. 20506

Dear Dr. Bromley:

In 1990, you were unable to accept our invitation to see Prince William Sound. I would like you to have another opportunity to see what nature, aided by Exxon's cleanup, has been able to accomplish. The visit will include two days touring Prince William Sound via helicopter. This will give you the opportunity to see the hardest hit areas and walk the shorelines. If weather conditions preclude helicopter tours, a vessel tour will be provided which will include the opportunity to spend the night in the vessel in the Sound. We have planned four tours for mid-August. A tentative agenda and schedule of tours is attached.

In addition to providing the tour, Exxon would be pleased to provide round-trip transportation to and from Alaska as well as lodging and meals during your tour. Since the tour dates are fast approaching, please call Jim Sheeren at (713) 656-3548 and provide us your response. Jim will coordinate your travel and lodging arrangements and answer any questions you may have.

I have enclosed two recent reports on conditions in Prince William Sound for background information, "Two Years After the Spill: Environmental Recovery in Prince William Sound and the Gulf of Alaska" by Drs. Baker, Clark and Kingston and "Shoreline Conditions Following the Exxon Valdez Spill as of Fall 1990" by Dr. Owens.

I sincerely hope you will be able to accept this invitation to tour Prince William Sound.

Yours truly,
L. R. Raymond

Enclosures



Prince William Sound Tour

• TENTATIVE AGENDA

Travel Day Arrive in Anchorage

Day 1 Helicopter Tour
 8:00 A.M. Meet at hangar, Briefing
 8:45 A.M. Suit up
 9:00 A.M. Depart for Prince William Sound
 10:00 A.M. Tour several representative locations,
 Lunch
 2:00 P.M. Depart for Anchorage
 3:00 P.M. Arrive in Anchorage
 Evening Dinner/Informal discussion

Day 2 Helicopter Tour
 8:00 A.M. Meet at hangar, Briefing
 8:45 A.M. Suit up
 9:00 A.M. Depart for Prince William Sound
 10:00 A.M. Tour several representative locations,
 Lunch
 Optional - fishing, flightseeing
 2:00 P.M. Depart for Anchorage
 3:00 P.M. Arrive in Anchorage
 Evening Dinner/Informal discussion

Travel Day Depart from Anchorage

NOTE: If low clouds preclude helicopter travel to the Sound on Day 1, a vessel trip from Whittier will be arranged and guests may spend the night on the vessel in the Sound

• SCHEDULE

<u>Tour</u>	<u>Travel</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Travel</u>
1	8/8	8/9	8/10	8/11
2	8/10	8/11	8/12	8/13
3	8/12	8/13	8/14	8/15
4	8/14	8/15	8/16	8/17

Two Years After the Spill: Environmental Recovery in Prince William Sound and the Gulf of Alaska

March 1991



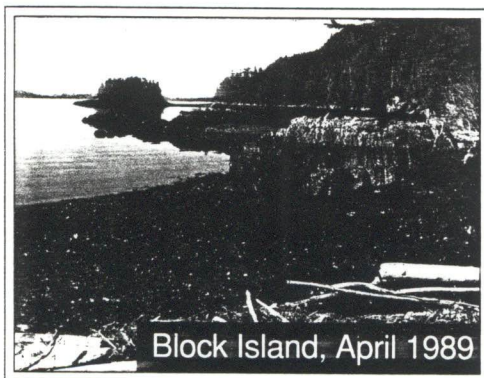
Jennifer M. Baker, Ph.D.

Robert B. Clark, Ph.D.

Paul F. Kingston, Ph.D.



Shoreline Conditions Following the *Exxon Valdez* Spill as of Fall 1990



by
Edward H. Owens, Ph.D.
Woodward-Clyde 

Consulting Engineers • Geologists • Environmental Scientists

Presented at
the 14th Annual
Arctic and Marine Oilspill Program
Technical Seminar
June 1991

Two Years After the Spill: Environmental Recovery in Prince William Sound and the Gulf of Alaska

March 1991



Jenifer M. Baker, Ph.D.

Robert B. Clark, Ph.D.

Paul F. Kingston, Ph.D.



INTRODUCTION

A striking feature of the Valdez oil spill and its impact on the environment is the great disparity between public perceptions and fact. In 1989, the public learned from extensive media coverage that the oil spill had fouled beaches, killed seabirds and other sealife and disrupted fishing. As in other oil spills, natural recovery started quickly after the initial impact. The recovery, however, is not such dramatic news and has attracted much less media attention. In 1991, the public is therefore still left with its impression of "disaster," but is less aware that the affected areas are now well on the way to recovery.



The authors (from left to right: Dr. Paul Kingston, Dr. Robert Clark, and Dr. Jenifer Baker) during one of their 1990 visits to Prince William Sound, Alaska. All three have extensive international experience studying the impact of oil on the marine environment.

As James Mielke commented in his report to Congress for the Congressional Research Service, *Oil in the Ocean: The Short- and Long-Term Impacts of a Spill*, this is not a unique situation. Very much the same public misperception of "disaster" followed the wreck of the *Argo Merchant* on the Nantucket Shoals off the Massachusetts coast in 1976, when, in fact, minimal ecosystem damage was caused. The wreck of the *Amoco Cadiz* on the French coast in 1978 was the largest tanker oil spill on record (six times the size of the Valdez spill) and was claimed to be an ecological disaster. Although extensive damage was caused to the coastal environment, recovery in most areas was rapid.

The report we have written here is concerned with the recovery processes that have taken place in Prince William Sound and the Gulf of Alaska since the oil spill. Our observations and conclusions are based on factual evidence and run counter to some public perceptions, but they may help give reassurance that natural recovery is well underway and that the Valdez oil spill has no different implications than those relating to other cold water oil spills that have occurred around the world.

In December 1989, Exxon invited us to prepare a survey of the information in the published scientific literature on the recovery processes and rates of recovery of cold water marine environments following oil spills. At that time, there were no scientific publications relating to the Valdez oil spill and so it did not feature in our report.

Following the preparation of this technical report, we visited Prince

William Sound in the Spring (April, May) and Fall (September) of 1990 to form an impression of the recovery of oiled shores 12-18 months after the spill by "skilled eye" survey. Such surveys, using experienced observers to look for key features to monitor changes in the environment, are commonly used as part of gross environmental damage assessments. Our chief objectives were to discover if the recovery processes on the shores that had been impacted by oil were following the same pattern and were occurring at the same rate as those experienced in comparable situations following oil spills in other parts of the world.

We selected a variety of shore types for examination (including some that one of us, Dr. Baker, had studied in June 1989 before they were cleaned). They included shores that had been heavily oiled, lightly oiled or, for comparison, shores that had not been oiled at all; sheltered beaches and some exposed to severe wave action; and beaches that had been cleaned in various ways or, in one case, not cleaned.

In addition, we were able to form a view about the recovery potential of other elements in the marine environment that were at risk from the oil, based on our observations in the area, experience from previous oil spills, and reported events in the Sound during Summer 1990. We also addressed some of the concerns that have been expressed in public discussion or in the media (which we have followed closely since the event) or which we have encountered in discussions with local officials, other interested parties and members of the public.



Green Island (above) and Smith Island (below) in Prince William Sound, once heavily oiled, demonstrate the degree of recovery experienced by the shorelines in the area.



BACKGROUND TO OIL SPILLS

Oil spills, large and small, have happened in many parts of the world, and there is an enormous amount of scientific knowledge and information about the effects of oil on different types of marine environments, the recovery processes and rates of recovery. This experience has been reviewed and conclusions from it have been drawn several times by various distinguished bodies, including the U.S. National Academy of Sciences in 1975 and 1985, the U.K. Royal Commission on Environmental Pollution in 1981 and the U.N. Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) in 1982 and 1990. One of us, Dr. Clark, contributed to the first three of these reviews and was a founding member of GESAMP.

The consensus from all these overviews is that oil spills always have features in common and these need to be borne in mind when reading this report on the recovery of Prince William Sound following the 1989 oil spill. The features include:

- ▶ **Crude oil loses most of its toxicity within a few days of being spilled at sea.** Weathered oil is unlikely to poison plants or animals, but may smother them, and floating oil, whether still toxic or not, can be damaging to seabirds and sea otters if it contaminates their plumage or fur. In Prince William Sound and the Gulf of Alaska almost all of the oil reaching the shore had weathered at sea for many days or weeks.

Thin sheens may still occur after the bulk of the oil has either come ashore or dispersed at sea, but there is no evidence that they have any significant impact on marine ecosystems.

► **Recovery of the environment depends on the capacity of the unaffected plants and animals to replace the one-time immediate losses.** The speed of the recovery depends, first, on how quickly the damaging effects of the oil are removed, thus allowing recovery to start;



Occasional oil sheens may appear long after the bulk oil is removed. Sheens have little or no impact, as evidenced by the presence of beach plants.

second, on the numbers and species of survivors; and third, on how far the damaged area is from the nearest plants and other marine life available to recolonize it. No area in Prince William Sound was far from an undamaged area which acted as a reservoir for recolonization. Moreover, even on shores that were oiled there were many surviving plants and other marine life.

► **Once the bulk oil has been removed from the environment, either by human intervention or by natural processes, the mortality of marine organisms declines rapidly.** Most mortalities are immediate, but some organisms that have suffered sub-lethal damage may not recover and die after a short interval, or are unable to compete for long in the struggle for existence. Oil impacts are essentially short term. Concerns that damage which is not currently apparent will appear in future years is not supported by scientific evidence from any previous spills.

SURVEY OF SHORES

Following the spill, oiling of shores was an obvious concern because of threats to wildlife using the shores and because of fears that residual oil might be a long-term threat to marine life.

Clean-up operations in 1989 addressed these concerns and were more extensive and thorough than those after any previous oil spill in the world. The successful removal of bulk oil from beaches minimized long-term threats to wildlife, largely averted the formation of asphalt pavements and maximized the benefits of natural clean-up processes. These natural processes substantially reduced the amounts of residual oil during the period September 1989 to March 1990. In April 1990 we observed that shores in Prince William Sound and the Gulf of Alaska had a generally clean appearance but some weathered oil remained, mostly in sheltered inner bays or on upper shores. By September 1990 some of this remaining oil was more obvious, possibly resulting from the higher summer temperatures warming the oil, and allowing it to thin out and migrate through the beach material more easily. Another possibility is that this was the intended result of some types of beach cleaning which aim to expose sub-surface oil to promote its weathering.

In April 1990 we saw that recovery had begun and predicted normal growth and development would take place over the summer season. When we revisited the same beaches in September 1990, our predictions were

confirmed.

We examined the plant and animal life on shores because this intertidal flora and fauna is a good indicator of water quality. The early life stages—spores and larvae—of these organisms float in the surface waters of the sea before settling on the shore and they are particularly sensitive to toxic effects even at low levels of contamination. Furthermore, these shore plants and animals are important because most are low in the food chain and many fish, birds and mammals depend on them for food.

The summer settlement and growth of the organisms we saw was good biological evidence that the sea and the shores were clean enough for recovery to take place. Mussels, barnacles and rockweed that were abundant on the shores as newly settled juveniles in Spring had become established as young adult populations by the Fall. Such development had taken place even where there had been no clean-up or there was still residual oil on the shore. For example:



▲ April, 1990



► On the upper shore we found beach grasses in oily sediments sprouting in April and well grown in the Fall showing that there had been vigorous growth in the Summer.

◀ September, 1990

► We saw that there had already been a good post-spill settlement of barnacles by April. In September there were well-established juvenile populations of barnacles on all shores together with

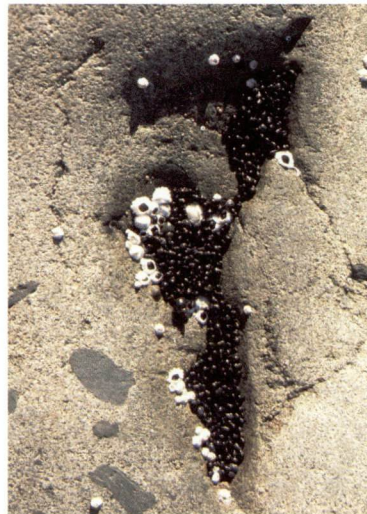


additional settlement of individuals that had taken place during the Summer.

► The rockweed sporelings (newly settled young plants) established in the Spring had developed into healthy stands of young adult plants.



► In the Spring, periwinkles (sea snails) were found under stones on several shores and frequently seen spawning. In September, rocks in most localities visited had large numbers of young individuals indicating a successful breeding season.





► On one beach on Seal Island, we discovered a lagoon in which oil was found under stones. Nevertheless, this lagoon had the richest and most varied marine fauna of any site we investigated. The same elements of

the fauna were present in April and September, a further indication that the presence of residual oil is not necessarily harmful to marine life.

► Mussels that had survived the initial oiling had been joined by newly settled juveniles.

Our observations on the biological status of the shores suggest that the water quality in Prince William Sound is good. This is corroborated by the thorough study on water quality in Prince William Sound done for Battelle Ocean Sciences by Dr. Jerry Neff in which he shows that hydrocarbon levels in the water had returned to normal background levels by Summer 1989. Even at the highest hydrocarbon levels measured, concentrations were so low that they did not exceed the stringent drinking water standards of the U.S. Environmental Protection Agency.

COMMERCIAL FISHERIES

Commercial fishing is the second largest revenue-producing industry in Alaska, primarily involving salmon, herring and halibut.

Both wild and hatchery-reared salmon, as well as wild and pen-reared shellfish (oysters, shrimp and crabs) are harvested commercially. During the oil spill response, high priority was given to these hatcheries and farms as well as to protection and cleaning of the shores near salmon streams.

Except for such hatcheries and farms, observations at oil spills around the world consistently indicate that free-swimming, open-water fish are rarely at risk from oil spills. Fish swim away from floating oil and this behaviour



Prince William Sound fishermen enjoyed record-breaking pink salmon and herring harvests in 1990.

explains why there has never been a commercially important fish-kill of wild species following an oil spill. In fact, the only adult fish-kill on record following an oil spill was on the French coast when several tons of small rock-living fish (not commercial species) were killed at the site of the wreck of the *Amoco Cadiz*.

Fish eggs and larvae are more vulnerable and have often been killed in large numbers by floating oil. However, fish over-produce eggs on an enormous scale and the overwhelming majority of them die at an early stage, generally as food for predators. Even a heavy mortality from an oil spill has no detectable effect on the adult population which is exploited by a commercial fishery. This has been confirmed during the *Torrey Canyon* spill off southwest England and the *Argo Merchant* spill off Nantucket. In both cases a 90% mortality of fish eggs and larvae (pilchard and pollack, respectively) was observed in the affected area, but this had no impact on the local fishery.

Developmental abnormalities occur naturally in wild fish populations, and the frequency of these abnormalities is increased in populations chronically exposed to oil. These abnormal fish do not survive long in the struggle for existence. Such delayed mortality is likely to have an equally negligible impact on a commercial fishery as the immediate mortality following an oil spill.

The Valdez oil spill was no exception to the general experience. No fish-kills were confirmed in Prince William Sound as a result of the oil spill of 1989. There were, however, concerns about the possible impact of the

oil on the breeding cycle of two commercially important kinds of fish—salmon and herring.

Pink Salmon

Unlike the other four species of Pacific salmon, pink salmon have a two-year life cycle and spawn in summer in gravel at the mouth of creeks or in intertidal areas. They spend the following fall and winter developing, to emerge in the spring. They then spend a year offshore to return as spawning adults the following summer. In Spring 1989 when the oil reached the shore, young pink salmon were still in Prince William Sound close to the spawning



Pink salmon have a two-year life cycle. Adults that returned to the Sound to spawn in 1990 swam under oiled waters as juveniles in 1989.

areas, and the concern was that heavy losses of these younger salmon might have a serious impact on the number of fish returning to breed a year later in 1990. The fear was unfounded.

The 1990 pink salmon catch of these returning adults in Prince William Sound broke all records, with over 44 million fish caught compared to the previous record catch of 29 million. Even in September, when the peak of the spawning was over, we observed large numbers of spawning pink salmon at several beaches in Prince William Sound and the Gulf of Alaska.

Other Salmon

Unlike pink salmon, other salmon species spawn in several of the suitable rivers of Prince William Sound and the Gulf of Alaska. They breed upstream and the young fish eventually return to the open ocean for 4-5 years before returning to the rivers to breed. There were no reports of kills of salmon or their young in 1989 when oil was on the water, nor in 1990 when there was no longer oil on the water.

Herring

Herring congregate for spawning in enormous numbers in certain parts of Prince William Sound every April. The 1989 breeding season took place two weeks after the oil spill. There were fears that the spawning fish or their eggs would be damaged, and that the next year's and subsequent years' crops would be severely limited.

These fears fortunately appear to be groundless. We were present at the opening of the fishery in April 1990, one year after the spill. It was widely

reported that the fish were so abundant that the entire year's seine harvest quota was filled in just 20 minutes' fishing with a catch of 8,300 tons.

Halibut

This is another commercially important fish in the area. Halibut are bottom-living fish and there has been no indication that they were affected by the oil or that the commercial catch has suffered in any way.



Over 16,000 sea otters live in Prince William Sound and adjacent areas of the Gulf of Alaska.

SEA OTTERS

Sea Otters are appealing creatures and therefore have a high profile in the eyes of the general public. Although they were reduced to the verge of extinction by fur hunters in the last century, their numbers recovered in Alaska. However, a common public misperception is that they are still an endangered species in Alaska and thus there was great concern at the events following the Valdez spill.

Unlike other sea mammals, sea otters are vulnerable to oil on the sea primarily because if their fur becomes matted with oil, they rapidly lose body heat and die from hypothermia. The total mortality following the spill is unknown, but the best scientific estimate is that only a small fraction of the otter population in Prince William Sound died.

During our aerial surveys in April 1990 sea otters were frequently seen around many islands in Prince William Sound. Numerous other observers have reported frequent sightings of large numbers of otters including juveniles and pups in the Sound. It is apparent that there is a substantial surviving population from which the losses are being restored.

Research reported by Dr. James Estes in 1990 and carried out in Alaska, British Columbia and Washington state since the 1960s has shown that populations of sea otters throughout this region have increased at the very high rate of 17-20% per year until they reach a population limit set by the availability of their food.

Sea otters are abundant in Prince William Sound. With a potential for the population to grow at nearly 20% per year, we have concluded that whatever losses suffered in the oil spill are likely to be rapidly made good by natural reproduction.



Sea lions were not seriously at risk from the spill.

OTHER SEA MAMMALS

Scientific research suggests that whales, dolphins, seals and sea lions are not seriously at risk from oil spills. One of the reasons is that they rely on a layer of blubber under the skin, rather than fur, to insulate them from the cold. Whales and dolphins are hairless and even if they encounter floating oil, the oil does not stick to their bodies. Experiments with seals have shown that oil may stick to the fur but rapidly washes off.

In previous oil spills, there have been occasional reports of very small numbers of oiled seal or seal pup carcasses being found. These reports have generally not been well substantiated and it is not clear that oil was the cause of death. Similarly, whales do not appear to have been affected by oil spills. Gray whales migrated through the Santa Barbara Channel following the blowout of 1969, but there were no reports of casualties. The disappearance of some members of a resident pod of killer whales in Prince William Sound in 1989 and 1990 is therefore unexpected; it is not clear how they could have been affected by the oil, if, indeed, they were.



The abundance of nesting seabirds in the area and the size of their breeding colonies do not support fears of long-term adverse spill impacts.

SEABIRDS

Seabirds, particularly auks, are the most conspicuous casualties from oil spills. There are enormous seabird colonies in Prince William Sound and the Gulf of Alaska so even a small percentage of casualties means large numbers of birds were killed. The important question is how rapidly these losses will be restored by natural processes.

The dominant seabirds in the area are auks (murres, puffins, etc.) and gulls. Gulls are rarely affected by oil and at the time of the oil spill puffins had not yet returned to the Sound from their winter quarters farther south. Therefore, the concern centres on murres.

As in other cold water oil spills, the chief seabird casualties in Prince William Sound and the Gulf of Alaska were murres. There has been a good deal of concern that the damage caused to the murre population in Prince William Sound and the Gulf of Alaska would take decades to restore. Experience in other parts of the world suggests that this fear is not well founded.

Murres have an extremely low reproductive rate and several scientific studies have predicted, on theoretical grounds, that a substantial loss from a breeding colony would take 50 years or more to restore by natural growth. There were natural fears that this would apply to the colonies in the affected area, but this is most unlikely because when the theory has been tested by actually counting the size of breeding colonies in other areas affected by oil spills, it has proved to be wrong.

Murres, like many other seabirds, do not start breeding until they are 5-7 years old and, even then, do not necessarily breed every year. There is therefore a large reserve of non-breeding adults outside the breeding colonies, and this population of non-breeding adults replaces any losses from the breeding colonies. This accounts for the fact that breeding populations are not reduced even after natural disasters caused by severe weather or after oil spills. As an example of a natural disaster, over 100,000 murres died in the severe winter of 1971-72 in southwest Alaska.

Observations from the northeast Atlantic are relevant to Alaska because the same species is involved and because in this area there are long-term data available.

Tens and hundreds of thousands of murres have been killed in the northeast Atlantic *every year* since the 1920's by oil pollution from shipping in heavily trafficked sea lanes. Far from this causing a steady decline in populations, as the theory predicts, murres and other auks have all undergone a population explosion in the northeast Atlantic and are now at the limit of their food supply.

In the Gulf of Alaska the murre breeding season does not begin until May or June, but even in April 1990 we saw large numbers congregating near some of the larger breeding sites, including Barwell Island where the colony had reportedly suffered heavy losses in 1989. Many more murres were widely distributed throughout Prince William Sound and the Gulf of Alaska. To judge from experience in the northeast Atlantic, the size of the

breeding colonies in Prince William Sound and the Gulf of Alaska should be restored within a short time.

A remaining worry is that seabirds might continue to be killed by oil sheens on the water even though most of the oil was removed from the environment in 1989. During extensive overflights of Prince William Sound and parts of the Gulf of Alaska in April, May and September, 1990, we saw very few sheens. These were small, and their silvery colour indicated that they were very thin films of oil. There is no scientific evidence that these are harmful.

Sheens of this type are caused by boats discharging oily bilge water (as we observed on one occasion), by residual oil washing off beaches (as we observed off one beach), but are also produced naturally by algae. Seabirds are constantly exposed to sheens from natural or man-made sources, and spend most of their time, when they are not feeding, preening their feathers to keep them in a clean, waterproof condition.



BALD EAGLES

This noble bird is the national emblem of the United States, so feelings about it run high. It is an endangered species in the lower 48 states where it exists only in very small numbers. There was natural concern that some had been harmed by the oil.

Although there are very few bald eagles in the lower 48 states, they are not rare in Alaska. There are estimated to be 40,000 bald eagles in Alaska, probably the world's largest concentration of these birds. About 5,000 of them are in Prince William Sound.

During extensive aerial surveys of Prince William Sound and the Gulf of Alaska at the start of the 1990 breeding season, we observed bald eagles



Bald eagles are not endangered in Alaska, with more than 5,000 concentrated in the Prince William Sound area.

on prominent look-out trees at regular intervals around all forested coasts. At some sites we observed courtship displays and competition between male birds for territories.

Birds of prey have never before been victims of marine oil spills, but bald eagles are scavengers on the shoreline and presumably this activity resulted in some becoming oiled. Special teams captured 113 eagles in the most heavily oiled areas during the Summer of 1989. Evidence of oiling was noted on 35% of these 113 birds, and all but three of them were cleaned and eventually returned to the wild.

Eagles in the oiled areas had poor breeding success in 1989 with only about 200 young being produced in the Prince William Sound area. Scientific observers have attributed this to the disturbances caused by the clean-up activities and not the oil itself. In contrast, 1990 had a greatly reduced clean-up effort, and there was an active nest count of 1,031 with chicks being reared in previously oiled territories, according to the United States Fish and Wildlife Service.

The habits of these birds make it most likely that the breeding population will be quickly restored to its former level. Bald eagles do not breed until they are 5-6 years old and young non-breeding adult birds are widely distributed along rivers inland. There is competition for the breeding sites and the dominant birds occupy the best situations; any losses among the breeding population are filled by new recruits, at least by the next breeding season.

RESTORATION PROGRAMMES

There has been some public discussion about replanting and restocking damaged areas in Prince William Sound.

Such programmes to hasten biological recovery have occasionally been implemented elsewhere when there have been compelling reasons such as the prevention of coastal erosion. For example, a salt marsh on the French coast that had been severely damaged by oil-spill clean-up measures was replanted with appropriate vegetation, and sea grass beds destroyed by waste discharges in Florida and Australia have also been replanted. The reason for these extreme measures was because the salt marsh and sea grass beds were important in those areas as traps for sediment washed from the land, and without these barriers there would have been severe coastal erosion. That is why priority was given for their rehabilitation.

We have not seen damage requiring such measures in Prince William Sound and the Gulf of Alaska. Salt marshes in the area are very small so their significance in controlling coastal erosion is minimal. Moreover, in 1990 we saw that salt marsh plants, sea grass and beach grasses were growing well even on shores which had been heavily oiled in 1989 and still retained some residual oil.

Other shore organisms showed signs of rapid natural recovery. Many of the shores impacted in Prince William Sound were boulders or cobble stones exposed to severe wave action during storms (high energy beaches). Most of the plants and animals living on these shores are removed each year as a result of this natural turbulence. However, rapid recolonization takes place each season as part of the natural cycle of events in such hostile environments. There is an abundance of recolonizing organisms providing a reservoir from which shores damaged for any reason can be rapidly restored.

In conclusion, we saw nothing to indicate that further human intervention in the marine restoration process would be of any value.

CLEAN-UP

There have been continuing public discussions about whether further clean-up of remaining oil on the beaches in Prince William Sound and the Gulf of Alaska is necessary.

Whether or not further clean-up measures to remove this residual oil are justified largely depends on the human use a beach is put to. Our judgment is that where recovery of animal and plant life is already well established, the residual oil is obviously doing no harm and the organisms



With plant and animal life established, further intrusive clean-up could be counterproductive.

established on the shore will hasten the final removal and degradation of the oil residues. Further intrusive cleaning such as beach excavation and rock washing of beaches would kill the plants and animals already there and set the recovery process back to the beginning .

Experience has shown that after other oil spills, heavily-used tourist beaches may need to have most of the physically detectable oil removed. In that case, drastic measures are needed even at the expense of biological recovery. However, such beaches do not exist in Prince William Sound. Beaches need to be considered one by one, to decide whether there are special considerations which warrant further cleaning even though this could set back biological recovery.

CONCLUSIONS

There is a wealth of information about the recovery of cold water marine ecosystems following oil spills in various parts of the world. In all cases recovery events have been similar to those seen in Prince William Sound. If anything, because of the exceptionally thorough clean-up measures and natural cleaning processes, biological recovery has started sooner and proceeded further in Alaska than might have been anticipated.

There is no reason to suppose that the recovery process in the Prince William Sound oil spill are any different from those following other cold water oil spills around the world, many of them larger and more damaging. Although there have been a number of pessimistic forecasts in the media, there is nothing to suggest that there will be further delayed or long-term effects from the oil now that recovery is well underway.

These conclusions will not surprise any scientist experienced in the recovery of ecosystems following oil spills. In 1985, the U.S. National Academy of Science published an expert assessment of the threat posed by oil spills which is entirely consistent with our judgements, and there have been a number of similar expert reports published by distinguished international bodies to the same effect.

BIOGRAPHIES

Each author has had extensive international experience studying the impact of oil on the marine environment extending back over 20 years. Also, each has acted at various times as an independent scientific consultant to environmental bodies, government agencies or commercial organizations. The authors are all familiar with the scientific literature on oil spills and, indeed, have contributed to it significantly over the years.

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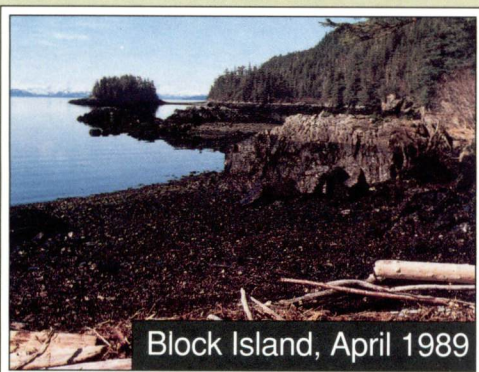
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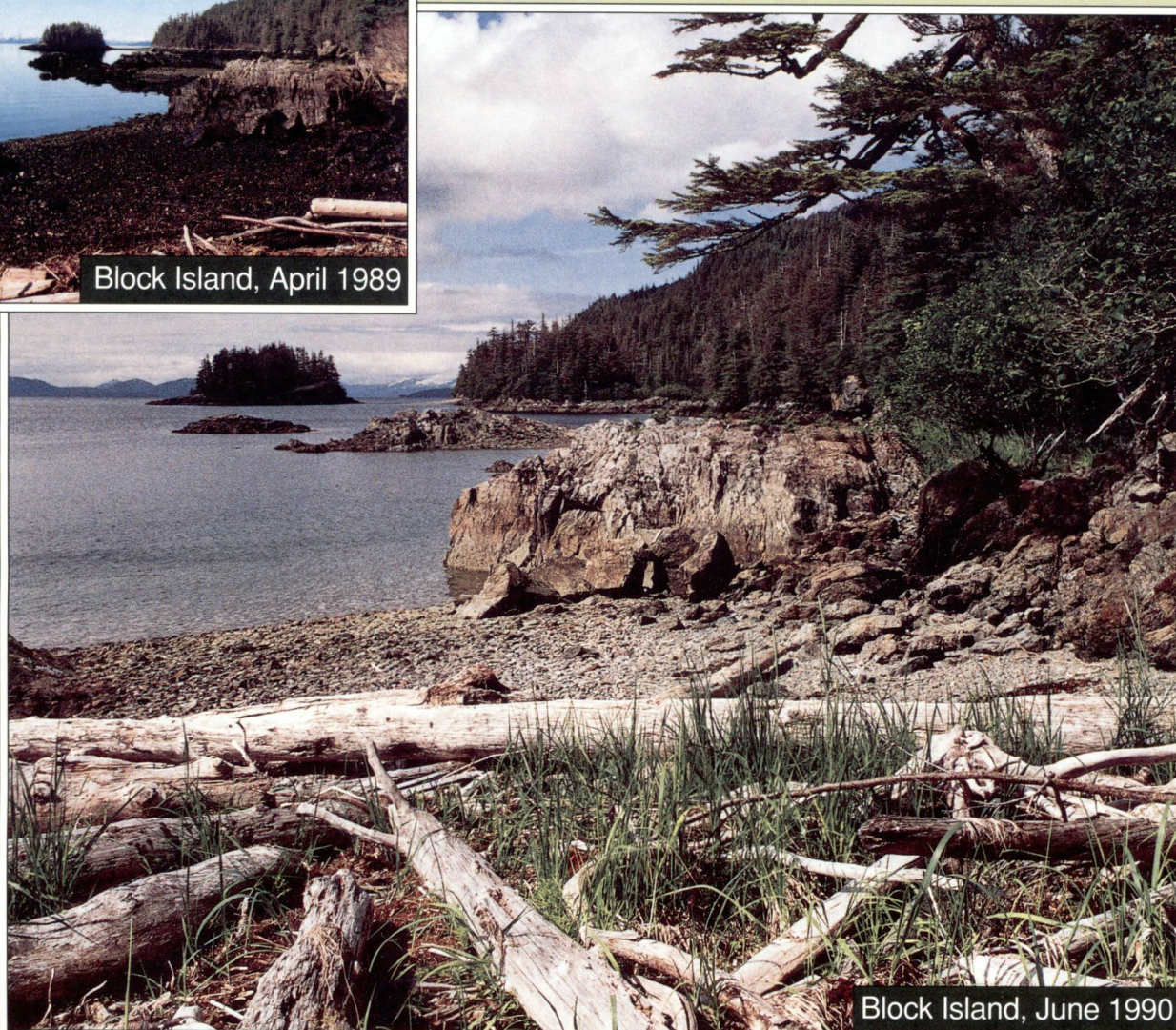


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Shoreline Conditions Following the *Exxon Valdez* Spill as of Fall 1990



Block Island, April 1989



Block Island, June 1990

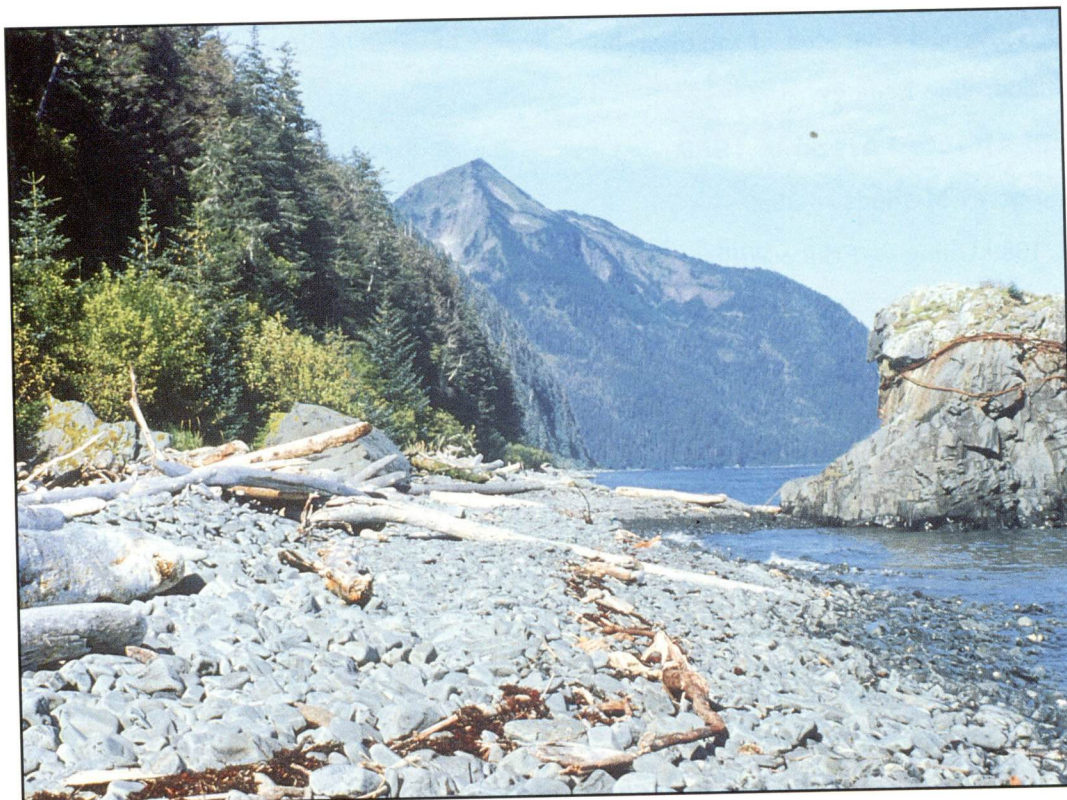
by
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Consulting Engineers • Geologists • Environmental Scientists

Presented at
the 14th Annual
Arctic and Marine Oilspill Program
Technical Seminar
June 1991

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This site on Knight Island was heavily oiled in 1989. Like most of Prince William Sound, it was essentially clean by fall 1990.

1.0 Summary

By fall 1990 — 18 months after the *Exxon Valdez* grounding — scientific surveys of Prince William Sound (PWS) and the Kenai and Kodiak Region (K-K) of the Gulf of Alaska had confirmed that the coastline is essentially clean. Except for a few scattered sections with weathered residue, the survey teams did not find oil on the shorelines. Oil had not been on the surface of the water for months. Teams of independent scientists collected data during the first shoreline surveys throughout the summer of 1989. Woodward-Clyde consultants and Exxon presented the scientific findings to the U.S. Coast Guard, the Alaska Department of Environmental Conservation (ADEC) and the interagency shoreline cleanup committee so that decisions could be made concerning cleanup operations. These surveys showed that oil from the accident reached less than 20% of the shoreline in PWS. Oiling was continuous on some stretches of shoreline but scattered in other areas, since the oil slicks broke apart and drifted under the influence of local winds and currents.

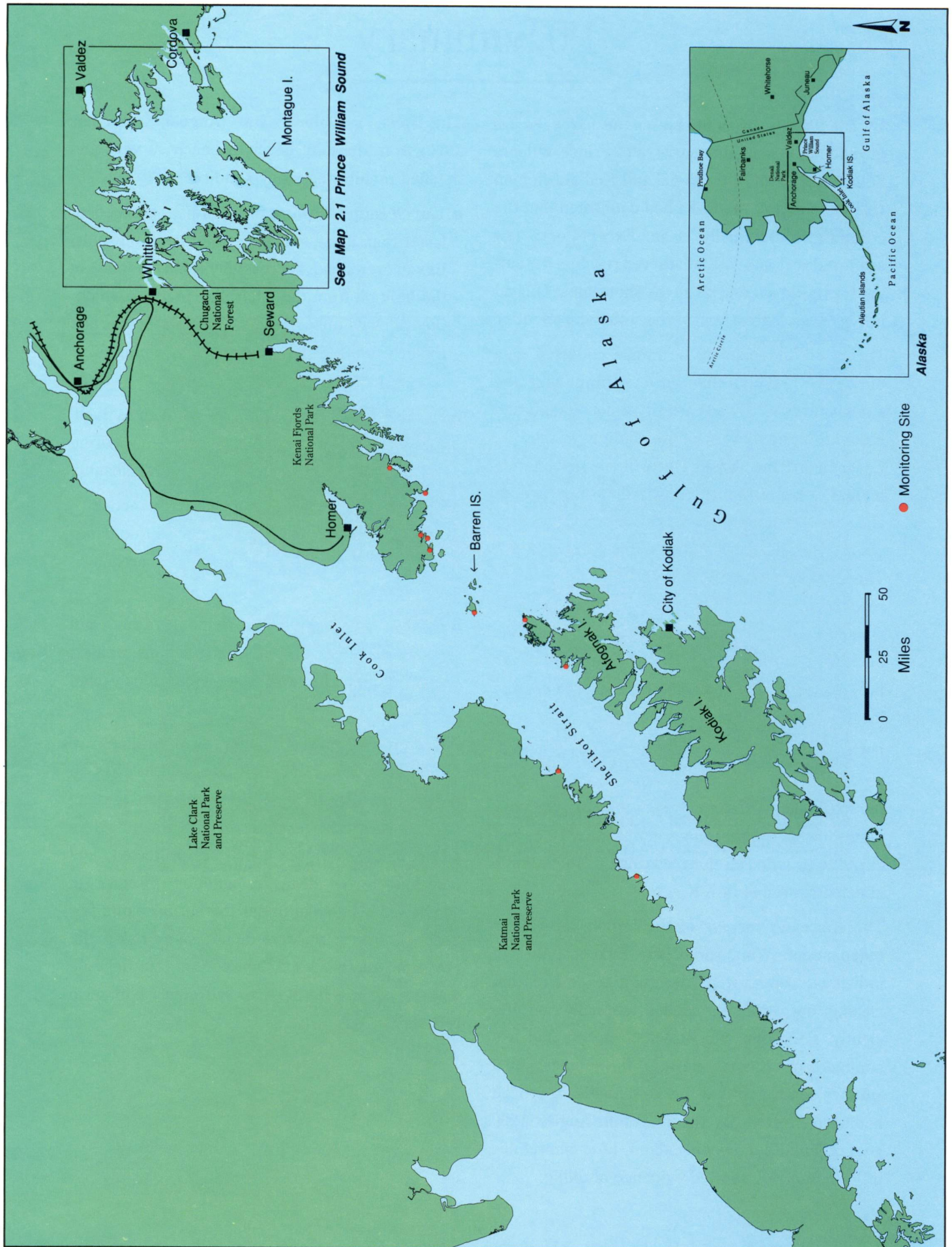
Oil from the spill reached K-K over a period of several weeks after the accident, so survey teams in 1989 found mostly weathered residue or oil-water emulsions on the shorelines in this area. Tides and currents stranded oil along less than 15% of the spill-affected shoreline of K-K.

The shoreline surveys of the region, as well as independent Woodward-Clyde/Exxon studies of individual sites, were designed to ensure that cleanup operations proceeded rationally and efficiently. Following one winter of storms and two summers of Exxon cleanup, the joint regional surveys confirmed that the systematic approach had been effective. By the time of the August 1990 joint regional survey, only about 1% of shorelines in PWS and K-K showed evidence of oiling.

The latest available data (August/September 1990) from the joint beach-by-beach surveys and detailed monitoring studies indicate:

- The cleanup following the spill has proceeded faster than those following other large oil spills. Exxon crews had successfully removed most of the bulk oil from the shoreline in 1989, which then allowed the natural cleaning processes and Exxon's 1990 efforts to remove remaining oil more rapidly.
- Exxon's use of cleanup techniques such as flushing and bioremediation, caused little environmental damage and accelerated natural cleanup.
- The intertidal zones are biologically active. Intertidal plants and animals are reproducing and colonizing the previously oiled areas of PWS and K-K.
- Survey teams sighted large numbers of adult and young sea otters, eagles, seals, sea lions, whales, seabirds and other wildlife in the previously oiled areas.

Based on data collected so far, the shorelines are clean, although occasional stains and patches do remain on a few surfaces. These are found particularly in rock crevices and underneath boulders and cobbles, surfaces which are protected and take longer to clean. In addition, pockets of weathered oil persist under the surfaces of a few beaches. These residues do not pose a risk to the environment (NOAA, 1990), continue to degrade and are not interfering with the area's biological recovery.



By the time the oil reached the Kenai-Kodiak Region, it had weathered significantly.

2.0 Background

2.1 Introduction

When the tanker *Exxon Valdez* ran aground on March 24, 1989, it spilled approximately 258,000 barrels of Alaskan North Slope crude oil onto the waters of Prince William Sound (PWS). As with any spill of this magnitude in a remote environment, it was virtually impossible to control or contain all of the oil. In Prince William Sound, some of the oil washed onto the shorelines generally southwest of the accident site. Eventually, some of the oil also escaped through the narrow straits that connect PWS with the northern Pacific Ocean and became stranded on shorelines along the Kenai Peninsula and the Kodiak Island-Shelikof Strait region of the Gulf of Alaska (K-K). (See maps)

To understand fully what happened to this oil in the year and a half after the spill, it is important to understand the characteristics of oil spilled at sea, the region's geography, and the geologic and ecologic nature of the area's shoreline.

2.2 Characteristics of Oil

When spilled at sea, crude oil immediately begins to change its character as a result of a variety of physical, chemical and biological processes referred to as weathering. About one-third of the spilled oil, including most of the toxic fractions, evaporates rapidly into the atmosphere. The remaining components degrade or weather more slowly (National Academy of Sciences, 1985). This more weathered, or degraded, oil poses less of a toxic threat to organisms, but it can smother sedentary animals such as barnacles.

During the ensuing days and weeks, the spilled oil becomes thicker and flows less freely (*i.e.*, becomes more viscous). If it is stranded along shorelines, it weathers to a persistent, tar-like residue. When mixed with fine-grained sediments, such as sand or gravel, a hard tarmat or asphalt

pavement can form. If the oil is churned by wave and current action, water mixes with the oil to form an emulsion or "mousse," as it is often called. These emulsions (which can contain 70% water) weather more slowly and stay relatively mobile. Both the tar-mats and the mousse continue to weather slowly until completely dispersed, biodegraded and consumed by natural processes.

In the case of a tanker grounding, oil typically spreads rapidly on the water's surface as it escapes from the ship's tanks. As it spreads, the oil is moved farther away from the tanker, primarily by surface currents but also by winds (Murray, 1982). Most crude oils, including the *Exxon Valdez* cargo, are lighter than water and float. As spilled oil spreads on the surface of the water, it continues to evaporate and weather.

Generally, oil stranded along shores near the site of the spill was less weathered than oil that traveled farther on the water's surface. Three days passed before oil from the *Exxon Valdez* came in contact with land — Smith Island, 20 miles from Bligh Reef. By then, most of the volatile fractions had evaporated and the oil was less toxic. The oil that reached the shorelines of K-K had weathered for several weeks in some cases, formed into mousse, and generally was much more viscous.

2.3 The Geography of Prince William Sound and the Kenai-Kodiak Region

The cleanup following the spill was strongly influenced by the geography of the region. As discussed later, wave action and tidal flushing play a primary role in the cleanup of shorelines, and it is the area's geography that dictates levels of wave energy at the shorelines.

Map 2.1: Prince William Sound



Oil slicks drifted southwest from the accident, leaving the northern and eastern portions of Prince William Sound free of oil.



The open ocean coasts of the Gulf of Alaska are an extremely high wave-energy environment. This coastal zone is exposed to the full force of waves from the vast north Pacific Ocean, and its shorelines rank among the highest wave-energy environments in the world.

In contrast, PWS is a large basin-shaped embayment, or well-flushed inland sea, approximately 100 miles across and connected to the Pacific Ocean by a series of narrow straits. The shape of PWS limits the size of waves. Nonetheless, the area is still subject to wave action from winter storms. In addition, PWS has a tidal range on the order of 10 to 18 feet, and the continually changing water levels spread incoming wave energy over a wide vertical, and sometimes horizontal, intertidal zone.

Wave-energy levels within PWS vary considerably between adjacent sections of coastline. In the western part of the Sound, where oil was washed ashore, there are a large number of islands with numerous bays and passages carved by glaciers during the Ice Ages. As a result, the shoreline configuration is very complex and includes sheltered areas protected from wave action. Unlike sheltered sections of the coast, exposed shorelines receive the full effect of storm-generated waves, and stranded oil is thereby more rapidly abraded and washed from the intertidal zone.

Under normal circumstances, sheltered shores would lag behind exposed ones in the time required for natural cleanup. However, in Prince William Sound, cleanup rates were comparable in areas of both sheltered and exposed coasts. This result, as discussed later, is due to the combination of Exxon's cleanup operations and natural cleansing.

2.4 Geological Character of the Shoreline

Not all shorelines are alike, and the types of shorelines in PWS and K-K influenced the cleanup techniques which were employed as well as the rates of oil removal.

The shorelines in the spill area are predominantly rock outcrops or headlands (72%) separated by mixed sediment beaches, which include boulders, cobble, and fine sediments. (See photos next page.)

Since the majority of the coast is bedrock with intervening pocket beaches, many of which contain fine-grained sediments, stranded oil typically could not penetrate most shoreline surfaces. Even when the oil was generally fresh and mobile, it was confined to the top inch or two of the sediments.

There are only a few areas with very fine-grained sediments (mud and sands) and those occur where there is a local, adjacent source for these materials. This lack of fine-grained material in PWS has resulted in the formation of only a few mudflats and marshes. Within Prince William Sound, only one small muddy area was oiled by the spill.

At a few pebble-cobble beaches, where the fine sands have been washed out by wave action, oil could penetrate more than a foot below the surface. Such beaches, however, account for less than 4% of the coastline. Just as oil did, tide waters are able to penetrate the subsurface, helping to flush out mobile oil from the subsurface of these beaches.



Bedrock - 72%



Mixed Sediments - 24%



Pebble Cobble Beach - <4%



Mudflat - Marsh - <1%

2.5 Shoreline Ecology

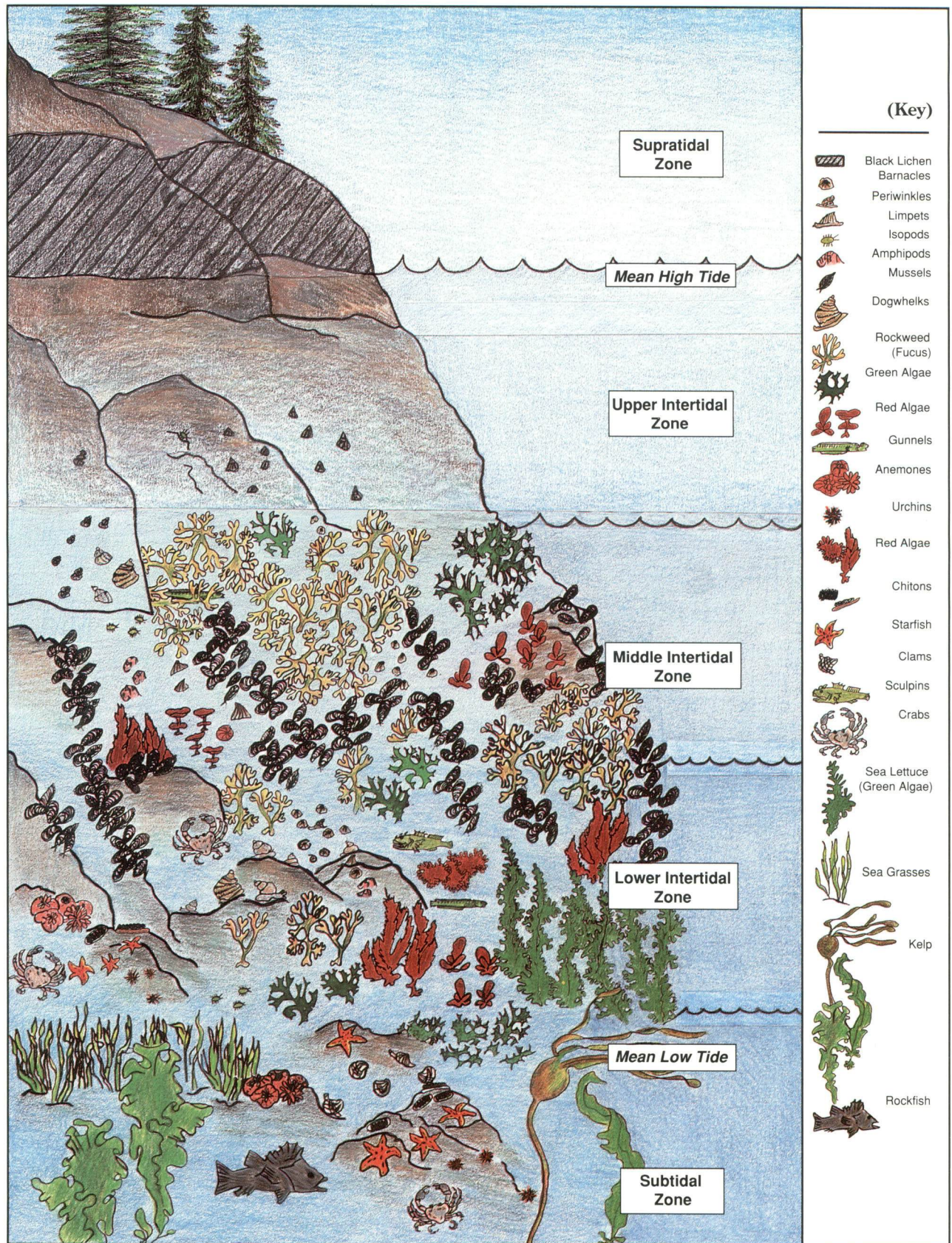
The area's rugged coastal environment supports a very rich and robust intertidal biological community. Life in the intertidal zone is well-adapted to the rocky substrate and the sub-arctic environment.

Each species has its own environmental requirements and life history. There is great natural variability in both space and time, and geologically similar shoreline types exhibit different mosaics of biological communities.

The region does, however, have a noticeable pattern of intertidal zonation of species. (See Figure 2.0.) The principal feature of the supratidal zone, which is above most wave action but within the splash zone, is a band of black lichen. (The lichen is often confused with stranded oil by casual observers). The upper intertidal zone is usually barren or sparsely populated by species that are more common in lower tidal zones. In contrast, the mid- and lower-intertidal zones are rich with life, characterized by barnacles, snails, limpets and rockweed. These zones can also be occupied by mussels or by a variety of brown, green and red algae and contain a number of large grazers, scavengers and predators such as chitons, crabs, anemones, whelks, starfish, sculpins and gunnels.

Oil from a spill tends to adhere to the dry, upper part of the tidal zone. The top one-third of the intertidal zone is driest because it is exposed for the longest time and typically is above the zone of groundwater drainage. In contrast, the lower half of the intertidal zone frequently stays wet, even when exposed at low tide, due to water draining out of the beach. Oil can reach the supratidal zone only when high spring tides or storms with high breaking waves move oil or oiled sediments above the mean high-tide level.

Fig 2.0: Definition of Intertidal Zones Showing Location of Major Species.



The different tidal zones are inhabited by different species. Intertidal life is well-adapted to the harsh subarctic environments.



Most of the oil was stranded in the upper tidal zone and not on the biologically-rich lower zones (June 1989).



— *Band of naturally occurring black lichen*

— *Patches of mussels*

Most coasts have naturally occurring black lichen and mussels which are sometimes confused with oil (June 1990).

3.0 Spill-Affected Areas in 1989

3.1 Survey Methods — 1989

Following the oil spill, two separate techniques were used to map the distribution of oil on the shorelines. Immediately following the accident, Exxon initiated surveys using helicopters flying at slow speeds and low altitudes during low tides (Teal, 1991). One geologist color videotaped the intertidal zone and recorded a detailed audio commentary on the shore-zone character and oiling conditions. A second geologist sketched the oil conditions on flight-line maps and noted the aircraft location. The two scientists used the flight-line maps and the video tapes to produce oil cover maps, which were used initially to direct cleanup operations. Over 5,000 miles of shoreline were quickly assessed using this technique.

Teams of independent scientists also surveyed the shoreline from the ground. Although this "ground-truth" effort took longer than the video mapping, these Shoreline Cleanup Assessment Teams (SCAT) obtained more detailed information to guide decisions about cleanup and treatment. The SCAT geologist from Woodward-Clyde divided the coast into shoreline segments (shorelines divided by geographic features) and systematically collected data on the physical shoreline character and on the distribution and character of any stranded oil. The geologist drew field sketches and described in detail how each segment had been affected by the oil.

Other team members gathered data for the coastal ecology and the cultural-archaeological resource protection components of the programs. For example, the intertidal ecologist generally characterized the biota and recommended constraints to minimize the effects of treatment activities on sensitive communities. The archaeologist identified cultural and historical features of the shore zone to prevent disturbance of these resources during field operations.

All of this SCAT data was used as the U.S. Coast Guard approved the cleanup strategy for each shoreline segment. The strategy was developed by Exxon with input from ADEC and other governmental agencies. Exxon completed all work specified by the U.S. Coast Guard by September 15, 1989. Exxon returned in 1990 for further cleanup. By September 1989, the SCAT surveys had covered over 3,400 miles of coast, including all of the affected areas. Each segment was categorized according to the width of oil bands:

Heavy — wider than 6 meters,

Moderate — 3 to 6 meters,

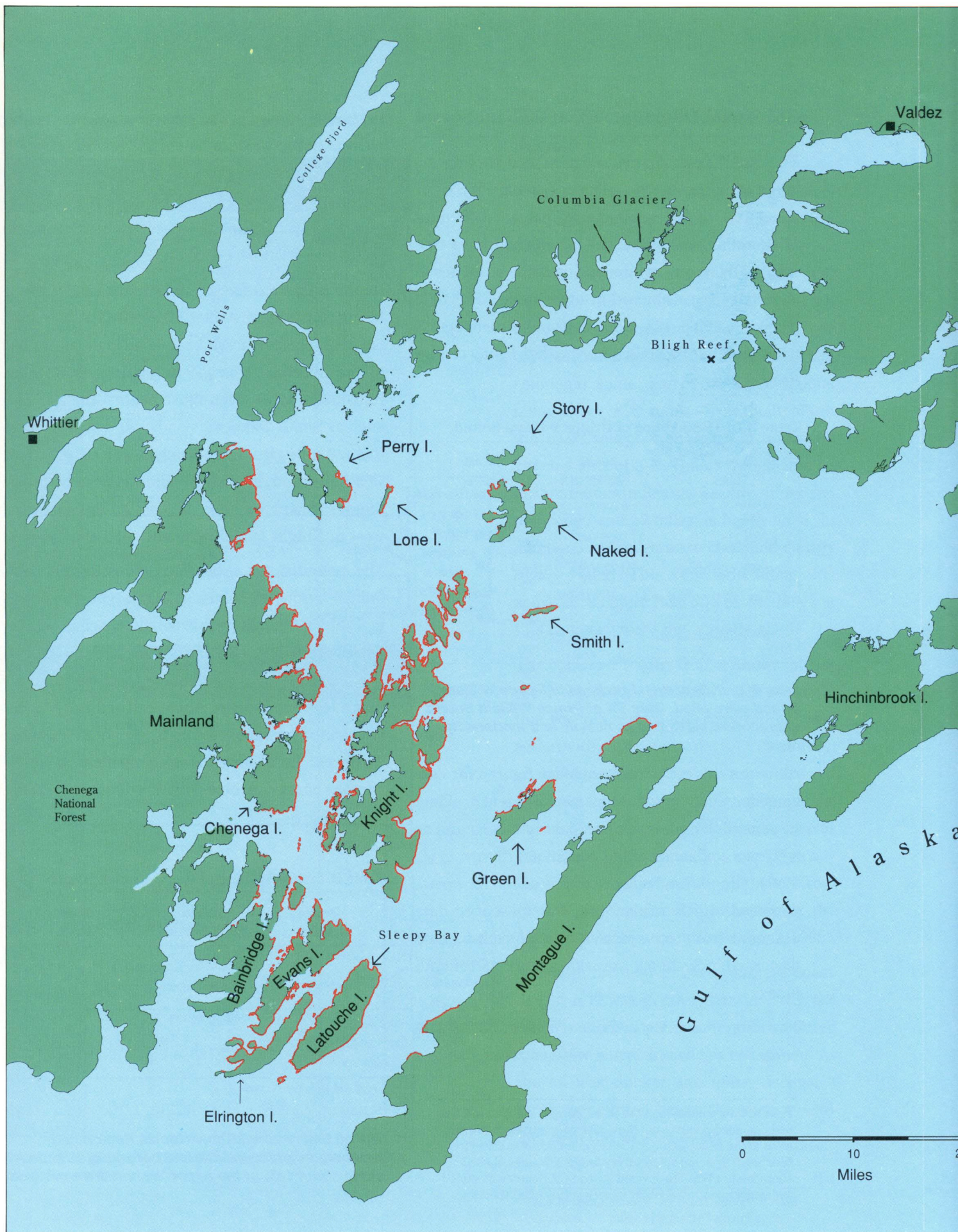
Light — less than 3 meters wide,

Very Light — any width with sporadic oiling

(i.e., scattered tar balls or splashes of oil),

Unoiied — no observed oil.

At the command center in Valdez the SCAT data was entered into a computer database called a Geographical Information System (GIS), which provided on-site information management. This data set served as the basis for all subsequent comparisons of shoreline oiling conditions.



Oil from the spill reached less than 20% of the shoreline in Prince William Sound.

3.2 1989 Oiling — Prince William Sound

The SCAT field surveys documented varying degrees of oiling on 486¹ miles of coast in PWS — or about 16% of the area's approximately 3,000 miles of shoreline which includes islands and bays (see map). Oiling was continuous on some stretches of shorelines but scattered in other areas. The field teams classified 145 miles as *heavily* or *moderately* oiled. Another 341 miles were either *lightly* or *very lightly* oiled.

Table 3.0: 1989 Oiling of Prince William Sound

<u>Degree of Oiling</u>	<u>Beach Width Affected</u>	<u>Total Miles</u>
<i>Heavy</i>	> 6 meters	87
<i>Moderate</i>	3 to 6 meters	58
<i>Light</i>	< 3 meters	202
<i>Very Light</i>	any width with <10% cover	<u>139</u>
898 miles surveyed.		486

Less than 20% of the shorelines in Prince William Sound were oiled. Only 5% of Prince William Sound shores were classified as heavily and moderately oiled.

Although this report uses mileage figures for convenience, such figures overstate the extent of oiling. In general, length is not particularly meaningful as a measure of actual oiling conditions (Sergy, *et al.*, 1991). Length is a measure that is useful for operations and logistics planning, but oil-cover data obtained from surveys of a beach (such as data discussed in Section 5) provide a more meaningful index.

The shoreline oiling in Prince William Sound was limited to the southern and western areas, due to a

prevailing counter clockwise, southwest setting current in the western half of the Sound (Royer, *et al.*, 1990). The majority of the shores that were most affected were within 20 to 75 miles of the spill site. No oil was carried to the shorelines in the northern or eastern portions of PWS.

As the oil moved toward the southwest, the north-facing coasts nearest the spill received a continuous cover of relatively fresh, mobile oil in the upper half of the intertidal zone. South-facing coasts often remained oil-free, even those nearest the spill site, such as Smith and Seal Islands. At distances more than 30 miles from the accident, the oil was more weathered and its distribution was usually discontinuous; many sections of coast on the south and west of Knight Island were not oiled at all.

The potential for subsurface oiling in 1989 was limited by the predominant beach types, as shown in Table 3.2. Only pebble-cobble beaches without fine sediments, less than 4% of the total oiled shoreline length, are susceptible to oil penetration more than a few inches deep. About half of these beaches are located on exposed coasts, which are cleansed by waves. In sheltered areas, only about 2% of the affected coast is pebble-cobble without fine grains.

Table 3.1: 1989 Oiling of Kenai-Kodiak Region

<u>Degree of Oiling</u>	<u>Beach Width Affected</u>	<u>Total Miles</u>
<i>Heavy</i>	> 6 meters	26
<i>Moderate</i>	3 to 6 meters	31
<i>Light</i>	< 3 meters	58
<i>Very Light</i>	any width with <10% cover	<u>703</u>
2494 miles surveyed.		818

The oil that reached Kenai-Kodiak Region had weathered significantly before becoming stranded along about 14% of the region's shoreline.

¹ Prior to the completion of the SCAT survey, Woodward-Clyde had compiled results from the aerial video survey to provide input to the initial summer 1989 cleanup plan and prioritize beaches. The aerial video survey found 357 miles of oiled shoreline in PWS. The ground based SCAT survey identified additional miles, particularly of very lightly oiled shoreline.

Table 3.2: Potential for Oil Penetration as a Function of Shoreline Character in PWS

Exposed Coasts			
	Shoreline Characteristics	Percent of Affected PWS Coast	Relative Potential for Oil Penetration
Bedrock	Rock alone is not as common as rock with a rubble (boulder) veneer	32%	none
Mixed Sediments	Often a surface layer, or armor, of large cobbles; with fines filling spaces in subsurface	12%	Limited to a few inches
Pebble-Cobble	Open spaces between particles	1.5%	High
Sand	Well sorted, fine-grained	0%	Limited to surface inch or two
Sheltered Coasts			
Bedrock	Bare rock is found at headlands, elsewhere usually occurs with a rubble veneer	40%	none
Mixed Sediments	Usually a surface layer of coarse material resting on mixed fine and coarse sediments	12%	Limited to a few inches
Pebble-Cobble	Open spaces between particles	2%	High
Sand	Well sorted, fine-grained	0%	Limited to surface inch or two
Marsh-Mud	Mud and Silt	<1%	No penetration

Accessible to rapid wave washing and abrasion

very small percentage of beaches affected.

Most of the oiled shoreline did not permit oil penetration below the surface.

3.3 1989 Oiling — Kenai-Kodiak Region

For several weeks following the spill, currents and winds carried oil out through the straits that connect PWS with the Kenai-Kodiak region of the Gulf of Alaska. Oil from the spill weathered at sea, so survey teams in K-K found mostly tarry residue or oil/water emulsions on the shorelines. They estimated some degree of discontinuous oiling along 818² miles — or about 13% of the 6,000 miles of shoreline in the spill-affected area of K-K. Teams categorized 57 discontinuous miles as *heavily* or *moderately* oiled and 58 miles as *lightly* oiled. In addition, 703 miles were classified as *very lightly* oiled. This very light oiling was sporadic, so more than 90% of the miles in this category were not actually oiled.

The open coast of the Gulf of Alaska did not receive very much oil, and much of the oil that washed ashore was removed by wave action within a matter of days. Occasionally, oil drifted into sheltered bays or coves and washed ashore. Along the Kenai Peninsula, the east-facing bays and headlands, such as Gore Point and Tonsina Bay, were typically the only ones oiled, as the oil drifted from east to west under the influence of the Alaska Coastal Current (Royer, *et al.*, 1990).

Although the total length of affected coastline in K-K was greater than in PWS, the oiled sections were patchy and scattered among long stretches of clean shoreline. As the oil was thicker and more viscous, it rarely penetrated below the surface sediments in the Kenai-Kodiak region.

² Prior to completion of the SCAT survey, Exxon estimated 732 miles of impacted shoreline to develop the initial summer 1989 cleanup plan and prioritize beaches for the K-K region.

4.0 Remaining Evidence of Oil — 1990

4.1 Survey Methods — 1990

The latest available data on shoreline conditions in PWS and K-K come from two separate regional surveys: a Spring Shoreline Assessment Team (SSAT) survey conducted in April, 1990 and a survey conducted in August, 1990 (the August Shoreline Assessment Program or ASAP). Both efforts were conducted jointly with participation from federal agencies (the U.S. Coast Guard and the National Oceanic and Atmospheric Administration) and state agencies (the Alaska Department of Environmental Conservation and the Alaska Department of Natural Resources), the land owner representatives.

The SSAT survey, with 20 teams working simultaneously, covered, on foot, all of the shorelines that had been treated in 1989. The primary purpose of the survey was to support the cleanup operation's plans by recording oiling conditions after natural cleaning during the winter months. An important element of this survey was that the agency and landowner representatives were able to see the

shoreline sites and oiling conditions at the same time as the field scientists. Each team report included detailed shoreline descriptions prepared by the field scientists and comments by the individual representatives, as well as wildlife observations.

During the SSAT survey, teams dug more than 5,000 pits to evaluate potential oiling at subsurface depths greater than 6 inches. At each shoreline segment they searched for subsurface oil at locations where team members believed oil would most likely be found.

Although the 1989 system for classifying the oil distribution on the shoreline was adequate at that time, a different system was needed for the 1990 SSAT and ASAP surveys. By 1990, natural cleansing and cleanup operations had changed the character of the oil and made its distribution less uniform. It is not always possible, as a result, to make comparisons between 1989 and 1990 categories. A "heavy" rating in 1989, for example, is not directly comparable to the "wide" rating in 1990. The "heavy" classification indicated a continuous covering of



Teams of independent scientists surveyed the area in 1990 with participation by the U.S. Coast Guard, the State of Alaska, and Exxon (March 1990).

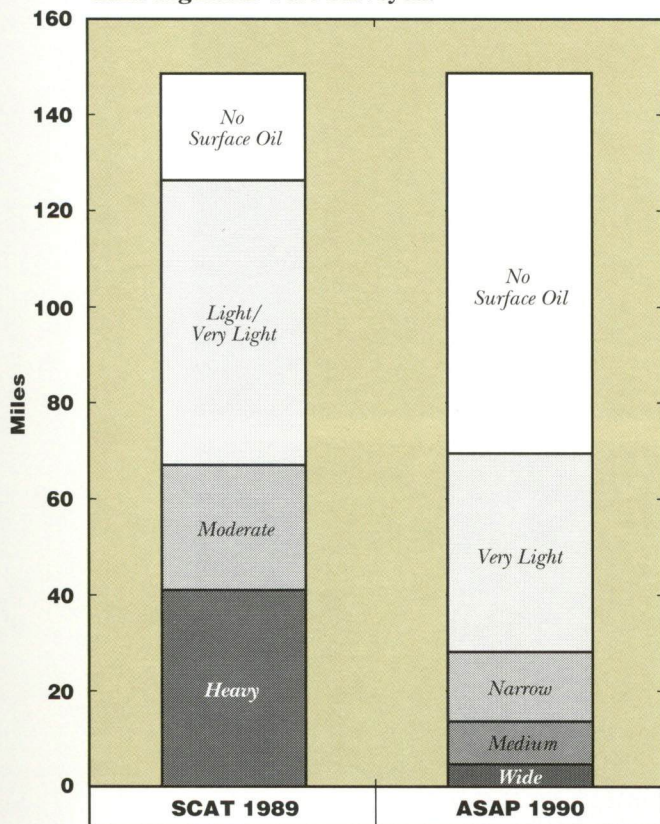
relatively fresh oil, whereas the “*wide*” classification involves a 50% or greater covering of weathered residue greater than 6 meters *wide* (see photos next page).

The ASAP survey documented changes in oil conditions resulting from 1990 summer treatment programs and ongoing wave action. It focused on areas that were treated in 1990 but did not assess all of the oiled areas in the *narrow* and *very light* categories. The results of the 1990 surveys present the changing shoreline conditions over the entire study area and confirm the general pattern of recovery.

4.2 Surface Oiling — Fall 1990

The oiled shoreline lengths noted in the tables are expected to drop significantly over the 1990-1991 winter months as waves and tides continue to clean the shorelines.

Figure 4.0: Comparison of SCAT and ASAP data for Prince William Sound and Kenai-Kodiak where the same segments were surveyed.



When the miles common to the summer 1989 and August 1990 surveys are compared, the reduction in oiling is apparent.

Prince William Sound

Following the 1990 cleanup operations, the ASAP survey identified 44.6 miles of oiled shoreline in PWS, with 10.6 miles in the *wide* or *moderate* categories. The maps comparing Knight Island in 1989 and 1990 illustrate this dramatic reduction (see maps 4.0 and 4.1).

ASAP did not cover all of the coasts visited in 1989 or spring 1990, but teams did survey the majority of the *wide* and *medium* shorelines (see Figure 4.0 for a comparison of the common miles). The intention in this survey was to focus on shorelines that might still require treatment in late 1990 or 1991. The results, nevertheless, indicate the scale of the remaining oil distribution.

Table 4.0: 1990 Oiling in Prince William Sound Observed During the ASAP Survey

Degree of Oiling	Beach Width Affected	Percent Oil Cover	Total Miles
Wide	> 6 meters	and > 50%	4.3
Medium	> 6 meters	and < 50%	6.3
		or	
	3 – 6 meters	and > 10%	
Narrow	< 3 meters	and > 10%	10.6
Very Light	Any amount	< 10%	23.4
			44.6
89 miles surveyed.			

Oil residue remained on a small fraction of Prince William Sound shorelines by fall 1990.

Kenai-Kodiak Region

Outside of PWS, the 1990 ASAP survey documented 26.1 miles of shoreline with some evidence of surface oiling. Only 2.6 miles fell in the *wide* or *medium* categories of 1990 as compared to 57 miles in the *heavy* or *moderate* categories in 1989.

Table 4.1: 1990 Oiling in Kenai-Kodiak Region Observed During the ASAP Survey

Degree of Oiling	Beach Width Affected	Percent Oil Cover	Total Miles
Wide	> 6 meters	and > 50%	0.1
Medium	> 6 meters	and < 50%	2.5
		or	
	3 – 6 meters	and > 10%	
Narrow	< 3 meters	and > 10%	3.5
Very Light	Any amount	< 10%	20.0
			26.1
65 miles surveyed.			

As of August 1990, less than 1% of the Kenai-Kodiak Region had some remaining oil.

1989 Oiling Classification

Heavy



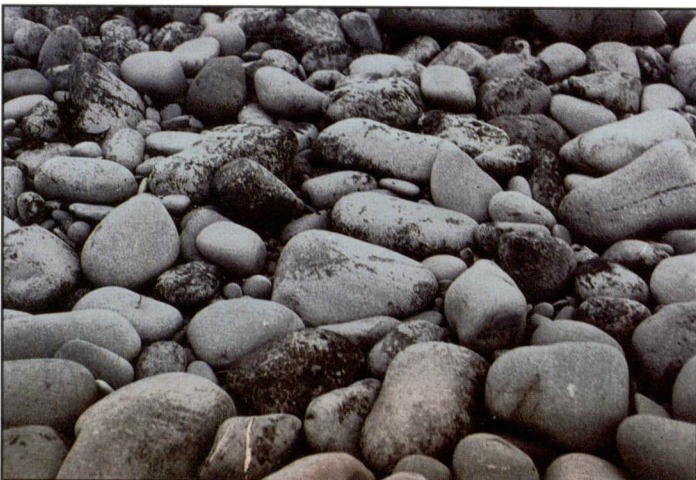
Moderate



Light



Very Light



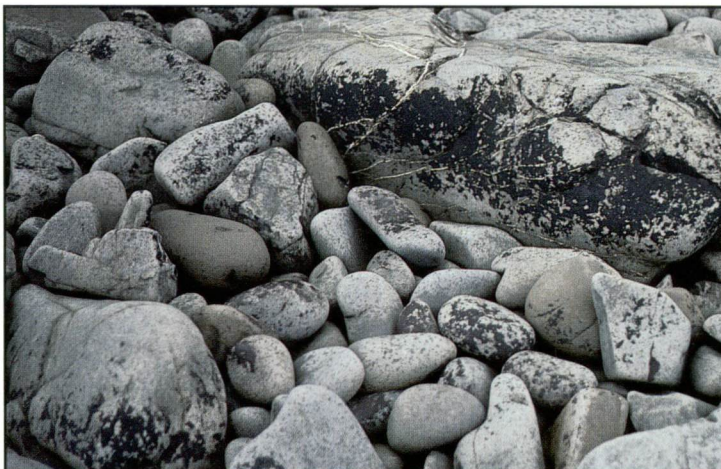
1990 Oiling Classification



Wide



Medium



Narrow

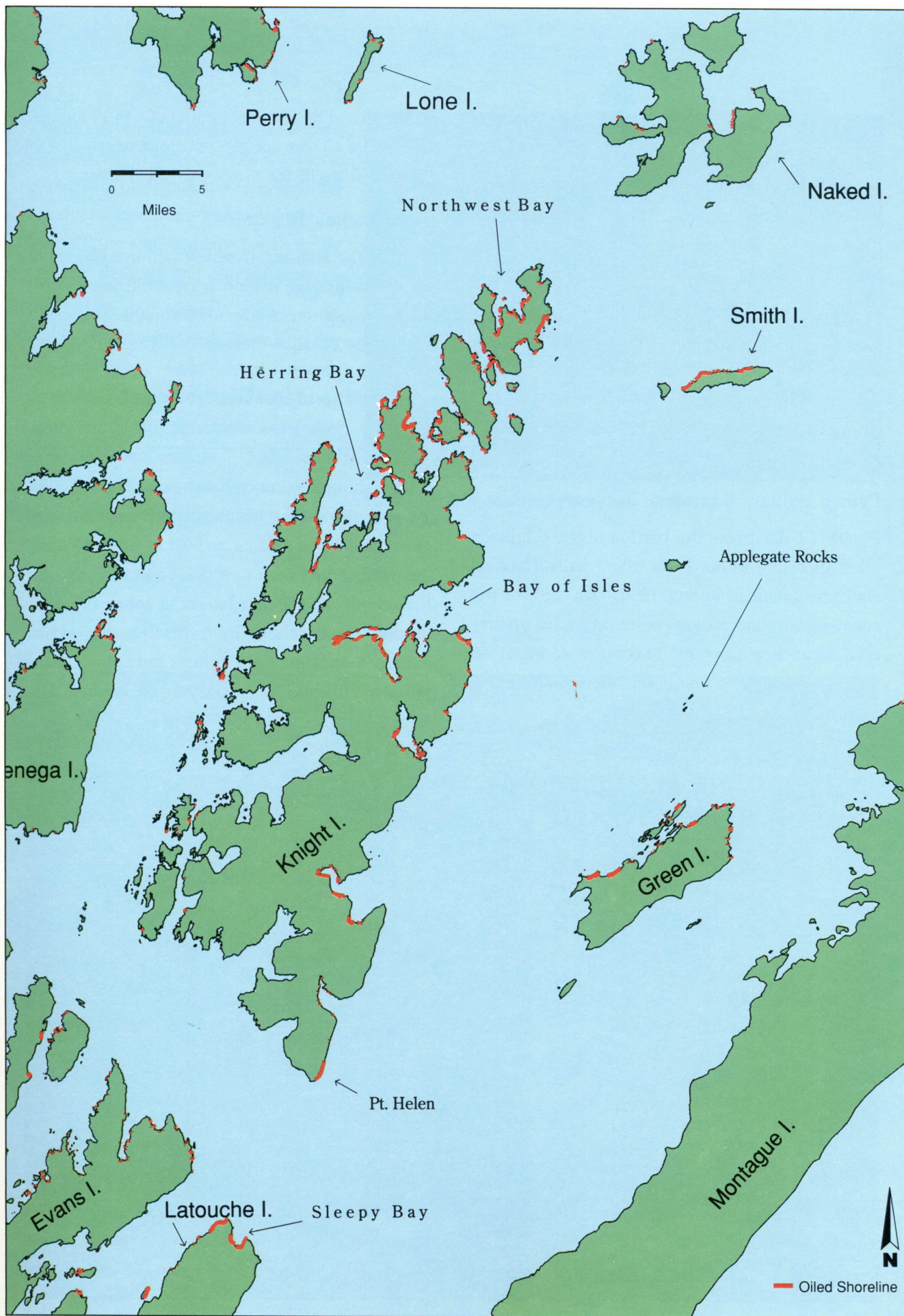


Very Light

The character of oil had changed through time due to natural cleaning and cleanup operations. Therefore a more appropriate classification system was developed for 1990. Categories from 1989 and 1990 are not strictly comparable.



Oiled shorelines in the Knight Island area, one of the most heavily oiled areas, from the summer 1989 SCAT survey.



By Fall 1990, ASAP survey teams found oil at very few of the segments around the once-heavily oiled Knight Island.

4.3 Subsurface Oiling — Spring 1990

As noted above, subsurface oiling was not extensive in 1989. It was not present on most of the sheltered, lower wave-energy beaches, as these contain fine-grained sediments (sands) that prevent penetration of oil beyond the upper few inches.

Because of natural cleansing and cleanup operations, subsurface oiling was even less common in 1990. Where subsurface oil remained, it has not significantly interfered with biological recovery (NOAA, 1990).

Prince William Sound

Figure 4.1 illustrates the portion of the originally oiled shoreline within PWS where subsurface oil could be found in spring 1990. On 1.8% of the affected shoreline, oil was present at depths greater than 12 inches (up to a maximum of about 40 inches). At another 1.6% of the affected shoreline,

residue could be found at depths of 4 to 12 inches. Subsurface oil was not present along nearly 97% of the shorelines in the previously oiled areas.

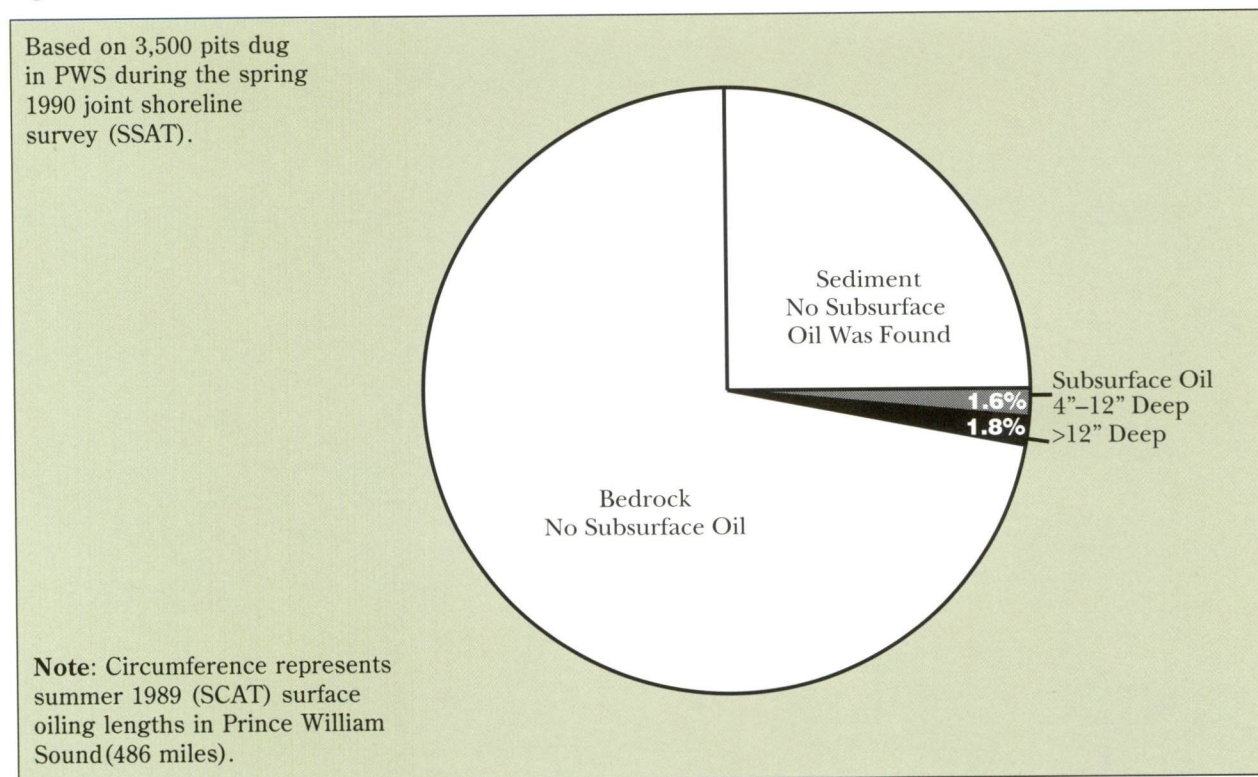
Kenai-Kodiak Region

Oil from the spill rarely penetrated the surface of the Kenai-Kodiak Region because it had formed into mousse or tar-like residue which remained on the surface because of its viscosity.

4.4 SSAT and ASAP Biological Observations

While visiting the various beaches throughout PWS and K-K, the survey teams noted the presence of intertidal flora and fauna, as well as other wildlife. Teams observed both new plant and algal growth throughout the region's intertidal zones and colonization of shorelines by barnacles, sea snails, crabs, sea stars, mussels, limpets and other species typical to the area. In August, salmon streams were often filled with spawning adults.

Figure 4.1: Remaining Subsurface Oil in 1990



Oil persisted under the surface at depths greater than 4 inches on about 3% of the originally oiled shorelines.

Teams also spotted most of the species represented in the area's vast seabird population: murre, kittiwakes, puffins, sea ducks, and cormorants, to name a few. They noted many bald eagles nesting, fledging and hunting prey.

The teams documented many young and adult marine mammals during the beach surveys. Sea otters, harbour seals and Steller's sea lions were most prevalent. Land mammals were also recorded. For example, Sitka deer, Kodiak bear and smaller mammals were observed during the shoreline evaluation.



Starfish in intertidal rock pool (July 1990).



Lower intertidal zone rich with biota (June 1990).

5.0 Cleanup Processes

5.1 Monitoring Program

Woodward-Clyde and Exxon established a detailed long-term scientific monitoring program in May-June 1989. The program involved 28 study sites, 18 of which were located in Prince William Sound. There was a bias in the selection of these study sites, since the monitoring program initially focused on beaches that were the most heavily oiled. The sample included only a few sites that were less oiled; these were in sheltered environments thought likely to recover naturally at a slow rate.

Teams of scientists surveyed the sites regularly for 18 months until September 1990 (Owens, 1991). By that time, the monitoring program had involved

approximately 1200 field days of effort (104 days of field work with 4 teams, of 3 people each, operating simultaneously). The program's coastal geologists and ecologists collected information within a standardized framework so that data could be easily compared among sites and through time at the same site. The scientists initially established a set of cross-beach transects at each site and these lines were used to record the distribution of the surface oil cover during repeated site visits.

The monitoring teams surveyed more than 3,000 cross-beach transects to obtain data on changes in the surface oil, and they dug pits to look for subsurface oiling. Transects were also photographed to qualitatively measure biological changes. Among



Scientists studied more than 3,000 transects to analyze cleanup processes (March 1990).

other activities, the team members photo-documented each site, took elevation measurements along transects and collected samples of surface and subsurface sediments for laboratory testing. Time-lapse photography was used at several of the sites to show the changes in beach cover caused by storm and tidal action. The data base from these efforts far exceeds any previous spill study and provides valuable insights into the fate and persistence of stranded oil. Table 5.0 provides a summary of changes in surface oil coverage over an 18 month period.

5.2 Natural Removal of Oil

The results of the monitoring program were not only useful in determining the 1990 cleanup strategy, but they also provide insights into how and why the oil conditions changed at the selected

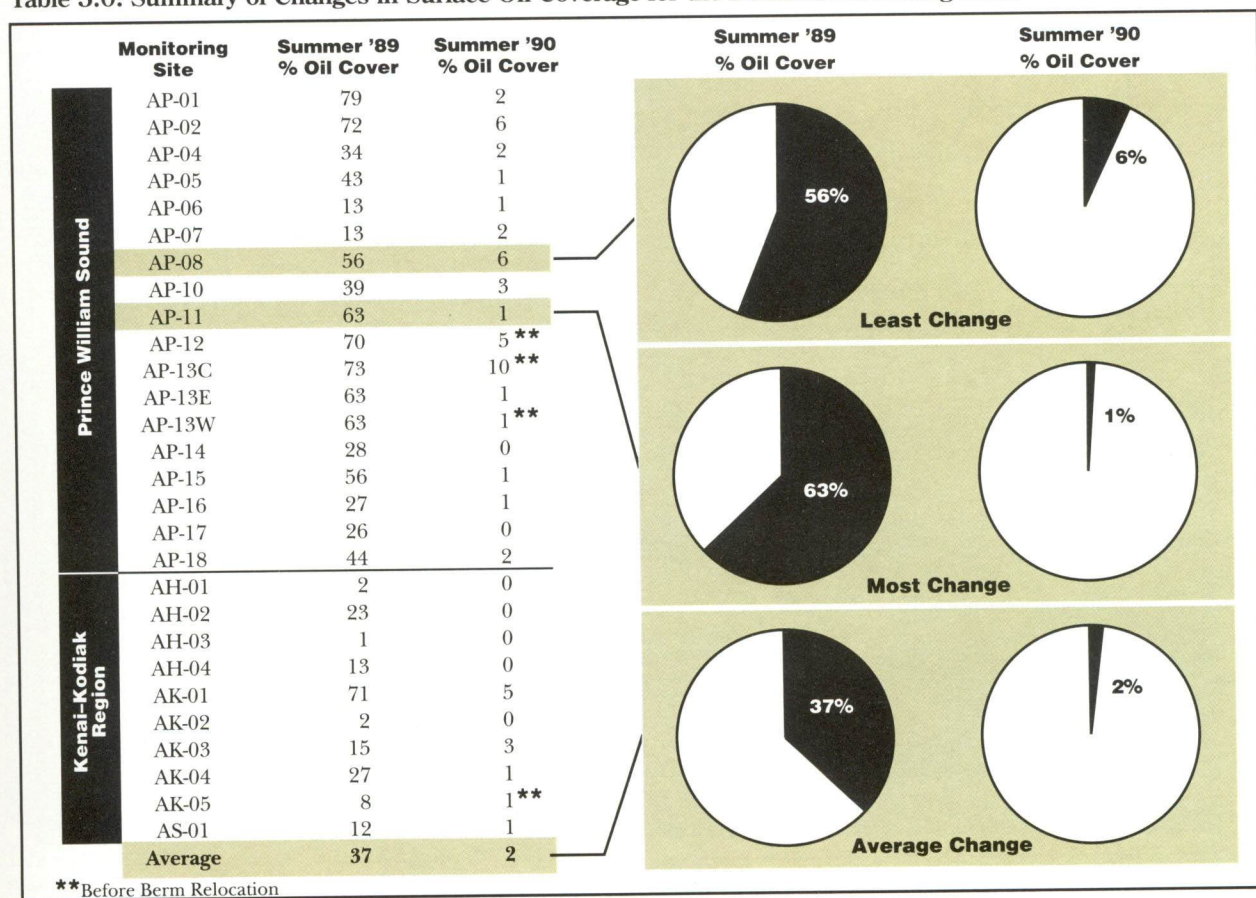
beaches. A number of natural processes work together to remove oil from shorelines following a spill at sea. These natural processes and their role in removing oil from the shorelines of PWS and K-K are described in this section.

Wave Action and Tidal Flushing

Natural washing and abrasion caused by wave action and tidal flushing were the most important processes by which oil was removed from shorelines in the months following the spill. Waves and twice-daily tides of 10 to 18 feet moved sediment particles to abrade oil and then washed away free or mobile oil particles. The oil released by this process is dispersed into the adjacent ocean waters to be further broken down by natural biological processes.

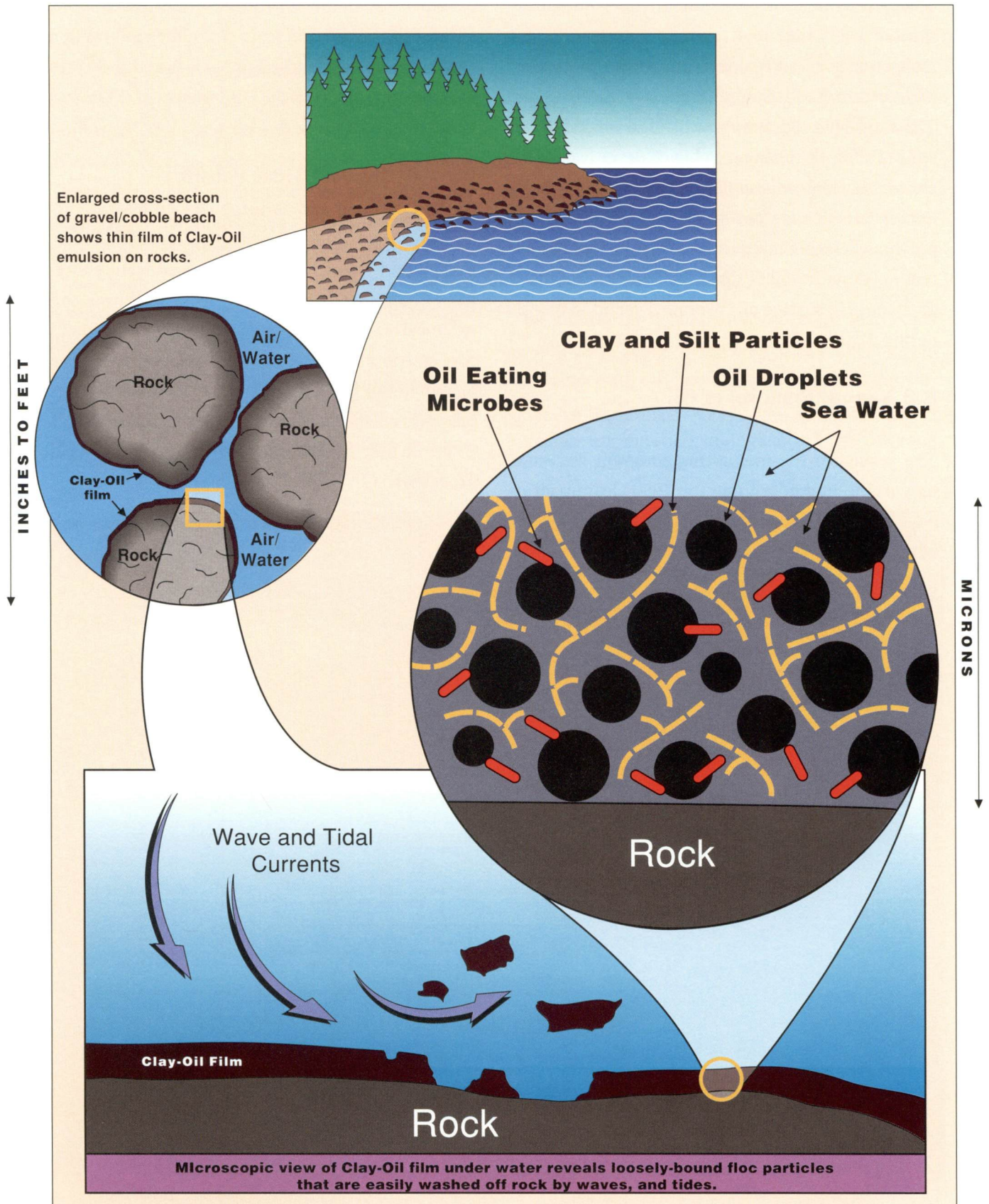
The rate at which this natural removal occurred

Table 5.0: Summary of Changes in Surface Oil Coverage for the Detailed Monitoring Sites.



On average, the surface oil for the monitoring sites reduced from 37% to 2% in about a year.

Figure 5.0 Schematic of Clay-Oil Flocculation



Natural clay-oil flocculation cleaned subsurface oil and low energy beaches much faster than expected.

was a function of the intensity of wave energy that reached the shoreline, the thickness and depth of penetration of the stranded oil, and the mobility of the beach sediments on which the oil was stranded. Usually, small amounts of surface oil stranded on exposed, high wave-energy coasts washed off very quickly. The more oil there is, the longer the time needed for self-cleaning. On lower-energy shorelines, oil was washed and abraded by wave action during winter storms, when waves would enter the sheltered environments. On these sheltered coasts, the penetration of oil below the surface was restricted by fine-grained sediments between the larger material. The oil, therefore, was accessible to wave action, and the fine sediments acted as an abrasive tool with which even small waves cleaned the shorelines.

Mobile oil penetrating cobble beaches that had no fine-grained sediments also was subjected to tidal flushing. As the oil weathered, it became more persistent and was protected from wave abrasion by overlying sediments. However, these sediments were reworked by storm waves which change the beach form (scouring to several feet) and redistribute sediments across the beach.



The abrasive action of storm waves and sediments was the primary natural cleaning process.

Biodegradation

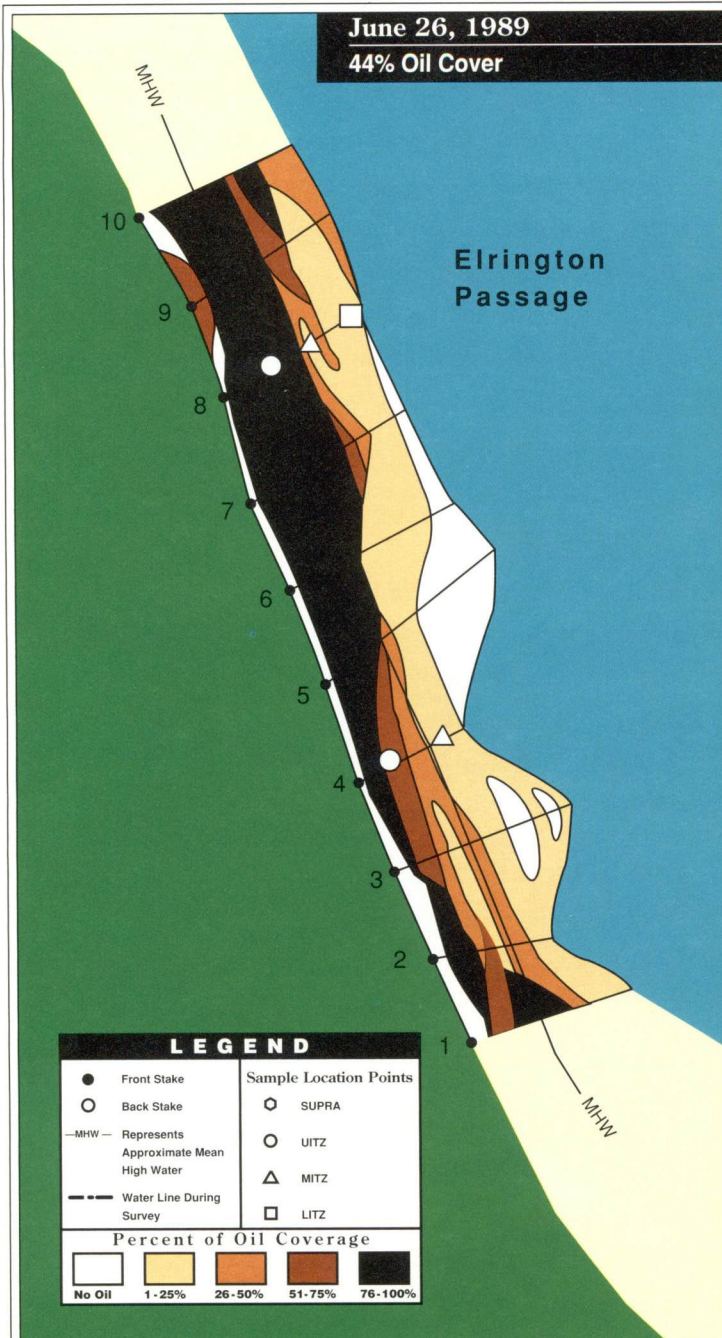
Biodegradation is one of the key natural processes which removes oil following a spill. The microorganisms that consume oil are called hydrocarbon-oxidizing microbes because they break down oil molecules by adding oxygen. The microbes create new molecules which are in turn degraded until all that remains are harmless substances, mostly water and carbon dioxide.

The role of biodegradation becomes a significant weathering factor as wave action and tidal flushing become less effective. The oil-consuming microorganisms work best on thin oil coats or stains on the surface. Biodegradation also plays a significant role in removing subsurface oil.

Clay-Oil Flocculation

A process which was found to be significant in removing stranded oil and which has not been studied on previous spills was the interaction of fine, suspended sediments and seawater with the surface of the oil residue to form solid/liquid emulsions (Bragg, *et al.*, 1990). Micron-sized clay or silt particles, termed "glacial flour," are carried into Prince William Sound waters by rivers fed from the inland glaciers and ice fields. Because of minute electrical charges, the fine mineral particles are attracted to, and bond with, the surface of oil films through a process called flocculation. This causes the oil to be broken up into very fine emulsion particles containing oil, seawater and mineral fines. The oil particles' adhesion to the rock surfaces is weakened and the particles are washed away by waves and tidal currents for further biodegradation. (See Figure 5.0).

Field scientists noted in January 1990 that the oil in several sheltered, low-energy environments within PWS had disappeared from rocks and boulders without any evident cause. [go to 31]



Elrington Island: "The Natural Cleaning of a Sheltered Site"

As indicated on the oil coverage maps of this sheltered site on southwest Elrington Island, natural cleansing progressively reduces surface oil cover. At the time of the first June 1989 survey, this beach had a continuous band of oil in the upper intertidal zone.

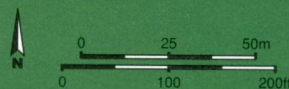
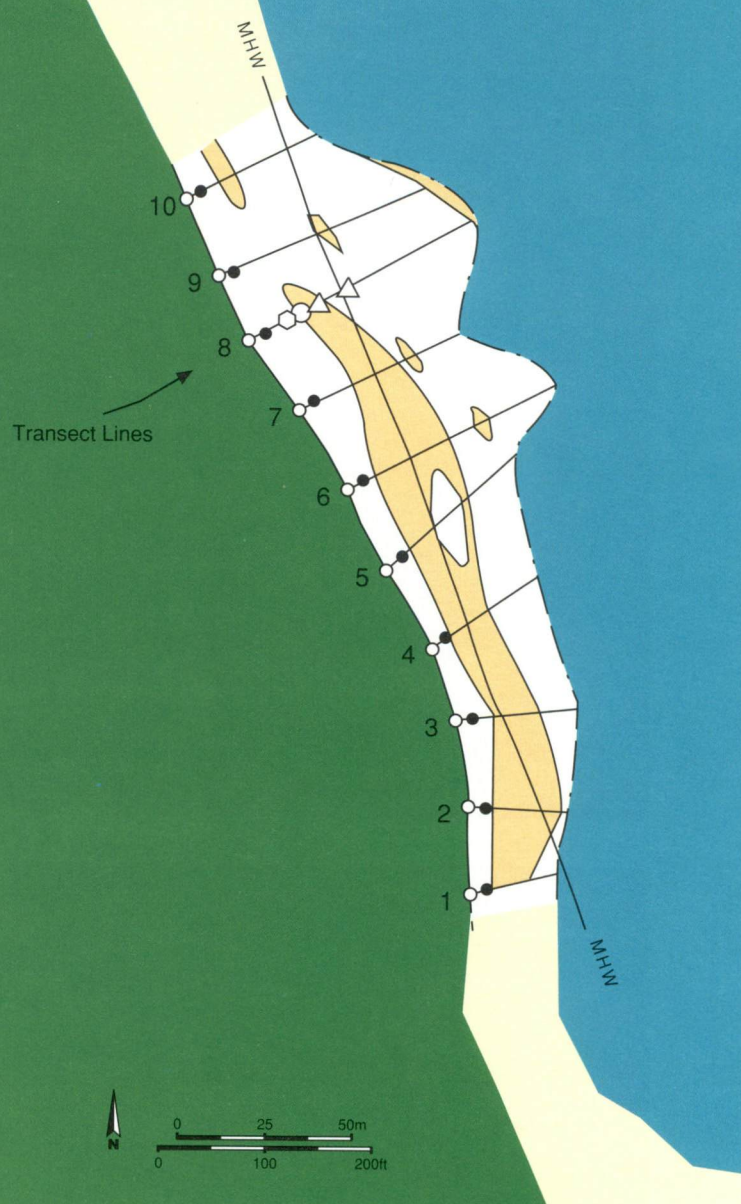
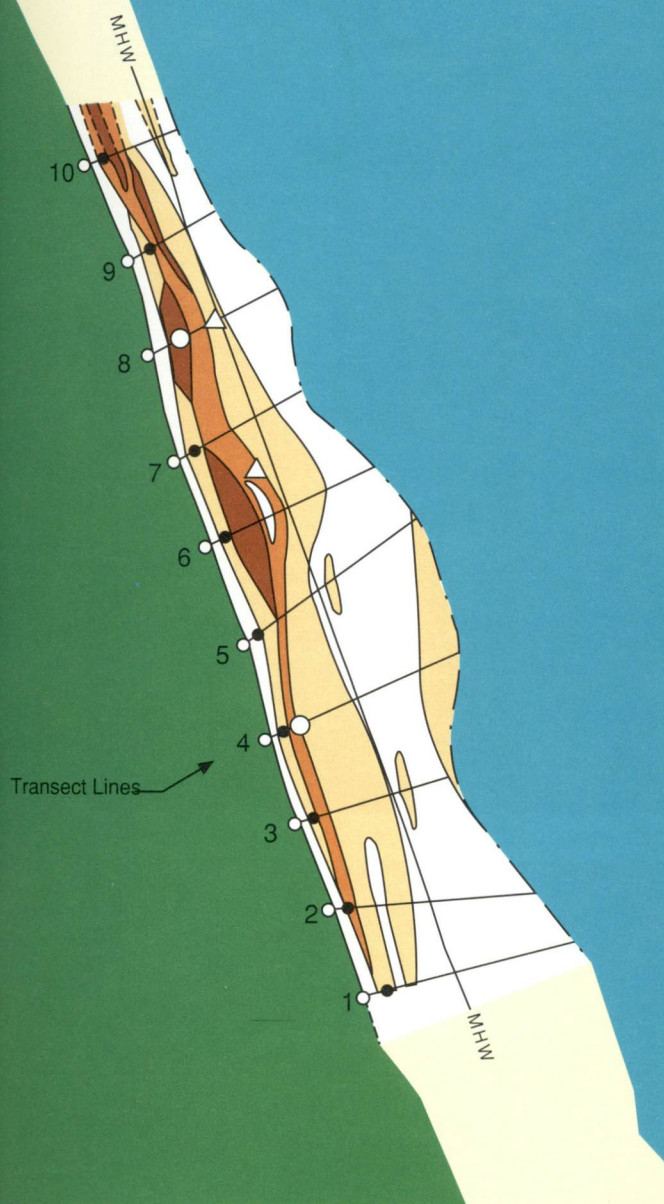
This beach was not treated until September 1989,



Wave action, clay flocculation and biodegradation effectively removed oil during the winter of 1989-90.

December 5, 1989
8% Oil Cover

September 3, 1990
2% Oil Cover



1989



ectively

1990



when fertilizers were applied to promote biodegradation. By then, the oil band had already been partially, but not completely, removed by summer wave action. Within a year, virtually all of the oil had been removed, largely by winter wave action, clay-oil flocculation and bioremediation.



May 1989



Dramatic changes in shoreline oiling of Smith Island between 1989 and 1990.

August 1989

Meanwhile, in 1989, samples of oiled sediments and nearshore seawater had been shipped in late fall to Exxon's research laboratories for bioremediation studies which used columns that simulated rising and falling tides. As the laboratory scientists monitored tidal flushing under controlled conditions, they observed that clay-oil flocculation breaks down the oil into minute particles which are easily washed away from the sediments. Careful inspection of field samples then confirmed clay-oil flocculation as the process responsible for oil removal.

By the first half of the winter of 1989/90, clay-oil flocculation had contributed to the cleaning at many of the rocky and boulder shorelines in the sheltered areas of Prince William Sound. Although the flocculation process also occurs in high energy shorelines, the relative significance of this process is greater in lower energy areas and in subsurface sediments where storm waves and abrasion are less effective.

As with the other natural cleansing processes, clay-oil flocculation works to remove oil from the subsurface as well as the surface (Jahns, *et al.*, 1991). Again, this process promotes biodegradation by exposing a larger surface area of the oil to microbes and oxygen.

5.3 Exxon Cleanup Program

5.3.1 The 1989 Program

Scientists understood some of the natural cleansing processes from their studies of earlier spills. This allowed Exxon to use and enhance the natural processes during its shoreline treatment program (Nauman, 1991).

Flood and Flushing

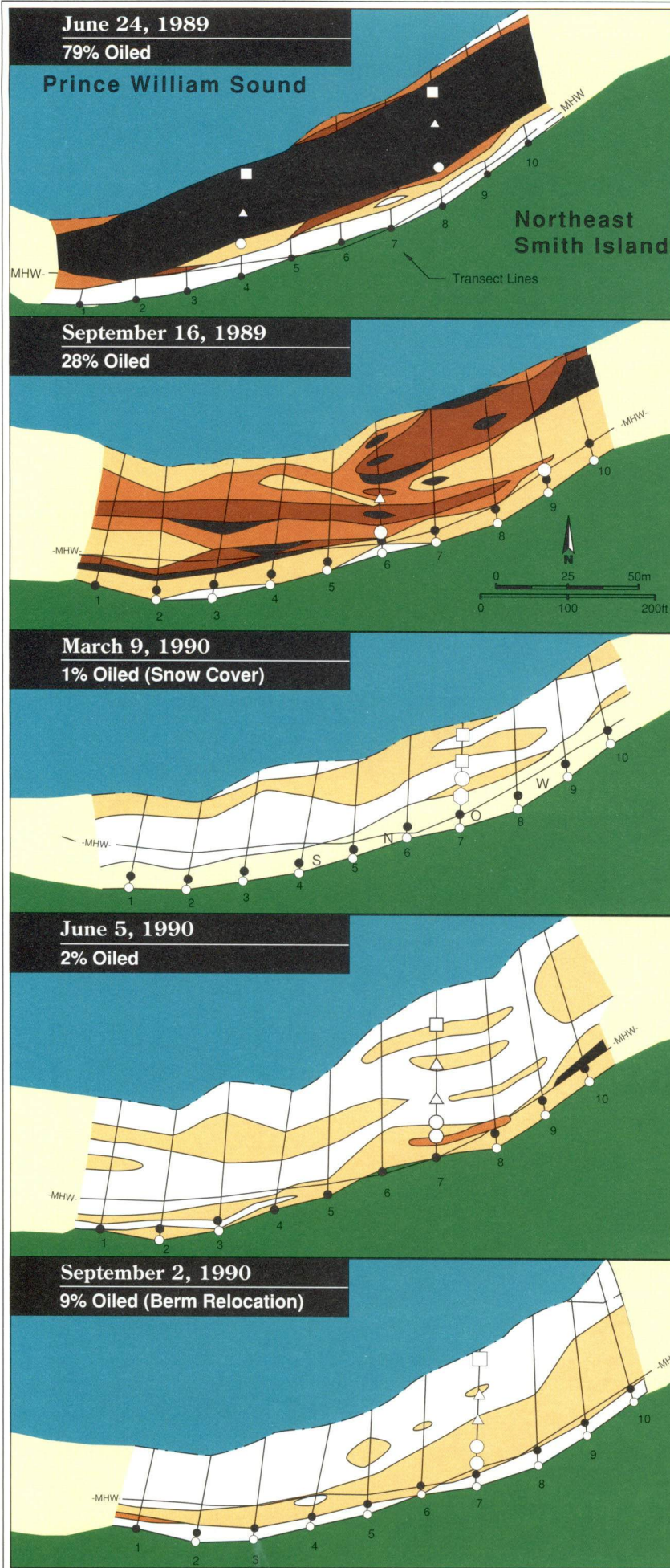
The 1989 cleanup in PWS focused primarily on flushing the free and mobile oil from shorelines, often using heated seawater. The oil that was washed from the shores was contained within booms and picked up using a variety of equipment, including sorbents and skimmers. Flushing was avoided during low tide to keep the lower intertidal free of oil.

By removing the bulk oil, subsequent wave action could be more effective and the area's wildlife would be protected. At the end of the summer of 1989, virtually all of the mobile and free oil had been removed from the shorelines. Comparison of two sites on northern Smith Island, which received different levels of flushing treatments, can be used to assess the success of the 1989 strategy (see next page).

Northeast Smith Island: "Wave Action at a High Energy Site"

The effect of the higher wave-energy levels at the northeast Smith Island site is illustrated by the role of winter wave action in the removal of subsurface oil. Following washing in May and September 1989, coats of oil remained on the subsurface sediments to a depth of approximately 3 feet. There are only

small amounts of sand-sized sediments on this exposed cobble beach, so that the spaces between the larger particles are open and the oil was able to penetrate into the subsurface. The cobble sediments were reworked by storm waves down to the bedrock in late fall/early winter, so that by the end of November 1989 a cross-beach trench dug in the upper intertidal zone exposed clean sediments throughout. See photos on opposite page.



A Tale of Two Sites: "The Effectiveness of Flood and Flushing"

Two sites on Smith Island — both cobble beaches — were in the direct path of the oil spill. Initially, both sites had very similar, virtually 100% intertidal oil coverage. The recovery rates of these two sites, however, have been remarkably different, partially as a result of different treatments.

At the northeast site (left), considerable effort was made to remove mobile oil from the beach in May and early September 1989 to minimize any threat to adjacent sea lion haulouts. By June, oil coverage had been reduced by the first, very intense washing program and by summer wave action to 79%. Following the second washing phase, oil coverage had been reduced to 28% by 16 September 1989. Winter storms in mid-October and again during January and February 1990 reduced oil coverage further, to 1% by 9 March.

Some of the oil that remained on the highest parts of the northeast site was covered with snow at the time of the March survey and was not observed until the June 1990 site visit. These oiled sediments from the backshore berms were relocated into the upper intertidal zone to allow wave action to abrade and wash the residual oil from the sediments over the summer.

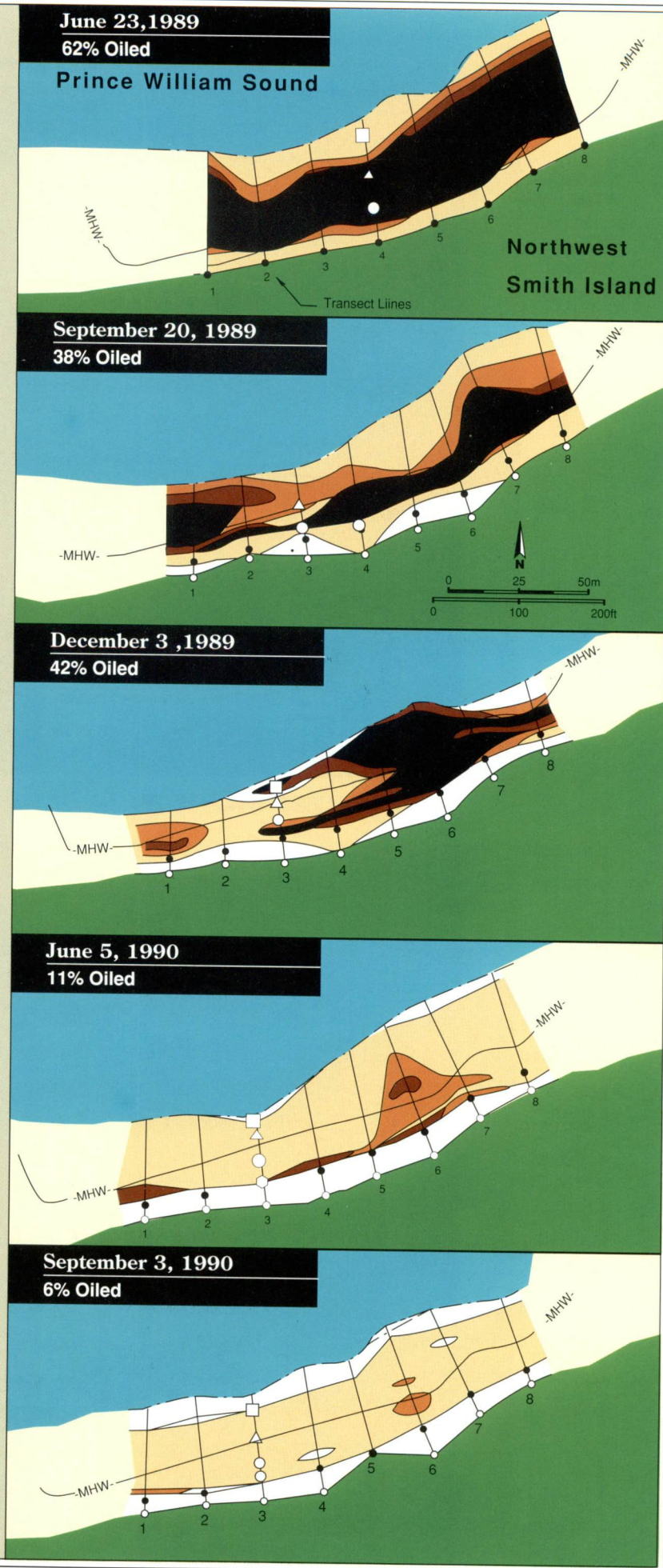
In contrast, the northwest Smith Island site (right) was warm-water flushed only toward the end of the 1989 summer treatment program, by which time the oil had weathered and was more difficult to remove. Natural

wave action and cleanup reduced the oil cover to 42% by early December, as compared to 14% (not shown) at the other Smith Island site. Wave action associated with the largest winter storms on this coast, during December, was able to reduce coverage to 22% by early January 1990 (not shown). By September 1990 the oil cover was still 6%. This remaining coverage is one of the highest observed at the monitoring sites.

Two factors account for the different cleaning rates at these two sites. At the northeast site, the level of treatment effort was considerably higher because of the adjacent ecologically sensitive areas. Thus, the natural cleansing processes were assisted considerably by removal of much of the bulk surface oil. At the northwest site, which did not benefit from early, intense treatments, the available wave energy was insufficient to remove all the weathered oil coats effectively.

A second factor accounting for different recovery rates is related to shoreline orientation. The northwest site has a much shorter fetch over which winds could build waves when compared to the northeast site. As a result, the levels of wave energy for abrasion and washing of the stranded oil are lower at the northwest site.

The results at these two sites are not unique. The benefit of the 1989 cleanup is also illustrated by comparing the summer 1989 SCAT data with October 1989 data from an ADEC survey. The SCAT survey had identified 150 miles of shoreline in PWS that were in the heavy or medium oiling category. As a result of the summer treatment program and natural washing, there was a reduction of almost 40% (to 90 miles) in this combined category based on the October 1989 ADEC survey.





Exxon accelerated natural biodegradation of oil by applying fertilizers that enhanced the ability of naturally-occurring microbes to consume oil.

Bioremediation

Soon after the spill, scientists with the United States Environmental Protection Agency (EPA) and Exxon suggested that the cleanup could be accelerated with help from the area's naturally-occurring oil-eating microbes. Using a technique known as bioremediation, fertilizers with nitrogen and phosphorus could be added to the shorelines so that the indigenous microbes would be able to biodegrade or "consume" the oil more readily (see Figure 5.1).

In the summer of 1989, the EPA and Exxon launched a cooperative program to test the capacity of bioremediation to accelerate shoreline cleanup and to ensure that it was an environmentally safe activity. The State of Alaska Department of Environmental Conservation approved widespread use of bioremediation on the basis of the promising test results.

By the end of the summer of 1989, Exxon had bioremediated more than 70 miles of shoreline.

5.3.2 The 1990 Cleanup Program

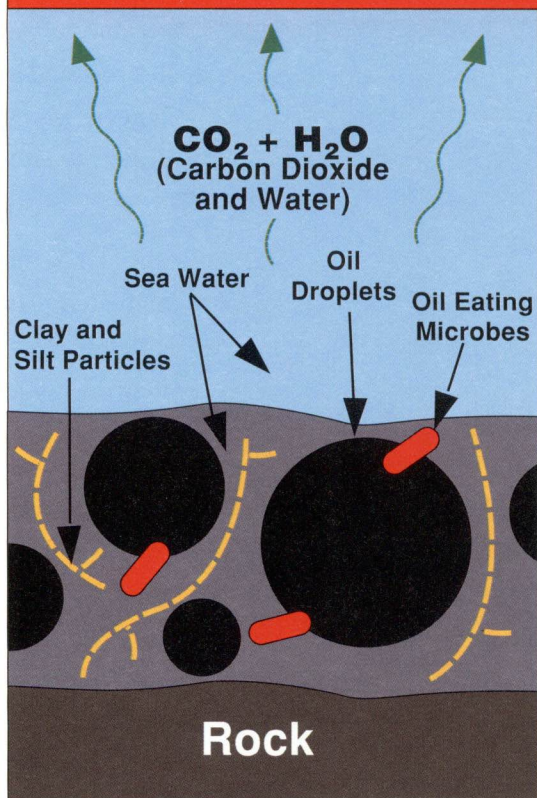
Wave action over the 1989-1990 winter months, along with biodegradation and enhanced by clay-oil flocculation, considerably reduced the amount of residual oil on shorelines. To cleanup the remaining oil in 1990, Exxon continued using bioremediation, but it also employed other techniques, some of which were not used widely in 1989. A guiding principle was to use non-intrusive techniques which would not interrupt the biological recovery.

Bioremediation

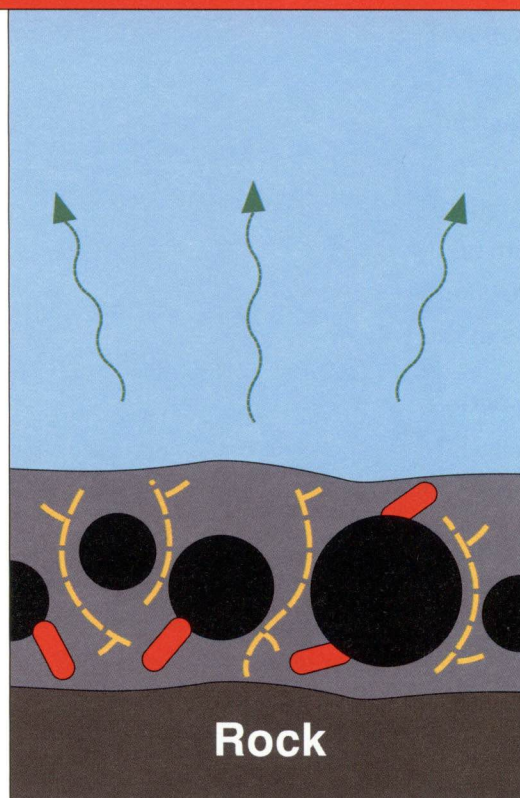
The results in 1989 were so encouraging that another bioremediation program was launched in 1990, when some 400 remaining patches of oiled shoreline of PWS and K-K were treated. A report issued jointly by EPA, ADEC and Exxon estimates that bioremediation typically accelerated natural biodegradation fivefold and occasionally as much as tenfold (Prince, *et al.*, 1990).

Figure 5.1 A Microscopic Schematic of Bioremediation Process

Natural Degradation



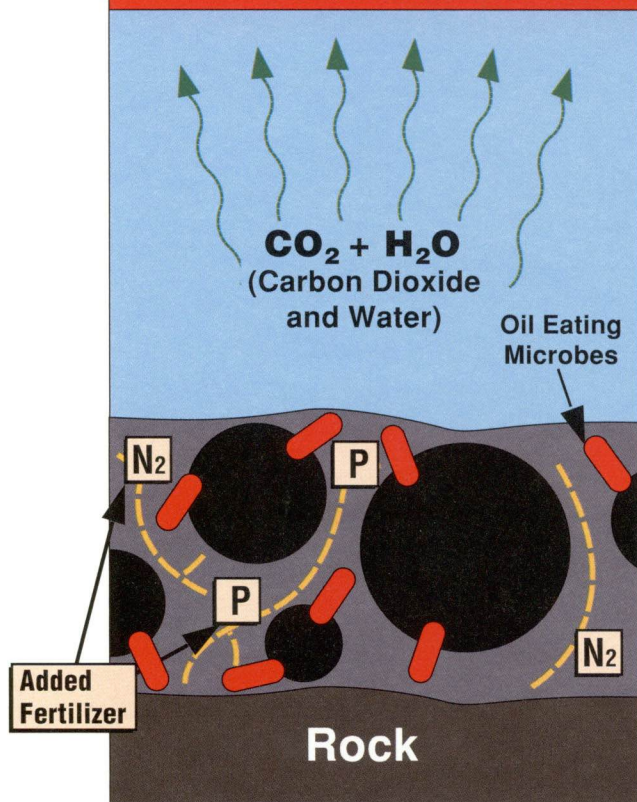
Initially



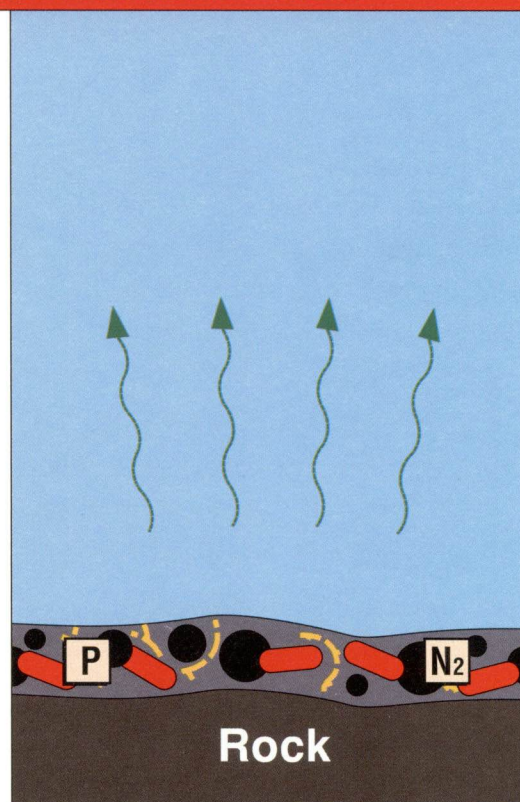
3 months later

Naturally-occurring microbes have consumed or degraded oil since the spill, but effectiveness has been limited by the lack of nitrogen and other nutrients.

Enhanced with Bioremediation



Add fertilizers



3 months later

After Exxon applied fertilizers with nitrogen and phosphorus to oiled areas, biodegradation was usually accelerated fivefold and occasionally as much as tenfold.

Manual Removal

In the spring of 1990, survey teams found residual oil in small patches along shorelines, often behind boulders or in rock crevices. During the summer cleanup operations, much of this oil was removed manually with rakes, shovels and sorbents. In 1989 such manual efforts were largely limited to the tar-like deposits in the K-K region.

Berm Relocation

Part of the oil which remained after the winter was located on the highest parts of the beach, in the supratidal zone. In these areas, oil had been stranded on the berms above the normal limit of wave action. This residue had been pushed there either by spring tides earlier in the summer of 1989 or by severe storm wave action. This residue remained there through the winter, although it did continue to weather and degrade.

A program to deal with these oiled berms was developed with approval from the U.S. Coast Guard. Crews relocated the oiled berm sediments back down the beach to expose them to more effective bioremediation and natural cleaning by wave action. This relocation program involved work on approximately 30 beaches and was accompanied by manual pick-up of mousse and tar. The level of effort varied depending on the amount of oil in the berm areas. In a few cases, crews moved more than 1,000 cubic yards of material in order to expose the oiled sediments, to allow wave action to abrade, and push the cleaned material back up the beach. At each relocation site, mobile oil was picked up and booms were deployed to contain and collect any oil that might be released onto the nearshore waters.

The 1990 berm relocation activities brought oil residue within reach of wave processes but, as anticipated, also caused a temporary increase in the local surface oil cover. At two of the monitoring locations the surface oil cover had been as low as 5% and 10% in June 1990 but increased to over 25%

at the time of September 1990 survey due to the berm relocation program. The activities resulted in the release of only small amounts of sheen, which indicates that the exposed oil had already weathered and become viscous.

Following the movement of berm material into the intertidal zone, a beach was bioremediated. In some sections the fertilizers were added several times to replenish the nutrients that help oil-eating microbes degrade oil.

Ushagat Island: "Helping Natural Cleaning"

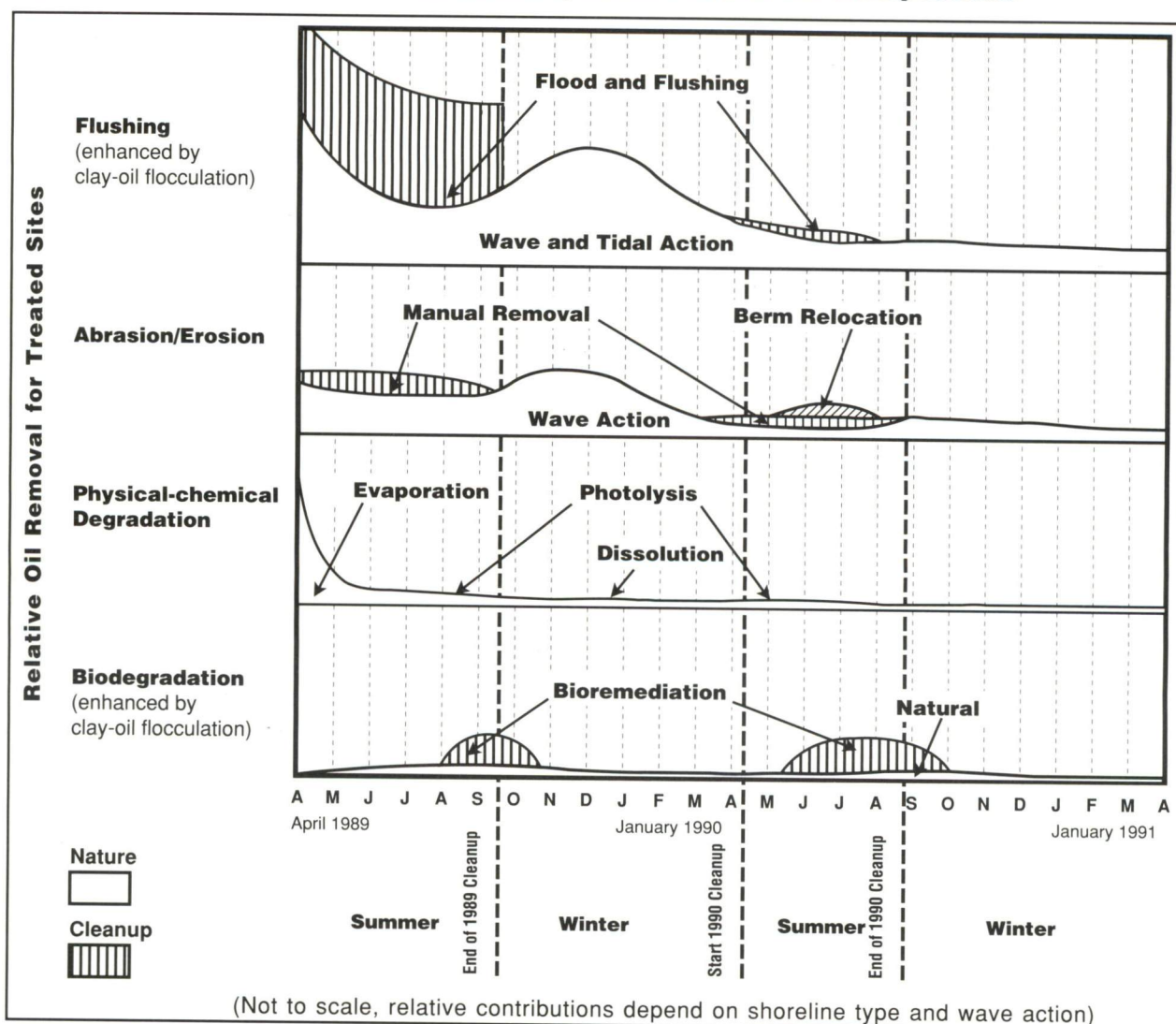
At the Ushagat Island monitoring site, located at the mouth of Cook Inlet, a layer of oil had been deposited on the backshore, above the intertidal zone, over a 300 yard-long section of beach. This oil had been buried during the winter of 1989-1990 as storm-wave action pushed clean sediments up the beach.

To accelerate natural cleaning of this buried oil, Exxon's cleanup program called for exposing the oiled sediments and relocating them to where they could be reworked by winter wave action. A three-foot layer of clean material had to be pushed to one side before the oiled sediments could be moved down the beach. In September 1990, a bulldozer pushed the oiled material down the beach to the top of the intertidal zone, where it could be reworked by subsequent winter waves. This was done to prevent the possible release of any sheens during late summer as seabirds congregated nearby in preparation for their southern migration. The U.S. Coast Guard found the beach clean in January 1991.



Oiled storm berms, shown above, were pulled down the beach so that storm waves could clean them naturally (August 1990).

Figure 5.2: Contribution to Shoreline Oil Removal by Natural Processes and Cleanup Activities



Exxon worked with nature to enhance natural cleaning processes. As a result, cleanup proceeded rapidly with little environmental impact.

Sleepy Bay: "Natural Cleaning of Sub-surface Oil"

In 1989, two long headlands steered oil slicks toward a large pocket beach in Sleepy Bay where the oil was impounded against the shore. The oil penetrated deeply into the pebble-cobble sediments. By June 1989, the upper intertidal zone was oiled throughout to a depth of 60 cm.

A series of pits dug at the same location over one year show how subsurface oil is removed. Wave action progressively reworked the surface sedi-

ments to greater depths, decreasing steadily the thickness of subsurface oiling. By the end of November 1989, winter wave action had cleaned the surface, but left a 25-30 cm thick "lens" of oiled material below. By June 1990, one year after our initial measurements, subsurface oil had been further reduced to a 10 cm thick "lens" overlain by clean material. This lens of oiled sediment will continue to cleanse and biodegrade and is not a threat to biological recovery (NOAA, 1990).



Sleepy Bay was one of the most heavily oiled segments in May 1989 (top). By June 1990 (bottom), it was one of the few places in the area where an oil residue was still present.

Data from post-relocation surveys in August and September 1990 show a marked reduction in surface and subsurface oiling following this treatment program.

Tilling

Winter wave action had effectively cleaned most of the oiled subsurface sediments. On some beaches where residual subsurface oil remained after the 1989-1990 winter, the sediments were turned over by tilling and exposed to wave action and bioremediation. ASAP surveys indicate that this effort also accelerated natural cleaning processes.

5.4 Biological Observations

As part of the overall monitoring program, biologists qualitatively examined major intertidal species, such as barnacles, mussels, limpets, snails, green algae and seaweed. Cross-shore transects were surveyed regularly at all of the monitoring sites beginning in September 1989. (See Figure 5.3. for example of typical data gathered.) In June 1990, Exxon increased the number of biological sites to include a range of typical habitats and several unoiled reference sites. This expansion of the program provided data on relative rates of recruitment by the key juvenile organisms, as well as the relative density of juvenile and adult organisms on oiled and unoiled sites.

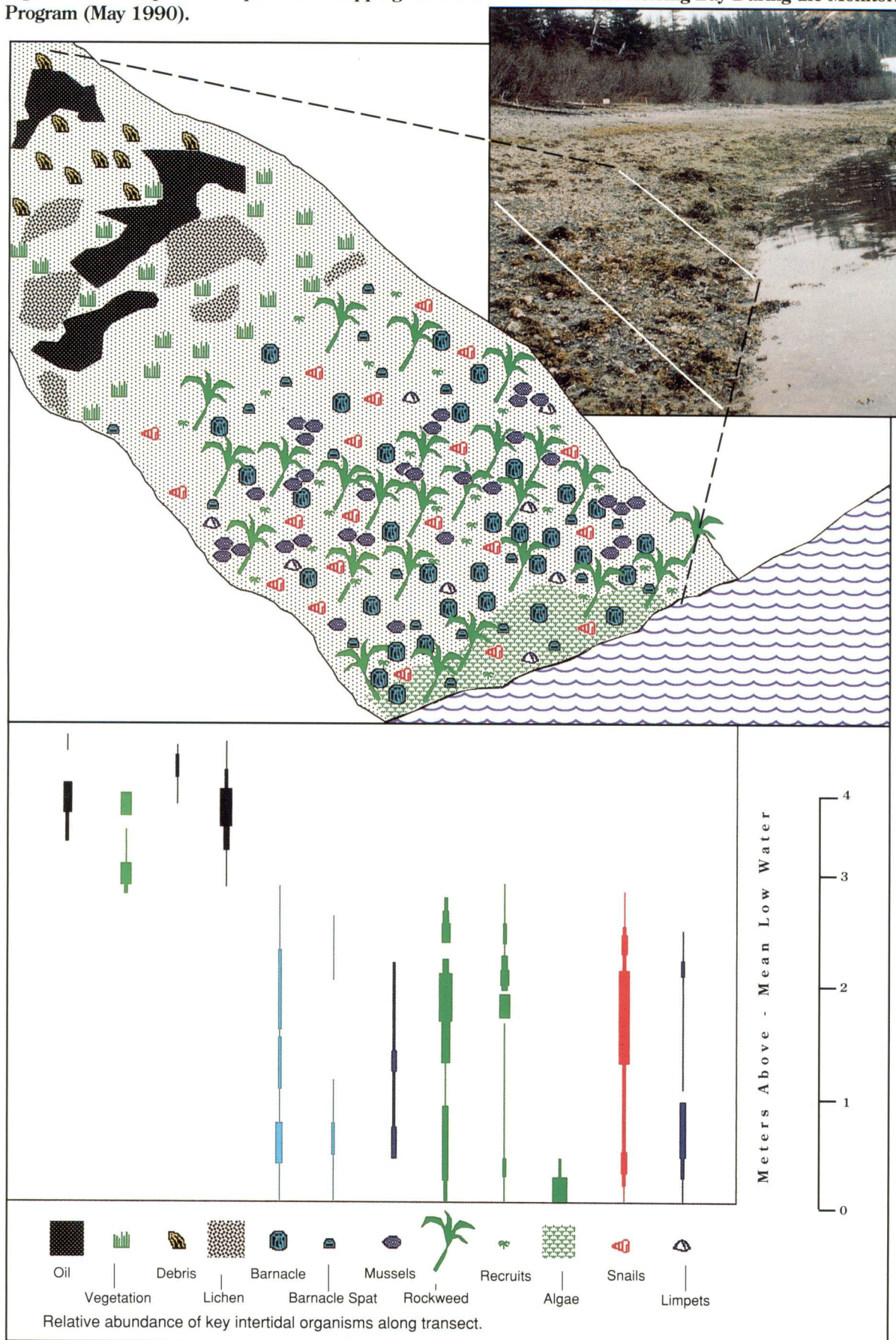
The lower sections of the intertidal zone, which are biologically the richest zones, typically were not

heavily oiled during 1989. By the spring of 1990 virtually all of the lower halves of the intertidal zones were oil-free. That oil which remained was predominantly on the highest parts of the beach, where the biota are normally sparse.

The oil spill had adverse effects on the intertidal biota at most monitoring sites, and those effects were still evident one year after the spill. However, the population densities of key organisms usually were not substantially different from those observed on the unoiled reference sites. Recruitment of juveniles was proceeding normally by spring 1990 (Baker, *et al.*, 1990).

Teams did not discover significant mortalities of any intertidal species. Given the apparent extent of biological recovery in the area, it can reasonably be expected that only a biologic expert will be able to discern differences in biota and shorelines by late summer 1991. Despite reported losses in sea otter and seabird populations and short-term damage in the intertidal zone, there are no indications so far of long-term damage by the spill to the Alaskan environment (Dicks, 1990). This is consistent with previous experiences with large oil spills in other areas of the world.

Figure 5.3: Example of Computerized Mapping of Intertidal Biota at East Herring Bay During the Monitoring Program (May 1990).



A thorough assessment of intertidal biology occurred as part of the monitoring program.

6.0 Historical Perspective

The *Exxon Valdez* oil spill touched off a storm of controversy about the impact of oil spills on marine environments. In the immediate aftermath of the 258,000 barrel spill, many people were concerned that the affected region would be very slow to recover and might never recover fully.

In light of these public reactions to the accident, it is informative to view this spill and the cleanup by Exxon which followed it in the context of previous oil spills. The comparison shows not only that PWS and K-K have recovered far more rapidly than expected but also that the cleanup successfully enhanced the natural recovery process.

Torrey Canyon

Oil has been spilled on the sea for as long as it has been transported. Yet, despite many spills that reached coastlines, particularly during the Second World War, it was not until the 1967 grounding of the *Torrey Canyon* that oil spills became subject to systematic cleanups. That highly publicized spill released 900,000 barrels of oil into waters off the English coast. It prompted government and industry agencies to develop contingency or response plans and cleanup capabilities.

To clean the shoreline following the *Torrey Canyon* spill, 10,000 tons of chemical detergents were used to wash oil off the rocky coasts of Cornwall. The detergent cleaning probably killed many of the intertidal organisms that otherwise would have survived the oil spill. However, biological recolonization did occur, so within ten years the intertidal zone had largely recovered its pre-spill condition (Southward and Southward, 1978).

As a result of the *Torrey Canyon* experience, detergents have not been used in the U.S. and Canada. Recognizing the potential benefits of improved beach cleaners, Exxon developed a new generation of low-toxic beach cleaner (Corexit 9580) for special circumstances. Despite extensive tests, this

technique was not approved by the regulatory authorities for wide-scale application in Alaska.

Amoco Cadiz

In 1978, the *Amoco Cadiz* spilled approximately 1,700,000 barrels of light crude and fuel oil off the Brittany coast of France, making it the world's largest tanker-related oil spill, more than six times larger than the *Exxon Valdez* spill. Oil affected a variety of shoreline types, including sand beaches, rocky headlands, estuaries and mudflats. The four-month cleanup program involved removal of the oil by a variety of techniques, the most useful of which included removing oil directly from the shoreline with vacuum trucks. Some oil still remains in subsurface sediments on beaches where trenches were dug by cleanup crews to collect oil for the vacuum trucks. Exxon did not practice this technique.

Marshes and sheltered estuaries were disturbed as heavy equipment attempted to remove oil from these sensitive environments. For the *Exxon Valdez* spill, such intrusive techniques were not used on the single marsh that was oiled.

Metula

A further contrast is provided by the *Metula* oil spill (390,000 barrels) which occurred in 1974 in the Straits of Magellan in southern Chile. This spill of light Arabian crude oil was not cleaned or treated in any way. Surveys of the *Metula* spill site two and twelve years after the accident have shown that the oil has been cleansed naturally from most of the shorelines. The open-coast beaches were cleaned quickly, but scientists found residual oil in the sheltered bays and marshes near the spill site. The oil that remains is largely in the form of asphalt pavements or tar mats which are likely to persist for many years unless removed. To prevent this situation from occurring in Alaska, Exxon removed bulk oil in 1989 and residual tar mats in 1990 from the shoreline.

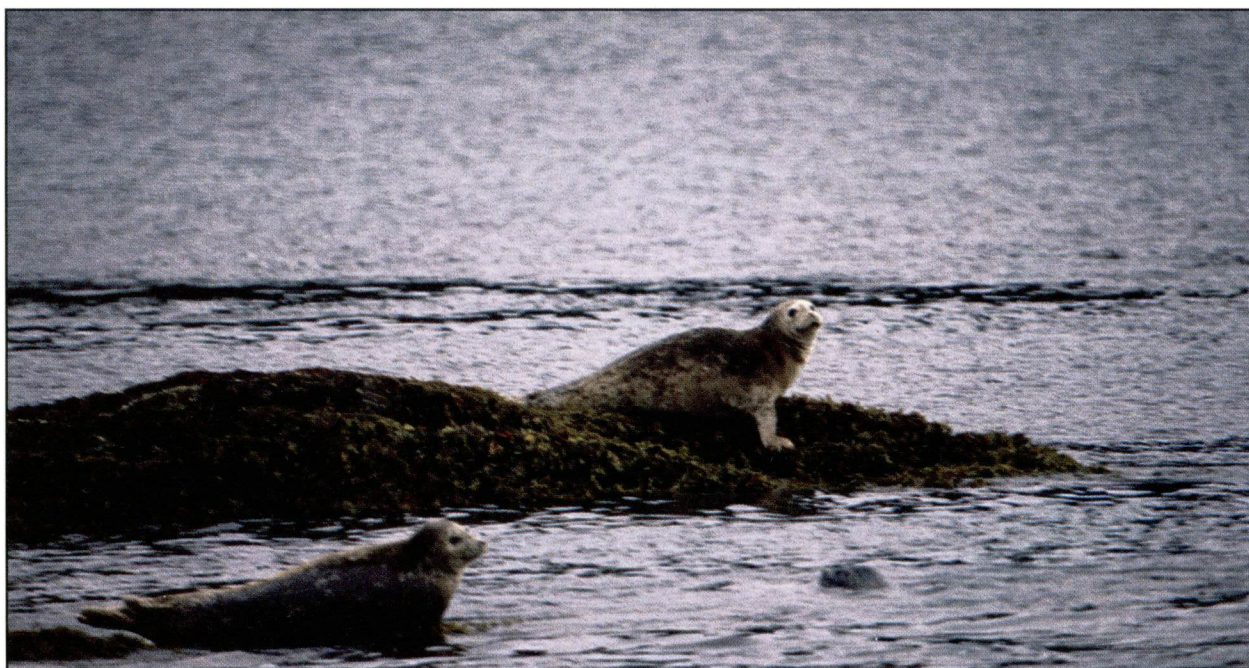
Arrow

The *Arrow* spill (60,000 barrels of Bunker C oil) of 1970 in Nova Scotia occurred in an environment which is very similar to southern Alaska, with many rock outcrops and pebble/cobble beaches. Some 30 miles of shoreline, out of the 300 miles that were oiled, were cleaned mechanically using bulldozers and front-end loaders. Monitoring of the beaches at locations where mechanical removal was used showed that the removed material was not replaced naturally, and, as a result, the beaches eroded within a matter of a few months. Surveys taken three years later showed that the beaches had still not recovered (Owens and Rashid, 1976). Because of the erosion that occurred after the *Arrow* cleanup, the removal of oiled sediments as part of a cleanup is not recommended when a replacement supply of sediments is not available.

The intertidal ecology would have probably recovered if large-scale sediment removal had been conducted in PWS and K-K, but coarse sediments would not have been replaced naturally. For this reason, oiled beach sediments were generally not removed and were allowed to become clean naturally.

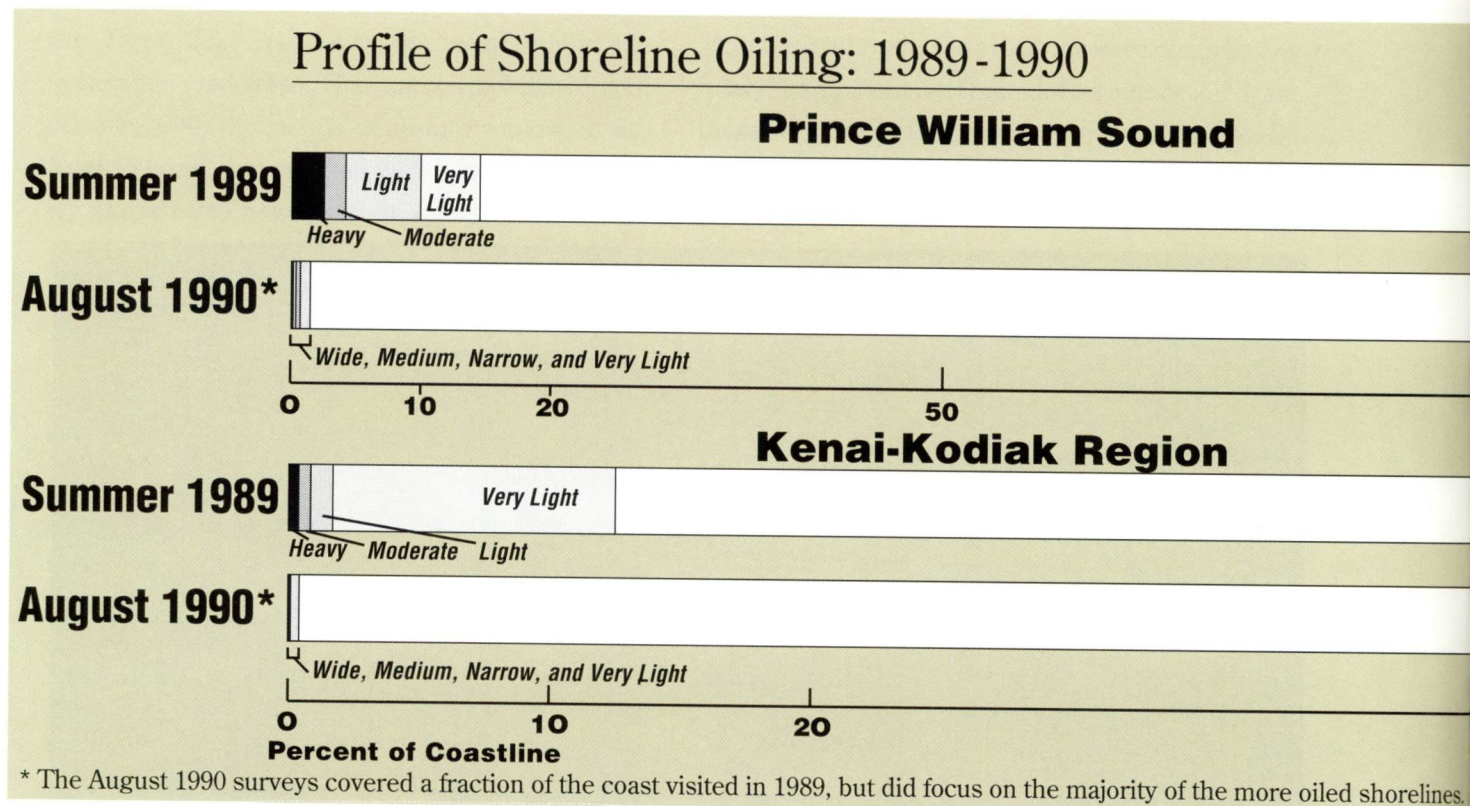
Key Lesson

The key lesson learned from studying these previous oil spills is that shorelines will become clean naturally. To accelerate cleaning, treatment strategies should take natural processes into account, as occurred following the *Exxon Valdez* spill.



Both land and sea mammals were observed on the shorelines during the 1990 surveys (August 1990).

Figure 7.0: Results of 1989 and 1990 Shoreline Oiling Surveys



Survey teams found evidence of oiling on only about 1% of shorelines in the August 1990 survey.

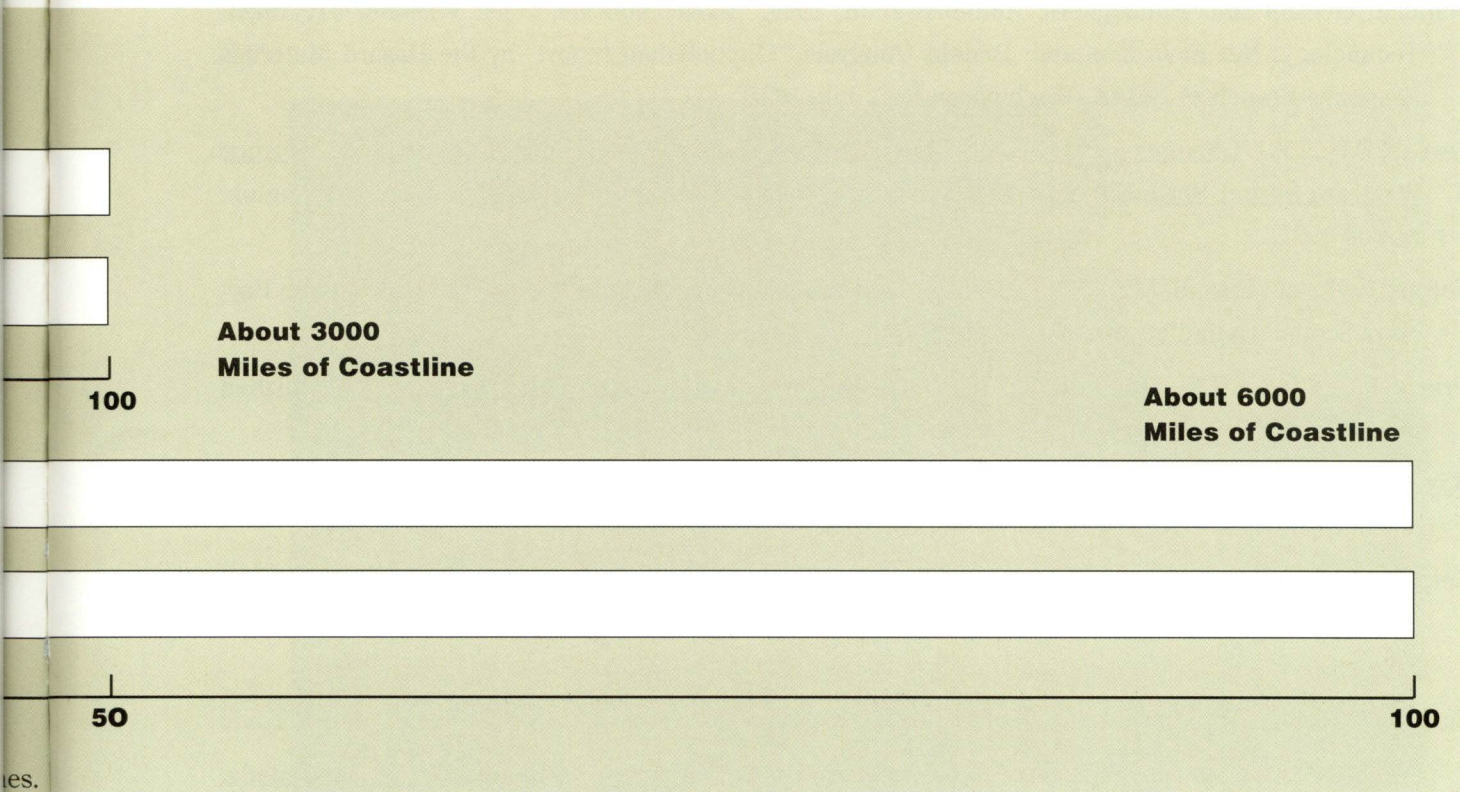
7.0 Conclusion

Some 35 oil spills worldwide have been larger than the *Exxon Valdez* spill, but never before have shoreline studies been as intense or as fruitful as those described here. The studies provided a basis for cleanup operations, and they allowed Exxon and the regulatory agencies to develop a successful cleanup program.

On the most basic level, the research has improved our understanding of the natural processes that remove oil from the environment. Only with careful monitoring and documentation were Exxon scientists able to discover the significant role of clay-oil flocculation or to appreciate fully the contributions of biodegradation, wave action and tidal flushing.

Perhaps more importantly, the studies have also allowed scientists to test and prove new cleanup techniques. The Woodward-Clyde studies have documented the effectiveness of working with nature to clean up after an oil spill. They have shown that such techniques as bulk oil removal, berm relocation and bioremediation enhance nature's ability to recover from oil spills.

As a result of these studies, the scientific community is now better positioned to deal with future spills. The knowledge gained from this accident can help government and industry respond even more effectively to the next oil spill.



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Acknowledgements

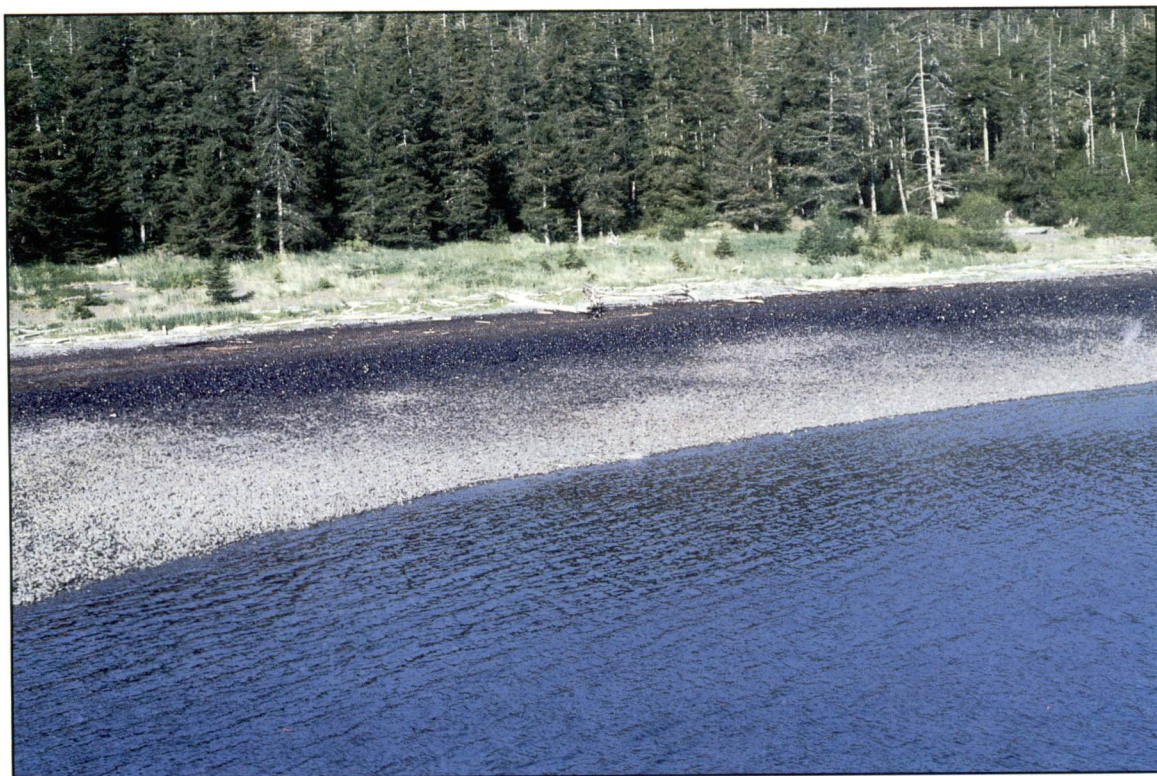
The field studies that followed the *Exxon Valdez* spill were, by far, the most extensive ever undertaken to study the fate of oil on shorelines following a spill. The unprecedented project has generated a wealth of data and knowledge about the impact of the oil on shorelines and the effectiveness of the cleanup processes. A project of such magnitude would not have been possible without the dedication and support of many individuals, in particular Exxon program manager Andrew R. Teal.

The hard work and professionalism of the many scientists and technicians who labored diligently during the past 18 months deserve appreciation. I especially wish to thank the more than 50 scientists and engineers from Woodward-Clyde Consultants, as well as the many subcontractors who supported them. The teams spent an aggregate of well over 3,000 labor-days in the field between April 1989 and September 1990. They achieved a perfect safety record, which was no small accomplishment considering that the program continued through the winter of 1989-1990, that shorelines were slippery, and that we constantly used small boats, float planes and helicopters.

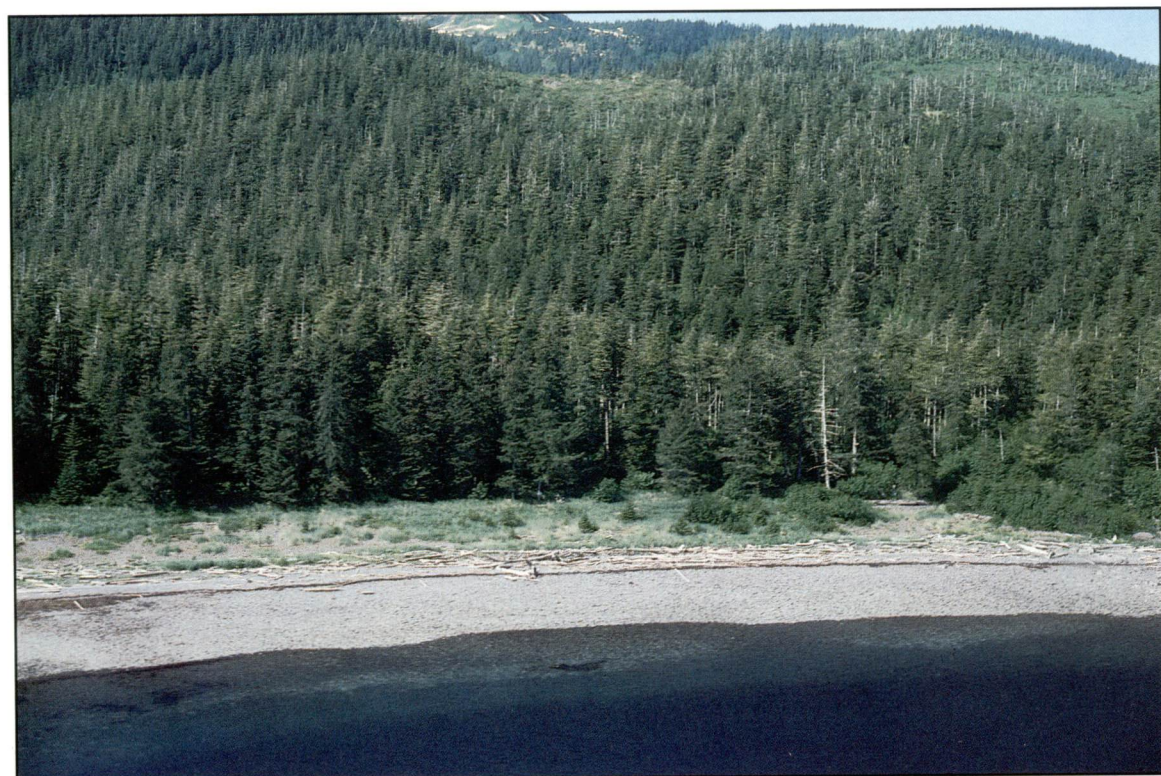
Woodward-Clyde senior biologist Dr. Ken Critchlow contributed the sections of this report concerning intertidal ecology. Thanks are also extended to the numerous representatives from the U.S. Coast Guard, the Alaska Department of Environmental Conservation, and Exxon, whose cooperation was so essential to the success of the project. And finally, acknowledgement is made to Exxon for funding the research that forms the basis for this report.



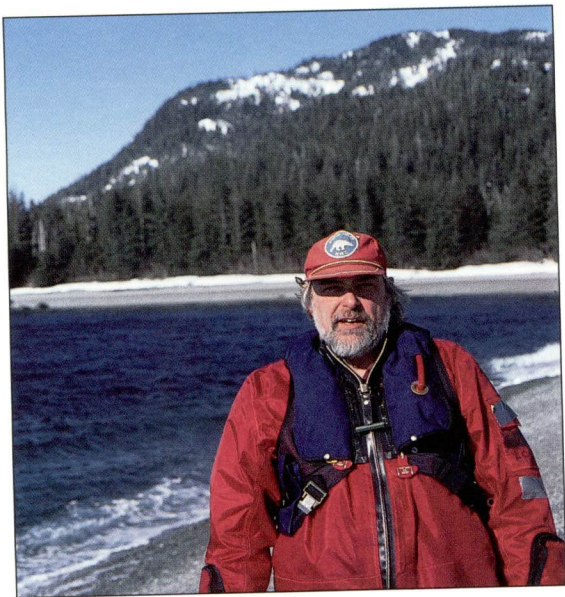
Typical rugged coast in Prince William Sound



North East Latouche, September 1989



North East Latouche, June 1990



Dr. Ed Owens, Vice-President and Manager of Coastal and Environmental Services, Woodward-Clyde Consultants, in Prince William Sound, Alaska.

About the Author

Following the spill, Dr. Owens was appointed as technical advisor to Exxon's Shoreline Cleanup Advisory Team (SCAT). He helped establish and implement the shoreline assessment surveys, the 1989 aerial video surveys, the long-term scientific monitoring program, and the 1990 joint shoreline surveys.

Since 1970, Dr. Owens has been involved in a variety of studies related to the impact and cleanup of oil spills, especially those in cold-water environments. He advised cleanup officials during the 1970 *Arrow* oil spill in Nova Scotia, the 1980 Hasbah 6 blowout in the Arabian Gulf, and the *Nestucca* spill in British Columbia in 1989. In addition, Dr. Owens designed and conducted field studies and experiments for the Baffin Island Oil Spill (BIOS) project, as well as post-spill surveys of the *Metula* and *Amoco Cadiz* sites. Most recently (February 1991)

he conducted shoreline surveys for the governments of Bahrain and Qatar in the wake of the Kuwait-Iraq oil spills.

Dr. Owens has conducted more than 30 oil-spill training workshops in Canada, Alaska, the Caribbean, and East Africa. He is a member of the Environmental Geology Committee of the American Association of Petroleum Geologists and an expert consultant for the United Nations International Maritime Organization. He has authored or co-authored more than 120 articles and reports about coastal geology and oil spills.

About Woodward-Clyde Consultants

Woodward-Clyde has achieved international prominence in environmental, geotechnical and waste management services. Founded in 1950, the firm has more than 50 offices and over 2,000 employees throughout the world. Engineering News-Record has listed the firm among the top 50 U.S. design firms since that listing began in 1965.

Woodward-Clyde, with headquarters in Denver, is recognized internationally as a leader in the field of oil spill cleanup and research. Staff members have accumulated practical experience through participation or observation of more than 100 oil spills.

Woodward-Clyde's experience with marine and coastal environments has been brought together in its Coastal Science and Engineering Center to provide an interactive approach to biological, chemical and physical studies. The Center provides a forum within which the professional staff brings state-of-the-art technology, proven management capabilities and innovative solutions to problems. Based in Woodward-Clyde's Seattle and Anchorage offices, the Center's scientists and engineers have considerable international as well as Alaskan experience.



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