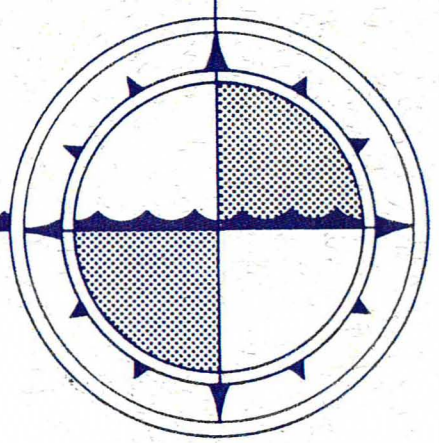
Pacific Marine Science Report 72-11

PRELIMINARY REPORT ON THE OIL SPILL FROM THE GROUNDED FREIGHTER "VANLENE" MARCH, 1972

R.H. Herlinveaux



ENVIRONMENT CANADA
Water Management Service
Marine Sciences Directorate
Pacific Region
1230 Government St.
Victoria, B.C.

MARINE SCIENCES DIRECTORATE, PACIFIC REGION

PACIFIC MARINE SCIENCE REPORT NO. 72-11

PRELIMINARY REPORT ON THE OIL SPILL FROM THE GROUNDED FREIGHTER "VANLENE"

March, 1972

by

R. H. Herlinveaux

M.S.D., Oceanographic Section
Pacific Environment Institute
West Vancouver, B.C.

Victoria, B.C.
Marine Sciences Directorate, Pacific Region
Environmement Canada
June, 1972

Introduction

On the evening of March 14, 1972 the freighter "Vanlene", bound for Vancouver from Japan, ran aground at the entrance to Barkley Sound on the west coast of Vancouver Island (Figure 1). (The "Vanlene" was sailing under a "flag of convenience", Panamanian registry.) At the time of collision the vessel was approximately 30 miles off course. Fortunately, the entire 38-man crew was rescued by the timely efforts of the Canadian tug "Neva Straits", which then transferred the survivors to CNAV "Laymore" - which had also been called to the scene - for landing at Alberni.

In the course of the grounding, several of the "Vanlene's" fuel and lubricating oil tanks were ruptured, the worst breaks occurring in the vicinity of the engine room; the oil immediately commenced to leak from the vessel (Figure 2). It may be noted that, at the time of grounding, the "Vanlene" had on board approximately a total of 100,000 imperial gallons of bunker B, diesel fuel and lubricating oil.

Several Canadian government ships had answered the distress message of the "Vanlene"; therefore on the first day of the spill CCGS "Camsell" and "Ready", along with CNAV "Laymore" and "Comox Post" of the Fisheries Service, were on the scene. "Sudbury II", the ocean-going tug of Seaspan International Ltd., also appeared in the area on tender to M.O.T. as a salvage vessel. Another sea-going tug, the CNAV "St. Anthony", was later brought into operation to transport pumps, "booms", "slicklickers" and supplies to the scene. The CSS "Vector" arrived on March 18 carrying Fisheries Research Board personnel to assess possible damage to shell fish and to the herring spawning grounds and also to survey the extent of oil contamination. The "Comox Post" and several fishing vessels were used by biology students from Simon Fraser University to conduct beach surveillance for oil.

Objectives of the Operation Described in this Report

After the rescue of the "Vanlene" crew, an operation primarily concerned with the effect of the oil spillage from the vessel came into being. Its objectives were:

1. The assessment of the oil-containing capacity of the vessel.

2. The arrangement for acquisition of material and equipment (booms , slicklickers , etc.) to combat spillage.

...2

3. The determination of the extent of the spilled oil by aerial and surface reconnaissance.

4. The corraling of spilled oil by the use of two types of booms.

5. The "treatment" of oil with peat moss.

6. Experiments to determine the usefulness of booms and slicklickers in removing oil from open water.

7. The setting up of methods to efficiently assess the extent of the oil spill and to designate several "experimental" areas for observation to determine long-term effects.

8. Removal of oil remaining on the vessel.

Most of the above items will be thoroughly covered in separate reports to be issued later. The present report is therefore basically preliminary in nature.

General Weather Conditions

The air (40°-50°F) and water (40°-43°F) temperatures experienced during the period March 14-23 were not unseasonal. Precipitation was typical for this time and area; during the period of the operation there occurred three days of heavy rain (approximately 3 in/day) and several days of clear "westerly" weather, accompanied by offshore fog banks. The offshore winds were variable, several days of southeast winds being succeeded by westerlies interspersed with the odd day of northeast winds. This variability in the wind resulted in concomitant variability in sea state at the scene of the grounding.

Geographic Location

The grounding of the "Vanlene" occurred on rocks off Austin Island at the southwestern end of the Broken Group Islands in Barkley Sound (Figure 1).

The sound is a large, roughly rectangular body of water with three main channels: Trevor, Imperial Eagle and Loudoun, which are separated from each other by groups of islands. The coastline is indented by several narrow inlets and small bays. On the northwestern portion the foreshore consists basically of a gently-sloped rock and gravel beach, whereas elsewhere the foreshore tends to be rather steep and rocky.

...3

Oceanographic and Meteorological Features

During the winter months runoff in the area tends to be extensive, four main rivers - Effingham, Toquart, Maggie and Sarita - being the main contributors within the sound. Alberni Inlet is a source of low-salinity runoff water from the more-inland drainage area.

During March, 1972 runoff was above average along the coast (Water Survey of Canada, private communication). Several estuarine circulation patterns can arise from varying runoff and changing meteorological conditions. These patterns can perhaps be illustrated by means of the surface-salinity distributions. Herlinveaux (1966) showed examples of these distributions from surface data collected in 1954, and deduced that these were basically two forms, as shown in Figures 3A and 3B. The associated circulations, on the basis of the few actual measurements conducted in the area at the time, are indicated by the arrows. Although the runoff was lower for the period dealt with in Figure 3 than in the working period in March, 1972 one might expect that the patterns would not change significantly in form but only perhaps in intensity.

The orographic features associated with the borders of the sound deflect the winds from a "normal" geostrophic pattern. As a result, winds tend to possess an onshore component, regardless of the wind direction off the west coast; the predominant components are westerly and southeasterly. The presence of diurnal winds, common when clear skies prevail, results in changes in wind direction in the morning and late evening. Periods of calm are generally associated with the times of change. At any given time, for moderate or light winds, marked variation can exist within the sound; this can, for example, be detected from the air by the variability in sea state. This characteristic of the wind within the area is believed to have a marked effect on surface-water movement. Examples of such movements are shown in Figures 4 and 5.

These figures (aerial composite photos of the area, courtesy of the Air Division of the Surveys and Mapping Branch, B. C. Department of Lands, Forests and Water Resources) show wind-wave movement from two dominant wind directions - westerly (Figure 4) and southeasterly (Figure 5). Also shown in these figures are "streaks" or "bands" of darker water (slicks). These are assumed to be associated with "oil" produced by organic material within the intertidal zones of the reefs and islets.

Throughout the entire period of the operation (March 14-23) a westerly swell predominated in the sound. The sea state varied with the wind intensity and direction.

...4

The location of the "Vanlene" grounding is also indicated with a large "X" on Figure 4. This location is exposed to the open ocean environment from the southeast to the northwest, but tends to be in a "lee" position with respect to west and north.

Personnel

The co-ordinator of the project to study the consequences of oil spillage, Mr. L. E. Slaght of M.O.T., was assisted by personnel from various departments. Mr. R. Baird, of the Steamship Inspection Branch, was to report on the state of the "Vanlene" and to work in close cooperation with the Salvage Master of Seaspan. LCDR. S.J. Fairbairn, Canadian Forces, had the responsibility of acquiring vessels and equipment and supplies such as sea trucks, barges, "booms", peat moss, etc. all of which were on route to the area within a day. Mr. J. Bennett of Bennett Pollution Control Ltd. supervised the assembly and deployment of the "Bennett boom", and advised and assisted in the use of the large pump he had brought to the scene for emptying the vessel's oil tanks.

A team of biologists located at the Bamfield Marine Station was carrying out field work in the Bamfield area. Dr. W. Austin, head of the team, volunteered to move into the oil-affected area to determine the extent of contamination. Dr. Austin, assisted by Dr. L. Dreuhl, organized 30 to 40 University biology students to survey a number of sampling areas, some contaminated by oil, some not, for periodic examination in an on-going study to determine extent of permanent and temporary damage. This team continued to sample the area quite extensively up to March 19, and have since returned to the area several times.

Another group arrived on March 18 on the CSS "Vector". This group consisted of Dr. D. Quayle and Mr. D. Outram of the Pacific Biological Station, Nanaimo. They surveyed the vicinity of the islands and the herring spawning areas from Mayne and Toquart Bays to Amphitrite Point. They found little evidence of oil at this time; a few sea gulls were noticed to be spotted with oil but they could have flown in from areas nearer the wreck. It may be noted that Quayle and Outram returned to the area about three weeks later, on the neap-tide period; their findings on these two and on further investigations to be made will be published separately. Mr. A. Ages, who also accompanied this group, was interested in determining the extent to which the oil had spread. His conclusions have already been published (Ages, 1972). He also tried sampling the water column in several areas to determine if the oil was emulsified and had spread throughout the water column.

...5

Capt. A. McRae, of the Fleet diving unit, Canadian Forces, had an eight-man diving team on board the CNAV "Laymore" at the time of the "Vanlene" sinking. The diving team was deployed to determine the extent of damage and to recover the ship's engineering logs and engineering diagrams; they succeeded in both tasks.

Aerial Surveys

Observations from a helicopter were carried out by Mr. Slaght whenever weather conditions permitted. The flights showed that the oil had travelled into Loudoun Channel (Figure 1) on the first day following spillage, but visibility was insufficient to carry out complete assessment of the area on a daily basis. However, those oil slicks that were noted were moving northwestward in the same general direction as the "natural" slicks shown in Figure 5.

These aerial surveys indicated that the oil most distant from the wreck was dispersing readily; attention was therefore focussed both on the oil in the immediate vicinity of the wreck and on that remaining aboard.

Observations

A "harbour boom" was first deployed through the islets north of the wreck, to the northerly side of Austin Island. This type of boom was constructed of large fishing floats, about 6" to 8" in diameter, strung on a nylon towline, the whole enclosed in a canvas-like material.

The original plan was to direct and localize the oil behind Austin Island so that it could be collected by the "slicklickers" when they became available. Unfortunately, before an attempt could be made to "gather up" the oil, the wind increased and the sea became somewhat choppy; the oil commenced "jumping" the harbour boom and moving away from the designated "corral".

The work boat from the CCGS "Camsell" was directed to proceed to the beach areas characterized by the heaviest concentration of oil (such as Cooper Island - Figure 6A) and also to any large slicks they could locate. The crew spread dry peat moss over the affected areas. The continuous torrential rains and the heavy surf in the vicinity of the beach made this spreading a thoroughly miserable job; at the beaches it became impossible to continue on the high tide because of large numbers of logs washed onto the foreshore. However,

...6

approximately 30 bales of moss (each of approximately 10 cu. ft. in volume) were spread during the first day to hold the oil and prevent it from endangering bird life in that area.

In addition, the "Comox Post" was used both in transporting students to survey various locations (Page 4) and in spreading peat moss on very oily patches found around the islands.

On some contaminated beach areas the limbs of shoreline trees overhung the water at high tide. In one area the limbs of shoreline trees were covered in oil by the incoming tide.

RESULTS:

Removal of Oil from Fuel Tanks

On the morning of March 20, it appeared that at least one more tank containing bunker B had ruptured, even though it was believed that no significant quantity of such oil remained on the ship. The resulting slick, driven by a northeast wind, moved onto and between the seaward islands of Barkley Sound. Up to this time these islands had received very little oil. It was therefore decided that an attempt should be made to pump both the forward tank (believed to contain an appreciable amount of oil) and the engine room with the large " Bennett" pump. By evening, 2500 gallons had been removed. The next day, Seaspan personnel attempted to pump again, using a pump smaller than the Bennett type; some success was achieved.

Effectiveness of "Harbour" Booms

Harbour booms were the first used in the wreck area, and as long as there was little current and a calm sea oil could be corralled. However, most of the time foot-high seas moved the oil over the top of the boom; also if the water movement was perpendicular to the boom, some oil moved under the boom.

"Bennett" Boom

The Bennett boom was assembled alongside the wharf in Bamfield (Figure 7) in approximately 26 hours. The 1500 ft. boom basically consists of synthetic materials which were weighted down by a lead-like apron buoyed up by

...7

"styrofoam logs". The apron hung 6 ft. down in the water while it extended up, like a sail, 2 ft. above the buoying system. The boom can be towed at a speed of at least 8 knots. After assembly it was towed out from Bamfield, but could not be put into operation immediately because of weather conditions. Finally, the boom was secured between the rocks to the north of the "Vanlene", and a tug towed the other end alongside the vessel (Figure 8). Some oil was actually corralled by the boom (Figure 9) but it could not be removed. On several occasions, a weather prediction for the following day was obtained by radio. Plans were therefore made to use the Bennett boom to take advantage of the "corralling effect" of the expected wind drift. Unfortunately, the weather system either moved faster than expected or did not materialize at all; thus by the time the boom was in place, the prevailing surface current was in an unprofitable direction (Figure 10).

On March 21 the boom was set out to the eastward of the wreck; it was planned to use slicklickers to pick up any intercepted oil. However, only a very small amount of oil appeared (Figure 11); in addition, the slicklicker was, unfortunately, non-operational.

The Bennett boom, when used as a surface-movement deflector, worked well and oil moving in the area could be directed as already noted (Figure 9). However, when the boom was used as a collector on the open coast (surface flow almost directly onto the boom) it did not stop the oil movement in the deeper water, but as it approached the shallows oil was very noticeably being collected (Figure 12). The oil did not "jump" the boom as it had in the harbour boom situation. On the basis of the present experience it is believed that, unless a very deep boom (which would be unwieldy) could be built, oil could never be effectively corralled in the presence of an appreciable swell and/or surface current. However, used as a deflector it worked rather well when the current flow direction was at an angle to the boom. It was planned, on one trial, to tow the Bennett boom in the shape of a "V" and operate a slicklicker at the apex of the "V", but sea conditions prevented such a trial.

Slicklickers

Two slicklickers appeared on the scene; one, the older type model and the other, new from the east coast. The older model was tried several times; however, the swell present even behind the island did not allow any oil to be "licked" up as the apparatus kept diving under the oil and picking up only water. On the first day of use, the newer machine was plagued with leakage problems due to loose plates in the flotation pontoons. This condition resulted in both motors being flooded with salt water. From this time on, the machine had to be pushed by a power barge.

...8

CONCLUSIONS:

It was fortunate that the "Vanlene' oil spill was a minor one. It was quickly realized that, even for a spill of this size, the personnel involved were very inadequately equipped and generally ineffective in coping with the situation. Both types of booms ("Harbour" and "Bennett") used in an attempt to corral the oil, were found to be effective only as "deflectors" of the spill in open coastal areas. If the current was directly "onto" the booms, oil would move under them. The slicklickers were found to be of little use in open coastal areas.

Although the weather conditions hindered the oil retrieval operations, the heavy precipitation and run-off proved to be a blessing in disguise, since the fresh water runoff formed a stream around the shore of Barkley Sound which tended to keep the oil away from the shore. To some degree, this happened around the Broken Group Islands. Only when the weather had cleared and runoff had diminished did any significant quantity of oil show up on the foreshores. The high runoff in Barkley Sound also resulted in a strong estuarine flow along the northern shore which carried seaward, at a rate of up to 1.5 to 2.0 knots, any oil that entered it. This also indicated, however, that oil from the "Vanlene" could have been carried as far as Estevan Point (Figure 1) in a two-day period.

DISCUSSION AND RECOMMENDATIONS:

To deal with future crises of this nature, it is recommended that an "emergency measures group" be formed of representatives from M.O.T., C.F.B. and D.O.E. These representatives are to be contacted as soon as an oil spill occurs. They will then, as a group, proceed to the emergency area to assess the extent of the spill and thus to determine the size of the "clearing" operation required. The group itself could consist of a single person from each of the three departments. Each of these in turn would be backed up by one or more persons, who, once the degree of emergency was determined, would designate personnel in the appropriate department to carry out certain duties in the overall plan.

The most difficult task of such a procedure would be determination of the degree of emergency. Because of the many problems of handling oil on the open coast, a major effort should be expended, if feasible, to remove the ship from the grounding site and into a more "protected" or secluded location where the oil still aboard could be

...9

removed more conveniently. However, if the general area involved is especially vulnerable to the effects of oil contamination (a recreational, fish-spawning or wildlife area) then the location to which the ship is to be moved must be extremely carefully selected to minimize the possibility of permanent ecological damage.

If the vessel cannot be moved, the problem becomes much more complicated. The primary objective would then be the removal of the oil from the vessel, the secondary one to direct the escaping oil itself to a confined area where it could be more easily removed. The tertiary target would be the clean-up of the shore.

ld

In the case of tanker collisions in open coastal areas, the problem again changes. If the tanker can be towed into port the spilled oil at the collision site could be tracked by monitoring the surface drift with a transponder buoy; even better perhaps would be the use of current followers lying "in" the surface itself, eg. plywood sheets. When the general drift has been determined, equipment and ships could be deployed to an area where the oil could be contained and handled. A future possibility is tracking of oil spills by infra-red scanner in conjunction with film or video equipment.

The Department of Environment (D.O.E.) should have on file - and easily accessible - all work that has been carried out on water movements, locations of spawning grounds and nesting areas, etc. on the B. C. Coast. The information should include all published and unpublished data, together with a list of personnel who have been involved in such work and their fields of interest.

Suggested Equipment Requirements

1. Enough "walkie-talkie" equipment and/or portable radios to set up a communications network between all "local" working units and operational headquarters, with a common frequency assigned at least for the duration of the emergency.

2. A portable weather station and wave recorder for "local" use; in addition the data could be transmitted to the Atmospheric Environment Service's nearest major office for use in prediction of weather for the area.

3. Slicklickers that are not seastate limited eg. centrifuge ("cream-separator") type.

4. Peat-moss dispensers similar to "straw guns"; goggles for the operators of such equipment.

...10

5. Rubber bag "dracons" both for the collection of oil and water mixtures from slicklickers and for the separation of the two constituents.

6. A pumping system capable of preheating bunker B and C oils, to facilitate emptying of vessel fuel tanks.

7. A system for "through-the-hull" sounding to determine fuel volumes remaining in directly inaccessible tanks.

8. A portable file (or a booklet) of aerial photographs, indicating sea and swell conditions to be expected with "major" wind systems, and surface drift, along the entire B. C. Coast.

9. Radio D.F. equipment at suitable locations along the B. C. Coast to aid in accurately determining positions of distressed vessels.

Acknowledgement

The author wishes to acknowledge the assistance of Dr. L. F. Giovando in the preparation of this report.

References

Ages, A. B. (1972) The Vanlene Accident, March 1972. Mar. Sc. Br. Dept. of Env. Pacific Marine Science Report 72-74, 17 p.

Herlinveaux, R. H. (1966) Oceanographic Phase of the Fatty Basin Study for a Lobster Transplant. Fish. Res. Bd. Marine Sciences Report No. 228, 66 p.

...11

TABLE OF FIGURES

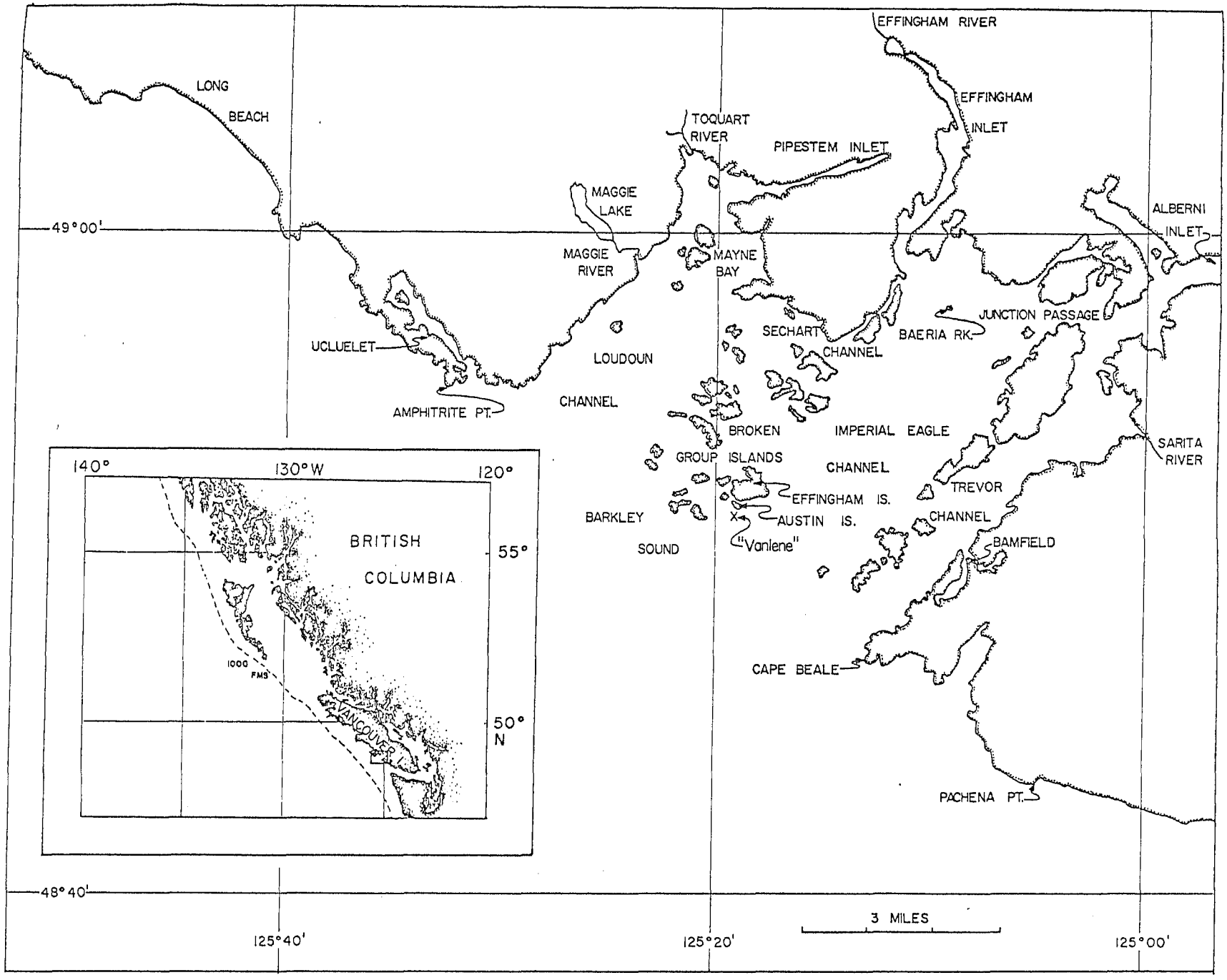


Figure 1 Map of the area showing the site of the "Vanlene" grounding in Barkley Sound.

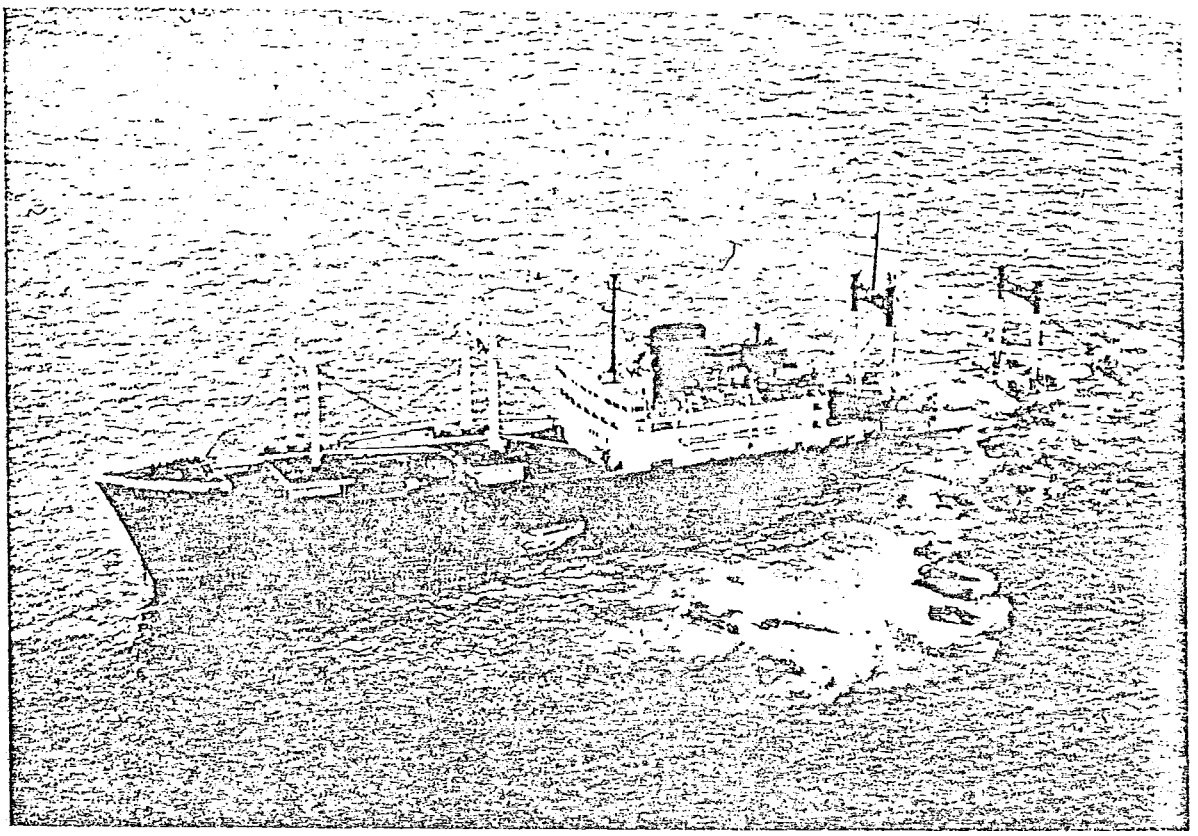


Figure 2 The "Vanlene" aground off Austin Island, Barkley Sound.

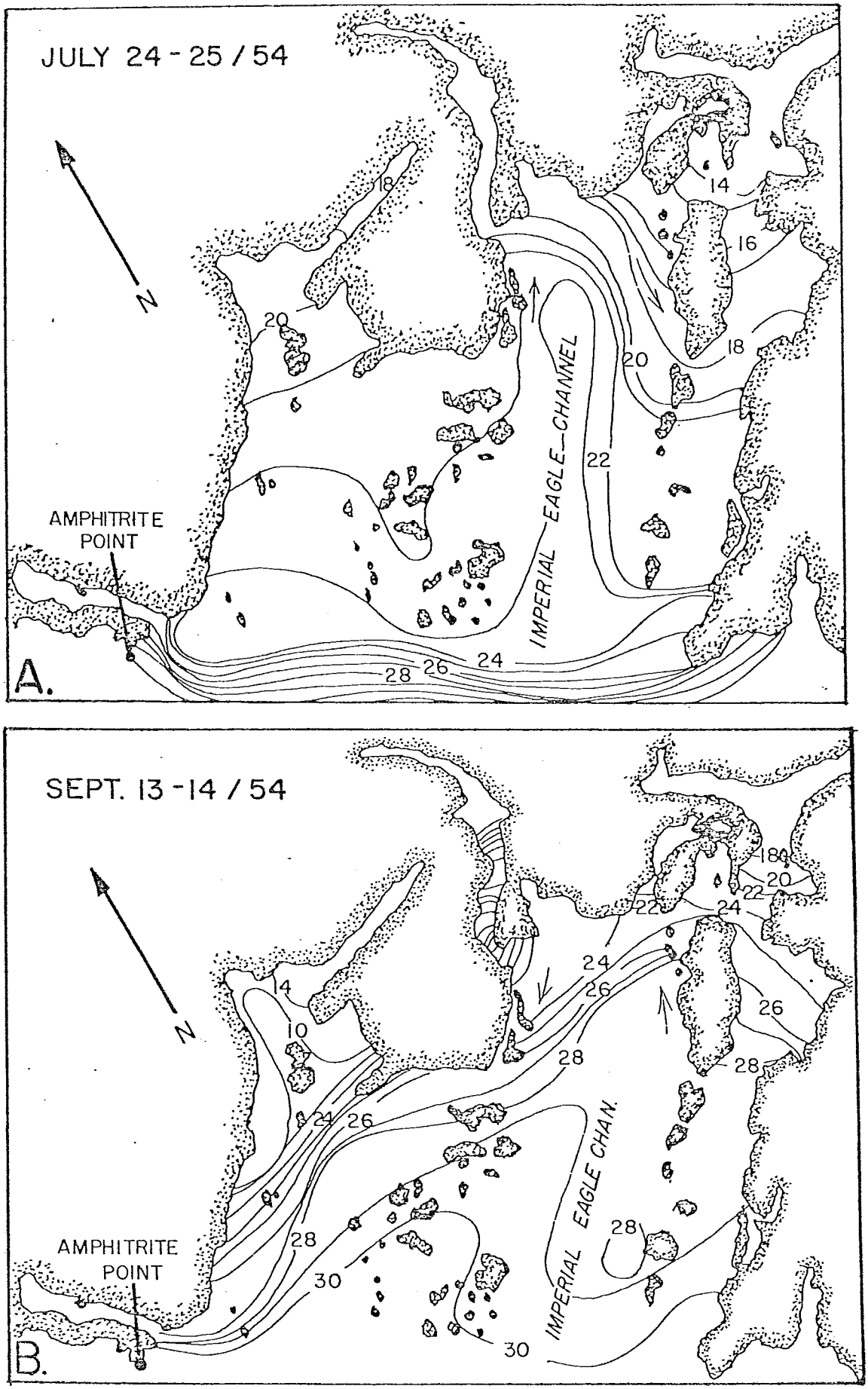


Figure 3 Representative surface-salinity distributions that were experienced in Barkley Sound during July and September, 1954.

Figure 4 Aerial composite photograph of the area (Air Division of the Surveys and Mapping Branch, B. C. Department of Lands, Forest and Water Resources) showing surface slick movement and wave movement during westerly winds.

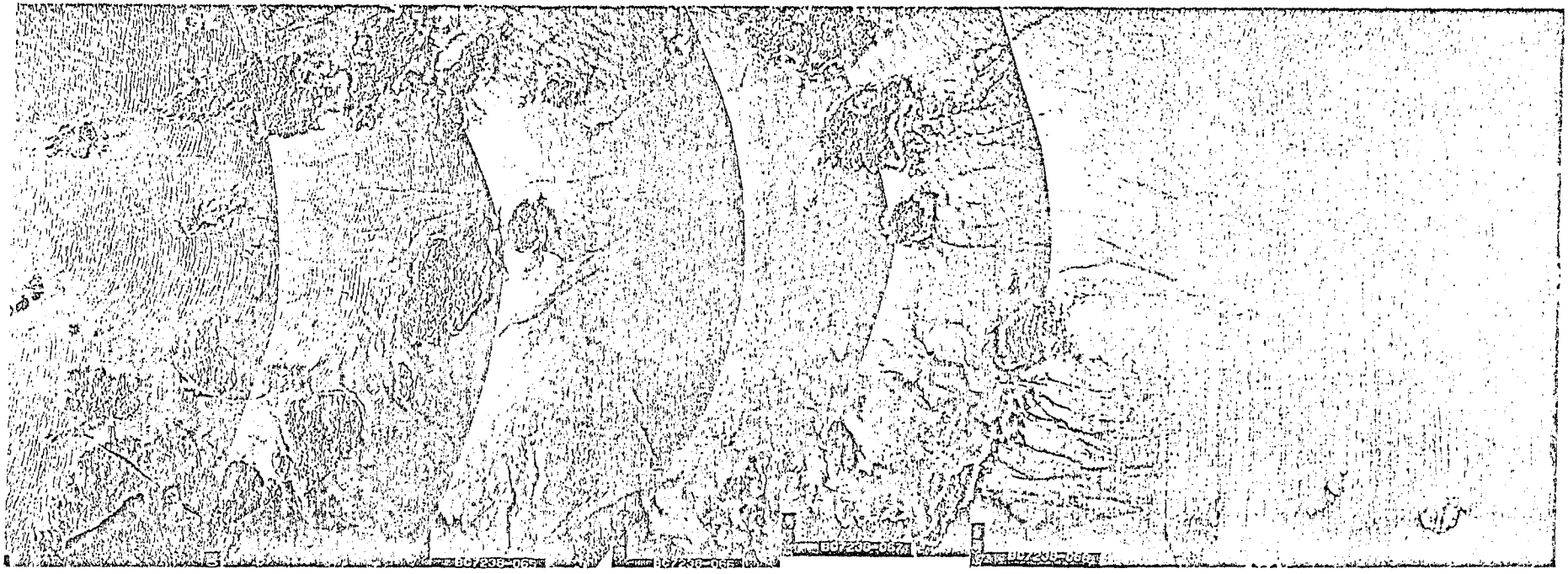
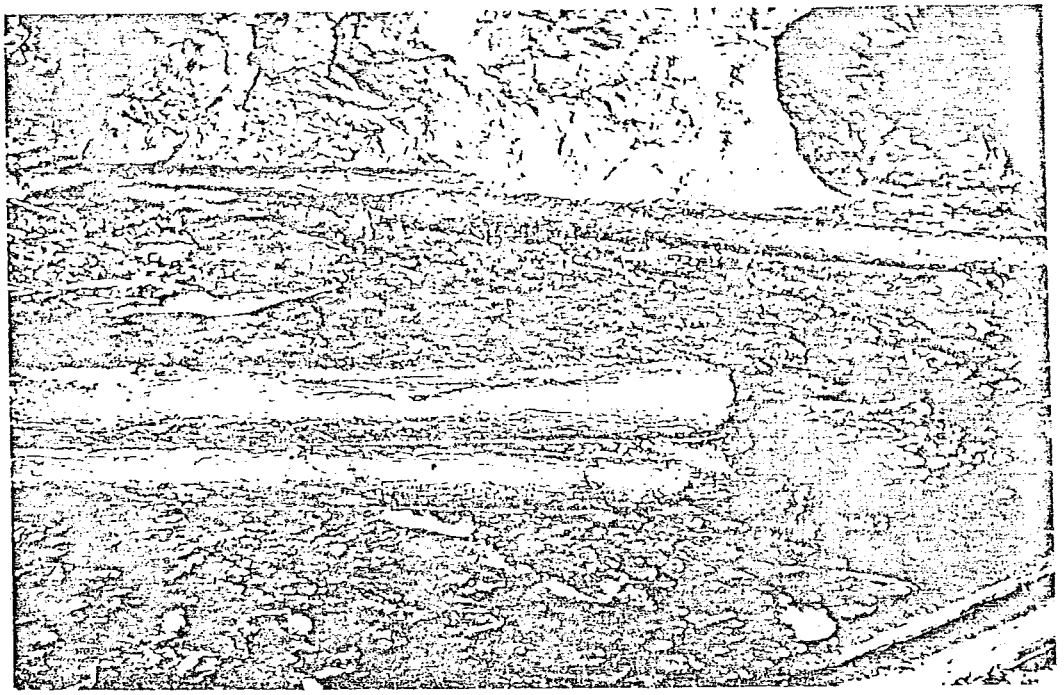


Figure 5 Aerial composite photograph of the area (Air Division of the Surveys and Mapping Branch, B. C. Department of Lands, Forest and Water Resources) showing surface slick movement and wave movement during southeasterly winds.



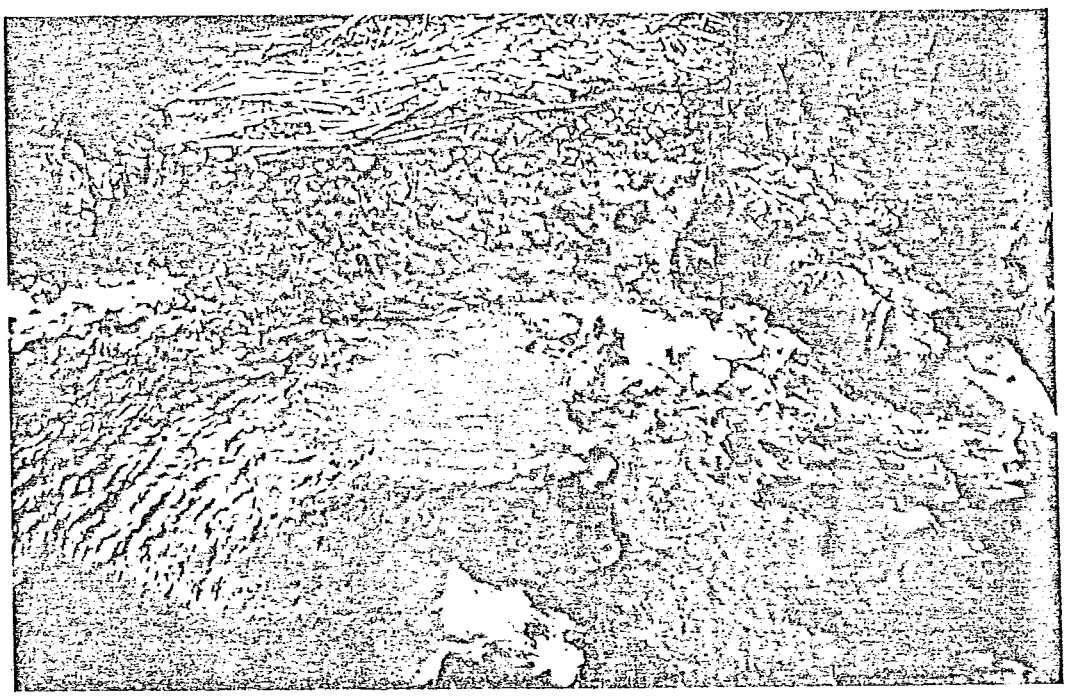


Figure 6A One portion of the oil-contaminated beach on Cooper Island.

Figure 6B An accumulation of oil in one of the bays in the area (Effingham Island).

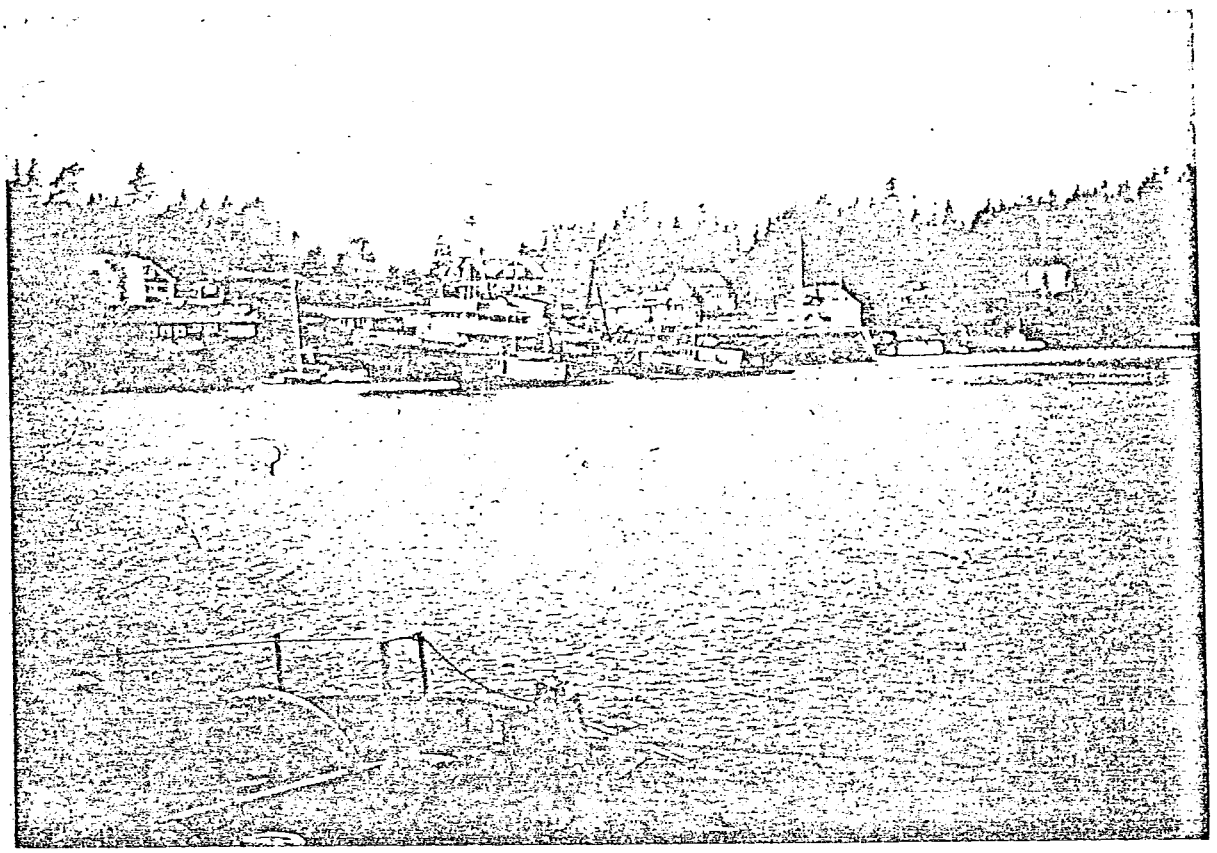


Figure 7 Bamfield wharfs where the "Bennett" boom was assembled.

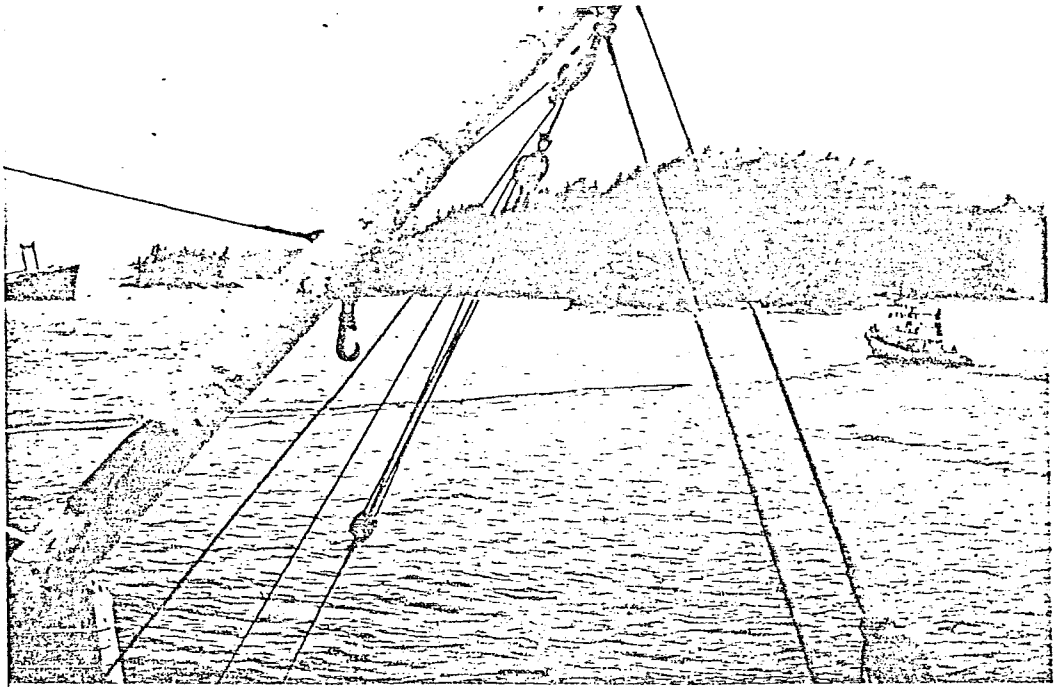


Figure 8 "Bennett" boom being towed by tug to an islet where boom was secured.

Figure 9 The "Bennett" boom secured to the islet and oil moving down boom in high enough concentration to be collected.

Figure 10 Oil slick reversing its direction of flow; boom in foreground at bottom of picture, CCGS "Camsell" at top.

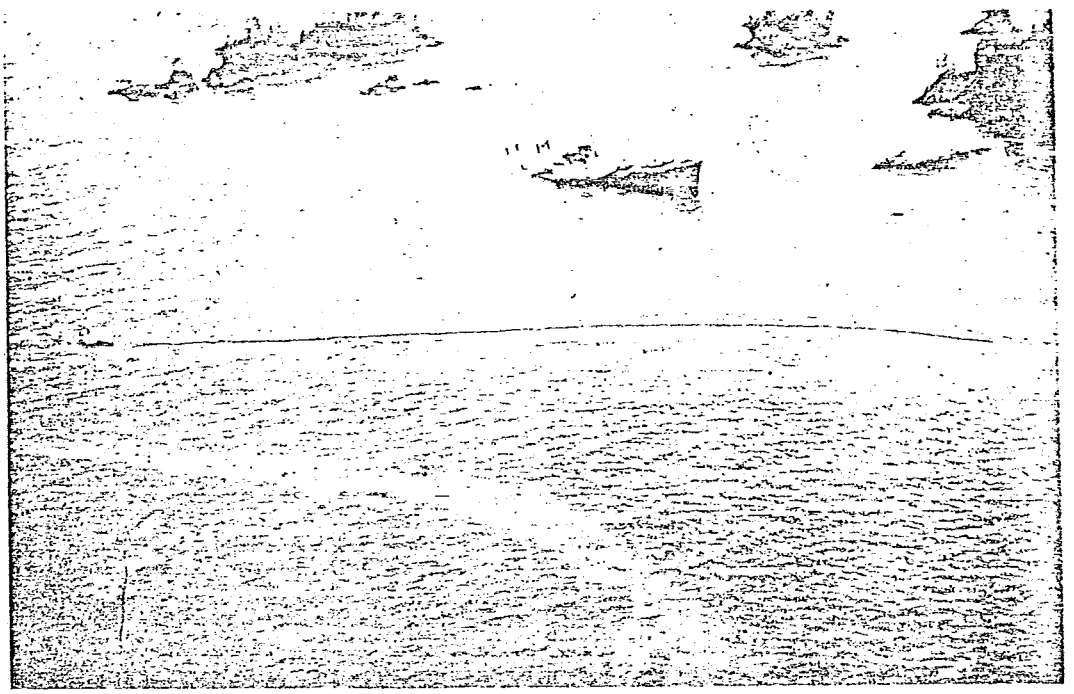


Figure 11 Boom in position (little oil in the immediate grounding area).

Figure 12 "Bennett" boom in direct path of surface movement - oil on both sides of boom.

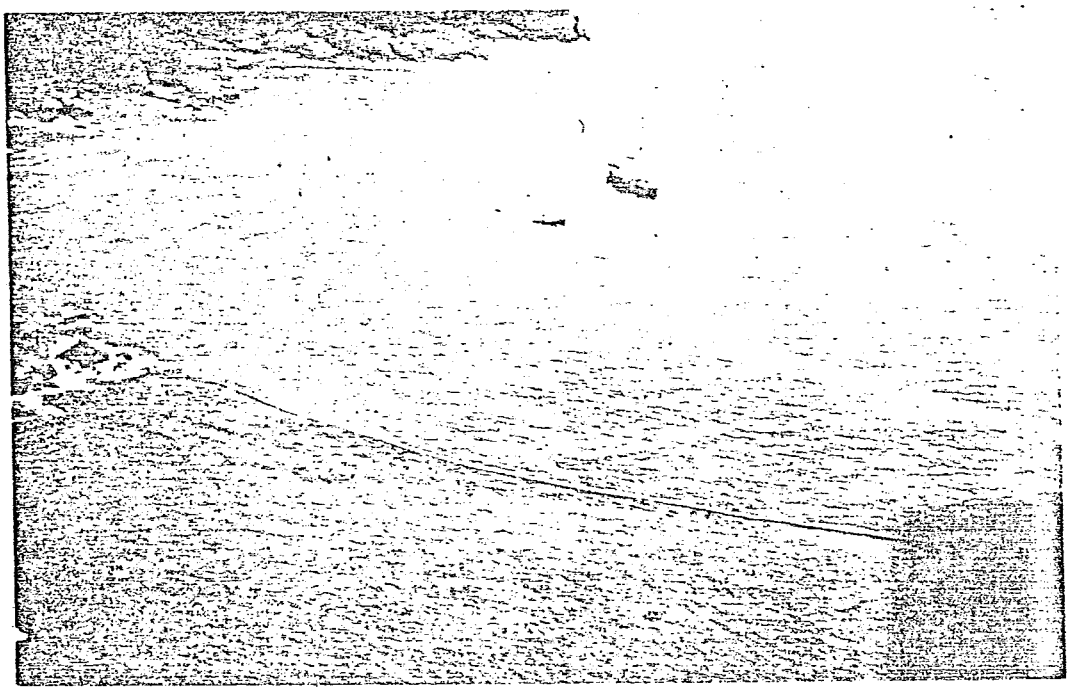


Figure 13 "Bennett" boom with the surface flow directly onto the boom from the right to mid-photograph and a flow at an angle to the boom in the shallower water to the left in the picture.