EXXON VALDEZ **OIL SPILL**

RESTORATION PROJECT ANNUAL REPORT

Archaeological Site Monitoring and Restoration, 1993

Restoration Project 93006

Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

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Annual Report

Study History: The Index Site Monitoring project originated as a multi-agency attempt to monitor vandalism and other site injury through time in the *Exxon Valdez* Oil Spill area. Many sites were vandalized or unintentionally injured during and immediately after oil spill cleanup efforts ceased. Additionally, the potential for oil to adversely affect research values made monitoring intertidal sites for intrusion of buried or retransported remnants of the oil spill another concern of land managers. Because the large number of injured sites made monitoring of each site impossible, only a few sites were chosen for visitation. Monitoring a select sample of sites commenced after Project 93006 was approved by the *Exxon Valdez* Oil Spill Trustees as a reasonable approach of tracking injury to sites. The aim of the program was to provide monitoring of sites in the oil spill area for a ten-year period after the spill to allow managers to detect upward or downward trends of injury. Participants in the 1993 study included the State of Alaska, the United States Fish and Wildlife Service, and the National Park Service. The United States Forest Service supported the idea of the study, but it did not become an active partner in the research until 1994.

Abstract: Twenty-three sites were visited and evaluated in 1993. In an attempt to determine continued or recent injury the sites were subjected to archaeological survey, mapping, and the collection of sediment samples. The sediment samples from these index sites were tested for the encroachment of oil. The tests determined that many of the sites contained traces of oil. Only two of these, however, SEL-188 and XMK-058, revealed the chemical fingerprint of *Exxon Valdez* oil. With respect to physical injury, SEL-188, AFG-027, and AFG-028 continue to undergo erosion, AFG-043 continues to be eroded on the seaward side, and AFG-026 and KOD-171 show erosion and vandalism.

Key Words: Archaeology, *Exxon Valdez*, index sites, monitoring, vandalism.

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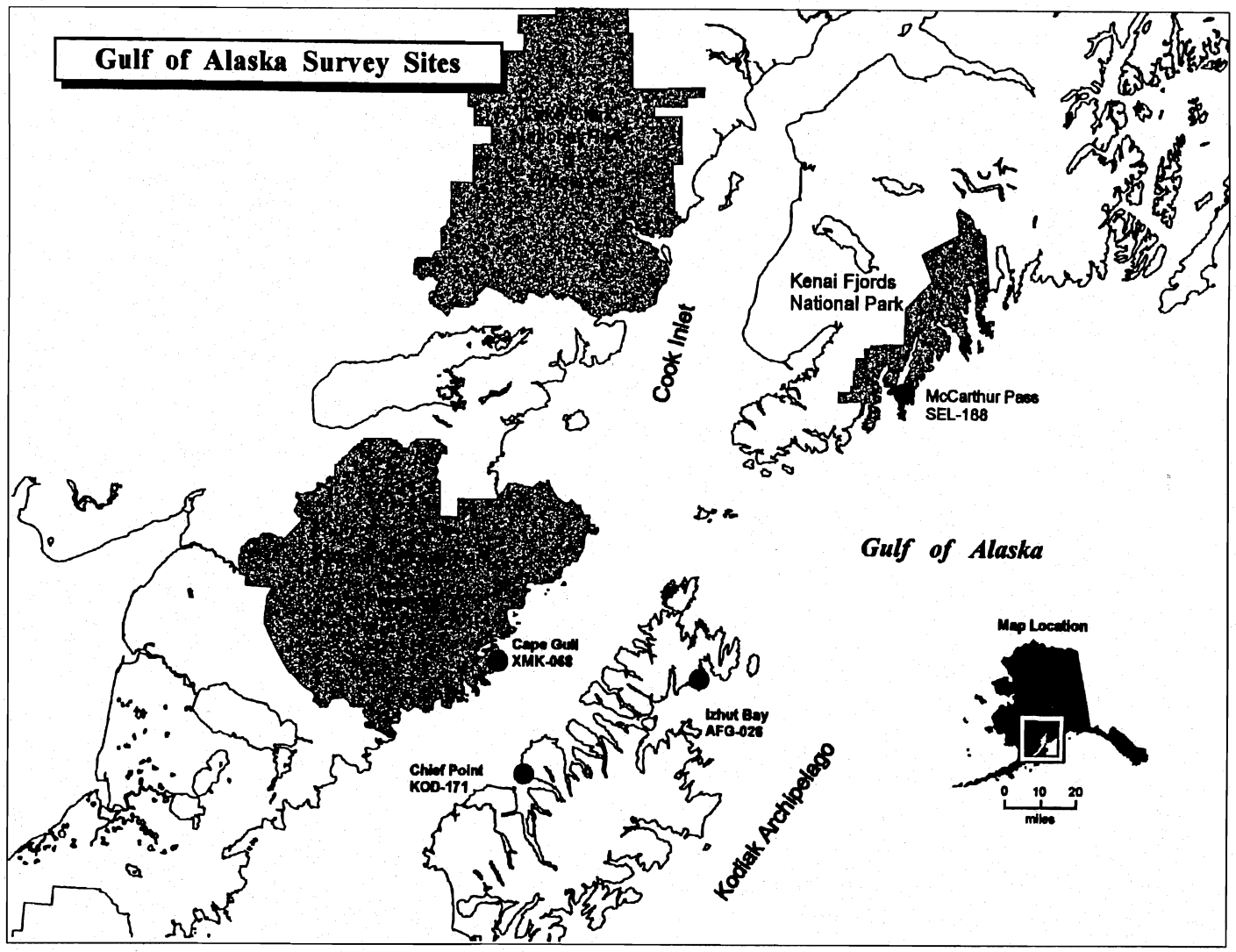

Figure 1. Project areas.

State of Alaska, Department of Natural Resources Field Monitoring, 1993

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Restoration tasks proposed at sites for which the State of Alaska asserts responsibility under the *Exxon Valdez* Oil Spill Restoration vary from simple mapping and photography at most sites to sediment collection and physical restoration at others. The lateness of final project approval and inclement weather dictated some site visits identified in the detailed project plan had to be delayed until following seasons. Sites most endangered and thought to need the greatest restoration responses were selected for attention first.

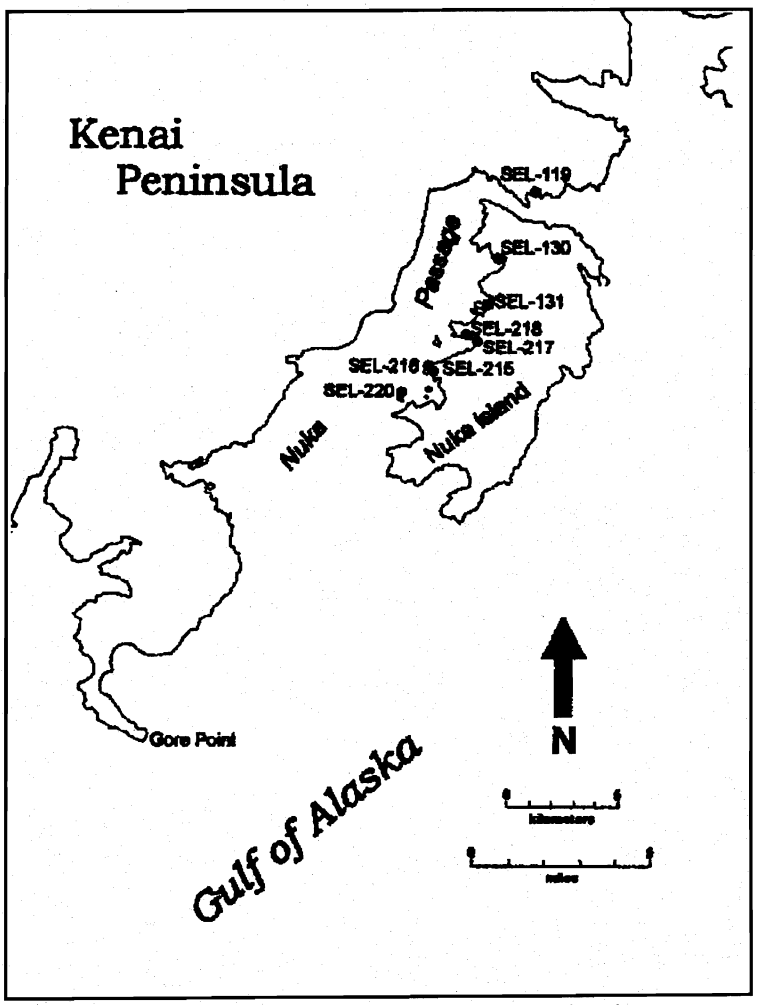

Figure 2. Sites investigated in the Nuka Island area.

Nuka Passage

Archaeological restoration assessment of the Nuka Passage sites was conducted by the Office of History and Archaeology (OHA) archaeologists David McMahan and Mark Pipkin on 12-15 July 1993. In accordance with the restoration work plan,

activities at SEL-215 and SEL-220 included: (1) documentation of site conditions through photography from permanent control points; and (2) collection of subsurface sediment samples from the lower, middle, and upper intertidal zones (Figure 1). A permanent datum was established at SEL-220 and topographical data was collected. As time permitted, the team also examined other sites in the area. These included the large village site at SEL-119, intertidal scatters at SEL-216 and SEL-217, the Home Cove site (SEL-130), and Herring Pete's House (SEL-131).

Procedures for subsurface testing and sample collection at SEL-215 and SEL-220 were similar to those sued by OHA in 1991 (Reger *et al.* 1992:4-5). At each site three test pits, approximately 25 cm to 50 cm in diameter and 30 cm to 50 cm deep, were excavated at shore-ward intervals in the intertidal zone. The exact horizontal and vertical location of each pit was related with a transit and tape to one or more permanent datums, which were established in 1991. For each pit, primary and duplicate samples were collected from: (A) 0 cm to 10 cm below the surface, and (B) 10 cm above the bottom. A primary sample from the top 10 cm of a test pit in the lower intertidal zone at SEL-215, for example, would be labeled "93-3A (1 of 2)." During back-filling, aluminum identifier tags were buried 10 cm below the surface to aid relocation by metal detector.

SEL-215 (Segment NK-004)

This site, discovered by Exxon archaeologists in 1990 (Figure 2), was initially described as a mid and upper intertidal scatter of lithic artifacts over a 40 m x 40 m area however, intertidal peat was found by OHA (McMahan) to contain *in situ* cultural materials. Excavations by OHA in 1991 yielded a variety of stone and wood artifacts with an average radiocarbon age of about 730 years ago (Reger *et al.* 1992:7-21, 89) (Figure 3). Recovery of two glass trade beads from the upper peat indicates that a minor historic component is also present. A 1991 assessment suggested that cultural deposits were continuing to erode.

SEL-215 was documented by McMahan and Pipkin on 13 July 1993. Visual inspection of the site revealed no oiling or disturbance, with the exception of minor

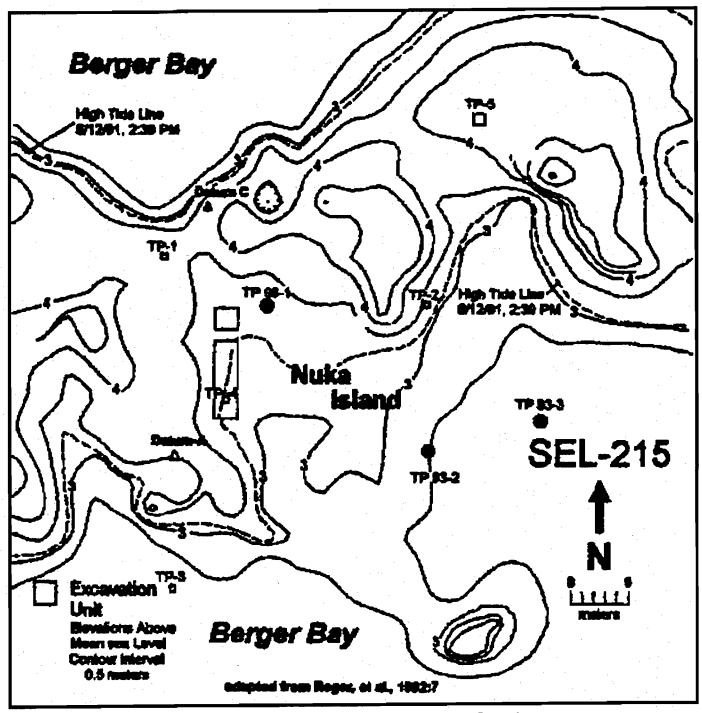

Figure 3. Archaeological site SEL-215.

erosion, from the date of the last visit in 1991. The 1991 OHA excavation trench partially filled with fine beach sediments, was clearly discernible within the peat (Figure 4). A few wood chips of cultural origin, as well as small fragments of fire-cracked rock (FCR), were exposed in unexcavated areas of the eroding peat. Color and black/white photographs were taken from 1991 OHA Datums A and C (Reger *et al.* 1991:Figure 5) and from the 1990 Exxon Datum. Sediment samples were collected from three test pits at SEL-215 and located relative to OHA Datums A and C (Table 1). None of the test pits penetrated subsurface cultural deposits.

Table 1. SEL-215 Test Pit Log

TP-#	Place in ITZ	From Datum	Azimuth (mag.)	Distance (m)	Dimensions (cm)	Depth (cm)	Elevation (m AMSL)*
93-1	Upper	A	048.25°	14.85	30 x 30	30	3.19
93-2	Upper	A	108.75°	20.30	25 x 30	30	2.54
93-3	Lower	A	104.00°	29.25	30 x 30	30	1.60
Datum C		A	028.50°	(Azimuth is only for instrument calibration)			

*Elevations, which are approximate, were calculated from the height of datum monuments as related to high tide on 6/12/91 p.m. (refer to Reger *et al.* 1992:Figure 5; McMahan 1991 and 1993 field notes).

Figure 4. SEL-215. Erosion of 1991 test trench.

SEL-220 (Segment NK-004-B

This site, discovered by OHA archaeologists in June 1990 (Figure 6), was initially identified as an isolated splitting adze and lag deposits of FCR in the upper intertidal zone. Two whale bones in the intertidal zone were thought to have been recently carried in by the tide. During June 1991 OHA archaeologists conducted subsurface testing at the site. Test pits revealed midden deposits in an area not in the intertidal zone, but which is flooded by very high tides and during storms (Reger *et al.* 1992:23).

McMahan and Pipkin inspected and documented SEL-220 on 13 July 1993, and found no evidence of oiling or disturbance since the site was visited in 1991. A splitting adze, in addition to the one noted in 1990, was discovered in the roots of a standing tree in the upper intertidal zone. The location of the adze was mapped and it was photographed but not collected. Two culturally modified trees (CMTs) were noted in the forest at the northeast side of the site. Color and black/white photographs

were taken from 1991 OHA Datums A and B. Engraved aluminum caps were mounted on rebar and driven to ground level (Reger *et al.* 1992:23). Sediment samples were collected from three test pits at SEL-220 and test pit provenience (Table 2). None of the test pits revealed definite *in situ* cultural deposits, however, one test pit in the upper intertidal zone (Test Pit 3) penetrated an organic-enriched brown muck with possible charcoal staining at the 18 to 23 cm level.

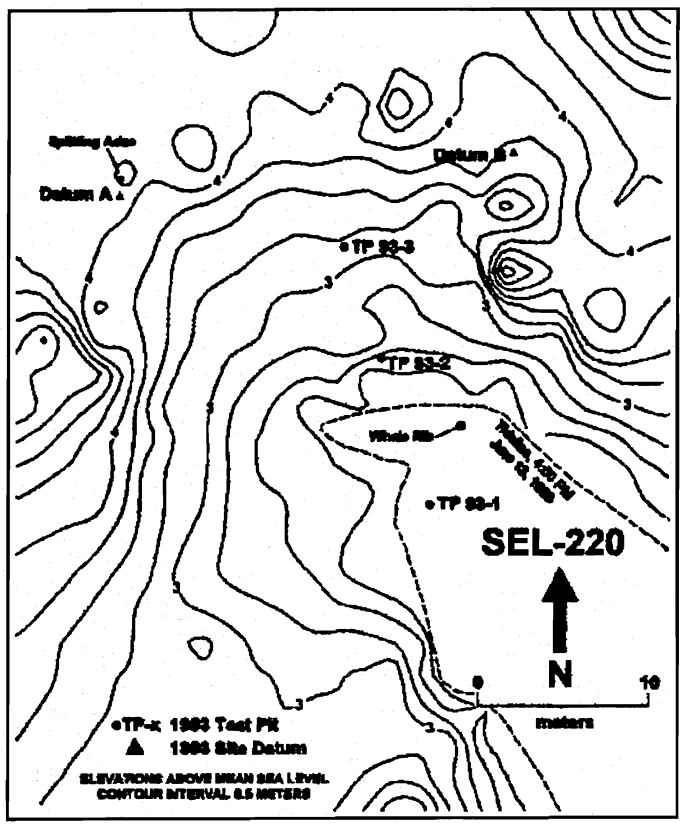

Figure 5. Archaeological site SEL-220.

SEL-178 (Port Dick Cabin Site, Segment PD-004)

The Port Dick Cabin site, SEL-178, is a midden and house pit site near the head of the west arm of Port Dick (Figure 7). It was the location of a helipad and storage area for an oil boom during the response phase of cleanup. Trails and the helipad were established on the site and caused some erosion of the site surface. Additionally, artifacts are eroding from the west edge of the site onto the beach and danger of vandalism by looters was judged to be high. The intent of the 1993 field effort was to establish a baseline of information about the site against which to judge future site degradation.

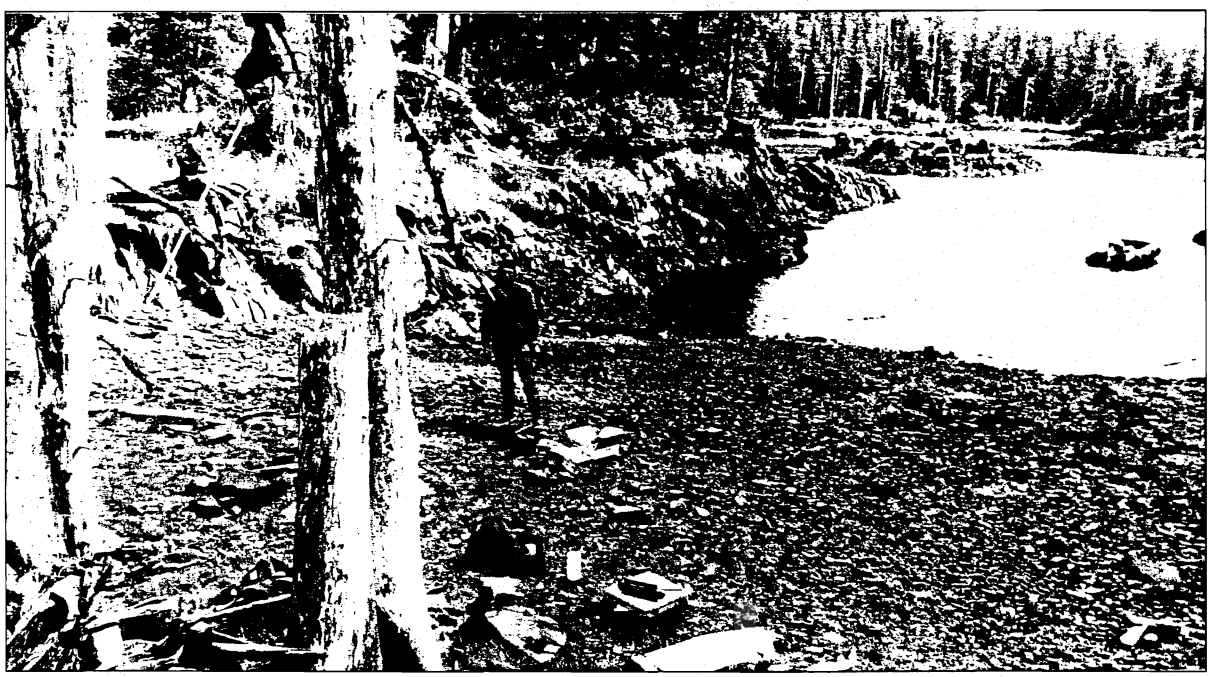

Figure 6. SEL-220. View southeast.

Table 2. SEL-220 Test Pit Log

TP-#	Place in ITZ	From Datum	Azimuth (mag.)	Distance (m)	Dimensions (cm)	Depth (cm)	Elevation (m BD)*
93-1	Lower	B	220.50°	21.70	25 x 25	250	3.38
93-2	Upper	B	239.00°	14.90	25 x 25	320	2.56
93-3	Upper	B	266.75°	11.92	30 x 30	320	1.82
Datum A		B	291.00°	(Azimuth is only for instrument calibration)			

*Below Datum. Due to timing of the investigation, between tides, AMSL elevations cannot be accurately determined for datum monuments. These values are not comparable to those in Table 1.

Archaeologists Reger and Pipkin examined the site on 8-9 September 1993. A search was made of the site for the datum established by the State University of New York, Binghamton, during 1991. No datum was found so a new datum was created and marked by driving a 10" iron spike into the high point at the north end of the site

Figure 7. SEL-178. View of the site datum location.

(Figure 8). All surface features and sample locations reference that datum (Table 3). A secondary datum was created near the southwest corner of the site to calibrate future compass readings. That datum is the top of a 0.75 m long iron rod driven into the site midden. The rod has a loop at the top.

Three sample locations were excavated in the vicinity of the helipad to test for spilled fuel in the site sediments. The sampling procedure followed that described for other areas. Two 50 cm x 50 cm test pits were excavated along trails that cross the site to assess the amount of erosion of the site by foot traffic. No damage could be discerned. Test Pit A, partially in the trail along the base of the spit, contained no identifiable cultural deposits. Test Pit B was placed within the limits of the southern most house depression and penetrated several buried layers interpreted as floor deposits. The multiple dark brown/black silty layers were encountered between 18 cm and 40 cm below ground surface (BS). No degradation of the deposits was evident. A few ground slate fragments and FCR were found on the beach but no artifacts were collected.

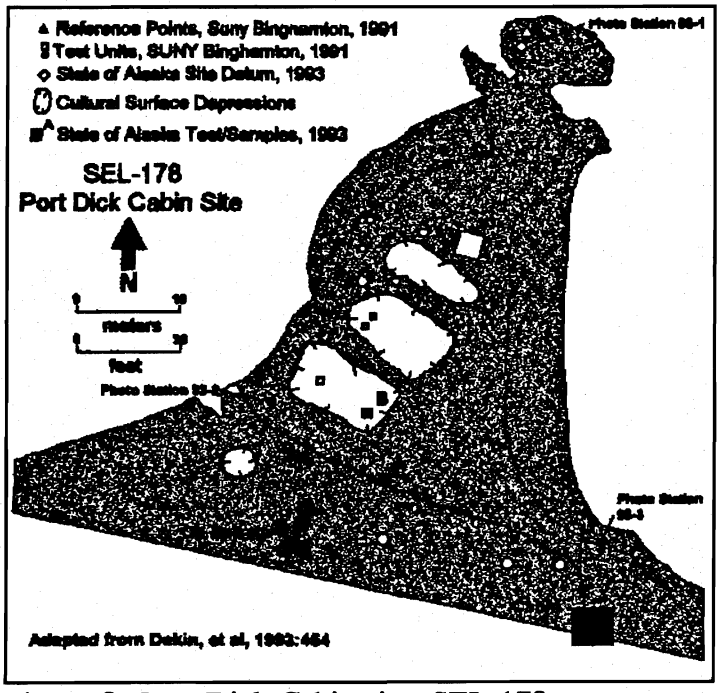

Figure 8. Port Dick Cabin site, SEL-178.

Photographic stations were established at the 1993 site datum (Photo Station 93-1), at the secondary site datum (Photo Station 93-2), and on top of a prominent rock at the southeast corner of the spit (Photo Station 93-3). Panoramic views of the site were photographed from each station to create visual references for future investigations.

Survey and Monitoring Visits

SEL-119 (Segment YP-002)

SEL-119 is a large mainland village site comprised of numerous pit features in the forest fringe of a broad gravel beach (McMahan and Holmes 1987:20-22); McMahan 1993:27-28). The OHA team examined the site on 14 July 1993 but found no evidence of oiling or disturbance of features in the forest fringe.

SEL-216 (Segment NK-004C)

SEL-216, discovered by Exxon archaeologists in 1990, consists of an intertidal lithic scatter which includes hammer stones, boulder spall scrapers, and a chipped greenstone biface. In June 1991 OHA archaeologists tested the site and determined that no buried cultural deposits are present (Reger *et al.* 1992:22). Inspection of the intertidal zone revealed no evidence of surface oiling or disturbance since it was visited in 1991.

Table 3. SEL-178 Map Data

(Azimuths and distances from Site Datum 1)

Description & Notes	Azimuth (magnetic)	Distance (m)
Features & Landmarks		
Helipad soil sample No. 93-1/3	189.75°	21.00
Helipad soil sample No. 93-2/3	183.50°	23.20
Helipad soil sample No. 93-3/	201.75°	22.00
Test Pit A (base of spit trail)	196.50°	48.50
Test Pit B (southern house depression)	202.00°	45.50
Photo Station 93-2 (secondary datum, SW corner of site)	209.00°	54.00
Photo Station 93-3	151.25°	52.00
Southern House Depression (main room)		
Southwest corner	209.50°	48.50
Northwest corner	210.00°	41.50
Southeast corner	203.75°	48.70
Northeast corner	200.00°	42.00

SEL-217 (Segment NK-004C)

SEL-217, discovered by Exxon archaeologists in 1990, is an upper intertidal FCR and lithic artifact scatter which includes splitting and planing adzes, a chipped and battered tabular basalt rock, a smoothed or worn exotic granite boulder, a greenstone wedge, and a battered cobble. In June 1991 OHA archaeologists tested the site and determined that no buried cultural deposits are present (Reger *et al.* 1992:22-23). OHA archaeologists visited the site on 14 July 1993 and found no evidence of oiling or disturbance since it was visited in 1991. A brief shoreline survey, however, extended site limits to the south and identified a number of culturally modified trees in the adjacent uplands.

SEL-130 (Home Cove Site; No Segment #)

SEL-130, discovered by OHA in 1986 (McMahan and Holmes 1987:22-34), consists of an upper intertidal scatter of both Euro-American artifacts and aboriginal stone artifacts that are thought to be derived from a lag deposit. Artifacts from this site have been mapped and collected by OHA since 1986 as part of the agency's research activities on Stat Park lands. The assemblage includes a hand-forged copper kettle, earthenware ceramics, "Russian style" iron axes, a U.S. military belt buckle, iron spikes, a musket lockplate, notched cobbles, stone splitting adzes, and a stone lamp. CMTs and massive quantities of FCR are also present over the site. Although not oiled, this site was monitored by agency archaeologists during 1989-1991 due to the presence of cleanup crews on other area beaches.

The OHA team visited SEL-130 on 12 July 1993 and found no evidence of oiling or disturbance since it was visited in 1991. A metal detector survey of the site area revealed an unidentified iron cylinder and a half-cylinder piece of lead on the surface of the upper intertidal zone. These items were not collected. Also noted in the upper intertidal zone was a hand-squared and sharpened wooden stake that is probably historic.

SEL-131 (Herring Pete's House; No Segment #)

Herring Pete Sather's house (SEL-131), the only standing structure in Nuka Passage, was extensively documented by OHA in 1986 (McMahan and Holmes 1987:34-54) and is considered to be eligible for the National Register of Historic Places. The structure was recently acquired by the University of Alaska and has substantially deteriorated since 1986. Like SEL-119 and SEL-130, this site was not damaged by oil but was monitored by agency archaeologists during 1989-1991 due to the presence of cleanup crews on nearby beaches. This site was found to be largely undisturbed since used as a base camp in 1991. The intact roof needs resurfacing and wind-tattered plastic placed over the windows by OHA in 1990 should be replaced. If maintenance is not accomplished in a relatively short time, this historically and logistically important structure will deteriorate beyond repair.

Shuyak Island

Archaeological restoration assessment of Shuyak Island sites was conducted by OHA archaeologists Douglas Reger, David McMahan, and Mark Pipkin during August 1993. In accordance with the restoration work plan, the OHA crew completed specific tasks at AFG-081 and AFG-098 in the Big Bay area and AFG-046 in Perevalnie Passage (Figure 9). At AFG-081 work included mapping and photography of the extent of vandalism to an exposed midden. Activities at AFG-098 and AFG-046 included: (1) documentation of current site condition through photography from permanent control points; and (2) collection of subsurface sediment samples from the lower, middle, and upper intertidal zones. Testing and sampling were as described in the Nuka Passage section of this report. Work at AFG-046 also included documentation and mapping of human remains and artifacts within the intertidal zone, and collection of some surface artifacts.

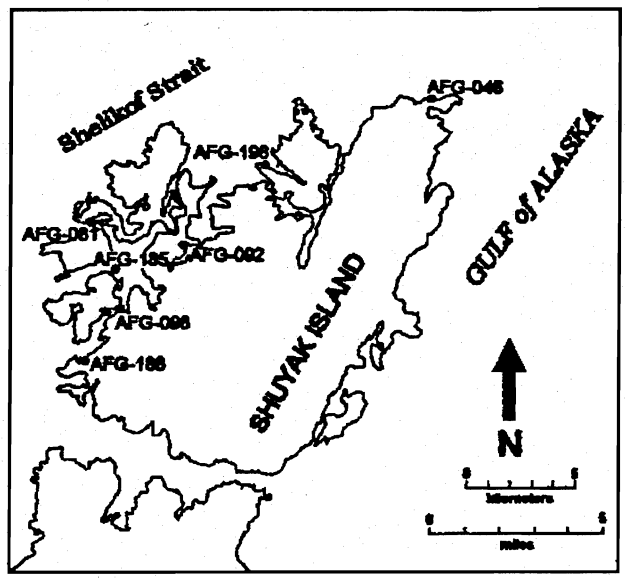

Figure 9. Shuyak Island area sites.

AFG-081 (Segment WO-003)

This large Koniag period site, discovered by OHA in 1983, consists of six large house pits (the largest measuring 12 m in diameter), an eroding midden, and extensive deposits of FCR (Figures 10, 11, and 12). The site is located on an isthmus between a high energy beach which faces Shelikof Strait and a protected lagoon. No cultural material has been located on or adjacent to the Shelikof Strait beach which has a massive gravel berm and large quantities of recent storm debris. Artifacts, faunal remains, and FCR are eroding from a 3 m to 4 m high bluff near the house

pits., on the lagoon side (Dekin *et al.* 1993; McMahan 1993:65). The high visibility of the site, and use of Big Bay as an anchorage for cleanup task force vessels, caused concern that the site was an easy target for vandals. Apparently, in the spring of 1989, vandals did in fact excavate a horizontal pit into the exposed midden on the lagoon side of the site. AFG-081 was monitored by both the state and Exxon archaeologists during 1989-1992.

Restoration work at AFG-081 by McMahan and Pipkin on 19-21 August 1993 included: (1) controlled excavation, then stabilization, of the vandalized area of the midden, and (2) mapping of data points over the site. Initial examination of the site revealed that the vandal pit, which extended horizontally into the exposed midden, had slumped and revegetated since visited by McMahan in July 1992. The vandal pit, which may have been enlarged by erosion, was 3.6 m wide, 1 m high, and 1m+ deep at the time of inspection. The slumped surface and vegetated scarp surrounding the

Figure 10. AFG-081. East margin, vandalism hole at center.

Figure 11. AFG-081. Stratigraphy of vandalism hole.

vandal pit was partially removed by shovel. The face of the scarp was trowel-excavated to expose a stratigraphic profile to the base of the disturbance, identify 2 m wide section of the midden scarp was exposed in this manner, leaving a 1.5 m back wall, the base of which was about 1 m above high tide. The OHA excavation did not reach the bottom of cultural deposits, and FCR prevented the use of a tube type soil probe. Artifacts recovered during excavation of the scarp face include two small fragments of ground slate, one of which appears to have been spalled from a medial-ridged projectile point; one unretouched greenstone cobble spall; one sea otter molar; and two sea mammal long bone fragments, one of which has been modified (Table 4). The artifacts, all collected from slumped deposits, appear to have originated in the uppermost cultural horizon. Soil samples collected from four of the identified strata were subjected to water flotation to extract flora and charcoal samples. Charcoal from three of the samples were submitted for radiocarbon dating (see Appendix 1). Based on the presence of spruce macrofossils in the lowest sample, all exposed strata probably date within the last 1,000 years. After documentation the pit was back-filled with soil and boulders, then covered with driftwood.

Mapping data were collected and a primary datum consisting of an unmarked iron spike was established at the edge of the forested area 19 m northeast of the midden exposure. Three transit stations, located on high areas of the site, were used to record house pit perimeters and depths, location of the midden excavation described above, and locations of other distinguishing landmarks.

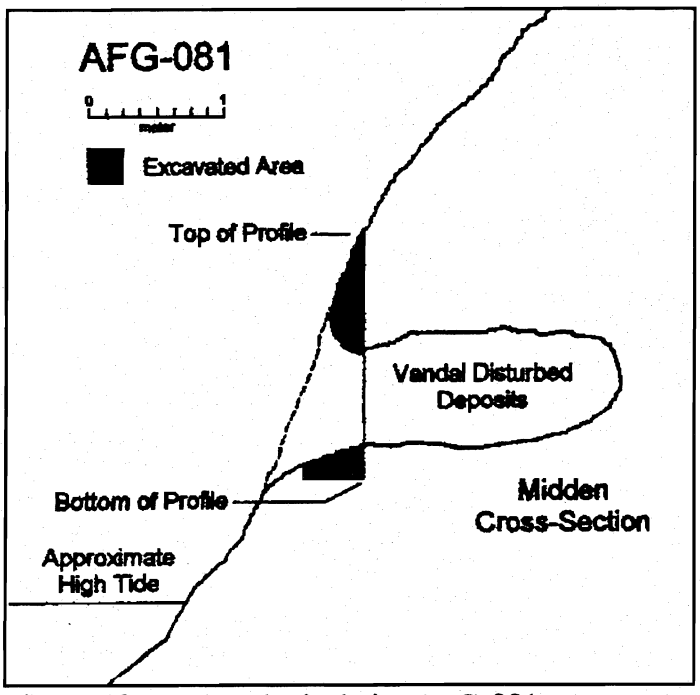

Figure 12. Archaeological site AFG-081.

AFG-098 (Twin Creeks I; Segment NB-001)

This site, located near a gravel berm that separates Neketa Bay from Big Bay, was first reported by OHA in June 1989 as a small intertidal artifact scatter. In July 1990 Exxon archaeologists documented more extensive boundaries and located artifacts diagnostic of Ocean Bay culture and late prehistoric occupations. OHA tested the site in 1991 and found buried intertidal midden deposits. Subsequent OHA excavations revealed subsurface features and an assemblage of artifacts (including organic materials) important in defining the later prehistory of the area (Reger *et al.*1992:40-68). Artifact typology, stratigraphy, and a series of 10 radiocarbon dates suggest that two periods of Koniag occupation are represented (Reger et al. 1992:93). Scattered oil (mousse) was present at the site as late as August 1991.

Table 4. Artifacts from Cleanup of the AFG-081 Vandal Pit
(All except #7 are from slumped matrix, probably upper level)

UAF Accession #	Description
UA93.153.1	Ground slate projectile point fragment; midsection spall with medial ridge; 4.7 cm x 1.3 cm x 0.3 cm
UA93.153.2	Ground slate fragment; 2.7 cm x 1.9 cm x 0.3 cm
UA93.153.3	Spall from a small greenstone cobble; unretouched except for impact scar
UA93.153.4	Sea-mammal long-bone fragment, cut at one end and possibly worked or utilized at the other end; 8.9 cm x 2.2 cm x 0.35 cm
UA93.153.5	Sea-otter molar; unworked
UA93.153.6	Sea-mammal long-bone section, unworked; 3.2 cm x 2.3 cm x 1.8 cm
UA93.153.7	Ground slate ulu fragment, straight blade form; 8.8 cm x 5.2 cm x 0.45 cm; from Layer G in profile

Visual inspection of the site by McMahan and Pipkin on 18 August 1993 revealed no surface oiling or evidence of disturbance since July 1992. In the area of 1991 intertidal excavations, the beach had reclaimed itself and excavation units were barely discernable. Black/white photographs were taken from 1991 OHA Datum A1 and from the northeast corner of the 1991 main trench (unit N50/E51) (Reger *et al.* 1992:Figure 29). Sediment samples collected from three test pits at AFG-098 were located relative to OHA Datum A1 by use of a transit and tape (Table 5). Test Pits 1 and 2 were in sterile beach gravels but Test Pit 3 penetrated an intertidal midden deposit. Artifacts were not collected from any of the test pits during sampling.

Two flotation samples from the lower cultural component at AFG-098 were collected to more completely document the vegetational history of Shuyak Island. This was accompanied by re-excavating a portion of the 1991 trench, using earlier stratigraphic drawings (Reger *et al.* 1992: Figure 32) as a guide, and removing

Table 5. AFG-098 Test Pit Log

TP-#	Place in ITZ	From Datum	Azimuth (mag.)	Distance (m)	Dimensions (cm)	Depth (cm)	Elevation (m AMSL)*
93-1	Lower	A1	026.75°	43.50	35 x 35	35	2.40
93-2	Upper	A1	033.00°	49.50	45 x 45	60	3.36
93-3	Upper	A1	042.00°	52.40	50 x 40	50	4.41
NE Corner, 1991 trench (N50/E51)		A1	037.75°	65.40	(Azimuth/Distance for instrument calibration)		

*Elevations, which are approximate, were calculated from the height of Datum A1 as related to high tide on 7/11/91 p.m. (refer to Reger *et al.* 1992:Figure 29; McMahan 1991 & 1993 field notes).

samples from the side wall. During 1991 field work, prior to separation of the components by age, only samples from the more widespread upper component were collected and analyzed (Reger *et al.* 1991:Appendix 1).

AFG-046 (Perevalnie Passage; Segment SI-005a)

AFG-046 consists of three house pits and nine smaller depressions on a 2 m to 3 m high bluff which is capped by an eroding midden up to 1.5 m thick (Figures 13 and 14). In 1983 OHA archaeologist Steven Klingler collected slate flakes, ground slate, flaked stone, worked and cut bone, notched stones, and numerous cobble spalls from the site. During 1989 Exxon archaeologists monitored cleanup of the oiled intertidal zone and supervised the collection of artifacts from the beach (Mobley *et al.* 1990:142-143). The range of artifacts suggests the possibility of several cultural components, ranging from Ocean Bay to transitional Koniag. A series of six radiocarbon dates from the base of the top of the midden deposit range from approximately 4,000 to 1,300 years B.P. (Dekin *et al.* 1993:530). Due to the perceived importance of the site, and extensive oiling on the adjacent beach, Exxon and agency archaeologists have made a number of monitoring visits to the site since the spring of 1989. Recent vandalism to midden deposits was noted during several of these visits.

OHA archaeologists Reger, McMahan, and Pipkin examined AFG-046 on 24-27 August 1993. Visual inspection of the site revealed no evidence of surface oiling or recent vandalism. However, the team did note a burial exposed in the beach scarp by recent erosion and slumping, as well as a number of artifacts and human bones in the intertidal zone. Of numerous lithic and bone artifacts within the intertidal zone, a few diagnostic specimens were mapped and collected. Also noted was the cross section of a house pit exposed in the beach scarp by erosion and slumping. Color and black/white photographs were taken from two photo stations within the intertidal zone. For the best perspective, features were also photographed from points outside the control stations. A transit station was established off a rocky headland at the approximate center of the site for purposes of mapping artifacts, features, photo stations, and test pits. Subsurface sediment samples (Table 6) were collected from three test pits at shore-ward intervals in the manner previously described.

Human remains at AFG-046 consist of: (1) an adult *in situ* burial exposed in the beach scarp; and (2) miscellaneous adult bones within the intertidal zone. The burial, which was probably a flexed primary inhumation, is located about 1 m below

Table 6. AFG-046 Test Pit Log

TP-#	Place in ITZ	From Datum	Azimuth (mag.)	Distance (m)	Dimensions (cm)	(cm)	Depth Elevation (m AMSL)
93-1	Upper	TS1	82.00°	79.70			
93-2	Middle	TS1	78.75°	78.60			
93-3	Lower	TS1	70.25°	66.50			

the top of the scarp in a dense midden of shell, fauna, and FCR. The position of repose appears to have been on the right side. The left side of the cranium (including a portion of the left side of the mandible, most of the occipital, and the left parieto-squamosal area) was exposed, along with the left humerus (distal half) and left femur

Figure 13. AFG-046. 1993 datum (at the tide line) from west photo reference point.

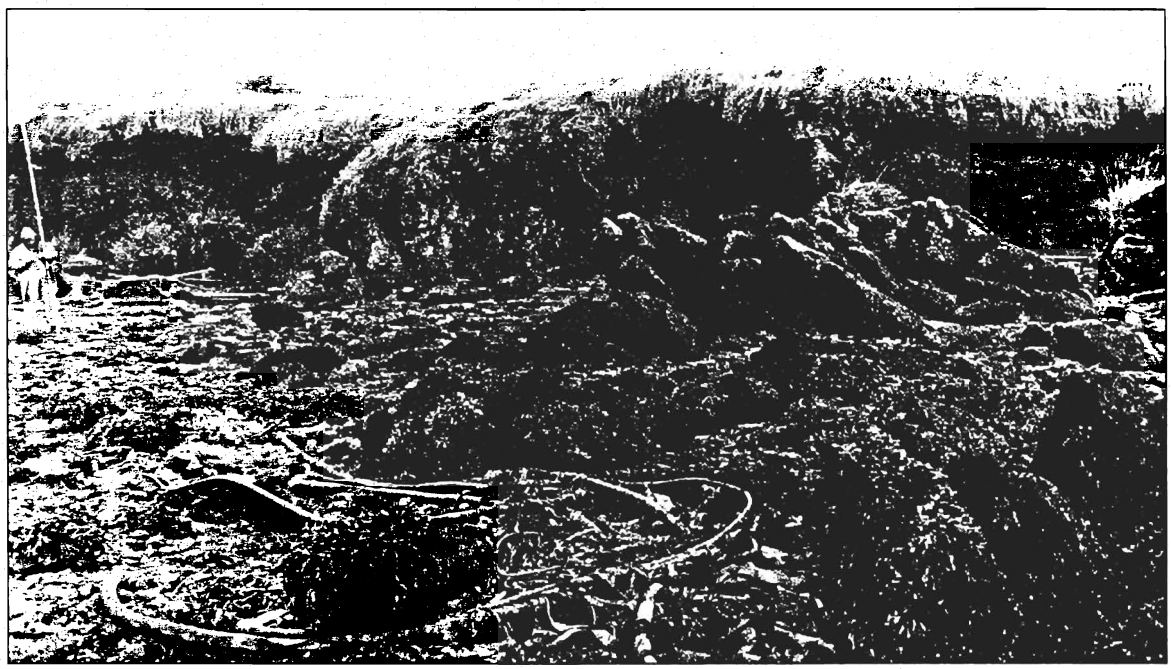

Figure 14. AFG-046. View south at east photo reference point (center rock pile).

(proximal third). Field analysis was not attempted and the remains were left undisturbed. Locations and descriptions of intertidal human bones are included in Table 7, along with artifacts and features. Based upon location and degree of weathering of the intertidal bones, they are believed not to be related to the exposed burial. Also, from duplication of elements it is apparent that more than one individual is represented by the intertidal assemblage. Osteological analysis, other than a brief description, was not attempted. Human bones within the intertidal zone were not collected, but were placed in a rocky cleft at the base of the beach scarp. Other human bones were previously placed in the same cleft by Exxon and OHA archaeologists for protection from vandals and erosion (Mobley *et al.* 1990:143).

Survey and Monitoring Visits

As time permitted, the team conducted limited survey and examination of other Shuyak Island sites. These included a previously reported house pit site (AFG-188) and two historic mining sites (AFG-092 and AFG-185). The team also documented a house pit site (AFG-198) which had been recently reported by an Alaska Department of Fish and Game official (ADF&G).

AFG-092 (Segment CI-001?)

AFG-092, reported by the Alaska Department of Parks and Outdoor Recreation (ADPOR) officials in 1986, is a probable historic mining site. Reported features included wooden posts eroding from the beach scarp, a shallow pit, and an 8 ft. hole in a large earth mound. OHA archaeologists Reger and McMahan visited the site in July 1990 and noted that the two old excavations are probably prospect pits. The site was again visited by OHA archaeologists McMahan and Pipkin in August 1993. The previously documented features were found to be in undisturbed condition. Also documented was a prominent CMT adjacent to one of the pits.

Table 7. AFG-046 Map Data: Features, Artifacts, and Human Remains
(Azimuths and distances from Transit Station 1)

Description & Notes	Shot#	Azimuth (magnetic)	Distance (m)
Features & Landmarks			
Abandoned dozer, west edge of blade (for calibration)	01	061.00°	041.00
Boulder circle, west edge (intertidal feature)	02	078.50°	075.00
Separated rocky headland, south edge (for calibration)	03	258.00°	028.00
West Photo Station, consisting of an intertidal outcrop	04	258.00°	018.90
East Photo Station, consisting of an intertidal outcrop	05	119.50°	026.00
House pit, cross section exposed in beach scarp	16	094.75°	071.00
Artifacts			
Stemmed projectile point, ground slate (UA93.152.1). Biconvex cross section, acute angle barb; 5.2 cm x 1.8 cm x 0.3 cm	06	067.50°	056.00
Ulu fragment, ground slate (UA93.152.2); 7.9 cm x 4.3 cm x 0.3 cm	08	108.50°	040.50
Wedge, sea-mammal bone (UA93.142.3); 11.2 cm x 4.2 cm x 1.7 cm	09	117.00°	036.10
Stone lamp fragment (UA93.152.4); plain, 14.2 cm x 13.2 cm x 5.0 cm	13	140.50°	026.00
Ground and chipped slate biface (UA93.152.5); possibly a projectile or ulu that was reworked by flaking, tear-shaped; 10.4 cm x 3.2 cm x 0.5 cm	15	136.50°	022.10
Human Remains (all adult)			
Burial, exposed in beach scarp 1 m below top	14	140.50°	028.00
Rocky cleft at base of beach scarp; intertidal bones were removed to this location for protection	18	203.75°	020.00
Occipital, right edge missing; fits with #10 below	07	108.50°	040.50
Right parietal, posterior half; fits with #07 above	10	120.00°	019.10
Innominate fragment, sciatic notch region, male	11	123.00°	011.00
Rib fragment; with #11 above	11	123.00°	011.00
Lumbar vertebra, No. 2-4; moderate arthritic lipping of centrum	17	237.75°	021.50
Left radius, proximal end missing	19	252.25°	041.00
Right tibia (and fibula fragment)	20	125.00°	036.20

AFG-185 (Kevin Murphy Site; Segment BG-003)

AFG-185, reported by ADPOR Ranger Kevin Murphy in July 1990, appears to be a historic mining site. Features include a large squared pit that has been truncated by the beach scarp, and a box-like arrangement of axe-trimmed timbers within the intertidal zone (McMahan 1993:88-89). Other timbers protrude from the base of the beach scarp and a chopped CMT is located in the forest fringe. A subsurface test pit suggests that the site predates deposition of the 1912 Katmai ash. McMahan and ADPOR Ranger Kevin Murphy visited the site on 19 August 1993 and found it undisturbed. A brief metal detector survey of the intertidal one and adjacent forest fringe was negative. Dating of this site remains problematic.

AFG-188 (Segment NB-001)

AFG-188, discovered by OHA archaeologists in July 1990, consists of a two-chambered house pit, a single-chambered house pit, and a midden deposit (McMahan 1993:90-91). The site is in a meadow of puschki, nettles, and grass adjacent to a high-energy pocket beach. At the request of Ranger Murphy, OHA archaeologists McMahan and Pipkin examined the site and surrounding area on 19 August 1993. The purpose of the survey was to document potential impacts to the site as a result of recent trail construction by the owner of a private lodge in Shuyak Harbor. At the time of examination, the site was undisturbed. The trail enters from wooded uplands on the west side of the site, extends along the beach in front of the site, and again enters wooded uplands northeast of the site. The trail, which was created by limited brushing and marking by survey tape, does not appear to threaten the site.

AFG-198 (Segment CI-001)

AFG-198 consists of three (and possibly four) circular house depressions 4 m to 5 m in diameter and partially filled with storm debris. The depressions, marked by concentrations of puschki, are located in a grassy meadow just behind the storm berm of a high-energy cobble beach. A 0.5 m thick midden, eroding from the adjacent beach scarp, contains numerous bird, fish, and large-mammal bones in a matrix of

shell, FCR, and organic-enriched soil. The site is thought to be of Koniag affiliation based on site location and a high degree of organic preservation. The site was reported to ADPOR District Ranger Claire Holland in July 1993 by ADF&G

Conclusion

The sites visited under restoration activities do not appear to have suffered recent vandalism, however, evidence of past damage persists. The baseline data and documentation of site condition will allow future site visits to quickly detect any new destruction. Photographs from established photo stations will allow duplication of visual perspectives even by investigators new to the sites. Sediment samples from the sites were not thought to contain crude oil as none could be detected by odor or visually. Consequently, the samples were not submitted for chemical processing.

SEL-215 and SEL-220 have not suffered from recent vandalism but both continue to suffer from tidal erosion and exposure of deposits to potential looting. The most logical method of protecting the data in the sites is excavation, however, that should only be attempted if looting begins. The test trench in the intertidal peat area of SEL-215 should be filled and armored with rock to slow erosion of the site.

Erosion of the site deposits in the Port Dick Cabin site, SEL-178, continues on the west side of the spit but at a very slow rate. The danger of looting remains because of the remote location, presence of intertidal remains, and recognition of the site from the presence of housepits. Use of the site as a staging area for hunters and fishermen also will continue the danger of contamination from boat, helicopter, and airplane fuels. The site needs to be monitored occasionally but no stabilization or excavation is justifiable.

Restoration of AFG-081 will hopefully result in revegetation of the vandalized deposits. The heavy rocks placed in the hole will reduce the slumping expected in undercut midden and the vegetation placed over the new fill should provide a base for new vegetation to grow. The site should be monitored to track site stabilization and detect any new damage. Because the site is in Shuyak State Park and easily monitored

by park rangers stationed there during the summer, monitoring appears to be the most effective method of site protection.

The Perevalnie Passage site was only mapped and displaced artifacts collected; no attempt was made to restore damaged deposits. Erosion by the sea continues in large areas of the sites but more protected areas are stabilizing naturally. Clear evidence of campers on the beach adjacent to exposed midden signals that the high danger of vandalism continues. Exposed human skeletal remains will continue to identify the location as a site even to those not knowledgeable about the artifacts on the beach. Long-term stabilization of the site as a restorative measure does not appear to be feasible in the face of continued exposure to winter storms. A significant amount of excavation would be necessary to allow placement of rocks as armor over the site. The most effective method of protecting the information in the site seems to be data recovery rather than solely stabilization and monitoring. That method is particularly appropriate given the remote location of the site and its exposure. Excavation will entail some replacement of soil and covering with sod or rock armor but armoring of the entire site exposure is not advisable.

U.S. Fish and Wildlife Service Field Monitoring, 1993

Debra Corbett
Charles Diters
Bridget Fahey
Alaska Regional Office

The sites examined by the U.S. Fish and Wildlife Service (USFWS) are located on Afognak Island (4) and on Kodiak Island (1). Several features of the work carried out correspond to all the sites examined. These are as follows:

Though the USFWS did not manage the upland portions of the Afognak sites and part of the eastern end of the Kodiak site, that part of the sites was traversed for orientation purposes, the features were examined briefly, and all reported potholes relocated. Videotape footage was taken of the sites, features, potholes, and exposed midden. Hydrocarbon samples were taken from the intertidal zone using protocols outlined by the National Park service. A second, open jar was kept nearby to collect air as a control. The jars were sealed, labelled, and stored in the freezer aboard the USFWS vessel *Ursa Major II.* All samples were collected from the intertidal zone according to National Park Service protocol.

AFG-026 (McDonald Lagoon)

This site, thought to be one originally documented by Hrdlicka (1944) in 1941, is located in McDonald Lagoon on the west side of Izhut Bay, south of the entrance to Kitoi Bay on the southeast coast of Afognak Island. The site was documented by Clark (1974). He reported trenches and pits excavated sometime before his visit. A small collection of artifacts was made from eroded contexts. Exxon investigators visited the site in 1989 and again in August 1990, when they documented "recent" vandalism (Haggarty *et al.* 1991). The upland portion of the site is owned by the Afognak Native Association and it is described only generally in this report. Intertidal areas are under the jurisdiction of the USFWS. The site was visited August 18, 1993.

AFG-026 is a prehistoric midden site, probably Koniag phase, which dates

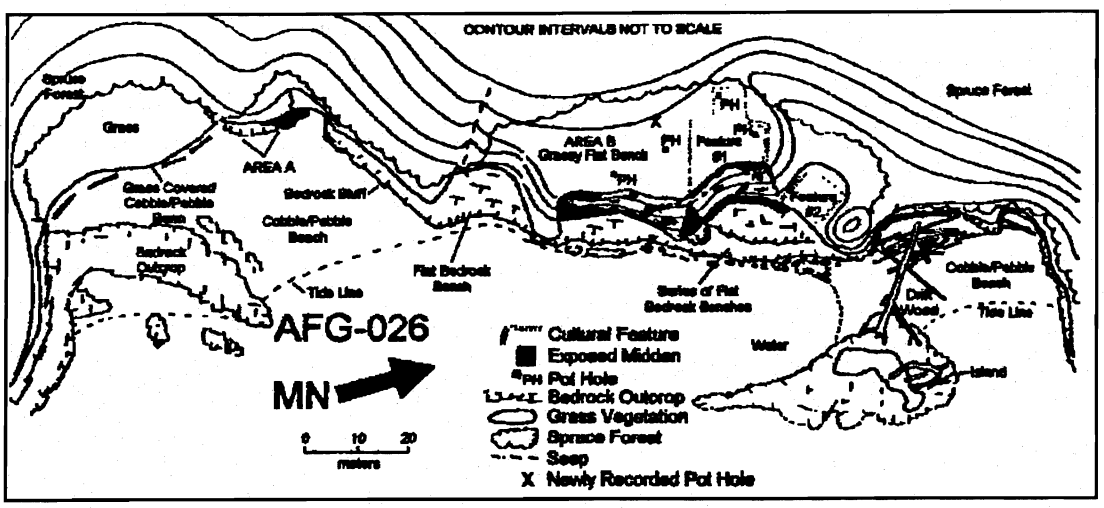

Figure 15. Archaeological site AFG-026.

from about A.D. 1000 to about A.D. 1800. The site consists of two areas. Area A is a midden measuring 18 m x 3 m x 1 m. It sits atop a small knoll at the head of a 50 m wide pocket beach. An erosion exposure 3 m to 4 m long reveals FCR, clam and mussel shells, and some mammal bone.

The main portion of the site, Area B, is to the northeast, separated from Area A by a bedrock outcrop and forest. Part of the area, 80 m x 20 m x 1 m, is on a grassy bench 5 m to 6 m above the beach. The grassy area drops steeply to about 3 m to 4 m above the beach and extends to the north an additional 20 m.

Two large depressions, probably house pits, were identified. The largest measures 20 m x 15 m, including an entryway. It sits on the northern edge of the site overlooking the lower terrace. The smaller, 10 m x 8 m, house pit dominates the lower terrace.

Portions of the bluff face are eroding and have been disturbed by pothunters. In addition six shovel holes were previously reported in the features or on the surface of the site. Cultural materials found in the exposures included clam and mussel shell, mammal and bird bone, FCR, and notched and grooved pebbles.

The hydrocarbon samples were taken from the intertidal zone below Area B.

All the features and potholes documented by Exxon crews were relocated. In addition, another pothole was discovered. Two potholes were found inside Feature 1,

Figure 16. Revegetating pot hole. AFG-026.

the largest house pit. Two small potholes in the eroding bluff face adjacent to Feature 1 and two pits found on the surface of the site, outside the features had all been described by earlier investigators. A third pit on the surface of the site was newly discovered during our reconnaissance. All were revegetated and exposed shell and bone were weathered. These pits are probably younger than the pits described by Clark (1974) but, except for the two on the eroding face of the midden, may be older than 1989.

The bluff below Feature 1 exhibits fresh disturbance. Large slump blocks are slowly moving down the slope. Midden material exposed within the last few months include shell and FCR. No artifacts were seen but a stone-lined cache in the floor of Feature 1 was exposed. Two potholes were dug into the eroding face. These two potholes lacked the degree of revegetation seen in the others on the upper surface of the site and may represent the recent vandalism noted by Reanier in 1989 (in Haggarty *et al.* 1991).

The intertidal zone lacks *in situ* cultural deposits. Any materials found on the beach have eroded from the upland midden. Our reconnaissance found no freshly exposed artifacts. FCR, shell, other faunal remains, and artifacts will continue to appear on the beach as long as the site is eroding.

All the potholes were excavated into cultural materials and exposed shell and FCR midden. The damage is concentrated on Feature 1. Two holes had been excavated into the floor of the feature by looters, with an additional one excavated into the outside berm. The two potholes in the eroding face of the midden are dug into the feature. The other two potholes are in general midden deposits on the surface of the site.

Continuing erosion of the midden face, accelerated in areas by pothunting will continue to affect the upland portion of the site. There are no *in situ* materials in the intertidal zone that will be affected by erosion or vandalism. However, casual collectors may be picking up items exposed by erosion in the intertidal zone.

No restoration activities are warranted for the USFWS managed intertidal zone as there is no damage to this portion of the site. Patrols may deter casual collection of artifacts which erode from the upland areas. As an added benefit patrols may deter excavation which is accelerating the natural erosion at the site.

AFG-027 (Kitoi Bay)

This site is located on the north side of the entrance to Kitoi Bay, a branch of Izhut Bay on the east coast of Afognak Island (Figure 17). The site was reported by Clark (1974) as a 31 m long midden. Due to subsidence from the 1964 earthquake a house pit on a lower terrace was flooded at high tide. In 1989 Exxon archaeologist Reanier (in Haggarty *et al.* 1991) described nine areas of disturbance, at least four occurring that year. The house in the intertidal zone was not relocated and presumed destroyed by erosion. Another visit by Exxon archaeologists in 1990 found no evidence of any additional vandalism (Haggarty *et al.* 1991). The upland portion of the site is owned by the Afognak Native Association and is described only generally in this report. Intertidal areas are under the jurisdiction of the USFWS.

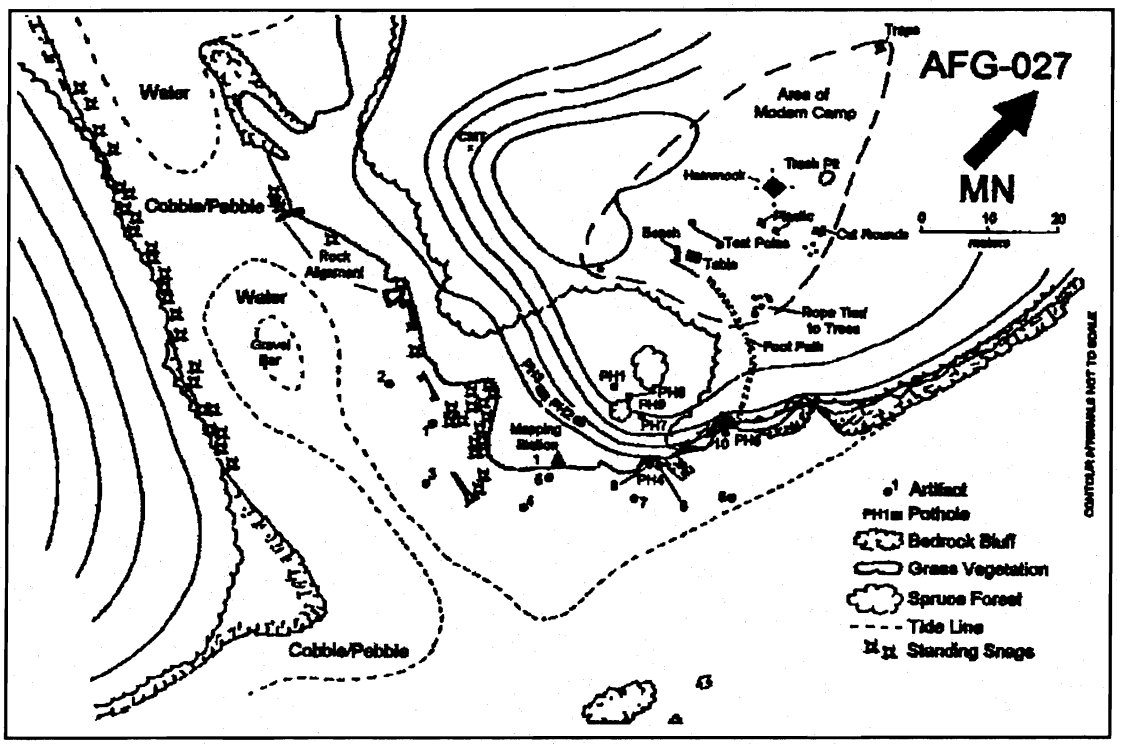

Figure 17. Archaeological site AFG-027.

AFG-027 was visited August 18, 1993. It is a prehistoric midden site. The major portion of the site is a 30 m long midden raised about 3 m above current sea level. The midden is marked by a clearing in the spruce forest, and dominated by grass, fireweed, wild celery, and devil's club. Deposits are about 40 cm thick; and contain shell, bird, fish, and sea mammal bone; and large quantities of burned and unburned slate. A lower midden, now in the intertidal zone, apparently subsided about 1 meter as a result of the 1964 earthquake. A reported house pit in this area was not relocated by either the Exxon archaeologists or our reconnaissance. Shell and FCR are abundant in this intertidal zone. The reported oval rock alignment was relocated, and a second possibly natural, alignment was found.

A modern hunting camp inside the spruce forest was briefly visited. The camp features a fish net hammock, wooden furniture, metal, cut tree stumps, and a 2 x 4 lashed between two trees.

The site appears much as described in the Exxon reports and files. There has

been no new vandalism though erosion is occurring due to older potholes excavated in the bluff face at the eastern end of the midden mound. Of particular concern is the hole dug around the roots of a large spruce tree. Eventually the tree will fall, further disturbing the midden and opening a larger area to erosion.

The intertidal zone appears stable. Several of the artifacts reported from 1989 were relocated. The beaches are relatively low energy environments, low angled and situated near the head of deep embayments. Undoubtedly reconfiguration of the beach took place after the 1964 earthquake but the beach has apparently stabilized. Though the house pit is not visible it seems likely buried deposits are largely intact.

All of the looters' potholes had been excavated into cultural materials and exposed shell and FCR midden. The damage is concentrated along the bluff edge. On-going erosion of the midden face, accelerated in areas by pothunting will continue to effect the upland portion of the site.

The *in situ* materials in the intertidal zone do not appear to be threatened by erosion or vandalism. There are no excavations in the intertidal midden area and artifacts located in 1989 are still in place.

No restoration activities are warranted for the USFWS portion of this site as there is no immediate or recent threat to the intertidal zone.

AFG-028 (Ruth Bay)

The site is located on the south shore of Ruth Bay, a small arm of the northern inlet of Izhut Bay, on the east coast of Afognak Island. The site was first reported by Clark (1974), who described an actively eroding midden. Exxon investigators visited the site in 1989 and 1990 (Haggarty *et al.* 1991). They reported both natural erosion and recent vandalism at the site. The upland portion of the site is owned by the Afognak Native Association and is described only generally in this report. Intertidal areas are under the jurisdiction of the USFWS.

Clark (1974) described an intensely overgrown midden 63 m long and 23 m wide. Active erosion along 90% of the front of the site showed deposits up to 1 m deep. Artifacts, including ground slate points, incised slate figurines, adzes, ulu

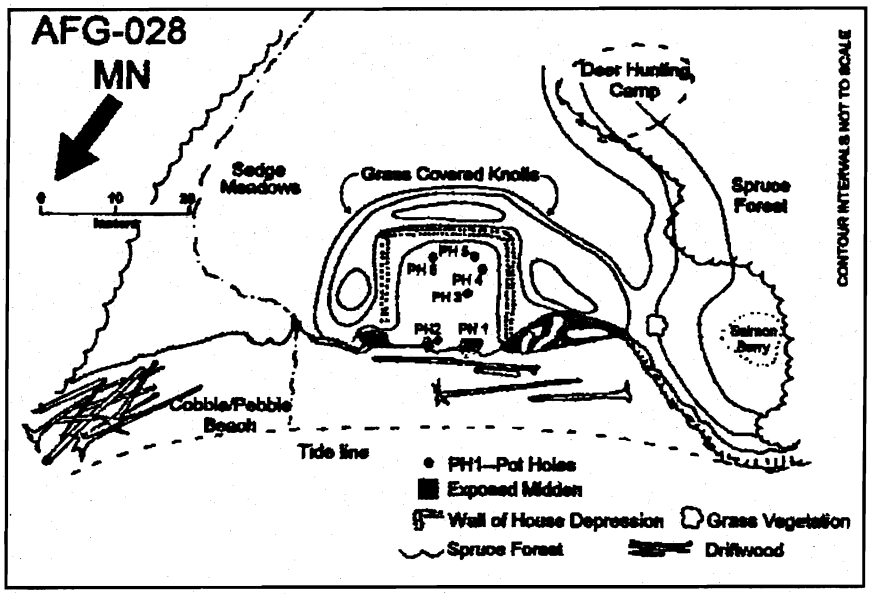

Figure 18. Archaeological site AFG-028.

blades, mauls. lamps, bone wedges, and harpoon sockets suggested Koniag phase occupation with Kachemak affiliation.

The 1989 Exxon investigation described a 16 m x 16 m depression in the center of the midden area. This presumed house pit was eroding at the midden edge and investigators reported erosion along 35 m of the midden face. The slopes are steep and unstable, vulnerable to both wind and water erosion. Several areas had been recently pothunted, including four holes inside the house pit and two on the eroding edge. All had been excavated within the last three to four months. The largest pothole, at the eastern edge of the midden was 3 m long. A second hole on the outside of the house showed freshly turned soil and trampled vegetation.

The site was visited by the USFWS on 19 August 1993 and appeared much as described in the Exxon reports and files. A previously unreported modern deer hunting camp was located just inland from the site. There has been no new vandalism though erosion is occurring on the steep bluff face.

All reported potholes are naturally revegetating. None of the artifacts noted by Exxon archaeologists in 1990 were relocated. Though we specifically searched for artifacts they may simply have been missed in the slate gravel of the beach. Alternatively they may have been buried or washed away naturally or collected by deer hunters.

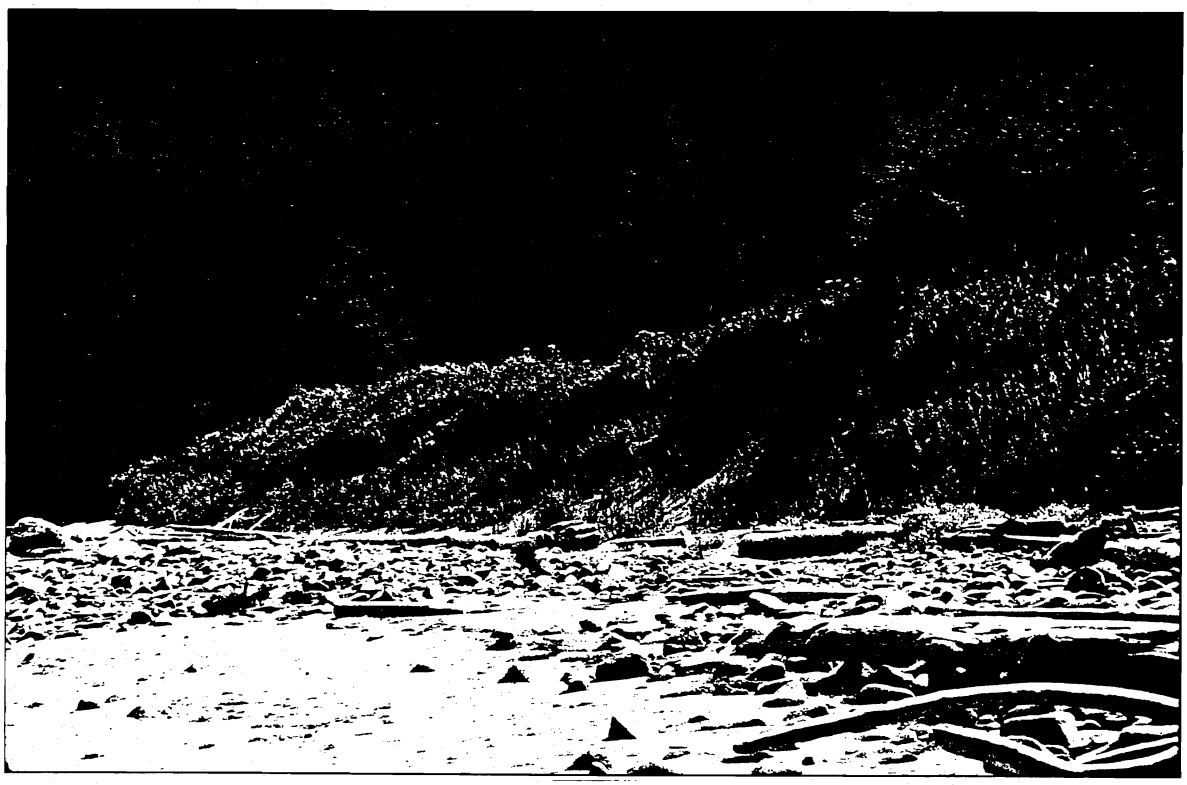

Figure 19. Archaeological site AFG-028.

All the potholes in the upland portion of the site had been excavated into cultural materials by looters. The damage is greatest along the bluff edge where it is magnifying the erosion. On-going erosion of the midden face will continue to affect the upland portion of the site and supply artifacts to the intertidal zone.

No restoration activities are warranted for the USFWS portion of this site as there is no recent or immediate threat to the intertidal resource.

AFG-143 (Cajun Point)

This site is located on the south side of the entrance to Kitoi Bay, a branch of Izhut Bay on the east coast of Afognak Island. Exxon archaeologists visited and recorded the site in 1989 and updated the information during a second visit in 1990 (Haggarty *et al.* 1991).

The site consists of a shallow, 15 cm to 20 cm thick prehistoric midden on a 1 m to 1.5 m high slate shelf. The midden area covers 50 m x 30 m, apparently much

reduced from the original size by subsidence and erosion. Three, possibly four, shallow house pits occupy the center of the grassy clearing. The house pits range from 5 m x 7 m to 8 m x 9 m, all are rectangular with no evidence of side rooms. Three pocket beaches bordering the site are littered with artifacts eroding from the midden and a stand of spruce trees shields the site from the channel to the north. Subsidence has seriously affected this site. Dead spruce trees surround the site. To the south a low, once forested swale is now a marsh.

All the definite house pits contained from one to three small potholes. The six potholes reported by Exxon archaeologists in 1989 were weathered and beginning to revegetate.

The site appears much as described in the Exxon reports and files. We relocated all the features and reported potholes. No new damage was noted and all potholes were revegetating naturally. Peat deposits in the intertidal areas indicate subsurface deposits, though now submerged, are otherwise intact. Several of the artifacts found in 1990 were relocated, others had been collected previously.

Looters had excavated all the potholes into cultural materials. The damage is concentrated in the features, but it appears to be old and has not recurred. On-going erosion of the midden face will continue to effect the upland portion of the site.

The *in situ* materials in the intertidal zone do not appear to be threatened by erosion or vandalism. There are no excavations in the intertidal midden area and artifacts located in 1989 and 1990 are still in place. Intact peat deposits in the intertidal zone suggest erosion is not a major problem for some submerged deposits. However, the exposed FCR features lack surrounding midden material. In all likelihood the looser midden material was washed away in the years immediately following subsidence.

No restoration activities are warranted for the USFWS portion of this site as there is no evidence of injury to the intertidal resources.

KOD-171 (Chief Cove 1)

This site is located on the north shore of Chief Cove on the north shore of Chief Cove, a small indentation on the north shore of Spiridon Bay, the northern arm of Uyak Bay on the west coast of Kodiak Island. The site was originally reported by Ales Hrdlicka (1944), who reported both Paleo-Koniag (Kachemak) and Koniag phases, as well as historic Russian materials in the site. In 1978, Nowak reported 22 house pits on the top of the bluff and scattered along old beach ridges to the north. In 1989, Exxon archaeologists visited the site and reported two excavations in the eroding face of the midden. A 1990 visit confirmed the damage but found no new holes (Haggarty *et al.* 1991). The site was revisited by archaeologists from the State University of New York (SUNY) at Binghamton in 1991 (Dekin *et al.* 1993). The SUNY researchers found only five pit house features, but the investigators noted trouble with the definition of archaeological features due to heavy vegetation. Additional erosion and potholes were reported. The site is located within the Kodiak National Wildlife Refuge (KNWR).

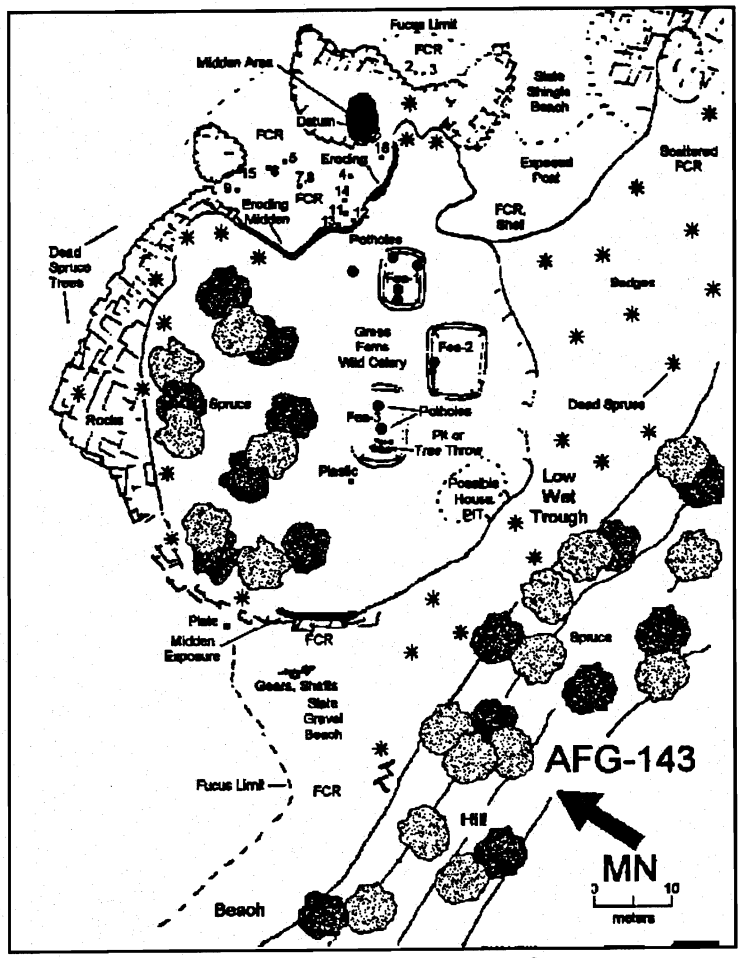

Figure 20. Archaeological site AFG-143.

The main portion of the site is situated along the shore and adjacent uplands of the south-facing beach on the north shore of Chief Cove. The west end of the site is at the base of a low sand and gravel tombolo that ends at a rocky headland to the

west. The site extends eastward for about 70 m and rises to an elevation of 15m+. A beach ridge and a series of relic ridges with the house pits extends 200 m to the north of the base of the tombolo. The site is L-shaped; features and cultural remains cluster within 25 m of the shoreline.

Midden is exposed along the length of the southern bluff. Deposits range from 0.5 m to over 2.0 m in depth, with thickness increasing to the east. Midden materials consist primarily of charcoal and ashy soil, mixed with eolian sands, with lenses of shell and bone. Two tephra layers are visible in exposures. To the north cultural deposits are harder to identify. Shell and bone, eroded from the site, are common along the beach, especially near the south end. Fire cracked rock, slate fragments and faunal remains are also found on the beaches below the eroding or disturbed areas.

Evidence of human presence is less clear on the relic ridges comprising the northern portion of the site. Features are shallow and poorly defined. During the 1990 investigation, 50 soil probes were placed in and near the features in an attempt to confirm the cultural association. The probes were generally unsuccessful in recovering clear evidence of human occupation though charcoal was found in a few. Deposits are shallow; nowhere did the probes exceed 15 cm in depth.

All reported features are pits, presumably house depressions. The total number is uncertain due to the dense vegetation cover on the site. Nowak reported 22, most other researchers identify far fewer. Nowak's estimate is probably a better indication of the true site size and complexity. Identified pits range between 2 m and 8 m square and are between 0.5 m and 1.5 m deep. Two of the larger features are reported to have entrance tunnels. In 1990, two house pits were found eroding off the south bluff face; these were not relocated in 1991.

Erosion is affecting both shores of the site but is especially pronounced in the south beach. Investigations in 1989, confirmed in 1990, report at least two large excavations made into the eroding face of the southerly bluff. The 1991 investigation described two exposures on the bluff near the east end of the site. While partially the result of erosion, both showed clear signs of illegal excavation. Two additional excavations were found inside two features at the low, western end of the bluff. Both

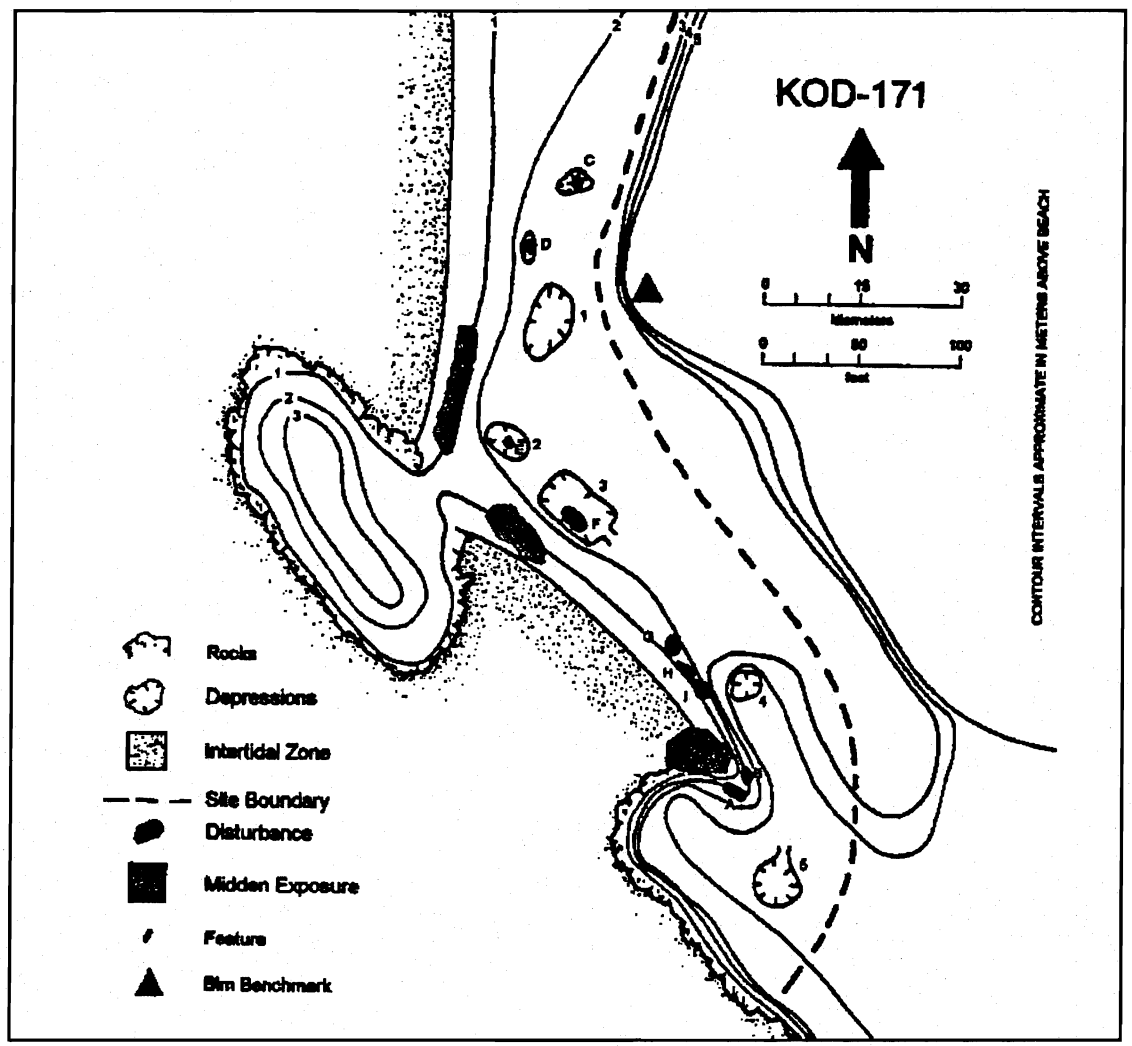

Figure 21. Archaeological site KOD-171.

of these holes were of apparent human origin and were recent, probably from that summer. Two additional exposures, in possible house pits, were noted to the north. FCR and shell were found exposed on the ground. As no pit, spoil pile, or other evidence of disturbance was found, the cultural materials were presumed to have been exposed by wind.

Human excavations were noted previously in features and along the bluffs. Most of the previously reported damage was relocated and confirmed. Our investigation discovered three additional potholes in the bluffs but none in features.

Erosion continues, primarily at the southwestern end of the site. Bluff face excavations have in some cases caused the erosion, and in other areas have accelerated natural erosion. Shell and bone are also exposed on the pocket beach at the eastern end of the bluff.

All of the potholes were excavated by looters into cultural materials. The damage is concentrated along the south facing bluff with some in features. There were a total of seven excavations described in 1990, 1991, and 1993. Two additional potholes described in 1991 were determined in 1993 to be natural.

The total volume is approximately 2281 m^3. About 7 m^3, or 0.3% of the site has been disturbed by vandals. An undetermined amount of the site has been lost to erosion. While only a small amount of the site is involved the damage is continuing and the effects will multiply unless the digging is stopped.

The potholes are described as in the 1991 report and are marked on the accompanying map. Holes A and B are located above the pocket beach at the far eastern end of the site. A steep draw leads to the top of the bluff. A trickle of water flows down the draw and a path winds up the hill along the channel. Pit A measures 3.0 m x 0.5 m and B is 1.0 m x 1.5 m; each totals 0.75 m^3 in volume.

Working along the bluffs to the west, Pits G, H, and I were discovered during 1993. Pit G is the largest, 3.0 m x 1.0 m with a volume of 2.1 m^3. Pit H measures 2.5 m x 0.5 m and I is 2.5 m x 1.0 m. Volumes were estimated at 0.63 and 1.0 m^3, respectively.

Pits E and F are both located in house pits along the top of the south facing bluff. Pit F measures 2.5 m x 1.0 m in area for a total volume of about 1.75 m^3. Pit E is a small shovel test with a volume of about 0.1 m^3.

The last two pits, C and D, were described in 1991 as shallow and lacking spoil piles. They were thought to be wind eroded depressions. Our investigations suggest they are simply the unvegetated bottoms of shallow house pits and not the result of either erosion or vandalism.

The erosion rate is impossible to measure without return visits. Three areas of eroded midden material on the beach measured approximately 17 m, 10 m, and 5 m

in length. Two of these areas are at the shallow southwestern edge of the site. Erosion here does not seem to be influenced by human vandalism of the site. The third is below the area vandalized by Pits A and B.

No specific restoration activities were undertaken in 1993. Vandalism, currently on a small scale, is a persistent problem and likely to increase without action. Until vandalism, the root cause of the damage, is addressed, restoration of the relatively small potholes will do nothing to stabilize the site.

Three steps must be taken to curb vandalism at Chief Cove. The first is to continue annual monitoring visits. In addition to documenting the continued pothunting we will be able to measure annual erosion rates.

During the monitoring trips we will contact the seasonal and year-round residents of Chief Cove and Chief Island. The contacts will be part of an educational effort to make local residents aware of the value and importance of archaeological sites, as well as the legal basis for protection. Continued visits by representatives of the KNWR will also reinforce the importance of the sites.

The only way to protect the site is to involve local residents in site protection. Several area residents are interested in what can be learned from archaeology. This interest can and should be cultivated. Ideally a local chapter of the Alaska Heritage Resources Stewards would take form. The resident stewards would continue educational and monitoring efforts and act as deterrents to casual digging.

If we are unsuccessful in fostering a Stewardship effort other steps may be taken. Possibilities include installing a resident site monitor during peak periods of use or law enforcement action.

U.S. National Park Service Field Monitoring, 1993

Steven L. Klingler
Alaska Systems Support Office
Patricia L. McClenahan
Katmai National Park & Preserve

The sites visited by the National Park Service are located along the Pacific Coast of Kenai Fjords National Park and the Shelikof Coast of Katmai National Park and Preserve. In 1993 these were subjected to pedestrian survey, photographing, and mapping in a effort to visually determine injuries to the sites through oiling or vandalism or both. Hydrocarbon samples were taken from the intertidal zone using the standard protocols. One sterile sample jar was filled at each site with sediments from the beach using a spoon sterilized with methylene chloride. A second, open jar was kept nearby to collect air as a control. The jars were sealed, labeled, and stored for analysis.

SEL-188 (McArthur Pass)

This site is located on the southern coast of the Kenai Peninsula in Kenai Fjords National Park and consists of a remnant of prehistoric midden on a narrow wooded bench fronted by a scatter of intertidal artifacts (Figures 22 and 23). The site was originally identified and investigated during the 1989 *Exxon Valdez* oil spill and cleanup activities, and was further tested in 1990 and 1991 (Betts *et al.* 1991; Dekin *et al.* 1992). Radiocarbon dates ranging from 1710 $\pm$ 120 B.P. to 560 $\pm$ 50 B.P. have been obtained from the site. These dates and the few diagnostic artifacts recovered suggest that the site represents an occupation of Kachemak period (middle to late) affiliated peoples.

SEL-188 was heavily oiled during the *Exxon Valdez* spill incident and suffered further injury during the oil spill response activity. The site is one of 24 known archaeological sites identified as still being in need of appropriate restoration activities (Jesperson and Griffin 1992; McAllister 1992). Since extensive work previously done

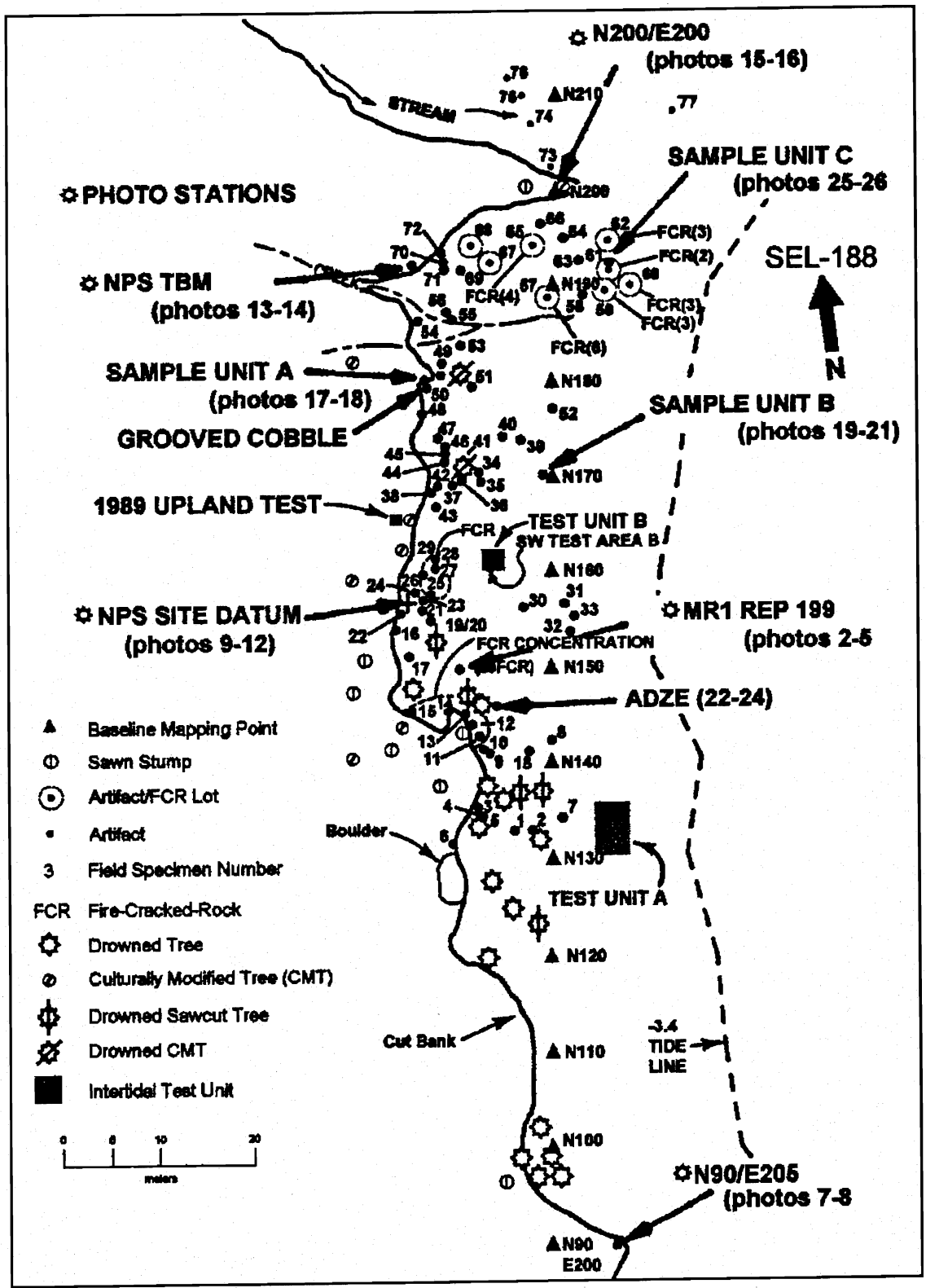

Figure 22. Archaeological site SEL-188.

Figure 23. Archaeological site SEL-188 at high tide.

at SEL-188 is considered to have accomplished other restoration measures (Betts *et al.* 1991; Dekin *et al.* 1992), the only restoration measure which was recommended during this project was oil effect monitoring.

On 23 July 1993 National Park Service Archaeologists Steven Klingler and Megan Partlow examined SEL-188, noting that the site had undergone considerable erosion. Cut stumps and cultural modified trees (CMTs) were completely exposed in place (the current high-tide line was about 1.35 m to 1.75 m above the bottom of the trunks, evidence of an estimated 2 m subsidence of the area resulting from the 1964 earthquake). The intertidal beach consists primarily of bedrock and fractured boulders and cobbles of granite/diorite, with little of what would be considered sediments present. Scattered slate debitage and ground slate fragments were noted within the intertidal zone. A fragment of a longitudinally grooved cobble and a complete splitting adze were also noted on the beach.

A 3.66 m high tide occurred at 5.15 p.m. Its elevation was marked at that

time and sample unit elevations were taken relative to that point. Following the falling tide, a sediment sampling series, adhering as closely as possible to the work plan protocol (U.S. National Park Service 1993), was begun about 7 p.m. The actual sampling locations were chosen by finding a location within the zone to be sampled (upper, middle, and lower intertidal) that did have collectable sediments present.

Sample Unit A was located 3.15 m west of the "Eye of the Needle" CMT, on the southern face of a remnant point of soil (located at approximately N181/E186 of the 1990 Exxon grid). The sediment consisted of a 19 cm thick sod/humic zone sitting on top of a local bedrock boulder just above the bare intertidal zone. Only a single sample pair (primary and duplicate) was taken due to the thinness of the soil deposit. Samples 2A and 2B were taken from 10 cm to 16 cm below the ground surface (about 1.3 m above the high-tide mark, that is, at about 4.96 m elevation). At the same time a control (air) sample was taken.

Sample Unit B was located at approximately N170.3/E198.2, at about 2.31 m elevation. Several large rock fragments were removed from a small pocket of pebble/sand sediment. The pocket was of insufficient depth to take more than a single sample pair, therefore, Samples 3A and 3B were taken from the surface down to bedrock. Much of the sample appeared to be asphalt.

Sample Unit C, located approximately N192.3/E205.6, at about 0.81 m elevation, was situated in the area between two small drainage streams. A small boulder was removed to expose a small pocket of course gravel. Again, the sediments were too shallow to collect more than a single sample pair.

AFG-043 (Kaguyak Village)

This site is located on the coast of Shelikof Strait north of Cape Chiniak in Katmai National Park (Figures 24 and 25). It is a historic village site that may also have a prehistoric cultural component. The village consists of about 25 house depressions, 13 historical structures, a kashim, the remains of a burned Russian Orthodox church, and a cemetery area. A part of the site belongs to the Russian Orthodox church and has been leased to private parties.

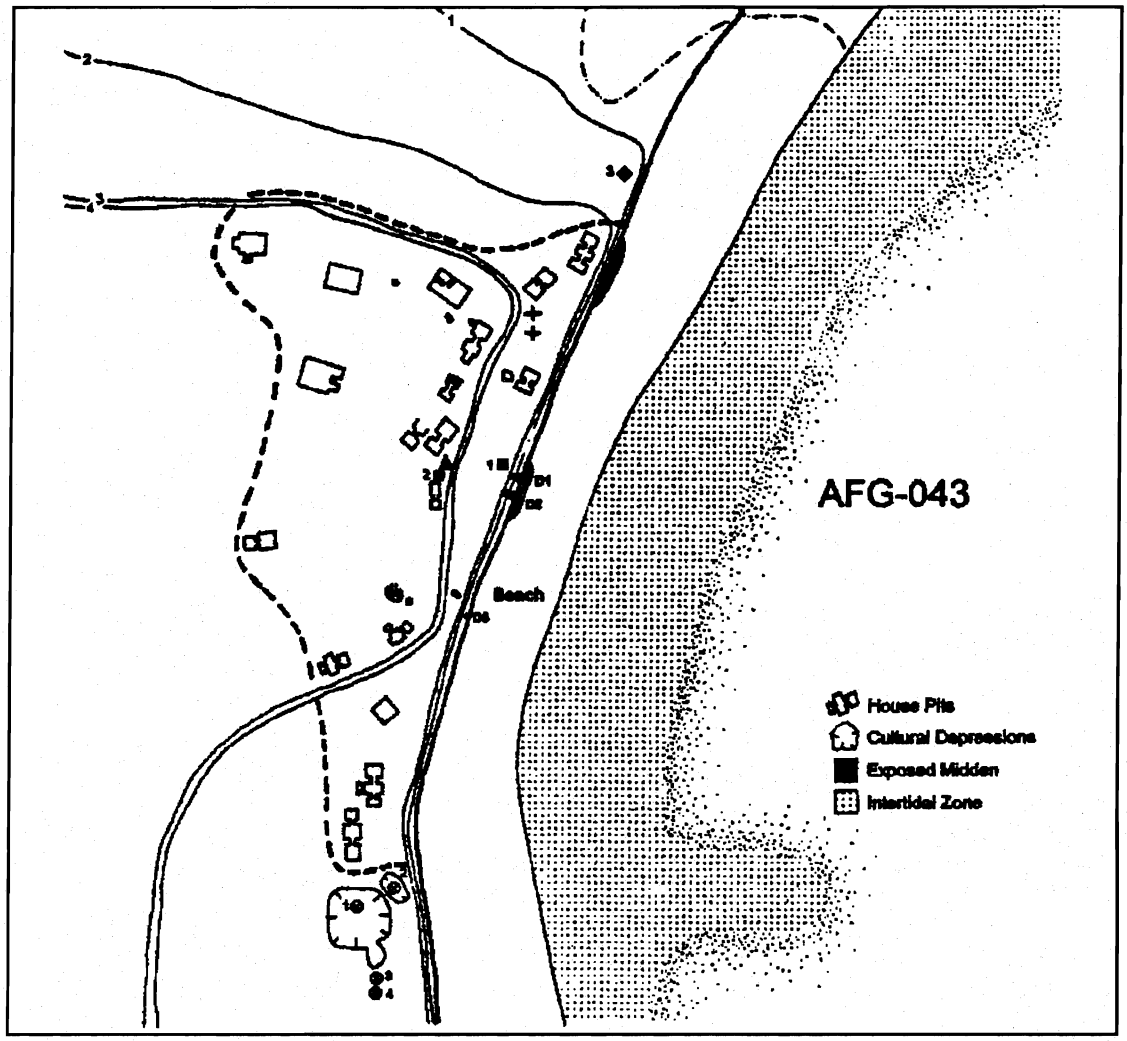

Figure 24. Archaeological site AFG-043.

Exxon investigators who visited this site documented recent vandalism on the site and erosional areas on the high seaward cutbank. It is one of the NPS sites documented as injured and still requiring restoration action (Jesperson and Griffin 1992; McAllister 1992). The status of the reported injury was difficult to assess due to the tall, thick grass that covered the entire site.

NPS archaeologists Patricia McClenahan, Gary Somers, Roger Harritt, and Richard Bland visited the site on 7 and 8 September 1993. NPS project archaeologists accomplished a thorough check of the accuracy of the 1991 Exxon project site map, which was found to be accurate. All the previously recorded features, datums, and

Figure 25. Archaeological site AFG-043.

disturbances the 1991 team mapped were located, and no fresh disturbances were seen. At the time of the 1993 visit, the site was stable and well-vegetated, except for continuing active erosion along parts of the cutbank. No holes were backfilled nor stratigraphic profiles drawn because the existing healthy vegetation stabilizing the holes would have been damaged by such action.

The archaeological team took two charcoal samples (see Appendix 1) from exposed burned timbers protruding from the erosional cutbank at the edge of the site, above the storm toss zone, taking measurements from the existing main site datum (Datum #1).

The team took a series of soil samples for testing for hydrocarbons, as called for in the plan. Sample locations were all measured from the existing datum (Table 8).

Table 8. Sediment samples from AFG-043.

Soil Sample #	Dist. from Datum #1	Compass bearing	Vertical location	C14 date B.P.
Control	10.8 m	90°	N/A	Air sample
#1	10.8 m	90°	10 cmbs	Sediment
#2	10.8 m	90°	40 cmbs	Sediment
#3	20 m	90°	10 cmbs	Sediment
#4	20 m	90°	40 cmbs	Sediment
#5	40 m	90°	10 cmbs	Sediment
#6	40 m	90°	40 cmbs	Sediment

Harritt noted tar on the lower beach within the tidal margin. Photographs were taken from photo points tied in to the existing datum. No artifacts were noted.

XMK-058 (Cape Gull Cove)

The site is located on the western shore of Shelikof Strait west of Kukak Bay. It consists of a prehistoric midden, three observed house depressions, and four smaller depressions (Figures 26 and 27). The Katmai ash is deep here and would tend to obscure more subtle features. The scatter of intertidal artifacts recorded by previous investigators was not in evidence at the time of the 1993 visit.

Archaeological restoration assessment of the Cape Gull Cove site was conducted by NPS archaeologists Patricia McClenahan, Gary Somers, Roger Harritt, and Richard Bland on September 9, 1993. The planned activities for the 1993 field season consisted of full field site damage assessment, physical restoration where called for, and oil effect monitoring.

In accordance with the Restoration Work Plan, activities at XMK-058 included: (1) documentation of site conditions through photography from permanent photo datums; (2) assessment of the 1991 EVOS site map; and (3) collection of subsurface sediment samples from the lower, middle, and upper intertidal zones for analysis for hydrocarbons. The permanent datum established by Dekin's crew in 1991 was the permanent datum for all of the 1993 project activities. Color print photographs of the site were taken from the 1991 EVOS Main Datum.

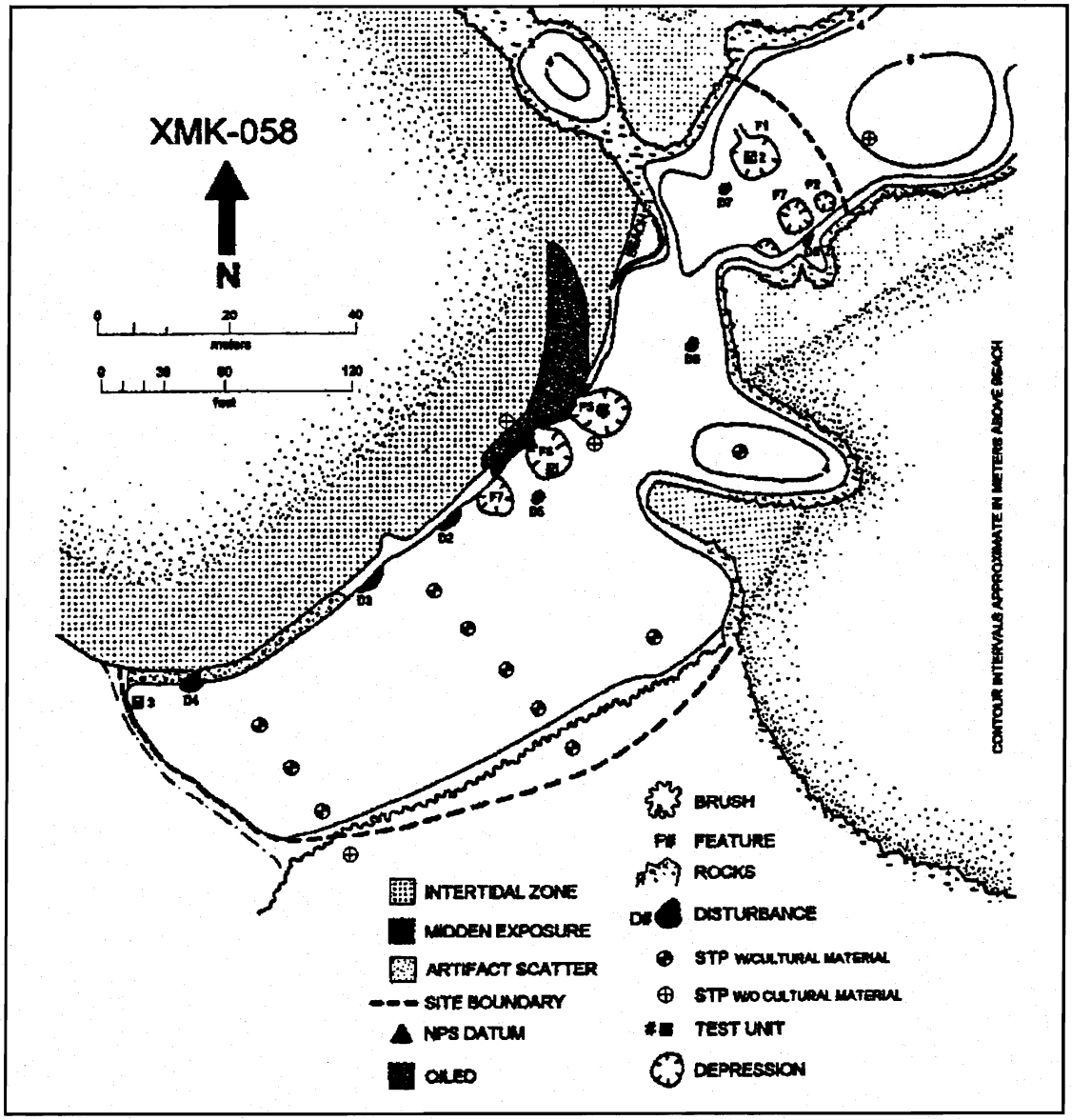

Figure 26. Archaeological site XMK-058.

The site history indicates heavy oiling during the *Exxon Valdez* incident, minor vandalism, and other injury during oil spill response activity. Black tar was readily visible on the rocky headland and intertidal shore as a heavy staining. No mousse or sheen was visible at the time of this site visit.

Project archaeologists assessed the 1991 EVOS project map for accuracy. After locating the site datums, the archaeologists found the site map to be accurate as far as they were able to tell. The site was extremely heavily vegetated, precluding

Figure 27. Archaeological site XMK-058.

location of all of the features noted on the map. However, the site was stable and well covered with substantial ground cover at the time of the project. No new disturbances were visible. Cultural features and disturbances the team was able to locate are accurately placed on the map. There were no exposed artifacts on the site or below the small cutbank at the high water mark.

The degree, type, and status of initial injury to the site, beyond the obvious oiling of the rocky shoreline and headland, was impossible for the team to judge due to dense, shoulder-high grass. No open holes were found. The low cutbank was well vegetated and stable. No stratigraphic profile drawings were made. No charcoal samples were taken, due to a lack of visible features. Photographs were tied in to the existing datum and to a previous test located at the lower edge of the site just above the high water line.

A series of sediment samples was taken to be analyzed for hydrocarbons. The intertidal zone is rocky, and no sediments were available below the depths indicated (Table 9).

Table 9. Sediment samples from XMK-058.

Sediment sample#	Dist. from Datum #1	Compass bearing	Vertical location	Comments
Control	At Datum #1			Air sample
#1	At Datum #1		10 cmbs	Sediment
#2	At Datum #1		40 cmbs	Sediment
#3	20 m	296°	10 cmbs	Sediment

No restoration work was done. The 1993 team was unable to analyze the reported looting damage due to mature vegetation.

SEDIMENT SAMPLE ANALYSIS AND RESULTS

Methods of Sample Analysis

by
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Study Area

A primary objective of this study was to determine the injury caused to cultural sites as a result of oil from the *Exxon Valdez* oil spill. This was to be done through analysis of soil samples from selected sites. Study sites included McArthur Pass within Kenai Fjords National Park, Cape Gull located along the shoreline of Katmai National Park and Preserve, Chief Point and Izhut Bay located within the Kodiak Archipelago (Figure 1.)

Sampling Protocols

The sampling technique used by the National Park Service followed NOAA protocols for collection of sediment. Following the 1993 field season, eleven samples (eight sediment and three blanks) were identified for hydrocarbon analysis by the National Marine Fisheries Service Auke Bay Laboratory.

Sediments

As a precaution, collectors hands were washed with dishwashing detergent. Sampling equipment including a trowel and spoons were pre-washed with a detergent, rinsed in Methylene chloride and wrapped in aluminum foil that was also rinsed with Methylene chloride. At each sampling site, spoons were unwrapped, and sediments were collected from the surface and placed in 250 ml, hydrocarbon-free, factory sealed, I-Chem jars. Samples were transported in a chilled cooler and frozen within 2-

4 hours. One blank sample was taken at each site. This consisted of a chemically clean 250 ml jar that was kept open for the duration of the taking of one substrate sample.

Documentation

Site information such as site name, sample identifier (six numeric code e.g. 401102), sample location indicator, date, samplers name, sample number, and type of sample were recorded on the jars.

Handling

All sample handling, data collection, chain-of-custody procedures, and shipping methods followed established EVOS Natural Resource Damage Assessment (NRDA) protocols as developed by the NOAA/Auke Bay Laboratory.

Chemistry

Sediment samples collected 1993 were analyzed using a Gas Chromatography/Mass Spectrometer (GC/MS) following methods developed by Short et al. (1996). GC/MS provides a detailed spectral analysis of the hydrocarbon constituents which allows "fingerprinting" of the hydrocarbon source, as well as comparisons of relative abundance's of the constituents. The primary results presented are total polynuclear aromatic hydrocarbons (TPAH) in ng/g dry weight. This represents the sum of all measured aromatic hydrocarbons except perylene, which is produced by biogenic sources (Babcock et al. 1996). Graphical depiction of the abundance of polynuclear aromatic hydrocarbons (PAH) are in terms of relative PAH abundance and are normalized to TPAH to depict patterns independent of the actual quantities of PAH's present in the samples.

Quality Control/Quality Assurance

Integrity of analytical results were first demonstrated by analysis of method blanks (1 with each batch of 11 samples analyzed) and detection of hydrocarbon

analytes above the method detection limits (MDL's). Second, accuracy was assessed by comparison of certified amounts and analytical results for method blanks spiked with certified hydrocarbon standards obtained from the National Institute of Standards and Technology for each batch of samples analyzed. In addition, precision within and among batches of samples analyzed was assessed by analyzing two reference samples with each batch and calculating the coefficient of variation (CVs) for each analyte across reference samples of all batches analyzed (Short, memo, 07/06/95).

Results of Sample Analysis

A summary of the eight sediment samples collected in the summer of 1993 that were identified for hydrocarbon analysis is provided in Table 10. Two of the sites SEL-188 (McArthur Pass) and XMK-058 (Cape Gull) were collected in triplicate. AFG-026 (Izhut Bay) and KOD-171 (Chief Point) samples consisted of one sediment sample per site. Blank samples were obtained and analyzed for each site except KOD-171(Chief Point). Using criteria based on various hydrocarbon ratios to discern probable sources of hydrocarbons detected in these analyses, Jeffery Short, Supervisory Research Chemist, Auke Bay Lab, found no reason not to conclude that the hydrocarbons found in two of the eight samples (identified by the letter E in the Oil Code column of Table 10) are from *Exxon Valdez* oil (Short et al. 1997).

The highest concentrations of oil (TPAH ng/g dry weight) were in two sediment samples collected from SEL-188 (7,756.92 ng/g and 820.20 ng/g) (Table 10). Sample ID 401104 contains relatively fresh oil, while Sample ID 401106 is comprised of well weathered *Exxon Valdez* oil (Short, personal communication, 1998). Two of the samples from XMK-058 (Sample IDs 401110 and 401111) are probably from *Exxon Valdez* spilled oil but concentrations are too low to positively fingerprint (Short et al. 1997). In the remaining samples, polynuclear aromatic hydrocarbons (PAH) are too frequently below detection limits to identify sources and are identified by the letter L in Table 10 (Short, memo, 07/06/95).

Table 10. Total petroleum aromatic hydrocarbons (TPAH ng/g dry weight) for the eight sediment samples collected along the Gulf of Alaska.

Sample ID	Invest #	AHRS#	General Location	Date Col.	TPAH ng/g dw	Oil Code[1]
401102	SEL 188/A/2A	SEL-188	McArthur Pass	23-Jul-93		
401102	SEL 188/A/2A	SEL-188	McArthur Pass	23-Jul-93	0.99	L
401104	SEL 188/A/3A	SEL-188	McArthur Pass	23-Jul-93	7756.92	E
401106	SEL 188/A/4A	SEL-188	McArthur Pass	23-Jul-93	820.20	E
401108	XMK 058/1/A	XMK-058	Cape Gull	09-Sep-93	2.23	L
401110	XMK 058/3/E	XMK-058	Cape Gull	09-Sep-93	37.24	L
401111	XMK 058/5/C	XMK-058	Cape Gull	09-Sep-93	128.17	L
401116	4	AFG-026	Izhut Bay	18-Aug-93	11.77	L
401118	10	KOD-171	Chief Cove	18-Aug-93	16.54	L

[1]E=*Exxon Valdez* Oil L=TPAH concentrations too low to discern sources.

Exxon Valdez oil and mussel fingerprints

GC/MS analyses also provide a spectral "fingerprint" of the oil, allowing identification of the type of oil, when sufficient quantities present. Comparisons between *Exxon Valdez* crude oil and polynuclear aromatic hydrocarbons (PAH) of sediments from this study are possible by normalizing the concentrations of analytes to total polynuclear aromatic hydrocarbons (TPAH) to depict patterns independent of the actual quantities of PAHs present in sediments (Short et al. 1997).

The polynuclear aromatic hydrocarbon patterns in four of the sediments collected from the archeological sites in 1993 are depicted in Figure 28. A PAH fingerprint of *Exxon Valdez* mousse is shown for comparison (Figure 28a). Polynuclear aromatic hydrocarbon fingerprints for two samples at SEL-188(Fig. 28b and 28c) show a pattern similar to EVO (Figure 28a). Figures 28d and 28e are from XMK-058 and are probably from *Exxon Valdez* oil, but concentrations of PAH's are too low to fingerprint (Short et al. 1997).

Quality Control/Quality Assurance

The integrity of the analytical results may be summarized as follows. First, no hydrocarbon analytes were found in method blanks above the method detection limits (MDL's) of hydrocarbon analytes. Method detection limits range from about 0.5 to 3 ng PAH/g wet sediment weight, or from about 3 to 16 ng alkane/g wet sediment weight, depending on the analyte and sample mass analyzed. Second, accuracy was assessed by comparison of certified amounts and analytical results for method blanks spiked with certified hydrocarbon standards obtained from the National Institute of Standards and Technology, for each batch of samples analyzed. Accuracy's ranged from 70.0% to 118.0% for PAH (median 99.6%), and from 94.6% to 116.4% for alkanes (median 101.7%), at amounts comparable with sample concentrations about 10 times MDL's. Finally, precision within and among batches of samples analyzed was assessed by analyzing two reference samples with each batch, and calculating the coefficient of variation (CVs) for each analyte across reference samples of all batches analyzed. For PAH, CVs ranged from 3.0% to 25.1% (median 6.3%), and for alkanes CVs ranged from 1.0% to 7.0% (median 1.9%). These CVs indicate the comparability of results that were analyzed in different batches (Short, memo, 07/06/95). A more complete summary of these quality assurance results is included in Appendix 2.

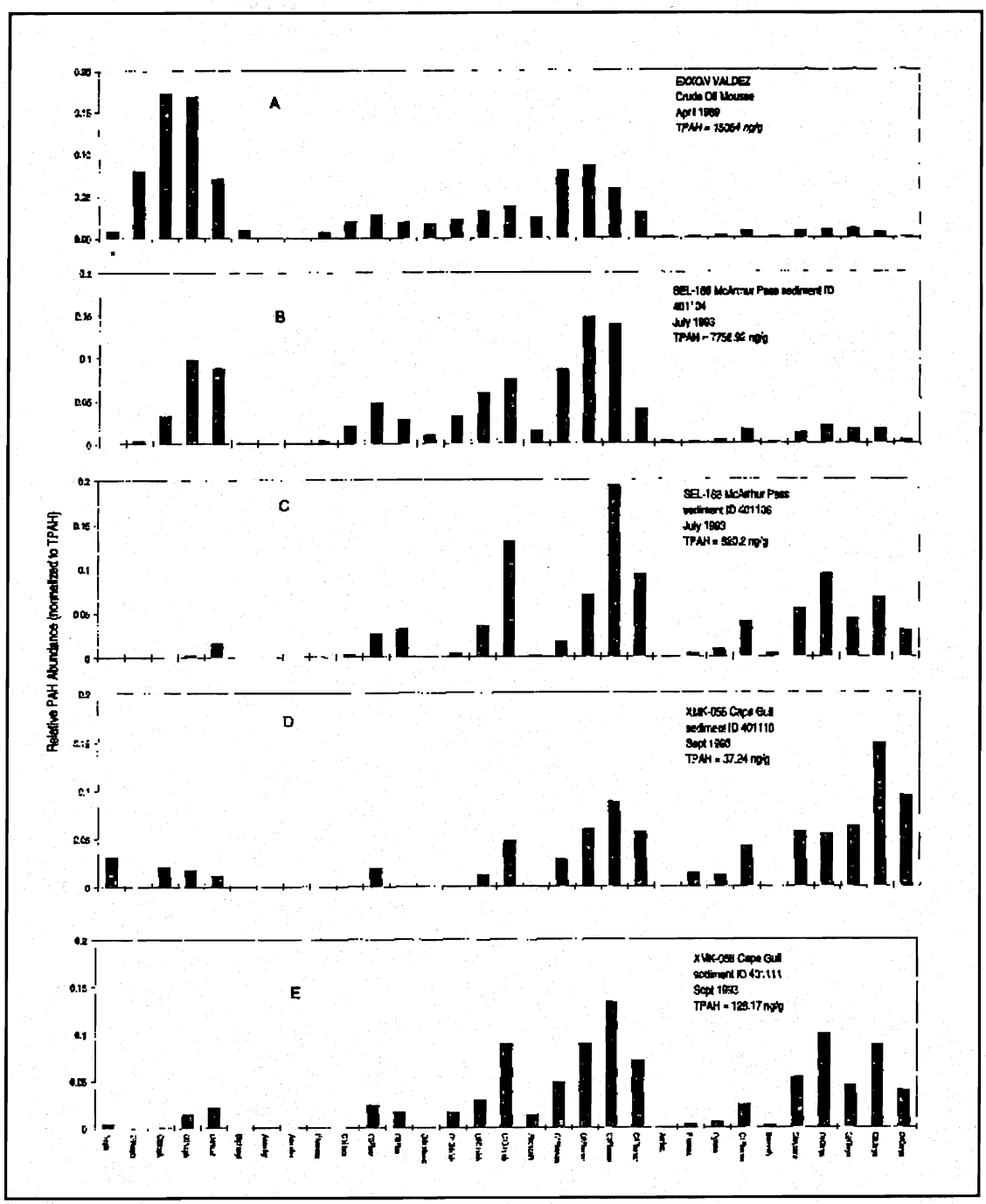

Figure 28. Relative abundance of individual polynuclear aromatic hydrocarbons (PAH) in *Exxon Valdez* mousse and sediments at selected sites along the Gulf of Alaska.

Conclusion

In summary, 23 index sites were visited and evaluated in 1993. In an attempt to determine continued or recent injury the sites were subjected to archaeological survey, mapping, and the collection of sediment samples. The sediment samples of these index sites were tested for encroachment of oil. The tests determined that many of the sites contained traces of oil. Only two of these, however, SEL-188 and XMK-058, revealed the chemical fingerprint of *Exxon Valdez* oil, and only one, SEL-188, revealed sufficient amounts of oil to indicate this with certainty. With respect to physical injury, SEL-188, AFG-027, and AFG-028 continue to undergo erosion, AFG-043 continues to be eroded on the seaward side, and AFG-026 and KOD-171 show erosion and vandalism.

APPENDIX 1

Radiocarbon Dates
(On charred material)

Lab #	Sample #	C-14 age B.P.	C13 adjusted age
Beta-70580	AFG-043, No. 1	90 ± 50	90 ± 50
Beta-70581	AFG-043, No. 2	250 ± 60	250 ± 60
Beta-70582	AFG-046-1	1430 ± 80	1430 ± 80
Beta-70583	AFG-081 (1 of 3)	290 ± 70	290 ± 70
Beta-70584	AFG-081 (2 of 3)	640 ± 80	640 ± 80
Beta-70585	AFG-082 (3 of 3)	600 ± 90	600 ± 90

APPENDIX 2

(Note: Crossed-out figures in Appendix 1 are non-related data that were processed simultaneously in the lab.

Aliphatics

id	401102	401110	-900	-550	-901
repl	1	1	1	1	1
qcbatch	R04205	R04205	R04205	R04205	R04205
labsam	401102	401110	MBLK	AREF	SBLK
matrix	SEDIMENT	SEDIMENT	QCBLANK	QCSED	QCSBLANK
catno	RMB_049	RMB_049	RMB_000	RMB_000	RMB_000
drywt	7.12	15.07	0.00	0.00	0.00
wetwt	20.84	20.11	1.00	1.02	1.00
deuterated recoveries:					
C12 - d26	67.43	68.24	62.52	65.23	72.90
C16 - d34	81.32	78.74	74.58	80.68	84.52
C20 - d42	85.57	87.97	88.11	80.32	90.17
C24 - d50	86.01	84.08	87.01	87.28	90.19
C30 - d64	86.23	81.54	87.66	74.88	90.84
concentrations (ng/g):					
ALKANE, C10-	13.16 b	0.00 a	0.00 a	1533.86	10283.64
ALKANE, C11-	6.52 b	2.89 b	0.54 b	1764.03	10600.06
ALKANE, C12-	4.11 b	2.56 b	0.00 a	2022.01	10931.04
ALKANE, C13-	1.39 b	1.76 b	0.00 a	1790.92	11379.47
ALKANE, C14-	3.03 b	1.99 b	1.16 b	1852.36	11809.71
ALKANE, C15-	5.72 b	10.15 b	0.00 a	5287.70	12456.81
ALKANE, C16-	2.33 b	6.28 b	1.42 b	1959.56	11081.78
ALKANE, C17-	7.65 b	10.61 b	1.39 b	2456.35	11598.18
PRISTANE	1.25 b	24.99 b	0.00 a	1199.51 b	13190.25
ALKANE, C18-	16.61 b	10.99 b	1.00 b	1617.08	9435.11
PHYTANE	0.00 a	13.35 b	0.00 a	924.17 b	7833.30
ALKANE, C19-	43.94 b	9.88 b	0.72 b	1513.65	9614.30
ALKANE, C20-	76.16	13.02 b	0.69 b	1675.03	10603.09
ALKANE, C21-	264.08	13.30 b	0.99 b	1573.97	10457.15
ALKANE, C22-	108.97	30.46 b	1.30 b	1601.01	10223.54
ALKANE, C23-	388.75	6.77 b	1.47 b	1596.90	10651.34
ALKANE, C24-	125.78	34.55 b	0.88 b	1247.76	10018.51
ALKANE, C25-	601.84	17.38 b	2.00 b	1950.80	10389.27
ALKANE, C26-	177.82	19.27 b	1.37 b	1477.74	10870.84
ALKANE, C27-	2032.19	15.31 b	4.25 b	1583.49	10256.65
ALKANE, C28-	287.74	10.47 b	0.00 a	1192.98	9981.28
ALKANE, C29-	2179.08	11.90 b	4.48 b	1786.05	9715.37
ALKANE, C30-	172.21	28.90 b	1.22 b	801.68 b	8856.60
ALKANE, C32-	108.03	22.43 b	4.93 b	482.57 b	10190.64
ALKANE, C34-	24.60 b	66.82	0.00 a	539.65 b	10262.42
TOT. ALKANES	14242.36	1775.85	1215.85	93965.59	267056.28
[UCM]	0.00	11107.24	3032.62	471825.97	0.00

05-31-1995 11:16:02 Auke Bay Laboratory Jeff Short

Aromatics

id	401102	401110	-550	-550	-900
repl	1	1	1	2	1
qcbatch	R04205	R04205	R04205	R04205	R04205
labsam	401102	401110	AREF	BREF	MBLK
matrix	SEDIMENT	SEDIMENT	QCSED	QCSED	QCBLANK
catno	RMB_049	RMB_049	RMB_000	RMB_000	RMB_000
drywt	7.12	15.07	0.00	0.00	0.00
wetwt	20.84	20.11	1.02	1.10	1.00
deuterated recoveries:					
NAPHTHALENE d-8	56.61	75.28	54.94	57.70	59.19
ACENAPHTHENE d-10	75.09	80.77	77.42	78.21	69.84
PHENANTHRENE d-10	57.26	63.75	63.06	63.76	55.81
ANTHRACENE d-10	86.38	92.47	89.17	88.77	91.33
BENZ-a-ANTHRACENE d-12	134.36	143.60	141.54	124.95	144.88
CHRYSENE d-12	92.50	100.50	98.72	86.20	100.02
BENZO-a-PYRENE d-12	97.90	119.49	98.44	80.18	103.73
PERYLENE d-12	99.28	119.21	96.71	81.07	91.89
concentrations (ng/g):					
naphthalene	1.73 b	1.52 b	973.99	1007.10	0.97 b
2-methylnaphthalene	0.52 b	0.44 b	1258.36	1234.61	0.45 b
1-methylnaphthalene	0.30 b	0.36 b	813.99	787.06	0.36 b
2,6-dimethylnaphthalene	0.15 b	0.20 b	540.22	523.56	0.16 b
C-2 naphthalenes	0.73 b	0.98 b	2026.71	1961.49	0.45 b
2,3,5-trimethylnaphthal	0.20 b	0.22 b	275.13	266.91	0.00 a
C-3 naphthalenes	0.64 b	0.84 b	1445.85	1401.23	0.24 b
C-4 naphthalenes	0.21 b	0.53 b	572.61	559.40	0.00 a
biphenyl	0.15 b	0.12 b	218.31	212.05	0.21 b
acenaphthylene	0.00 a	0.00 a	32.30 b	31.24 b	0.00 a
acenaphthene	0.04 b	0.05 b	32.66 b	28.16 b	0.11 b
fluorene	0.06 b	0.07 b	107.86	103.95	0.12 b
C-1 fluorenes	0.16 b	0.27 b	259.03	252.77	0.19 b
C-2 fluorenes	0.06 b	0.91 b	231.96	225.07	0.11 b
C-3 fluorenes	0.00 a	0.13 b	99.06	95.05	0.04 b
dibenzothiophene	0.02 b	0.06 b	209.08	209.30	0.07 b
C-1 dibenzothiophenes	0.04 b	0.24 b	319.50	306.81	0.06 b
C-2 dibenzothiophenes	0.08 b	0.58 b	348.82	318.93	0.00 a
C-3 dibenzothiophenes	0.04 b	2.34 b	399.20	359.72	0.00 a
phenanthrene	0.46 b	0.63 b	966.10	961.64	0.71 b
1-methylphenanthrene	0.00 a	0.42 b	410.99	381.28	0.00 a
C-1 phenanthrenes/anthr	0.16 b	1.37 b	1930.44	1789.82	0.67 b
C-2 phenanthrenes/anthr	0.41 b	2.94 b	1757.17 m	1629.54 m	0.15 b
C-3 phenanthrenes/anthr	0.12 b	4.35	1096.39	993.99	0.08 b
C-4 phenanthrenes/anthr	0.00 b	2.80	370.55	337.72	0.58 b
anthracene	0.06 b	0.14 b	148.50	152.91	0.00 a
fluoranthene	0.31 b	0.64 b	982.55	934.91	0.00 a
pyrene	0.13 b	0.57 b	921.07	859.99	0.22 b
C-1 fluoranthenes/pyren	0.00 b	2.06 b	447.02	408.18	0.13 b
benz-a-anthracene	0.01 b	0.01 b	221.73	230.31	0.16 b
chrysene	0.00 b	2.78	351.88	376.11	0.87 b
C-1 chrysenes	0.00 b	2.69 b	247.37	209.17	0.59 b
C-2 chrysenes	0.00 a	3.07 b	111.22	71.30	0.00 a
C-3 chrysenes	0.19 b	7.34	71.49	57.52 b	0.00 a
C-4 chrysenes	0.00 a	4.67	17.86 b	5.59 b	0.00 a
benzo-b-fluoranthene	0.00 b	0.73 b	570.60	634.62	0.63 b
benzo-k-fluoranthene	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
benzo-e-pyrene	0.00 b	3.47	223.14	255.12	0.91 b
benzo-a-pyrene	0.00 a	0.58 b	129.29	134.76	0.00 a
perylene	0.14 b	0.26 b	248.77	255.92	0.00 a
indeno-123-cd-pyrene	0.00 a	0.41 b	138.51	132.51	0.00 a
dibenzo-a,h-anthracene	0.00 a	0.28 b	37.90	34.03	0.03 b
benzo-g,h,i-perylene	0.00 b	1.82	145.87	128.98	0.18 b

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Aromatics

id	-901	-600	-600
repl	1	1	2
qcbatch	R04205	R04205	R04205
labsam	SBLK	NISTARO	NISTARO
matrix	QCSBLANK	QCCALI	QCCALI
catno	RMB_000	RMB_000	RMB_000
drywt	0.00	0.00	0.00
wetwt	1.00	1.00	1.00
deuterated recoveries:			
NAPHTHALENE d-8	52.38	103.20	103.22
ACENAPHTHENE d-10	65.34	102.10	102.44
PHENANTHRENE d-10	67.22	98.86	99.03
ANTHRACENE d-10	89.38	97.28	95.33
BENZ-a-ANTHRACENE d-12	129.03	155.03	117.14
CHRYSENE d-12	94.92	155.51	131.11
BENZO-a-PYRENE d-12	96.40	155.07	117.94
PERYLENE d-12	89.93	153.07	120.98
concentrations (ng/g):			
naphthalene	396.63	340.36	339.27
2-methylnaphthalene	476.37	383.59	376.81
1-methylnaphthalene	504.02	399.02	394.34
2,6-dimethylnaphthalene	369.48	350.64	336.56
C-2 naphthalenes	375.16 b		
2,3,5-trimethylnaphthal	385.16	311.20	302.16
C-3 naphthalenes	394.73 b		
C-4 naphthalenes	3.66 b		
biphenyl	412.13	343.73	338.40
acenaphthylene	386.55	336.48	313.47
acenaphthene	422.55	353.36	347.39
fluorene	435.40	342.03	327.93
C-1 fluorenes	6.54 b		
C-2 fluorenes	2.27 b		
C-3 fluorenes	0.00 b		
dibenzothiophene	540.31	399.00	383.11
C-1 dibenzothiophenes	1.51 b		
C-2 dibenzothiophenes	2.95 b		
C-3 dibenzothiophenes	1.16 b		
phenanthrene	475.35	346.62	339.68
1-methylphenanthrene	673.84	480.72	401.22
C-1 phenanthrenes/anthr	675.68 b		
C-2 phenanthrenes/anthr	10.87 b		
C-3 phenanthrenes/anthr	2.58 b		
C-4 phenanthrenes/anthr	0.00 b		
anthracene	500.17	384.25	371.74
fluoranthene	567.69	405.53	337.21
pyrene	572.59	415.19	338.46
C-1 fluoranthenes/pyren	0.00 b		
benz-a-anthracene	239.87	164.12	154.86
chrysene	485.70	324.09	323.52
C-1 chrysenes	0.00 b		
C-2 chrysenes	0.00 a		
C-3 chrysenes	0.00 a		
C-4 chrysenes	0.00 a		
benzo-b-fluoranthene	319.10	246.66	223.13
benzo-k-fluoranthene	352.88	254.17	265.80
benzo-e-pyrene	358.69	260.64	266.03
benzo-a-pyrene	393.88	311.11	314.90
perylene	402.81	324.43	324.57
indeno-123-cd-pyrene	276.65	293.65	228.94
dibenzo-a,h-anthracene	205.21	239.53	185.24
benzo-g,h,i-perylene	247.66	243.97	202.53

Aliphatics

id	401104	-900	-550	-901	-550
repl	1	1	1	1	2
qcbatch	R02285	R02285	R02285	R02285	R02285
labsam	401104	MBLK	AREF	SBLK	BREF
matrix	SEDIMENT	QCBLANK	QCSED	QCSBLANK	QCSED
catno	RMB_049	RMB_000	RMB_000	RMB_000	RMB_000
drywt	0.00	0.00	0.00	0.00	0.00
wetwt	0.12	1.00	1.00	1.00	1.00
deuterated recoveries:					
C12 - d26	59.53	83.77	63.46	77.71	77.71
C16 - d34	89.27	82.42	89.61	89.21	89.21
C20 - d42	47.38	99.76	99.14	96.51	96.51
C24 - d50	97.44	101.85	102.87	99.46	99.46
C30 - d64	63.09	107.68	104.87	105.38	105.38
concentrations (ng/g):					
ALKANE, C10-	0.00 a	0.00 a	10763.87	10924.12	10924.12
ALKANE, C11-	267.87 b	0.00 a	11010.15	11067.56	11067.56
ALKANE, C12-	1948.89 b	0.00 a	11042.84	11008.56	11008.56
ALKANE, C13-	12141.42	0.00 a	11502.27	11108.82	11108.82
ALKANE, C14-	28834.36	0.00 a	10405.62	11387.78	11387.78
ALKANE, C15-	56353.14	0.00 a	11984.04	12049.08	12049.08
ALKANE, C16-	76096.42	0.00 a	11327.05	11180.16	11180.16
ALKANE, C17-	107090.79	0.00 a	12155.86	11757.33	11757.33
PRISTANE	178747.14	0.00 a	14082.35	13763.92	13763.92
ALKANE, C18-	169788.38	0.00 a	9654.08	9604.54	9604.54
PHYTANE	226949.28	0.00 a	8185.98	8162.33	8162.33
ALKANE, C19-	118479.12	0.00 a	10038.39	9921.04	9921.04
ALKANE, C20-	179804.02	0.67 b	11122.38	11002.54	11002.54
ALKANE, C21-	170818.95	0.80 b	11082.40	10967.29	10967.29
ALKANE, C22-	89731.98	1.09 b	10408.83	10355.63	10355.63
ALKANE, C23-	76449.31	1.78 b	10910.27	10861.12	10861.12
ALKANE, C24-	82160.75	1.30 b	10323.24	10304.19	10304.19
ALKANE, C25-	80335.93	1.23 b	10669.74	10665.22	10665.22
ALKANE, C26-	83324.84	1.14 b	11124.98	11189.39	11189.39
ALKANE, C27-	2334.71 b	0.86 b	10558.99	10688.90	10688.90
ALKANE, C28-	75011.99	0.30 b	10287.82	10043.71	10043.71
ALKANE, C29-	90245.48	0.41 b	10092.89	9979.81	9979.81
ALKANE, C30-	90280.85	0.00 a	9025.59	9013.56	9013.56
ALKANE, C32-	65632.87	0.00 a	10252.35	10379.61	10379.61
ALKANE, C34-	80282.49	0.00 a	9887.01	10178.91	10178.91
TOT. ALKANES	4902408.00	1371.00	115435.00	310846.00	92539.00
[UCM]	44620148.00	0.00	234875.00	0.00	21666.00

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Aliphatics

id	-600	-600
repl	1	2
qcbatch	R02285	R02285
labsam	NMFSALI	NMFSALI
matrix	QCCALI	QCCALI
catno	RMB_000	RMB_000
drywt	0.00	0.00
wetwt	1.00	1.00
deuterated recoveries:		
C12 - d26	96.27	97.22
C16 - d34	98.09	98.36
C20 - d42	101.93	101.58
C24 - d50	95.97	103.18
C30 - d64	112.32	109.42
concentrations (ng/g):		
ALKANE, C10-	13210.88	13420.07
ALKANE, C11-	12960.64	12946.90
ALKANE, C12-	13167.47	13154.61
ALKANE, C13-	13310.55	13262.57
ALKANE, C14-	14440.76	14509.31
ALKANE, C15-	14370.67	14378.71
ALKANE, C16-	12886.28	12881.96
ALKANE, C17-	13499.91	13490.05
PRISTANE	15174.27	15098.85
ALKANE, C18-	11787.35	11802.06
PHYTANE		
ALKANE, C19-	12059.56	12089.54
ALKANE, C20-	13370.48	13398.95
ALKANE, C21-	13324.06	13362.61
ALKANE, C22-	13313.00	12397.44
ALKANE, C23-	13946.01	13038.83
ALKANE, C24-	13143.73	12365.01
ALKANE, C25-	13597.94	12793.53
ALKANE, C26-	14201.49	13389.10
ALKANE, C27-	13499.33	12749.59
ALKANE, C28-	11423.60	11976.39
ALKANE, C29-	11284.21	11883.96
ALKANE, C30-	11438.81	10745.16
ALKANE, C32-	11981.43	12488.71
ALKANE, C34-	11993.87	12534.79
TOT. ALKANES		
[UCM]		

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Aromatics

id	401104	-550	-550	-900	-901
repl	1	1	2	1	1
qcbatch	R02285	R02285	R02285	R02285	R02285
labsam	401104	AREF	BREF	MBLK	SBLK
matrix	SEDIMENT	QCSED	QCSED	QCBLANK	QCSBLANK
catno	RMB_049	RMB_000	RMB_000	RMB_000	RMB_000
drywt	0.00	0.00	0.00	0.00	0.00
wetwt	0.12	1.00	1.00	1.00	1.00
deuterated recoveries:					
NAPHTHALENE d-8	63.82	51.40	62.65	53.28	62.65
ACENAPHTHENE d-10	80.23	64.38	70.20	64.32	70.20
PHENANTHRENE d-10	84.97	80.98	72.75	70.93	72.75
ANTHRACENE d-10	85.98	84.39	78.20	76.36	78.20
BENZ-a-ANTHRACENE d-12	103.89	95.69	95.31	79.72	95.31
CHRYSENE d-12	89.13	98.35	103.05	80.22	103.05
BENZO-a-PYRENE d-12	97.96	78.38	75.56	47.31	75.56
PERYLENE d-12	89.83	40.56	33.93	15.20	33.93
concentrations (ng/g):					
naphthalene	0.00 b	385.04	394.24	1.05 b	394.24
2-methylnaphthalene	932.28	441.63	442.37	0.41 b	442.37
1-methylnaphthalene	1146.75	476.32	473.60	0.30 b	473.60
2,6-dimethylnaphthalene	5786.62	318.41	353.34	0.00 a	353.34
C-2 naphthalenes	28181.06 m	316.29 a	357.63 b	0.11 b	357.63 b
2,3,5-trimethylnaphthal	17006.75 m	365.35	360.02	0.00 a	360.02
C-3 naphthalenes	88254.01 m	368.70 b	362.38 b	0.00 a	362.38 b
C-4 naphthalenes	78893.20 m	0.00 a	0.00 a	0.00 a	0.00 a
biphenyl	524.52 b	415.69	413.05	0.00 a	413.05
acenaphthylene	0.00 a	384.98	373.89	0.00 a	373.89
acenaphthene	267.35 b	411.94	419.39	0.00 a	419.39
fluorene	2470.95	510.12	433.15	0.14 b	433.15
C-1 fluorenes	17528.91 m	5.77 b	4.92 b	0.00 a	4.92 b
C-2 fluorenes	42542.88 m	0.00 a	0.00 a	0.00 a	0.00 a
C-3 fluorenes	24149.97 m	0.00 a	1.49 b	0.00 a	1.49 b
dibenzothiophene	8177.37	452.78	474.11	0.00 a	474.11
C-1 dibenzothiophenes	27893.32 m	0.00 a	0.00 a	0.00 a	0.00 a
C-2 dibenzothiophenes	52238.83 m	0.00 a	0.00 a	0.00 a	0.00 a
C-3 dibenzothiophenes	66756.81 m	0.00 a	0.00 a	0.00 a	0.00 a
phenanthrene	13093.93	421.36	429.92	0.19 b	429.92
1-methylphenanthrene	18985.47 m	442.68	470.87	0.00 a	470.87
C-1 phenanthrenes/anthr	77248.22 m	445.21 b	472.89 b	0.00 a	472.89 b
C-2 phenanthrenes/anthr	132669.09 m	0.00 a	0.00 a	0.00 a	0.00 a
C-3 phenanthrenes/anthr	125086.15 m	0.00 a	0.00 a	0.00 a	0.00 a
C-4 phenanthrenes/anthr	35619.78 m	0.00 a	0.00 a	0.00 a	0.00 a
anthracene	1490.34	472.15	459.89	0.00 a	459.89
fluoranthene	461.00	373.17	385.00	0.00 a	385.00
pyrene	3118.22	372.82	389.05	0.00 a	389.05
C-1 fluoranthenes/pyren	13686.54 m	0.00 a	0.00 a	0.00 a	0.00 a
benz-a-anthracene	359.31 b	213.16	197.28	0.00 a	197.28
chrysene	10226.30	439.41	425.17	0.00 a	425.17
C-1 chrysenes	17967.29 m	0.00 a	0.00 a	0.00 a	0.00 a
C-2 chrysenes	14260.83	0.00 a	0.00 a	0.00 a	0.00 a
C-3 chrysenes	13944.00	0.00 a	0.00 a	0.00 a	0.00 a
C-4 chrysenes	3154.54	0.00 a	0.00 a	0.00 a	0.00 a
benzo-b-fluoranthene	1304.42	354.11	354.52	0.00 a	354.52
benzo-k-fluoranthene	0.00 a	358.30	381.51	0.00 a	381.51
benzo-e-pyrene	2521.29	398.69	386.75	0.00 a	386.75
benzo-a-pyrene	332.08 b	403.19	395.79	0.00 a	395.79
perylene	149.28 b	450.55	442.77	0.00 a	442.77
indeno-123-cd-pyrene	53.74 b	269.64	282.94	0.00 a	282.94
dibenzo-a,h-anthracene	218.89 b	199.75	220.22	0.00 a	220.22
benzo-g,h,i-perylene	689.76	264.40	272.74	0.00 a	272.74

Aromatics

id	-600	-600
repl	1	2
qcbatch	R02285	R02285
labsam	NISTARO	NISTARO
matrix	QCCALI	QCCALI
catno	RMB_000	RMB_000
drywt	0.00	0.00
wetwt	1.00	1.00
deuterated recoveries:		
NAPHTHALENE d-8	101.85	104.81
ACENAPHTHENE d-10	101.89	102.59
PHENANTHRENE d-10	101.60	101.69
ANTHRACENE d-10	102.69	99.95
BENZ-a-ANTHRACENE d-12	114.36	104.54
CHRYSENE d-12	111.08	111.54
BENZO-a-PYRENE d-12	115.68	104.44
PERYLENE d-12	112.38	105.39
concentrations (ng/g):		
naphthalene	344.61	342.39
2-methylnaphthalene	393.42	384.95
1-methylnaphthalene	410.13	403.28
2,6-dimethylnaphthalene	358.59	351.85
C-2 naphthalenes		
2,3,5-trimethylnaphthal	325.17	311.87
C-3 naphthalenes		
C-4 naphthalenes		
biphenyl	345.31	346.38
acenaphthylene	342.95	321.34
acenaphthene	362.65	356.86
fluorene	365.41	355.74
C-1 fluorenes		
C-2 fluorenes		
C-3 fluorenes		
dibenzothiophene	398.31	391.34
C-1 dibenzothiophenes		
C-2 dibenzothiophenes		
C-3 dibenzothiophenes		
phenanthrene	351.85	349.44
1-methylphenanthrene	369.29	345.69
C-1 phenanthrenes/anthr		
C-2 phenanthrenes/anthr		
C-3 phenanthrenes/anthr		
C-4 phenanthrenes/anthr		
anthracene	393.97	389.14
fluoranthene	307.93	286.33
pyrene	311.32	285.96
C-1 fluoranthenes/pyren		
benz-a-anthracene	179.95	169.06
chrysene	351.33	344.35
C-1 chrysenes		
C-2 chrysenes		
C-3 chrysenes		
C-4 chrysenes		
benzo-b-fluoranthene	258.40	248.11
benzo-k-fluoranthene	269.57	268.24
benzo-e-pyrene	266.77	266.89
benzo-a-pyrene	327.76	333.15
perylene	348.07	346.05
indeno-123-cd-pyrene	322.86	262.79
dibenzo-a,h-anthracene	275.54	231.15
benzo-g,h,i-perylene	261.55	224.91

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Aliphatics

id	401101	401106	401108	401109	401111
repl	1	1	1	1	1
qcbatch	R02215	R02215	R02215	R02215	R02215
labsam	401101	401106	401108	401109	401111
matrix	BLANK	SEDIMENT	SEDIMENT	BLANK	SEDIMENT
catno	RMB_049	RMB_049	RMB_049	RMB_049	RMB_049
drywt	0.00	14.78	4.92	0.00	20.37
wetwt	20.00	20.81	20.02	20.00	22.07
deuterated recoveries:					
C12 - d26	91.93	65.50	75.33	85.27	60.61
C16 - d34	90.53	88.22	78.37	87.42	76.46
C20 - d42	96.82	92.00	86.11	96.10	84.92
C24 - d50	95.42	88.13	88.55	98.56	86.51
C30 - d64	88.15	82.46	93.85	101.20	84.05
concentrations (ng/g):					
ALKANE, C10-	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
ALKANE, C11-	0.55 b	3.22 b	4.44 b	0.68 b	1.50 b
ALKANE, C12-	0.00 a	2.59 b	6.66 b	0.00 a	0.98 b
ALKANE, C13-	0.00 a	1.59 b	0.67 b	0.00 a	1.26 b
ALKANE, C14-	0.00 b	9.14 b	3.66 b	0.32 b	2.12 b
ALKANE, C15-	0.00 a	48.49	40.49 b	0.00 b	0.00 b
ALKANE, C16-	0.00 b	0.19 b	5.36 b	0.00 b	11.18 b
ALKANE, C17-	0.00 b	66.71	9.08 b	0.00 b	36.06 b
PRISTANE	0.00 a	31.53 b	3.50 b	0.00 a	65.62
ALKANE, C18-	0.00 b	8.96 b	14.03 b	0.77 b	33.30 b
PHYTANE	0.00 a	4.37 b	0.00 a	0.00 a	38.49 b
ALKANE, C19-	0.00 a	17.55 b	7.26 b	0.00 b	33.16 b
ALKANE, C20-	0.00 a	10.34 b	14.03 b	0.00 b	42.24 b
ALKANE, C21-	0.00 b	27.55 b	18.60 b	0.00 b	43.22 b
ALKANE, C22-	0.00 b	85.31	17.80 b	0.00 b	47.38
ALKANE, C23-	0.00 b	6.30 b	58.50	0.00 b	44.33 b
ALKANE, C24-	0.00 b	105.39	17.09 b	0.00 b	67.10
ALKANE, C25-	0.00 b	50.48	162.99	0.00 b	51.77
ALKANE, C26-	0.00 b	16.28 b	62.24	1.18 b	61.37
ALKANE, C27-	0.00 a	159.48	448.33	0.00 a	59.82
ALKANE, C28-	0.00 a	14.80 b	150.45	0.00 b	27.62 b
ALKANE, C29-	0.00 a	67.80	872.10	1.58 b	43.81
ALKANE, C30-	0.00 a	101.93	34.98 b	0.00 a	53.10
ALKANE, C32-	0.00 a	107.84	46.36 b	20.66 b	65.59
ALKANE, C34-	0.00 a	267.50	0.00 a	0.00 a	1.86 b
TOT. ALKANES	0.00	6170.20	5047.20	31.00	2813.90
[UCM]	2024.50	82345.60	2226.80	2145.10	31137.90

Aliphatics

id	401116	401117	401118	500201	500203
repl	1	1	1	1	1
qcbatch	R02215	R02215	R02215	R02215	R02215
labsam	401116	401117	401118	500201	500203
matrix	SEDIMENT	BLANK	SEDIMENT	SEDIMENT	BLANK
catno	RMB_049	RMB_049	RMB_049	RMB_049	RMB_049
drywt	17.37	0.00	17.96	0.39	0.00
wetwt	19.78	20.00	18.67	0.46	1.00
deuterated recoveries:					
C12 - d26	78.37	86.97	79.10	39.86	89.84
C16 - d34	79.55	87.93	78.59	43.52	89.76
C20 - d42	91.12	96.05	86.47	41.48	100.18
C24 - d50	94.16	97.79	87.10	70.64	161.01
C30 - d64	100.85	100.60	87.90	48.00	119.45
concentrations (ng/g):					
ALKANE, C10-	0.00 a	0.00 a	0.00 a	58.06 b	0.00 a
ALKANE, C11-	1.54 b	0.60 b	0.84 b	47.64 b	0.00 a
ALKANE, C12-	0.00 a	0.00 a	1.08 b	153.07 b	0.00 a
ALKANE, C13-	0.00 a	0.00 a	0.91 b	792.14 b	0.00 a
ALKANE, C14-	0.43 b	0.00 b	1.18 b	3040.16	0.00 a
ALKANE, C15-	6.90 b	0.00 b	0.67 b	14955.47	24.46 b
ALKANE, C16-	1.59 b	0.00 b	1.60 b	17507.40	0.00 a
ALKANE, C17-	5.60 b	0.00 b	1.92 b	33435.35	0.00 a
PRISTANE	22.02 b	0.00 a	4.29 b	151786.83 m	0.00 a
ALKANE, C18-	3.75 b	0.00 b	3.15 b	15503.28	0.00 a
PHYTANE	4.50 b	0.00 a	0.76 b	110430.40 m	0.00 a
ALKANE, C19-	3.87 b	0.00 a	1.56 b	17670.90	0.00 a
ALKANE, C20-	4.89 b	0.00 a	2.01 b	36431.63	0.00 a
ALKANE, C21-	3.84 b	0.14 b	2.16 b	35082.97	0.00 a
ALKANE, C22-	2.38 b	0.00 a	1.18 b	29554.93	0.00 a
ALKANE, C23-	3.78 b	0.00 b	2.24 b	25982.49	0.00 a
ALKANE, C24-	1.31 b	0.00 a	1.95 b	45591.19	0.00 b
ALKANE, C25-	7.90 b	0.09 b	3.31 b	48536.40	0.00 b
ALKANE, C26-	1.13 b	0.28 b	3.87 b	65062.80	5.02 b
ALKANE, C27-	19.45 b	1.69 b	4.52 b	75005.32	24.39 b
ALKANE, C28-	3.58 b	0.00 a	2.57 b	78279.37	0.00 a
ALKANE, C29-	31.35 b	3.12 b	6.92 b	74630.53	30.11 b
ALKANE, C30-	0.00 a	0.00 a	6.47 b	75182.72	0.00 a
ALKANE, C32-	6.20 b	0.00 a	7.86 b	52555.59	0.00 a
ALKANE, C34-	0.00 a	0.00 a	0.00 a	56211.58	0.00 a
TOT. ALKANES	291.50	0.00	8.70	2417210.00	13623.70
[UCM]	0.00	0.00	0.00	26187828.00	173409.70

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Aliphatics

id	-900	-550	-901	-550	-600
repl	1	1	1	2	1
qcbatch	R02215	R02215	R02215	R02215	R02215
labsam	MBLK	AREF	SBLK	BREF	NMFSALI
matrix	QCBLANK	QCSED	QCSBLANK	QCSED	QCCALI
catno	RMB_000	RMB_000	RMB_000	RMB_000	RMB_000
drywt	0.00	0.00	0.00	0.00	0.00
wetwt	1.00	1.03	1.00	1.07	1.00
deuterated recoveries:					
C12 - d26	86.60	74.92	81.67	67.05	95.94
C16 - d34	85.23	83.18	85.51	78.38	97.47
C20 - d42	91.59	90.50	93.74	85.84	101.54
C24 - d50	93.21	92.34	98.56	89.11	104.35
C30 - d64	99.65	96.98	112.53	87.27	117.76
concentrations (ng/g):					
ALKANE, C10-	0.00 a	1514.59	10473.47	1581.42	13257.27
ALKANE, C11-	0.00 a	1817.63	11022.45	1798.94	12946.16
ALKANE, C12-	0.00 a	1939.36	10957.46	1953.47	13158.37
ALKANE, C13-	0.00 a	2075.41	10946.47	2067.00	13267.61
ALKANE, C14-	1.63 b	1864.34	12132.30	1828.87	14502.56
ALKANE, C15-	17.01 b	2172.30	12087.48	2454.39	14399.80
ALKANE, C16-	2.57 b	1884.51	11233.26	1918.04	12911.55
ALKANE, C17-	2.66 b	2327.11	11442.99	2357.44	13421.85
PRISTANE	0.00 a	1405.47	13788.20	1427.37	15291.00
ALKANE, C18-	1.67 b	1434.43	9569.86	1474.29	11680.75
PHYTANE	0.00 a	769.36 b	8107.37	823.21 b	
ALKANE, C19-	1.23 b	1291.26	9809.92	1343.85	11942.61
ALKANE, C20-	1.58 b	1390.95	10947.28	1408.39	13284.82
ALKANE, C21-	1.15 b	1333.85	10967.57	1379.85	13292.97
ALKANE, C22-	2.79 b	1307.94	10159.38	1335.11	12366.89
ALKANE, C23-	2.13 b	1451.15	10765.26	1424.46	13083.66
ALKANE, C24-	2.23 b	1322.95	10278.48	1224.82	12612.23
ALKANE, C25-	2.78 b	1749.25	10734.42	1674.72	12966.86
ALKANE, C26-	0.89 b	1293.85	11423.19	1210.68	13688.65
ALKANE, C27-	1.43 b	1869.87	11013.73	1683.10	13139.33
ALKANE, C28-	1.78 b	910.67 b	9604.02	792.82 b	11785.85
ALKANE, C29-	0.00 a	2104.33	9694.06	1804.89	11826.20
ALKANE, C30-	0.00 a	890.40	9175.18	702.56 b	10477.62
ALKANE, C32-	0.00 a	742.52 b	10552.66	624.37 b	13274.08
ALKANE, C34-	0.00 a	610.66 b	10976.26	574.56 b	13433.30
TOT. ALKANES	1361.50	59589.00	268268.91	60280.40	
[UCM]	1015.10	278900.41	42352.30	248131.70	

Aliphatics

id	-600	500215	
repl	2	1	
qcbatch	R02215	R02215	
labsam	NMFSALI	500215	
matrix	QCCALI	BLANK	
catno	RMB_000	RMB_049	
drywt	0.00	0.00	
wetwt	1.00	1.00	
deuterated recoveries:			
C12 - d26	95.24	93.49	
C16 - d34	97.51	93.34	
C20 - d42	102.48	102.40	
C24 - d50	104.50	105.14	
C30 - d64	113.78	111.60	
concentrations (ng/g):			
ALKANE, C10-	13229.95	0.00	a
ALKANE, C11-	12802.03	0.00	a
ALKANE, C12-	13134.40	0.00	a
ALKANE, C13-	13265.84	0.00	a
ALKANE, C14-	14416.29	0.00	a
ALKANE, C15-	14351.62	0.00	a
ALKANE, C16-	12904.78	0.00	a
ALKANE, C17-	13397.91	0.00	a
PRISTANE	15297.47	0.00	a
ALKANE, C18-	11608.12	0.00	a
PHYTANE		0.00	a
ALKANE, C19-	11850.69	0.00	a
ALKANE, C20-	13160.55	0.00	a
ALKANE, C21-	13159.78	0.00	a
ALKANE, C22-	12302.76	0.00	a
ALKANE, C23-	12988.01	0.00	a
ALKANE, C24-	12337.74	0.00	a
ALKANE, C25-	12787.76	0.00	a
ALKANE, C26-	13452.42	0.00	a
ALKANE, C27-	12817.77	0.00	a
ALKANE, C28-	11822.41	0.00	a
ALKANE, C29-	11793.32	0.00	a
ALKANE, C30-	10713.02	0.00	a
ALKANE, C32-	12691.41	0.00	a
ALKANE, C34-	12918.52	0.00	a
TOT. ALKANES		0.00	
[UCM]		26323.40	

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Aromatics

id	401101	401106	401108	401109	401111
repl	1	1	1	1	1
qcbatch	RO2215	RO2215	RO2215	RO2215	RO2215
labsam	401101	401106	401108	401109	401111
matrix	BLANK	SEDIMENT	SEDIMENT	BLANK	SEDIMENT
catno	RMB_049	RMB_049	RMB_049	RMB_049	RMB_049
drywt	0.00	14.78	4.92	0.00	20.37
wetwt	20.00	20.81	20.02	20.00	22.07
deuterated recoveries:					
NAPHTHALENE d-8	51.24	45.08	58.09	51.62	55.24
ACENAPHTHENE d-10	64.46	64.35	71.15	70.89	66.97
PHENANTHRENE d-10	70.80	70.52	68.64	74.56	65.29
ANTHRACENE d-10	73.17	74.33	80.22	75.39	64.29
BENZ-a-ANTHRACENE d-12	48.48	61.55	57.05	48.02	55.02
CHRYSENE d-12	56.03	50.36	53.07	52.43	48.66
BENZO-a-PYRENE d-12	41.04	54.99	46.88	40.29	47.99
PERYLENE d-12	39.79	51.24	46.81	36.90	45.70
concentrations (ng/g):					
naphthalene	0.00 b	0.42 b	3.23	0.16 b	0.56 b
2-methylnaphthalene	0.00 b	0.27 b	0.24 b	0.29 b	0.12 b
1-methylnaphthalene	0.00 b	0.09 b	0.01 b	0.07 b	0.04 b
2,6-dimethylnaphthalene	0.00 a	0.00 a	0.27 b	0.36 b	0.00 a
C-2 naphthalenes	0.00 b	0.09 b	0.21 b	0.50 b	0.23 b
2,3,5-trimethylnaphthal	0.00 a	0.00 b	0.00 b	0.00 b	0.39 b
C-3 naphthalenes	0.00 b	1.98 b	0.25 b	0.56 b	1.94 b
C-4 naphthalenes	0.00 a	17.19	0.19 b	0.31 b	2.95
biphenyl	0.00 a	0.29 b	0.28 b	0.50 b	0.00 a
acenaphthylene	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
acenaphthene	0.00 b	0.28 b	0.01 b	0.11 b	0.03 b
fluorene	0.00 a	0.24 b	0.00 b	0.10 b	0.09 b
C-1 fluorenes	0.00 b	3.00	0.33 b	0.62 b	0.73 b
C-2 fluorenes	0.00 a	30.99	0.18 b	0.59 b	3.23
C-3 fluorenes	0.00 a	36.82	0.00 a	0.00 a	2.24 b
dibenzothiophene	0.00 b	0.26 b	0.04 b	0.07 b	0.39 b
C-1 dibenzothiophenes	0.00 a	3.32 b	0.09 b	0.11 b	2.30 b
C-2 dibenzothiophenes	0.00 a	40.47	0.14 b	0.08 b	4.11
C-3 dibenzothiophenes	0.02 b	149.93 m	0.55 b	0.03 b	12.25
phenanthrene	0.00 b	1.02 b	0.26 b	2.99	1.81 b
1-methylphenanthrene	0.00 a	0.99 b	0.16 b	0.25 b	1.76 b
C-1 phenanthrenes/anthr	0.00 a	19.29	0.53 b	1.13 b	6.55
C-2 phenanthrenes/anthr	0.00 a	80.02	0.28 b	0.26 b	12.32
C-3 phenanthrenes/anthr	0.00 a	222.95 m	0.32 b	0.09 b	18.57
C-4 phenanthrenes/anthr	0.04 b	107.24 m	0.19 b	0.97 b	9.84
anthracene	0.00 a	0.47 b	0.13 b	0.00 a	0.09 b
fluoranthene	0.00 a	3.94	0.53 b	0.23 b	0.43 b
pyrene	0.00 a	9.84	0.43 b	0.26 b	0.70 b
C-1 fluoranthenes/pyren	0.00 a	44.71	0.49 b	0.13 b	3.24
benz-a-anthracene	0.00 a	3.60	0.14 b	0.12 b	0.26 b
chrysene	0.07 b	61.37	1.34 b	2.13 b	7.33
C-1 chrysenes	0.00 a	107.14 m	0.67 b	0.57 b	13.80
C-2 chrysenes	0.00 a	48.54	0.25 b	0.00 a	6.11
C-3 chrysenes	0.00 a	76.68	0.56 b	0.00 a	12.16
C-4 chrysenes	0.00 a	34.40	0.00 a	0.00 a	5.41
benzo-b-fluoranthene	0.00 a	10.28	1.23 b	0.49 b	2.09 b
benzo-k-fluoranthene	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
benzo-e-pyrene	0.09 b	24.04	1.20 b	0.43 b	5.88
benzo-a-pyrene	0.00 a	3.04 b	0.45 b	0.00 a	0.44 b
perylene	0.00 a	1.47 b	0.18 b	0.00 a	0.36 b
indeno-123-cd-pyrene	0.00 a	1.57 b	0.00 a	0.00 a	0.33 b
dibenzo-a,h-anthracene	0.00 a	2.57	0.00 a	0.00 a	0.42 b
benzo-g,h,i-perylene	0.00 a	7.42	0.50 b	0.00 a	2.04 b

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Aromatics

id	401116	401117	401118	500201	500203
repl	1	1	1	1	1
qcbatch	R02215	R02215	R02215	R02215	R02215
labsam	401116	401117	401118	500201	500203
matrix	SEDIMENT	BLANK	SEDIMENT	SEDIMENT	BLANK
catno	RMB_049	RMB_049	RMB_049	RMB_049	RMB_049
drywt	17.37	0.00	17.96	0.39	0.00
wetwt	19.78	20.00	18.67	0.46	1.00
deuterated recoveries:					
NAPHTHALENE d-8	48.73	60.44	45.52	67.87	44.93
ACENAPHTHENE d-10	64.86	69.45	56.09	82.95	57.38
PHENANTHRENE d-10	71.17	69.06	56.95	89.87	71.84
ANTHRACENE d-10	75.80	77.03	77.42	89.29	77.08
BENZ-a-ANTHRACENE d-12	48.71	47.84	46.92	66.48	53.61
CHRYSENE d-12	49.74	52.00	40.76	57.45	52.29
BENZO-a-PYRENE d-12	39.66	35.84	26.24	69.01	48.39
PERYLENE d-12	37.53	33.42	24.87	63.14	44.71
concentrations (ng/g):					
naphthalene	0.44 b	0.00 b	0.94 b	0.00 b	0.00 b
2-methylnaphthalene	0.33 b	0.00 b	0.70 b	39.47 b	0.00 b
1-methylnaphthalene	0.13 b	0.00 b	0.50 b	116.08 b	0.00 b
2,6-dimethylnaphthalene	0.26 b	0.00 a	0.64 b	1177.40	0.00 a
C-2 naphthalenes	0.00 b	0.00 b	1.63 b	7377.72 m	0.00 b
2,3,5-trimethylnaphthal	0.04 b	0.00 a	0.23 b	8492.75 m	0.00 a
C-3 naphthalenes	0.36 b	0.00 b	1.37 b	41146.37 m	0.00 b
C-4 naphthalenes	0.21 b	0.00 a	0.37 b	52193.77 m	0.00 b
biphenyl	0.34 b	0.00 a	0.94 b	54.09 b	5.03 b
acenaphthylene	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
acenaphthene	0.00 b	0.00 b	0.21 b	78.01 b	0.00 b
fluorene	0.10 b	0.00 a	0.34 b	942.97	0.00 a
C-1 fluorenes	0.57 b	0.00 b	0.49 b	11061.34 m	0.00 b
C-2 fluorenes	1.00 b	0.00 a	0.79 b	34560.13 m	3.45 b
C-3 fluorenes	0.04 b	0.00 a	0.00 a	14733.55 m	0.00 a
dibenzothiophene	0.12 b	0.00 a	0.26 b	3556.10	0.00 b
C-1 dibenzothiophenes	0.44 b	0.00 b	0.42 b	22384.67 m	3.38 b
C-2 dibenzothiophenes	0.49 b	0.00 a	0.20 b	28635.57 m	4.83 b
C-3 dibenzothiophenes	0.40 b	0.00 a	0.15 b	34514.19 m	4.13 b
phenanthrene	1.43 b	0.00 b	3.39	6254.09 m	0.00 b
1-methylphenanthrene	0.53 b	0.00 a	0.50 b	10801.34 m	0.00 a
C-1 phenanthrenes/anthr	1.95 b	0.00 a	2.26 b	45494.74 m	0.80 b
C-2 phenanthrenes/anthr	1.62 b	0.00 a	1.46 b	75504.42 m	7.26 b
C-3 phenanthrenes/anthr	0.65 b	0.00 a	0.22 b	61209.18 m	7.26 b
C-4 phenanthrenes/anthr	1.04 b	0.00 a	1.07 b	20945.55 m	3.42 b
anthracene	0.18 b	0.00 a	0.00 a	579.86	0.00 a
fluoranthene	0.60 b	0.00 a	0.46 b	216.87	0.00 a
pyrene	0.48 b	0.00 a	0.48 b	1496.42	0.00 a
C-1 fluoranthenes/pyren	0.24 b	0.00 a	0.29 b	5895.52 m	0.32 b
benz-a-anthracene	0.30 b	0.00 a	0.14 b	628.98	0.00 a
chrysene	2.70 b	0.00 a	2.62 b	7732.69 m	0.00 b
C-1 chrysenes	1.23 b	0.00 a	1.41 b	13828.91 m	1.30 b
C-2 chrysenes	0.00 a	0.00 a	0.00 a	6417.07 m	0.00 a
C-3 chrysenes	0.00 a	0.00 a	0.00 a	8487.38 m	0.00 a
C-4 chrysenes	0.00 a	0.00 a	0.00 a	2895.42	0.00 a
benzo-b-fluoranthene	1.86 b	0.00 a	1.20 b	937.56	0.00 a
benzo-k-fluoranthene	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
benzo-e-pyrene	1.45 b	0.00 a	1.62 b	1903.15	0.00 a
benzo-a-pyrene	0.18 b	0.00 a	0.00 a	233.76	0.00 a
perylene	0.28 b	0.00 a	0.39 b	99.38 b	0.00 a
indeno-123-cd-pyrene	0.00 a	0.00 a	0.00 a	94.32 b	0.00 a
dibenzo-a,h-anthracene	0.00 a	0.00 a	0.00 a	220.59	0.00 a
benzo-g,h,i-perylene	0.00 a	0.00 a	0.00 a	553.41	0.00 a

Aromatics

id	-550	-550	-900	-901	-600
repl	1	2	1	1	1
qcbatch	R02215	R02215	R02215	R02215	R02215
labsam	AREF	BREF	MBLK	SBLK	NISTARO
matrix	QCSED	QCSED	QCBLANK	QCSBLANK	QCCALI
catno	RMB_000	RMB_000	RMB_000	RMB_000	RMB_000
drywt	0.00	0.00	0.00	0.00	0.00
wetwt	1.03	1.07	1.00	1.00	1.00
deuterated recoveries:					
NAPHTHALENE d-8	49.58	9.41	45.29	42.74	99.12
ACENAPHTHENE d-10	69.56	12.72	56.86	58.57	100.59
PHENANTHRENE d-10	73.98	14.24	57.79	65.50	95.62
ANTHRACENE d-10	78.86	74.62	64.18	69.58	92.90
BENZ-a-ANTHRACENE d-12	58.37	50.26	42.55	47.36	66.04
CHRYSENE d-12	51.55	13.09	42.50	50.01	65.81
BENZO-a-PYRENE d-12	42.49	5.94	33.76	45.66	63.27
PERYLENE d-12	39.24	5.67	30.68	38.99	64.07
concentrations (ng/g):					
naphthalene	912.46	907.65	1.42 b	369.74	335.82
2-methylnaphthalene	1115.94	974.61	0.51 b	437.29	390.07
1-methylnaphthalene	768.46	741.08	0.46 b	487.44	423.89
2,6-dimethylnaphthalene	467.67	385.64	0.00 a	307.49	354.50
C-2 naphthalenes	1818.30	1616.07	1.13 b	299.28 b	
2,3,5-trimethylnaphthal	247.38	223.62	0.20 b	368.05	331.08
C-3 naphthalenes	1173.95	992.89	0.37 b	370.09 b	
C-4 naphthalenes	556.55	454.44	0.07 b	0.00 a	
biphenyl	202.86	171.67	0.00 a	377.09	342.74
acenaphthylene	29.91 b	26.11 b	0.00 a	404.74	337.58
acenaphthene	30.22 b	22.24 b	0.17 b	391.12	360.86
fluorene	105.21	91.77	0.16 b	442.62	347.72
C-1 fluorenes	201.75	160.81	0.15 b	2.86 b	
C-2 fluorenes	230.89	166.97	0.00 a	0.00 a	
C-3 fluorenes	72.26	49.00 b	0.00 a	0.00 a	
dibenzothiophene	152.74	131.40	0.06 b	443.81	400.94
C-1 dibenzothiophenes	281.01	248.54	0.03 b	0.00 b	
C-2 dibenzothiophenes	202.18	203.11	0.00 a	0.00 a	
C-3 dibenzothiophenes	229.58	200.64	0.00 a	0.00 a	
phenanthrene	781.55	699.58	0.97 b	418.05	362.51
1-methylphenanthrene	222.52	206.29	0.00 a	366.07	345.79
C-1 phenanthrenes/anthr	977.74	797.39	0.15 b	364.75 b	
C-2 phenanthrenes/anthr	818.27	742.39	0.05 b	0.00 a	
C-3 phenanthrenes/anthr	509.55	447.65	0.00 a	0.00 a	
C-4 phenanthrenes/anthr	215.17	165.43	0.00 a	0.00 a	
anthracene	110.95	131.96	0.00 a	460.19	395.53
fluoranthene	420.13	393.91	0.00 a	280.34	264.17
pyrene	393.14	359.90	0.00 a	282.78	264.01
C-1 fluoranthenes/pyren	181.11	166.08	0.00 a	0.00 a	
benz-a-anthracene	209.53	157.44	0.00 a	235.14	179.84
chrysene	371.17	258.70	0.12 b	483.95	347.68
C-1 chrysenes	252.97	161.24	0.00 a	0.00 a	
C-2 chrysenes	42.21 b	25.63 b	0.00 a	0.00 a	
C-3 chrysenes	55.21 b	14.49 b	0.00 a	0.00 a	
C-4 chrysenes	16.72 b	2.74 b	0.00 a	0.00 a	
benzo-b-fluoranthene	612.03	757.68	0.00 a	361.30	260.60
benzo-k-fluoranthene	0.00 a	0.00 a	0.00 a	379.65	276.80
benzo-e-pyrene	271.41	346.91	0.00 a	379.27	279.16
benzo-a-pyrene	140.28	153.86	0.00 a	448.38	342.29
perylene	276.12	265.98	0.00 a	467.88	357.07
indeno-123-cd-pyrene	137.88	45.08 b	0.00 a	321.75	299.07
dibenzo-a,h-anthracene	38.91 b	0.00 a	0.00 a	215.27	235.59
benzo-g,h,i-perylene	138.87	148.29	0.00 a	308.79	239.35

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Aromatics

id	-600	500215	
repl	2	1	
qcbatch	R02215	R02215	
labsam	NISTARO	500215	
matrix	QCCALI	BLANK	
catno	RMB_000	RMB_049	
drywt	0.00	0.00	
wetwt	1.00	1.00	
deuterated recoveries:			
NAPHTHALENE d-8	99.62	25.34	
ACENAPHTHENE d-10	101.87	32.15	
PHENANTHRENE d-10	98.89	35.62	
ANTHRACENE d-10	93.83	36.28	
BENZ-a-ANTHRACENE d-12	58.41	23.95	
CHRYSENE d-12	67.93	25.25	
BENZO-a-PYRENE d-12	64.32	20.51	
PERYLENE d-12	68.32	18.80	
concentrations (ng/g):			
naphthalene	329.75	0.00	b
2-methylnaphthalene	377.20	0.00	b
1-methylnaphthalene	415.81	0.00	b
2,6-dimethylnaphthalene	339.28	0.00	a
C-2 naphthalenes		0.00	b
2,3,5-trimethylnaphthal	308.25	0.00	a
C-3 naphthalenes		0.00	a
C-4 naphthalenes		0.00	a
biphenyl	322.76	0.00	a
acenaphthylene	330.36	0.00	a
acenaphthene	340.50	0.00	a
fluorene	324.83	0.00	a
C-1 fluorenes		0.00	a
C-2 fluorenes		0.00	a
C-3 fluorenes		0.00	a
dibenzothiophene	364.19	0.00	a
C-1 dibenzothiophenes		0.00	a
C-2 dibenzothiophenes		0.00	a
C-3 dibenzothiophenes		0.00	a
phenanthrene	342.54	0.00	b
1-methylphenanthrene	285.36	0.00	a
C-1 phenanthrenes/anthr		0.00	a
C-2 phenanthrenes/anthr		0.00	a
C-3 phenanthrenes/anthr		0.00	a
C-4 phenanthrenes/anthr		0.00	a
anthracene	366.98	0.00	a
fluoranthene	223.55	0.00	a
pyrene	227.92	0.00	a
C-1 fluoranthenes/pyren		0.00	a
benz-a-anthracene	182.03	0.00	a
chrysene	387.98	0.00	a
C-1 chrysenes		0.00	a
C-2 chrysenes		0.00	a
C-3 chrysenes		0.00	a
C-4 chrysenes		0.00	a
benzo-b-fluoranthene	277.33	0.00	a
benzo-k-fluoranthene	313.98	0.00	a
benzo-e-pyrene	321.46	0.00	a
benzo-a-pyrene	383.06	0.00	a
perylene	394.46	0.00	a
indeno-123-cd-pyrene	260.16	0.00	a
dibenzo-a,h-anthracene	184.07	0.00	a
benzo-g,h,i-perylene	234.44	0.00	a

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