RPWG
Y

BRIAN -

Nancy -

Could you add name, (position) address for everyone to the notes?

Sally

13 SEPT

BRIAN -

HERE'S MY NOTES FROM YESTERDAY'S MONITORING MEETING. HOPE THEY MAKE SENSE...

>NANC

OOPS!

BY THE WAY, I CALLED JOHN ARMSTRONG "J. ANDERSON" THROUGHT THESE NOTES (MUST HAVE BEEN THINKING OF MY OFFICE MATE BACK IN D.C. - JOE ANDERSON). I THINK I CORRECTED MOST OF THE REFERENCES ON THIS COPY (THO NOT ON THE COPIES GIVEN TO R. NADEAU AND K. HOOD). I MAY HAVE MISSED SOME, SO IF THERE'S ANY REFERENCE TO "ANDERSON" IN THESE NOTES, IT SHOULD SAY "ARMSTRONG".

-NANC

B. ROSS
H. KIBBY
S. RABINOWITCH
LUCINDA TIER
K. HOOD
J. ~~ANDERSON~~ ARMSTRONG

R. NADEAU
N. MENNING
J. STRAND (via phone)

12 Sept 1990

(for the RPWG)

Purpose: put together concepts, for potential monitoring plan/program (conceptual framework)

timeline: to be ready to start next year.

- needs?
- breadth of focus? (Success of restoration measures v. monitor natural recovery v. long-term, holistic program)
- rates of recovery?

What is monitoring supposed to accomplish?

RPWG needs: ① monitor success of restoration measures (esp. direct measures)
② putting together costs of mon'g program for claim
③ for which "resources" is natural recovery "inadequate"?

Much restoration work will be compensatory in nature but intended to assist certain species/populations recover. We may want to monitor these species — e.g. measure when something is recovered regardless of whether it's natural...

K. Hood — ecosystem scale monitoring is probably unrealistic (too big); maybe should look at recovery + restoration only.

B. Ross: What is the definition of restoration? What is the endpoint(s) of "recovery"?

Must also consider: (from K. Hood)
populations to be monitored ...

H. Kibby - must start w/ the objective. Pop'n fluctuations over time? (This is double.) Pop'n recovery to baseline? (Not doable w/out baseline numbers.)

B. Ross: Is the objective closed-end (when recovery occurs) or is it a matter of policy (more ongoing)? This latter can be justified under basic mandates given the impact of the spill (S. Rabinowitch response to J. ~~Anderson~~ Armstrong question).

J. ~~Andrusen~~ mustang – may need to get a reading from the Legal Team on whether this latter option is justifiable.

B. Ross – is part of the objective to coordinate various agencies monitoring programs or only to fill some holes?

K. Hood – should we set goals for each resource category

B. Ross – do we want to tie it to what we know is damaged? Does this restrict us from doing anything until the damage assessment data is in?

K. Hood – Some groups, e.g. The State, may have a better shot at longer-term monitoring. Other groups may play stronger role in short-term efforts

S. Rabinowitch – NPS, too. Have basic responsibilities that includes basic research. Want money for it.

L. Tier (responding to J. ~~Andrusen~~ mustang ?) – could monitor geologic changes, intertidal organisms to represent health of ecosystems, fate & persistence of oil. Can select representative habitats to monitor.

B. Ross – coordinating objective? Monitoring v. research?

R. Nadeau – Coordination, QA/QC, etc. Need for standard, agreed upon protocols/approaches for all agencies to use (yet still able to meet individual agency needs)

S. Rabinowitch – ~~###~~ Can probably agree that the big picture level of coordination is necessary.

H. Kibby – But still need agencies to sit together and agree to follow RPWG recommendations for big goal(s)

→ John Strand connection via phone ←

Objectives

(Kibby: difficult to do w/out baseline info (~~A~~ [mustering?] suggests could use controls or expert opinion...)

- Recovery monitoring (whether natural or not); dynamics of populations affected by spill (as opposed to general monitoring that agencies are responsible for anyway)
  (including rates of recovery →) Monitor recovery + dynamics of resources potentially affected by the spill. Need to be clear about assumptions of what we are comparing it to — Southern Gulf Coast, expert opinion?.
  When does it end? Does it need an end? Agencies with basic trust responsibilities (e.g. NPS) can go on forever. Also, court-designated trust fund with funding may not need an endpoint. Each species may have a different termination.
- Any monitoring program should use methods that provide information useful ~~to~~ to land managing agencies. (e.g. protocols).

But lose ability to find interactions and subtle effects if we stick to a species-by-species approach. Are we monitoring just to know or to make management decisions?

Need someone to be assigned responsibility to pull together a synthesis. The synthesis mechanism must be set up up front so that the right data is collected. Need an overall framework, or synthesis concept, to guide the effort.

- Establish a synthesis methodology or mechanism within which all monitoring will take place.
- Produce a synthesis report periodically.

12 Sept PAGE 4

- Are we gathering qualitative or quantitative data. What precision is needed → Data quality objective (DQO). A DQO would be part of a synthesis methodology. Managers must choose the DQO. May differ for different agencies ~~but~~ and for different species.

- What is the scope of an overall program? Fate + persistence of oil? Level of physical monitoring? (Bioremediation efforts showed great variability requiring large number of samples; this would very likely be the case with many other physical measures. Besides, how useful is it to managers anyway?) Probably shouldn't try to measure oil in the environment per se but should be looking at oil in fish tissues, etc. Are we monitoring for damages or for recovery + dynamics of potentially affected resources? Maybe both, depending on whether we are pre-settlement or post-settlement...

Who are we developing a database for? What data do they need? Need to be careful not to do their jobs for them

Recovery from injuries must cover all injuries — various uses, etc.

J. Strand: HAZMAT shoreline monitoring program is looking at the efficacy of treatment

Need to be cost-conscious — tweak existing monitoring efforts to get the info we need.

Use historical data only after designing your monitoring program.

12 Sept PAGE 5

- Need to monitor oil in the environment as one of the parameters. Other parameters:
  - obviously affected spps & habitats (high priority to monitor)
  - spp/habitats showing minimal or no effects (lower priority)
  - air quality (lower priority)
  - water quality (lower priority)
  - hydrocarbon levels in key organisms (high priority)

[Need to keep in mind what Exxon is doing in their assessment work (at least until a settlement & full disclosure of data).]

(cont'd)

- some spps not covered by damage assessment may be monitored as indicators...

<Break>

- Scheduling: 21 Sept RPWG meeting
  - can each agency...
    - id what they collect, what they need to collect?
    - id who their contact people are for monitoring? → this group could be useful for designing a monitoring plan. Could hold a workshop. (RPWG has money.)

- Who should develop the monitoring plan? EPA? RPWG? Contractor? (Should ask the workgroup this question.)
- K. Hood would like 75-80% of this done by early December for budget & planning purposes (subject to segregation).

12 Sept PAGE 6

Does monitoring come into play NOW or after a settlement? This policy issue needs to be resolved. General feeling in the room is that we need to collect data (or access to d.a. data + people) as soon as possible.

Include on list of objectives for RPWG consideration → monitoring for long term damage.

What is monitored should be driven by utilization (human uses)

J. Anderson suggests that there may be v. little more than is already being done that we need to push for.

H. Kibby stressed that we must come up with the synthesis methodology now to even determine what we need.

If RPWG goes with a contractor, Battelle + others are accessible in the near term thru ORD vehicles. PTI out of Region 10 office are accessible.

Need to ask RPWG if we want to be in the field this year or planning this year.

S. Rabinowitch - What could be done this summer?

Brian - look @ NOAA's effort... It's a matter of money + people applied. Can we, however, identify these holes in the damage assessment that need filling in time for this next field season?

↓

Can't choose w/out synthesis methodology. May be able to work off of synthesis maps for da...

12 Sept PAGE 7

John ~~Anderson's~~ mystring's remaining questions:

- incorporation of da work
- who funds restoration?
- who would do it?
- who would synthesize?
- need for DBMS (e.g. ODES)?
- public review of draft mon'g plan + any reports.

tbl – Obj. for monitoring program should not include evaluating restoration projects (should be included in the project itself and is included to a ~~limited~~ limited extent in the broad goal...)

Agricultural and Forestry
Experiment Station
(907) 474-7188

Instruction and
Public Service
(907) 474-7083

School of Agriculture and Land Resources Management
University of Alaska-Fairbanks
Fairbanks, Alaska 99775-0080

RPWG
Y

August 10, 1990

Stan Senner, Oil Spill Restoration and Planning Office
437 E Street, Suite 301
Anchorage, Alaska 99501

Dear Stan,

I have enclosed for your consideration a one-year $30,000 proposal for the Green Island research and long term monitoring project that we discussed earlier. I am leaving a copy with my business for processing and signature as an official University of Alaska proposal, and I will transmit that as soon as possible. I will be in the field from August 13-18, but I will try to contact you at least once during that week.

If funding can be arranged Nora, my crew and I would plan site work for the low tides of September 4-6. A letter of intent in response to the formal proposal woul allow us to expend funds.

I will be in the office starting August 20.

Sincerely,

Glenn Patrick Juday

Glenn Patrick Juday, Assistant Professor of Forest Ecology and
Alaska Ecological Reserves Coordinator

OIL SPILL RESTORATION FEASIBILITY MONITORING PROGRAM, GREEN ISLAND RESEARCH NATURAL AREA

Proposed Starting Date August 10, 1990

Proposed Completion Date December 30, 1991

Proposed Amount $29,993

OIL SPILL RESTORATION FEASIBILITY MONITORING PROGRAM, GREEN ISLAND RESEARCH NATURAL AREA

Introduction

This proposal represents a one-year plan of work involving a site visit to the Green Island Research Natural Area in Prince William Sound. The oil spill research and monitoring work underway there is described in Juday and Foster (1990). The proposed work is a study of natural background changes and recovery of a beach and intertidal system affected by low to moderate amounts of Alaska North Slope crude oil released by the Exxon Valdez spill in March 1989. A three-year plan of research that focuses on monitoring species diversity, community structure, and rate of recovery is attached. This proposal would support only a second-season site visit that would permit an evaluation of the initial changes to the site and the techniques of monitoring that are most effective. The results should provide guidance to the effort to recover and restore environments after the spill by indicating continuing damage (if any) and the response of the full range of species two seasons after the spill, which would represent a test of the "no further treatment" alternative to restoration.

Objectives

1. Obtain quantitative measures of species abundance in permanent beach and intertidal plots that have been established at Green Island;

2. Determine the changes in community composition from August 1989 and July 1986 and changes in community structure from August 1989;

3. Obtain a complete list of marine intertidal species present in monitoring plots in 1990 at Green Island to identify potentially oil-affected species;

4. Identify techniques of plot marking and re-location that work in the highly energetic shoreline and intertidal environment of Prince William Sound and that are the most field-efficient in monitoring;

5. Determine the general direction and rate of recovery of oil-affected beach and intertidal ecosystems at Green Island.

Methods

1. We will re-locate and re-photograph as many of the 36 intertidal plots established in August 1989 as possible;

2. We will collect or note all identifiable species in the Lunch Point, Nora's Point, and Little Green Island study areas in the late 1990 field season;

3. We will remeasure oil on at least 100 meters of horizontal beach transects at Lunch Point and Nora's Point.

4. We will determine the quantitative abundance of seagrasses in the intertidal transect areas at Green Island.

5. We will synthesize results of our study, the application of our techniques, and make recommendations about recovery and restoration needs.

BUDGET - Green Island RNA Oil Spill Restoration Monitoring Feasibility Study

	work mo.	Salary & SB	Indirect costs
CO-PIs			
Ecologist	1	$ 7,713	$ 3,317
Taxonomic specialist	1	$ 3,413	$ 1,468
FIELD & LAB ASSISTANTS			
Field crew	1.5	$ 3,915	$ 1,684
Graduate Student	1	$ 833	$ 358
TRAVEL-LOGISTICS		$ 4,300	$ 1,849
SUPPLIES		$ 800	$ 343
EQUIPMENT		$ 0	
subtotal		$20,974	$ 9,019
TOTAL		$29,993	

For NPS
Jucinda Tear
Carl Schoch

Monitoring

Rpwg
Y
9-5
@RPO
w/ ~~Sandy~~ Stan and Lucinda

- Thought - systematically ask agencies + academic insts: what work has been done w/ r/t monitoring, what databases, what protocols — for spill area.
→ (a F.S. analogous to Land Status study)

- Need to have any large monitoring program, that involves diff agencies, to use consistent protocols ... + data collection/reporting forms + formats among agencies.

- Jucinda - idea of a "modular" approach to monitoring (endpoints meaningful to individual areas even if it doesn't continue longer...)

- Quantitative vs. Qualitative, and focus (natl resources vs other "park purposes", etc)

RPWG

Y

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT

OFFICE OF ENVIRONMENTAL PROCESSES AND EFFECTS RESEARCH
WASHINGTON, DC 20460
USA

FACSIMILE TRANSMISSION COVER SHEET

DATE: August 10, 1990 NUMBER OF PAGES: 7 (including this cover sheet)

TO: Brian Foss TELEPHONE NO: 271-2464

OFFICE: RPWC-7Ak FAX NO: 8-907-271-2467

FROM: Ken Hood TELEPHONE NO: 8-382-5976

OFFICE: ARTF-O/OMEP

MESSAGE: Brian: Here is a "straw" document on monitoring to get the ball rolling for the 8/14 meeting. Connor has looked at it. A copy goes to John Armstrong and Hal Kibby. All changes, ideas, comments welcome!

Ken

FAX MACHINE: (202) 382-6370
FTS: 382-6370

CONFIRMATION: (202) 382-5945
FTS: 382-5945

MDPC/2/90

First page

DESIGN AND OTHER CONSIDERATIONS FOR

MONITORING RECOVERY AND RESTORATION

OF OIL DAMAGED ALASKAN NATURAL RESOURCES

As construed by the (unsigned) Memorandum of Agreement, EPA and the state of Alaska are to monitor and report the progress of recovery of Prince William Sound. Wording of this phrase and the interpretation of "monitor" is not clear, but it is presently construed to mean that EPA will not actually do the monitoring of the resource conditions. Instead, others will be asked do the actual measurements, while EPA will keep track of the progress and results of the other agencies. (This interpretation is subject to change, of course.)

To initiate and implement this plan, EPA should undertake to develop a general blueprint on the monitoring function so that the detailed field plans of the others can be put into a cohesive context. For the most, part "others" is construed to mean the Trustee Departments, including the State of Alaska. Development of an overall general plan will permit future identification of areas which may not be covered and reduce overlap and duplication of effort, should it occur.

In the case of the Exxon-Valdez spill, the objective is to restore the natural resource populations and environments to previously existing conditions before the spill. A monitoring effort to assess recovery and restoration of oil damaged natural populations will focus on injured populations linking it to the damage assessments.

Determining when the PWS is restored will not be a simple nor easy matter because of insufficient information on the natural resources prior to the oil spill. There is scant information on the population levels of many of the populations. Likewise, there is little detailed information on species diversity or the overall ecosystem of PWS and adjacent Gulf of Alaska. An agreement on what population levels will constitute recovery would be helpful for certain resources, while it may be of less use for others.

What to monitor will need to be defined although a certain amount of agreement has been tacitly reached if one reviews the list of organisms studied for the damage assessment. Reduced to the least number, perhaps no more than 20 to 35 species need to be monitored in the fish, shellfish, marine and terrestrial mammals, and bird groups. Determination of a minimum number of additional populations to monitor in the coastal and near coastal environments will enlarge the total number of damaged species and habitats to be included. Agreement on what to monitor must be sought with

those who will do the actual measurements.

Once the populations to be monitored are identified, resolution of suitable end points to be measured should be addressed. This is a matter of some complexity and may vary with each population. A life stage needs to be selected for measurement for each specie, but the stage selected may vary between different species. How often the measurements are made may vary, depending on the specie life cycle. It is apparent that each fish, animal, plant, etc. system to be monitored will need separate ——————consideration.

Sampling rates will vary depending upon the populations being monitored. Fish populations may be dealing with hundreds of million or individuals, while some mammal populations may deal with only hundreds of individuals. Habitats are widely varied and accessing the populations will be a continuing problem due to the climate, sea, and terrain.

Data collection should be undertaken by those most familiar with the location and levels of damage. These scientists, technitions, and resource managers are mostly in place by the Trustee organizations. Questions of chain of custody and quality assurance and other methodology will need resolution. Peer review of the field monitoring plans is recommended. Interpretation of the data may depend, in some situations, upon statistical or population modeling techniques because base line populations are not known or are poorly established. A reporting and synthesis system (agency?) should be developed. A suitable time table and schedule would need to be worked out.

A sunset date (or dates) should be established at the beginning of the effort, but provisions for review and revision of the plans every two or three years would help focus the effort and control costs. Such a review would also permit evaluation of restoration procedures aimed at enhancing the rate of restoration of populations or environments which are either severely damaged or which are especially slow to recover.

SUGGESTED APPROACH TO DEVELOPING A PWS/REGION MONITORING PLAN

TAKING INTO ACCOUNT GOAL SETTING AND COSTS

Taking into account the above discussion, a suggested course of action is set forth below. Following the points below is a draft table with a tentative (but not fully complete) listing of populations to be monitored, the lead agency(s) for each and a ranking based upon the level of effort undertaken during the damage assessment work.

The action points are:

1. EPA should build consensus for a monitoring program with the Trustee agencies, taking advantage of the NOAA effort now underway.

2. Working with Region 10 and Alaska, a draft list of populations and environments to be monitored should be developed for presentation to the Trustee agencies for discussion. A ranked listing would permit running to be first distributed upon those items deemed most important. Criteria for ranking should be set forth e.g. economic importance, societal importance, ecological importance and the like.

3. Tentative identification of populations for monitoring, with lead agency, should be made, then either the agencies could be individually contacted or a planning workshop (several workshops?) could be informally conducted. No doubt the original list and effort would undergo substantial change during these discussions but since the other agencies would be shouldering the costs, EPA could facilitate the negotiations as well as the meetings. At these meetings, the points mentioned in the narrative would be addressed and each agency would have opportunity to do its own costing.

4. Regarding cost control, adjusting the number of populations/environments to be monitored can be used to match priority needs with available funds. If funds are too limiting, then either requests for more funds can be considered, or the decision to monitor the recovery in the way suggested here can be revisited for revision or abandonment.

5. Frequency of collecting data, amount of data, sampling rates, etc. can be adjusted or reduced, in some situations, to reduce costs; but the plan design, data analysis, and synthesis will also need to be adjusted. For example, some data taken annually might be taken only biennially to yield approximately the same information but with less precision.

6. Piggy-backing on information which is routinely collected for other purposes might be usefully worked into the monitoring planning. Substantial information is annually collected by some resource managers e.g. for salmon management etc.

CANDIDATE COMPONENTS AND AGENCIES FOR MONITORING
AGGREGATED BY ENVIRONMENTS AND BIOLOGY
AND
APPROXIMATE RANK BY LEVEL OF DAMAGE ASSESSMENT EFFORT

Component	Rank+	Agency
Coastal habitats	9430	USFS/ and others
Near coastal habitats Subtital sediments etc	808	NOAA & Alaska
Fish/Shellfish		
Salmon (all species)	4322	ADF&G
Herring	558	ADF&G
Crab (all species)	560	NOAA
Spot Shrimp	296	ADF&G & NOAA
Clams	229	ADG&G
Marine Mammals		
Sea otter	1105	FWS
Whales, Killer & Humpback	347	NOAA
Sea lion. Harbor seal	331	NOAA and others
Terrestrial Mammals		
River otter, Mink	375	ADF&G
Bear, brown & black	136	ADF&G and others
Black tailed deer	123	ADF&G

Birds

Raptors		
Bald eagle	675	FWS
Peregrine falcon	108	ADF&G
Passerines	10	FWS
Seabird colony surveys	251	FWS
Seaducks	150	FWS and others
Census and Seasonal Dist.	471	FWS
(Technical Services**)		
(Mapping)	792	DNR & FWS and others

*Rank has been derived from the approximate federal expenditures for the second year damage assessment work. The figures are in $K. Alaska state expenditures were not available.

**Mapping is included in this table because of the large area which may need to be monitored. A carefully developed sampling and site selection plan seems a useful tool to control costs, yet provide seasonal coverage. Maps already developed may assist in development of a monitoring scheme.

United States Department of the Interior

NATIONAL PARK SERVICE

ALASKA REGIONAL OFFICE
2525 Gambell Street, Room 107
Anchorage, Alaska 99503-2892

TAKE PRIDE IN AMERICA

IN REPLY REFER TO

Brian

RPWG

Y

TO: Restoration Planning Work Group Members
FROM: Sanford P. Rabinowitch, DOI
SUBJECT: **Natural Recovery (Monitoring)**
DATE: August 15, 1990

The attached rough paper and sample data sheets have been generated by two NPS staff working on the Katmai National Park coastline. They are provided for your concept review.

NPS has interest in playing a significant role in RPWG's natural recovery (monitoring) efforts. No proposal has been prepared but one could be generated consistent with objectives listed in our Technical Support Project Number 3. Such a proposal could then be available for the peer review process we anticipate having in place in the upcoming months.

I am interested in your thoughts about how well this fits into our work group approach. If it does can we allocate some current funding to develop a proposal? NPS staff is available to discuss the potential project subject to their schedules.

cc: Dan Hamson
Cordell Roy

sandy/evos/monitor.1

MONITORING

I. Definitions

The differences between monitoring and research are sometimes blurry. The two processes feed in to and complement one another. In discussing research and monitoring of environmental parameters (whether physical, biological, or ecological) we distinguish between them as follows:

> Monitoring is the process of gathering information. Monitoring protocols vary depending on the type of information required. One can monitor without conducting research.
>
> Research is the process of seeking the answer to a question. One may do this by monitoring or by experimentation. Monitoring or experimental design varies depending on the research question being asked. Environmental experimentation often involves monitoring results over time, since questions usually relate to change in a system.

II. Reasons to monitor

Most Parks believe it is important to monitor resources on their uplands; these resources are indicators of the health of the habitat and the Park is responsible for protecting that health. By asking questions about resources (what are they, how are they distributed, how they change over different time scales) the Park (and through the Park, the public) learns about the interelatedness of ecosystems and the intrinsic functions and values of each system. Through this understanding, a Park is better able to set policy and carry out its preservation mandates.

Another, slightly more philosophical, value is achieved through better understanding the ecosystems within a Park. By increasing understanding, a Park is better able to define its identity. A more defined sense of identity improves a Park's ability to defend its priorities internally by establishing policy and allocating financial resources and externally by solidifying its political presence and ability to justify funding.

III. Reasons to monitor coastal areas

Although Parks are not the land owners of the intertidal and subtidal areas surrounding their lands, the incentives for monitoring the physical and biological resources of their coasts are the same as for monitoring their upland resources. Monitoring provides information about coastal ecosystems and their relationships to upland areas. In our work this summer, bears were seen every day using both rocky and soft sediment intertidal areas. Beaches are highways, literally "freeways", and they sequester food

sources important for spring and summer bear feeding. Bears are frequently seen digging for molluscs and crustaceans, eating drift algae, feeding on carion on the beaches, swimming among islands, feeding on coastal grasses and sedges, playing and cavorting with their young. Their activities are so widespread and frequent, that they may be considered intertidal animals. In addition, wolf, fox, and wolverine tracks are common in long paths and short excursions along beaches and foxes and wolverines were seen on many occasions. Seabirds and eagles nest and feed all along the coast and on offshore islands. Marine mammals are abundant, and their carcasses provide food for bears. All of these animals rely more heavily on the coasts for food and movement than may have been understood previously. Further observations may reveal other interactions.

Although many other agencies have ownership or jurisdiction over coastal resources, the Parks' focus on habitat, and work done so far in Katmai Park, would enable it to take the lead in establishing habitat based coastal monitoring. The Park Service could coordinate an interagency effort that "contracts" the expertise of the various responsible agencies to perform monitoring of their resources, while the Parks take responsibility for the intertidal and subtidal plants and invertebrates that are also indicators of coastal health. Such monitoring would contribute to the understanding of natural variation and natural recovery from catastrophes. This understanding would help determine and focus clean up and/or restoration activities in the event of future catastrophes such as the Exxon Valdez oil spill.

Monitoring the relatively pristine habitats of national parks would be of great value to the scientific and resource management communities in general. Natural variation of marine ecosystems is great and the complex of influences is often difficult to unravel. Natural variation makes the effects of anthropogenically induced change difficult to assess. Research and monitoring in pristine park environments would contribute invaluabley to the understanding of natural variation in many fields.

IV. Expectations of Monitoring programs

Monitoring does not necessarily answer everyone's questions about everything. In fact, monitoring often raises new questions and generates ideas for new research projects or monitoring programs. A monitoring program, however well conceived, funded, and documented, is not a panacaea for all resource management problems. A monitoring program must have certain stable components, but must also be flexible to be able to direct resources to new areas of interest or special studies. In this way, research and monitoring must complement one another.

Monitoring is expensive. Costs include time, equipment, personell, transportation, data management. Different levels of monitoring are required to provide different types of information. Some information is necessary in order to best design a means for gathering other information. Because of the costs and using the levels of monitoring involved, a park should be able to move into a monitoring program in a rational, stepped manner that allows it

to plan ahead and budget for each new phase.

V. Levels of monitoring, addition of research

Different kinds of assessment and levels of effort provide different kinds of information. The costs of one type of effort are not necessarily greater or less than another.

Qualitative assessment is useful to describe habitats, resources, distributions, and often, interactions. Qualitative assessments can help in describing a range of types so that further monitoring will adequately sample from the full range. In a cursory way qualitative assessments can be used to describe temporal differences in abundance if changes are large (presence/absence) and causes are not important.

Quantitative sampling (over time or space) is required in order to determine extent of change. In order for quantitative sampling to furnish statistically significant information in environments as physically and temporally variable as inter and subtidal areas, adequate numbers of replicates must be sampled.

Monitoring connotes sampling over at least time and usually space. Long term monitoring is recommended to keep in touch with the state of a system, and to be prepared to assess the effects of incremental, long term changes such as global warming or catastrophic changes such as an earthquake or oil spill.

The scientific community may be tapped if the desire to perform shorter term research projects arises to answer questions generated by monitoring. The scientific community may itself become interested in conducting research along park coastlines as it becomes aware of park resources. This type of research should be carefully reviewed by the park of interest.

VI. Planning, Coordination, and Implementation

Many agencies have jurisdictions in coastal and marine systems. US Fish and Wildlife is responsible for eagles, seabirds, and otters, Alaska Department of Fish and Game for anadramous fish, shellfish, commercial and sport fish, and bears, National Marine Fisheries Service for marine mammals, nonnn-commercial fish, fish spawning and larval distribution. Alaska Department of Natural Resources owns intertidal and subtidal lands, although they do not currently excercise any management perogative over biological resources in these areas. These interests can be used constructively to garner the expertise and divide the labor needed to monitor the many aquatic, terrestrial, and aquiline resources found in coastal areas. The coastal assessments that are being carried out in Katmai National Park could provide a prototype for coordinating these efforts, and placing the Park Service as the overseer of habitat health. Overintensive activities in coastal areas can be destructive; multi-agency monitoring efforts need to be coordinated from planning to implementation, to data management in order to most efficiently gather information that will be useable.

Not all agencies will need or want to be involved at the same level in monitoring activities. A panel representing interested agenies should be convened to reach aggreement on the mutually beneficial values of monitoring before any interagency monitoring strategy can continue. Efforts to coordinate information in a data management system that is available to all agencies should be considered. (A GIS system is recommended.)

VII. Monitoring marine systems:

We recommend using a species by species approach to monitor large, mobile species such as bears, wolves, foxes, wolverines, marine mammals, sea birds, eagles, and certain fish species. In Katmai, agencies responsible for these species have been requested to perform monitoring to Park standards of their respective responsibilities. Monitoring habitats is recommended to assess smaller and less mobile marine invertebrate, marine and terrestrial plants, and use by the above mobile species. Habitat monitoring has been carried out by the Park Service.

A coastal monitoring program should be as simple, non-disruptive and involve as few people as possible to gather the information desired. The prototype established by the Park Service in Katmai could be used by different agencies to gather information on their own lands. Gathering and documenting information in as comparable a manner as possible will facilitate information sharing and comparative studies. Also, monitoring will bring to light information that should be of interest to interpretive centers, and increase public awareness of the importance of and care needed for coastal areas.

VIII. Our proposal

We recommend:

- that the Park Service, using the prototype begun in Katmia, initiate interagency coordination of expertise in monitoring large, mobile species and take the lead in describing coastal habitats and establishing a model habitat monitoring program. Other agencies may want to adopt Park established protocols for monitoring their resources in their own and other agency's jurisdictions.

- that protocols for the second phase of monitoring continue to be established in Katmai and other parks

- that the Restoration Group fund a feasibility study of a tiered, modular coastal monitoring program for the Parks. Such a study should describe several possibilities that demonstrate the advantages and costs of internal and external coordination and implementation schemes.

Below we set forth a tiered, modular monitoring program, and the rationale for each step. Any and all upland land owners should be able to use this program to monitor their lands. The protocols for the phases that have been carried out along the Katmai coast are described. Additional time and funding would be required to establish protocols for the next phases.

Phase I.

Gather tools needed to conduct coastal survey.
aereal photos
topographical maps
Draw maps

Phase II.

Contract coastal geomorphologist and intertidal biologist to conduct survey
Consider and contract most efficient means of transporting surveyors to coast and amount of support they will need
boat, helicopter, dropoff/camp/pick-up
To extent possible, take advantage of lowest (spring) tides, give boats and crews breaks during high tides

Phase III.

Conduct coastal survey. Geomorphologist maps coast, biologist maps biology at particular sites along the way.
From survey, develop range of geomorphological and biological groupings (habitats). To the extent possible, use habitat descriptions as included below.
How to catalogue/organize...database?
by geomorphological habitats then by site with organisms

Phase IV.

Decide what types of questions are of interest.
what, where, how much/many, change, comparative studies, special questions
Select module from monitoring program based on questions chosen
1) what (has been answered through survey and mapping)
2) where(has been answered through survey and mapping)
3) how much/many (requires return to representative sites and quantitative sampling)
4) change (to detect seasonal or yearly at different levels requires repetitive quantitative sampling at representative sites)
5) comparative studies (design to suit problem)
6) special questions may be submitted to the scientific community for expertise, design, and implementation.Methodologies and sampling should be coordinated with monitoring program
Choose sites that represent habitats from Phase III.

Phase V.

Estimate funds, personel, and equipment at hand and how frequently sampling needs to occur to answer questions posed.
Decide to sample all areas at once or stagger sampling depending on financial/personell/equipment constraints

Phase VI.

Hire coordinator, rangers, consultants, data managers to carry out whatever level of monitoring has been chosen

- survey and mapping
- habitat classification
- interpretive documents
- site selection
- transects
- repeated monitoring

Phase VII.

Comparative studies.

Find geomorphological habitat type in oiled area
Find comparable habitat sites in Katmai
Sample five replicates per zone at each site
for >5 years for hard substrates
>10 years for soft sediment areas

Within Katmai.

Lagoon at north end of Cape Gull:

Sample

What:

- water quality
- clam and echurian tissue

For how long:

- >10 years

Where:

- in oiled zone, midway to center of lagoon, center of lagoon
- first year sample at surface, 3 in, 6 in, 12 in, 18 in, 24 in, 36 in, 48 in.
- select representative levels to be sampled in remaining years

Sample 1

NATIONAL PARK SERVICE SHORELINE OIL ASSESSMENTS					
DATE: 6/14 to 6/16/90 **OBSERVER:** Schoch **SEGMENT:** K09-28-KI02A					
LOCATION: Kinak Bay, west shore to Hidden Harbor					
SEGMENT LENGTH: 22720 meters **IMPACTED LENGTH:** 20 meters					
WIDE	MODERATE	NARROW	VERY LIGHT	NO OIL	TOTAL
0	0	0	20 m	22700 m	22720 m

TYPE OF OIL IMPACT			
SITZ	UITZ	MITZ	LITZ
none	sporadic stain mousse, up to 10 cm diameter	none	none

TREATMENT RECOMMENDATIONS			
EXXON	NPS	TAG	FOSC
not assessed	no treatment		

ECOLOGICAL CONSTRAINTS		
WILDLIFE	OTHER	TREATMENT WINDOW
harbor seals brown bears		N/A

TREATMENT			
BEGIN	END	# BAGS	COMMENTS

SUBSTRATE TYPE				
UPLAND	SITZ	UITZ	MITZ	LITZ
vertical cliff and steep slopes, alders and grass	bdrs and brk,alluv fans	brk cliff snd beach bdr,cob	brk cliff pocket snd beach	same

National Park Service
Shoreline Oil Assessment
Katmai National Park And Preserve

Segment #: K09-28-KI02A

Date: 6/14/90, 6/15/90, 6/16/90

Location: Kinak Bay, west shore to Hidden Harbor

Survey Time: 6/14/90, 1050 to 1600
6/15/90, 1100 to 1400
6/16/90, 1200 to 1400

Tide Height: 6/14/90, +3.59 to +0.50 to +4.99
6/15/90, +5.35 to +1.3
6/16/90, +5.57 to +2.51

General Description: refer to the sketch map for locations of the follwoing geomorphological descriptions. The assessment of this segment began at vertical bedrock cliffs along a cape separating Amalik Bay from Kinak Bay, and proceded north. A general characterization of this shoreline would include: initially long and narrow, boulder and cobbles shores, becoming convoluted with vertical bedrock headlands and sandy pocket beaches. Assessments of vertical sections of shoreline within this segment were from a skiff operated as near to the shore as safely possible. All remaining shorelines were walked, with the noted exceptions (see sketch map). Pocket beaches on the west shore of Kinak Bay were primarily sandy. The sand is of two distinctly different types. Gray to brown, medium grained particles underly tan to white, coarse particles of lower density. These lower density particles are probably of volcanic origin indicated by a very porous morphology and microcrystaline structure. The darker variety originates from the weathering of surrounding bedrock.

A. Exposed, sandy pocket beach

B. Exposed, rocky, steep bedrock. Vertical bedrock cliffs marked the beginning of the segment north and east of the unnamed cape. A small sandy pocket beach followed the cliff section. A small amount of drift debris had accumulated and no oil was observed. Angular boulders and bedrock outcrops formed offshore reefs jutting out to the southeast at the north end of the pocket beach. A 500 m long sandy beach followed with no drift debris and a small amount of drift logs. Then another 500 meters of angular boulder and cobble shore to a prominent vertical sandstone fin or buttress. The following 2700 meters is primarily angular boulders and cobbles with areas of interstitial pebbles. A small amount of oil was found at the southern end of this section. The upland adjacent to the shoreline is a steep slope vegetated with alders and grass. A southeast facing sandy

pocket beach about 200 meters long marks the beginning of a series of headlands and sandy embayments continuing for about 3700 meters. Substrate particle size generally becomes coarser and more angular futher into the bay. Two major streams have developed alluvial fans which have sandstone pebble foreshores and a veneer of white pumice sand. Towards the north a series of avalanche chutes have deposited large volumes of rubble and organics. Snow banks persist at the base of the chutes. This section ends at a large embayment formed by a headland which protrudes east into the bay. Within the embayment, two streams have deposited alluvium which has filled small re-entrants. Pumice sand has also collected here, presumably deposited by a longshore current flowing into the Kinak Bay. The sandy pumice remains unconsolidated and liquified, and does not support a persons weight. Sandstone alluvium is compacted, mixed with angular pebbles and cobbles, and well consolidated. Sand bars and shoaling water were observed about 50 meters offshore, and the skiff was unable to land on the eastern beach due to shallow water and wave exposure. The headland forming this embayment is mostly steep to vertical sandstone with occasional sections of steep angular boulders. Pocket beaches become shorter and narrower but retain the white pumice sand veneer. About 1800 meters north of this headland, a relatively large northeast flowing stream has deposited an alluvial fan of coarse rounded cobbles and pebbles. Below the upper intertidal the substrate becomes mostly angular pebbles and coarse sand. The upper margin of the upper intertidal is marked by a terrestrial grass mat. The following 1600 meters of shoreline is mostly low tide beaches of angular cobbles and boulders with stretches of vertical bedrock walls. An incubating adult bald eagle was observed on the north end of a small island about 300 meters offshore. An alluvial fan of coarse angular cobbles and pebbles, mixed with sand and decaying organics, occupies about 600 meters of shoreline. Numerous brown bears were observed walking through this area over a period of four days. The shore to Hidden Harbor is primarily a low tide beach only with angular boulders, cobbles and pebbles. The narrows into Hidden Harbor has a strong tidal current flow. Above the high tide line throughout this area, are sandstone cliffs. The north and northeast shore of this restricted embayment is an alluvial fan of four dominant stream systems. Several lesser or intermittent streams also flow into the bay but probably do not transport much fluvial material. Pumice sand was observed along the northern shoreline, deposited as a thin layer on coarse angular substrate.

Oil Impact Description: An area about 20 meters long and 4 meters wide with very sporadic spatters of mousse and stain was observed about 40 meters north of the sandstone fin near the entrance to Kinak Bay on the west shore. About 20 spatters were found, of various sizes but about 10 cm in diameter and up to 20 cm long. The oil was found on large angular boulders, sandy interstitial spaces and angular cobbles, all sandstone.

Biological assessment

K0928-02 15-16 June
1990

This segment is moderately to fully protected from wave exposure. Fucus is remarkably frequent and dense in the mid- and upper zones, forming a dense cover, especially on gently sloping surfaces. Patches of bright yellow juvenile plants are common. ussels were also common, attaining large (5-6 cm) sizes; they grew in clusters below Balanus on rock walls or, less frequently, consolidated angular cobble. Much of the subtidal appears to be sandy, with scattered reefs and steep islands and offshore rocks. The water is full of diatoms, hydromedusae, jellyfish, drift Fucus and barnacle moults.

The most striking feature of this segment were the prevalence of barnacles and the extraordinarily abundant sets of barnacle spat throughout the mid- and upper intertidal zones (from Chthamalus dalli through Semibalanus cariosus). From the beginning of the segment to Hidden Harbor, there was virtually 100% cover of blue-grey spat on bare rock, other barnacles, mussels, dead wood, empty shells, small cobble and even some drift Fucus. The majority of the spat were about 3 mm long, but at places, there were 3-4 sizes, ranging from 1-4 mm. Spat were absent only on very mobile cobble and on rock directly bathed in freshwater. In Hidden Harbor, our observations took place at high tide; there was an extensive cover of tan spat in the upper zone.

1. Verical bedrock walls, stable large boulders and pinnacles. Distinct and wide (up to 1.5 m in places) Verrucaria zone. Many terrestrial lichens just above (Caloplaca, Umbilicaria, yellow, white, green, pink, etc.) or sometimes overlapping with Verrucaria on tumbled boulders. Broad barnacle zone with narrow band of Chthamalus (appearing white) above, and 2 m of Balanus, with Fucus, Gloiopeltis and Endocladia, usually in small patches. In sheltered areas, particularly those with freshwater runoff, epiphytic ectocarpoid browns (probably including Pilayella) are frequent. Porphyra grows on slightly more exposed points and on sand-influenced boulders, with Acrosiphonia. Limpets and littorines; occasional Siphonaria. Small aggregation of pink nemertean worms noted once on barnacle spat. Mussels in dense clusters or forming a band, usually grey with spat; mortality generally low, except in localized areas. At one beach, there was a marked and recent die-off in Semibalanus at the bottom of walls terminating in a sandy pocket beach, possibly from sand inundation.

Fucus extends down into the Alaria zone, especially on sloping boulders. Dense juvenile Alaria, often frayed. Semibalanus under Alaria, with numerous Nucella lamellosa; also thick swaths of Pterosiphonia, sometimes forming a conspicuous band; Palmaria callophylloides, Acrosiphonia arcta, Chaetomorpha/Rhizoclonium in wooly skeins, yellow-green Halosaccion (on sloping surfaces among Fucus), and, furthest down, Ptilota. Evasterias and Dermasterias frequent at water's edge. One Solaster (not identified to species) observed from

skiff.

2. Cobble. Large patches of Gloiopeltis, sometimes eroded back to a thin brown crust, occurs on higher, more stable and larger rocks and slabs. Lower, angular cobble is occasionally matted with mussels in the mid-zone and sprinkled with spat. Amphipods, limpets and juvenile mussels occur under cobble. Mobile, rounded cobble is often associated with sand and ephemeral green algae (ulvoids, filaments). Green algae are also present are common in freshwater streams, even on mobile substrates.

3. Sand. The sand, rich in pumice, is deep and light, especially in areas of accumulation against bedrock.

National Park Service

Shoreline Oil Assessment

Observer: ....Schoch..... Zone: ....Kodiak.....Segment #: .K09:28-K1002.

Date: ...6/14/90 .. 6/15/90.... Place: ...KINAK BAY.. WEST Shore.....

Time: .1050-1600 ...1100-1400.... Tide Height:.....Segment Length: .227.29..me

Weather: (cloudy) sunny fog (rain) (windy)

Observations from: (ground) (vessel) SCAT helicopter

Upland Description: (bedrock) rubble alluvial fan grass forest (alders/willows) marsh lagoon pond (bluff)

Upland Slope Angle: low medium (high) vertical

Intertidal Slope Angle: low (medium) (high) vertical

Wave Exposure: low medium high Wave Type: swell (cresting) breaking no

Length of Beach:.....meters Width:.....meters

Impacted Area (length)

Total length of impacted area:.....20.....meters

Wide: >6 m and >50% oil cover.....meters

Moderate: 3 m to 6m and 10% to 50% oil cover.....meters

Narrow: <3m and >10% oil cover.....meters

Very Light: <10% oil cover regardless of width (splatters)...20.....mete

Subsurface Oil Assessment

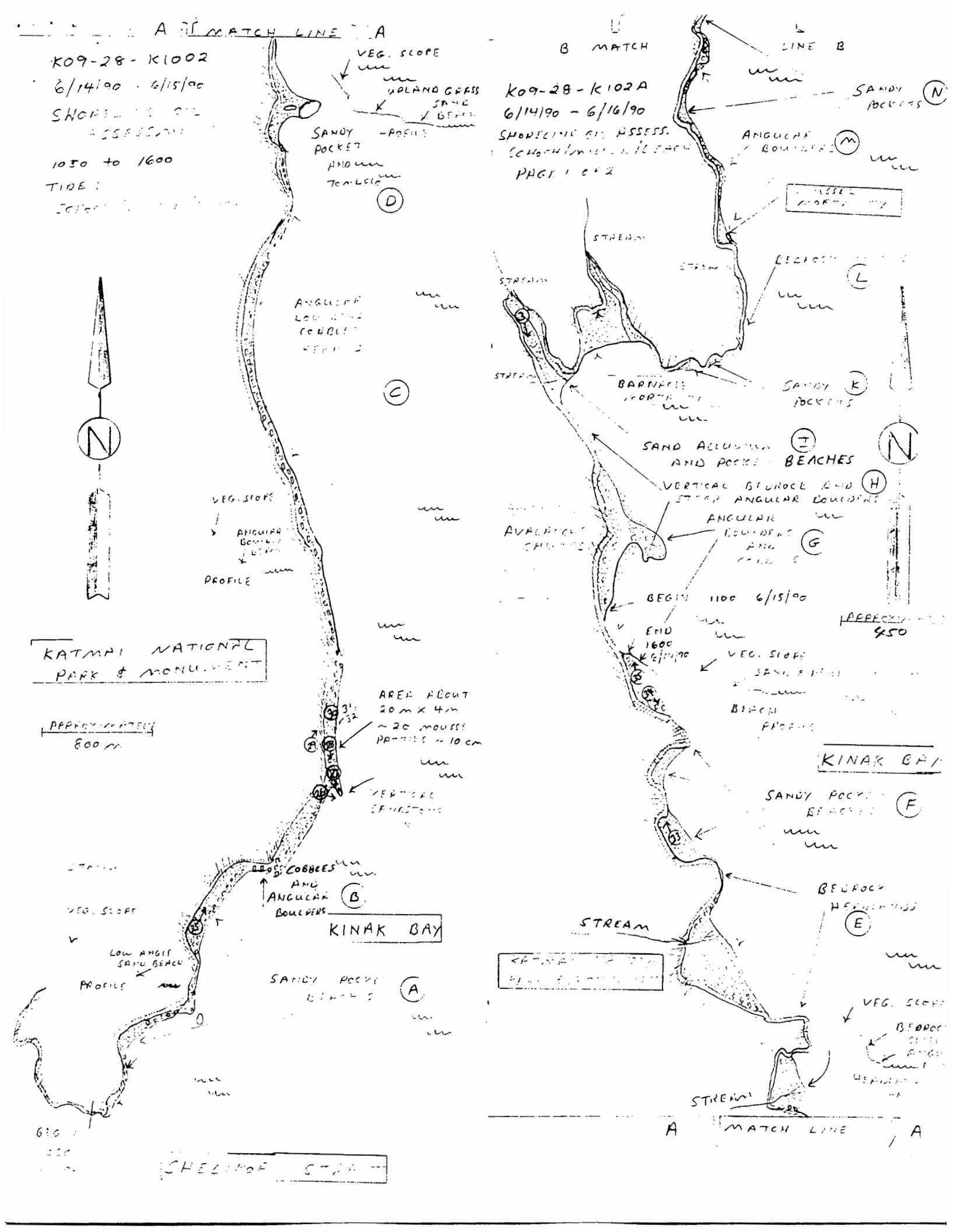
Pit #	Oil Type	Matrix Size	Intertidal Pit Location	Oiled Depth Interval	Pit Depth	% Sedimer Saturati
1	N/O	PITS	DUG			
2						
3						
4						
5						
6						
7						
8						

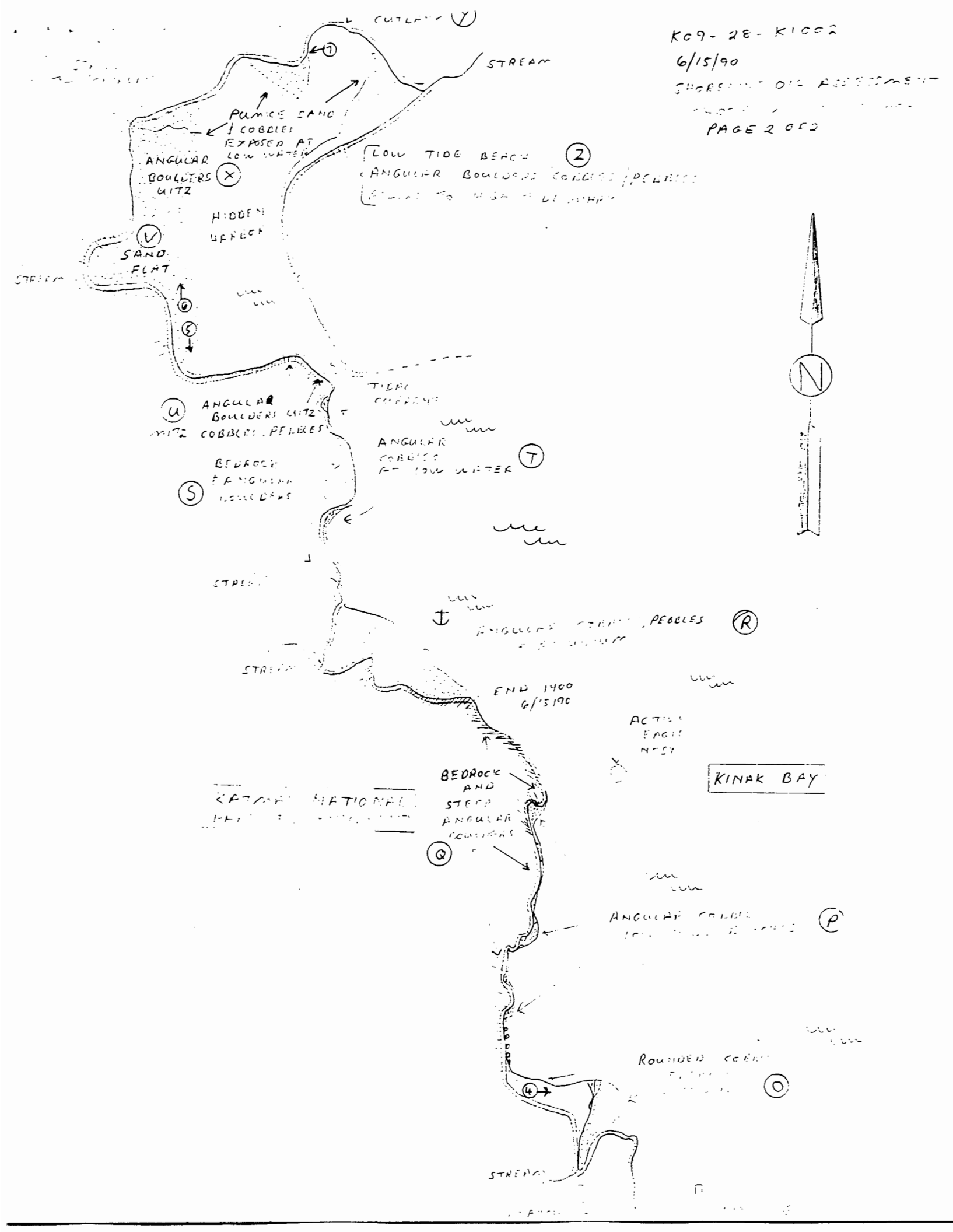
Middle Intertidal Observer: ...Schoch..... Segment #: K99:29:K100

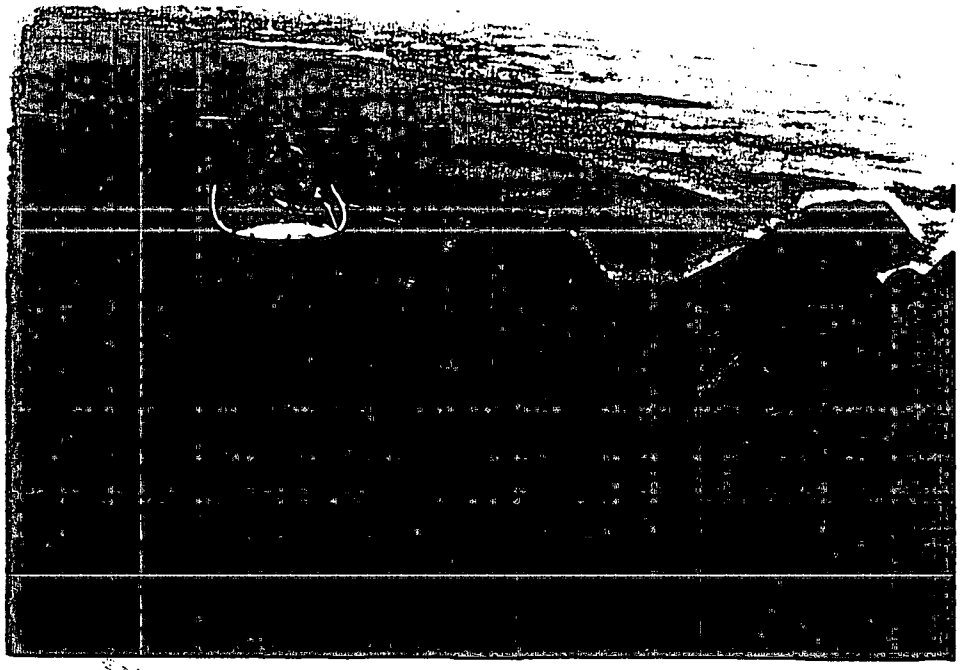
Substrate	%	oil type	continuous	broken	patchy/numerous	sparse
bedrock	40	asphalt				
		pooled				
boulder	40	cover				
		coat				
cobble	10	stain		NO	OIL	
		mousse				
pebble	5	patties		OBSERVED		
		tarballs				
sand	5	sheen				
		logs				
silt/mud	0	plastic				
		dead algae				
organics	0	dead wildlife number and type	0			

Lower Intertidal

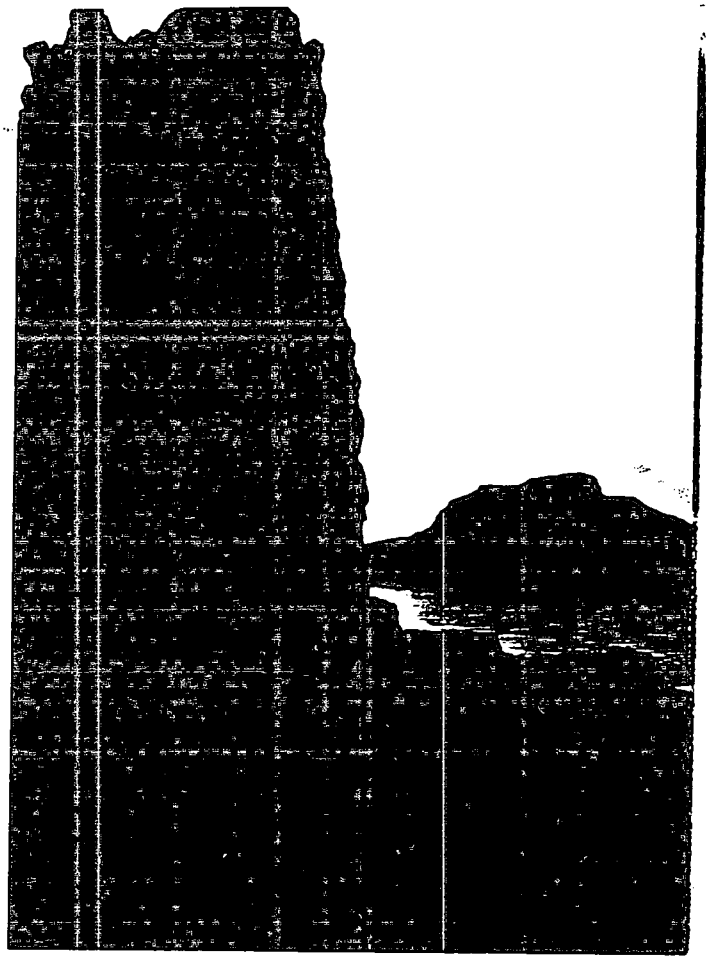
Substrate	%	oil type	continuous	broken	patchy/numerous	sparse
bedrock	40	asphalt				
		pooled				
boulder	40	cover				
		coat				
cobble	10	stain		NO	OIL	
		mousse				
pebble	5	patties		OBSERVED		
		tarballs				
sand	5	sheen				
		logs				
silt/mud	?	plastic				
		dead algae				
organics	?	dead wildlife number and type	0			

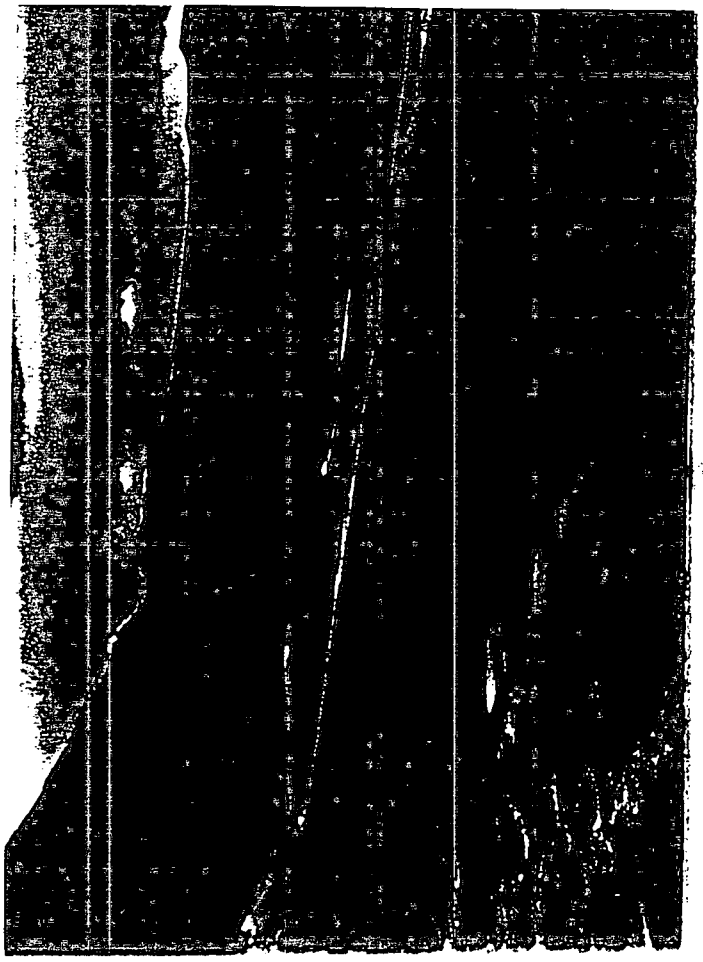

A MATCH LINE A
K09-28-K1002
6/14/90 - 6/15/90
1050 to 1600
TIDE
VEG. SLOPE
UPLAND GRASS
SANDY POCKET BEACH
PROFILE
D
ANGULAR COBBLE
C
N
VEG. SLOPE
ANGULAR BOULDERS
PROFILE
KATMAI NATIONAL PARK & MONUMENT
APPROX. 800 m
AREA ABOUT 20 m X 4 m ~ 20 MOUSSE PATCHES ~ 10 cm
VERTICAL BEDROCK
COBBLES AND ANGULAR BOULDERS
B
KINAK BAY
VEG. SLOPE
LOW ANGLE SAND BEACH
PROFILE
SANDY POCKET BEACHES
A
SHELIKOF STRAIT
B MATCH LINE B
K09-28-K102A
6/14/90 - 6/16/90
SHORELINE OIL ASSESS.
PAGE 1 OF 2
SANDY POCKETS
N
ANGULAR BOULDERS
M
STREAM
L
BARNACLE
SANDY POCKETS
K
SAND ALLUVIAL AND POCKET BEACHES
J
N
VERTICAL BEDROCK AND STEEP ANGULAR BOULDERS
H
ANGULAR BOULDERS AND
G
BEGIN 1100 6/15/90
END 1600 6/14/90
APPROX 450
VEG. SLOPE
SAND BEACH
BEACH PROFILE
KINAK BAY
SANDY POCKET BEACHES
F
BEDROCK
E
STREAM
VEG. SLOPE
BEDROCK
STREAM
A MATCH LINE A


STREAM
PUMICE SAND
COBBLES EXPOSED AT LOW WATER
ANGULAR BOULDERS MIXED
HIDDEN REEF
SAND FLAT
STREAM
LOW TIDE BEACH
ANGULAR BOULDERS COBBLES PEBBLES
TIDE CURRENTS
ANGULAR BOULDERS MIXED COBBLES PEBBLES
BEDROCK ANGULAR BOULDERS
ANGULAR COBBLES AT LOW WATER
N
STREAM
ANGULAR PEBBLES
STREAM
END 1400 6/15/90
ACTIVE EAGLE NEST
KINAK BAY
BEDROCK AND STEEP ANGULAR BOULDERS
ANGULAR
ROUNDED
STREAM




MINOLTA





Sample 2

NATIONAL PARK SERVICE SHORELINE OIL ASSESSMENTS					
DATE: 7/11/90 **OBSERVER:** Schoch			**SEGMENT:** K09232-CG.03A		
LOCATION: Katmai, Cape Gull outer coast					
SEGMENT LENGTH: 4050 meters			**IMPACTED LENGTH:** 157 meters		
WIDE	MODERATE	NARROW	VERY LIGHT	NO OIL	TOTAL
0	12 m	15 m	130 m	3893 m	4050 m

TYPE OF OIL IMPACT			
SITZ	UITZ	MITZ	LITZ
none	pooled mousse, cover, coat, stain	none	none

TREATMENT RECOMMENDATIONS			
EXXON	NPS	TAG	FOSC
no treatment see SSAT assess.	remove pooled mousse from 1m x 5m area in crevice		

ECOLOGICAL CONSTRAINTS		
WILDLIFE	OTHER	TREATMENT WINDOW
brown bears harbor seals		open

TREATMENT			
BEGIN	END	# BAGS	COMMENTS

SUBSTRATE TYPE				
UPLAND	SITZ	UITZ	MITZ	LITZ
vertical cliffs from 5 to 40 meters high, alders and grass	cliffs	mostly boulders	mostly boulders, ledges	mostly boulders and ledges

National Park Service
Shoreline Oil Assessment
Katmai National Park And Preserve

Segment #: K09-23-CG.03A (and CG.02A appended)

Date: 7/11/90

Location: Katmai, Cape Gull outer coast

Survey Time: 0800 to 1400

Tide Height: +6.74 to -1.2 to +3.85

General Description: refer to sketch map for locations of geomorphological descriptions:

CG.03A

A. Exposed, pocket beach with sub-angular boulders at waterline and extending into the LITZ. Rounded boulders in the UITZ and a rounded cobble berm mixed with dead kelp. Except for the berm, sand is present throughout the intertidal area in interstitial spaces.

B. Exposed, rocky, large angular boulders, interstitial voids.

C. Exposed, rocky, rounded boulders and cobbles on bedrock terrace, very large sub-angular boulders scattered throughout this area.

D. Exposed, pocket beach of angular cobbles and rounded pebbles with a matrix of sand throughout. This beach is unusual in that it is completely encircled and protected by bedrock. The upland is a steep cliff face about 10 meters high which curves to protect the ends of the beach. The outer edge of the beach has a bedrock and boulder reef oriented parallel to the shoreline. The reef is about 1 - 2 meters high and is completely submerged only at high tides. The remaining intertidal seaward of the reef is about 50 meters wide at low tide and mostly large sub-angular boulders and occasional stacks through the MITZ.

E. Exposed, rocky, large angular boulders. Upland cliffs have large vertical crevices opening to the east. These have rounded boulders and cobbles tightly packed with pebbles and some sand. The end and sides of the crevices are rapidly eroding sandstone.

F. Exposed, continuous linear beach of sand and large rounded boulders covering a bedrock terrace. The upland is a 5 meter sandstone cliff topped by grasses and alders. A stream flows over the cliff, cascading down a bedrock ledge and over the sandy beach substrate.

G. Exposed, rocky, large angular boulders piled at base of 15 meters cliff.

H. Exposed, pocket beach with rounded boulders in the MITZ, rounded cobbles through the UITZ and forming a loosely packed berm.

I. Exposed, rocky, large angular boulders with interstitial voids. The north end of this section is an exposed bedrock point which gradually submerges to a reef that extends offshore about 1000 meters to several islands.

J. Exposed, pocket beach with rounded boulders through the MITZ and rounded cobbles in the UITZ and storm berm. the berm is piled against the cliff base.

K. Exposed, rocky, bedrock terrace, columnar jointing, large sea cave present and to the north the terrace is convoluted with numerous cavities and pockets.

L. Exposed, small pocket beaches above the bedrock terrace and only in the UITZ, composed mostly of rounded cobbles and pebbles forming a berm covered with drift logs.

M. Exposed, rocky, steep bedrock headland topped by unconsolidated sediments covered with grass.

CG.02A

N. Sheltered, pocket beach and tidal flat. The UITZ is mostly angular cobbles and boulders bedded in pebbles and sand. The MITZ is a sandy tidal flat. The angular cobbles increase in size to the northwest and decrease in angularity.

O. Sheltered, tidal flat. Sand deposited over cobbles below the zone described above, eel grass and organic mud occurs in the lower MITZ and LITZ.

Oil Impact

D. Spatters of oil mousse were found beginning about 100 meters south of this pocket beach. The spatters occured mostly on large boulders and cobbles. An arch just south of the pocket beach has several very large boulders at the base. Mousse patties were found here in interstitial spaces, the oil still fluid, brown and sheening. To the north of the arch, in bedrock crevices opening to the north and to the pocket beach, oil mousse was observed as a weathered stain and coating on boulders and cobbles and in the sandy matrix. Mousse patties are sporadically scattered throughout the angular cobble beach area but have sediments entrained and would be difficult to remove. The north end of the pocket beach has very large sub-angular boulders with oil mousse in pocks and fracture cracks. This would also be very difficult to remove. The area is exposed to high wave energy at times of

high water and the oil will continue to weather and degrade. The reason the oil has persisted through the first year is probably due to the parallel reef which protects the beach somewhat and attenuates wave energy.

E. Pooled mousse was found deep in the interstitial spaces of boulders and cobbles within narrow re-entrants oriented easterly. The oil was about 5 cm thick and lying over a sandy layer. The largest patch was about 1m x 5m and a more sporadic area of 1m x 20 m within the crevice. The northerly crevice has pooled mousse under a large boulder, the oil covering an area about 1m x 2m. This oil could be removed manually without disturbing the substrate. If allowed to remain the oil will probably persist unchanged for a long time considering the minimal weathering evident afetr the first year.

N. The oil in this area has been described by the SSAT reports.

K09-23-CG003

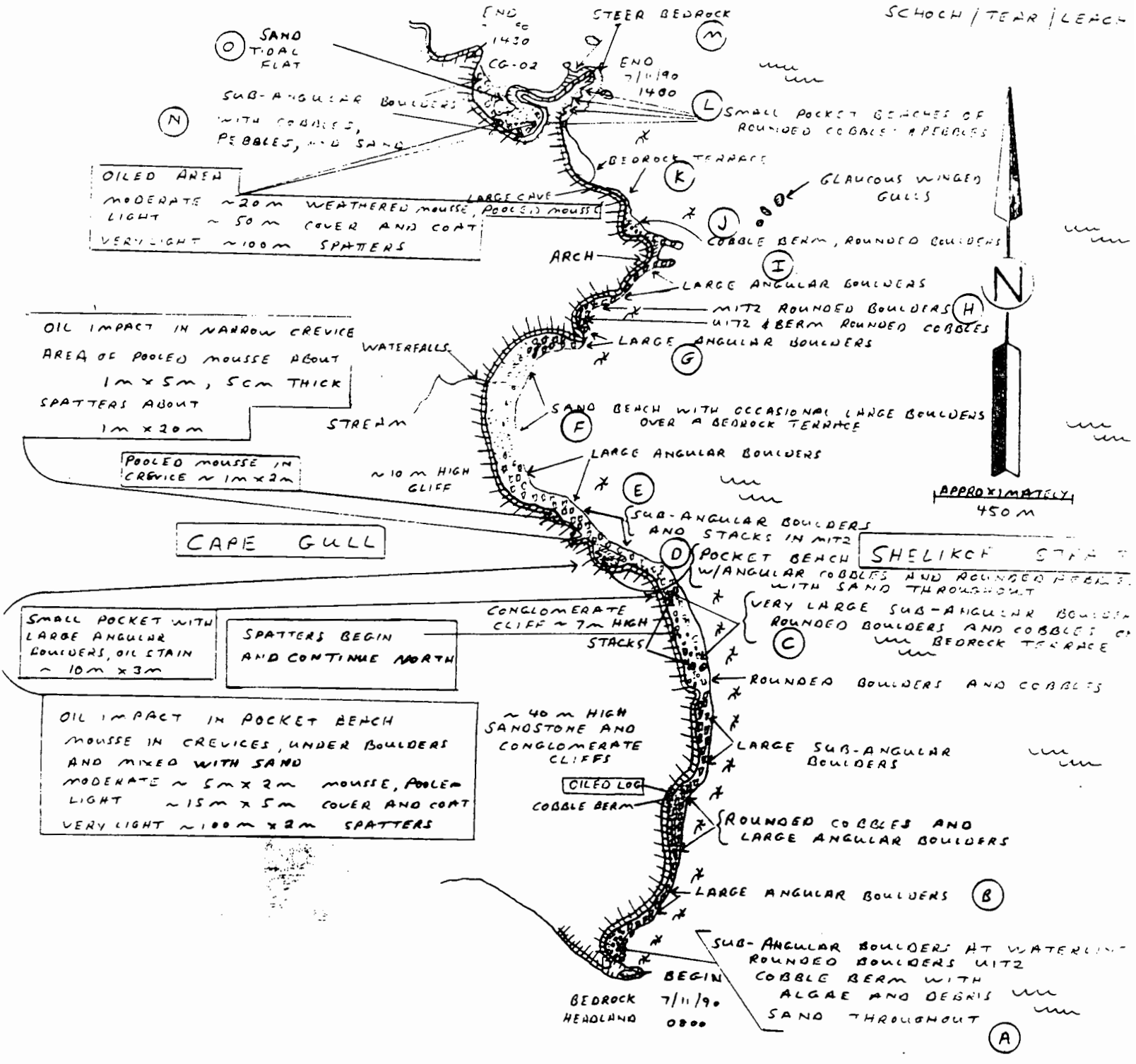
K09-23-CG002

7/11/90

SHORELINE OIL ASSE

SCHOCH / TEAR / LEACH

KAFLIA BAY



National Park Service

Shoreline Oil Assessment

Observer: Schoch Zone: Kodiak Segment #: K09-23-CG003

Date: 7/6/90 Place: Katmai, Cape Gull

Time: 0800 - 1400 Tide Height: +6.7 to +3.5 to -1.2 Segment Length: 405.0 m

Weather: (cloudy) sunny fog rain windy

Observations from: (ground) vessel helicopter

Upland Description: (bedrock) rubble alluvial fan grass forest alders/willows marsh lagoon pond (bluff)

Upland Slope Angle: low medium, high (vertical)

Intertidal Slope Angle: low (medium) high vertical

Wave Exposure: low medium (high) Wave Type: swell cresting breaking (nc

Length of Beach: .....meters Width: .....meters

Impacted Area (length)

Total length of impacted area: 157 meters

Wide: >6 m and >50% oil cover.... 0 meters

Moderate: 3 m to 6m and 10% to 50% oil cover..... 12 meters

Narrow: <3m and >10% oil cover..... 15 meters

Very Light: <10% oil cover regardless of width (splatters).. 130 mete

Subsurface Oil Assessment

Pit #	Oil Type	Matrix Size	Intertidal Pit Location	Oiled Depth Interval	Pit Depth	% Sedime Saturat
1						
2						
3						
4						
5						
6						
7						
8						

K09-23-CG003, K09-22-CG002 11 July 1990
Cape Gull and north to Kaflia Bay
Tide height: +2.4 to -.8 to +1.4

This section of the coast is largely fractured, rocky headland with pocket beaches of boulders and cobble (see geomorph. description). The cliffs and terraces are spectacular to view, and the lower intertidal abounds with invertebrate life. Many species of algae are also found, though plant size and abundance is not as astounding as on low, wide wave-cut terraces. The number of pools and terraces is low along the segment; water is often funnelled into crevices or shoots between hard substrate fingers with considerable force. Some areas are devoid of algae; cobble bashing is probably not infrequent.

Upper intertidal algae include, in order of abundance, *Fucus, Porphyra, Myelophycus, Gloiopeltis, Palmaria callophylloides, P. hecatensis, Halosaccion.* In the mid intertidal and pools, the above can be found along with *Odonthallia, Neorhodomela, Soranthera, Ulva,* and corallines. In some midintertidal areas, *Iridaea heterocarpa, Analipus, Chordaria, Chaetomorpha, Ralphsia, Mastocarpus.* In lower areas and in pools, *Alaria taeniata, Laminaria groenlandica.* In deep, lower pools, the above with *Cymathere triplicata.* Especially in lower pools, or on wave cut terraces, all of the above may be found growing together.

The animal community is quite diverse. Clear zonation is marked on the shore, and the evenness of the upper and lower bounds of each zone may indicate regularity of physical and biological processes. A rich echinoderm community (abundant, large *Evasterias, Dermasterias, Pycnopodia, Solaster*) keeps mussels small and high, but rich seas and good flow make juvenile mussels plentiful. *Henricia* also roams the lower intertidal and urchins (*Strongylocentrotus drobachiensis*) nestle in crevices on corallines. Filter feeders are abundant; a great diversity of anenomes can be found (*Tealia, Haliplanella,* many species of *Metridium*), spirorbid worms, sabellids, large and small barnacles, and mussels. Not all space is covered by barnacles, and a healthy community of limpets, chitons (*Katharina, Tonicella*), siphonaria (*Siphonaria thersites*), and pulmonates (*Onchidella borealis*) grazes. Littorines are also abundant, especially on drift algae caught amongst large cobble boulders. Other gastropods include *Nucella canaliculata?, N. lamellosa, Amphissa, Margerites.* Nemerteans (*Emplectonema, Amphiporus, Tubulanus*) are plentiful on barnacles and under cobbles. Sponges (*Halichondria, Haliclona*) can be found, but not in the abundances of wave-cut terraces. Bryozoans (*Dendrobeania* especially on rocks and *Alaria* holdfasts; *Membranipora* on *Alaria* and drift *Laminaria*) and hydroids can be found in patches. In one small, sandy lagoon, (CG002) echiurans and *Macoma balthica* were numerous. Shells of *Mya arenaria, Clinocardium, Saxodomus,* and *Hiatella arctica* were strewn on the sand.

1) A) Cobble beach put in: magnificent headland immediately to south, very clear zonation on north face. Barnacles abundant on

some cobble/boulders, *Fucus* light and sparse, littorines abundant, *Pterosiphonia* low. Not all rocks are covered; lower areas especially are smooth and polished. Drift along beach includes rich assortment of offshore algae: *Laminaria dentigera, L. groenlandica, Agarum, Alaria, Nereocystis, Cymathere, Pleurophycus, Desmarestia, Odonthallia washingtoniensis.*
2) Rocky headland/angular boulders: On north face, light *Myelophycus, Porphyra* to the *Alaria* zone. Abundant, very tiny mussels.
3) B,C,D) Embayments: long, frondy *Acrosiphonia* with *Palmaria hecatensis* and *P. callophylloides. Cymathere triplicata* growing in pools with *Alaria*, corallines.
4) E) Large angular boulders: *Halosaccion* and *Gloiopeltis* sparse in higher zones with varying *Fucus* cover. Limpets, littorines. Middle to low; large limpets, *Pagurus* in bryozoan covered *Nucella* shells. *Haliplanella, Siphonaria, Onchidella, Katharina* crawling through large *Semibalanus.* Low in pools: juvenile mussels, corallines, *Porphyra, Pterosiphonia, Alaria, Cymathere, Tealia.* Small *Metridium,* brown with white "ring" at base of tentacles and small white tip. Also brown anenome (red/green?) with brown oral disc and tentacles, *Leptasterias,* spirorbids, *Anthopleura artemesia,* and some *Nucella lamellosa.*
5) Terrace before beach: *Iridaea heterocarpa* abundant, green, fertile, with spoonweed in pumice and shell bottomed pool. Corallines growing on *Neorhodomela, Odonthallia, Colpomenia bullosa, Soranthera, Chordaria* in small patches. Erect corallines, long *Porphyra,* patches of *Ralphsia, Chaetomorpha, Mastocarpus. Margarites pupillus,* many small purple sabellids.
6) F) Sandy beach with long, low *Alaria* covered fingers extending southeast in sand, boulders in low intertidal. Waterfall and mouth of stream carve furrows and create small sand bars on beach: On rocky fingers and boulders; juvenile mussels, good barnacle cover, *Dendrobeania, Emplectonema, A. artemesia. Myelophycus, Palmaria hecatensis, Fucus, Acrosiphonia, Ulva, Enteromorpha.* In sand, slurpy tube weed. Abundant drift caught on bars and against boulders on north end of beach: *Laminaria dentigera, L. groenlandica, Alaria, Agarum, Odonthallia washingtoniensis, Desmarestia, Nereocystis.*
7) G) Large boulders with flat pools: *Analipus, Fucus,* spoonweed, *Odonthallia, Neorhodomella, Iridaea heterocarpa* in pools. In pools and on rocks, *Metridium, Haliplanella, Halichondria, Haliclona, Leptasterias, Dendrobeania, Margerites, Amphissa, Almagorda, Katharina, Evasterias, Tonicella, N. lamellosa* huge, *N. canaliculata* abundant, *Henricia,* small red *Musculus discors* type mussel on *Odonthallia* and *Alaria,* clinging by soft, white, wormy byssal thread. *Emplectonema, Amphiporus* abundant on barnacles. *Saxodomus* shells in pools.
8) K) Narrow, high, rocky bedrock terrace, drops abruptly to depth: *Rhodochorton* on cliff face with fresh water permeation. *Porphyra* on seaward edge of terrace, high with some *P. hecatensis* lower. In *Alaria* zone below, abundant echinoderms: huge *Pycnopodia, Evasterias,* all sizes *Solaster, Dermasterias.* Four types of *Metridium* in a few clustered pools: Large orange with white tentacles; very small white; brown with orange disc, white

tentacles; brown with very ruffly white tentacles. *Strongylocentrotus droebachiensis* abundant in crevices and pools with spirorbids, sculpin, *Tonicella*, *Haliclona permollis*, *Eudistylia*, small purple sabellids.

CG.002A

Small, sandy lagoon: Echiurans and *Macoma balthica* numerous. Shells of *Mya arenaria*, *Clinocardium*, *Saxodomus*, sand dollars, and small *Hiatella arctica* strewn on the sand.

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U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT

OFFICE OF ENVIRONMENTAL PROCESSES AND EFFECTS RESEARCH
WASHINGTON, DC 20460
USA

FACSIMILE TRANSMISSION COVER SHEET

DATE: 8/29/90 NUMBER OF PAGES: 10
(including this cover sheet)

TO: Brian Ross TELEPHONE NO: 271-2464

OFFICE: RPWG FAX NO: 8-868-2467

FROM: Ken Hood TELEPHONE NO: 8-382-5976

OFFICE: ARTFO

MESSAGE: Brian; Here is the document I discussed with you - a first draft of the monitoring process. It included Conrad's Klevenos remarks. No time schedule is included. Comments, Changes, suggestions etc welcome! Not added but should be included ~~post~~ perhaps is some Public Participation

Ken Hood

FAX MACHINE: (202) 382-6370
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MDPC/2/90

- First page - more to follow -

-DRAFT-

PROPOSED MONITORING PROCESS PLAN FOR PRINCE WILLIAM SOUND

1. What needs to be considered for a monitoring effort?

Objective of the monitoring

- Recovery
- Restoration

Populations to monitor

- minimum number
- optimum number
- list by species?
- list by habitat?
  - marine
  - coastal/near coastal
  - terrestrial

Intangible values to monitor

- recreation
- archeology

What end points to monitor

- life cycle?
- presence or absence of specie/habitat
- measure fishery landings (commercial, sport) and not total population
- measure total population and net change with time
- set monitoring end points differently for each specie/habitat?

Periodicity of measurements; attach to life cycle? by calendar or time period i.e. annually etc.?

Sunset dates: vary with specie? situation?

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2. How should the process be put in motion?

Establish need and interest among as many as possible. Develop an early concept paper to stir discussion and interest.

Identify scientist/technicians/resource managers and their affiliations with special expertise for each different area of monitoring interest

Use of a Technical Workshop to develop detailed plans, structure and schedule

Determine workshop attendees, location and time of meeting, "official sponsorship", duration, product, budget needs,

Determine costs and source of support

-DRAFT-

ACTIVITY SEQUENCE FOR DEVELOPING THE MONITORING PROCESS

Proposed sequence of events for the planning process:

1. Pre-planning within EPA

Discuss proposal to develop a monitoring scheme with Armstrong, Ross, Nadeau, others (now underway)...need to devise a method for engaging Alaska at earliest stage. Avoid a 'invented at EPA image'.

Hood develop a draft "strawman" plan and schedule for process and work shop (also now in draft preparation).

Strawman document circulated to Armstrong, Ross, Nadeau, others within EPA for comment and revision. Early on, Torok and Ross 'float' the concept and need with Alaska and through RPWG. Engender interest and participation where ever possible. Probably useful to address need for monitoring and avoid policy and budget aspects at the early stages

Individual and /or conference calls to update progress, determine next actions, or reconcile views if needed

Revise draft document preparatory to unofficially circulating it to scientists and others in the trustee departments and to Alaska officials. Introduction at the technical level to people on the scene should spark some worthy changes and engender a broader sense of participation.

2. Broader planning with others.

Present document to a select list of specialists for comment and suggested revision. The goal is to develop as good a monitoring concept as possible, preferably with some elasticity and options, and to de-emphasize cost until a responsive plan has been devised.

Revise and insert comments and changes as needed from technicians and others.

3. Development of a technical workshop to plan the details of a monitoring effort

Central to developing a detailed monitoring program would be a technical planning workshop. The goal of the workshop would be to identify and devise the detailed monitoring plan to reveal the rate of recovery for each specie/habitat which was judged injured or in need of restoration and to evaluate the effectiveness of the restoration processes designed to enhance recovery. The workshop would identify the "lead" personnel

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(and/or agency, department, state) who would conduct the monitoring, and would estimate the duration and cost of each segment of the proposed activity. A possible reporting scheme for the monitoring results would be proposed during these discussions. This is presently envisioned as a relatively small meeting of 25-35(?) people.

Separately, but in concert with the lead participants of the monitoring effort, a plan should be devised as to who pays for what, identify any serious shortfalls between the plan and funding/FTE available, and propose a strategy for either reducing the plan or providing the needed additional resources. This group is envisioned as a very small number (5-7) (?) of people.

After the technical workshop, there will probably be a cycle of approvals needed for the proposed actives.

4. Monitoring

Schedule implementation of the planned field monitoring as early as feasible. These activities will come into focus more readily as we progress through some of the above activities.

First-Cut proposed Candidate for monitoring

SPORT/COMMERCIAL FISH LIST

			Sport	Commercial
Oncorhynchus gorbuscha	X	Pink Salmon	S	C
O. kisutch	X	Coho Salmon	S	C
O. tshawytscha	X	Chinook Salmon	S	C
O. nerka	X	Sockeye Salmon	S	C
O. keta		Chum Salmon	S	
Hippoglossus stenolepis	X	Pacific Halibut	S	C
Sebastes		Rockfish	S	
S. ruberrimus		Yelloweye Rockfish		
S. ciliatus		Dusky "		
S. melanops		Black		
Sebastolobus spps.		Rockfish	S	
Salvelinus malma	X	Dolly Varden Char	S	C
Oncorhynchus clarki		Cutthroat Trout	S	
		Steelhead Trout		
Ophiodon elongatus		Lingcod	S	

OTHER SPECIES CAUGHT

Clupea harengus	X	Pacific herring	C
		lingcod	
		pollock cod	
		sculpin	
		skate	
		octopus	
		flounder	

BIVALVE MOLLUSC

Clinocardium nutalli		Cockle
Protothaca stminea	one of these	Littleneck Clam
Saxidomus giganteus		Butter Clam

CRABS

	X	Dungeness Crab
one of these		Brown King Crab
		Red King
		Blue King
		C. bairdi

VEGETATION SPECIES (Vegetation Catagories)

- X Eelgrass
- X Fucus
- X Kelp
- X Large brown kelp

X = candidates for monitoring

BOTTOM AND SHELLFISH WHICH SUPPORT COMMERCIAL FISHERIES

Pot Fisheries

X King Crab
X Dungeness Crab
X Tanner Crab

Trawl and Pot Fisheries

X Sidestipe Shrimp

Long Line, Trawl and Jig Fisheries

X Halibut
Pollock
Sablefish
X Pacific Cod
Dover Sole
Flathead Sole
Arrowtooth Flounder
Rockfish

2-4 of this group

CLAMS OUTSIDE PRINCE WILLIAM SOUND

X Littleneck
Cockle
X Butter
X Razor

MARINE MAMMALS

Humpback Whale	Megaptera novaeangliae
Killer Whale	Orcinus orca
Sea Lion	Eumetopias jubatus
Harbor Seal	Phoca vitulina richardsi
X Sea Otter	Enhydra lutris

TERRESTRIAL ANIMALS

Sitka Blacktail Deer	Odocoileus hemionus sitkensis
Black Bear	(sought but none captured)
Brown Bear	Ursus arctos
River Otter	Lutra canadensis
Mink	Mustela vision

CARNIVORES AND SMALL MANNALS NOT LISTED ABOVE

Fox
Wolverine
Wolve
Marten
Weasel

BIRDS

Seabird Colony Survey of the PWS
xBald Eagle
yPeal's Peregrine Falcon
XMarbled Murrelets
XStorm Petrels
xBlack-legged Kittiwakes
XPigeon Guillemots
XGlaucous-winged Gulls
xSea Ducks:
Harlequin Ducks
Barrow's Goldeneyes
White-winged Scoters
Surf Scoters
? Shorebirds (estimated PWS population=half million)

Earlier list of lead agencies and possible elements for monitoring.

CANDIDATE COMPONENTS AND AGENCIES FOR MONITORING
AGGREGATED BY ENVIRONMENTS AND BIOLOGY
(LISTING PRESENTED IN APPROXOMATE DECENDING ORDER OF IMPORTANCE)*

Component	Agency
Coastal habitats	USFS/ and others
Near coastal habitats Subtital sediments etc	NOAA & Alaska
Fish/Shellfish	
Salmon (all species)	ADF&G
Herring	ADF&G
Crab (all species)	NOAA
Spot Shrimp	ADF&G & NOAA
Clams	ADG&G
Marine Mammals	
Sea otter	FWS
Whales, Killer & Humpback	NOAA
Sea lion, Harbor seal	NOAA and others
Terrestrial Mammals	
River otter, Mink	ADF&G
Bear, brown & black	ADF&G and others
Black tailed deer	ADF&G

Birds

Raptors	
Bald eagle	FWS
Peregrine falcon	ADF&G
Passerines	FWS
Seabird colony surveys	FWS
Seaducks	FWS and others
Census and Seasonal Dist.	FWS

(Technical Services**)

(Mapping)	DNR & FWS and others

*Rank has been derived from the approximate level of federal expenditures for the second year damage assessment work.

**Mapping is included in this table because of the large area which may need to be monitored. A carefully developed sampling and site selection plan seems a useful tool to control costs, yet provide reasonal coverage. Maps already developed may assist in development of a monitoring scheme.

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ISSUES

- Recovery / Effectiveness
  ~~vs~~ (Specie x ~~x~~ species) vs Ecosystem
- ~~vs~~ Qualitative vs Quantitative
- Objectives
- Def. of Recovery

(Monitoring vs Research
↓ measuring dynamics using accepted approaches
↓ novel ground)

Policy issue – does ~~monitoring~~ restoration monitoring ~~stop~~ when "recovery" has been achieved, or is it ongoing for injured resources?
and: Now vs after settlement?

- Habitat, Populations, ~~Species~~, Oil?

Need for Consistent protocols, QA/QC –

"Monitor long-term ~~damage~~ injuries, recovery (incl. rates), and dynamics of affected & potentially affected resources & uses."

Develop synthesis methodology now (thru spring) I.D. any holes in NRDA that need to be covered now & focus otherwise on developing monitoring program to be implemented after settlement.