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EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

September 22, 1997

Mr. Stanley E. Senner
Science Coordinator
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, Alaska 99501

Dear Mr. Senner:

At your request, I have perused the hydrocarbon results for two *Exxon Valdez* Natural Resource Damage Assessment projects that were never completed. These two projects concerned injuries to oysters and to scallops and were designated as projects "Fish/Shellfish 16" and "Fish/Shellfish 25", respectively. Following is my summary and interpretation of the hydrocarbon results for these projects. These results are currently available in the "*Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995" (EVTHD) that has been released to the public under project Subtidal 8.

Fish/Shellfish 16

A total of 38 samples of oysters were collected and analyzed for hydrocarbons under project Fish/Shellfish 16. These samples were collected from four stations in Prince William Sound (PWS) in 1989 and 1990. Two of the stations were at oyster farms at Deep Bay and Salmo Point on the eastern end of Hawkins Island just northwest of Cordova, while the remaining two stations were at oyster farms on Fairmont and Perry islands in the north and northwest parts of PWS, respectively. In 1989, samples were collected monthly from April through September (except for August) at the two stations near Cordova, while at the remaining two stations, samples were collected in April, May and September. In 1990, samples were collected once in either April or May.

Some of the samples collected from the Fairmont and Perry island stations were probably contaminated by oil spilled from the *Exxon Valdez*. The total PAH (TPAH) concentration ranged from 690 to 4,780 ng TPAH/g dry wt. in four of the eleven samples collected in 1989 from these stations, and the pattern of relative PAH abundances was generally consistent with weathered oil spilled

from the *Exxon Valdez* (EVO). Three of these samples were collected in April-May and contained the highest TPAH concentrations, but the other sample was collected in September and TPAH concentrations were less than 200 ng TPAH/g dry wt. in the two companion replicate samples. Similarly low TPAH concentrations were present in four samples collected in 1990, and individual PAH concentrations were too often below method detection limits (MDL) to indicate potential hydrocarbon sources for these samples.

Concentrations of TPAH were occasionally quite high in samples collected from the two stations near Cordova, and were probably derived from multiple sources. At the Deep Bay station, TPAH concentrations ranged from 56 to 8,670 ng TPAH/g dry wt. in the nine samples collected during 1989. The pattern of relative PAH abundances was consistent with diesel oil in two of the more contaminated samples, and was consistent with mixtures that may have included EVO in others. At the Salmo Point station, TPAH concentrations ranged from 35 to 732 ng TPAH/g dry wt. in the nine samples collected during 1989, and the pattern of relative PAH abundances was not consistent with any single known hydrocarbon source. The proximity of these stations to Cordova suggests that hydrocarbons may have derived from boat traffic and from the boat de-contamination facility that removed EVO attached to boat hulls at Cordova in 1989. However, the variability of hydrocarbon concentrations among replicated samples from these stations suggests that spurious contamination introduced during collection or initial storage cannot be dismissed.

Fish/Shellfish 25

A total of 21 samples of scallops were collected and analyzed for hydrocarbons under project Fish/Shellfish 25. These samples were collected from three stations around Kodiak Island during Fall 1989. At the Near Island station, six samples were collected mid-October and another six were collected mid-December, from a depth of 10 m. The mean TPAH concentration of samples collected mid-October was 1,700 ± 242 ng TPAH/g dry wt. (± 95% CI), which increased to 4,410 ± 635 ng TPAH/g dry wt. by mid-December. The pattern of relative PAH abundance was consistent with weathered oil spilled from the *Exxon Valdez* in all 12 samples, although an additional combustion source is indicated as a minor source as well. Abundant normal alkanes, together with pristane and especially phytane, corroborate a crude oil source for most of these PAH. However, I am hesitant to conclude that oil from the *Exxon Valdez* is the source of the detected PAH, for two reasons: First, I am not aware of any corroborating evidence of *Exxon Valdez* oil elsewhere in the vicinity of the sampled station. Second, the collection station is near a charted shipwreck, which might sporadically release a bunker oil that mimics analysis results for crude oil.

The TPAH concentrations in the remaining nine samples were too low to identify potential sources reliably. Six of these samples were collected from Uyak Bay and these had TPAH concentrations that ranged from below the MDL to 283 ng TPAH/g dry wt. The three samples collected from Cape Chiniak had TPAH concentrations that were less than 26 ng TPAH/g dry wt.

I hope these remarks satisfy your requirement for closure regarding these two projects. If not, please contact me at your convenience (907-789-6065; jeff.short@noaa.gov) to determine how we should proceed.

Sincerely,

Jeffrey W. Short
Supervisory Research Chemist

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STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT
PRELIMINARY STATUS REPORT

Prince William Sound Oysters

Fish/Shellfish Study Number 16

Michael Kaill[1] and Malin M. Babcock[2]

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

2. National Marine Fisheries Service, Auke Bay Laboratory, P.O. Box 210155, Auke Bay, Alaska 99821

Lead Agencies - Alaska Department of Fish and Game
National Marine Fisheries Service

Cost - $30.3K

Dates of Study Plan - 27 March 1989 to 28 February 1990

	Signature	Date
State of Alaska		
Principal Investigator:	M M Kaill	Jan 12 1990
Supervisor:	D. L. Holland (Acting)	Jan 12, 1990
for OSIAR Senior Biometrician:		1/12/90
OSIAR Program Manager:		
OSIAR Director:	Michael P. Dean	1/12/90
NOAA/NMFS Auke Bay Laboratory		
Principal Investigator: Malin M. Babcock	Malin Babcock	1/11/90
Damage Assessment Coordinator: Stanley Rice	Stan Rice	1/11/90
Organization Leader: George R. Snyder		1/11/90
Financial Officer: Deborah Rathbone	Debi Rathbone	1/11/90

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Prince William Sound Oysters

Fish/Shellfish Study Number 16

EXECUTIVE SUMMARY

The long-term growth, survival, and hydrocarbon uptake portion of this project was begun during September, 1989. Fifteen thousand Pacific oysters (Crassostrea gigas) were stocked into nets at both oiled and non-oiled sites. Initial stocking mortality during the first time period appeared to be high. The project is proceeding normally as per the schedule proposed in the Detailed Study Plan. The initial project staging work, preparatory to advancing into the active field season, will be completed by March 1, 1990.

Oyster sampling at established sites was completed in September, 1989. All samples have been submitted to the contract laboratory for petroleum hydrocarbon analyses. As of this date results have not been received.

OBJECTIVES

A. Determine the effects of oil contamination on Pacific oyster growth and survival by comparing growth and survival of oysters cultured in oiled and non-oiled environments over at least 2 years. Measurement of long-term rates of aromatic hydrocarbon contaminant uptake and depuration and the relationship of these factors to growth and survival will be an integral part of this study.[1]

B. Measure hydrocarbon uptake, depuration and recovery in oysters at all farm site(s) in Prince William Sound.[2]

C. If any loss of production to oyster farms was caused by oil contamination, identify alternative strategies for restoration.[1]

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[1] This objective performed by the Alaska Department of Fish and Game.

[2] This objective performed by the National Oceanic and Atmospheric Administration.

Part of Objective A deals with assembling historic information on long-term growth and survival of oysters in Prince William Sound prior to the oil spill.

The basis for Objectives A and C arise from the assumption that a future shellfish production potential was in existence in Prince William Sound prior to March 24, 1989. The commercial mariculture industry in Prince William Sound was already culturing 3 million Pacific Oysters at that time. Does the state's opportunity to expand entry into the mariculture industry through lease of submerged tidelands and use of public waters continue to the same extent as it did prior to the introduction into the marine environment of eleven million gallons of crude oil?

This study is designed to provide some critical information about growth and survival that will be incorporated into the bio-economic models that may be employed in making that determination. Previous modeling efforts used for aquaculture policy formulation have demonstrated the sensitivity of outcomes to the critical parameters of growth and survival.

Other projects, such as Air/Water Studies numbers 1 and 3, could be used to document the geographic extent of sub-tidal habitat suitable for shellfish production that may have been impacted through oil contact. Part of Air/Water Study Number 3 is focusing on the question of whether mussels (Mytilus trossulus, formerly referred to as M. edulis), a comparable bivalve mollusk, assimilated aromatic hydrocarbons during a seven week exposure to the water column. Objective A will attempt to enhance those results, and focus on the question of whether long-term growth, survival, and product quality is affected by the level of hydrocarbon contamination. The experiment is designed to detect the presence or absence of these effects, in situ, as would be experienced by future shellfish culture operations at both oiled and non-oiled locations in Prince William Sound.

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METHODOLOGY

Growth/Survival Tests:

On September 20, 1989, applications to secure the legally required shellfish transport permits were submitted by the principal investigator to the state for expedited pathological approval. Pathology approval was granted on September 22 and the Commissioner of Fish and Game subsequently authorized the

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transport of this specific lot of oysters within the State of Alaska. Fifteen-thousand hydrocarbon free oysters, averaging mm in shell height, were purchased by the project and imported from Innovative Aquaculture, Inc. of Campbell River, British Columbia, an approved out-of-state source. Triplicate hydrocarbon samples, each weighing approximately 15 grams, and blank were taken by Air Data Couriers and forwarded to Auke Bay Laboratory according to rigorous and routine Chain of Custody procedures, as outlined in the September 12, 1989, Analytical Chemistry Quality Assurance/Quality Control Plan.

A commercial vessel was chartered and the imported oysters were deployed in 15 test nets from September 26 through September 30. The test nets were standard 12 mm mesh, 10 layer Japanese lantern net rearing cages (Figure 1). The tops of the cages were suspended with small polyform floats and enough scope was left between the nets and the anchors so that the tops would remain approximately 1 meter below the surface at low tide. The nets had to be moored in deep enough water so that the bottoms did not contact the sea floor and become subject to predation. A trailer buoy with the net number and ADF&G identification was attached to mark the location and retrieve the net.

Seeding rates were 100 oysters per layer for a total of 1000 per net. Before the nets were deployed, a subsample of 60 oysters per layer for three layers were measured with digital calipers and shell height was recorded. Figure 2 illustrates the relationship of shell height to the dimensions of length and width. A total of 3240 shell height measurements were initially obtained, representing approximately 22% of the entire test lot. Sea surface temperature, salinity, and Sechi disk measurements were recorded for each test net location at the time of deployment.

Nets were deployed at two oiled sites and two non-oiled sites that were determined to have the requisite environmental characteristics to enable successful culture of oysters. The determination of oil versus non-oil locations was based on information from maps provided by the Department of Environmental Conservation. The oiled areas were screened to determine locations that were likely to be suitable for culture of oysters. As it turns out, both of the non-oiled control sites and one of the oiled test sites are adjacent to the location of existing oyster farms that have previously exhibited successful operation, thus providing a high degree of probability for successfully culturing oysters at a commercially suitable rate of growth. The other oiled site is at a location determined by the principal investigator to be suitable for future mariculture development based on geographic criteria of estimated salinity, water

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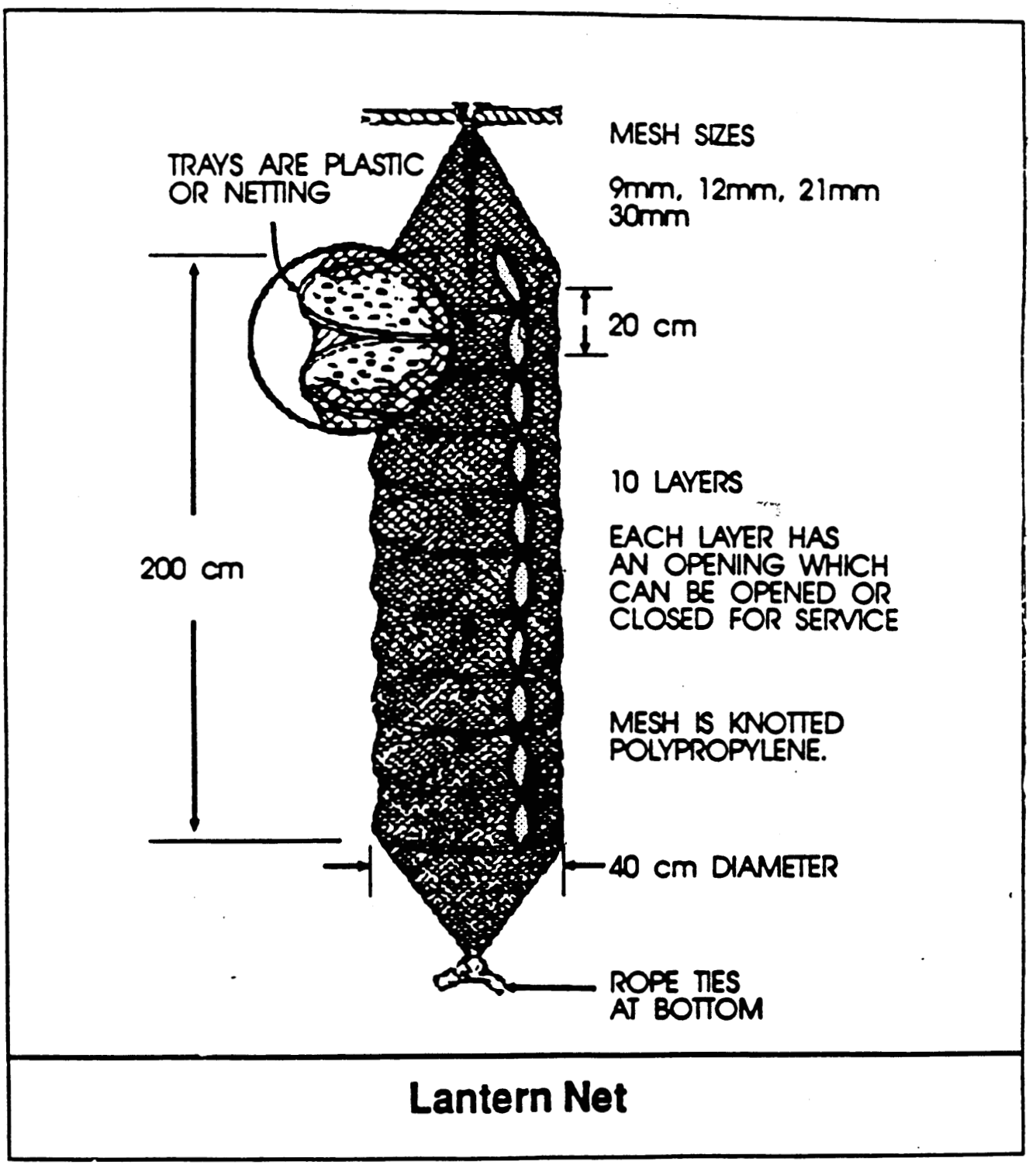

Figure 1. Lantern Net (Swann, 1989)

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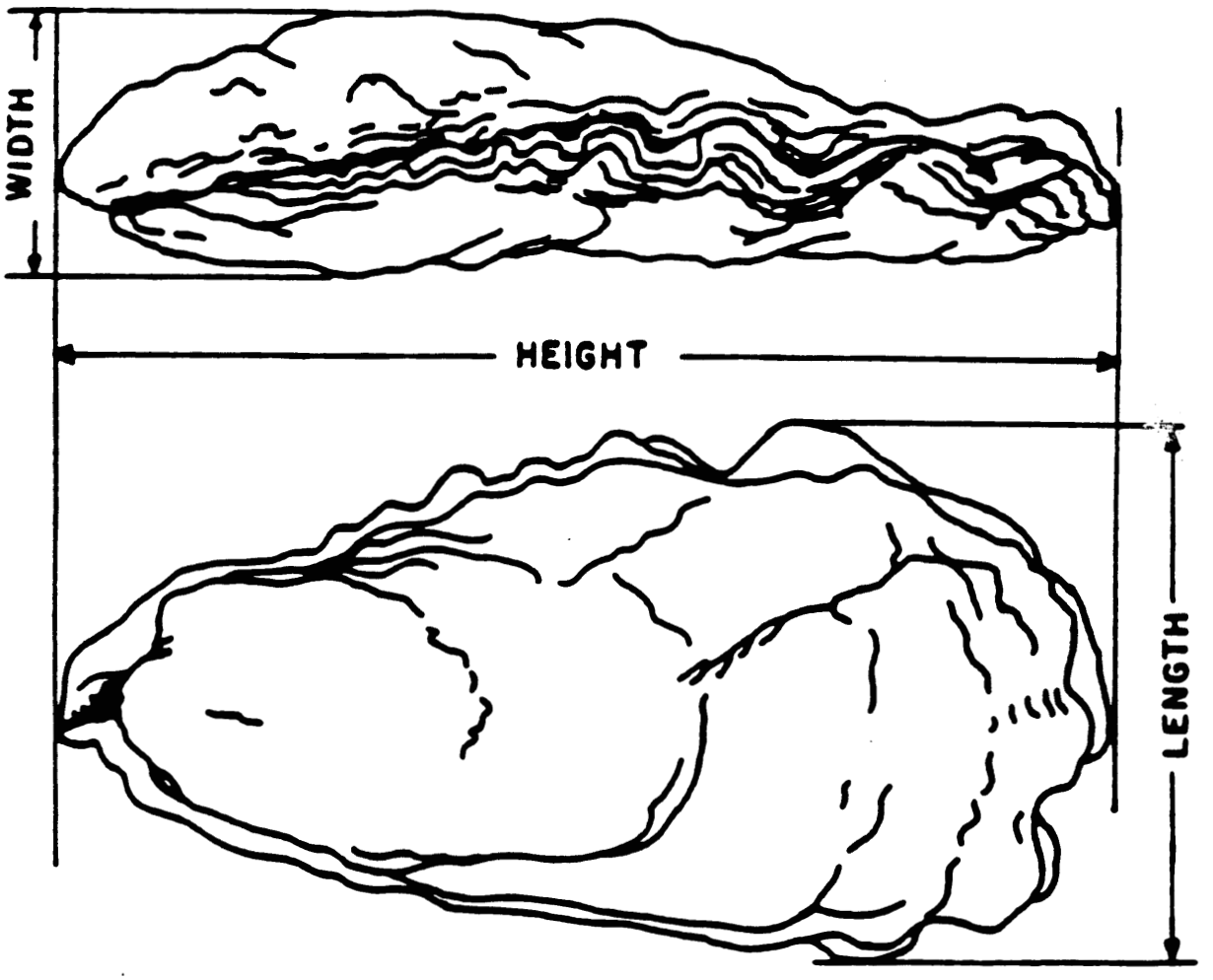

Figure 2. Oyster shell dimensions (after Quayle, 1988)

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temperature, and protection from storms.

The oiled sites are at Herring Bay on Knight Island and at the existing oyster farm at South Bay on Perry Island. The non-oiled control sites are at the Fairmont Island oyster farm near Wells Bay/Unakwik Inlet, and the Salmo Point/Deep Bay oyster farm on Hawkins Island (Figure 3).

After the net deployment was completed, the project experimental design was reviewed by the OSIAR biometrician. This review resulted in the determination that the number of test nets would have to be increased in order to provide 95% confidence of the test of hypothesis that there was no detectable difference in growth and survival between the two groups. Shellfish transport permits were obtained and a second shipment of 15,000 oysters and additional nets were purchased by the project in mid-October. Shipping problems resulted in the nets arriving one week after the oyster spat, which was being stored in shipping containers on the dock at Whittier. The resultant high deadloss and breach in chain of custody resulted in cancelation of the attempt to increase the experimental size during winter.

The assistant project biologist proceeded to Prince William Sound during the week of November 6 through 10 to verify the status of the test nets but was prevented from reaching the sites due to severe winter weather. This person was able to reach the control sites at Hawkins Island during the week of December 10, 1989, and sample nets 11, 12, 13, 14, and 15, at Deep Bay and Salmo Point.

The salinity-conductivity-temperature gauges, Sechi disk, and Ryan temperature recorders had not been received, and so measurements to verify the consistency of these important growth controlling factors were not recorded. Measurements were confined to recording shell height with manual calipers on a waterproof notebook. Approximately 1500 oysters were examined for growth and survival. The sample methodology consisted of hauling the net from its mooring onto a 4' by 8' work table, un-sewing the side opening, and removing all oysters from layers 1, 3, 5, 7, and 9. (Samples from alternate layers will be taken during the next trip to the control site.)

The contents of each layer were sorted into two groups, live animals and dead shells. A random sample of 30 live animals from each layer was measured to determine growth in shell height. Once these had been measured, the number of live animals remaining was counted and recorded. During this process, additional dead shells were encountered and separated from the total live animal group. Next, the dead shells were measured and sorted into groups according to size and then enumerated.

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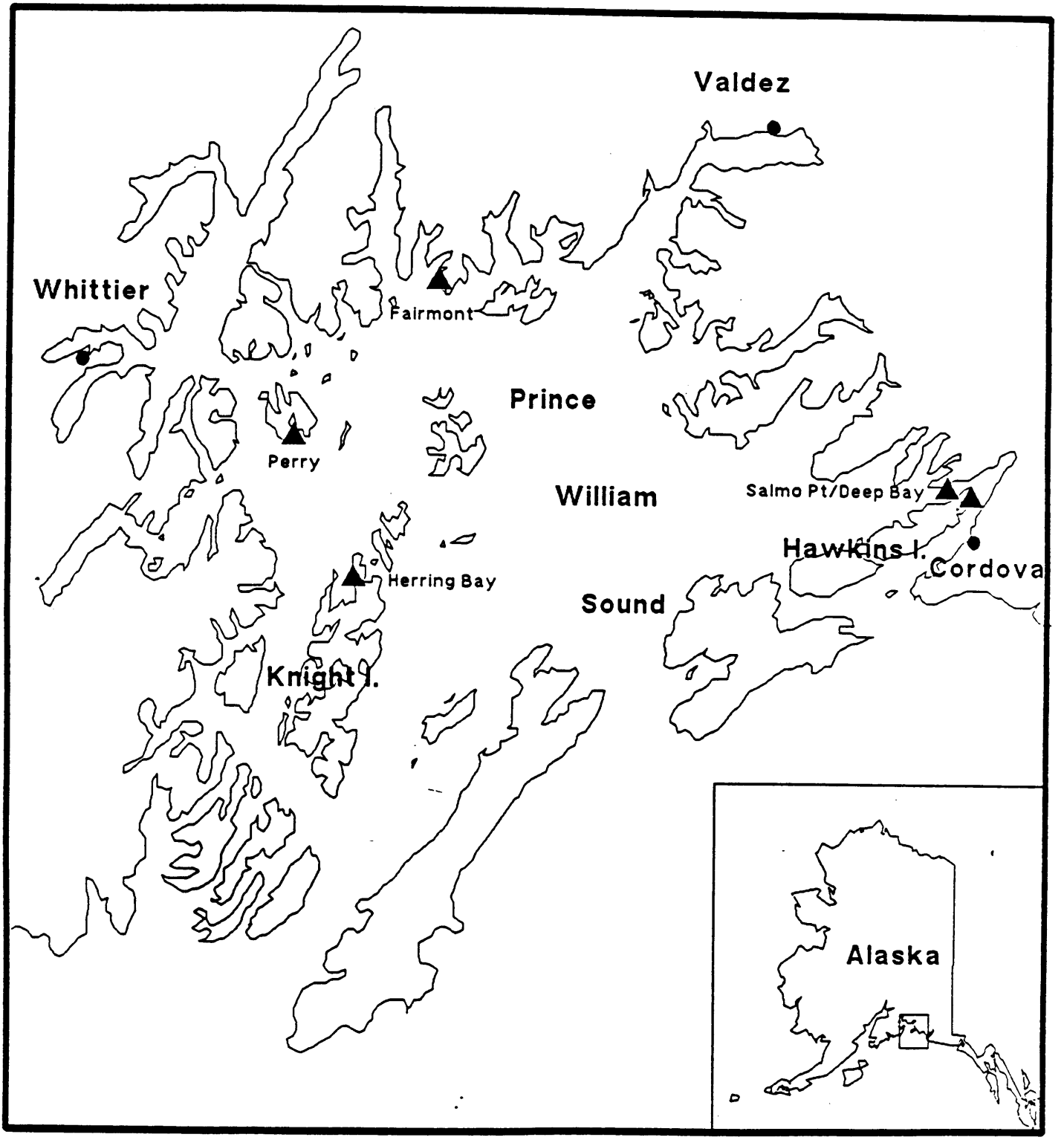
Figure 3. Oyster test and sampling sites in Prince William Sound, Alaska.



Finally, when all animals had been counted and sorted, the live oysters were replaced into the layer they were removed from. After all five layers had been sampled, the aperture of the net was sewn together again and the net was returned to its mooring.

Based on the schedule in the detailed study plan, the next sample for this control site would occur in March, 1990, and repeat monthly thereafter. If it is possible to reach the test sites on the west side of Prince William Sound before that time then the Hawkins Island sample will be repeated to synchronize the sample intervals.

Hydrocarbon Surveys, Existing Farms:

This part of the project will establish the extent of injury, and determine rates of recovery from that injury. Oysters were sampled approximately bimonthly at 4 locations in Prince William Sound (Figure 3) during April - September 1989 (Table 1).

Whole, unshucked oysters (3 - 10 cm) were placed in precleaned, hydrocarbon-free 16 oz. or 32 oz sample jars or rinsed aluminum foil. Samples were collected to provide at least 10 - 15 g tissue which is the amount necessary for hydrocarbon analyses. Duplicate or triplicate samples were taken. Blanks were taken for the later sampling periods.

Sample jars and lids were purchased precleaned, rinsed with methylene chloride or baked at 440 C for 4 hours. Aluminum foil was rinsed with methylene chloride immediately preceding sampling. Labels included site location, date, time, collector, and species. Latitude and longitude were determined for the locations and this information was included on the Chain-of-Custody Sheets.

All samples were frozen within 1 hour of collection, and samples were transferred to Sid Korn of the Auke Bay Laboratory following rigorous and routine Chain-of-Custody procedures.

Standard Operating Procedures and a Quality Assurance/Quality Control Plan, per se, for this study do not exist. Methods of sample collection follow the general guidelines set forth by the Auke Bay Lab and the Hydrocarbon Technical Committee both in written material and in training sessions.

RESULTS

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Table 1. Oyster samples collected from Prince William Sound, 1989, following the EXXON VALDEZ oil spill. Samples collected by NOAA National Marine Fisheries Service Staff.

BATCH	ID	COLLECTOR	LAT.	LONG.	SITE	DATECOL
V89_08	1395	CLARK	60.53.36.	147.26.45.	FAIRMONT	04/13/89
V89_08	1396	CLARK	60.53.36.	147.26.45.	FAIRMONT	04/13/89
V89_27	2724	MOLES	60.53.36.	147.26.45.	FAIRMONT	05/13/89
V89_70	7982	O'CLAIR	60.53.36.	147.26.45.	FAIRMONT	09/11/89
V89_70	7984	O'CLAIR	60.53.36.	147.26.45.	FAIRMONT	09/11/89
V89_08	1393	CLARK	60.40.55.	147.55. 0.	PERRY	04/13/89
V89_08	1394	CLARK	60.40.55.	147.55. 0.	PERRY	04/13/89
V89_27	2725	MOLES	60.40.55.	147.55. 0.	PERRY	05/13/89
V89_	5833	RICE	60.40.55.	147.55. 0.	PERRY	07/12/89
V89_70	7980	O'CLAIR	60.40.55.	147.55. 0.	PERRY	09/10/89
V89_70	7979	O'CLAIR	60.40.55.	147.55. 0.	PERRY	09/10/89
V89_70	7978	O'CLAIR	60.40.55.	147.55. 0.	PERRY	09/10/89
V89_70	7981	O'CLAIR	60.40.55.	147.55. 0.	PERRY	09/10/89B
V89_08	1391	CLARK	60.35.12.	145.46.56.	DEEPBAY	04/14/89
V89_08	1392	CLARK	60.35.12.	145.46.56.	DEEPBAY	04/14/89
V89_27	2723	MOLES	60.35.12.	145.46.56.	DEEPBAY	05/17/89
V89_42	4515	BABCOCK	60.35.12.	145.46.56.	DEEPBAY	06/21/89
V89_42	4516	BABCOCK	60.35.12.	145.46.56.	DEEPBAY	06/21/89
V89_56	80000	DERRAH	60.35.12.	145.46.56.	DEEPBAY	07/13/89
V89_72	8285	FLETCHER	60.35.12.	145.46.56.	DEEPBAY	09/19/89
V89_72	8284	FLETCHER	60.35.12.	145.46.56.	DEEPBAY	09/19/89
V89_72	8283	FLETCHER	60.35.12.	145.46.56.	DEEPBAY	09/19/89
V89_72	8286	FLETCHER	60.35.12.	145.46.56.	DEEPBAY	09/19/89B
V89_08	1397	CLARK	60.35.38.	145.48. 0.	SALMPT	04/14/89
V89_08	1398	CLARK	60.35.38.	145.48. 0.	SALMPT	04/14/89
V89_27	2722	MOLES	60.35.38.	145.48. 0.	SALMPT	05/17/89
V89_42	4513	BABCOCK	60.35.38.	145.48. 0.	SALMPT	06/21/89
V89_42	4514	BABCOCK	60.35.38.	145.48. 0.	SALMPT	06/21/89
V89_56	80001	DERRAH	60.35.38.	145.48. 0.	SALMPT	07/13/89
V89_72	8282	FLETCHER	60.35.38.	145.48. 0.	SALMPT	09/19/89
V89_72	8281	FLETCHER	60.35.38.	145.48. 0.	SALMPT	09/19/89
V89_72	8280	FLETCHER	60.35.38.	145.48. 0.	SALMPT	09/19/89

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Growth/Survival Tests:

This project was initiated in late September of 1989. Winter is acknowledged as a quiescent growth period for oysters. This was addressed in the detailed study plan, which calls for initial project staging followed by early growth and survival to be recorded at three month intervals during this time period. Consequently, results describing the long-term effects of chronic hydrocarbon contamination on growth and survival of oysters are not available at this time.

As mentioned in the methodology section, an interim inspection trip was made by the assistant project biologist to the control site at Hawkins Island. The results of shell height measurements, to date, are described in Table 2. Table 3 describes the results of the survival rate portion of the study. Survival rate is determined as per the suggestion of the peer review team, that is live oysters divided by the total number of live plus dead oysters for an individual layer.

The results in Table 2 appear to indicate that modest growth in shell height occurred between September and December, 1989. These initial results are believed to be misleading due to a problem with loss of small oysters and separated dead shells halves through the mesh to lower layers and outside of the nets. The size frequency distribution of the animals at the time of initial placement in the nets has not been calculated or analyzed yet to determine approximation to a normal distribution.

The average total number (live plus dead) of oyster shells per layer is shown in parentheses on Table 3. Net 13, for instance, showed an average loss per layer of 59 percent. Some of the top layers in individual nets had losses as high as 75 percent, while several of the lower layers actually showed a gain of as much as 11 percent over the initial stocking number. This has the effect of biasing the subsequent shell height measurements in favor of larger shell sizes that are less likely to pass through the mesh size. It may further tend to possibly introduce compensatory effects into the estimations of growth and survival.

It is recommended that these initial losses be attributed to stocking mortality and that growth and survival be determined from counts and measurements made at a new time 0. Additional analysis and consultation with a biometrician is recommended to explore whether the compensation effects to growth and survival are significant and whether they are constant throughout the experimental design. The possibility exists that they may, instead, be interactive with the variables of temperature,

Table 2.
Prince William Sound Oyster Growth.

NET	STATUS	NAME	LATTITUDE	LONGITUDE	AVERAGE SHELL HEIGHT (mm)					
					Sep-89	Dec-89	Mar-90	Apr-90	May-90	Jun-90
1	control	Fairmont I.	60.53.00 N	147.27.00 W	22.98	NA	NA	NA	NA	NA
2	control	Fairmont I.	60.53.00 N	147.27.00 W	22.07	NA	NA	NA	NA	NA
3	control	Fairmont I.	60.53.00 N	147.27.00 W	NA	NA	NA	NA	NA	NA
4	oiled	Herring Bay	60.28.30 N	147.43.00 W	22.58	NA	NA	NA	NA	NA
5	oiled	Herring Bay	60.28.30 N	147.43.00 W	NA	NA	NA	NA	NA	NA
6	oiled	Herring Bay	60.28.30 N	147.43.00 W	NA	NA	NA	NA	NA	NA
7	oiled	Herring Bay	60.28.30 N	147.43.00 W	22.22	NA	NA	NA	NA	NA
8	oiled	Perry I.	60.40.00 N	147.54.00 W	23.45	NA	NA	NA	NA	NA
9	oiled	Perry I.	60.40.00 N	147.54.00 W	NA	NA	NA	NA	NA	NA
10	oiled	Perry I.	60.40.00 N	147.54.00 W	NA	NA	NA	NA	NA	NA
11	control	Deep Bay	60.34.00 N	145.46.00 W	22.09	30.16	NA	NA	NA	NA
12	control	Deep Bay	60.34.00 N	145.46.00 W	23.15	28.42	NA	NA	NA	NA
13	control	Deep Bay	60.34.00 N	145.46.00 W	20.91	25.65	NA	NA	NA	NA
14	control	Salmo Point	60.35.30 N	145.47.00 W	NA	26.68	NA	NA	NA	NA
15	control	Salmo Point	60.35.30 N	145.47.00 W	21.67	25.89	NA	NA	NA	NA

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Table 3.
Prince William Sound Oyster Survival.

NET	STATUS	NAME	AVERAGE SURVIVAL RATE: live/total (total: live plus dead) Sep-89	Dec-89	Mar-90	Apr-90	May-90	Jun-90
1	control	Fairmont I.	1.00 (100)	NA	NA	NA	NA	NA
2	control	Fairmont I.	1.00 (100)	NA	NA	NA	NA	NA
3	control	Fairmont I.	1.00 (100)	NA	NA	NA	NA	NA
4	oiled	Herring Bay	1.00 (100)	NA	NA	NA	NA	NA
5	oiled	Herring Bay	1.00 (100)	NA	NA	NA	NA	NA
6	oiled	Herring Bay	1.00 (100)	NA	NA	NA	NA	NA
7	oiled	Herring Bay	1.00 (100)	NA	NA	NA	NA	NA
8	oiled	Perry I.	1.00 (100)	NA	NA	NA	NA	NA
9	oiled	Perry I.	1.00 (100)	NA	NA	NA	NA	NA
10	oiled	Perry I.	1.00 (100)	NA	NA	NA	NA	NA
11	control	Deep Bay	1.00 (100)	0.65 (73)	NA	NA	NA	NA
12	control	Deep Bay	1.00 (100)	0.62 (86)	NA	NA	NA	NA
13	control	Deep Bay	1.00 (100)	0.29 (41)	NA	NA	NA	NA
14	control	Salmo Point	1.00 (100)	0.54 (68)	NA	NA	NA	NA
15	control	Salmo Point	1.00 (100)	0.33 (49)	NA	NA	NA	NA

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salinity, and presence or absence of oil contamination.

Hydrocarbon Surveys, Existing Farms:

Sample collection and dates sampled are shown in Table 3. All samples have been submitted to Texas A & M University for hydrocarbon analyses. The first batch (n = 12) was sent early November and the remaining samples, in mid November. To date, results have not been received.

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STATUS OF INJURY ASSESSMENT

Growth/Survival Tests:

It is too early in the course of the study to make conclusions concerning oil induced long-term differential growth and survival rates, or rate of hydrocarbon uptake and depuration for test oysters grown in Prince William Sound. Additional data, obtained from measurements made during the coming growing season, would be sufficient to formulate preliminary conclusions regarding the long-term growth and survival portions of the project.

Receipt of raw data from one commercial oyster grower at the Fairmont control site is anticipated in the near future. This data will be assembled into a historic growth and survival database for comparison with the long-term results from the test nets. Similarly, the baseline hydrocarbon analysis of the samples taken prior to stocking the test oysters purchased for this project into Prince William Sound is anticipated soon. This can then be compared to the results to be obtained from the series of 15 gram composite tissue samples, scheduled for collection in March, 1990. At that time it might then be possible to begin to gauge the rate of hydrocarbon uptake and depuration of test oysters cultured as sentinel organisms in the waters of Prince William Sound.

There has been internal staff discussion to the effect that the introduction of the variables of temperature, salinity, water quality, and other intrinsic site characteristics would tend to confound results and make the possibility of firm conclusions unlikely. The preliminary conclusion of the principal investigator is an acknowledgement that this possibility may exist. The test equipment identified in the detailed study plan will be utilized to measure the range and variability of these parameters at each of the test and control sites. However, to date no derivation of the likelihood of these events has been

attempted by, or provided to, the project team. The intent of initially constraining the site selection to existing oyster farms or likely sites for future successful mariculture development was an attempt to minimize this possibility.

It is recommended that a statistical review be conducted to assess the probabilities of the worst case outcome described above, based on the confidence provided by the design of the experiment. A sensitivity analysis of the hypothetical results to changes in the parameters of temperature, salinity, and turbidity would be one possible method to address this question.

It is also recommended that further coordination between this project and Economic Uses Study #4 be pursued to determine the degree of demand reduction for state-owned submerged tidelands that is attributable to a perceived attenuation of water quality or mariculture productivity and product quality.

Hydrocarbon Surveys, Existing Farms:

As stated under the RESULTS section, data describing the results of the hydrocarbon analyses have not been received from the contract laboratory.

Winter storm activity appears to be resulting in resuspension and movement of Prudhoe Bay crude oil from previously heavily oiled beaches. One of the existing oyster sites (Perry Island) is within 1 mile of heavily oiled beaches; therefore, this site is vulnerable to exposure from this activity. Although the oysters in Prince William Sound sampled in this portion of the project represent private industry, the species are used world-wide as an indicator species measuring exposure to a variety of chemical contaminants. As these mariculture facilities utilize public waters and leased adjacent public lands, demonstration of any level of petroleum hydrocarbons in the organisms indicates injury to public resources.

If any samples collected in 1989 show elevated levels of petroleum hydrocarbons, the time period necessary for complete depuration is probably not long enough for this to be demonstrated in the September samples. Because of this and the potential re-oiling at Perry Island, we feel it advisable to conduct sampling at existing farms during the 1990 field season. The level of effort would be identical to the 1989 season.

This is an interim or draft document. Data presentation, analysis, interpretation, and conclusions are subject to change. Readers are encouraged to contact the Environmental Section, Alaska Department of Law before citing.