COOK INLET, ALASKA
Oceanographic and Ice Conditions and NOAA's 18-Year Oil Spill Response History 1984-2001

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General Description of Cook Inlet

Cook Inlet is a large tidal estuary that extends the North Pacific Ocean approximately 350 km into Southcentral Alaska. The inlet varies from more than 130 km wide at its southern mouth to less than 15 km at the northern extremity of Knik Arm. The Aleutian and Alaska Mountain Ranges border the inlet to the west and the northwest, The Talkeetna and Chugach Mountains to the northeast, and the Kenai Mountains to the east and southeast.

This estuary is divided into three subareas, the head region, upper inlet, and lower inlet. The head region includes Knik and Turnagain Arms which are relatively shallow and each approximately 60 km long. The major constricting point, about 25% of the way down the inlet from the north known as the Forelands, is the boundary between the upper and lower inlet.

Four major islands exist in Cook Inlet. The largest two are Kalgin Island, located in the northern part of the lower inlet, and Augustine Island, a volcanic edifice in the southwestern corner of lower Cook Inlet. The other two islands, Chisik Island in the lower inlet on the west, and Fire Island in the upper inlet, are largely extensions of the mainland.

The largest city in Alaska, Anchorage, is located at the transition between the upper and head regions of the inlet on the east side.

The principal sources of fresh water into the inlet are the the Susitna, Matanuska, and Knik Rivers which enter the the head region and the northern upper inlet. They have a combined peak discharge of about 90×10^3 $m^3 s^{-1}$ (Sharma et al., 1974) which represents about 70% of the fresh water input into the inlet. These and other glacier-fed rivers carry millions of tons of suspended sediment into the inlet each year. Winter flows from these rivers are significantly lower with almost no suspended sediment.

The salinity of Cook Inlet varies from 32 parts per thousand (ppt) near the entrance to 27 ppt near the Forelands and 10 ppt near the head of the inlet (Smith, 1993). In winter the salinity increases in the upper inlet due to a decrease in fresh water from the rivers and freezing of fresh water. At the Forelands the higher salinity ocean water from the lower inlet meets and mixes with the turbid and low salinity runoff flowing out of the upper inlet. Estimates of residence time for fresh water in the upper inlet are unknown.

Suspended sediments average 200 mg/l with a high of 2000 mg/l in the upper inlet (Sharma and Burell, 1970). Suspended sediment loads in excess of 3000 mg/l have been measured in Knik Arm (Smith, 1993). Visibility in the upper inlet is limited to a few centimeters.

Due to its northeast-southwest elongation with mountains on both sides, winds are seasonally channeled by the inlet. Figure 1 shows that in the summer the winds are predominately from the south and southwest, while in the winter the colder, denser air masses from the interior drive winds predominately out of the north and northeast. As a result of these wind directions, the weather in

Cook Inlet can be of continental or maritime origin.

High, glaciated mountains extending along the entire west side of Cook Inlet probably produce strong and locally variable winds descending into Cook Inlet, but no data from this side has been available. In the fall of 1999, weather stations were installed on the Christy Lee dock at the Drift River terminal and on Augustine Island to monitor conditions on the west side of Cook Inlet.

Fifteen oil production platforms are currently in Cook Inlet, between the Forelands and the North Forelands. In addition, submerged gas and oil pipelines and electric power cables cross the inlet. Major port facilities are located at Anchorage, Kenai, Nikiski, and Homer with several smaller facilities located along the shoreline.

Tidal Characteristics of Cook Inlet

The long, narrow configuration of Cook Inlet produces tidal heights second only to the Bay of Fundy in Newfoundland and results in two high and two low tides of unequal height in each period of approximately 25 hours. The mean tidal range varies from 3 m at the entrance to 9 m at the head of the inlet. The extreme spring tidal range is approximately 12 m and occurs in the upper inlet. Interestingly, the tidal heights at the entrance and at the head are approximately 180° out of phase. Figure 2 shows the instantaneous tidal heights along the length of Cook Inlet from Anchorage in the north to Seldovia in the south. In response to the tides, the water in Cook Inlet is basically acting like a standing wave.

Tidal currents average one to two knots maximum at the entrance and five to six knots maximum around Anchorage. During times of extreme tides maximum currents of eight knots occur near the Forelands. If the average maximum tidal current is plotted as a function of position along the inlet and broken into flood and ebb components, the results shown in Figure 3 are obtained. The maximum ebb current, at all points along the axis of the inlet, is approximately a knot greater than the maximum flood current, accounting for the net outflow of water from Cook Inlet into Shelikof Strait.

Every seven days the tidal influence moves from a neap to a spring condition causing a greater than twofold increase in tidal velocities. A typical spring to neap tidal current variation for the Forelands is shown in Figure 4. These data were obtained using Shio, a NOAA tide predicition model.

As a result of the large tidal currents changing direction four times per day, any floating objects, like ice or an oil slick, can move past a fair stretch of Cook Inlet coastline. This factor is called tidal excursion, defined as the maximum extent of movement a floating object or parcel of water would transgress over a full cycle of the tide. Figure 5 shows the average maximum tidal excursion along the inlet from north to south. From the Forelands north, tidal excursions range between 28 km to 37 km, while in the southern inlet this excursion distance is less than 18 kilometers.

Circulation in Cook Inlet

The main features of the spring-summer circulation in Cook Inlet have been described by Burbank (1977) and Muench et.al. (1978), however, the circulation during the autumn-winter period has not been studied in detail. Some of these features of the net circulation for the inlet south of the Forelands, as developed by Burbank, are shown in Figure 6.

The intense westward flowing Kenai Coastal Current (KCC), which flows along the northern periphery of the Gulf of Alaska, enters Cook Inlet through Kennedy Entrance. It flows across the inlet mouth, with the majority of water exiting via Shelikof Strait. A portion of the clear ocean water of the KCC progresses northward along the eastern side of the inlet, with minor lateral mixing, to the latitude of Kasilof-Ninilchik. This distinct water mass moves northward where it mixes extensively with the turbid inlet water in the area near the Forelands, eventually crossing west near Kalgin Island.

Circulation on the west side of the inlet is dominated by a concentrated southward flow of water significantly diluted by the large fresh water input into the upper inlet.

Complex circulation patterns are observed from south of Kalgin Island to the Forelands. This results from the convergence of ebbing and flooding waters, from high current velocities, and from a unique coastline and seafloor configuration. These factors combine to cause both a strong, cross-inlet current as well the development of major convergence, or "rip" zones, as they are locally known (Figure 6).

Three distinct convergence zones have been identified in this part of the inlet (Figure 7) - the east rip, the mid-channel rip, and the west rip. These surface convergence zones strongly influence the trajectory of floating objects in this region. These zones tend to develop near-vertical boundaries between distinct water masses with the occurrence of shearing, convergence, and divergence being manifest between these water masses during ebb and flood tidal flow.

A distinct 50 m to 80 m seafloor channel, between the west rip and the mid-channel rip, seems to be controlling the distinct movement of this water mass. During flooding conditions, water in this channel flows faster northward as it experiences less bottom friction than water to the east and west (Figure 8), creating tremendous turbulence at the boundaries. Similarly, during the ebbing tidal current conditions, the water mass over this seafloor channel flows faster and in so doing actually develops a depression in the surface relative to the water masses on each side (Figure 9). This causes a convergence at the boundary accompanied by a turbulent down flow which is strong enough to temporarily submerge floating objects.

This effect was particularly evident during the *T/V Glacier Bay* oil spill in July, 1987. Oil was pulled, against the normal influence of the wind, concentrated in the convergence zones and forced under the surface. When the oil resurfaced it had a much more diffuse and dilute pattern. The mid-channel rip zone dominates the others as well as the entire hydrodynamic regime of this part of the inlet. It extends southward to Augustine Island (Burbank, 1977). The exact controlling influences causing the east rip zone are uncertain as its seafloor expression is not as distinct as that for the mid-channel rip zone.

The normal movement of water from the east to the west south of the Forelands can be expedited by the interaction of the tidal currents with the coastline configuration. At the Forelands the orientation of the axis of the inlet suddenly changes by approximately 45°. Just like the inertia of a rapidly moving car or truck causes it to be thrown to the outside of a corner, water masses moving through the Forelands experience this same inertial effect. A flooding tide is forced westward as it courses through the Forelands, and then moves further westward as it ebbs back through this constriction. Several oil spills have confirmed this phenomena as spills that occur off Nikiski during a flood tide end up in the mid-channel rip zone within a day or two. Undoubtedly, this effect is greater (westward migration is faster) the higher the tidal currents.

Several other localized circulation patterns have been observed in Cook Inlet. Gatto (1976) noted a clockwise back eddy during flood tide in the slack water area west of Clam Gulch, a counterclockwise current during ebb tide at Anchorage, and the movement of sediment-laden, ebbing water past the west side of Augustine Island, out of the inlet, around Cape Douglas, and through Shelikof Strait.

Observations during several oil spills in Cook Inlet indicate the development of a clockwise eddy immediately north of the East Forelands during a flood tide, as well as the ability of water between the Forelands and Kalgin Island to move from the eastern shore to west side very rapidly (2-4 days) during periods of stiff summer southwesterlies. In the winter, when these winds are absent, the mid-channel rip tends to short-circuit any cross channel migration.

The least understood part of the circulation of Cook Inlet is the area west of Kalgin Island. Conventional wisdom seems to imply that any water mass in this location would get caught in the southward egress of low salinity water that seems to dominate this side of the inlet, particularly during the high fresh water input during the summer. However, during the *T/V Glacier Bay* oil spill, it was observed that an oil slick along the western shore of the inlet, two-thirds of the way down Kalgin Island completely reversed its trajectory and returned northward and eastward across the top of Kalgin Island and moved into the mid-channel rip. Whether this is a normal occurrence under the influence of summer southwesterlies or an anomaly is uncertain. Hopefully, one won't have to wait until a spill from one of the oil tankers, which use this route to transport oil from the Drift River Terminal, occurs.

In addition, a rather deep 70 m to 90 m seafloor channel exists in this area (Figure 7) and undoubtedly ushers both a faster jet of water on both the flood and ebb tidal currents. Whether or not this is accompanied by convergence zones is uncertain; none have been reported.

- **Cook Inlet Circulation and Actual Oil Movement Examples**

The *T/V Glacier Bay* oil spill, in July of 1987, was very instructive regarding the mid-summer circulation in the middle Cook Inlet region. Figure 10 presents a summary of this event. In the early morning of July 2, the Glacier Bay sought temporary anchorage off the Kenai River within the 10 fathom contour where it grounded on a large boulder, initially releasing 10-15 bbls of North Slope crude. Moving further west offshore, another 100-400 bbls were released only a few hours later. These releases occurred basically at slack before flood, as indicated by the first dot in the tidal current inset. The vessel was then moved to the Nikiski dock where a couple thousand barrels of oil were released roughly 24 hours after the initial release (second dot on tidal current inset). Winds at the time and for the next several days were from the SW at 10-20 knots.

Normally, it might be expected that the SW wind would drive oil on to the shoreline north and south of the Kenai River, as the oil moved with the tide. This never occurred, as the oil was pulled into the east rip zone. Figures 11-23 document the subsequent movement of the oil as it migrates west across the inlet to impact the shoreline at Drift River around noon on July 6. Just prior to this shoreline oiling, the floating oil had moved two-thirds of the way down the west side of Kalgin Island, only to return north, oil the Drift River shoreline, and move back to the north and east of Kalgin Island. Ultimately, much of the oil became trapped on debris in the mid-channel rip zone where it formed a long line of oiled debris. Oil spill responders were able to contain large amounts of oiled debris which were tied off in free floating doughnuts to wait further action. These "oil doughnuts", which were already in the convergence zones, surprisingly lost their oiled debris which was pulled down by the vertical flow at the convergence boundary only to resurface in a much more diffuse and dilute pattern (Whitney, 1994).

In this part of the inlet the mid-channel rip zone seems to dominate the other rips as well as the entire hydrodynamic regime of this part of the inlet. This was further reinforced in January, 1992, during the East Forelands (KPL) spill (Figure 24). This spill of North Slope crude was again released on a building flood tide just offshore of Nikiski (dot on tidal current inset). Being the winter, however, this time the winds were light to strong from the NE. As expected the oil slick migrated westward into the mid-channel rip zone where the NE winds locked it in and moved it south past Kalgin Island.

- **Cook Inlet Circulation and Actual Ice Movement Example**

During the 1998-99 winter, NOAA and Cook Inlet Spill Prevention and Response Inc. (CISPRI) decided to conduct an experiment to determine the trajectories of ice in the middle Cook Inlet area with the idea being that in heavy ice conditions (greater than 8/10's ice coverage) spilled oil will move with the ice. As a result, two satellite tracked buoys were obtained from Alaska Clean Seas and were deployed on ice flows using the CISPRI support/response vessel, *M/V Heritage Service*.

As it turned out, the 1998-99 winter was one of the heaviest ice years in the past few decades, such that on February 15, 1999, when the two buoys were deployed, the upper and middle portion of Cook Inlet had 8 to 9/10's ice coverage. Figure 25 is a RADARSAT SAR image for February 14, 1844 AST. Since most of the surface is dynamic, broken ice, it produces a fairly good reflective surface over most of the inlet. The narrow, dark band, along with the entire west side of the inlet is probably sea ice covered with a smooth, non-reflective layer of snow. Similar large expanses of smooth, non-reflective snow covering ice probably occur in the SW-NE elongate dark areas half way between the East and North Forelands. The western elongate dark area is the Middle Ground Shoal, and the eastern smaller one matches the large, flat snow-covered ice area from which the second buoy was actually launched. The only open water in this image are the dark black spots scattered among the new frazil and skim ice along the eastern shoreline. Figure 26 shows a SAR image for February 28, 1836 AST, which also shows the preponderance of ice covering upper and middle Cook Inlet. These conditions continued until March 12 when the second buoy was plucked from the water on the west side of Kalgin Island, while buoy #1, launched just off Nikiski, was lost as it was last heard streaking towards the Barren Islands.

Buoy #1 transmitted only intermittently, however, buoy #2 produced a very nice continuous record of position every couple of hours for 25 days. It's trajectory is plotted, in a somewhat filtered form, in Figure 27. All the while astride a large ice flow, this buoy first moves west into Trading Bay before rounding the West Forelands, turns south into Redoubt Bay and moves all the way to the southern end of Kalgin Island in the west channel. Remarkably, from here it executes three complete clockwise rotations around Kalgin Island. Winds were monitored throughout this period and generally were light to variable, such that it is believed that the movement of buoy #2 is mostly a result of the water circulation in the winter time.

Interestingly enough, the movement of buoy #2 does mirror some of the oil spill movement discussed earlier. Like the Glacier Bay spill, the buoy migrated to the western side of the inlet and after almost moving south past Harriet Pt. (west side mainline point opposite south end of Kalgin Island), it returned north and moved around the north end of Kalgin Island into the mid-channel rip zone. Once in this zone, the buoy moved south like the East Forelands spill, even though there was only a light northern wind.

A possible explanation for the strange movement of buoy #2 is offered in Figure 28 in a net Cook Inlet surface circulation proposed by Burbank(1974). The northwest and west transport of clear seawater from Kennedy Entrance to the west side of the Kalgin Island Shoal has been frequently observed in ERTS imagery (Burbank, 1974; Gatto, 1976). This imagery was primarily obtained during the fall and winter when fresh water runoff is low, and suggests surface water transport across the mid-channel rip rather than a subsurface transport as observed by Burbank (1977). The reduced fresh water runoff during fall and winter probably significantly reduces surface water outflow in northern lower Cook Inlet which consequently could allow westward surface transport of intruding seawater across the mid-channel rip (Burbank, 1977). Furthermore, Burbank (1977) observes that, even during the summer, "after crossing the west side of the inlet (via either surface or sub-surface transport) the influence of intruding seawater (higher salinity and low turbidity) is distinctly observed extending northward to west of Kalgin Island." Between the northward flowing seawater current on the west side of Kalgin Island and the southward flowing mid-channel rip zone, it is not too far-fetched to imagine a current which moves objects in a clockwise merry-go-round around Kalgin Island, particularly during the fall and winter.

- **Conclusions Regarding Circulation and Oil Movement** (Whitney, 1999)

1. Oil spilled off the mouth of Kenai River tends to be more controlled by currents and rip zones than by winds. In general, this appears true for any oil spilled in the vicinity of the rip zones.

2. There is a back eddy on the north side of the east Forelands which always oils that beach when oil comes from the south along the shoreline. This is also probably true for both sides of the East and West Forelands.

3. Oil, and hence surface currents, tend to migrate from east to west in the central portion of Cook Inlet rather rapidly, like one day from Nikiski to the mid-channel rip zone and two days to the west side of Kalgin Island. Direction and speed of the wind seem to determine how far westerly the oil migrates.

4. Oil on the west side of Kalgin Island, which appears to be moving south past Harriet Pt., actually comes back north to the north end of Kalgin Island and enters the mid-channel rip, e.g., Glacier Bay spill, and ice buoy #2.

5. Oil tends to get temporarily pulled below the surface in the mid-channel rip zone with this being most pronounced during ebb tides and spring tides.

Air and Water Temperature in Cook Inlet (Nelson and Whitney, 1996)

Seawater temperatures generally drop to the freezing point (-1.7°C) in mid to late November. After ice forms, the water temperature generally stays about the same until the ice disappears in March, April, or May. An exception was January 1976 when the Mt. St. Augustine volcano erupted.

Air temperatures, as shown by Anchorage data, are quite variable. A pattern often followed is a gradual cooling in the fall through mid or late December followed by a warming trend for variable periods of time in late December or January. Warming often occurs to the point where Cook Inlet ice nearly disappears. This phenomena is referred to as the January thaw, which happens in more than 90% of the years.

January was warmer than December in 15 of the last 39 winter seasons. The colder December is, the more pronounced the January thaw seems. A cooling trend usually occurs in late January and February. The greatest difference was between December 1980 with a mean temperature of -17.3°C followed by January 1981 with a mean temperature of -0.3°C, a total of 17°C warmer than December (Brower, et. al., 1988).

Formation of Ice in Cook Inlet (Nelson and Whitney, 1996)

Being in a northerly latitude, Cook Inlet provides a unique environment for ice formation and growth. The large estuary is located in an area that has moderate snow fall, extended air temperatures less than -20°C, a freezing index of 1400 C days per year, and has high tides which result in large current velocities. This environment produces ice volumes far in excess of that expected from conventional ice growth in quiescent waters.

The amount of ice in Cook Inlet varies greatly from one year to another. Figure 29 shows the dates of first significant ice (defined as 10% coverage at the Phillips Platform in the upper inlet) in the 17 years from 1969 to 1986. The dates varied from October 7 to December 17. The mean date for first significant ice during this period was November 24 and the median date was November 20. The spring disappearance of significant ice was also quite variable ranging from March 10 in 1981 to May 15 in 1972. The average date for termination of significant ice was April 8 and the median date was April 9.

The usual effect on the Cook Inlet ice is a gradual increase in ice from late November through December and January showing very little increase or a slight decrease in ice followed by increasing ice in February. March usually shows a decrease in ice, and ice generally melts completely during April (Brower, et.al., 1988).

Figures 30-35 show the extent of average concentrations of ice in Cook Inlet for November through April. The data shown are for the latter half of each month. Cook Inlet ice often first forms in October and later melts before significant ice of a more permanent nature forms in the latter half of November.

Ice usually increases in coverage and thickness through most of December with open to close pack of new and young ice north of the Forelands and very open pack of new ice south to Ninilchik along the east shore of the inlet and to Kamishak Bay along the west shore of the inlet. Most winter seasons a warming occurs in late December and early January. During the warming, ice shows little or no increase and in fact often decreases. In late January and February ice again increases in coverage and thickness. The ultimate ice extent, strength, and thickness is quite variable depending on the extent of the January thaw. Maximum thickness of the pack varies from less than 1/2 m to 2 m (Brower et al., 1988).

Large volumes of shore fast ice form during the cold months. This ice can be floated by high tides. Ice from Turnagain Arm enters the inlet near Fire Island, and Kamishak Bay ice drifts into the northern Shelikof Strait. Shore ice, which had anchored to the tidal flats, also can be floated free. This ice can be as thick as 10 m and may enter shipping lanes. Relatively thick beach ice is the last to melt in Cook Inlet in the spring. Most ice has melted by the end of April.

General Cook Inlet Ice Characteristics (Nelson and Whitney, 1996)

- **Sea Ice**

Under relatively quiescent conditions ice growth in seawater is similar to ice growth on a lake surface. After the water has cooled, a thin layer of ice forms. This ice then grows at the ice-water interface at a rate determined by the transfer of latent heat from the ice-water interface to the cold air. Ice formed by this mechanism may reach a thickness of 1 m in Cook Inlet. This ice is relatively strong with a columnar grain structure. Sea ice is the predominant type of ice in Cook Inlet.

- **Conventional Growth at the Ice-Water Interface**

As heat is conducted from the ice-water interface to the cold air, ice will form at the ice-water interface. The rate of this ice formation is a function of the air temperature, ice thickness, and thermal resistance between the ice and cold air. The ice forming in this manner has physical properties comparable to conventional first year sea ice of similar crystaline structure.

- **Fingering and Rafting**

When two relatively thin ice sheets collide, they may alternately slide over and under each other (fingering) or one will slide over the other (rafting). This results in the doubling of the ice thickness in the overlap region.

- **Pressure Ridges**

In active areas such as Cook Inlet, collisions between ice features or pressures resulting from the combination of water flow and wind results in buckling of ice sheets or crushing of the ice sheet at cracks or where they collide. The ice features formed resemble pressure ridges. These features are composed of ice fragments with random alignment. Ice pressure ridges in Cook Inlet have been documented to be over 2 m thick (Nelson, 1995).

- **Slush Collection**

Cook Inlet has a unique environment that favors the formation of slush ice. Observations by Nelson (1995) suggest that a significant fraction of ice formed in Cook Inlet is a granular ice that resulted from coalescence of slush ice. To a lesser extent granular snow ice is formed.

The rate of ice formation for this ice is controlled by the thermal resistance over the ice and by the air temperature. For an air temperature of -20°C (-4°F) and a wind speed of 10 knots, assuming continuous ice formation at the thin layer condition, the equivalent ice formation rate would be approximately 0.15 m per day. Given the fraction of the inlet that has open water, the mass of ice formation by this mode is very large. The amount has not been quantified but greatly exceeds the volume that would be formed by "conventional" growth.

This floating slush or brash ice is trapped against or carried under existing ice features. Because of the potential depth of slush ice, United States Coast Guard rules require ships to "ballast down" to 3 m foreward and 2 m over the wheel to avoid ingesting slush ice into water intakes.

Once the slush is immobilized, the freezing process causes the slush to solidify into granular ice. During the winter of 1993-94, Nelson (1995) measured floating ice features with thicknesses in excess of 2 m that formed in the northern part of the lower inlet by this mode. These ice features formed in less than one week during air temperatures of approximately -20°C.

- **Shorefast Ice (Stamukhi)**

Shorefast ice is formed in the intertidal zone from the accumulation of ice formed offshore and from ice formed at the intertidal zone. Ice formed offshore is moved to the intertidal zone by water current, tides, and by wind action. Ice forms in place from tidal washing, formation of slush ice during slack high tide, and from the wetting of existing snow.

The shorefast ice accumulations are relatively porous and weak after the initial deposition but within a few tide cycles fill in and exhibit crushing strengths typical of granular sea ice. Shorefast ice bonds to the bottom in the shallower locations. This ice bonds to the extent that it is not floated during high tides. During high tides the water overflows the bonded ice shelf and deposits other floating ice on the existing ice shelf.

A tide crack forms in the shorefast ice shelf at a water depth where the ice is not securely bonded to the bottom. Seaward of the tide crack, the ice or snow surface is not wetted because that ice floats during high tides. Shoreward of the crack, the ice or snow surface is wetted since that ice, at high tide, is submerged. The ice offshore of the crack will eventually break up and move seaward or, during a relatively high tide, may be lifted and transported landward where it is deposited upon the shoreward ice that is bonded to the bottom. On high tide, occasional stamukhi of massive proportions are carried into the inlet. Stamukhi 6 m high, 9 m wide, and 18 m long grounded on Middle Ground Shoal were observed by Pan American Petroleum Corp. personnel in 1964.

Shore ice commonly reaches a thickness of 2 m although some ice features may form to a thickness in excess of 7.5 m (Nelson, 1995). Shorefast ice features may form rapidly. Nelson (1995) described the formation of a shorefast ice shelf that was 600 m wide and 5 m thick at the seaward side. This feature formed in two days.

Observers have seen ice cakes thicker than 6 m on the mud flats. These result from beach ice which has broken free, been deposited higher on the mud flats, and frozen to the underlying mud. Ice floes floating toward the beach are caught on top of the higher piece of ice and, as the tide recedes, the overhanging pieces break off, leaving a stack of layered ice with nearly straight sides. This process is repeated many times, limited only by the height of the tides and the strength with which the original beach ice is frozen into the mud.

- **Structure of Cook Inlet Ice**

Since the dominate mode of ice formation is the coalescence of slush ice, most shorefast ice observed in Cook Inlet has a granular grain structure. A significant fraction of floating ice also has a granular grain structure.

Salt content of the ice reflects the salt content of the water from which the ice formed and the mode of ice formation. The relatively sparse measurements of salt content suggest that the salt content of newly formed columnar ice is less than 5 ppt. Brine has been observed draining from grounded columnar and granular ice. It is assumed that the salt content of grounded ice would be reduced to almost zero within several weeks after grounding.

Glacier silt is included in much of the Cook Inlet ice. This silt is suspended in the water and entrained in the ice during ice formation and growth. Silt is also entrained into ice as the ice contacts the bottom during periods of low tide. Ice silt contents from almost zero to concentrations sufficient to cause the specific gravity of the ice to exceed unity have been observed (Nelson, 1995).

- **Ice Formation on Shore Based Structures**

Shore based structures such as pile supported docks are subject to wetting during each tidal cycle. During periods of low ambient temperature there is a buildup of ice on the wetted surfaces. During periods of ambient air temperature less than -20°C, ice buildup rates on the order of centimeters per day have been observed.

Space between adjacent piles can be completely filled with ice from direct growth and deposition from floating ice. The vertical extent of this ice formation can be that of the tidal range at that location. Vertical loads from this ice act downward at low tide and upward at high tide. In addition, the ice increases the cross section of the structure which can result in large horizontal forces from wind, water currents, and floating ice features.

- **Estuary and River Ice**

Fresh water and saline ice forms during the winter in estuaries and rivers around Cook Inlet. The river ice forms a vertical wall along the banks of rivers. This vertical wall can be 10 m high. Conventional fresh and saline ice also forms on the rivers and within the estuaries. This ice can grow to depths of 1 m. It is broken as the water surface rises and falls with the tide. Both river and estuary ice may be discharged into the inlet during spring breakup.

During the winter of 1964-65, K.A. Blenkarn (Brower, et.al., 1988) of Pan American Petroleum Corp. obtained quantitative information on the movement of ice in Cook Inlet. He found that ice tends to move out of the inlet at speeds varying between about 3 km and 8 km a day. However, not all Cook Inlet ice follows this pattern. Much of the ice forms and decays near its point of origin, particularly in Knik and Turnagain Arms.

Cook Inlet Oil Spills

Table 1 lists the 28 oil spills that have occurred in Cook Inlet from 1884 to 2001 for which the Coast Guard has requested assistance from NOAA, along with some other basic information like date, amount released, location, environmental effects, and some salient comments. This location information is graphically depicted in Figure 36. As can be seen, these spills are concentrated around the petroleum production and transportation facilities in middle Cook Inlet where 15 offshore oil and gas production platforms exist between the Forelands and the North Forelands. Major tanker docking and petroleum storage facilities exist at Drift River and Trading Bay on the west and at Nikiski on the east side.

The vast majority of oil spill volumes have been rather small (Figure 37), being on the order of tens of barrels or less. Since the 1987 *T/V Glacier Bay* spill, no large catastrophic spills of a persistent oil have occurred in the Inlet. The *M/V Loma B* sank at the Forelands with around 72,000 gallons of diesel on board, which probably released rather slowly over next several months or years, if at all. With the large amount of crude oil production, it is not surprising that the largest number of spills are from the platforms (Figure 38) and involve crude oil (Figure 39).

In observing these spills over the years, NOAA has learned that small oil spills involving one of the Cook Inlet crude oils or diesel are relatively short-lived (1-2 days or less). This appears to be due to the combination of the chemical composition of these oils, their high API gravity (low density) and the turbulence of Cook Inlet produced by the high tidal currents. Unlike Prudhoe Bay crude, all the Cook Inlet crudes have no wax content, a fact which makes them inherently lighter and much less persistent. As can be seen by Table 2, which lists the properties of Cook Inlet crudes and refined oil products, three of the crude oils (Granite Pt., McArthur R., and Middle Ground Shoal) are lighter than diesel (#2 Fuel Oil), and two of these are lighter than kerosene. All of the Cook Inlet oils have a relatively high evaporation percent (40% to 60% in couple of days). This, combined with the accelerated natural dispersion which the turbulence of Cook Inlet produces, causes small amounts of oil to dissipate much more rapidly than this same amount of oil spilled on a quiet body of water.

A rough measure of Cook Inlet's ability to assimilate, dissipate, and disperse oil spilled on its waters is provided in Table 3. Over the years, aerial observations have been the standard tool by which spilled oil is judged to still persist on the surface of the Inlet. For the 11 spills in Table 3 the observational threshold time duration when oil sheens are no longer visually detectable on the surface of the water has been recorded - often less than a day. This time period is compared to the final column on the table in which the NOAA Automated Data Inquiry for Oil Spills (ADIOS) oil weathering model is used to predict when greater than 90% of the oil has evaporated and naturally dispersed for the particular wind speed and water temperature during that incident. The observational threshold times are anywhere from 10% to 50% to an indeterminate percent of the ADIOS times. In other words, Cook Inlet has a dramatic natural ability to "take care" of oil spilled in this environment.

The logical question is, if all this oil is being dispersed into the water column of Cook Inlet, what is its ultimate fate and effect? The Cook Inlet Regional Citizens Advisory Counsel (CIRCAC) has tried to answer this question by testing bottom and intertidal samples throughout Cook Inlet for residual petroleum. Their samples have ranged from Chickaloon Bay in the north, bottom sediments and intertidal samples in the vicinity of the oil platforms, shoals and intertidal sites all around Kalgin Island, Tuxedni Bay, Chinitna Bay, Kamishak Bay, and northern Shelikof Strait. All these samples have produced negative results (CIRCAC, Sue Saupe, personal communication). Similar studies by Minerals Management Services (MMS) on both the water column and the sediments of Cook Inlet have produced the same negative results (Terschak and Henrichs, 2001; University of Alaska, 1995).

The high level of Cook Inlet turbulence seems to be keeping oil particles that have been naturally dispersed suspended in the water column during their residence in Cook Inlet. If an instantaneous 1000 bbl spill (larger than 90% of the aqueous Cook Inlet spills discussed here) occurred in the offshore Cook Inlet oil fields and was totally naturally dispersed in the water column, it would experience a tidal excursion range that would mix it in and keep it suspended in the Cook Inlet waters from Fire island south to below Kalgin Island within several days. This would result in a concentration of approximately 1 ppb (assuming no evaporation). Once in the water column, the extremely high surface to volume ratio of this oil begins to rapidly facilitate biodegradation by ubiquitous oleophilic plankton and other microorganisms as these organisms begin to metabolize the oil. Given the combined effect of the Cook Inlet high energy and natural biological oil-degraders, it should not be surprising that residual oil in the bottom and intertidal sediments of Cook Inlet is difficult to find.

Biological Degradation of Dispersed Oil[1]

No one has completely followed, from beginning to end, the biodegradation of dispersed oil in the sea, but there are a variety of studies that allow us to piece together the story. These studies indicate that dispersed oil is both degraded in the sea by micro-organisms and that it probably becomes part of the marine food web.

[1] This section authored by Dr. Alan Mearns, NOAA Hazmat senior scientist, Seattle WA.

Most of the work on the biodegradation and consumption of dispersed oil is based on studies using chemically dispersed oil, but the basic principles apply no matter how the oil is dispersed (Cretney et al., 1981; Green et al., 1982; and Swannel and Fabien, 1999). During the first few days, oil droplets are colonized by oil-degrading bacteria. Biodegradation studies on oiled beaches, unrelated to the dispersion studies, indicate that bacteria first degrade the alkanes and then, eventually, the aromatic compounds (Venosa et al., 1996); presumably, this is also what happens to oil droplets in the water column.

Some researchers have observed copepods feeding directly on naturally-dispersed oil particles or droplets (Conover, 1971); some of the oil is converted into fecal pellets which have a much faster sinking rate than the original droplets, and thus can clear the water column (see Note 1, below). Theoretically this process can result in sediment contamination if the concentrations of oil-contaminated fecal pellets are high enough. Apparently that is not the case in Cook Inlet: the sediments are clean (see above).

Within a few days to several weeks the suspended oil droplets are transformed by biological activity into a flock, composed mainly of bacteria (Green and Humphrey, 1982); other researchers have observed this flock and, in addition, have observed that this material becomes further colonized by grazing organisms such as nematodes and some species of copepods (Swannel and Daniel, 1999).

Micro-organisms and plankton that have consumed oil may themselves be consumed by fish and other animals. However, the oil compounds that are consumed are not biomagnified through the food web: i.e., they do not increase in concentration with feeding (or trophic) level, as does mercury or DDT. Instead, fish, mammals, and some crustaceans, have enzymes that rapidly degrade potentially toxic compounds, namely polycyclic aromatic hydrocarbons (PAH's), and the resulting degradation compounds are excreted. As long as the PAH concentrations are not too high, these animals survive the additional loading.

We can conclude that the net result of all these biological processes, over a period of several weeks, is that the hydrocarbons in the dispersed oil are transformed into biological products: micro-organisms, new tissue of larger organisms, fecal pellets which rapidly sink, and dissolved degradation compounds. Because the oil is dispersed, organisms participating in these processes are not exposed to concentrations as high as they would be if the oil was not dispersed or concentrated on a shoreline: in this case these processes could result in injuries to the exposed biota.

Note

(1) Naturally - or intentionally-dispersed oil is accumulated by the planktonic food web which plays a certain, important, but poorly quantified, role in removing oil from the sea. Following the wreck of the tanker *Arrow* in Chedabucto Bay, Nova Scotia (February, 1970) as much as 10% of the bunker C oil in the water column was associated with zooplankton. Zooplankton fecal pellets contained up to 70,000 ppm Bunker C. The oil had no apparent effect on the organisms. In addition to particulate oil, which was transported from the Bay by hydrodynamic processes, perhaps 20% more sank to the bottom as zooplankton fecal pellets (Conover, 1971). Further, for the oceans as a whole, it has been estimated that the rate of zooplankton grazing of particulate oil appears to be of the same order of magnitude as the input of petroleum (Sleeter and Butler, 1982). Fecal pellets sink at rates of 100 m to 300 m per day, or several hundred times the rate of 0.8 m/day for tar particles slightly denser than sea water: thus zooplankton feeding may be among the primary longer-term mechanisms removing oil from the water (Sleeter and Butler, 1982). Further, there is evidence to suggest that removal of particulate pollutants from the sea is directly related to the amount of primary production underway at the time (Burns and Kimrey, 1982). Thus oil spilled and dispersed during spring, summer, and fall may degrade and be consumed much

faster than in the winter (when there are no plankton blooms).

Summary

Up until approximately 1994, NOAA responded to roughly two oil spills a year in Cook Inlet. Since then, however, the average has been only one spill or less where NOAA has been asked to respond. The reason for this decrease, I believe, is a combination of more contingency planning on the part of oil handlers, more vigilance and safe operations on the part of oil handlers, the existence of the CIRCAC which is a keen watchdog over oil industry operations and practices, and greater education on the part of everyone.

The first offshore oil platform in Cook Inlet was erected in 1964, along with the subsea pipeline and attendant oil handling facilities. Almost 40 years later several of the pipelines have now been abandoned, and some of these have been left in a deteriorated condition with oil still in the lines. In the last couple of years several small but transient slicks and sheens have occurred. Currently British Petroleum is expending a lot of effort to decommission an old 14-mile long, oil-filled subsea pipeline that runs from platform Anna to the East Forelands. Corrosion has taken its toil on this line, resulting in the occurrence of several small leaks over the past few years. As the aging Cook Inlet oil fields begin to wind down, old oil-filled pipelines could be a significant problem in the future.

In the set of reference documents at the end of this report, all the NOAA incident reports for oil releases in Cook Inlet from 1984 through 2001 have been included. If you have any comments or questions regarding any of the included material, please feel free to contact me. I reside at the Coast Guard MSO Anchorage office at 510 L Street, my email is <john.whitney@noaa.gov>, and my phone is 907-271-3593. Aloha and Adios.

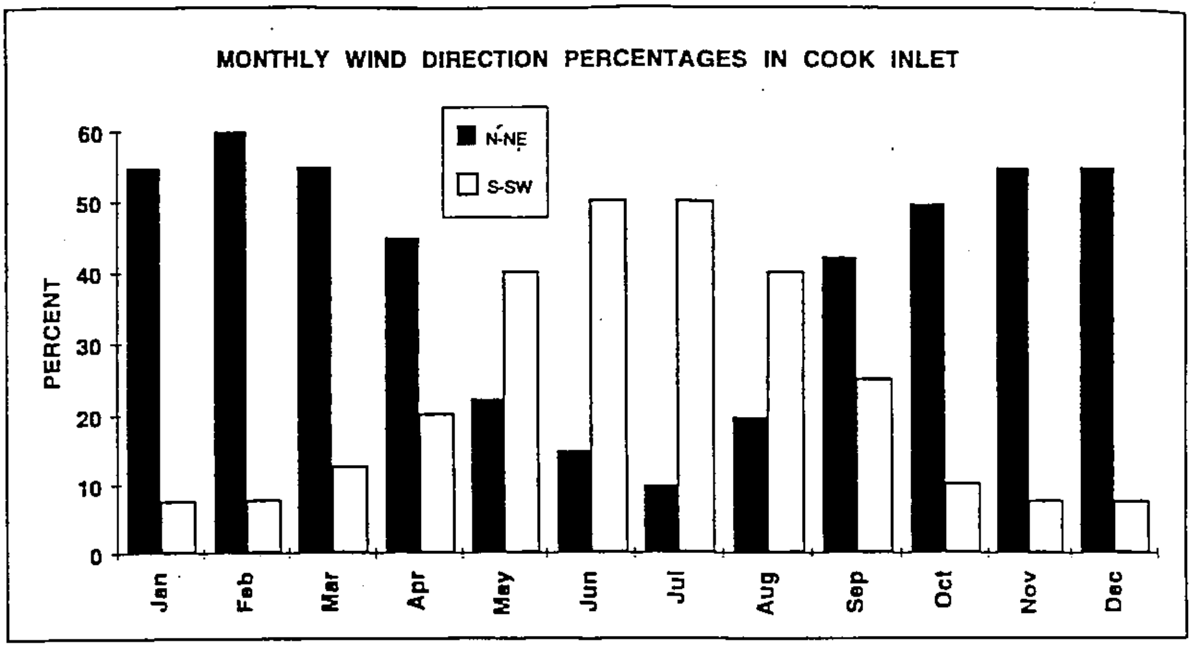


Figure 1: Monthly Wind Direction Percentages in Cook Inlet (data from Brower, 1988)

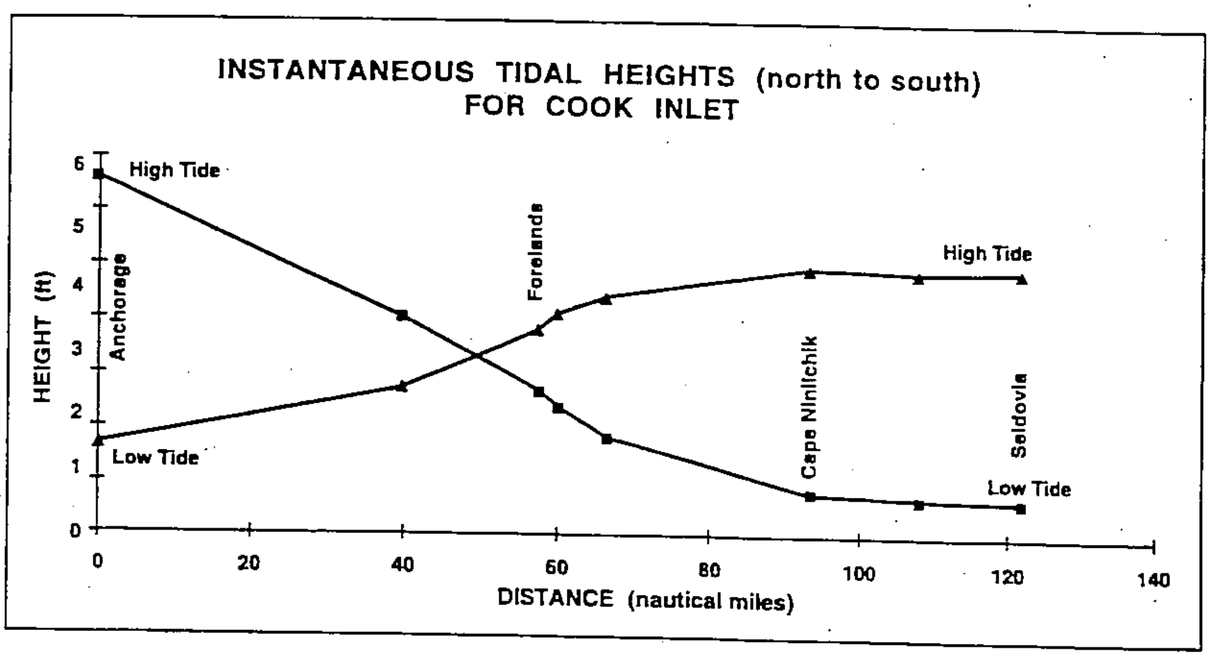


Figure 2: Instantaneous tidal Heights for Cook Inlet (data from SHIO, 1994)

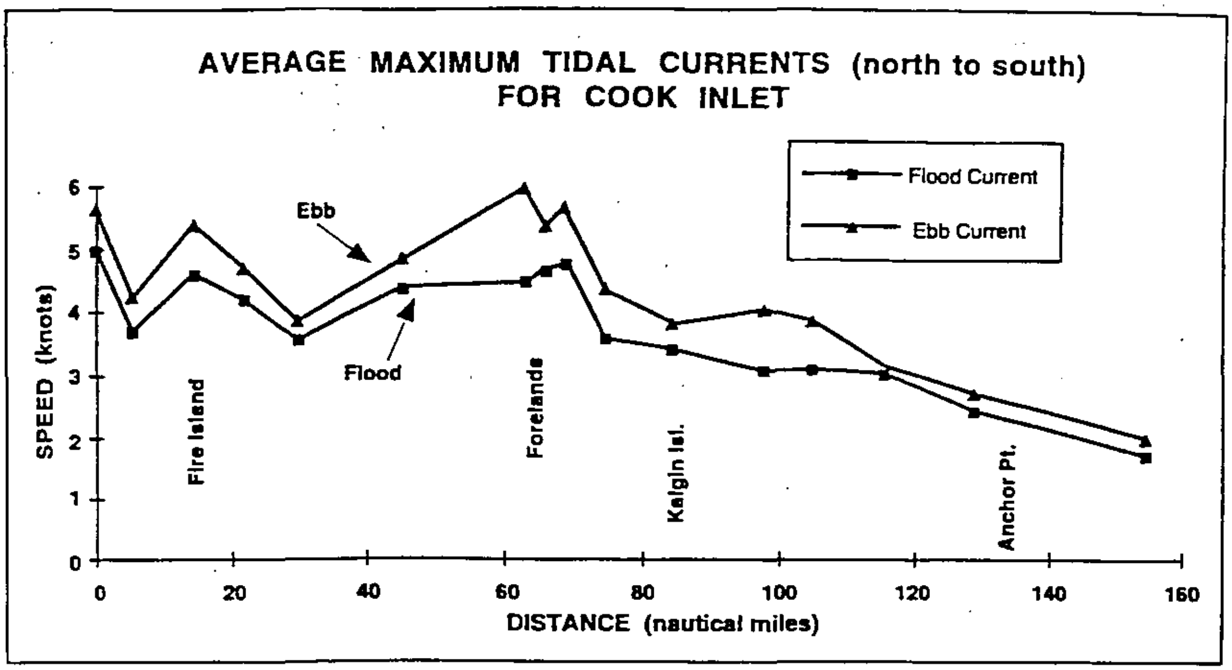


Figure 3: Average Maximum Tidal Currents for Cook Inlet (data from SHIO, 1994)

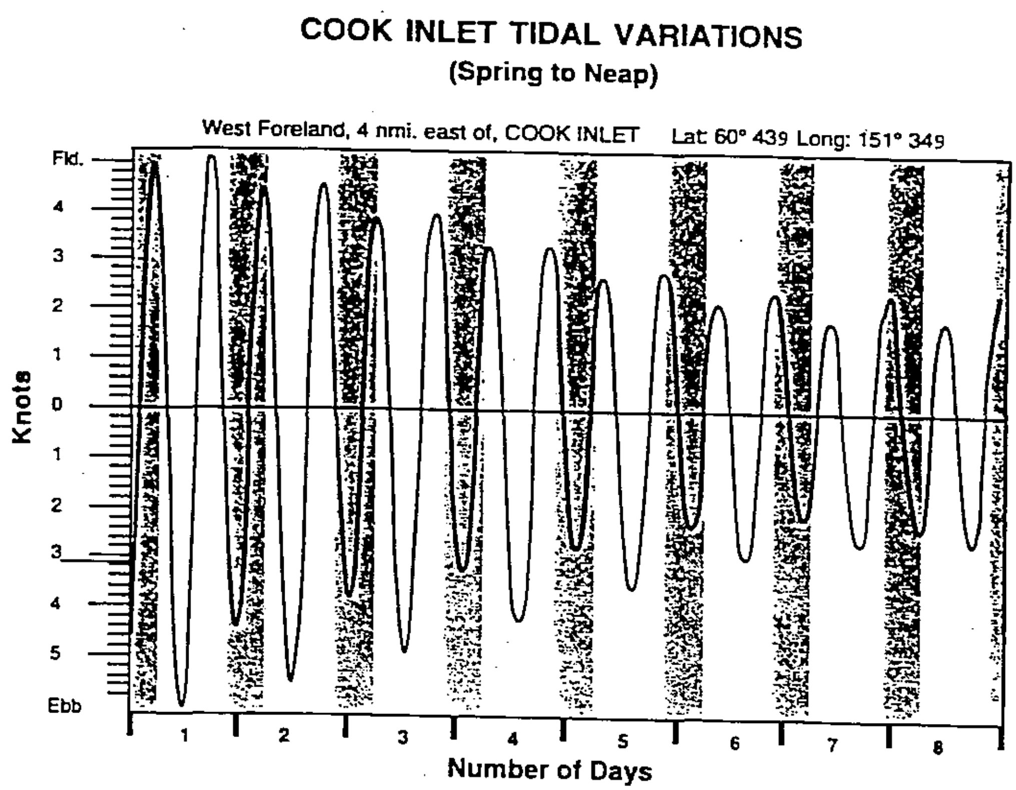


Figure 4: Typical Cook Inlet Tidal Current Variations—Spring to Neap (SHIO, 1994)

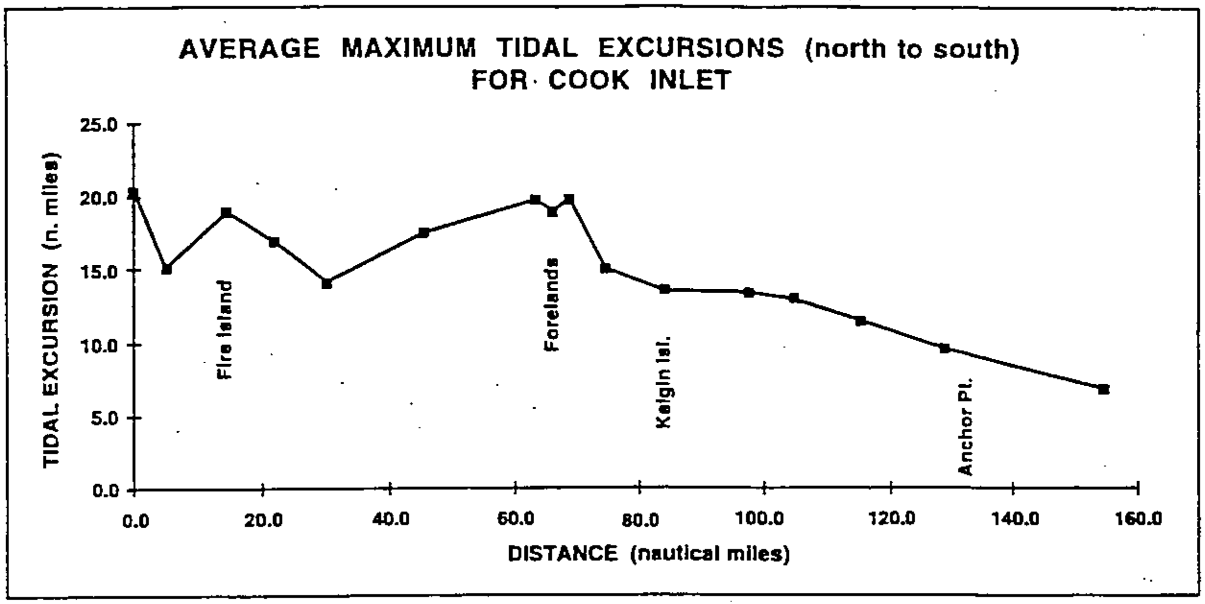


Figure 5: Average Maximum Tidal Excursions for Cook Inlet (Whitney, 1994)

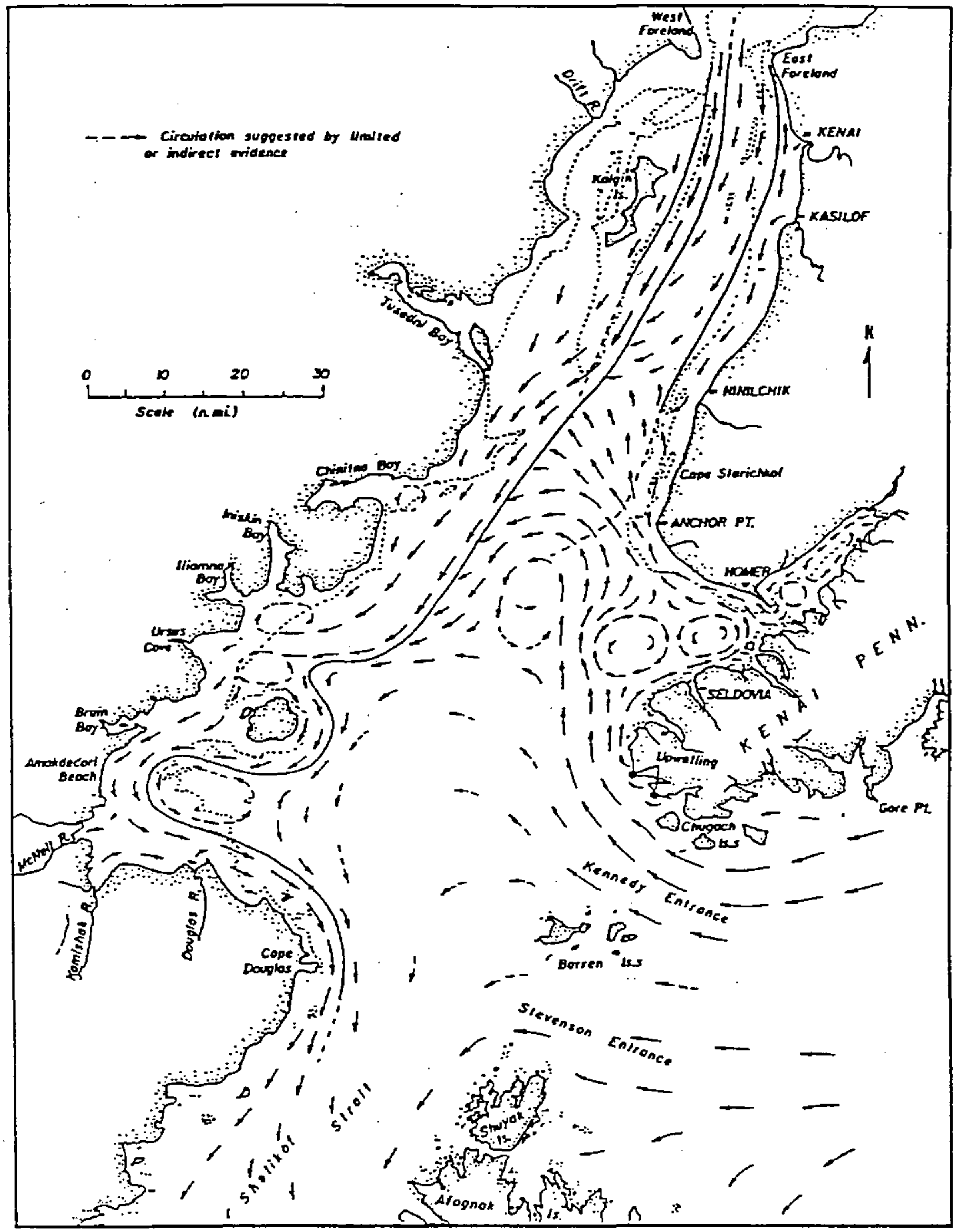


Figure 6: General Net Cook Inlet Circulation for Spring and Summer (Burbank, 1977)

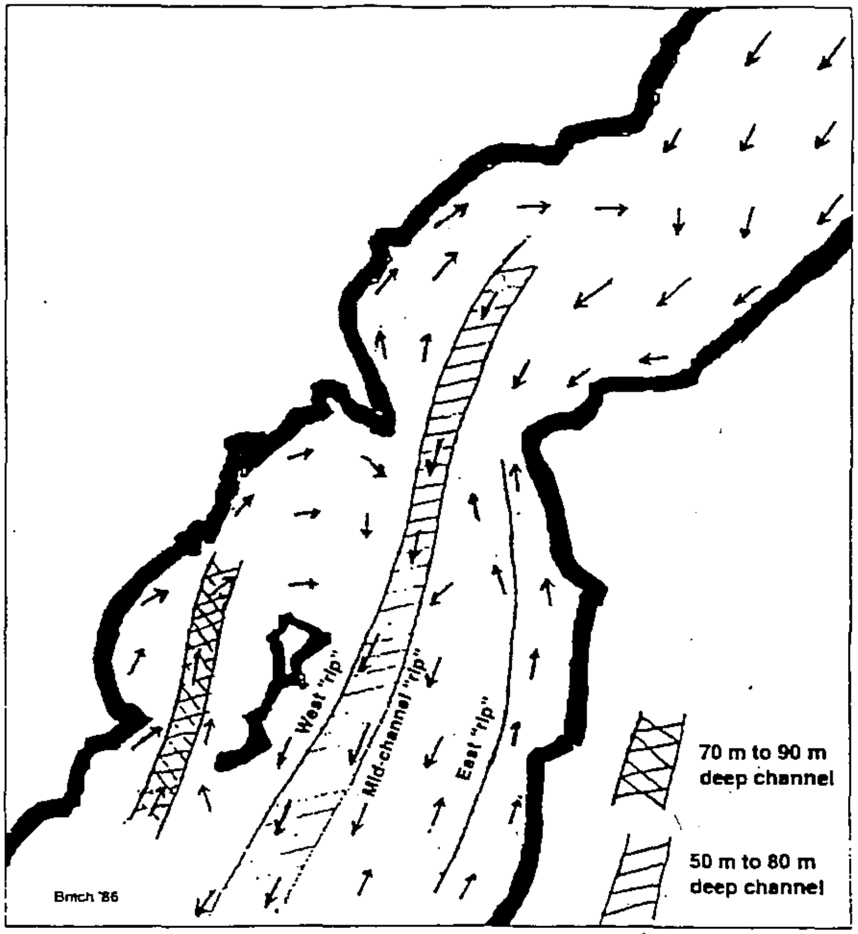


Figure 7: Middle Cook Inlet Convergence Zones (Whitney, 1994) Net circulation for spring and summer is from Britch, 1986.

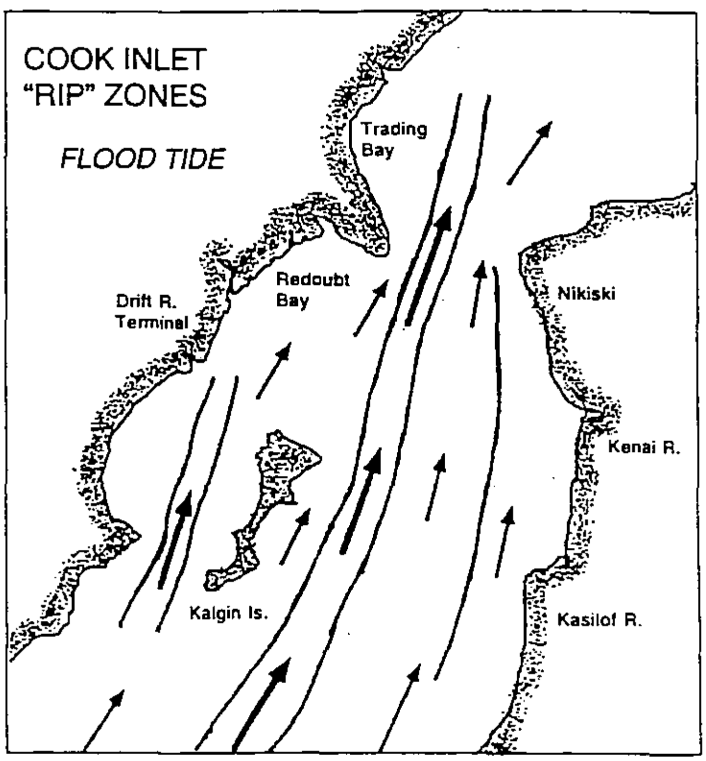


Figure 8: Cook Inlet "Rip" Zones—Ebb Tide (Whitney, 1994)

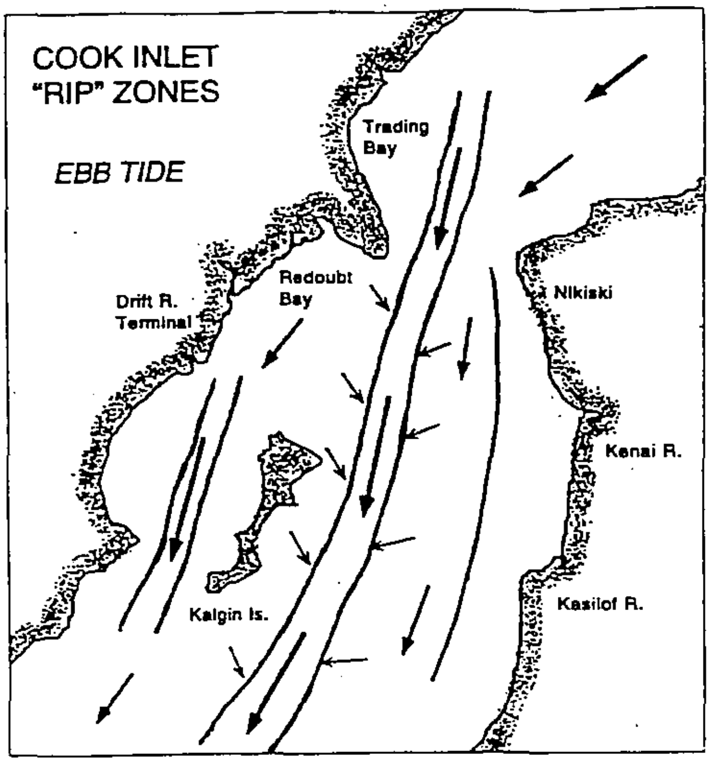


Figure 9: Cook Inlet "Rip" Zones—Ebb Tide
(Whitney, 1994)

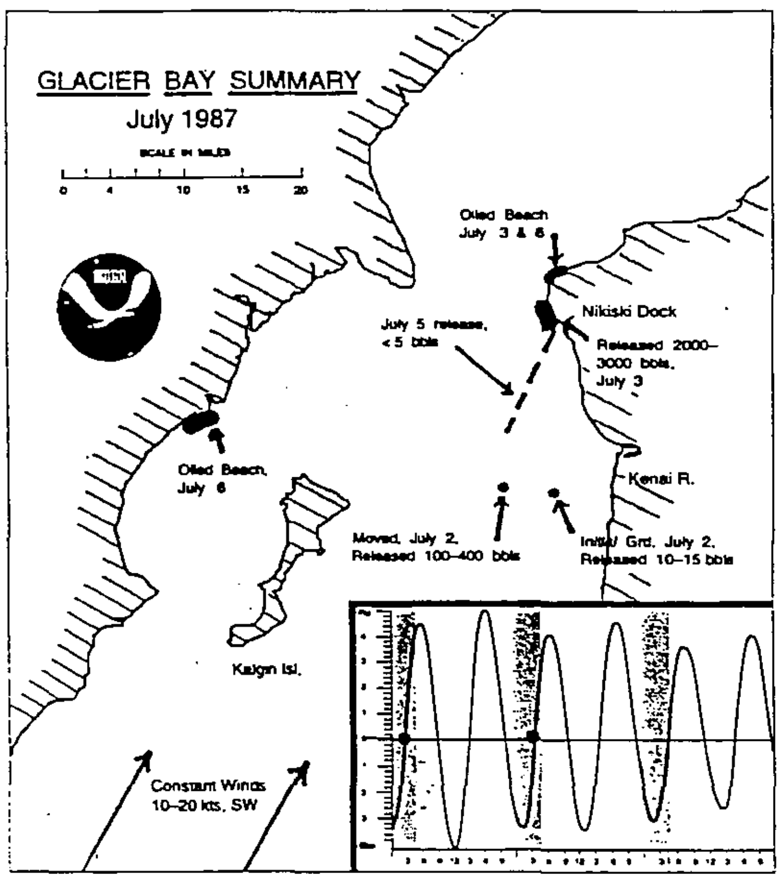


Figure 10: T/V Glacier Bay Oil Spill Summary,
July 1987

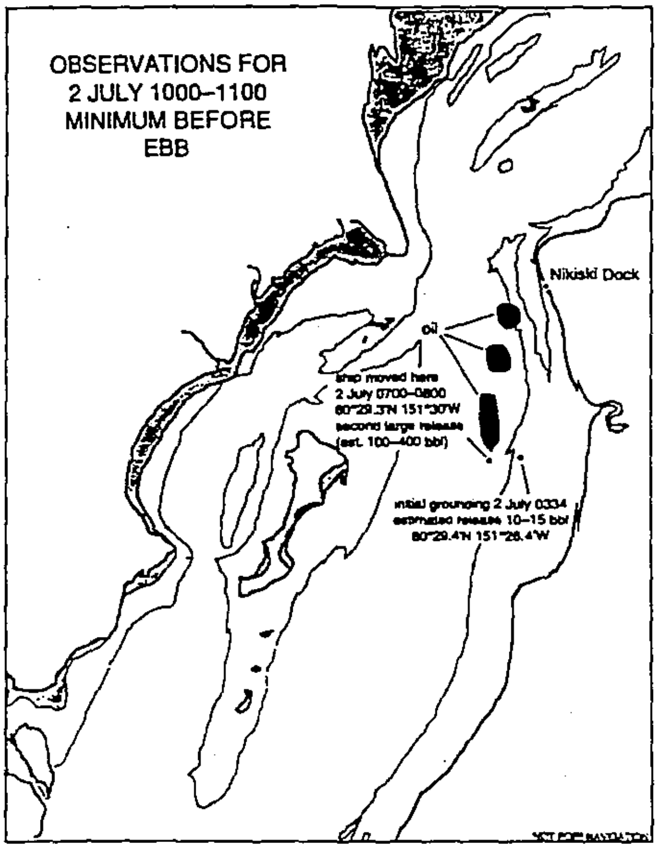


Figure 11: Glacier Bay Oil Observations for July 2, 1000-1100

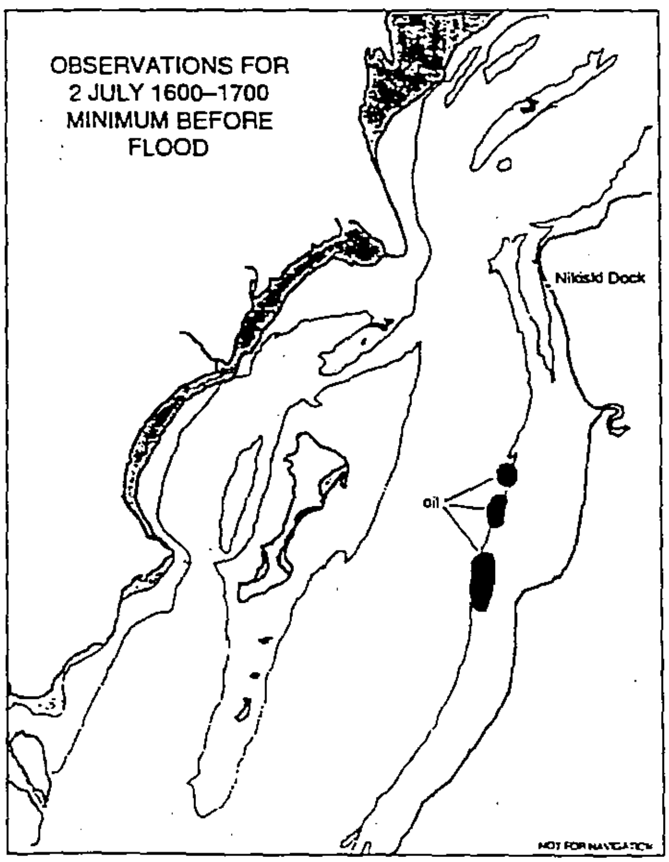


Figure 12: Glacier Bay Oil Observations for July 2, 1600-1700

Figure 13: Glacier Bay Oil Projected Positions for July 2, 2300-2400

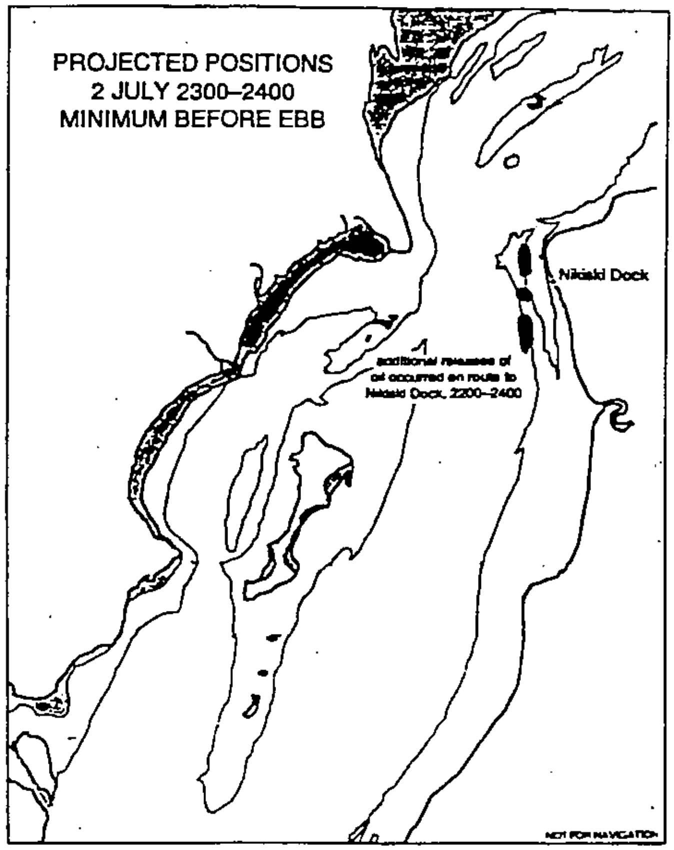
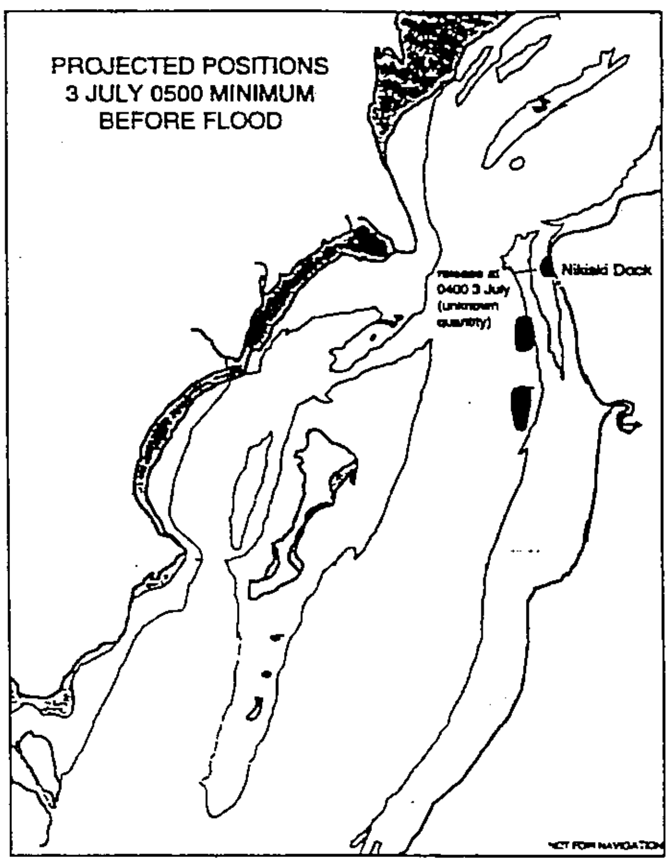


Figure 14: Glacier Bay Oil Projected Positions for July 3, 0500



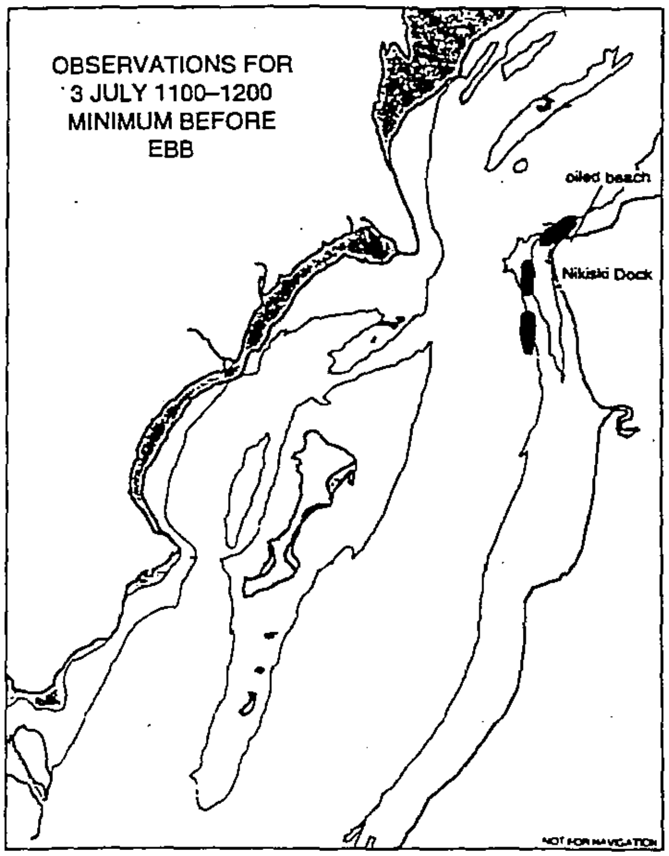


Figure 15: Glacier Bay Oil Observations for July 3, 1100-1200

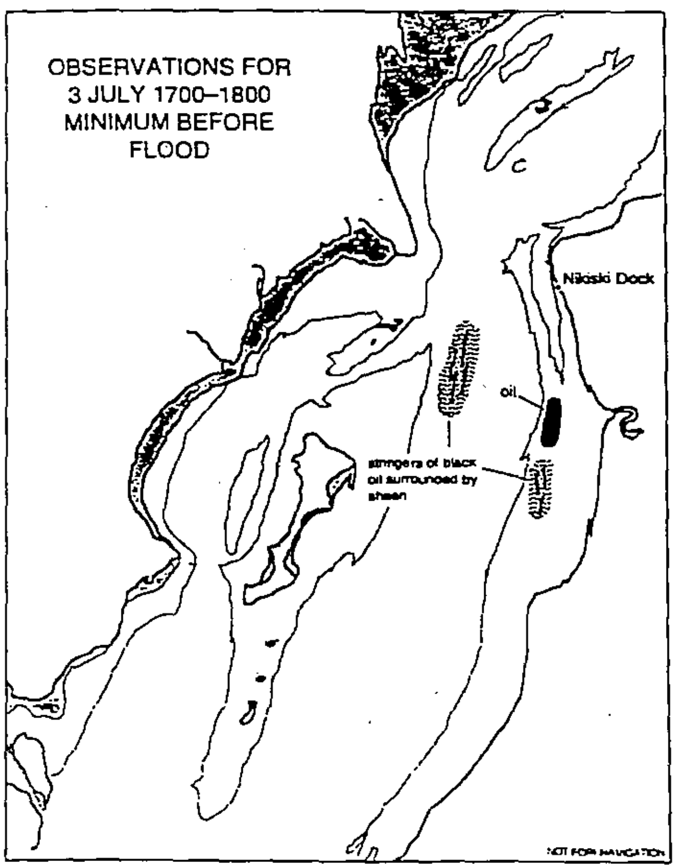


Figure 16: Glacier Bay Oil Observations for July 3, 1700-1800

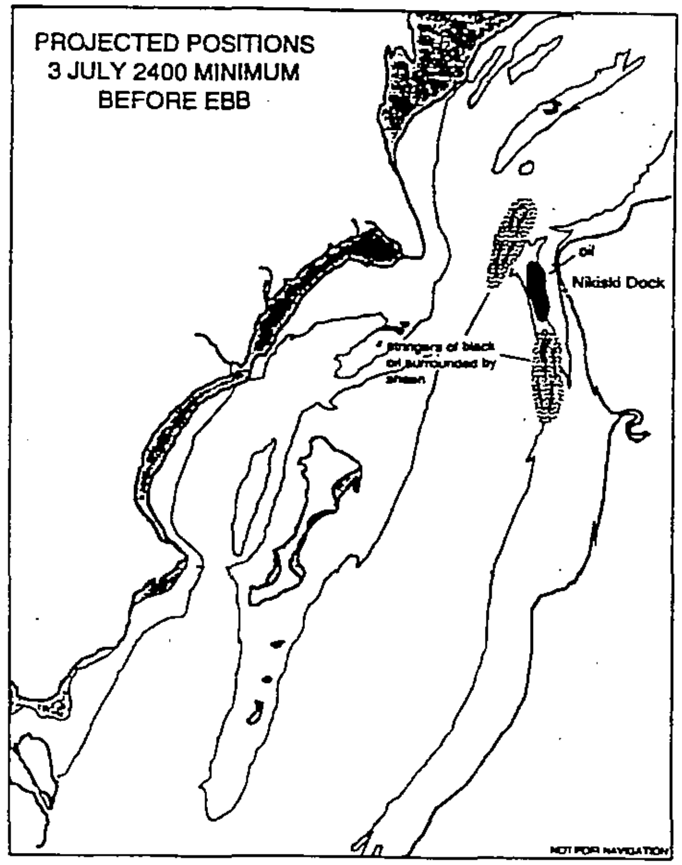


Figure 17: Glacier Bay Oil Projected Positions for July 3, 2400

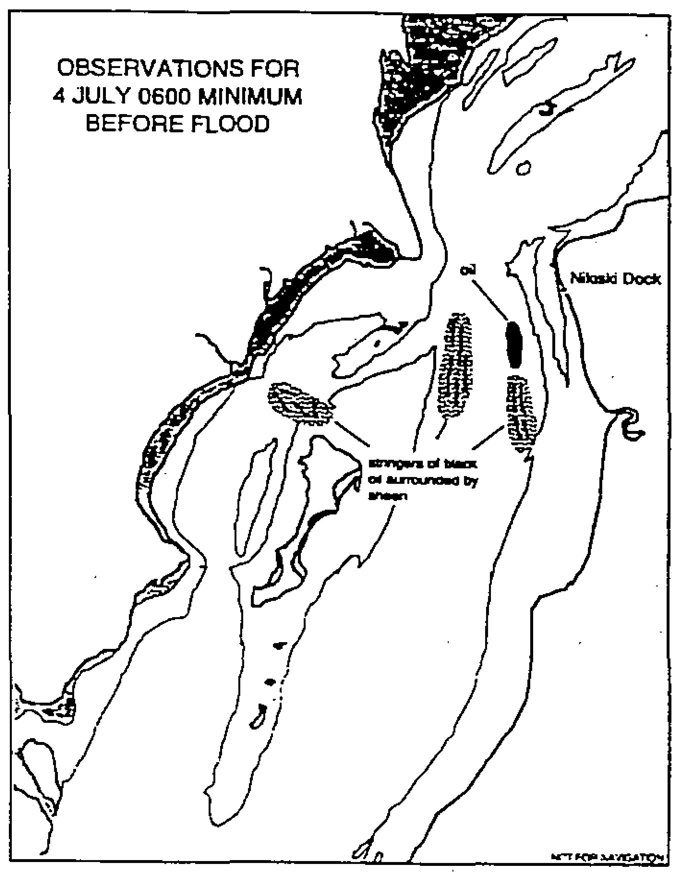


Figure 18: Glacier Bay Oil Observations for July 4, 0600

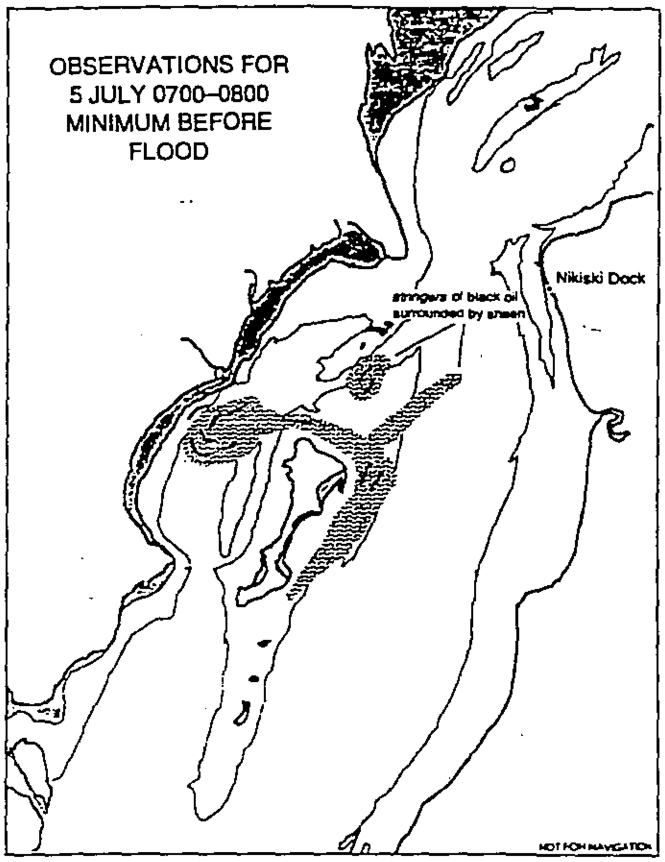


Figure 19: Glacier Bay Oil Observations for July 5, 0700-0800

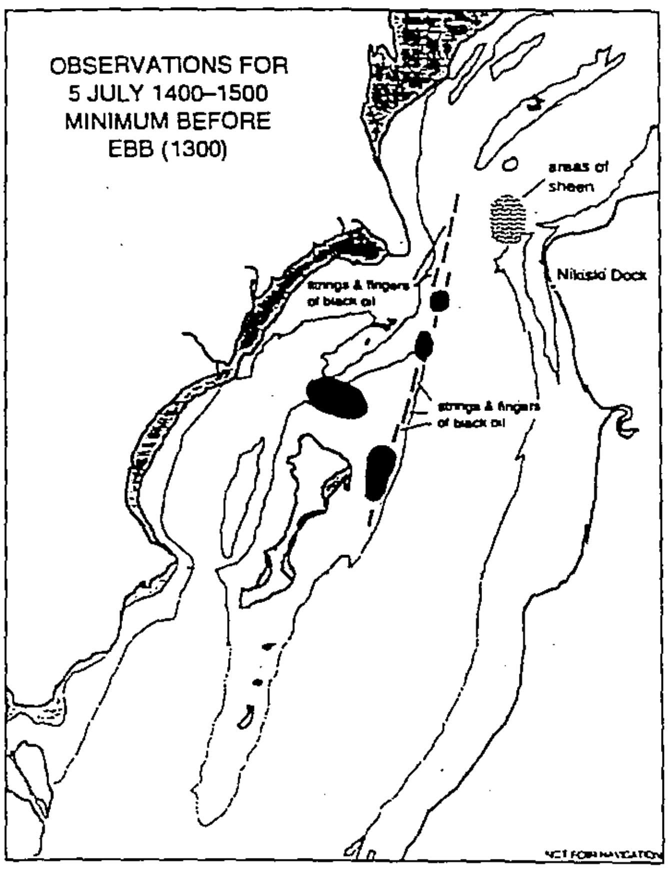


Figure 20: Glacier Bay Oil Observations for July 5, 1400-1500

Figure 21: Glacier Bay Oil Observations for July 5, 1830-1930

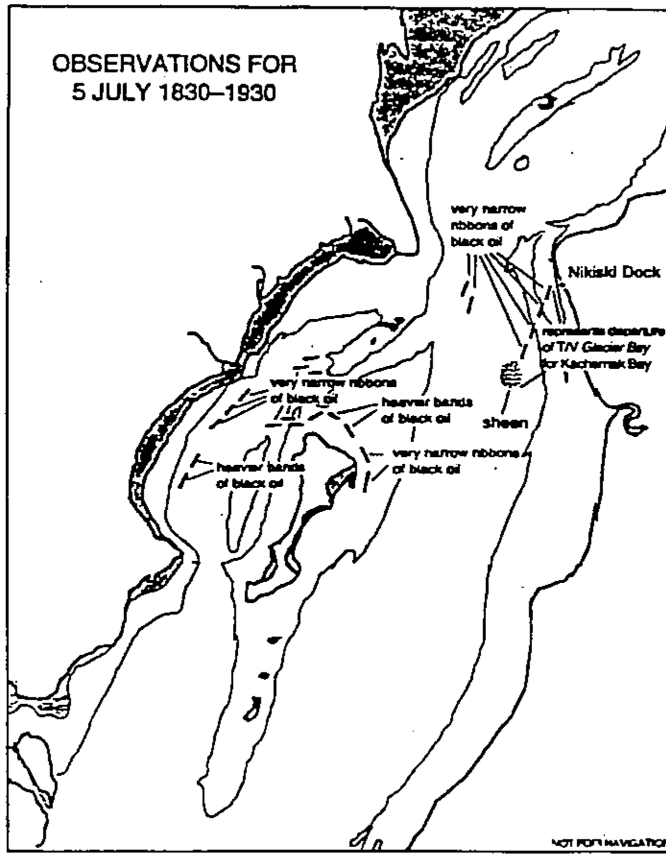
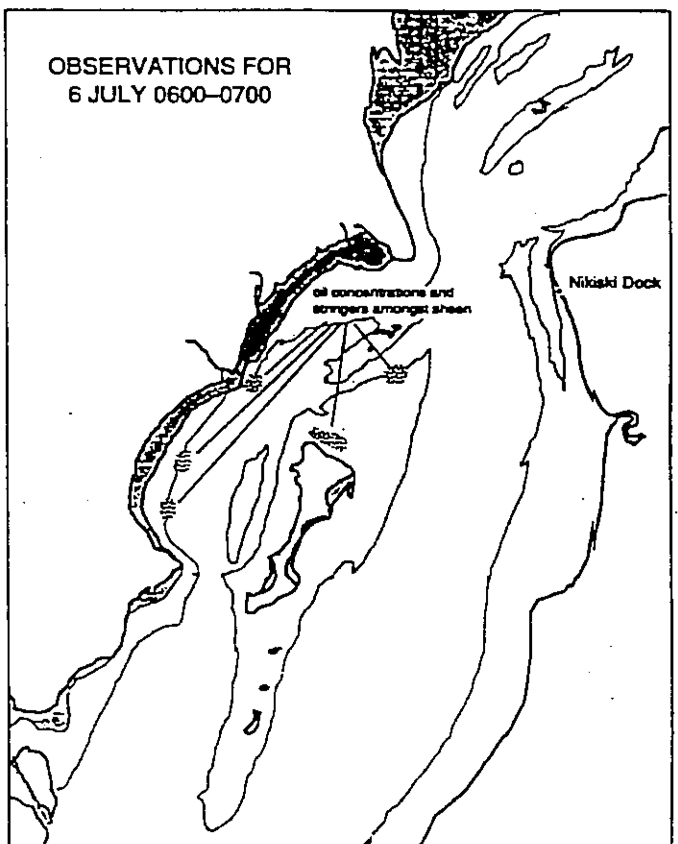


Figure 22: Glacier Bay Oil Observations for July 6, 0600-0700



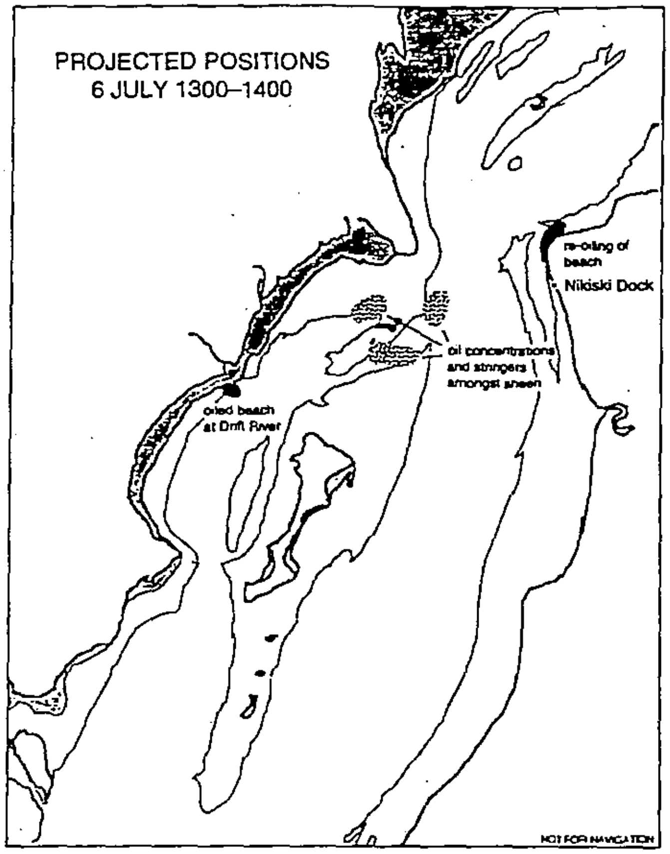


Figure 23: Glacier Bay Oil Projected Positions for July 6, 1300-1400

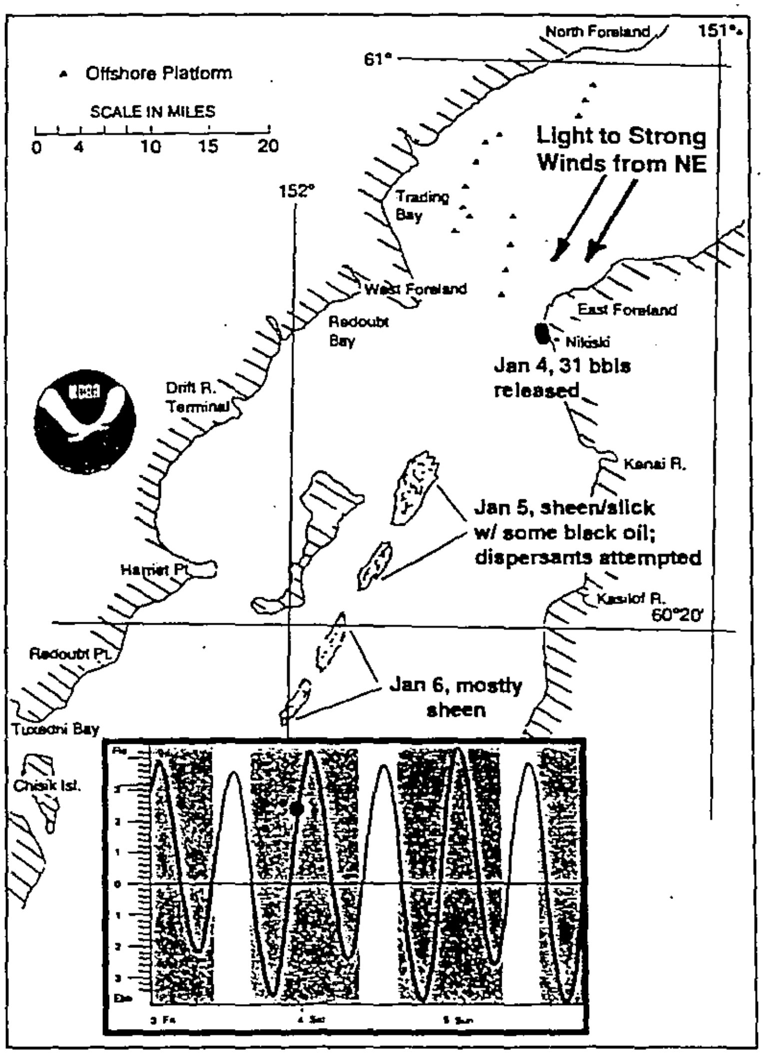


Figure 24: East Foreland (KPL) Spill Summary, January 1992

Figure 25: RADARSAT SAR image of middle Cook Inlet, February 15, 1999, showing 8/10 to 9/10 ice coverage. Dark, non-reflective returns from the west side of Cook Inlet are not open water. Instead it is sea ice covered with a smooth layer of snow.

Figure 26: RADARSAT SAR image of middle and upper Cook Inlet, March 1, 1999, showing extensive ice coverage.

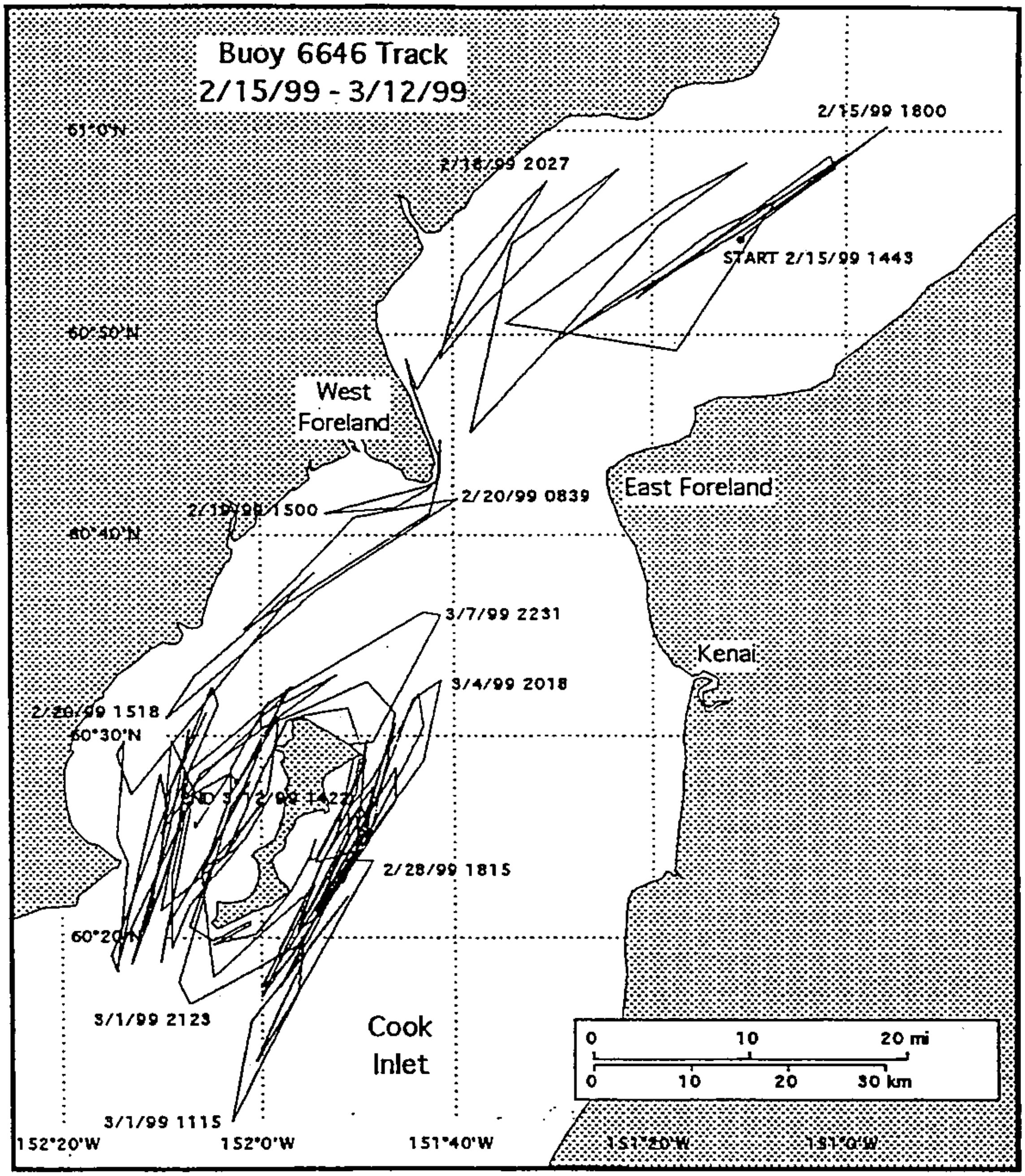


Figure 27: Movement of buoy riding on large ice pan in Cook Inlet, February 15 until March 12, 1999

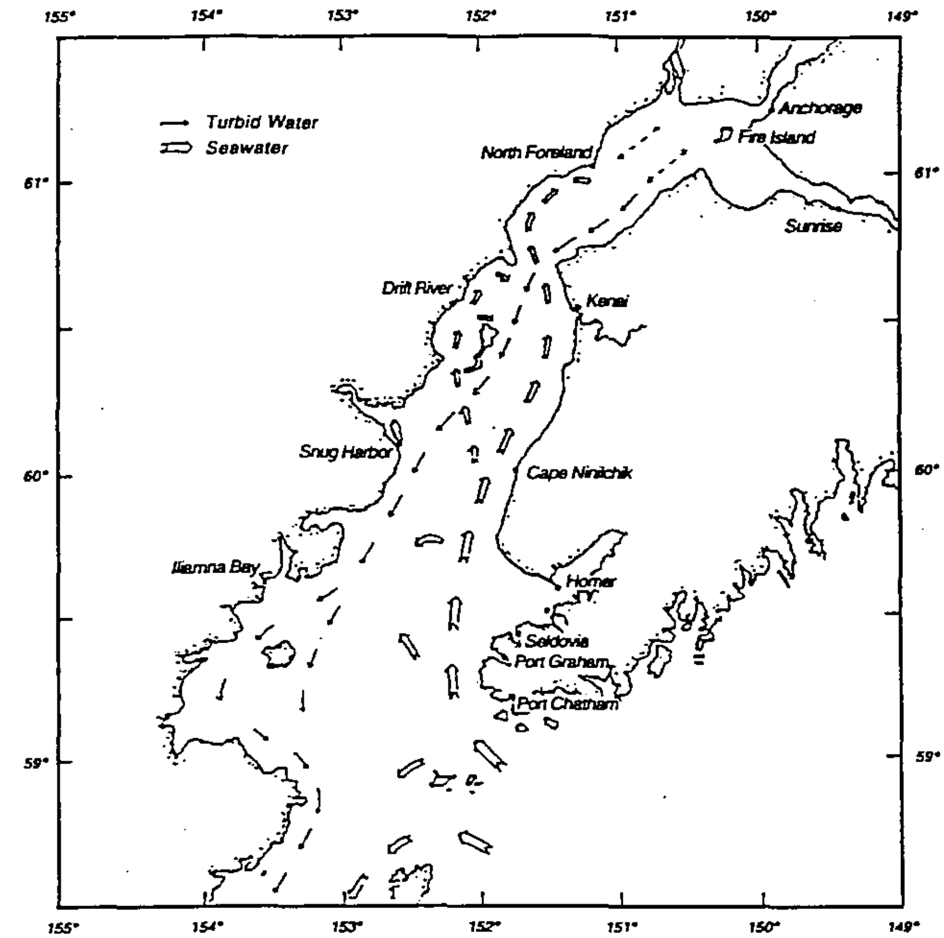


Figure 28: Net surface circulation within Cook Inlet inferred by Burbank, 1974

Year	First Ice	Ice Free
69-70	Nov 18	Mar 23
70-71	Oct 17	May 7
71-72	Nov 23	May 15
72-73	Nov 13	Apr 10
73-74	Nov 18	Apr 6
74-75	Nov 24	Apr 9
75-76	Nov 12	Apr 10
76-77	Dec 17	Apr 9
77-78	Nov 20	Mar 18
78-79	Dec 16	Mar 31
79-80	Dec 12	Mar 26
80-81	Dec 6	Mar 10
81-82	Nov 20	Apr 19
82-83	Nov 29	Mar 21
83-84	Dec 14	Mar 20
84-85	Dec 17/1st rep.	Feb 13, 85*
		Apr 17
85-86	Nov 5	Apr 18
Average	Nov 24	Apr 8
Median	Nov 20	Apr 9

* Ice disappeared; then reappeared 2/13/85

Figure 29: First significant ice and ice-free dates for Cook Inlet for the winters of 1969 through 1986 (Brower, 1988)

Figure 30-35: Maps showing the average extent of various concentrations of ice in Cook Inlet, November through April 1969-1986. Data is for the latter half of each month (Brower, 1988).

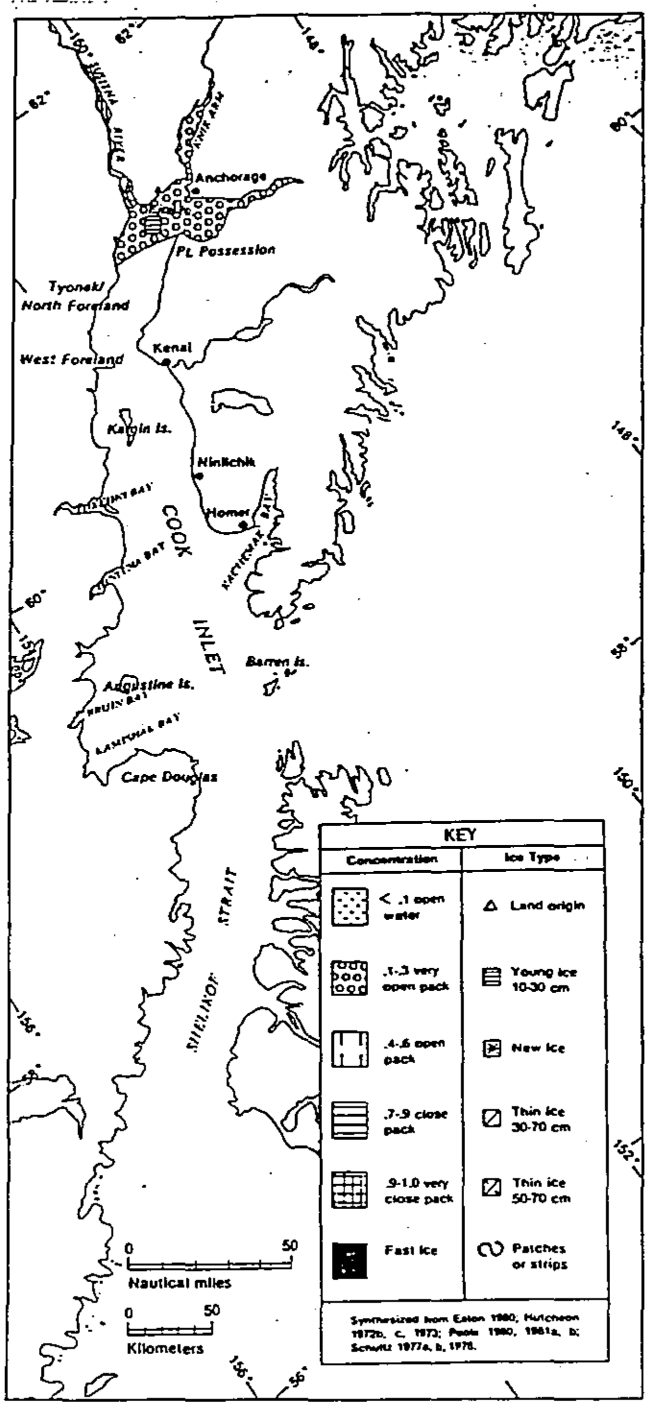


Figure 30: November

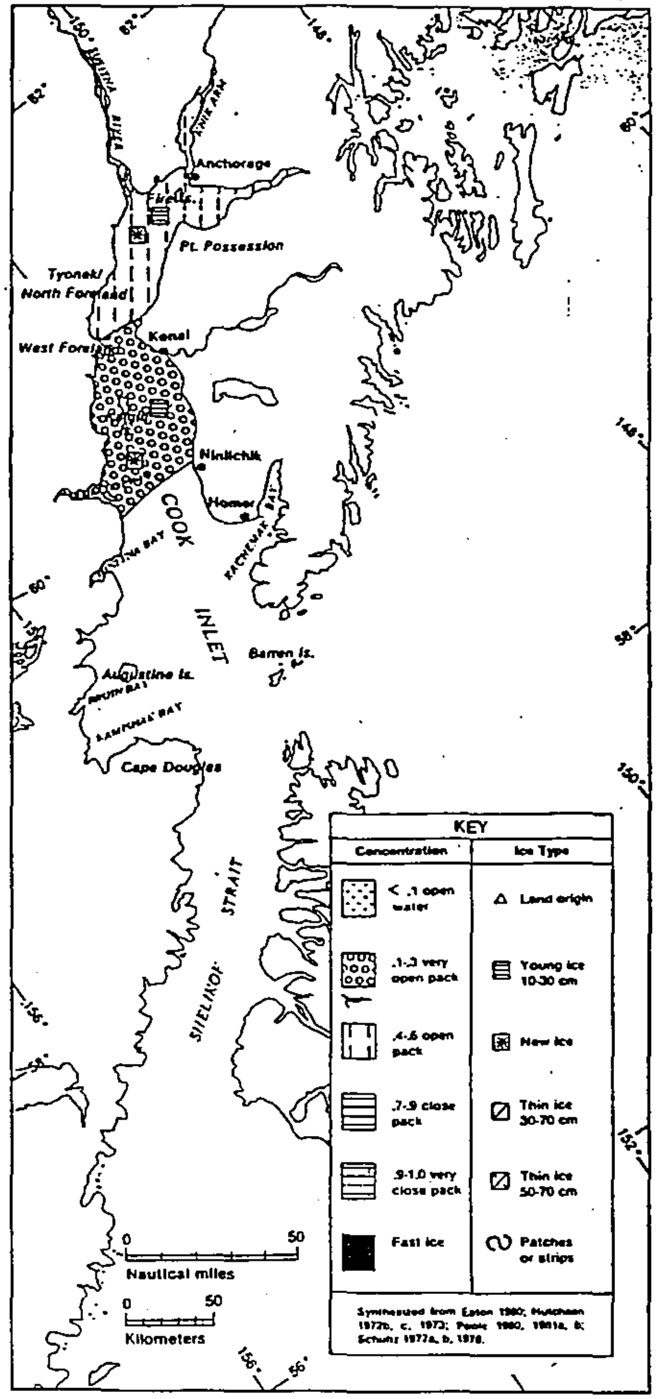


Figure 31: December

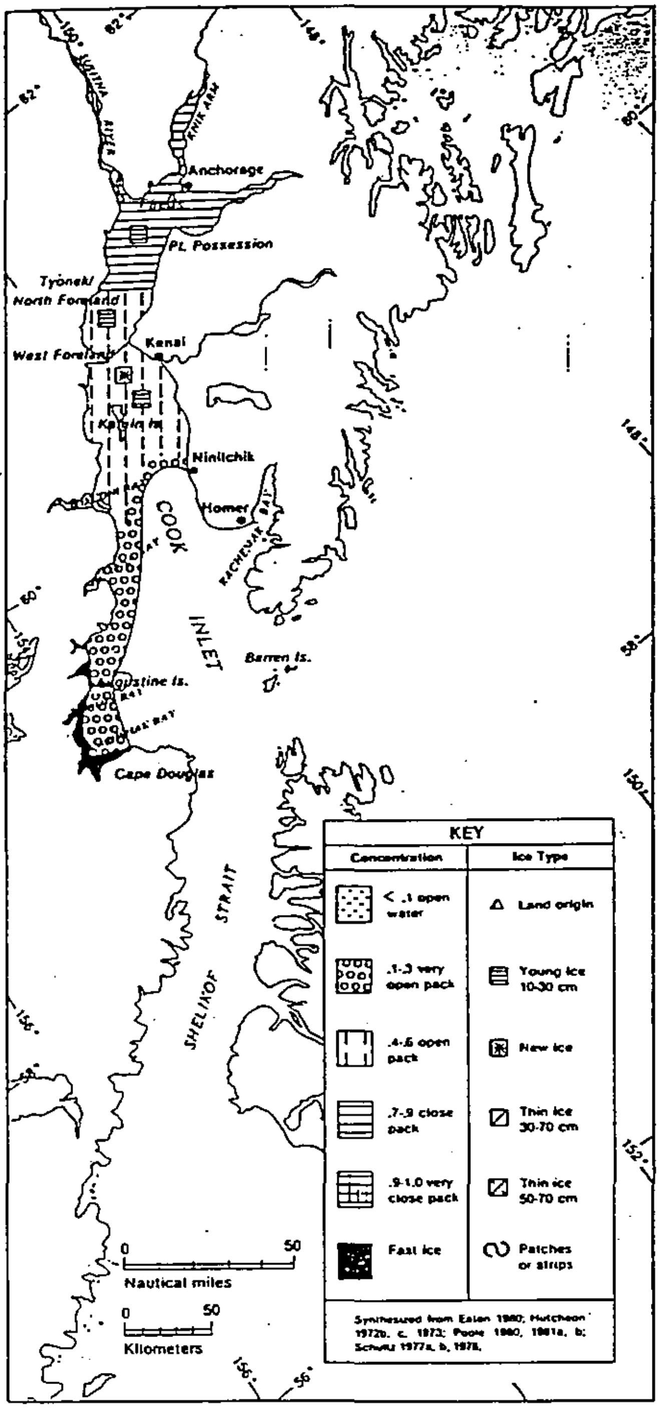


Figure 32: January

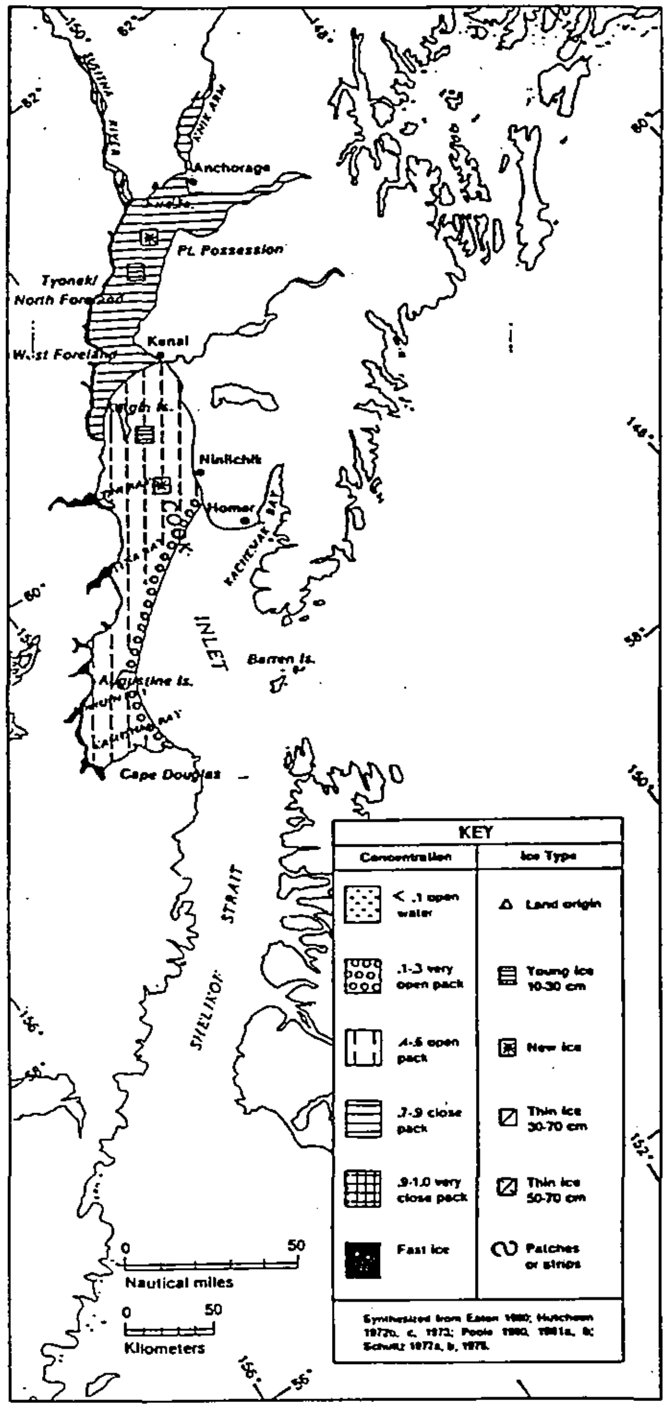


Figure 33: February

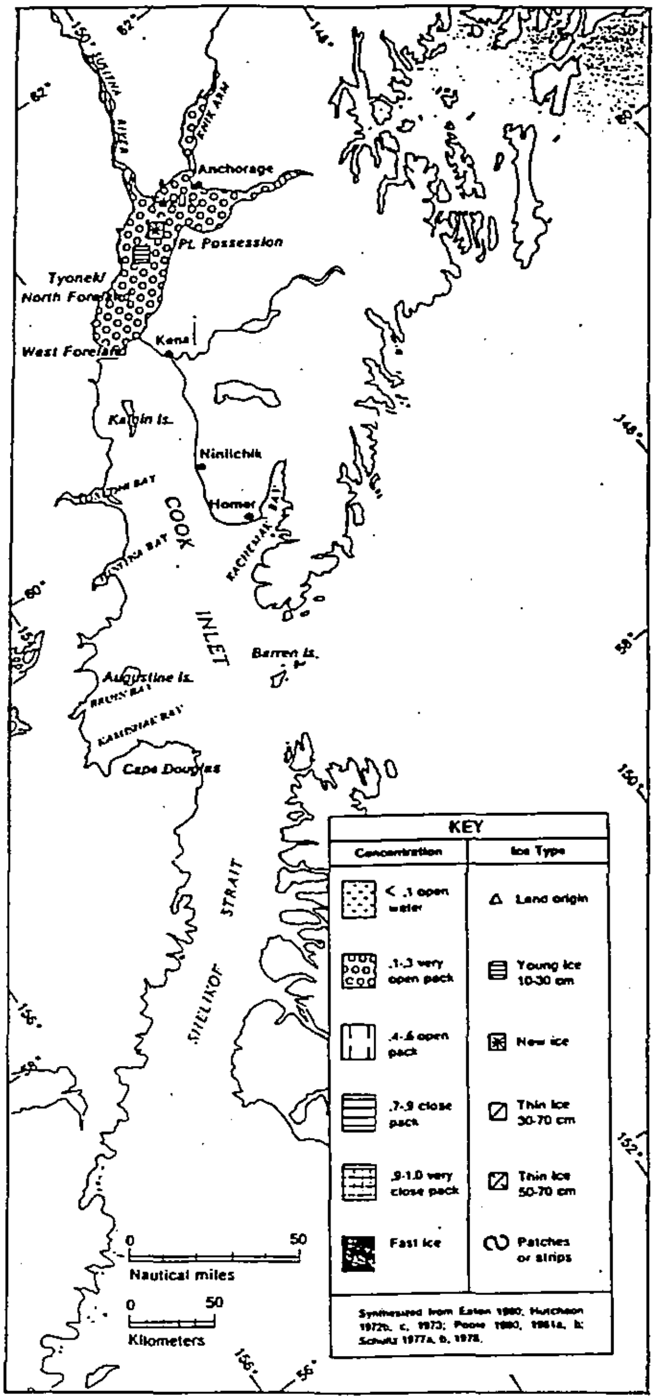


Figure 34: March

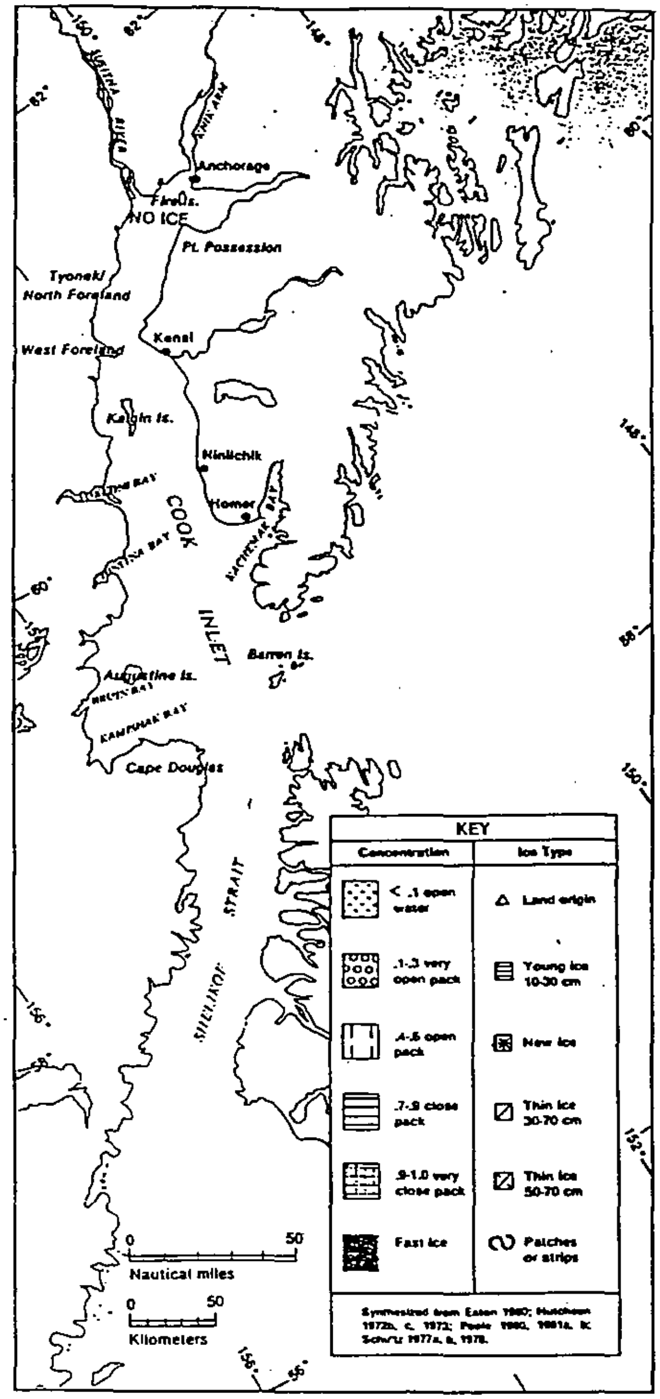


Figure 35: April

Table 1 - MAJOR COOK INLET OIL SPILLS: 1984-2001

No.	Incident	Date	Fuel Spilled	Released (Gals)	Location	Env. Effects	Other Comments
1	M/V Cepheus	Jan-84	Jet A	180,000	1.5 mi. off Anchorage City	None	Very heavy ice; No response
2	Anchorage Port	Dec-84	Jet A-50	106,000	Ruptured undergrd pipe-line @ Anchorage port	uncertain	66,000 gal VAC'ed & sorbed up, more in sump & trench dug
3	Grayling Platform	May-'85	Natural Gas		McArthur R. field-Upper Cc	None	No fire
4	Steelhead Platform	Jan-87	Diesel	6342	McArthur R. field-Upper Cc	None	No response, natural dispersion in < 6 hrs
5	T/V Glacier Bay	Jul-87	N. Slope cr.	130,000	Off Kenai R. and KPL Nikisl	4 dead birds	Belugas observed swimming amongst oil patches
6	Steelhead Platform	Dec-87	Natural Gas		McArthur R. field-Upper Cc	None	Fire for 7 days
7	Mystery Spill	Aug-88	Black oil	100	Upper Cook Inlet	None	No response, natural dispersion
8	M/V Alaska Constructor	Nov-88	Gasoline	0	Trading Bay, Upper Cook I	None	Fire, 3 men killed
9	Spark Platform	Nov-88	Trading Bay crude	840	Upper Cook Inlet	None	Oil naturally dispersed in < 1 day
10	T/V Oriental Crane	Dec-88	Bunker C	7644	KPL Dock, Nikiski	None	Manual cleanup
11	Anna Platform	Jan-89	Granite Pt Crude	4620	Upper Cook Inlet	None	Very heavy ice; No response; Natural dispersion in < 3 days
12	M/V Lorna B	Aug-89	Diesel	72,000	Upper Cook Inlet O & G fiel	None	Sunken vessel at 220', probable slow release of diesel
13	F/V Deborah D	Apr-90	Diesel	210	Ursus Cove, Kamishak Bay,	None	No response
14	T/V Coast Range	Dec-90	Ck. Inlet cr.	630	Drift River loading dock	None	Heavy ice and fog
15	M/V Atlantic Seahorse	Aug-91	Diesel	4000	Upper Cook Inlet off N. For	None	Natural dispersion in < 8 hrs

No.	Incident	Date	Fuel Spilled	Released (gals)	Location	Env. Effects	Other Comments
16	East Forelands spill	Jan-92	N. Slope cr.	1300	KPL Dock off Nikiski	None	Half recovered & half naturally dispersed in 3 days
17	Granite Point Platform	Apr-93	Diesel	2000	Upper Cook Inlet off Granit	None	Nat'l dispersion within 12 hours
18	King Salmon platform	Apr-92	Mid. Grd. Shoal cr.	375	Upper Cook Inlet O & G fiel	None	90% recovery with Foxtalil
19	Dolly Varden polatform	Nov-92	Crude & hydrau-lic fuel mix	42	Upper Cook Inlet O & G fiel	None	Nat'l dispersion in < 10 hrs
20	M/V Sun Tide	Aug-93	Diesel	6000	Upper Cook Inlet off N. Foı	None	Ineffectual response; natural dispersion in < 12 hrs
21	Baker Platform	Apr-94	Middle Grd. Shoal crude	4030	U. Cook Inlet	None	40% mech. recoveru; natural dispersion in 8 hrs.
22	Tug Barge Annahootz	Sep-94	Diesel	500	Port of Anchorage	None	<100 gals recovered, remaining naturally dispersed
23	Anna Platform	Nov-94	Granite Pt. crude	630	U. Cook Inlet	None	0% recovery; natural dispersion in <12 hrs
24	Tesoro Tank	Dec-95	N. Slope crude	1680	Off Nikiski dock	None	Natural dispersion in 24 hrs
25	Steelhead Platform	Mar-97	Diesel	8988	Upper Cook Inlet	None	Natural dispersion in <14 hrs
26	Dillon Pipeline	Oct-99	Middle Grd. Shoal Crude	504	Upper Cook Inlet	None	Naturally dispersed in 10-12 hrs
27	Cross Timbers Facility	May, 2001	Emulsified crude oil	100	East Forelands	None	Naturally dispersed overnight
28	Dillon Platform	Nov-01	Middle Grd. Shoal crude	2100	Upper Cook Inlet	None	Naturally dispersed in 8-10 hours

NOAA Oil Spill Responses: 1984-2001

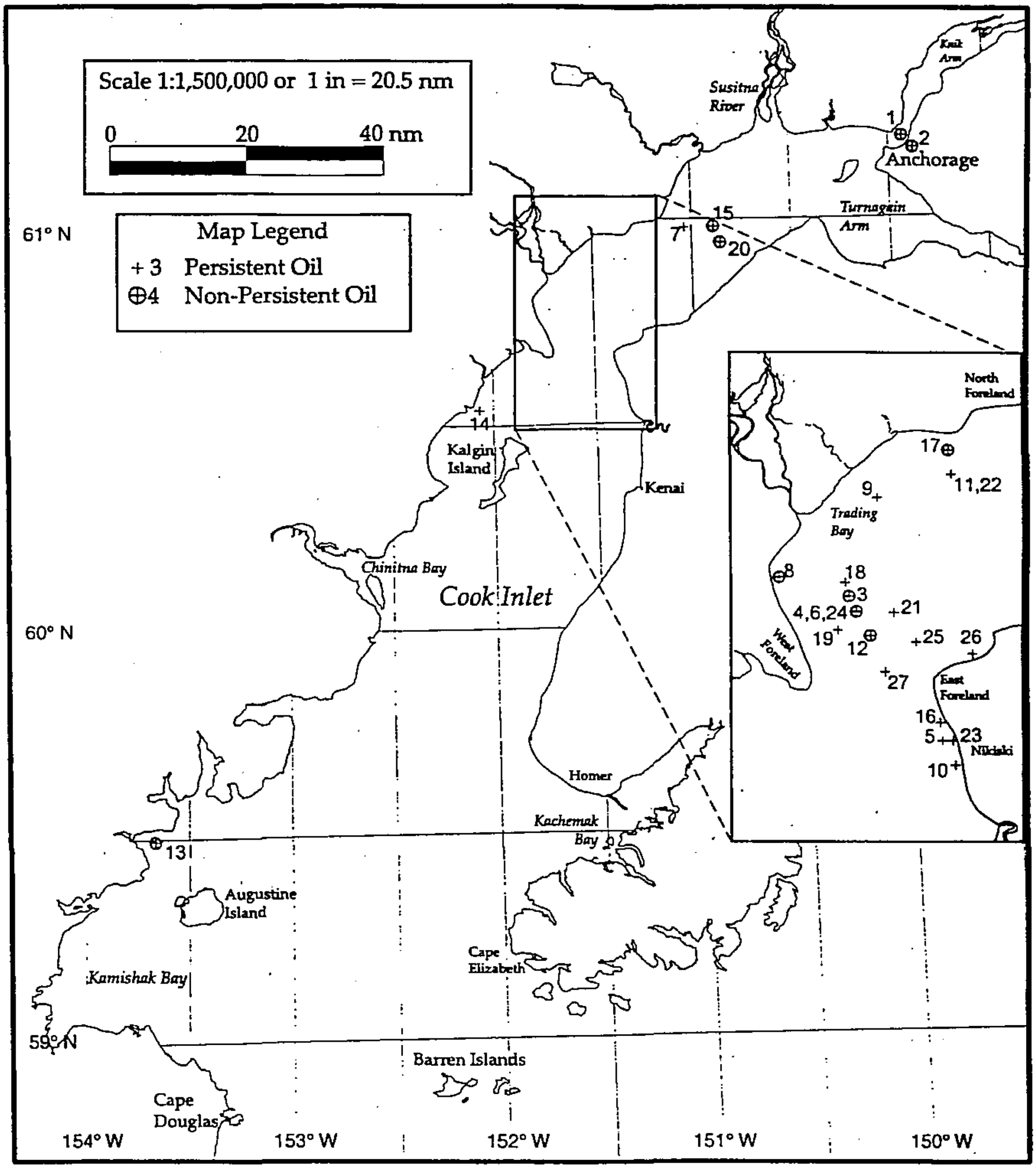


Figure 36: Plot of location of 27 major Cook Inlet oil spills, 1984-2001 (numbers refer to incident numbers in Table 1)

GSS

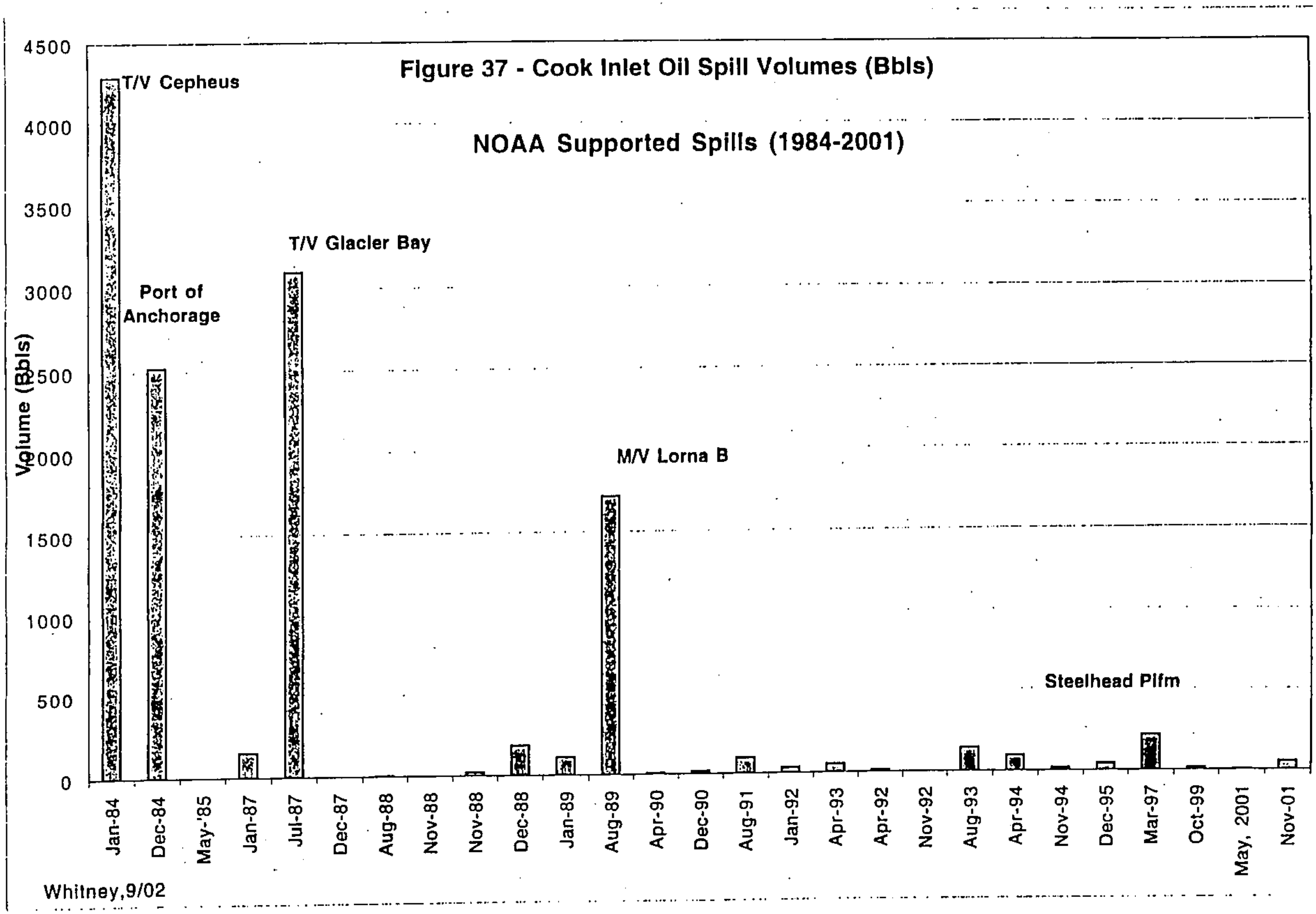


Figure 37: Oil Spill Volumes (Bbls) for NOAA Supported Spills, Cook Inlet, Alaska (1984-2001)

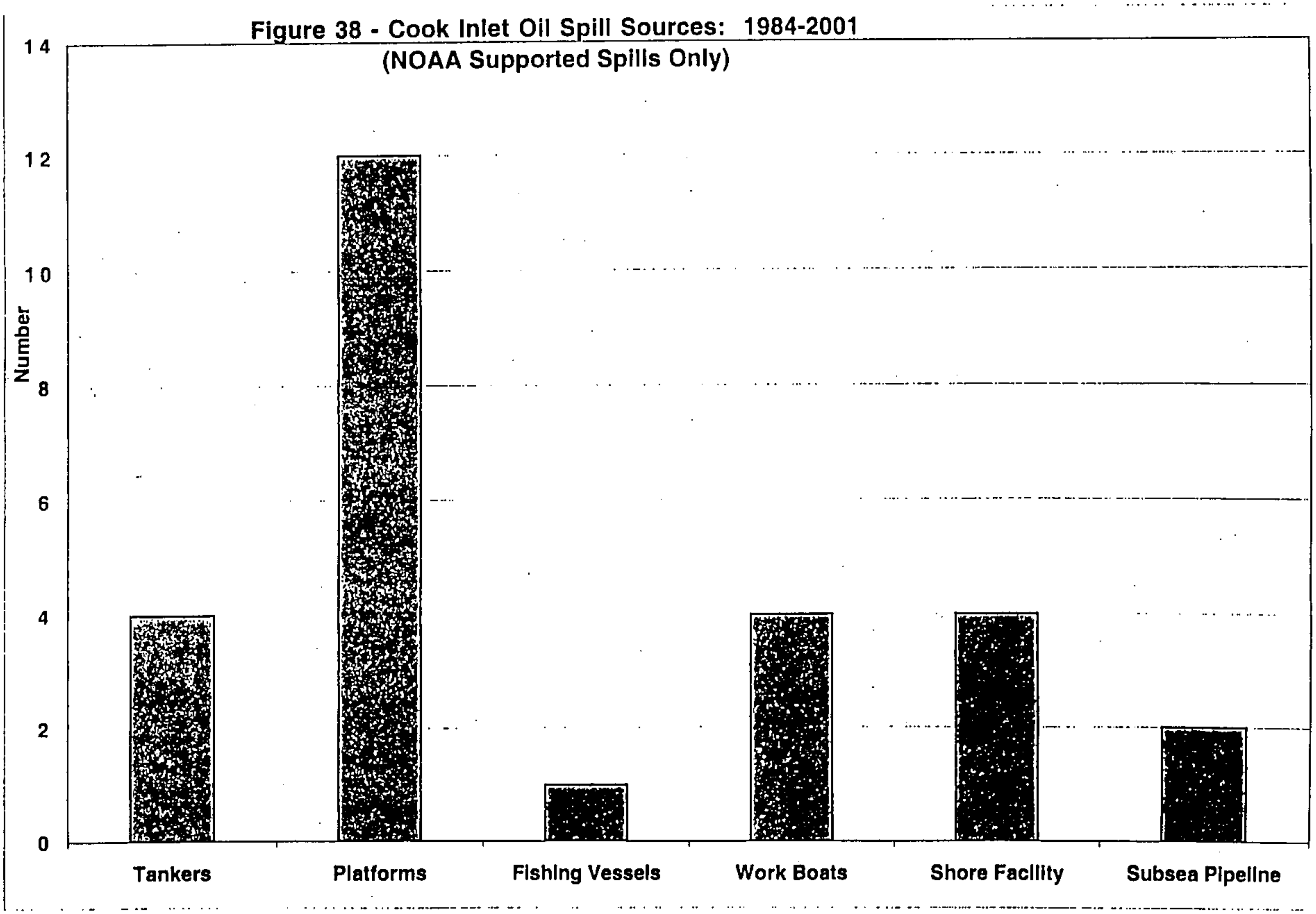


Figure 38: Cook Inlet Oil Spill Sources: 1984-2001

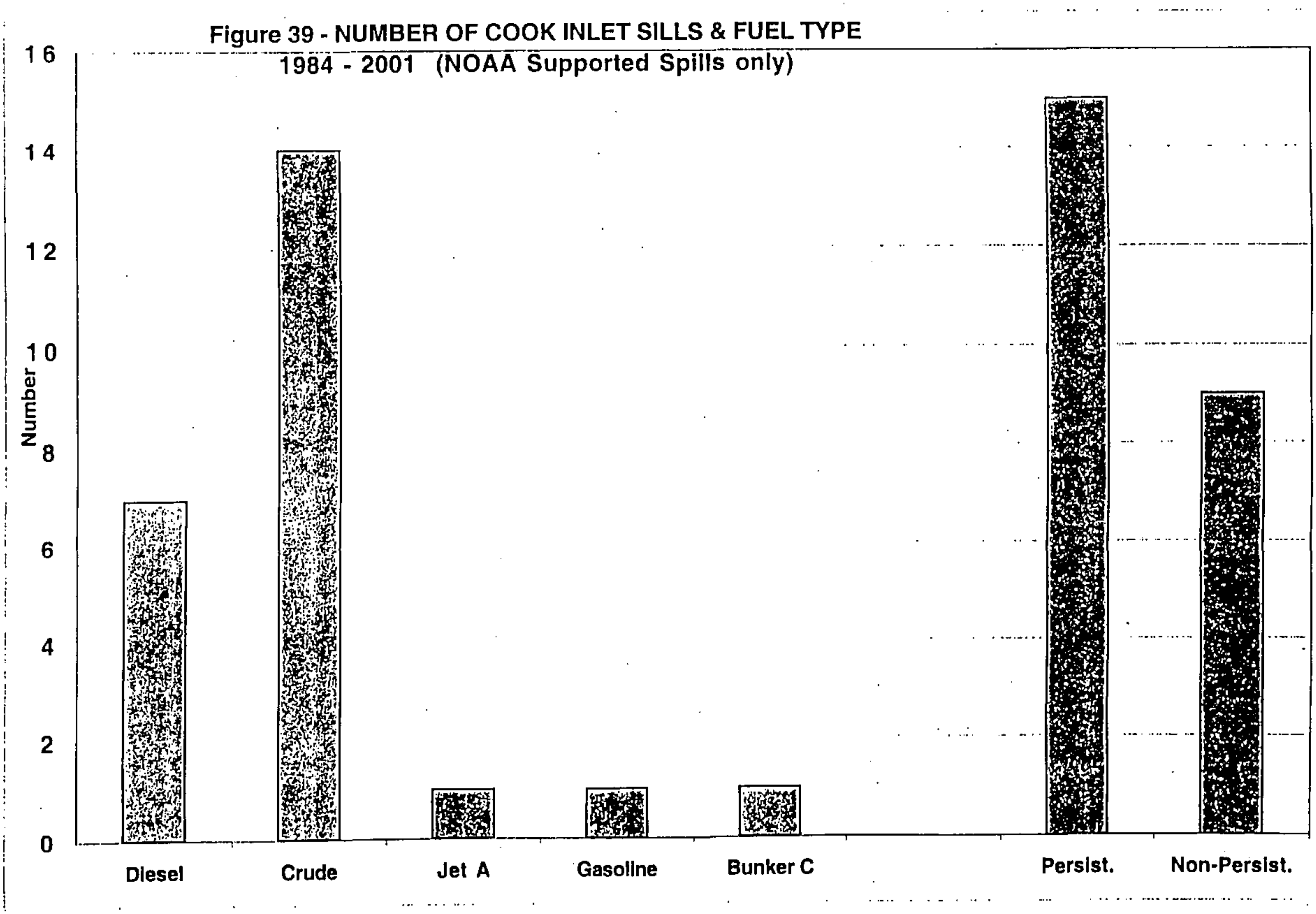


Figure 39: Number of Cook Inlet oil spills by fuel type, 1984-2001

Table 2 - PROPERTIES OF COOK INLET CRUDE AND REFINED OIL PRODUCTS

TYPE:	Ak North Sl. crude	Cook Inlet crude	Granite Pt crude	McArthur R. crude	Middlegr'd Sh. crude	Trading Bay crude	Swanson R. crude
API GRAVITY:	26.8	34.1	42.8	35.4	41.5	28.7	29.7
DENSITY(68°F):	0.89	0.85	0.81	0.85	0.82	0.88	0.88
POUR POINT (°F):	-5.8	-5	5	19.4	5	30.2	5
FLASH POINT (°F):	86	nd	nd	nd	nd	nd	nd
VISCOSITY: (centistokes)	42.4 @ 100°F	4.88 @ 100°F	3.4 @ 100°F	20.5 @ 60°F	8.32 @ 60°F	22.8 @ 60°F	18.6 @ 60°F

REFINED OILS

TYPE:	Gasoline	Kerosene	#2 Fuel Oil	10W/30 Oil	#6 Fuel Oil	Tesoro Resid 380	Tesoro Resid 900
API GRAVITY:	60	37	31.6	29	10	15	13.5
DENSITY(68°F):	0.734	0.83	0.84	0.87	0.966	0.966	0.976
POUR POINT (°F):	<-40	0	-4	-34	43	40	50
FLASH POINT (°F):	-40	100	131	370	176	150	>200
VISCOSITY: (centistokes)	0.69 @ 59°F	2.8 @ 59°F	4.3 @ 59°F	256 @ 59°F	>500 68°F	380 @ 122°F	900 @ 122°F

Table 3 - Observational vs. Predicted Evaporation/Dispersion for Cook Inlet

Date	Incident	Oil Type	Amount (Bbls)	Observational Threshold Evap./Disp. Time (Hours)	ADIOS Predicted Dispersion Time (Hours)
Jan-87	Steelhead Platform	Diesel	151	6 to 18	96-120
Aug-91	M/V Atlantic Seahorse	Diesel	95	6	12
Apr-93	Granite Point Platform	Diesel	48	12	30-48
Aug-93	M/V Sun Tide	Diesel	144	12	80-96
Nov-88	Spark Platform	Trading Bay	20	24	50% left in 120 hrs.
Jan-89	Anna Platform	Granite Pt.	110	72	30% left in 120 hrs.
Jan-92	East Forelands spill	North Slope	31	96	50% left in 120 hrs
Apr-94	Baker Platform	Mid.Grd.Shoal Cr.	96	8	70% in 120 hrs.
Nov-94	Ana Platform	Granite Pt. Cr.	15	12	80% in 120 hrs.
Dec-95	Tesoro Tank	N. Slope crude	40	24	40% in 120 hrs.
Mar-97	Steelhead Platform	Diesel	214	14	60% in 120 hrs.

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NOAA Spill Response Reports for Cook Inlet

Name of Spill: T/V Cepheus

NOAA SSC: David Kennedy/John Whitney

Date of Spill (mmddyy): 012184

Location of Spill: Cairn Pt., a mile and one half northwest of the Port of Anchorage

Latitude: 61,15.5,N

Longitude: 149,55.W

Oil Product: aviation fuel (Jet A kerosene) and bunker C

Oil Type:
Type 1 - Very Light Oils (jet fuels, gasoline)
Type 4 - Heavy Oils (heavy crude oils, No. 6 fuel oil, bunker c)

Quantity: 180,000 gallons of aviation fuel spilled

Source of Release: Tank Vessel

Resources at Risk:
very limited due to time of year and transient nature of aviation fuel

Other Special Interest:
sub zero air temperatures with greater than 90% broken ice coverage

Shoreline Types Impacted:

None

Keywords:

Ice,

Incident Summary:

On Saturday morning, Jan. 21, 1984, the 535 foot Greek tanker grounded a mile and one half NW of the Port of Anchorage across Knik Arm from Cairn Point. Within an hour and one half , a tug pulled it off ground and towed it to the Port. The vessel was loaded with 209,000 barrels of Jet A kerosene and had 40,000 gallons of Bunker C for its propulsion. The tanker was bound from the East Coast to Anchorage with a load of aviation fuel owned by MAPCO Petroleum Co. of Fairbanks. Some kerosene began gushing from the tanks when the vessel went aground, however; the amount and extent of the fuel spilled was considered minor by the CG, and fog, sub-zero temperatures, and over 90% ice coverage seriously hampered evaluating the situation. Kerosene continued to leak at the dockside, and patches of spilled fuel from the tanker stretch from the lower end of Fire Island to waters offshore of Eagle River, an area roughly 30 miles long. Because the ship's tanks were pressurized and technicians didn't want to open them fearing the fuel would spill more quickly if the tanks were vented, the Coast Guard didn't realize the extent of the spill until Thursday morning, Jan. 26.

At that point, it was estimated that 180,000 gallons of kerosene had been released. With the assistance of the members of the Pacific Strike Team, much of the remaining water contaminated and uncontaminated kerosene was pumped off the tanker. In addition, heating elements were applied to the Bunker C tanks, and that fuel was also mostly pumped off. A large percentage of the kerosene evaporated and it quickly mixed in the ice infested water, making it extremely difficult to recover any of the fuel. No on-water response was attempted. Divers examining the hull in the icy, silty waters of Cook Inlet were able to identify three narrow tears in the hull of 10, 4, and 1-foot lengths. ADEC and Coast Guard folks monitoring the spill deemed its environmental impact as minimal. Ten days after the initial grounding, low tide sediment samples were collected from around Fire Island, and the Susitna and Eagle River flats, by NOAA and ADEC, to test for any contamination. The results were negative.

Behavior of Oil:

According to ADIOS2, over 50% of the kerosene would evaporate with the first day, and then up to 80% within a few more days. In addition the strong currents and turbulence in upper Cook Inlet combined with the dramatic mechanical grinding effect of highly dynamic ice, will cause the kerosene that doesn't evaporate to disperse and dissipate within a very short period of time (probably around a day). Initially patches of the spilled kerosene were observed from Fire Island north to the Eagle River flats, but the fuel was very transient. As a result no shorelines were impacted.

Countermeasures and Mitigation:

No countermeasures wee employed to deal with spilled kerosene as it was impossible to do anything in the dynamic ice infested waters. The oil that was removed was pumped directly from the vessel to shore side tanks.

Other Special Interest Issues:

None

NOAA Activities:

Initially NOAA provided support to the Coast Guard via phone from Seattle. That support involved trajectory information and the possible fates and effects of kerosene spilled in dynamic ice conditions. The Coast Guard was informed that tidal excursions could range up to 30 miles, but that due to evaporation and natural dispersion, the kerosene would be very transient. The NOAA SSC came on-scene on Jan. 29 to conduct numerous low tide sediment tests for evidence of oil. None was found.

NOAA Response Report

Anchorage Port Spill
Anchorage, Alaska

December 20, 1984

David Kennedy, Scientific Support Coordinator

INCIDENT SUMMARY

At 1540 on December 18, 1984, MSO Anchorage was notified of a spill at the Anchorage Port. Oil of unknown type was accumulating in a drainage ditch near the Chevron Oil terminal.

Investigation by USCG, U.S. Army, and Chevron led to the discovery of a ruptured underground pipe line carring Jet A-50 fuel.

Cleanup contractors with VAC trucks and sorbent pads removed the majority of the estimated 106,000 gallon spill.

NOAA RESPONSE

At 1500 on December 20, 1984, MSO Anchorage briefed the NOAA SSC on the spill incident and cleanup progress. Of the estimated 106,000 gallons spilled, 66,000 gallons had been recovered and the cleanup contractor wanted to terminate operations.

MSO Anchorage requested NOAA to calculate the potential evaporation of Jet A-50 and to evaluate possible migration routes for any remaining fuel.

NOAA advised MSO Anchorage that because the low volatility, and ambient temperature it was highly unlikely the 40,000 gallons of Jet A-50 would evaporate. NOAA suggested that surveys should be done to investigate migration of the fuel along frost or frozen soil zones, sepage percolation into soil or loss to/through drains or scuppers in the vicinity. (See Jerry for ref.)

FINAL DISPOSITION OF THE INCIDENT

The cleanup contractor and MSO discovered additional fuel in a large drain sump and in a trench dug below the spill. This fuel was cleaned up and the spill site will be monitored until spring thaw for additional fuel deposits.

NOAA Response Report

Grayling Platform Blowout
Cook Inlet, Alaska
May 23, 1985

David Kennedy, Scientific Support Coordinator

INCIDENT SUMMARY

On the evening of May 22, 1985, a Union Oil Platform in Cook Inlet blew a combination of mud and natural gas 300 feet into the air while undergoing routine maintenance. The platform was evacuated without injuries or loss of life. There was no crude oil associated with the initial blowout but it was feared that the structural integrity of the platform was in jeopardy; if the platform collapsed, oil could escape from one of the other wells on the platform or from a pipeline connecting the platform to a land-based receiving facility.

NOAA RESPONSE

NOAA/OAD was notified of the incident at 1145 on May 23, 1985 by the U.S. Coast Guard Marine Safety Office (MSO), Anchorage, Alaska, and requested to provide information on resources at risk, oil dispersing recommendations, and spill trajectory. An inventory of resources at risk was provided to the Coast Guard with emphasis placed on the Trading Bay and Redoubt Bay areas which had very high concentrations of migratory waterfowl. Information was also passed on the effects of natural gas versus crude oil on affected resources. NOAA/OAD also prepared an assessment of dispersant use based on the draft dispersant use guidelines in preparation by the interagency Regional Response Team Dispersant Use Subcommittee. A trajectory model was initialized for Cook Inlet but was not run because crude oil was never spilled.

FINAL DISPOSITION OF THE INCIDENT

On May 28, 1985 the blowout "bridged" (caved in on itself), terminating the event. Structural repair of the rig has been completed and it is back in service.

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NOAA Response Report

Marathon Oil Company
Upper Cook Inlet, Alaska
January 19, 1987

John Whitney, Scientific Support Coordinator

INCIDENT SUMMARY

At approximately 0930 on January 19, 1987, an open fuel tank valve was discovered on the crane helping to erect the Marathon Oil Company's Steelhead offshore platform in Upper Cook Inlet, Alaska. The open valve had allowed 151 barrels of diesel to enter Cook Inlet over an unspecified period, although no oil slicks or sheens were noted on the water in the immediate vicinity of the platform.

NOAA RESPONSE

NOAA/OAD was notified of the incident at approximately 1715 on January 19, 1987, by the U.S. Coast Guard Marine Safety Office, Anchorage, and requested to provide trajectory information on which to base possible surveillance overflights.

NOAA advised the Coast Guard that, given the natural dispersion characteristics of the spilled diesel fuel and the very high tidal current condition of upper Cook Inlet, there would be a very low probability that any evidence of the oil spill could be detected from an aircraft. As a result, surveillance overflights were not recommended. This evaluation was further supported by a contact with the Cook Inlet Response Organization (CIRO).

FINAL DISPOSITION OF THE INCIDENT

Shortly after the spill was noted, Marathon Oil Co. dispatched a helicopter overflight to attempt to locate slicks or sheens. A search around the platform vicinity, often hampered by snowy conditions and low visibility, produced no positive results by 1500 on January 19. No Coast Guard helicopter flights were dispatched and the case was closed on January 21, 1987.

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NOAA Response Report

T/V Glacier Bay
Kenai, Cook Inlet, Alaska
July 2, 1987

John Whitney, Scientific Support Coordinator

INCIDENT SUMMARY

At 0334 on July 2, 1987, the tanker vessel Glacier Bay grounded and suffered hull damage south of the mouth of the Kenai River while en route to Nikiski from Valdez to unload approximately 16,380,000 gallons of North Slope Alaskan crude oil at the refinery. Initial reports indicated that 10-15 barrels (420 to 1,600 gallons) of oil had been lost.

NOAA RESPONSE

NOAA/OAD was notified of the incident at 0600 on July 2, 1987, by the U.S. Coast Guard Marine Safety Office, Anchorage. At 0830 on July 2, the Coast Guard reported that an additional 100 to 400 barrels (4,200 to 16,800 gallons) of oil had been released as the vessel attempted to move into deeper water and to pump oil into undamaged tanks. Continuing leakage was reported to have subsided to a light sheen, and the damaged tanks had reportedly been emptied. NOAA was requested to provide a trajectory analysis and resources at risk characterization for oil spilled to that point in time.

NOAA/NOAA identified the red salmon fishery in Cook Inlet as the major natural resource of concern, since the salmon run peaks in mid-July. NOAA provided an initial trajectory forecast, based upon the owner's estimate of oil spilled and the source being located south of the Kenai River. Given the strong currents and relatively small amount of oil, NOAA predicted small impact: the oil would oscillate north and south and gradually come ashore on the east side of the Kenai Peninsula. When oil was subsequently observed in offshore rip currents, NOAA predicted that small tarballs would be formed and washed ashore in minor amounts.

The Regional Response Team determined that the ship should be moved to Nikiski for offloading. The responsible party assumed cleanup responsibility and contracted with the Cook Inlet Response Organization (CIRO) to manage cleanup operations. At approximately noon on July 2, CIRO requested permission to disperse the spilled oil; the request was denied based on existing dispersant use guidelines for the Cook Inlet region. In the following days, CIRO continued to conduct cleanup operations and assessment surveys; however, the strong currents, debris, and the oil's viscosity confounded their efforts, resulting in little effective cleanup.

On July 8, conversations between NOAA and the USCG On-Scene Coordinator (OSC) indicated that additional technical assistance was needed on-scene. By the evening of July 8, four additional NOAA staff had arrived in Kenai to assist NOAA's Scientific Support Coordinator (SSC) who had been monitoring the situation with the OSC and the Alaska Department of Environmental Conservation. During the day, the estimate of the amount of oil spilled was increased substantially to 130,200 gallons.

On July 9, the Coast Guard declared the spill to be major (i.e., greater than 100,000 gallons) and assumed control of the spill due to dissatisfaction with the spiller's efforts and evidence that much more oil had been spilled than the owner had reported.

Over the next several days, NOAA staff established an electronic communications system so that all concerned parties would have immediate and consistent information; began systematic overflights of the area from Homer to Anchorage, where oil had been reported; and provided integrated maps of oil sightings from each day's overflights. NOAA also conducted extensive oil weathering, floating, and sinking experiments to better characterize the nature of the spill problem. NOAA also continued to provide trajectories and predictions on the oil behavior, based upon tidal and current information and the overflights. NOAA also worked to facilitate the flow of information between the governmental agencies responding to the spill, resulting in nightly debriefings of each agency's daily activities. Finally, the OSC was provided with answers to questions he might be posed by the press, and a summary of the amounts of oil remaining in the water and along the coast was provided. As of July 16, all NOAA personnel, except the SSC, had returned to Seattle.

FINAL DISPOSITION OF THE INCIDENT

Cleanup operations were extremely difficult because of the 4-6 knot currents. The oil tended to accumulate in rip currents and to be carried down with small flotsam and jetsam. Several times oil was boomed, and then "disappeared" before it could be collected—and reappeared hundreds of yards away, due to the rip currents.

Estimates of oil slicks and amounts were exceedingly difficult prior to July 8 because of the lack of trained observers on-scene. This is a typical problem in oil spills, and results in dissemination of misleading information.

The spiller originally assumed responsibility for the spill. However, cleanup personnel did not arrive on-scene until two days after the spill was reported and their operations were not generally effective.

The oil spill occurred during a major fishing season, the red salmon fishery, involving set netters, drift netters, and dip netters. The Alaska Department of Fish and Game closed part of the fishery north of Nikiski concentrating the fishermen where the bulk of the fish happened to be, resulting in extremely large catches. The following day, another area was opened to gill netters, but after opening briefly, had to be closed due to additional reported oil sightings. Besides the disappointment of expectant fishermen, some nets were oiled and the fish canneries were reluctant to purchase because some fish were oiled.

In conclusion, the spill was not severe in the usual sense—there was very little oiling of the beaches, four birds were reported dead, and the area is a high energy environment and so will cleanse itself rapidly. Several beluga whales were sighted, but no oil effects were apparent. The major problem has been temporary dislocation of the fishery and the confusion caused by erroneous initial reports on the magnitude of the spill.

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NOAA Response Report

Marathon Oil Company
Upper Cook Inlet, Alaska
December 21, 1987

John W. Whitney, Scientific Support Coordinator

Summary

At approximately 2000 on December 20, 1987, there was a natural gas blow out on Marathon Oil Company's Steelhead platform in the McArthur River oil and gas field in Upper Cook Inlet. At about 2320, the plume of gas caught fire, with flames erupting over 300 feet. The fire burned throughout the next several days. Those personnel not previously evacuated were immediately moved off the platform. The Steelhead is a relatively new platform and had only drilled two other gas wells and one oil well, all of which were shut-in prior to platform evacuation. Within hours after the first report of the blowout, the U.S. Coast Guard mobilized a fixed-wing aircraft and a helicopter from the Kodiak air station, and the Coast Guard cutter Sedge from Homer to the scene for possible rescue and pollution-control activities.

Behavior

At about 0830 on December 28, the formation from which the gas was blowing naturally bridged and plugged itself, and the fire extinguished itself. No pollution occurred throughout the blowout.

NOAA Activities

On December 21, 1987, NOAA/OMA contacted the Coast Guard Marine Safety Office (MSO), Anchorage, to offer assistance in responding to the incident. Although no oil pollution had yet occurred, the Coast Guard's concern was the possibility that some subsurface oil reservoir could reach the blowing gas and cause a major oil pollution situation. NOAA contacted a Marathon Oil Company geologist and was informed that the gas was blowing from a zone roughly 2,200 feet below the surface, whereas the oil reservoir in the McArthur River field was at about 9,000 feet and necessitated artificial lift. As a result, there was only a very remote possibility of any oil blowing out on its own or of communicating with the blowing gas. As a precautionary measure, the Cook Inlet Response Organization was contacted to ascertain their readiness to deal with a pollution incident; as were the Alaska Department of Fish and Game; the U.S. Fish and Wildlife Service, to evaluate the possible resources-at-risk from a spill, and the National Weather Service to get weather and sea surface information. Since the Steelhead platform is located in a pre-approved dispersant application zone, preliminary efforts were carried out to complete the necessary dispersant checklist guidelines. On the morning of December 21, the Coast Guard On-Scene Coordinator flew over the burning platform and observed no oil pollution. Meanwhile, Marathon had several boats continuously dousing the platform with water and contracted with a local cleanup company to control the fire. On December 24, Marathon committed to drilling a relief well and began mobilizing the Key Hawaii drilling platform from Seward, and drilling crews from Louisiana.

Contacts

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Drumheller, Rich, Marathon Oil Company geologist, Anchorage, personal communication, December 21, 1987.

Eldridge, Barry, Cook Inlet Response Organization, Anchorage, personal communication, December 21, 1987.

Metsker, Howard, U.S. Fish and Wildlife Service, Anchorage, personal communication , December 21, 1987.

Slater, Claudia, Alaska Department of Fish and Game, Anchorage, personal communication, December 21, 1987.

Watabayashi, Glen, National Oceanic and Atmospheric Administration, Seattle, personal communication, December 21, 1987.

NOAA Response Report

Mystery Spill
Upper Cook Inlet, Alaska
August 5, 1988

John W. Whitney, Scientific Support Coordinator

Summary

On August 5, 1988, personnel on the Phillips Petroleum gas platform in upper Cook Inlet observed several patches of black oil with sheen. At 1000, a U.S. Coast Guard C-130 overflight confirmed the oil slick and observed a few scattered patches in an area from 10 miles west of Fire Island southwest to Trading Bay.

Behavior

The Coast Guard and Alaska Department of Environmental Conservation took samples of the oil in order to attempt to fingerprint it. No further encounters with the oil were reported, and it is assumed that the oil gradually dispersed.

NOAA Activities

NOAA/OMA was notified of the incident at approximately 1330 on August 5, 1988, by the Coast Guard Marine Safety Office, Anchorage, and asked to stand by for a helicopter overflight. Resource agencies were also notified. By 1530, the NOAA Scientific Support Coordinator (SSC) was on an overflight of the spill scene. Two small areas of black oil with sheen were observed approximately half way between the North Forelands and Point Possession. The slicks represented approximately 100 gallons of oil. NOAA advised the Coast Guard that, due to the small amount of oil and the rapidly changing environmental conditions, the only reasonable response would be to monitor the slick. Three days later, on the evening of August 8, the SSC was called by MSO Anchorage with the information that two or three drift-net fishing boats had encountered oily debris while fishing west and south of Kalgin Island. Further, set netters had noted rather fresh looking oil on the north end of Kalgin Island. NOAA concluded that this was probably the same oil that had been observed on August 5 in upper Cook Inlet 50 miles to the north. The Coast Guard was advised to look for a possible continuous leak from some of the oil facilities in upper Cook Inlet and to attempt to fingerprint the oil to determine its source.

Contacts

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Contacts cont...

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Galt, Jerry, NOAA Hazmat, Seattle, personal communication, August 8, 1988

National Weather Service, Anchorage, personal communication, August 8, 1988

NOAA Response Report

M/V Alaska Constructor
Upper Cook Inlet, Alaska
November 2, 1988

John W. Whitney, Scientific Support Coordinator

Summary

At approximately 0830 on November 2, 1988, an explosion ripped through the Alaska Constructor, a 113-foot supply vessel en route from Anchorage to Trading Bay to deliver fuel to an earth-moving operation. The explosion occurred while the vessel was aground at Trading Bay. A tank truck containing 3,000 gallons of gasoline immediately caught fire on the vessel's deck. The Alaska Constructor also had 7,000 gallons of gasoline and 11,000 gallons of diesel in tanks below the deck. The Nikiski Fire Department, workboats in the vicinity, and a U.S. Coast Guard cutter responded to the blaze. One man escaped overboard in the shallow water, while three others remained trapped aboard the vessel. Cook Inlet Pipeline Co. activated the Cook Inlet Response Organization, which sent two vessels and a fireproof boom to curb any pollution.

Behavior

The blaze aboard the Alaska Constructor burned out at 1515 on November 3, consuming only the fuel aboard the gasoline truck. The below-deck gasoline and diesel tanks remained intact. One body was found onboard, while the other two individuals remained missing but were presumed dead. A slight sheen from the oil was noted surrounding the vessel. The vessel remained aground with a 10° list, and the remaining fuel was offloaded onto another vessel. The ALASKA CONSTRUCTOR was later towed to deeper water, where it was sunk by a demolition team.\

NOAA Activities

NOAA/OMA was notified of the incident at 1100 on November 2, 1988, by the Coast Guard Marine Safety Office, Anchorage. NOAA was informed that, due to the intense blaze, no pollution response was possible. Instead, the incident was being treated as a search and rescue mission to locate the three missing individuals. NOAA notified resource agencies, who agreed that there were minimal resources-at-risk at this time of year if significant pollution should arise.

Contacts

Becker, Paul, NOAA Regional Response Team representative, Anchorage, personal communication, November 2, 1988.

Contacts cont...

Bergmann, Pam, U.S. Department of the Interior Office of Environmental Protection, Anchorage, personal communication, November 2, 1988.

Gates, Paul, U.S. Department of the Interior Regional Response Team representative, Anchorage, personal communication, November 2, 1988.

Slater, Claudia, Alaska Department of Fish and Game, Anchorage, personal communication, November 2, 1988.

NOAA Response Report

Marathon Spark Platform
Upper Cook Inlet, Alaska
November 14, 1988

John W. Whitney, Scientific Support Coordinator

Summary

On November 14, 1988, a water well off the Marathon Oil Company Spark platform accidentally communicated with an oil reservoir, releasing approximately 20 barrels of Cook Inlet crude into Upper Cook Inlet, Alaska. A snow storm and poor visibility prevented the U.S. Coast Guard from monitoring the oil slick until that afternoon.

Behavior

A helicopter overflight on November 15 could not locate the oil slick, which presumably had naturally dispersed.\

NOAA Activities

NOAA/OMA was notified of the incident at 1000 on November 14, 1988, by the Coast Guard Marine Safety Office, Anchorage. NOAA was asked to provide a spill trajectory for surveillance aircraft to follow, when weather permitted. NOAA advised that the oil slick would probably become trapped in the rip zone and would gradually move south in response to the net tidal drift and wind. In the afternoon, a Marathon helicopter with a Coast Guard observer noted that the slick was breaking up. The slick was observed approximately four miles south of the Spark platform, the location predicted by NOAA. NOAA contacted Alaska resource agencies, who agreed that environmental resources would probably not be affected.

Contacts

Becker, Paul, U.S. Department of the Interior Regional Response Team representative, Anchorage, personal communication, November14, 1988.

Bergmann, Pam, U.S. Department of the Interior Office of Environmental Protection, Anchorage, personal communication, November 14, 1988.

Brooks, Tom, Marathon Environmental Coordinator, Anchorage, personal communication, November 14, 1988.

Slater, Claudia, Alaska Department of Fish and Game, Anchorage, personal communication, November 14, 1988.

Contacts cont...

Watabayashi, Glen, NOAA Hazardous Materials Response Branch, Seattle, personal communication, November 14, 1988.

NOAA Response Report

T/V Oriental Crane
Upper Cook Inlet, Alaska
December 12, 1988

John W. Whitney, Scientific Support Coordinator

Summary

Late in the morning on December 12, 1988, 25-knot winds knocked the Oriental Crane, a 300-foot Japanese fuel tanker, into the Kenai Pipeline dock, where the tanker was loading diesel fuel. The force of the collision punched an approximately eight inch-wide hole into a fuel tank of bunker C above the water line. Fuel leaked into the water for approximately 40 minutes before dropping below the level of the hole when the bunker C was pumped into another undamaged tank. An estimated 182 barrels of fuel oil were lost into Cook Inlet.

Behavior

Bankcraft, George, National Weather Service, Anchorage, personal communication, December 12, 1988.\

NOAA Activities

NOAA/OMA was notified of the incident at approximately 1100 on December 12, 1988 by the U.S. Coast Guard Marine Safety Office (MSO) Anchorage. NOAA was requested to provide an estimate of the spilled fuel's trajectory, and to advise of environmental resources-at-risk from the spill. NOAA talked to on-scene personnel from the Cook Inlet Response Organization to get more details of the incident and consulted the National Weather Service and National Ocean Service tidal information. NOAA then advised the Coast Guard that, since the release had occurred near the end of an ebb cycle, the oil would probably move one-half to one mile to the south and, on the returning flood cycle, would be blown ashore around the Nikiski docks and possibly to the north of the Nikiski docks. Consultation with the resource agencies indicated that the Nikiski portion of the beach during this time of year was essentially devoid of biological resources.

Contacts

Bankcraft, George, National Weather Service, Anchorage, personal communication, December 12, 1988.

Becker, Paul, NOAA Regional Response Team representative, Anchorage, personal communication, December 12, 1988.

Contacts cont...

Bergmann, Pam, U.S. Department of the Interior Office of Environmental Protection, Anchorage, personal communication, December 12, 1988.

Eldridge, Barry, Cook Inlet Response Organization, Nikiski, personal communication, December 12, 1988.

Robinson-Wilson, Everett, U.S. Fish and Wildlife Service, Anchorage, personal communication, December 12, 1988.

Sundberg, Kim, Alaska Department of Fish and Game, Anchorage, personal communication, December 12, 1988.

NOAA Response Report

Amoco Platform Anna
Upper Cook Inlet, Alaska
January 1, 1989

John W. Whitney, Scientific Support Coordinator

Summary

On the morning of January 31, 1989, Amoco oil platform Anna accidentally released approximately 520 barrels of an oil-water mixture into the ice-filled Upper Cook Inlet. Apparently, a valve malfunction caused a tank to overflow. An overflight by Amoco and U.S. Coast Guard personnel sighted crude oil approximately one mile south of the platform between leads and on the ice in seven patches measuring 15 feet by 50 feet). Due to extreme cold weather and heavy ice conditions, mechanical cleanup was not deemed feasible.

Behavior

The material spilled was a mixture of 110 barrels of crude oil and 410 barrels of contaminated water. Helicopter overflights tracked the slick and, by February 2, only minor oil staining of the ice was visible. Shortly thereafter, it was difficult to observe any evidence of the oil.

NOAA Activities

NOAA/OMA was notified of the incident on January 31, 1989, by the Coast Guard Marine Safety Office in Anchorage. NOAA contacted the environmental resource agencies and advised them of the incident. It was agreed that there were few resources in the area at risk from the oil at this time of year, but that the situation should be monitored. The possibility of in situ burning was explored, but it was noted that the current -20°F to -25°F temperatures would prevent the propane ignition system on the Helitorch from working. Also, there were no large pools of the crude oil to make burning feasible.

Contacts

Becker, Paul, NOAA Regional Response Team representative, Anchorage, personal communication, January 31, 1989.

Bergmann, Pam, U.S. Department of the Interior Office of Environmental Protection, Anchorage, Alaska, personal communication, January 31, 1989.

Eldridge, Barry, Cook Inlet Response Organization, Nikiski, Alaska, personal communication, February 1, 1989.

Contacts cont...

Slater, Claudia, Alaska Department of Fish and Game, Anchorage, Alaska, personal communication, January 31, 1989.

NOAA Response Report

M/V LORNA B
Upper Cook Inlet, Alaska
August 21, 1989

John W. Whitney, Scientific Support Coordinator

Summary

The tugboat LORNA B was towing a barge through Cook Inlet when it became entangled in the towing cable and sank at 1800 on August 19, 1989. The tug, under charter to Marathon Oil Company to support the offshore Steelhead Oil Platform reconstruction, sank one-half mile north of the platform in 220 feet of water. The vessel contained approximately 80,000 gallons of diesel and had 11 people on board, all of whom safely escaped. The vessel slowly leaked some diesel, and a small slick was noted north and south of the location for several miles. Marathon Oil Company and the Cook Inlet Resource Organization (CIRO) responded to the spill by dragging sorbent booms through the rapidly dispersing slick.

Behavior

Diesel continued to bubble up from the sunken tug for more than a week as owner representatives on-scene debated the feasibility of salvage operations and recovering the oil underwater. The surfacing oil formed a rainbow sheen measuring approximately 20 feet by 1,000 feet and dispersed along the rip zones in that vicinity. The vessel continues to be monitored in her sunken position.

NOAA Activities

NOAA/OMA was notified of the incident at 0930 on August 21, 1989 by the U.S. Coast Guard Marine Safety Office, Anchorage, and requested to advise on the spill's probable trajectory. NOAA advised the Coast Guard that, at this point, nothing could be effectively done to contain the slow leak of diesel in the very rapid currents of Upper Cook Inlet. NOAA concluded that the diesel would rapidly disperse. On August 26, the Coast Guard requested a catastrophic release scenario report even though agreeing that this was a very low probability event. They were informed that a sudden release of 5,000 gallons of lube oil would probably have more impact than a similar release of 72,000 gallons of diesel. Except for a cross-channel wind case, the diesel would probably disperse and dissipate in the strong currents of Upper Cook Inlet, whereas the lube oil would persist considerably longer. Lube oil would probably be trapped in the debris-filled rip zones, and possibly make landfall on the west side in sensitive tidal flat areas as a result of natural eddying to the north or south of the West Forelands or of a cross-channel wind. In addition, in September, birds migrate through the tidal flats of Redoubt Bay and Trading Bay.

Contacts

Becker, Paul, U.S. Department of Commerce Regional Response Team representative, Anchorage, personal communication, August 27, 1989.

Robinson-Wilson, Everett, U.S. Fish and Wildlife Service, Anchorage, personal communication, August 27, 1989.

Sundberg, Kim, Alaska Department of Fish and Game, Anchorage, personal communication, August 27, 1989.

Torgrimson, Gary M. 1984. The on-scene spill model (OSSM): a user's guide. Seattle: Ocean Assessments Division, NOAA. NOAA Technical Memorandum NOS OMA-12.

F/V Deborah D
Ursus Cove, Lower Cook Inlet
April 27, 1990

John W. Whitney, Scientific Support Coordinator

INCIDENT SUMMARY

On the evening of April 26, 1990, the 105' F/V Deborah D grounded in Ursus Cove in Lower Cook Inlet (59°30.59'N, 153°45.27'W) as part of its involvement in a herring opening. The vessel was fueled with approximately 4000 gallons of diesel and had normal amounts of lube oil and hydraulic fluid on board, and yet only some sheening was reported. It was reportedly setting on the bottom in 20' of water.

NOAA RESPONSE

The Anchorage Coast Guard MSO contacted NOAA Hazmat concerning the incident on the morning of April 27 and requested information on resources in the area. After contacting several of the resource agencies the following information was transferred to the Coast Guard. A herring spawning opening had just been completed in the Ursus Cove vicinity, and probably there were lots of salmon fry in the process of outmigrating. On shore there were likely to some bears, and lots of waterfowl were staging for the spring migration, particularly in the intertidal zone both in the water and on the beach. As regards cultural resources, the State Historical office reported no known sites, and no National Historic Landmarks occurred in the area. A weather report was obtained from NWS and transmitted to the CG.

CONCLUSION

Only minor amounts of fuel were released into the water, and the vessel was refloated and moved to more protected waters in the cove on May 4 for temporary repairs.

CONTACTS

1. Wayne Dolezal, ADFG, Anchorage, personal communication, April 27, 1990.

2. Don McKay, ADFG, Anchorage, personal communication, April 27, 1990.

3. Wes Uecher, ADFG. Homer, personal communication, April 27, 1990.

4. Pam Bergmann, DOI Dept. of Environmental Protection, personal communication, April 27, 1990.

5. Mary Lynn Nation, USFWS, Anchorage, personal communication, April 27, 1990.

6. Reuben Eaton, NWS, Anchorage, personal communication, April 27, 1990.

7. Paul Becker, DOC RRT Representative, personal communication, April 27, 1990.

NOAA Response Report

T/V COAST RANGE
Drift River Loading Facility, Cook Inlet, Alaska
December 18, 1990

John W. Whitney, Scientific Support Coordinator

Summary

During the early morning of December 17, 1990, the 635-foot tank vessel COAST RANGE broke loose from the Drift River Storage facility, spilling approximately 2,310 gallons of crude oil onto the deck and about 630 gallons into ice-covered Redoubt Bay. Cook Inlet Spill Prevention and Response, Inc. (CISPRI), the Cook Inlet industry oil spill cooperative, responded at first light.

NOAA Activities

NOAA was notified of the incident on December 18, 1990, by the U.S. Coast Guard Marine Safety Office (MSO) Anchorage. MSO did not request assistance. NOAA, in turn, notified the appropriate resource agencies of the incident. Normal cleanup procedures could not be carried out because of the thick ice. Heavy fog and snow also hampered the cleanup and grounded attempted overflights. Skimmers, deployed by CISPRI, picked up mostly water, therefore the response effort shifted to sorbents. A total of 13 drums of soiled sorbent material and approximately 3 barrels of oil were recovered. On the afternoon of December 20, overflight failed to sight oil and the case was closed.

References

Becker, Paul, Regional Response Team representative, Anchorage, personal communications, December 18, 1990. Bergmann, Pam, U.S. Department of the Interior, Office of Environmental Protection, Anchorage, personal communications, December 18, 1990. Slater, Claudia, Alaska Department of Fish and Game, Anchorage, personal communications, December 18, 1990.

Contacts

Paul Becker, DOC RRT representative, Anchorage, personal communication, December 12, 1990.

Pam Bergman, DOI Office of Environmental Protection, Anchorage, personal communication, December 12, 1990.

Claudia Slater, ADF&G, Anchorage, personal communication, December 12, 1990.

NOAA Response Report

M/V ATLANTIC SEAHORSE
Cook Inlet, Alaska
August 13, 1991

John W. Whitney, Scientific Support Coordinator

Summary

On August 13, 1991, a work boat, 210-foot motor vessel ATLANTIC SEAHORSE under contract to ARCO Alaska Inc. crashed the Glomar Adriatic 8 drilling rig, ruptured a fuel tank, and spilled approximately 4,000 gallons of diesel fuel into the water. The collision occurred approximately 4 miles offshore of the North Forelands in Upper Cook Inlet. With fuel leaking from her ruptured fuel tank, the ATLANTIC SEAHORSE was pinned against the drilling rig by heavy tidal currents for about 90 minutes. Cook Inlet Spill Prevention and Response, Inc. (CISPRI), the area cleanup cooperative, arrived and began skimming the surface and laying down containment boom and absorbent materials. The spill at this point was described as a light sheen on the surface measuring about 2 miles long and 250 yards wide.

NOAA Activities

NOAA was notified on August 14, 1991, by the U.S. Coast Guard Marine Safety Office, (MSO) Anchorage. No requests for assistance were made because at the time of NOAA's notification, the spilled diesel had dissipated. The fuel was broken up and dispersed by 5- to 6-foot seas. Cleanup efforts by ARCO and CISPRI ended the afternoon of August 13, 1991. No environmental damaged resulted from the spill as it dissipated well offshore.

Name of Spill: Kenai Pipeline East Forelands spill

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 01/04/92

Location of Spill: From a pipeline on the KPL dock at Nikiski, Alaska

Latitude: 60°41'

Longitude: 151°24' W

Oil Product: North Slope crude

Oil Type: Type 1

Type 1 - Very Light Oils (jet fuels, gasoline)
Type 2 - Light Oils (diesel, No. 2 fuel oil, light crudes)
Type 3 - Medium Oils (most crude oils)
Type 4 - Heavy Oils (heavy crude oils, No. 6 fuel oil, bunker c)

Barrels: 31

Source of Spill: Pipeline

Resources at Risk:

None

Dispersants: Yes, attempted from helo bucket. Corexit 9527 was judged too viscous to flow through spray equupment, and no dispersant was released onto oil slick

Bioremediation: No

In-situ Burning: No

Other Special Interest:

Considerable amount of broken ice was present in Cook Inlet at this time of year. Oil was observed to abut areas of ice accumulation but not penetrate into it. Air temperatures were around 20° F, and at times flying conditions were marginal due to low clouds. At times it was felt that these flying conditions were unsafe, putting people more at risk than was the environment at risk from the oil spill. Only Mustang flotation suits rather than survival suits were worn by aircraft personnel.

Shoreline Types Impacted:

None

Keywords:

Corexit 9527, dispersant

Incident Summary:

The incident occurred on January 4, 1992, at approximately 12:30 am at the KPL dock in Cook Inlet at the town of Nikiski, Alaska. An oily water ballast mixture was being transferred between tanks, when the heat tape failed on a pipeline causing it to burst and release the oily water mixture into Cook Inlet. The facility at the KPL dock is owned jointly by Chevron and Arco, and they immediately accepted full responsibility for the accident. As a result the Cook Inlet Oil spill coop, CISPRI, had a foxtail skimmer on the slick within 45 minutes with a second one on scene by daybreak. Federal involvement was strictly monitoring, and the actual response lasted only four days, after which no further oil was sighted in Cook Inlet. The weather was temperatures at 20-25°F with light to strong winds from the NE and intermittent low cloud banks.

Behavior of Oil:

As was to be expected the oil slick was immediately caught in the Cook Inlet "rip" zones and followed a very perdictable pattern of 10 to 15 mile north-south tidal excursions with a gradual westward movement across the Inlet. This spill occurred under almost identical conditions to the Glacier Bay spill in 1987, and therefore, it was fairly easy to predict its movement, even though we had 18 hours/day of darkness. Of the 31 Bbls spilled, 16 Bbls were skimmed up, practically all of that on the first day. Only limited black oil pancakes (1-4 ft across) in heavy sheen were found the second day, and by the fourth day the energetics of Cook Inlet had incorporated practically all of the oil. The following oil budget was prepared for the FOSC and RP:

1. Loss due to natural processes (evaporation and dissolution)	20 - 30%
2. Loss due to sedimentation	1 - 5%
3. Recovered as of 1/7/92	40%
4. Oil widely dispersed over 600 square miles	15 - 25%
5. Oil remaining in rip zones as tarballs, mousse, oiled debris, etc.	5 - 10%
6. Beached Oil	<2%

Countermeasures and Mitigation:

Once the spill was discovered the source was immediately secured. As a precautionary measure, boom pallets were made up for Swamp and Packers Creeks, on the east side of Kalgin Island, but never deployed. All the recovery was open water skimming with a foxtail skimmer suspended over the side of a large mud boat-sized vessel. No shoreline impact occurred.

Other Special Interest Issues:

Attempted use of dispersant Corexit 9527 was unsuccessful as product was too viscous to flow through spill spray helo bucket application equipment. This was quite a surprise and is being fully investigated by CISPRI and Exxon Chemical.

NOAA Activities:

The SSC was on-scene at the command post in Nikiski on Jan. 4, and provided several important support functions. A trajectory of the oil slick was developed and used to help track the oil as well as input into the dispersant application. The SSC completed his part of the dispersant checklist, and utilized the dispersant mission planner in CAMEO SSC to help the RP plan the actual dispersant application parameters. Shoreline maps were extracted from CAMEO SSC and everyone used them as the standard for marking overflight observations. The weather was regularly monitored by the SSC as well as all the resource agencies were contacted by the SSC to make the determination that do resources were at risk. In addition the SSC was asked to participate on all overflights, to be the judge of the efficacy of the dispersant operation, and attended all command level meetings to determine strategies and objectives. In order to support the states desire to examine shoreline for possible oiling, information on key collection areas was obtained from RPI. The SSC was released on January 7, 1992.

References:

1. Coastal Sensitivity Atlas for Cook Inlet, Alaska; RPI Inc.

2. Jacqui Michel and Miles Hayes, RPI Inc., Columbia, SC

3. Jerry Galt, NOAA Hazmat, Seattle

NOAA Response Report

UNOCAL Granite Point Platform
Granite Point, Upper Cook Inlet, Alaska
April 21, 1992

John W. Whitney, Scientific Support Coordinator

Summary

On April 21, 1993, 2,000 gallons of diesel were spilled from the UNOCAL Granite Point Platform into Upper Cook Inlet. While transferring diesel from the main fuel tank to a day tank, a valve was inadvertently left open. The day tank overflowed and poured diesel into the inlet for about five hours before the valve was closed. UNOCAL mustered a full response team to the CISPRI command post in Nikiski and launched several CISPRI vessels with sorbent sweep. The strong tidal currents stretched the diesel sheen for a few miles. The USCG joined UNOCAL on overflights monitoring the rapidly dispersing diesel. Within three tidal cycles the diesel sheen had disappeared. Collecting the diesel from response vessels proved unsuccessful. During the incident, the weather was clear with light winds from the southwest.

Behavior

The spilled diesel became a sheen very shortly after it hit the water and moved with the tidal current of Cook Inlet during three tidal cycles before dissipating. No impacts occurred and no oil was recovered.

Countermeasures/Mitigation

The energetics of Cook Inlet thinned and dispersed the diesel leaving vessels equipped with sorbent sweep skimmers largely ineffective.

NOAA Activities

NOAA was notified of the incident on April 21, 1993, by the USCG. NOAA advised that the sheen would rapidly dissipate and that cleanup would be largely unsuccessful.

References

Dave Kruth, NOAA HMRAD Information Management, Seattle

Glen Watabayashi, NOAA HMRAD MASS, Seattle

Claudia Slater, ADF&G, Anchorge

References cont...

Ron Britton, USFWS, Anchorage

Name of Spill: ARCO King Salmon Platform

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 04/25/92

Location of Spill: Upper Cook Inlet oil and gas complex, MacArthur River Field

Latitude: 60°53'N

Longitude: 151°37'W

Oil Product: Cook Inlet crude

Oil Type: Type 3

Barrels: 8-10

Source of Spill: Platform

Resources at Risk: Beluga whales, shorebirds, gulls, foraging areas, migration stopover areas; but none affected

Dispersants: No

Bioremediation: No

In-situ Burning: No

Other Special Interest: None

Shoreline Types Impacted: potentially tidal flats, but no oil went ashore

Keywords: skimmers, sorbent boom

Incident Summary: The instantaneous release of Cook Inlet crude occurred from the ARCO King Salmon platform at around 0845 on April 25, 1992. Apparently the King Salmon platform was draining its production seperator and ailed to equalize pressure, filling a skimmer tank too quickly, resulting in a tank overflow of 8-10 Bbls of crude oil, creating a black slick approximately 400' x 100'. At the time the weather was clear, seas calm, and winds light to non-existent. Within an hour the CISPRI spill cleanup coop was on the slick and used a Foxtail skimming system with a side tow boom to concentrate the oil. Recovery was roughly 90% efficient by the end of the first day, and for the remaining two days, during which heavy to light sheen remained, collection was mostly through sorbent booms being towed by six contracted fishing vessels. Although there were lots of beluga whales in the immediate vicinity of the spill and lots of birds on shore, no signs or reports of oiled or distressed waterfowl or wildlife • occurred throughout the response. The response ended on the evening of April 27 after three days.

Behavior of Oil: The spill occurred during the peak neap tide with virtually no wind influence. A hindcast evaluation of the oils movement showed that its north-south movement was essentially what would have been predicted from the tidal current charts. It was observed that the slick did move westward into Trading Bay to within a mile of the shoreline. As the sheen and slick moved parallel to the Trading Bay shoreline, it was interesting to confirm that oceanographic currents do not carry oil onshore. As the result of no wind through the spill, no shoreline areas were impacted.

Countermeasures and Mitigation: The rapid response and use of the Foxtail skimmer to achieve approximately 90% recovery efficiency were duely noted.

Other Special Interest Issues:

None

NOAA Activities: The Coast Guard did not call NOAA on-scene during this response. Instead, support was provided via phone and fax. After the response was complete, the NOAA SSC compiled all the overflight information in order to further understand the circulation of this part of Cook Inlet.

References:

1. Doug Mutter, DOI Office of Environmental Protection, Anchorage.
2. Claudia Slater, ADFG, Anchorage.
3. Brad Smith, NMFS, Anchorage.

NOAA Response Report

Dolly Vardon Platform
Cook Inlet, Alaska
November 23, 1992

John W. Whitney, Scientific Support Coordinator

Summary

At approximately 1530, on November 23, 1992, the waste liquids tank on the Marathon Dolly Vardon platform overflowed allowing oil to drain into Cook Inlet. A slick of approximately 40 gallons of waste crude and hydraulic fluid, about 200 yards wide by 3/4 of a mile long extended away from the platform. Marathon immediately dispatched a helicopter to track the slick until dark. After dark a Cook Inlet Spill Prevention and Response Inc. (CISPRI) spill response vessel tried unsuccessfully to locate the slick. A helicopter overflight the next morning found no trace of the oil.

Behavior

The high currents stretched the slick into a sheen almost immediately. The oil naturally dispersed within two tidal cycles with no impacts reported.

NOAA Activities

NOAA was notified of the incident on November 23, 1992, by spill response officials from Marathon who asked for a prediction of where they might find the oil at first light the next morning. The NOAA SSC told them that the oil would probably disperse overnight, but if it didn't, the best place to look would be the mid-channel rip between the Forelands and Kalgin Island. No further response was necessary.

References

NOAA. 1992. CAMEO(tm) 4.0 for the Apple(r) Macintosh(tm) Computer. Washington, D.C.: National Safety Council. 400 pp.

NWS in Anchorage

CAMEO SSC

NOAA Response Report

M/V Sun Tide
Upper Cook Inlet, Alaska
August 23, 1993

John W. Whitney, Scientific Support Coordinator

Summary

At 0300 on August 23, 1993, the spill response vessel, M/V Sun Tide collided with the ARCO jack-up drilling rig, Gilbert Rowe, and ruptured a diesel fuel tank releasing 6,000 gallons into Upper Cook Inlet between the North Forelands and Possession Point. The first overflight at daylight reported a one- by two-mile rainbow sheen. Subsequent overflights showed the product to be dispersing and evaporating rapidly and by early afternoon the sheen had nearly disappeared. The vessel laid out its own boom and CISPRI deployed 18 response vessels, including nine fishing boats to tow boom. Weather was mild with light winds and a two-foot chop on the water.

Behavior

The diesel dissipated far more rapidly than predicted. The prediction was that a sheen would be observed for up to 90 hours but the entire incident was over in 12 hours. This is probably attributable to the numerous convergence zones in this part of Cook Inlet and the turbulence developed as the water flowed past the oil platforms. The response efforts were essentially ineffectual and no impacts occurred.

NOAA Activities

NOAA was notified of the incident on August 23, 1993, by the USCG. The initial report gave the amount of diesel lost as 11,000 to 13,000 gallons. In actuality, only about 6,000 gallons were lost. NOAA advised the USCG that their best strategy would be to simply monitor the situation.

References

Claudia Slater, ADF&G, Anchorage

Mary Lynn Nation, USFWS, Anchorage

NOAA Response Report

UNOCAL Cook Inlet Baker Platform
Upper Cook Inlet, north of Forelands, Alaska
April 6, 1994

John W. Whitney, Scientific Support Coordinator

Summary

The USCG received a report just before noon on April 6, 1994, from UNOCAL that a valve had been accidentally left open on their Baker Platform and 50 to 100 barrels of crude had escaped into Cook Inlet. UNOCAL immediately called their incident command team to Nikiski and established a command post at the Cook Inlet Spill Prevention and Response Inc. (CISPRI) headquarters. CISPRI immediately launched a mechanical cleanup capability (boats and skimmers) while completing the dispersant and in-situ burn (ISB) request forms. Neither of these alternative response techniques were needed because the oil thinned, evaporated, and dispersed too rapidly. A total of 40 barrels were collected mechanically. The USCG and the FOSC were onscene; however, their role was strictly one of consultation and monitoring. The response lasted about 8 hours. Weather was warm and sunny; although a small amount of floating ice (<10%) was in the area.

Behavior

The spilled oil was middle ground shoal crude, a very light oil with an API of 42, predicted to evaporate 50 percent within the first 12 hours with no predicted dispersion. However, due to the dynamics of Cook Inlet, less time is needed for dispersion. Initially the oil formed a slick 1 mile by 1/3 mile and moved predictably with the tidal currents. UNOCAL calculated that 96 barrels were spilled and about 40 barrels were recovered. The balance is believed to have evaporated and dispersed naturally. No significant winds were present and no areas were impacted.

Countermeasures/Mitigation

CISPRI maintains a 24-hour floating response vessel that immediately deployed boom and skimmers; other vessels were immediately launched from the nearby CISPRI warehouse. The rapidity of their response is the reason they were able to achieve a 40 percent open-water recovery. ISB and dispersants were both approved and staged but not used.

Other Special Interest(s)

Approval was obtained to conduct an ISB; however, the oil thinned too rapidly to be re-concentrated sufficiently to conduct the burn. Similarly, dispersants were approved for use by the FOSC, but the oil evaporated and dispersed so rapidly that 5 or 6 hours

Other Special Interest(s) cont...

after the release there no slicks remaining that could be dispersed. Interestingly enough, after this response the Cook Inlet RCAC endorsed ISB as a primary response tool whenever there is ice present.

NOAA Activities

NOAA was notified of this incident on April 6, 1994, by the USCG who requested on-scene assistance. The SSC notified and consulted with the resource agencies and the weather service. Since both dispersants and ISB were considered, oil movement trajectories and oil behavior characteristics were provided to the FOSC, UNOCAL, CISPRI, and resource and regulatory agencies. Onscene, NOAA represented the FOSC on the dispersant's effectiveness spotter plane; however, after flying for about an hour, no oil was located. NOAA supported this incident for 10 hours.

References

NOAA. 1993. ADIOS(tm) (Automated Data Inquiry for oil Spills) User's Manual. Seattle: Hazardous Materials Response and Assessment Division, NOAA. 50 pp.

National Weather Service, Anchorage

Ron Britton, USFWS, Anchorage

Claudia Slater, ADF&G, Anchorage

Brad Smith, NMFS, Anchorage

NOAA MASS; Seattle NOAA Hazmat

ADIOS Oil Weathering Program, NOAA Hazmat, Seattle

Name of Spill: Tug Barge Annahootz

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): (090194)

Location of Spill: Port of Anchorage

Latitude: 61,05,N

Longitude: 150,00,W

Oil Product: Diesel

Oil Type:
Type 2 - Light Oils (diesel, No. 2 fuel oil, light crudes)

Quantity: 400-500 gallons

Source of Release: Barge

Resources at Risk:

None

Other Special Interest:
None

Keywords:

Evaporation

Incident Summary:

MSO Anchorage was notified on the morning of Sept 1, 1994, that the barge Annahootz had spilled approximately 500 gallons of diesel into Cook Inlet while onloading at the Port of Anchorage. Spill occured when oil folwed up through No. 1 port expansion trunk and sounding tube and onto the wooden deck of the barege which became saturated with oil. The response was initiated by Forty-Niner Transportation, the responsible party, but Verca, a local spill contractor, was hired to continue the response. The oil moved under the dock and out the north end in response to a back eddy from the ebbing tide. Containment boom and sorbents were deployed around the barge and at the north end of the dock. Sheen extended north along the shore from the vicinity of the dock to the vicinity of Cairn Point, 2-3 miles north, for approximately 50 to 100 yds offshore. An overflight by the owner and the SSC reported isolated ribbons and stringers of sheen observed with no more than 50 gallons of diesel on the water near Cairn Pt. The same overflight observed no wildlife activity on shore within 3-4 miles of Cairn Point. Much of the diesel dispersed naturally in the energetic currents of Cook Inlet. However, the next morning the MSO representatives noted approximately five small sheens dispersed throughout the dock area, but judeged that further cleanup was possible. Approximately 100-110 gallons of oil/water mix were recovered. The weather throughout the incident were light winds from the SW and good visibility.

Behavior of Oil:

No areas were impacted by the diesel slick which rapidly weathered and dispersed in the Cook Inlet energetic environment. Interestingly the sheen moved north along the coast during an ebb tide, apparently in response to a back eddy. Approximately 100-110 gallons of oil/water mix were recovered out of 400-500 gallons of diesel spilled.

Countermeasures and Mitigation:

Containment boom and sorbent boom was deployed around the barge. Some oil was recovered as the current carried the slick into a shoreline entrapment boom configuration. No open water recovery or shoreline cleanup were necessary. The COTP ordered that the oiled wood planking on the deck of the barge be removed and the deck cleaned. The barge sailed on Sept. 3.

Other Special Interest Issues:

None

NOAA Activities:

The SSC was notified of the Annahootz incident less than one hour after the MSO was notified. Support in terms of weather , tidal currents, and notification of resource agencies was provided. The SSC was asked to accompany the responsible party on an overflight of the Port of Anchorage during which the dock area and the coastline north of the dock for five miles was inspected. The sheen off Cairn Point was noted and estimated to be less than 50 gallons and rapidly dissapating. It was also noted that no wildlife appeared to be in the threatened area. The NOAA support lasted for only one day.

References:

1. DOI, Anchorage
2. Brad Smith, NMFS, Anchorage
3. Ron Britton, USFWS, Anchorage
4. NWS, Anchorage

Name of Spill: Unocal Platform Anna

NOAA SSC: David Kruth and John W. Whitney

Date of Spill (mmddyy): 111894

Location of Spill: At Granite Pt. oil field in Upper Cook Inlet

Latitude: 60,58.37,N

Longitude: 151,18.46,W

Oil Product: Granite Pt. crude oil

Oil Type:

Type 2 - Light Oils (diesel, No. 2 fuel oil, light crudes)

Quantity: 15 BBls

Source of Release: Platform

Resources at Risk:

Nonr

Other Special Interest:
None

Keywords:

Natural dispersion

Incident Summary:

While conducting drilling operations, Unocal platform Anna pumped drill mud through an open valve into a skim tank, overflowing onto the deck, entering the platform deck drains. This filled the deck drain tank with mud and displaced the water and oil contents. Approximately 125 bbls of mud were pumped into the half full tank, subsequently overfilling it. Approximately 60 bbls of water/mud fluid, containing an estimated 15 bbls crude oil, spilled into Cook Inlet. CISPRI, the industry spill coop, deployed its offshore recovery vessel, the Banda Seahorse, to the area for response. Cleanup and oil sighting was hampered by darkness in the predawn hours. The release of fluids into Cook Inlet occurred at about midnight. An overflight at mid morning sighted an intermittent dissipating silvery sheen approximately 4 miles X 20 yds. Unocal activated an ICS at the CISPRI command center in N ikiski. However, the oil naturally dispersed and diluted by noon with no observable shoreline impact. Throughout the incident the weather was clear and winds were NE at 10-20 knots producing choppy seas.

Behavior of Oil:

Granite Pt. crude is a very light oil having an API of 42.8. This combined with the natural energy of the Cook Inlet system caused the oil the disperse and dissapate in roughly 10 to 20% of the time predicted by ADIOS. None of the spilled oil was recovered.

Countermeasures and Mitigation:

Open water recovery was attempted and was largely uncuccessful due to the rapidly dispersing oil sheen.

Other Special Interest Issues:

None

NOAA Activities:

NOAA Seattle was notified of the spill around 0730 on Nov. 18, as the resident SSC was out of the state. A trajectory and oil fate was requested. NOAA Seattle complied with a trajectory was showed that the water at the platform site was ebbing which meant that the oil sheen could be found several miles NE of platform Anna, as an initial flood cycle has already occurred since the release. The support consisted of faxing a trajectory to MSO Anchorage.

References:

1. Glen Watabayashi, NOAA MASS, Seattle.

Name of Spill: Tesoro Tank Spill

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 120595

Location of Spill: Just offshore Nikiski in the central Cook Inlet area

Latitude: 60,41,N

Longitude: 151,26,W

Oil Product: s North Slope crude

Oil Type:

Type 3 - Medium Oils (most crude oils)

Quantity: 40 bbls into the Inlet

Source of Release: Facility & Pipeline

Resources at Risk:

Some seaducks and overwintering birds

Other Special Interest:

None

Keywords:

CISPRI

Incident Summary:

As the result of a frozen flow valve, an onshore Tesoro tank transferring North Slope crude overflowed into a diked area just before noon on Dec. 5, 1995. Workers at the scene, however, didn't realize that the valve to drain storm water from the diked area was left open. This valve led to a pipeline which discharged 200-300 meters offshore on the seafloor. This release into the water was discovered by a commerical helicopter pilot who spotted the sheen two hours after the initial overflow had occurred. The spill coop, CISPRI, was immediately notified and by 1600 its standby vessel, the Banda Seahorse, was able to respond. Due to the continuous release and the strong flooding tidal current, the oil was in stringers and sheen spread over an eight mile length. In the one or two hours before darkness the response boats were only able to drag viscous sweep and absorbent boom. The next day the oil slick area was much smaller, and by noon observers were unable to see any sheen on the water. Tesoro, the RP, established a full ICS at the command post in Nikiski, and MSD Kenai personnel handled the entire spill. Weather during the spill was extremely cold with tempertures to -20°F, with only slight winds.

Behavior of Oil:

The spilled oil never formed a coherent slick as it entered the water from a pipeline release over roughly 2-3 hours. Because of the strong tidal currents in Cook Inlet this caused the oil to be in stringers and ribbons over an eight mile spread. The flood tide carried the oil roughly 12 miles north of Nikiski around the East Forelands and extending past Boulder Point. The return ebb moved the slick westward and by the second ebb on Wednesday morning the slick was in the mid-channel rip zone shortly after which it totally dissapated from the surface. No shoreline or wildlife were impacted, and an unknown amount of the initial 40 bbls released into the water was collected with the absorbent boom. It is believed that most of the oil was naturally dispersed into the water column.

Countermeasures and Mitigation:
See above description

Other Special Interest Issues:

None

NOAA Activities:

The NOAA SSC was given a heads-up call regarding the spill on Tuesday afternoon initially by CISPRI. Once the full story came out a few hours later, tidal current data, a trajectory, and a prediction of the oil's fate was provided the Coast Guard. It was noted that the release occurred at roughly the slack before a flood tide, and that several spills in the past ten years had occurred in this location with that same tidal situation. As a result I was able to predict that the oil would move northward around the East Forelands before returning on the eff tide and moving westward in the process. No shoreline impacts were predicted, and it was suggested that the remnants of the oil would move into the mid-channel rip zone which would probably gobble up the last traces of the oil. On Wednesday morning Seattle MASS was asked to run a trajectory, which accurately portrayed the northern and southern movements of the slick, but didn't accurately predict the rapid actual westward movement of oil. Since this was a repeat of very similar situations in the past, we felt fairly comfortable in predicting the short duration of the slick and the lack of impacts. Everything was handled by phone and fax , and the NOAA support lasted roughly one day.

References:

1. Glenn Watabayashi, NOAA Seattle MASS
2. Glacier Bay spill report, July 1987, Cook Inlet
3. KPL spill report, January, 1992, Cook Inlet
4. NWS, Anchorage

Name of Spill: UNOCAL Steelhead Platform

NOAA SSC: John Whitney

USCG District: 17th

Date of Spill: March 6, 1997

Location of Spill: Upper Cook Inlet, 6 mi. N. of Forelands

Latitude: 60°45' N
Longitude: 151°40' W

Spilled Material: diesel
Spilled Material Type: TYPE 2

Amount: 214 barrels, 8988 gallons

Source of Spill: Offshore platform

Resources at Risk:
None

Chemical Countermeasures: n/a
Bioremediation: n/a
In-situ Burning: n/a

Other Special Interest: Release occurred via 6" underwa- ter pipe over four hours

Shoreline Types Impacted:
no shoreline oiled

Keywords:

Incident Summary:
NOAA SSC was notified by MSO Anchorage on Thursday evening, March 6, that a release of approximately 214 bbls of diesel had occurred from the UNOCAL Steelhead platform in Upper Cook Inlet. The Coast Guard asked me for a trajectory and fate evaluation of the diesel. I had just completed an ice survey of that portion of Cook Inlet earlier in the day, so I had a first hand view of the what the conditions were like. The CG and UNOCAL were able to get in one overflight prior to darkness, and it revealed a sheen of scattered diesel spread over an area 5 miles long by 3/4 mile wide and dispersing rapidly amongest the scattered small ice floes throughout the area. Due to an ebb tide, the CG was advised that the diesel sheen would stretch out and be carried southward into the mid-channel rip from the platform, and that the moderate amount of ice would mechanically work the diesel enhancing its natural dispersion, and that the diesel would be completely dispersed by morning. A 7 o'clock first-light overflight the next morning was unable to find any evidence of the diesel. Through out the incident the winds were calm and the temperatures were in the upper 20's F.

References:
ADIOS
National Weather Service, Anchorage
SHIO

Name of Spill: Dillon Pipeline

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 102399

Location of Spill: right at the Forelands in Cook Inlet

Latitude: 60,40,N

Longitude: 151,25,W

Oil Product: Middle Ground Shoal crude oil

Oil Type:
Type 2 - Light Oils (diesel, No. 2 fuel oil, light crudes)

Quantity: around 12 bbls

Source of Release: Pipeline

Resources at Risk:

None

Other Special Interest:
None

Shoreline Types Impacted:

None

Keywords:

Natural dispersion

Incident Summary:
Unocal, which operates 10 of the 15 production platforms that drill for oil in Cook Inlet, notified oil-spill responders at 5 a.m. on Oct. 23, when its sensors detected low pressure in the 6 mile line between the Dillon Platform and Unocal's facility in Nikiski. About 550 barrels of crude flows through the line daily. An 11 a.m. flyover detected a 10 mile lone sheen of oil. The sheen had largely dissipated by 2:30p.m. and responders reported no effect on the shoreline or wildlife. Unocal and spill response vessels laid boom lines and collected small amount of oil. Unocal shut down operations at the platform and ran water through the line to push the remaining oil to Nikiski. It planned to insert natural gas in the line to detect the location of the break, then send divers in to make repairs. It was determined that approximately 12 bbls of oil were released.

Behavior of Oil:
Middle Ground Shoal crude is a very light crude having an API of around 41, and as a result has a very high percent evaporation level. This combined with the strong natural dispersion tendency of the Cook Inlet tidal currents caused the oil to rapidly dissipate from the surface of the water. The initial 10 mile long slick was due to the strong tidal currents. No impacts occurred to shorelines or wildlife, and very little of the initial 12 bbls released was recovered.

Countermeasures and Mitigation:

Unocal and spill response vessels laid boom lines and collected small amount of oil. Unocal shut down operations at the platform and ran water through the line to push the remaining oil to Nikiski.

Other Special Interest Issues:

The spill occurred on a rising tide, which meant that the tidal currents were fairly strong. As has been noted in other Cook Inlet spills around the Forelands, the oil was immediately pulled into the mid-channel rip zone; and exhibited a sinking or disappearing behavior during the ebb tidal cycle. This phenomena has also been noted in other spills in which the strength of the convergence zones is so strong that the oil is actually pulled beneath the surface of the water.

NOAA Activities:

NOAA's involvement in this spill was by phone and fax; the Coast Guard did not request an on-scene presence. Over the phone, NOAA noted that the oil would move into the rip zones and tend to exhibit sinking characteristics. The detailed results of one of the early overflights was faxed to NOAA to calculate an oil budget. It was from this information that the 12 bbls figure was determined.

References:

1. ADIOS, NOAA Hazmat oil weathering computer program

2. SHIO, NOAA Hazmat tidal height and current computer program

Name of Spill: Cross Timbers Facility

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 051101

Location of Spill: East Forelands, Cook Inlet, Alaska

Latitude: 60,45,N

Longitude: 151,15,W

Oil Product: emulsified crude oil

Oil Type:

Type 3 - Medium Oils (most crude oils)

Quantity: 50 to 100 gallons

Source of Release: Facility

Resources at Risk:

none

Other Special Interest:
None

Shoreline Types Impacted:

Gravel beach

Keywords:

SAR imagery

Incident Summary:

On Friday, May 11, a mystery sheen was report on the water immediately west of the East Forelands in Cook Inlet. Since the sheen was fairly significant and no source had been identified, the Coast Guard opened the response fund and hired CISPRI to clean up the oil. Over the weekend everything was quiet until again on Monday, May 14, another mystery sheen with minor oil was reported off the East Forelands; in particular one sheen that seemed to be emanating from a point source seemed to point to a subsea pipeline release. This time the UNOCAL pipeline between their Dillon platform and the East Forelands was suspected as UNOCAL had been conducting a pigging operation over the affected time period. Being a good corporate citizen, UNOCAL did claim responsibility and began pressure testing their lines. On one of the overflights on Monday, it was also noticed that oily water was coming out of the bluff just immediately north of the East Forelands. On closer examination, this was determined to be the Cross Timbers, an onshore facility, produced water discharge line that had a NPDS discharge permit from EPA. However, at a corrosion point down the bluff water and oil was escaping from this pipeline which normally discharged 800 feet offshore. Samples from both the on water oil slick and the bluff discharge were taken and sent to the Coast Guard COIL laboratory for analysis. Meanwhile the UNOCAL pressure test on their subsea pipelines indicated that they were strong and intact. Several days later the COIL analysis came back with the somewhat surprising result that the on water oil slick and the Cross Timbers bluff oil discharge were, in fact, the same oil. Cross Timbers then assumed responsibility for the spill and proceeded to handle the subsequent clean up of the minor shoreline bluff oiling. Meanwhile EPA is investigating how Cross Timbers violated their NPDS permit by allowing such large amounts of oil into their produced waters discharge line.

Behavior of Oil:

On the water, the discharged oil formed a sheen containing shreds and tarballs of oil. The high energy of Cook Inlet quickly caused the slicks to disperse and dissipate.

Countermeasures and Mitigation:

A skimmer was deployed by CISPRI, but had minimal success in collecting any oil due to the natural high energy of the Cook Inlet system.

Other Special Interest Issues:

SAR imagery

NOAA Activities:

The Friday, May 11, release was so minor that the NOAA SSC was not notified of the situation until after the siting of the Monday mystery slick. With the minor amount of oil involved, trajectories and resource at risk were of little concern. Identifying the source was the most important issue. Meanwhile NOAA's NIST SAR group, in Maryland, got wind of the spill and as part of their Alaskan SAR demonstration project began examining SAR images for signs of the oilslick. A SAR image taken on Monday, May 14 at 1930 seemed to reveal some patches with smoothing of the water just offshore and south of Nikiski, and these were interpreted as possible oil slicks and sent to the NOAA SSC for ground trothing. One patch was particularly suspicious as there appeared to be a vessel, interpreted as a skimmer, in the middle of it. After consultation with a number of folks who were on-scene at the time of the image , both on the water and in the air, confirmation indicated that the dark patches on the SAR image seemed to be false positives of an oil slick. They were much too large for the quantity of oil, and weren't quite in the right places. The vessel identified in one of the patches is thought to possibly have been a CSX container vessel. A subsequent SAR image on Wednesday morning revealed nothing; although be this time there was nothing to detect due to the energetics of Cook Inlet natural oil dispersion. The NOAA SSC was not called on scene, and conducted all his analysis and communications from the MSO Anchorage office.

References:

NOAA NIST Alaska SAR Demonstration Project, Gaithersberg, MD

Name of Spill: Dillon Platform

NOAA SSC: John W. Whitney

Date of Spill (mmddyy): 112701

Location of Spill: Upper Cook Inlet, Middle Ground Shoal field

Latitude: 60,45,N

Longitude: 15130,W

Oil Product: crude oil, Middle Ground shoal crude

Oil Type:

Type 2 - Light Oils (diesel, No. 2 fuel oil, light crudes)

Quantity: approximately 50 barrels

Source of Release: Platform

Resources at Risk:

None

Other Special Interest:
None

Shoreline Types Impacted:

None

Keywords:

Natural dispersion

Incident Summary:

NOAA SSC was contacted by MSO Kenai at 9 a.m. on the morning of November 27, 2001, to report that a small, but undetermined amount of crude oil had spilled into Cook Inlet from the production platform, Dillon, in the Middle Ground Shoal Field. Turns out that the leak was detected at 2:30 am by a Unocal employee making inspection rounds. As a result Unocal shut down its platform and called in its cleanup contractor, Cook Inlet Spill Prevention and Response Inc. The spill came from a cracked fitting on a three-sixteenth-inch diameter pressurized pipe used in the platform's oil production system. The leak lasted for less than two hours as the pipe had been operating normally at the previous patrol at 12:30 am. A predawn overflight using an infrared camera detected a 50 X 300 foot sheen seven miles south of the platform, however, a sweep by the response vessel Seabulk Montana at 6:30 am found only traces of oil. Furthermore, an overflight at first light at 10:00 am showed no oil on the water. At the time the weather was clear and cold with 15 knot NE winds.

Behavior of Oil:

Dispersed naturally due to the dynamics of Cook Inlet and lightness of the oil.

Countermeasures and Mitigation:

A skimmer was deployed in the early morning darkness, but only traces of the oil were encountered. The shut down of the platform stopped the source of the leaking oil once the leak was discovered.

Other Special Interest Issues:

None

NOAA Activities:

Once contacted by the Coast Guard MSO Kenai and knowing the oil spill history and dynamics Cook Inlet, the NOAA SSC predicted that the small amount of the release would be naturally dispersed in a time frame of hours. Furthermore, the API gravity of Middle Shoal crude oil is extremely light at 42, a fact that lends further credence to the above prediction. Nevertheless, an oil slick trajectory was prepared for the Coast Guard and ADEC for their first light overflight at 10:00 in the morning. No oil was observed on the water on that overflight. The NWS was consulted regarding existing and predicted conditions, and it was learned that winds were 15 knots NE, with little chop on the water, with the same predicted for the remainder of the day.

References:

SHIO, a NOAA Hazmat tidal height and tidal current prediction computer program, Seattle.

NWS, Anchorage