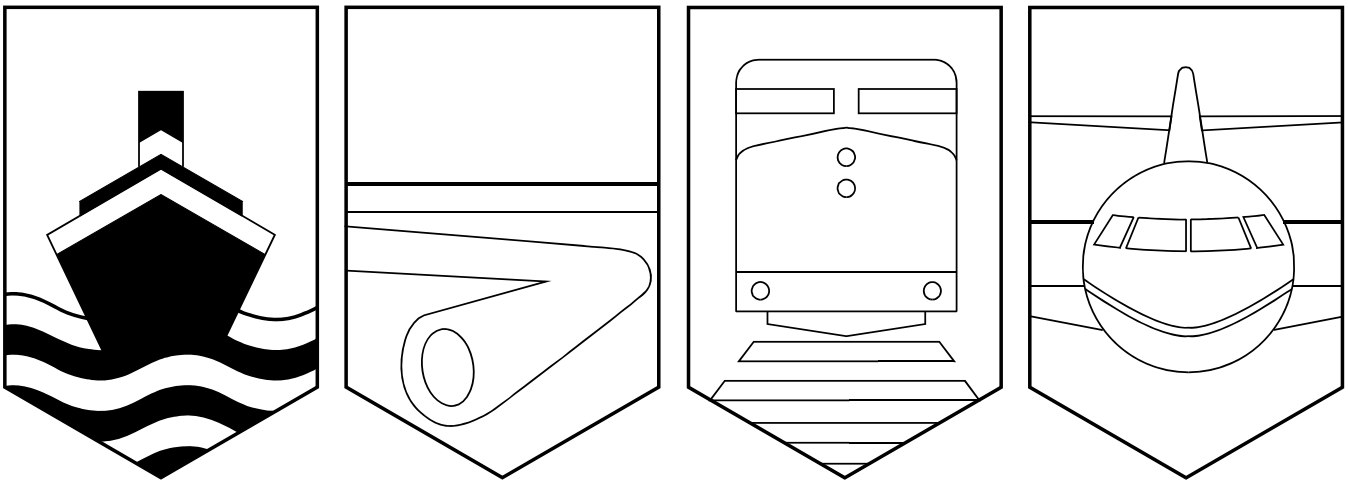
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



MARINE OCCURRENCE REPORT

SINKING

FISHING VESSEL "PACIFIC BANDIT"
OFF BARKLEY SOUND, BRITISH COLUMBIA
11 FEBRUARY 1995

REPORT NUMBER M95W0005

Canada

MANDATE OF THE TSB

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The TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

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Marine Occurrence Report

Sinking

Fishing Vessel "PACIFIC BANDIT"
Off Barkley Sound, British Columbia
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Synopsis

In the early morning hours of 11 February 1995, the "PACIFIC BANDIT", laden with about 23,000 kg of fish, was off the west coast of Vancouver Island, British Columbia, not engaged in fishing operations. The wind and sea conditions were such that the vessel was shipping and retaining seas on the main deck. The vessel listed to starboard, downflooded, capsized, and eventually sank. Two crew members were swept overboard; the other two abandoned the vessel and managed to board the liferaft. Three of the crew members were later rescued and one person, who was in the water without a lifejacket or an immersion suit, succumbed to hypothermia and drowned.

The Board determined that, while operating in moderate sea conditions, the "PACIFIC BANDIT" capsized when positive transverse stability was lost due to the cumulative effect of the shipped seas retained on deck, the stowage of the catch, the free surface effect of liquids, and downflooding to the below-deck spaces. The open weathertight doors and the broken galley windows accelerated the downflooding, which continued until the vessel lost all reserve buoyancy and sank.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 Particulars of the Vessel

	"PACIFIC BANDIT"
Official Number	347761
Licence Number	25685
Port of Registry	Victoria, B.C.[1]
Flag	Canadian
Type	Small fishing vessel
Gross Tons[2]	69
Length	17.02 m
Draught	Unknown
Cargo	Fish - 22,700 kg approx.
Crew	Four
Built	1973, Victoria, B.C.
Propulsion	400 BHP diesel engine driving a fixed-pitch propeller
Owners	Banditos Fishing Ltd. Surrey, B.C.

1.1.1 Description of the Vessel

The "PACIFIC BANDIT" was of welded steel construction with a raised forecastle deck. The forecastle space provided accommodation for three crew members. Access to the space was by way of a door on the centre line at the break of the forecastle. The steel cabin/wheel-house, situated abaft amidship, contained the skipper's cabin, bridge, galley and washroom. Three doors in the after end provided access to (from starboard to port) the

[1] See Glossary for all abbreviations, acronyms, and definitions.

[2] Units of measurement in this report conform to International Maritime Organization (IMO) standards or, where there is no such standard, are expressed in the International System (SI) of units.

washroom, the engine-room and the accommodation area. The accommodation entry door was a dutch door, comprising two sections designed such that the upper half could be secured in the open position while the lower half could be secured in the closed position. A net drum and two trawl winches were positioned on the afterdeck, abaft the wheel-house.

1.2 History of the Voyage

After partially replenishing fuel, and with a catch of some 22,700 kg of fish on board, the "PACIFIC BANDIT" departed Ucluelet, B.C. at about 1630[3], 10 February 1995, for the fishing grounds 30 miles south-west of Amphitrite Point, B.C. The paravane stabilizers had been deployed to dampen the vessel's roll.

Weather conditions were described as good with moderate north-westerly winds and 1 to 2 m seas from the north-west.

At about 2100, a set was made, and at 2300, the gear was hauled on board. There was only a small amount of fish in the net. The crew sorted the catch, then opened the small access hatch in the forward fish hold hatch cover and dumped the catch into the hold. The access hatch cover was then closed but not secured.

After securing the gear and tidying up, the cook/deck-hand (hereinafter referred to as the cook) and the deck-hand retired to the forecastle. The skipper advised the engineer/deck-hand (hereinafter referred to as the engineer) to steam slowly in a southerly direction toward a way-point eight miles from the vessel's present position, then to turn around and head north. The skipper then went to bed.

Reportedly, the vessel had a freeboard of 150 mm aft and 450 mm forward. At about 0100, the engineer called the cook to take over the watch. The engineer briefed the cook on the vessel's position and on the skipper's instructions, then retired to his cabin in the forecastle accommodation.

The vessel was operating in a following wind and sea for over two hours, during which period about 75 mm to 100 mm of sea water accumulated on the afterdeck on a more or less continuous basis. At about 0350, the vessel was heading in a southerly direction with a following sea. The cook, who was alone on watch, checked the vessel's position and altered course to starboard to bring the vessel's head into the northerly swell.

[3] All times are PST (Coordinated Universal Time (UTC) minus eight hours) unless otherwise stated.

The skipper, awakened by the vessel's motion, entered the wheel-house. At about the same time, the low water alarm for the main and auxiliary engines' cooling water system sounded. Using the intercom, the skipper instructed the engineer to check the alarm.

The engineer alerted the deck-hand and both left the forecastle accommodation. They stepped onto the main deck and found that about 0.5 m of sea water had accumulated on the starboard side. Both the skipper and the engineer observed that the vessel had a starboard list of about 10 degrees.

The engineer and the deck-hand made their way aft and entered the accommodation area. The engineer started the auxiliary engine from the wheel-house. He then entered the engine-room, opened the valves to the appropriate compartments, activated the pump, and pumped out the forward fish hold and the engine-room bilges; about 300 mm of water was observed in the engine-room bilge.

Reportedly, the skipper had planned to fish in the area the following morning to top up the fish hold, weather permitting. However, as the weather had deteriorated, the vessel's course was altered to a north-easterly direction, to head toward Tofino, B.C. With the swell now on the vessel's port bow, the shipped sea water was not clearing from the deck rapidly, so the skipper sent the cook and the deck-hand forward to remove the poundboards near the large freeing ports (locally referred to as scuppers).

The poundboards were dismantled, then thrown into the forward fish hold by way of the access hatch, and the cover was closed. The cook and the deck-hand then entered the forecastle and removed their wet clothing and rubber boots. They exited the compartment about 10 minutes later. The doors to the forecastle and after accommodations were in the open position.

By that time, the starboard list had increased to 20 to 30 degrees and sea water was downflooding into the forecastle through the open forecastle door. With the deck awash, the cook and deck-hand went forward and cut loose some poly floats. Meanwhile, the engineer checked the vacuum gauge for the forward fish hold--it indicated that the compartment was dry. He disengaged the pump, closed the valves, and left the engine-room when the starboard list suddenly increased. On his way to the wheel-house, he picked up his personal immersion suit from the cabin and donned it.

The skipper put the helm hard-a-port and increased engine rpm in an attempt to "buy time"; however, the list increased and the deck-hand and cook were swept overboard by a large wave breaking on the foredeck.

At 0432, the skipper transmitted "MAYDAY" messages to Tofino Vessel Traffic Centre (VTC) on channel 74 and to fishing vessels in the area on channel 8 of the very high frequency radiotelephone (VHF R/T). The "MAYDAY" messages were immediately responded to by the VTC and several other vessels in the area.

When two starboard galley windows were broken by the heavy seas and sea water was rapidly flooding the accommodation through open doors, the skipper decided to abandon ship. Meanwhile, the engineer had climbed up on the cabin roof and, after experiencing some difficulties, managed to cut the

inflatable liferaft lashings. When the vessel was on her beam-ends, the engineer launched the liferaft by kicking it free of the vessel. The skipper made his way aft through the water, surfaced near the liferaft canister, and hauled on the painter. A short time later, the liferaft inflated on top of him. The engineer was the first to board the liferaft.

When the skipper resurfaced, the engineer helped him aboard. They heard the other two crew members on the far side of the capsized vessel and called out to them; however, they could not see them in the darkness. The liferaft was still tied to the vessel. The skipper, fearing that the capsized vessel would sink and take the raft with her, searched for a knife to cut the painter. He could not find it in the darkness; the skipper and the engineer had to chew through the painter to release the liferaft. They then attempted to reach the other survivors, but the wind caused the liferaft to drift away. Meanwhile, the deck-hand and the cook, who were lightly clad and in the water, managed to hold on to some planks, albeit with great difficulty due to the conditions. They tried to paddle toward the capsized vessel but were unable to reach her. The vessel eventually sank in approximate position 48˚38'N, 126˚10'W, in 300 m of water.

A short time later, the deck-hand lost his grip on the planks. The cook held on to him, but the sea washed the deck-hand from his grasp, and the deck-hand disappeared into the darkness.

1.3 Search and Rescue

Upon receipt of the MAYDAY transmission, the VTC notified the Rescue Coordination Centre (RCC) Victoria, thus initiating official Search and Rescue (SAR) response. The RCC coordinated the search utilizing four air units, two primary marine SAR units, and a number of fishing and commercial vessels. The SAR air units located three survivors and directed the surface craft which rescued them at about 0715.

1.4 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Missing	1	-	-	1
Serious	-	-	-	-
Minor/None	3	-	-	3
Total	4	-	-	4

The survivors were suffering from mild to severe hypothermia when rescued. They were transported to a hospital, treated, and later released. The deck-hand is still missing and presumed drowned.

1.5 Damage to the Vessel

The vessel sank and has been declared a total loss.

1.6 Vessel Certification

The "PACIFIC BANDIT" had been inspected by the Ship Safety Branch (SSB) of the Canadian Coast Guard (CCG) on 17 June 1994, and a SIC 29 was issued for a full-term period, due to expire on 26 May 1998.

1.7 Personnel Certification, Training and History

Crew certification is not required on a fishing vessel of less than 100 tons gross tonnage such as the "PACIFIC BANDIT".

Only the engineer had taken the Marine Emergency Duties (MED) program as a prerequisite to obtaining a Fishing Master, Class III Certificate of Competency. The program provides training in life-saving, abandonment, fire-fighting, and first aid, with the use of appropriate equipment. There is at present no regulatory requirement for uncertificated crews of fishing vessels to undergo MED training. This was the engineer's third trip on the "PACIFIC BANDIT".

The skipper is an experienced fisherman who had been intermittently employed as skipper on the "PACIFIC BANDIT" since August 1994.

The cook began fishing in 1986, and this was his third trip on the "PACIFIC BANDIT".

The deck-hand was new to the fishing industry, and this was his third trip on the "PACIFIC BANDIT".

1.8 Stability Requirement

The "PACIFIC BANDIT" had not been inclined and no stability data had been generated. There was no regulatory requirement for such stability data. No stability data was available from any source to permit stability analysis, nor were the vessel's plans available.

1.8.1 Crew Observations--Roll Period

The survivors reported that the vessel was heavily laden, and the period of roll was described variously as "nice and easy" to "slower than normal".

1.9 Fish Hold

The forward fish hold was positioned between the forecastle and the wheel-house. The fish hold hatch coaming was about 1 m high. An aluminium hatch cover measuring 1.5 m x 2.5 m was fitted with a 0.45 m x 0.45 m access hatch to gain entry to the fish hold. The securing arrangement comprised a length of rope stretched over the hatch cover and secured to a pad eye/ring on either side of the hatch coaming. Neither the cover nor the access hatch was secured at the time of the accident.

The after fish hold was located aft of the wheel-house and contained a small quantity of ice and stores. The hatch coaming was 250 mm high. The coaming was fitted with a 1.2 m x 1.2 m aluminium cover and the latter with a 0.45 m x 0.45 m access hatch. Their securing arrangement was similar to that of the forward hold. Both openings to the after fish hold were secured at the time of the accident.

1.10 Fish Hold Penning

Consistent with good seamanship practice, although not required by regulations, the fish holds on board the "PACIFIC BANDIT" were divided into pens with portable longitudinal and transverse pen boards to prevent the movement of fish carried in bulk. The forward fish hold was divided into nine pens and the after fish hold into four pens. The fore-and-aft and athwartship pen boards in the forward fish hold did not extend to the deckhead but were about 450 mm below it, and the stowed fish extended some 150 mm above the pen boards.

1.11 Fish-loading Deck Scuttles

The forward fish hold was fitted with four slightly raised fish-loading scuttles on deck (hereinafter referred to as the deck scuttles), two each on the port and starboard sides, a pair forward and a pair abaft the main hatchway. The scuttles were used to load fish into the hold, and each scuttle was provided with an aluminium watertight cover secured by a single-action, key-operated closing mechanism. The covers were not hinged, nor were they permanently attached by a chain to the vessel's structure as required by the regulations.

According to the ship's crew, the seals of the forward deck scuttles on the forward fish hold were watertight, but the seals of the deck scuttles at the after end of the hold were not. The after deck scuttles allowed water accumulated on deck to leak into the forward fish hold. The crew was aware of this and reportedly had discussed replacing the seals at the end of the trip.

1.11.1 Shipboard Practice--Securing of Deck Scuttles

The general practice on board this vessel was for the person in attendance to secure the deck scuttle following its use. The skipper would then confirm with the crew that the scuttles were secured. On this occasion, the engineer had secured the deck scuttle and had so informed the skipper.

1.12 Poundboards on Deck

To facilitate sorting of the catch prior to loading it into the hold, the vessel was fitted with two tiers of 250 mm-high poundboards on deck to prevent fish from sliding overboard. The poundboards were not provided with the means required by regulations to facilitate rapid and effective drainage of water accumulated in the pounds. In this instance, the poundboards were left in place until after the weather had deteriorated and the shipped sea water could no longer drain rapidly from the deck.

1.12.1 Freeing Ports

The freeing ports aboard the "PACIFIC BANDIT" were similar to those seen on board a similar vessel, the "TWIN J". They were arranged in the bulwarks on the main deck. The gap between the top edge of the sheer strake and the bottom end of the bulwark plating on the main deck acted as freeing ports for the vessel. To facilitate rapid and effective drainage of water from the deck, four additional freeing ports had been fitted: two measuring about 0.5 m x 0.5 m in way of the forward fish hold, one on each of the port and starboard sides; and two measuring about 0.3 m x 0.3 m in way of the after fish hold, one on each side.

1.13 Fish Loading Procedure

After each set, the net was hauled on board, and the catch was emptied into the pounds (locally referred to as checkers) on deck and sorted. A deck scuttle would be opened and a crew member, positioned in the hold, would ice the fish as it was being dumped into the compartment.

1.14 Bilge Pumping Arrangement

The vessel's bilge pumping arrangement comprised a self-priming power bilge pump connected by 38 mm-diameter piping to suctions in the forward fish hold, the engine-room, and the after fish hold. The arrangement in the lazaret permitted water to drain into the engine-room bilge from where it could be pumped overboard. Reportedly, no problem was encountered with the pumping arrangement.

1.15 Other Watertight/Weathertight Openings

A watertight deck scuttle installed flush on the main deck provided access to the lazaret.

1.16 Weather and Tidal Information

1.16.1 Weather Forecast and Experienced

The marine weather forecast issued by the Pacific Weather Centre of Environment Canada at 1645, Friday 10 February 1995, called for north-west winds at 5 to 15 knots (kn) and 1 to 2 m seas; the outlook called for strong northerlies. The 2245 forecast called for winds to increase overnight to 15 to 25 kn, and 2 to 3 m seas.

The weather experienced by the vessel is consistent with that recorded at the nearest weather recording station at La Pérouse Bank, B.C. At the time of the accident, the wave height was about 2 m and the wind was northerly at 15 to 20 kn.

1.16.2 Current and Tide

High water was calculated to occur at Tofino at 2253, 10 February 1995, with a height of 3.05 m above chart datum, and low water at 0418 the following morning with a height of 1.95 m above chart datum. Maximum flood occurs 3 hours 50 minutes before high water at Tofino[4].

[4] Sailing Directions, British Columbia Coast, South Portion.

1.17 Life-saving Equipment

There is conflicting evidence with respect to the life-saving equipment information as recorded in the SIC 29 and SIRS II, and the equipment on board the "PACIFIC BANDIT" at the time of the accident. The conflicting information is as follows:

Document	Date of issue/expiry Date of entry	Lifejackets	Immersion suits	Skiff
SIC 29	17.06.94-26.05.98	6	0	4
SIRS II	17.06.94	3	3	4
On board at time of accident	11.02.95	4	4	4

The regulations made pursuant to the *Canada Shipping Act* as well as those made pursuant to the *British Columbia Workers' Compensation Board Act* require that the master ensure that the crew understands the use of life-saving equipment and is aware of its location. In this instance, the cook and deck-hand did not know that the lifejackets or the immersion suits were located in the forecastle accommodation, nor did they consider donning them.

No emergency drill had been practiced since the crew members who survived had joined the vessel.

1.17.1 Inflatable Liferaft

Additional Lashings to Secure the Liferaft

The inflatable liferaft was positioned in a cradle on the port side of the cabin-top and secured to the deck by securing straps. Additional rope lashings were used to further secure the liferaft to the deck, but no quick-release mechanism such as a Senhouse slip was used. There was no knife or other means of cutting the lashing ready to hand, and the engineer had to return below-deck to get a knife. Before he could finish cutting the lashings, the knife blade broke, but he eventually managed to launch the liferaft when the vessel was on her beam-ends.

Liferaft Inflation

The regulatory minimum length of the inflatable liferaft's painter is 15 m, but some manufacturers provide a longer painter. The inboard end of the painter is connected to the pull/operating cable which activates the (non-toxic) gas cylinder that inflates the liferaft. The whole length of the painter has to be hauled out of the canister before the liferaft can be inflated. As was the case in this occurrence, there have been other instances of crew members finding themselves in water without lifejackets before the

liferaft could be launched or inflated. In the 2 to 3 m seas, the skipper, who was not wearing a lifejacket, had to remain afloat and hold on to the liferaft with one hand while hauling on the painter with his other hand.

Liferaft Painter

Once on board the liferaft, the skipper could not find the knife inside the liferaft in darkness to cut the painter attaching the liferaft to the capsized vessel. He therefore began chewing through the nylon painter. The engineer completed the task some 20 minutes later, after the skipper had broken one of his teeth.

Liferaft Servicing and Defects

The six-person Beaufort liferaft had been serviced on 01 June 1994, some 16 days before the SIC 29 was issued. However, when the liferaft was deployed, the following defects were reported:

- the flashlight, which was in the sealed "A" pack, did not function; and

- the liferaft's dome light was unserviceable.

A parachute flare was successfully deployed to attract the attention of a rescue helicopter, and the surviving crew members were rescued shortly thereafter.

Entrance Covers Securing Arrangement

The entrance to the liferaft was provided with entrance covers that could be closed and secured in place by tie tapes. However, in the cold weather, the survivors had difficulty using the entrance tie tapes because their fingers were numb.

1.17.2 Malfunction of Liferaft Equipment

Flashlight

According to the servicing depot, industrial-type batteries are used for the flashlight and are always replaced at the time of annual servicing of the liferaft.

Dome Light

The batteries for the liferaft dome light are water-activated. As the contacts, when exposed to sea water, form a switch that turns the power on, safety caps are used to cover the contacts to protect against premature operation. The safety caps are attached to the grab line on the sides of the liferaft by a lanyard, such that the cap will automatically be dislodged as the liferaft inflates.

A post-occurrence inspection of the liferaft revealed that:

- the batteries for the dome light were dead;

- corrosion and broken wiring in the male-female plug for the batteries to the dome light rendered the plug unserviceable; and

- there was no lanyard attached to the safety caps.

The unit was sent to the TSB Engineering Laboratory for analysis where it was examined and tested. The laboratory report[5] concluded that the fractured surfaces showed heavy deposits of corrosion products (cuprous chloride) which indicates that the corrosion had occurred over an extended period of time and strongly suggests that the conductor was fractured prior to the deployment of the liferaft.

1.17.3 Emergency Position Indicating Radio Beacon (EPIRB)

Although none was required by regulations, the vessel carried a Class II EPIRB. The EPIRB had not been activated. It was located in the skipper's cabin and the flooding of the area precluded the skipper from gaining access to the EPIRB when he was forced to abandon ship.

1.18 Cold Water Survival

The sea water temperature in the immediate area was not recorded; however, the average temperature of sea water west of Vancouver Island is 7°C. Scientific studies of cooling rates on an average adult person holding still in ocean water of 7°C and wearing a standard lifejacket and light clothing show a predicted survival time of about two hours. Extra body fat can increase survival time.

The missing deck-hand was described as being 1.82 m tall and weighing approximately 82 kg. He was reportedly in good health and an excellent swimmer. He was not wearing a lifejacket or an approved personal flotation device (PFD).

[5] A copy of the TSB Engineering Laboratory Report 152/95 "Life Raft Light Failure" can be obtained from the TSB upon request.

2.0 Analysis

2.1 Loss of Paravane

Although there is no evidence to indicate that such was the case in this occurrence, instances are on record where the loss of a paravane on one side was one of the contributing factors to the capsizing of a vessel. The parting under stress of the wire or chain holding the port paravane would result in a starboard list. In such an event, the starboard paravane would act as a drag and cause the vessel to swing to starboard.

2.2 Use of Poundboards and Safety

The purpose of freeing ports is to facilitate rapid drainage of sea water shipped on deck. As the poundboards were in place and were not fitted with means such as drain holes/slots to facilitate the drainage of water, shipped sea water was retained on deck and the rate at which the water could escape through the freeing ports was slowed. The poundboards were not dismantled and stowed below-deck upon completion of fish-loading operations, even though north-west winds had been forecast to increase to 15 to 25 kn by morning with 2 to 3 m seas, and the outlook called for strong northerlies. Because of the time required to dismantle/ship the poundboards on deck, the crew had adopted a practice of keeping the poundboards in position even when not in use. The hazard associated with such a practice was not fully appreciated by the crew.

2.3 Free Surface Effect

Whenever there is a free surface due to liquids on board a vessel, there is a loss of effective metacentric height (GM) due to a virtual rise of the vessel's centre of gravity, as well as a loss of transverse stability caused by the movement of the liquid in partially filled compartments and/or of the shipped water on deck when the vessel rolls. This movement may involve a large shift of weight. In this instance, the free surface effect was generated by the shipped water retained on deck and the accumulation of sea water in the forecastle and after accommodations. As the vessel had replenished fuel and water the day before the accident, the free surface effect resulting from the consumables is considered to have been minimal.

In general, few fishermen fully understand free surface effect and fewer appreciate the substantial loss of transverse stability that occurs when water, even a few inches, is shipped and retained on deck. Coupled with the loss of effective water plane area when the deck edge is submerged, the effects can be disastrous.

2.4 Penning of Fish Holds

Although not required by regulation, the fish holds on the "PACIFIC BANDIT" were fitted with pen boards. Pen boards limit the movement of weights over a large area, thereby reducing the free surface effect of fish loaded in the compartment. Pen boards also limit/restrict the angle of heel associated with the large movement of weights (fish).

The arrangement of pen boards in the fish hold was such that the top of the cargo could shift transversely whenever cargo was loaded to or above the height of the pen boards. The resultant transverse shift of weight as the vessel rolled in the seas would have further increased the vessel's list. This situation would have been further complicated when sea water mixed with the fish cargo and facilitated its movement. The sea water had entered the compartment from the deck scuttles due to the poor condition of their seals.

For maximum effectiveness, the pen boards must extend well above the level of fish in the compartment. In this instance, the height to which the athwartship pen boards could be fitted, of necessity, had to be limited to facilitate the fish loading process because only four deck scuttles and an access hatch in the cover were available to load fish into the forward hold. However, similar limitations would not have applied to the fore-and-aft pen boards. The fitting of fore-and-aft pen boards as close to the deckhead as practicable would have mitigated the adverse effects of a shifting load on the vessel's transverse stability. At the same time, the fish-carrying capacity of the compartment would have been maximized.

2.5 Factors Affecting Stability

When the vessel was headed into the wind and seas, she commenced shipping sea water on the forward deck. The vessel's roll to starboard would have caused the cargo to move to starboard, increasing the starboard list. By the time the engineer stepped onto the deck, about 0.3 m of sea water had accumulated on the starboard side, and the weight of the water further outboard would have aggravated the list. As the list increased, the freeing ports on the starboard side submerged. This would have further retarded the rate at which sea water could be cleared from the deck. The additional weight of sea water shipped and retained on deck would have further aggravated the situation and progressively increased the heel. The situation was further compounded by the movement of the fish in the fish hold.

Because the doors to the forecastle and after accommodations were open, downflooding of the below-deck compartments occurred. The application and maintaining of hard-a-port helm and the increase in engine rpm aggravated the situation because the centrifugal forces generated by the turn to port would have caused all slack liquids to gravitate to starboard. This suggests that the forces generated by manoeuvring the vessel and the free surface effect of shipped water and other liquids, in conjunction with the movement of the fish in the fish hold, were such that they overcame any righting ability of the vessel. All positive transverse stability was lost and the vessel capsized.

The damage to the galley windows accelerated the flooding of the accommodation and below-deck

spaces, which continued until all reserve buoyancy was lost and the vessel sank.

2.6 Condition of the Deck Scuttle Seals

The life expectancy of such seals depends on a number of factors, including the material of construction, the frequency of use, and the climatic conditions under which the vessel is operating. The sinking of the vessel precluded any examination and, as such, the precise condition of the deck scuttle seals at the time of the accident could not be established. However, based on the statements provided by the ship's crew, the condition of the deck scuttle seals was such that water could enter the fish hold. The fact that the crew had discussed replacing the seals would suggest that the seals may have been in a deteriorated condition for a period of time.

The "PACIFIC BANDIT" had been inspected by the CCG SSB eight months previously and a full-term (four-year) certificate was issued. Although a S.I.7 was issued for other items, no reference was made to the deck scuttle seals. The absence of a S.I.7 would suggest that the watertight integrity of the seals was not compromised at the time of the inspection.

Two commonly used methods of checking the watertight integrity of deck scuttle seals are to subject the scuttles to a hose test or, alternatively, to pressure test the compartment, the former being the most commonly used method. In any event, for the scuttle seals to be leaking within a period of some eight months from inspection, a rapid and substantial deterioration of the seals had to have taken place. There is no evidence to suggest that the "PACIFIC BANDIT" was operated in other-than-normal conditions.

In the absence of records indicating the material of construction and the date that the seals had been replaced, it is not possible to determine the precise condition of the seals at the time of the ship inspection.

2.7 Inflatable Liferaft and Safety

Use of Liferaft Lashings

As liferafts on small fishing vessels are positioned close to the sea level, crews fear that liferafts could be dislodged from their stowed position. Some fishing vessels use additional rope lashings to secure the liferafts. However, liferafts need to be launched during emergencies when time is of the essence, and it is imperative that any securing arrangement be such that the liferaft can be launched expeditiously and safely. In this instance, the liferaft on the "PACIFIC BANDIT" was secured with additional rope lashings but did not have a quick-release mechanism, nor was a knife ready at hand.

Securing Arrangement for Entrance Covers

In cold climatic conditions such as those experienced in Canada, it is essential that the personnel in the

inflatable liferaft be protected against the elements. The inflatable liferaft standards require that the closing arrangement for the entrance covers be designed such that the covers can be "easily and quickly" opened from the inside and outside in all weather conditions. However, the crew experienced difficulty in handling the tie tapes in the cold weather. This would suggest that an alternative and/or supplementary means of securing the entrance covers may increase survival capability.

Method of Inflating the Liferaft

During abandonment, the cumulative effect of the anxiety resulting from the situation and the loss of valuable time associated with hauling the length of the painter to inflate the liferaft may decrease the survival time of a non-swimmer. An alternative or supplementary method of inflating the liferaft, as is currently fitted on some liferafts, could prevent valuable time from being lost and maximize the crew's chances of survival.

Liferaft and Liferaft Equipment Servicing

Although the flashlight batteries are always replaced at the time of annual servicing, the flashlight did not function. As the flashlight was not available for examination after the accident, the precise cause of the problem could not be established.

The quality control regime of the servicing depot would appear to have been less than optimal because:

- of the shortcomings revealed by the post-occurrence inspection of the liferaft; and

- of the TSB Engineering Laboratory findings that the corrosion at the battery terminals to the dome light had occurred over an extended period of time.

2.7.1 Emergency Drills

Because MED training is not a prerequisite for crews employed aboard fishing vessels of this size and type, it is imperative that the skippers conduct emergency drills and ensure that their crews know where the life-saving equipment and fire-fighting appliances are stowed, are knowledgeable in their use, and are aware of their duties and responsibilities during emergencies.

2.8 Location of EPIRB

As it is essential to take an EPIRB into the liferaft at the time of abandonment, the EPIRB must be strategically positioned in the wheel-house for immediate access. On this occasion, the EPIRB, which was in the skipper's cabin, had become inaccessible due to flooding when the skipper was forced to abandon ship; consequently, the EPIRB remained on board.

3.0 Conclusions

3.1 Findings

1. When the vessel was headed into the wind and seas, she began to ship sea water on deck.

2. The poundboards in position on deck were not fitted with a means to rapidly drain the sea water accumulating in the pounds.

3. The poundboards were not removed until the vessel had developed a significant starboard list.

4. The crew did not appreciate the hazard associated with the practice of leaving the poundboards in position when not engaged in fishing operations.

5. The condition of the seals of the two after deck scuttles to the forward fish hold was such that some of the sea water that had accumulated on deck leaked into the hold.

6. The pen boards in the forward fish hold did not extend to the deckhead, and the sea water entering the hold through the scuttles facilitated the free movement of the fish in the hold as the vessel rolled.

7. The vessel developed a starboard list which progressively increased due to the cumulative effect of the sea water shipped and retained on the starboard side of the main deck and of the cargo shifting to starboard.

8. The increase in list progressed to the point where the freeing ports on the starboard side became submerged, rendering them ineffective.

9. The crew did not fully appreciate the cumulative effect on the vessel's stability of the free surface effect generated by the sea water on deck and in the forecastle and after accommodations.

10. The forces generated by manoeuvring the vessel, the free surface effect of liquids, and the movement of the fish in the hold were such that they overcame the vessel's ability to right herself.

11. The vessel capsized when all positive transverse stability was lost.

12. Downflooding through the open accommodation doors and the damaged galley windows continued until the vessel lost reserve buoyancy and sank.

13. When abandoning the vessel, the engineer was the only crew member wearing an immersion suit. None of the crew donned a lifejacket.

14. No emergency drill had been practiced since the crew members who survived had joined the vessel, and some of the crew did not know where the lifejackets and immersion suits were stowed.

15. There is no requirement for uncertificated crews to undergo Marine Emergency Duties (MED) training.

16. The Emergency Position Indicating Radio Beacon (EPIRB) located in the skipper's cabin was neither activated nor taken aboard the liferaft.

17. Valuable time was lost in launching the inflatable liferaft because the raft was secured by additional rope lashings which were not fitted with a quick-release mechanism.

18. The crew members in the liferaft could not find the liferaft knife in darkness and were unable to quickly cut the liferaft painter or to go immediately to the assistance of the other crew in the water.

19. Because their fingers were numb with cold, the crew members in the liferaft experienced difficulty in tying the tapes to close the entrance covers.

20. The inflatable liferaft had been serviced by a credited servicing depot eight months before the accident, but its dome light and flashlight did not operate.

3.2 Causes

While operating in moderate sea conditions, the "PACIFIC BANDIT" capsized when positive transverse stability was lost due to the cumulative effect of the shipped seas retained on deck, the stowage of the catch, the free surface effect of liquids, and downflooding to the below-deck spaces. The open weathertight doors and the broken galley windows accelerated the downflooding, which continued until the vessel lost all reserve buoyancy and sank.

4.0 Safety Action

4.1 Action Required

4.1.1 Stability of Small Fishing Vessels

At the time of the occurrence, the "PACIFIC BANDIT" was fully loaded, with a relatively low freeboard. The adverse weather conditions and following seas caused large waves to be shipped over the stern. A hazardous situation was created as a result of several deficiencies existing on the "PACIFIC BANDIT": the poundboards had no means of draining sea water; the poor condition of the deck scuttle seals allowed sea water to leak into the fish hold; and the free movement of the fish above the pen boards in the hold reduced the transverse stability as the vessel rolled.

The adverse conditions affecting the seaworthiness of the "PACIFIC BANDIT" just before the sinking were similar to those identified in several other occurrences[6] over the past five years. All of these occurrences involved small fishing vessels, the crews of which apparently had little knowledge of, or concern about, the factors affecting vessel stability. At present, small fishing vessels, except those engaged in the herring or capelin fishery, are not required to have their stability evaluated, nor are the crews and operators required to demonstrate a knowledge and skill in the operation of these vessels.

Small fishing vessels make up the vast majority[7] of the Canadian fishing fleet, and in the last decade, 238 fishing vessels of less than 150 gross registered tons (GRT) have capsized or foundered in Canadian waters; more than two thirds of them were less than 15 GRT. In the western region alone, an average of 12 small fishing vessels have capsized or foundered annually, resulting in a total of 20 fatalities.

The Canadian Coast Guard (CCG) has issued numerous safety publications on vessel stability and unsafe operating practices. As evidenced by the aforementioned statistics, the message is not getting out to those who are actually operating and crewing the vessels. It is the Board's belief that many operators do not perceive their operating practices as unsafe; in fact, some practices may not appear to be unsafe, especially in favourable operating conditions. However, in adverse weather and seas, these same practices can quickly jeopardize vessel stability and often result in capsizings. The Board acknowledges that Transport Canada (TC) is in the process of replacing the Small Fishing Vessel Inspection Regulations (SFVIR) with the proposed Small Fishing Vessel Safety Regulations (SFVSR). One of the long-term objectives of the proposed regulations is to have a stability booklet for all fishing vessels over 15 m in length. However, given that many crews on fishing vessels may not fully appreciate that their day-to-day operating procedures and some seemingly minor vessel defects may be creating unsafe conditions, the Board recommends that:

The Department of Transport, in conjunction with other government departments, agencies,

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6 TSB Occurrence Nos. M90L3033 (LE BOUT DE LIGNE), M94W0026 (LADY DEVINE), M94W0090 (COMMAND PERFORMANCE), M95M0128 (LADY CANDACE), and M96L0037 (STEPHANE P. II).

7 Ninety-nine per cent of Canadian fishing vessels are less than 24 m in length.

> and organizations, immediately undertake a national safety promotion program for operators and crews of small fishing vessels to increase their awareness of the effects of unsafe operating practices on vessel stability.
>
> M96-13

For the longer term, the Board further recommends that:

> The Department of Transport conduct a study to identify the extent of unsafe loading and operating practices used by fishermen on small fishing vessels, with a view to developing guidelines for the safe operation of small fishing vessels.
>
> M96-14

4.1.2 Chances of Survival of the Crew on Fishing Vessels

Following its investigation into the sudden capsizing of the fishing vessel "STRAITS PRIDE II" (TSB Report No. M90N5017), in which three crew members failed to successfully abandon the vessel, the Board made two recommendations relating to the chances of survival of the crew on fishing vessels. The Board recommended that:

> The Department of Transport ensure that personnel who regularly crew closed-construction fishing vessels receive formal training in life-saving equipment and survival techniques; and
>
> (M92-06, issued March 1993)

> The Department of Transport expedite its revision of the Small Fishing Vessel Safety Regulations which will require the carriage of anti-exposure worksuits or survival suits by fishermen.
>
> (M92-07, issued March 1993)

In response, TC issued Ship Safety Bulletin No. 6/95 emphasizing the importance of carrying the recommended life-saving appliances on board small fishing vessels, and the training of personnel in their use. The Bulletin also encouraged all seafarers to obtain the necessary training and retain their skills through on-board practice.

In addition, TC advised that the proposed revised SFVSR will require anti-exposure worksuits as alternative equipment. Until the promulgation of the SFVSR, the CCG has indicated that it will promote the voluntary carriage of anti-exposure worksuits.

The frequency of small fishing vessel capsizings continues to be cause for concern. These capsizings continue in spite of considerable safety action to correct identified safety deficiencies. Notwithstanding the Ship Safety Bulletin and the promotion of anti-exposure worksuits, the Board notes that the survival of fishermen is still being jeopardized due to a lack of knowledge and training in the use of available life-saving equipment. The message is not getting through.

Thus, the Board believes that further action in response to earlier TSB recommendations on formal training in life-saving equipment and survival techniques (M92-06) and on the carriage of anti-exposure worksuits/survival suits (M92-07) is necessary. Therefore, to ensure that fishermen have a reasonable expectation of survival following abandonment, the Board recommends that:

> The Department of Transport explore alternative means of communication to encourage crews of small fishing vessels to train in the use of life-saving equipment.
>
> M96-15

In the past one and one-half years, at least four fishing vessel occurrences, in addition to this one, were reported to the TSB in which problems regarding the use of liferafts were identified. In April 1995, the 44-ton fishing vessel "HILI-KUM" sank; two of her crew drowned when the liferaft capsized. In November 1995, the 27 GRT fishing vessel "LADY CANDACE" capsized and sank rapidly; the liferaft had to be cut free from the securing lashings, and none of the crew knew that the raft was outfitted with a knife. On the same day, the "SIMON JACQUES" sank, taking the liferaft down before the crew had time to deploy it. In March 1996, a fire broke out on the 12 m fishing vessel "LITTLE BRAT"; when the raft was deployed, the crew was only able to get the top buoyant chamber inflated.

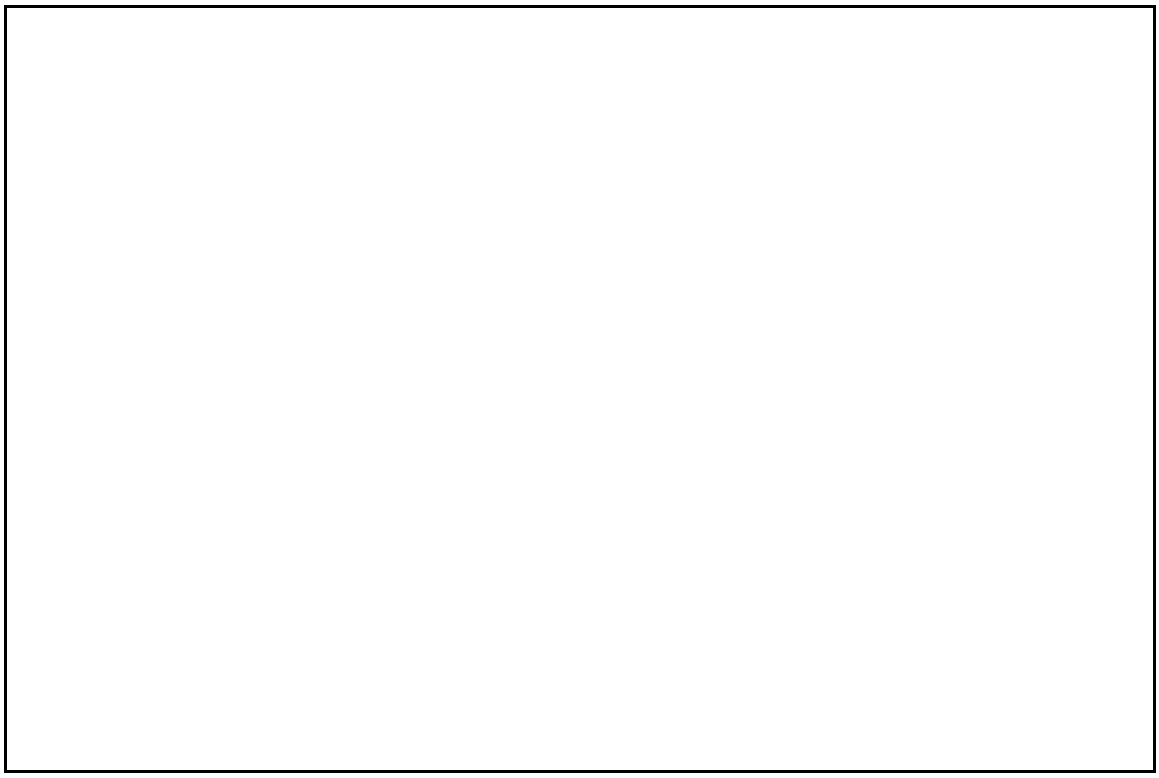
The survival of crews when abandoning ship at sea depends largely on the capability and reliability of their survival equipment, as well as on their familiarity and skill in using that equipment. The Board previously addressed shortcomings in the design of liferafts with respect to ease of boarding (TSB Recommendation M93-12) and their stowage and accessibility (TSB Recommendation M93-03). However, as noted in the above occurrences, crews' lack of familiarity with the use of liferafts continues to put seafarers at risk. Therefore, the Board recommends that:

> The Department of Transport encourage the owners and crews of small fishing vessels to conduct realistic emergency abandonment drills on a regular basis.
>
> M96-16

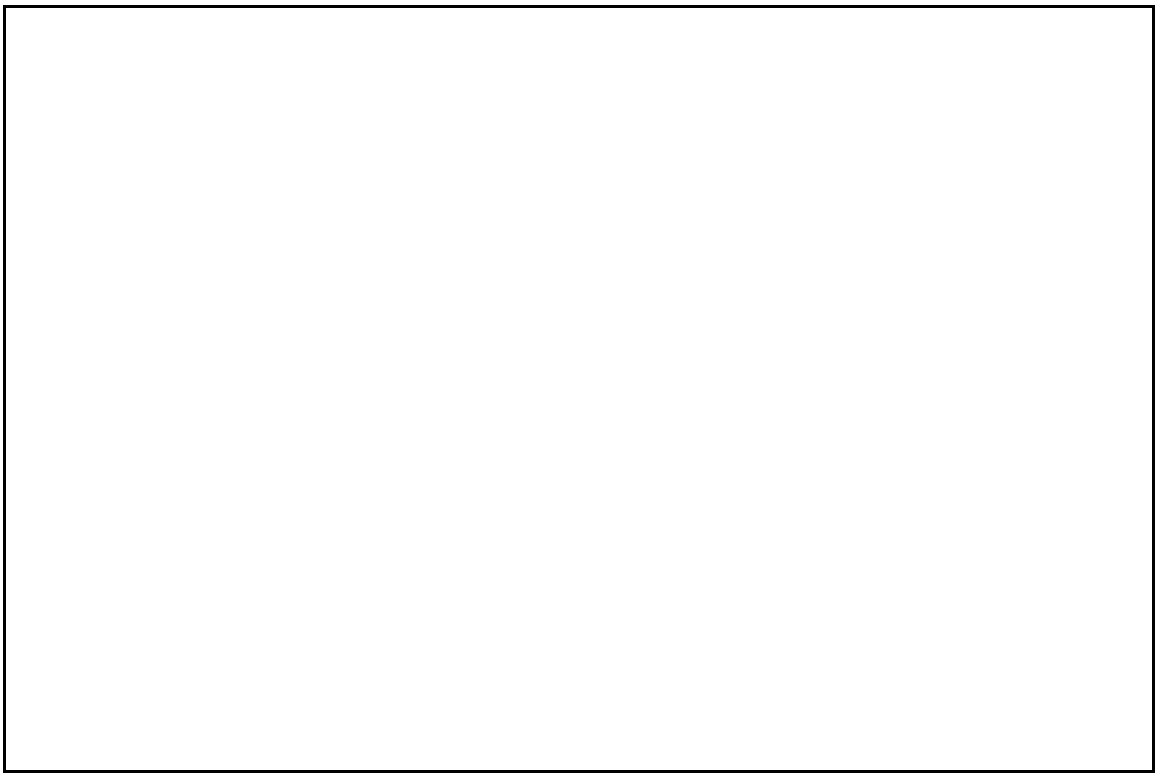
This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, Benoît Bouchard, and members Maurice Harquail and W.A. Tadros, authorized the release of this report on 27 November 1996.

Appendix A - Sketch of the Area of the Occurrence

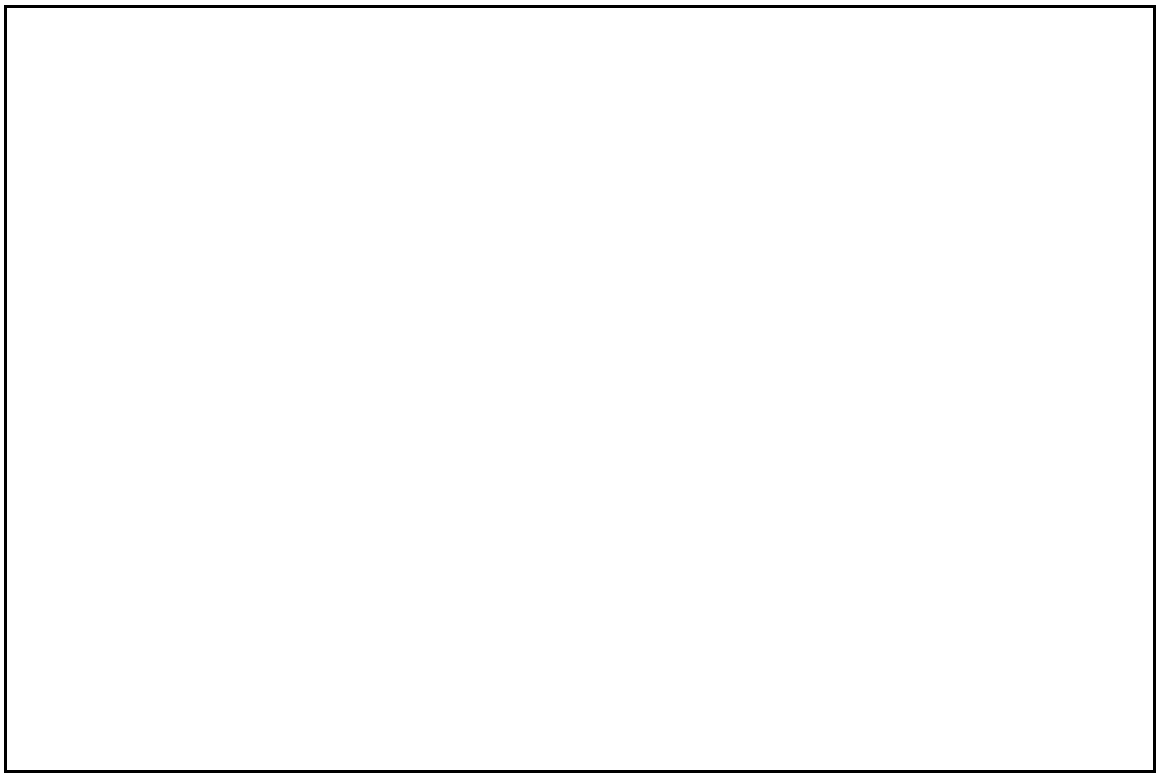
Appendix B - Photographs



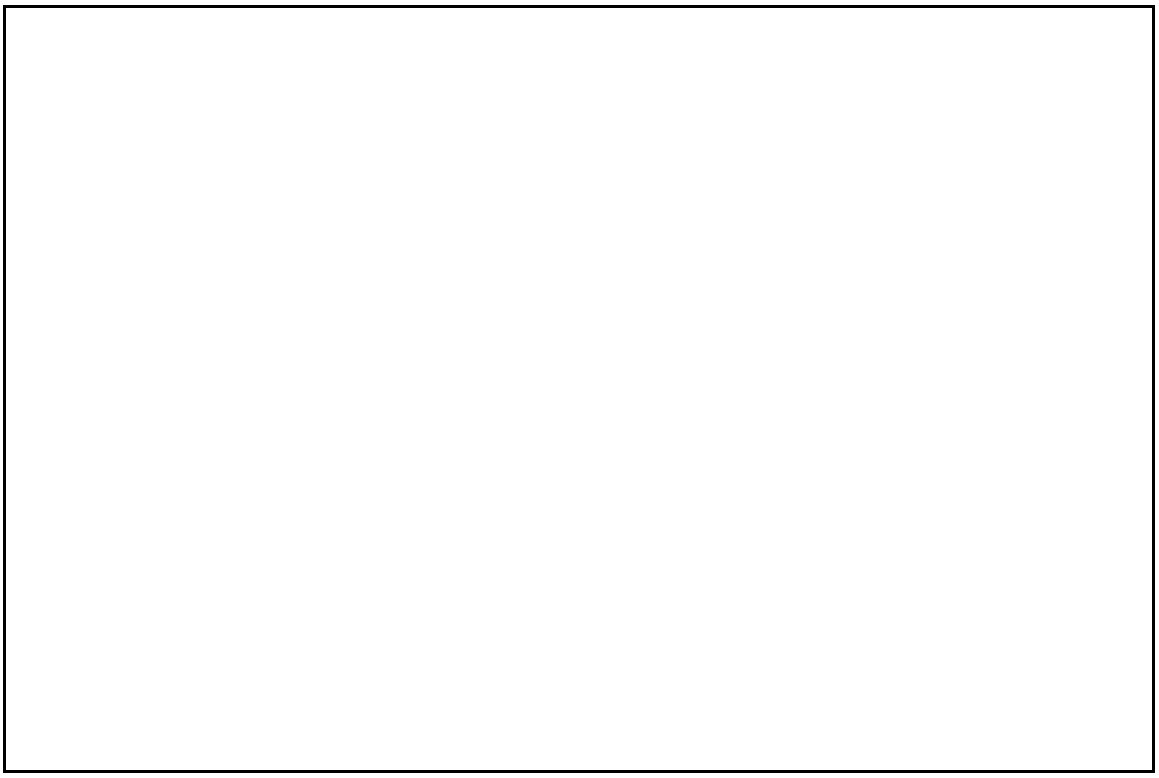
The "TWIN J" - A vessel similar to the "PACIFIC BANDIT"



Typical entry arrangement to the forecastle accommodation



Typical freeing port arrangement similar to that of the "PACIFIC BANDIT"



Typical hatch securing arrangement similar to that of the "PACIFIC BANDIT"

Appendix C - Glossary

B.C.	British Columbia
BHP	brake horsepower
C	Celsius
CCG	Canadian Coast Guard
EPIRB	Emergency Position Indicating Radio Beacon
GM	metacentric height - the distance between a vessel's transverse metacentre and her vertical centre of gravity. A measure of a vessel's ability to right herself from small angles of heel.
GRT	gross registered ton(s)
IMO	International Maritime Organization
kg	kilogram(s)
kn	knot(s): nautical mile(s) per hour
m	metre(s)
MED	Marine Emergency Duties
mm	millimetre(s)
N	north
PFD	personal flotation device
PST	Pacific standard time
RCC	Rescue Coordination Centre
rpm	revolution(s) per minute
SAR	Search and Rescue
SFVIR	Small Fishing Vessel Inspection Regulations
SFVSR	Small Fishing Vessel Safety Regulations
SI	International System (of units)
S.I.7	Ship Inspection form intended for listing deficiencies and/or instructions to the master and attached to the on-board Ship Inspection Certificate when the latter is short-termed.
SIC 29	Ship Inspection Certificate 29
SIRS II	Ship Inspection and Reporting System
SSB	Ship Safety Branch
TC	Transport Canada
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
VHF R/T	very high frequency radiotelephone
VTC	Vessel Traffic Centre
W	west
°	degree(s)
'	minute(s)