Potting Safety Assessment

Seafish Report No. SR524

May 1999

Sea Fish Industry Authority

Seafish Technology

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Summary

As part of an investigation into the safety of pot fishing, an analysis was made of potting related accidents from information provided by the Marine Accident Investigation Branch (MAIB).

Over a nine year period, forty two accidents involving pot fishing vessels were reported to the MAIB. Of these, there were sixteen vessel losses, nine fatalities and ten crew injuries.

Only four of the sixteen vessel losses can be attributed to potting operations. All were small vessels, two losses were caused by overloading and two capsized during the hauling operation. All other vessel losses were caused by factors common to fishing as a whole. Such grounding, flooding, collision and fire hazards are being tackled by safety initiatives industry wide.

Of the nine fatalities and ten injuries, four of the fatalities and all of the injuries are classed as 'Accidents to Personnel'. These accidents are directly attributed to the operation of potting. The remainder of fatalities are associated with vessel losses.

These statistics show that pot fishing has a fatality rate of 1 per 6,000 fishermen. Compared to the fatality rate of 1 per 680 fishermen for the catching sector as a whole, potting could be considered a relatively safe operation. However, this does not diminish the fact that potting has some very real dangers which resulted in four fatalities.

To investigate further, vessel trips were undertaken, one in Yorkshire and three in Devon, to evaluate if improvements could be made.

From the vessel trips and discussions, several hazards to fishermen have been identified.

- Struck by pot or anchor at davit block
- Injured by the hauler
- Trips and falls
- Manual handling
- Snagged in rope when shooting
- Pots out of sequence

From the discussions with pot fishermen, it is obvious that they are aware of these hazards and take great care to avoid them. However, mistakes do happen and any method of reducing or eliminating these hazards will be beneficial. The suggested methods are:

- Detachable pots – toggle system
- Rope pounds or divisions
- Automatic hauler stop

These suggestions may improve efficiency as well as safety and therefore, this report needs to be discussed by those involved in the fishery and Seafish will respond to their recommendations.

Acknowledgements

Seafish wishes to express their appreciation to all those who assisted with the vessel trips.

Chris Venmore,	South Devon Shell Fisherman's Association Owner of M.F.V. 'NICKY V'
Peter Watkinson	Owner and Skipper of M.F.V. 'ENDEAVOUR'
John Butler	Skipper M.F.V. 'NICKY V'
Mark Durrans	Owner and Skipper M.F.V. 'EXCEL'
Richard Elliot	Owner M.F.V. 'NEWBROOK'
Robin Steers	Skipper M.F.V. 'NEWBROOK'

Thanks must also be extended to the MAIB and the RNLI for their help in providing potting vessel accident data.

1. Introduction

Over £25 million worth of crabs and lobsters are harvested by potting each year, which represents a significant proportion of the total UK fisheries earnings. Potting is practised in all regions of the country and is a traditional fishing method which still poses very real risks to crews and their vessels. Hazards such as being dragged overboard or struck by a pot or an anchor can be fatal. Aside from these fatal dangers, handling pots is arduous work, and any mechanisation to improve the safety and lessen the physical effort will be of substantial benefit.

2. Objectives

To investigate possible ways to reduce the hazards present within pot fishing operations, whilst retaining efficiency.

Areas such as; pot handling, rope storage and shooting should be analysed and safer practices and equipment will be considered to improve safety.

3. Methodology

3.1 A desk study of previous accidents, to identify the most common and their causes.

3.2 Sea trips to identify the hazards present on individual vessels, and the measures taken to reduce these hazards.

3.3 Summarise the hazards present with the pot fishing method.

3.4 Identify possible solutions to these hazards, taking into account the practicality of such solutions.

4. Accident Information Search

4.1 Marine Accident Investigation Branch (MAIB)

A request was made to the Marine Accident Investigation Branch for information relating to accidents on potting vessels. The MAIB undertook a search of their accident database and printed out all the accident reports that identified a pot fishing vessel.

These accident reports contain basic information which includes:

- vessel name
- vessel registration
- accident categorisation
- a brief narrative which explains the events surrounding the accident and possible causes

As these reports relate to actual vessels, the reports given here have been summarised leaving out any identifying information.

4.2 Royal National Lifeboat Institution (RNLI)

The RNLI were approached to retrieve any relevant data on potting vessel accidents from their 'Sea Related Emergencies' (SEAREM) database.

SEAREM is held and compiled by the RNLI from incident reports received from various organisations in the UK and the Republic of Ireland.

Unfortunately, the database could not identify fishing methods and therefore it was not possible to retrieve any information concerning potting accidents.

4.3 Summary of Potting Vessel Accidents Reported between 1 January 1989 to 6 May 1998

Grounding	A small vessel, working off the west coast of Scotland, grounded whilst shooting pots close inshore.
	A single handed potter ran aground in poor visibility. A lack of familiarity with the new sounder and GPS systems, combined with the poor visibility to cause poor situational awareness.
	A small north west vessel became grounded, but was later refloated with assistance from another fishing vessel.
	A 9 metre vessel sank after hitting rocks, the two crew escaped into a liferaft.
Flooding	The engine room of an 11.7 metre potting vessel flooded due to the deck wash hose failing. Once the flooding was stopped, the engine room was pumped out and the vessel returned to port.
	The fish hold of a 9.75 metre potting vessel flooded when deck wash water flowed through an improperly secured hatch. The flooding was stopped and vessel taken in tow.
	On a small vessel, corrosion caused the failure of an engine room pipe, causing the engine space to flood.
	A GRP potting vessel sank at her moorings during the night. The flooding was caused by a fractured cooling pipe. No one was onboard at the time.
	A large 19 metre vessel experienced a leaking stern gland which caused flooding to the engine room. The vessel's own pumps became clogged, so pumping assistance was provided by a lifeboat.
	The caulking in between the planks of a wooden potting vessel came loose in heavy seas. This caused flooding and the vessel was beached to save her. There was no injury to the crew.

Flooding cont.	A 9.2 metre potting vessel sustained flooding of the aft compartment. The bilge alarm failed to operate and the vessel sank. The crew escaped into a liferaft. The cause of the flooding is unknown.
	A 37 year old wooden pot fishing vessel was potting when the crew discovered flooding in the aft cabin. Bilge pumping commenced but the pump later failed. The crew abandoned because of extensive flooding and the vessel capsized and sank by the stern.
	A small potting vessel was carrying some 200 whelk pots when she was lost with two crew. This had been her first trip out since being laid-up and it is thought that a leaking stern gland or rudder post caused the loss.
	A 9.75 metre GRP vessel sunk after the engine room flooded. The cause is not known, but a possible cause is a cooling pipe failure. The crew were taken off by another fishing vessel.
Hazardous Incidents	Concern was raised for a vessel overdue in foggy conditions. The vessel did return safely.
Capsize	An under 10 metre potting vessel was recovering a fleet of pots and had 190 pots already stored on deck. Due to this overloading, the vessel suddenly capsized and sank. The crew were thrown into the sea and were rescued after half an hour.
	A small south west vessel was hauling pots when one became fast on the seabed, the hauler was stopped but the vessel capsized and sank. The crew escaped and sat on the upturned hull until rescued.
	An open GRP vessel capsized due to adverse weather with the loss of both crewmen.
	An 8 metre open potting boat capsized when water on the deck did not drain off as usual. The crewman managed to escape and was rescued by helicopter.
Accident to Personnel	Whilst shooting, a bight of rope whipped up and caught a crewman around the ribs and neck. The crewman received bruising and rope burns.

Accident to Personnel cont.

During shooting a crewman got his foot caught in the rope. The rope came tight and jammed his foot against the shooting post. His foot was badly damaged and was later amputated.

Whilst hauling, the rope came out of the davit block and caught the skippers wrist. He was pulled overboard and drowned.

A bight of rope caught a pot pulling it overboard out of sequence. On the way it struck a crewman on the head, he later died in hospital.

A 23 metre vessel was potting in force 9 - 10. As pots were being hauled onboard a crewman was knocked out of the open shelter deck hatch. Several attempts were made to recover the crewman but were unsuccessful.

During shooting operations a crewman's foot became caught in the back line. Attempts were made to stop the vessel and cut the rope but the crewman lost his foot.

A lone fisherman tripped on a rope and fell overboard. He was later found on an island suffering from concussion and hypothermia.

A lone fisherman fell overboard and drowned. There were no witnesses and he was not wearing a lifejacket.

A crewmember was carried overboard as he attempted to clear some pots which had jammed during the shooting operation. He was recovered from the water and needed treatment for a badly damaged elbow.

A skipper fell onto the rotating hauler, where his hand became trapped. The hauler amputated his fingers before it could be stopped.

A crewman trying to cut free some tangled pots accidentally cut his own wrist.

During a potting trip in a small vessel off the west coast of Scotland, the skipper was struck on the head by the davit block during hauling operations.

Accident to Personnel cont.	A crewman was lifting the pot onto the gunwale for shooting when it fell off. As the rope to it came taut, it jammed the crewman's leg against the fish hold hatch. The crewman suffered a crushed leg but no broken bones.
	A crewmember on a 14 metre potting vessel was carried overboard and seriously injured during the shooting operation.
Fire	A 12 metre GRP potter had a fire in the engine room. The Halon fire extinguisher system failed, portable fire extinguishers were used but were ineffective. The crew abandoned the vessel into a liferaft with no injuries. The vessel later sank and the crew were rescued.
Foundering	A small pot fishing vessel was swamped whilst fishing. The two crew came ashore safely.
	A small vessel was overloaded with pots and foundered in bad weather.
	A pot fishing vessel reported overdue was subsequently located sunk on the sea bed. The probable cause is thought to be that she foundered, with the loss of her two crew.
	A 5.65 metre open potting vessel was overloaded with pots and sank. The single handed fisherman drowned and had not been wearing a lifejacket.
Dangerous Occurrences	Whilst the pot shooting operation was under way on a 15 metre Scottish vessel, retaining rails broke away causing a crewman to fall overboard. He was recovered with no injuries.
Machinery	A 11 metre vessel from the north east of Scotland sustained a fouled propeller while shooting pots. The anchor was dropped but failed to grip the sea bed, this allowed the wind to blow the vessel onto rocks.

Collisions and Contact

A small potting vessel collided with a trawler, causing the potter to sink. The two crew boarded a liferaft whilst the skipper stayed to make a distress call. The skipper drowned as the vessel sank.

A 23 metre potter was hauling pots with visibility 150 metres in fog. Another vessel was seen on the radar at 6 miles and when the vessel was within 1 mile the potter cut away her gear and tried to manoeuve away. The vessels collided, almost capsizing the potter. No injuries or serious damage were recorded.

4.4 Evaluation of Accident Reports

Table 1 - Summary of the Marine Accident Investigation Branch Accident Reports from 1 January 1989 - 6 May 1998

Type of Incident	Number of Incidents	Injuries	Fatalities	Vessels Lost
Grounding	4			1
Flooding	10		2	5
Capsize	4		2	4
Accident to Personnel	14	10	4	
Collisions and Contacts	2		1	1
Fire	1			1
Foundering	4			4
Dangerous Occurrence	1			
Machinery	1			
Hazardous Incident	1			
Totals	**42**	**10**	**9**	**16**

As can be seen in Table 1, the main hazard in pot fishing is 'accidents to personnel', which accounts for a third of all reported accidents. As will be noted from the accident reports, the majority of accidents to personnel directly relate to the operation of the fishing gear and the reports highlight several incidents in which crewmen become entangled in the rope whilst shooting, or crewmembers were struck by pots.

The next largest category of incidents is flooding which is often caused by poor maintenance. This, of course is not an incident that is specific to potting vessels and indeed, all the reported incidents of grounding, flooding, collisions, fire, etc are general concerns that affect the whole of the fishing industry.

Two of the four capsize incidents are due to pot fishing causes, as are two of the four foundering incidents. However, all these incidents are with respect to very small vessels and should not be considered as being typical of the pot fishing.

Most important to note, is that these incidents are for the whole of the UK over a nine year period and hence, the safety record of potting is not as bad as it may seem at first glance.

5. Vessel Trip One 'MFV ENDEAVOUR'

Vessel: M.F.V. 'ENDEAVOUR'
Port: Bridlington
Skipper: Peter Watkinson
Crew: 2
Date: 19 May 1998

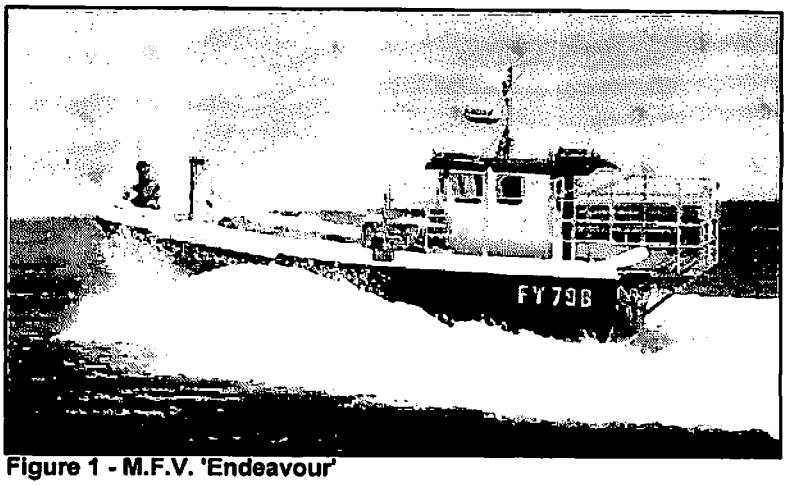


Figure 1 - M.F.V. 'Endeavour'

5.1 Vessel Information

The 'ENDEAVOUR' is a 9 metre G.R.P. fishing vessel with an aft wheelhouse and a forward mounted pot hauler. The hauler, which is installed on the port side, is a one ton vee wheel design with a capstan head extending from the centre. The hauler controls are installed on the sloping face of the column on which the hauler is mounted. Located with the hauler controls are a dual set of controls for the vessels Caterpillar engine and water jet propulsion system. Just aft of the hauler is a 'baiting table' fixed to the vessels gunwale. This is constructed with a metal frame supporting a wooden top incorporating a location for a fish box, containing the bait.

Mounted on the starboard side, opposite the pot hauler, is a Sjóvélar net hauler for hauling gill nets, which are worked alongside the pots.

Aft of the table, located into the top of the gunwale, is the stainless steel shooting pole. The pole is located about 30cm aft of the table, just forward of the wheelhouse and guides the rope over the vessel's rail when shooting.

On most days there is a crew of three to work the gear, though on the day of this trip only the skipper and one crewman were working.

The 'ENDEAVOUR' fishes parlour pots, in strings of 25 - 27 pots.

5.2 Hauling

Once the dahn buoy has been taken aboard by the crewman and stowed forward of the hauler, in the catch storage area, the rope from the dahn buoy is placed over the davit block and around the hauler. The hauler is then used to heave in the dahn tow and pull up the anchor at the start of the string of pots.

When the anchor breaks the surface and rises to the davit block, it is untied and stored with the dahn buoy. The dahn rope that has piled up around the base of the hauler is then picked up and also stored with the dahn.

The back rope is then taken around the hauler and the lifting of the pots begins. As the rope is pulled on board, it accumulates in a pile at the base of the hauler and is in the way of the hauler operators feet. Hence, once the pile has built up significantly, the hauler operator (the skipper) picks up the pile and moves it starboard out of the way.

The first indication of a pot coming to the surface is when the leg rope splice comes over the davit block. As the pot comes to the surface, the skipper stops the hauler and the pot is lifted, with a swinging action, onto the gunwale. Once onboard, the pot's leg rope is flicked off the davit block and is held to guide the splice around the restarted hauler.

Once the hauler has been restarted, the skipper can turn his attention to the pot resting on the gunwale and start to clear the pot (empty the catch). The amount of clearing that is achieved depends on the time taken for the next pot to rise. Most of the time the pot is partly cleared and then passed aft to the crewman in readiness for the next pot to be taken aboard. As the process of recovering the pots continues, the back rope piles on the deck and around the skippers feet.

During all this work, the skipper moves about very little. The only movement required is to move the rope from the base of the hauler. Towards the end of the fleet, there is no remaining space to move the rope to and hence it is allowed to pile up at the base of the hauler (See Figure 2).

Figure 2 - 'Back' rope pile under hauler

Once the pot has been passed on, the second crewman working at the baiting table clears the remainder of the catch and rebaits the pot. (See Figure 3).

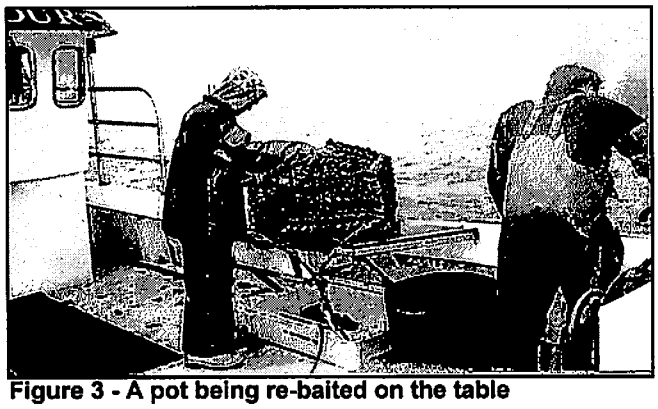


Figure 3 - A pot being re-baited on the table

Once the hauler has been restarted, the skipper can turn his attention to the pot resting on

When the pot has been cleared and re-baited it is then stacked. The first row of the stack is on the vessels deck, up against the gunwale on the starboard side. The row is started forward and leads back to the wheelhouse. Once this row is full, the pots are stacked in a new row on top of the first row. The pots are only stacked in rows three high and once full, a new stack is started on the deck in front of the previous one.

Each pot is connected to the back rope with a leg rope and this leg is pushed close into the base of the stack to avoid tangles. Often the length of the leg is insufficient to reach the stacked and so, a bright of back rope is pulled from the pile to enable the pot to be stacked correctly.

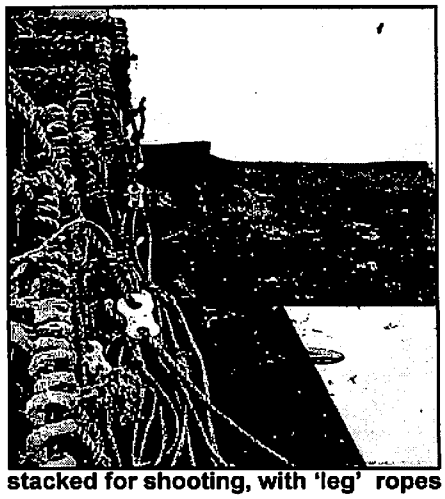


Figure 4 - Pots stacked for shooting, with 'leg' ropes tucked in close

Once all the pots have been taken aboard, final preparations are made for the shooting operation.

5.3 Shooting

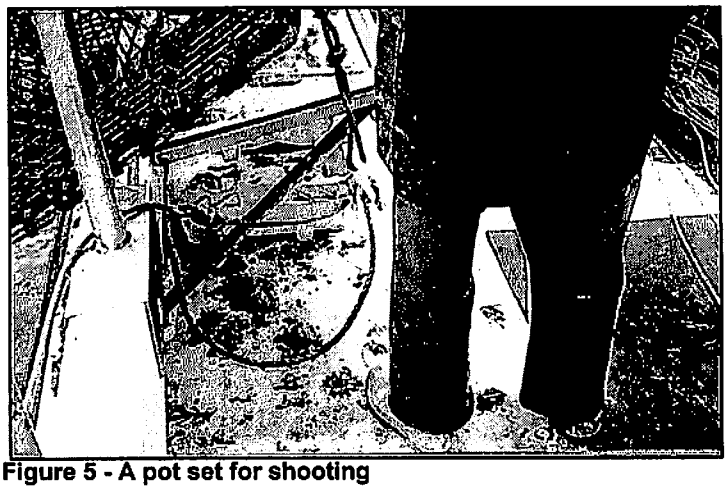


Figure 5 - A pot set for shooting

For shooting, the skipper moves from the hauler to the wheelhouse. The dahn is paid away and the end of the tow made fast to the shooting pole. Once the vessel has been manoeuvred into the right location, the dahn tow is untied and the anchor, with the start of the back rope attached, is dropped overboard.

The shooting pole, set in the port rail, just ahead of the wheelhouse, guides the back rope over the vessel's rail as the rope is pulled from the pile and across the deck by the way of the vessel.

The pots are taken from the stack in reverse order. The crewman lifts the pot and carries it over to the shooting position, where the pot is lifted onto the gunwale and held until it is pulled overboard.

As the crewman is holding the pot on the gunwale, the back rope is traversing across the deck near his feet. When necessary, to avoid this moving rope, the crewman will sometimes hold the pot at arms length to enable him to keep this legs clear.

Sometimes the back rope may become entangled, causing loops of rope to race across the deck and over the side. When this occurs, the crewman will hold the rope against the gunwale until the tension pulls out the kinks, to try to ensure that the rope will be stretched straight on the sea bed.

After each pot has gone overboard, the crewman moves to collect the next pot in the sequence. All the time the back rope is still being pulled overboard, and often snakes across the deck. Hence, the crewman takes care to avoid the rope.

Eventually, as the shoot continues, the rope pile becomes smaller and is concentrated forward where the rope was initially stored. The rope is now crossing the entire deck, making it difficult for the crewman handling the pots to avoid the moving rope as he picks pots up from the stack.

Once the last pot has gone overboard, the anchor and dahn buoy are thrown overboard to mark the end of the fleet.

MFV Endeavour

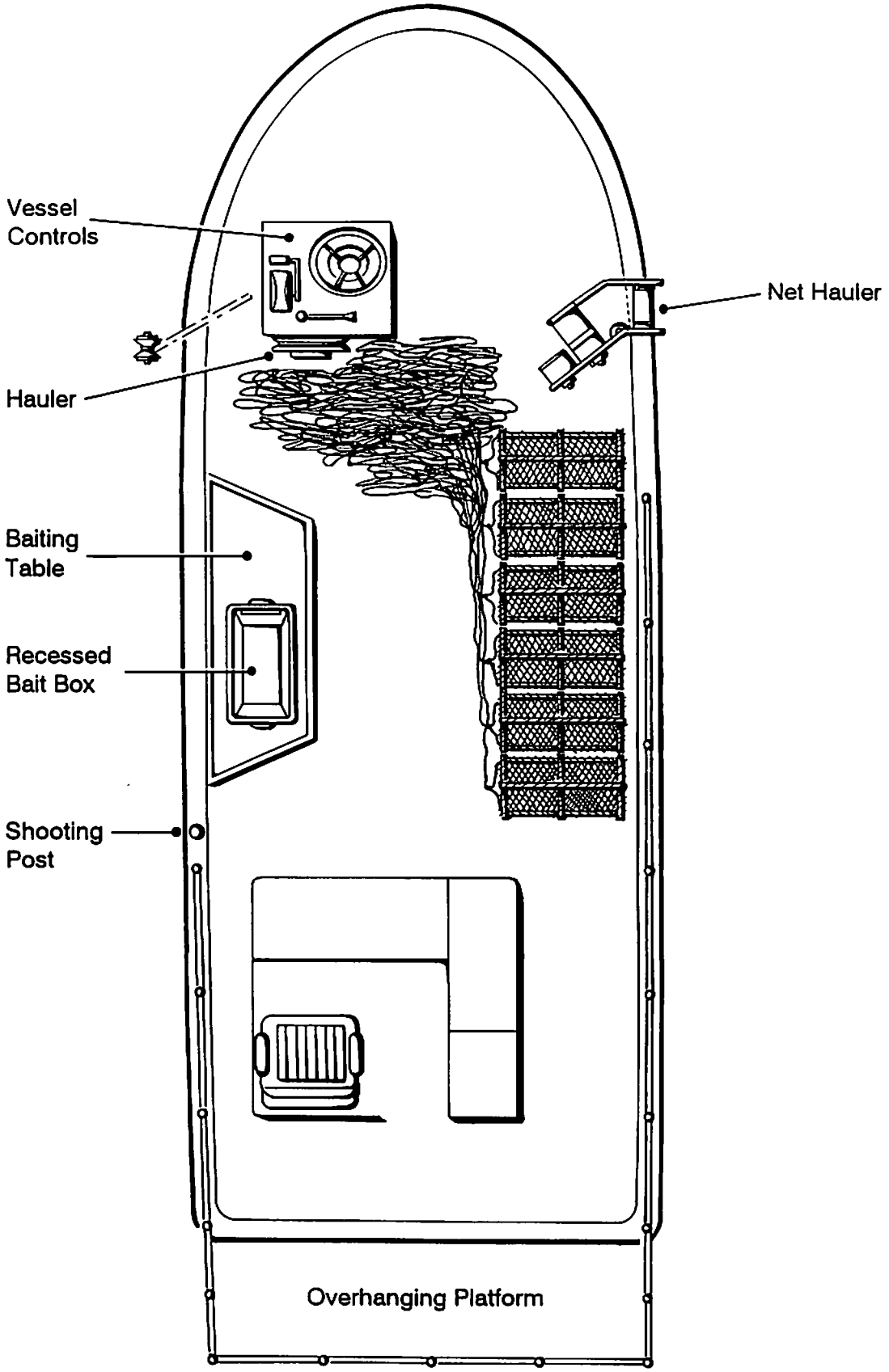


Fig.6

6. Vessel Trip Two 'M.F.V. NICKY V'

Vessel: M.F.V. ' NICKY V'
Port: Dartmouth
Skipper: John Buttler
Crew: 3
Date 2nd June 1998

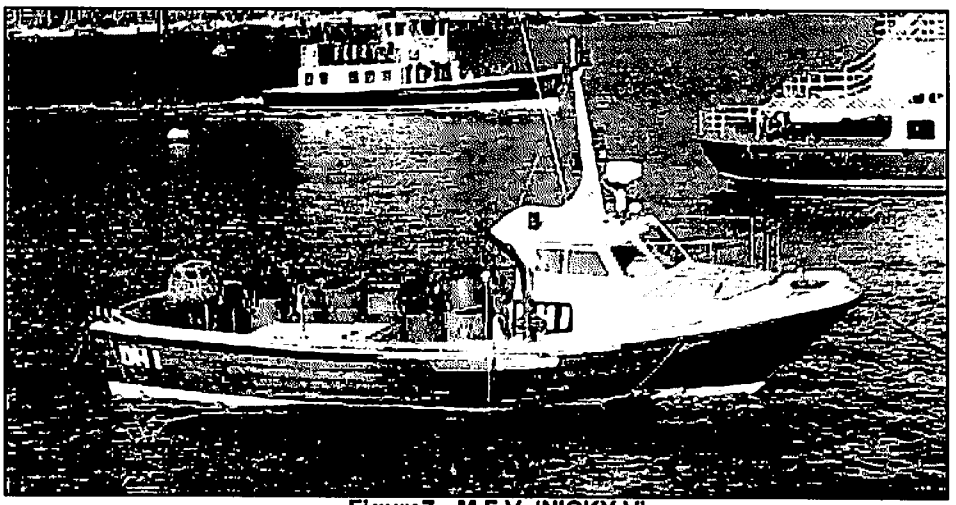


Figure7 - M.F.V. 'NICKY V'

6.1 Vessel Information

The 'NICKY V' is a 9m (32') GRP vessel with a forward wheelhouse. A one ton hydraulic vee wheel hauler is mounted on the aft face of the wheelhouse on the starboard side, with the controls set above the hauler.

The forward wheel house design gives a large open aft deck space for pot storage. This deck space is restricted slightly by the raised engine cover, though this presents few problems as the pots are stacked on top of the cover.

The pots used on the 'NICKY V' are mainly inkwell types, however some of the fleets consist of inkwell and parlour pots. A three man crew normally work the vessel operating from Dartmouth.

6.2 Hauling

During the hauling operation the crew work in a close knit team with one man at the hauler, a second man clearing pots and the third stacking the pots in readiness for shooting. Hauling commences with picking up the buoys and lifting the anchor at the start of the string of pots. The back rope is then lead over the davit block and around the hauler. As the hauler pulls in the back rope, the rope builds up in a pile on the deck adjacent to the hauler, and regularly the operator has to move the pile of rope across the deck to give space for more rope to be hauled.

Figure 8 - Rope pile

The first indication as each pot in turn approaches the surface is the leg rope splice. This comes over the davit block and up to the hauler, at which point the operator makes ready to stop the hauler. Once the pot has broken the surface, the hauler is slowed and then stopped with the pot raised as high as possible to the davit block. The pot is manually lifted onto the gunwale and the leg rope slipped off the davit block. The hauler is restarted and the leg rope is held out to ensure that the splice, connecting the pot to the back rope, travels cleanly around the hauler.

With the pot now resting on the gunwale, the hauler operator begins to clear the catch. This is achieved in varying degrees, as the hauler operator has to be ready to stop the hauler when the leg splice of the next pot surfaces. When this occurs he slides the partially cleared pot to the second crewman to finish clearing and rebait the pot.

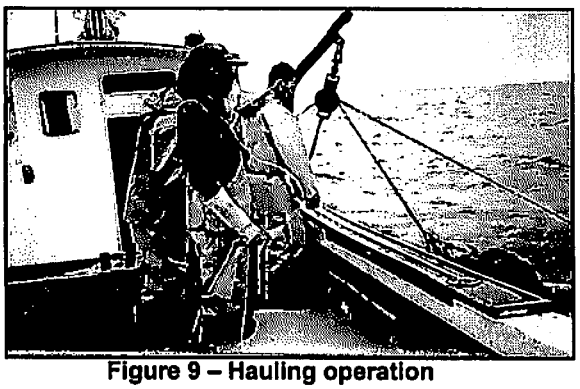


Figure 9 – Hauling operation

On a few occasions, when the operator was moving the piled up rope, or having difficulty clearing a pot, the hauler was stopped just as the pot reached the davit block. Obviously considerable experience is needed to achieve such fine timing.

Baiting of the pots is carried out using bait fish stored in a box at deck level. Hence, the man is required to bend down to pick up bait for every pot. Once baited, the pot is passed along the gunwale to the third crewman for stacking.

The pots are stacked down the port side of the vessel, and are built up in rows. Some of the stacks contain a mix of inkwell and parlour pots, which tends to make the stacks less stable and when stacking, the pots need to be supported until another pot is used to wedge them in securely.

As the haul nears the end of the fleet, the rope is left to gather at the base of the hauler. This build up of rope often covers all the deck in the region of the wheelhouse door.

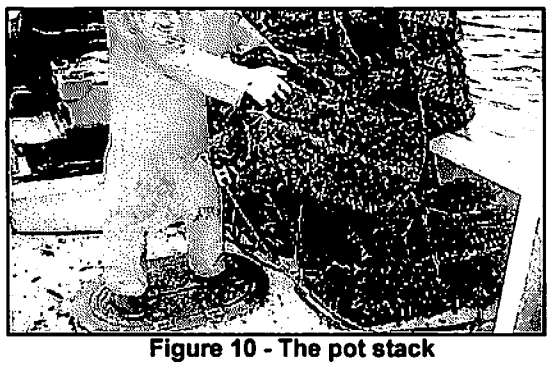


Figure 10 - The pot stack

6.3 Shooting

Once the hauling is completed, the skipper enters the wheelhouse to manoeuvre the vessel into a position ready to shoot the gear. To gain access to the wheelhouse the skipper has to walk over the pile of back rope. Whilst the vessel manoeuvres into position, the two remaining crew clear the aft deck ready for shooting and insert the stainless steel shooting pole into its mounting hole, which is roughly amidships in the gunwale top.

When the vessel is in the desired position the shooting operation begins. This only involves two persons, the skipper in the wheelhouse and one man to handle the pots. The third man is able to start 'nicking' the crab claws, which he does stood in a safe position at the stern of the vessel.

Having paid away the buoys and buoy rope, the anchor is let go with the end of the back rope attached to it. The vessel sails along the desired course and the rope is drawn from the pile on the deck to pass over the rail into the sea. In being drawn from the pile, the rope 'snakes' across the deck and is constrained to pass forward of the shooting pole as it travels over the rail.

The crewman picks up each pot in sequence and rests it on the gunwale at a point forward of the shooting pole. As the leg rope, connecting the pot to the back rope, becomes tight he allows the pot to fall off the rail into the sea.

Because the pot will not rest on the gunwale without support, the shooter has to hold the pot until it is pulled overboard, (see Figure 11). This leaves the shooter exposed to the possible danger of becoming entangled in the back rope (see Figure 12).

Figure 11 - Pot shooting underway

Figure 12 - Note the coil of rope by the shooters feet

When all the pots have been shot away, the final anchor is released along with the buoy rope and buoys.

MFV Nicky V

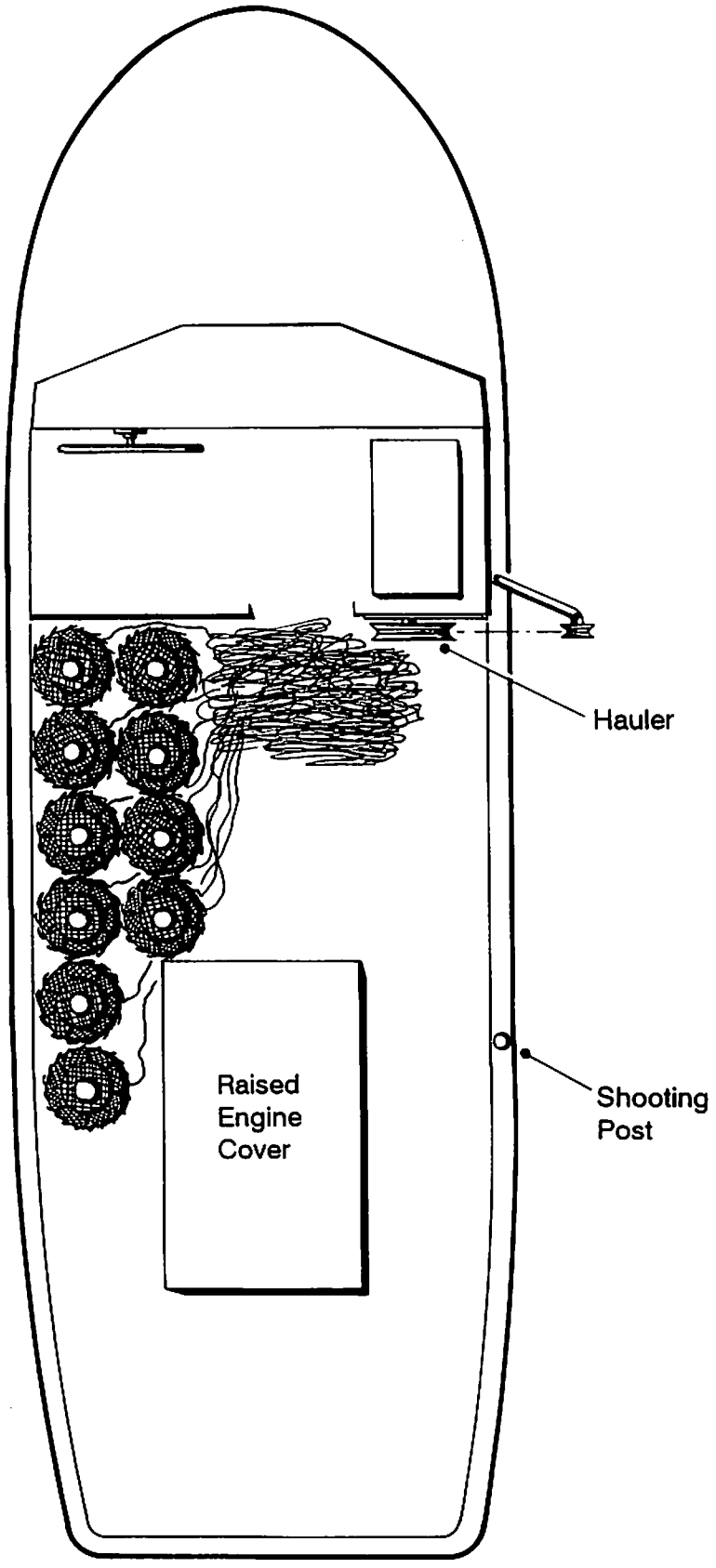


Fig.13

7. Vessel Trip Three M.F.V. 'EXCEL'

Vessel: M.F.V. ' EXCEL'
Port: Dartmouth
Skipper: Mark Durrans
Crew: 3
Date: 3rd June 1998

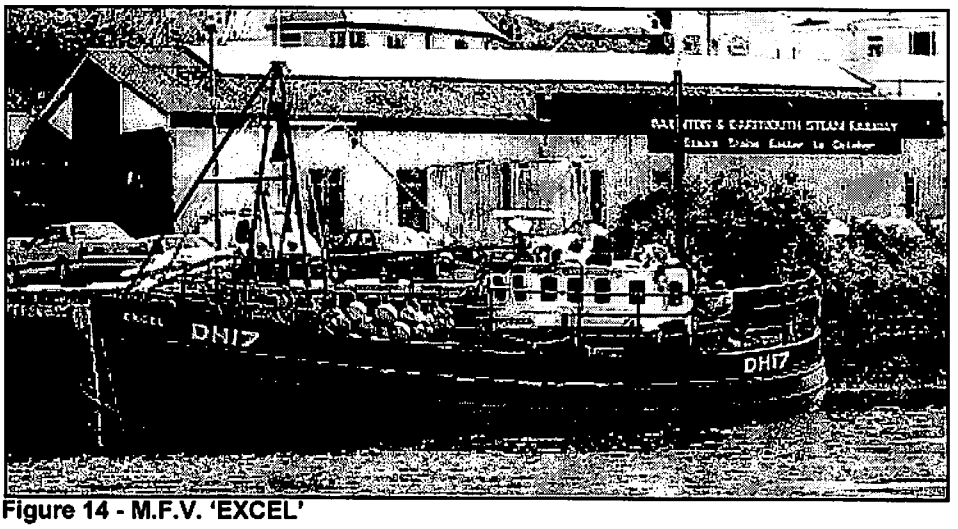


Figure 14 - M.F.V. 'EXCEL'

7.1 Vessel Information

The 'EXCEL' is a 15m (52') wooden hulled potting vessel with an aft mounted wheelhouse. The vessel is powered by a 138kW diesel engine, which also provides hydraulic power for the vee wheel hauler mounted centrally near the bow of the vessel. Controls for both the hauler and the vessel are mounted on the port side of the hauler pedestal.

In line with the hauler and on the starboard side is an open sided hanging block, which is suspended from a retractable outrigger mounted on the vessel's tripod mast structure. Some two metres aft of the hauler is a steel 'railing type' barrier that extends from the port rail to the centreline. This barrier serves to contain the pile of rope that builds up when the pots are hauled. On the starboard side, in line with the barrier, is a pot clearing/shooting table set level with the gunwale top. Both table and gunwale are sheathed in stainless steel. All of the deck area between the barrier and the forward face of the wheel house is clear for the stacking of pots.

Figure 15 - Hauling operations underway

7.2 Hauling

The skipper operates the hauler and is also able to control the vessel via the remote controls. As can be seen in Figure 15, there is a good distance between the hauler and the hanging block. This distance enables the operator to raise the pots right up to the block, without the leg rope splice entering the wheel of the hauler.

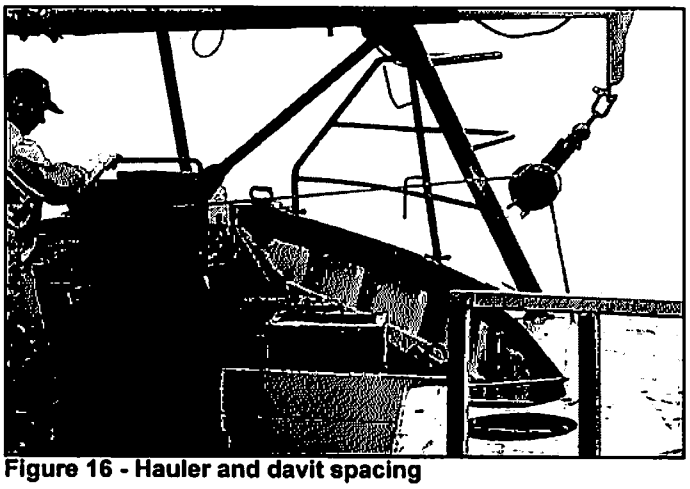


Figure 16 - Hauler and davit spacing

When each pot is raised up to the block, the skipper stops the hauler to allow the second crewman to lift the pot and rest it on the gunwale. The leg rope is then flicked clear of the block allowing the hauler to be restarted. The crewman then begins to clear the pot of its catch and continues with this until the next pot arrives, at which point he passes the pot to the third man who completes clearing and then rebaits and stacks the pots.

Occasionally the hauler operator moves the built up pile of rope aft up against the barrier to create space near the hauler. Sometimes the hauling operation is paused to give the man clearing the pots time to be ready to receive the next pot hauled.

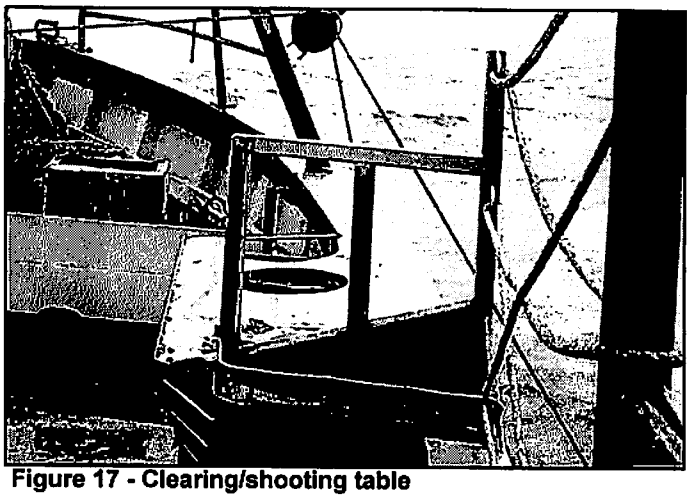


Figure 17 - Clearing/shooting table

The pots, when cleared and baited, are stacked in rows starboard to port across the front of the wheelhouse. All the pots are of the same design and are stacked tight into each other to ensure stability. The stacks are a maximum of three pots high, as any more would obscure the view from the wheelhouse. The leg ropes for the pots are laid out on the deck alongside the table in order to keep the deck clear.

7.3 Shooting

When changing from hauling to shooting, the skipper needs to move back into the wheelhouse. Because the pots are stacked up blocking the way, the skipper is forced to climb over the pots to gain access to the wheelhouse. Using the high side rails to hold onto, the skipper climbs up the stack of pots, across the top of two or three rows before descending onto the deck beside the wheelhouse. Once in the wheelhouse, the skipper is in a good position to view the whole shooting operation.

The shooting operation is carried out by the two crewmen who lift each pot in turn onto the table for it to be dragged overboard as the back rope becomes tight. As the loops of back rope drag across the deck the steel barrier prevents any possible snags on the stacked pots, and also provides safety for the crew. However, when the man places each pot on the table he has to stand very close to the leg ropes and the loops of back rope that lead to the stacked pots. These loops of rope move very rapidly as the rope is shot away and the loop will tighten suddenly to pull the next pot into the sea.

At the start of the shoot, the pots are close to the shooting table and the man has ample time to position the next pot. However, as the shoot progresses, the distance which the man has to cover to collect the pots increases and the help of the second crewman is needed to keep pace with the shoot. The second man picks up the pot from the stack and rolls the inkwell type pot across the deck to the man at the shooting table. This man at the table is stood close to the moving loops of the back rope and hence is exposed to some risk.

MFV Excel

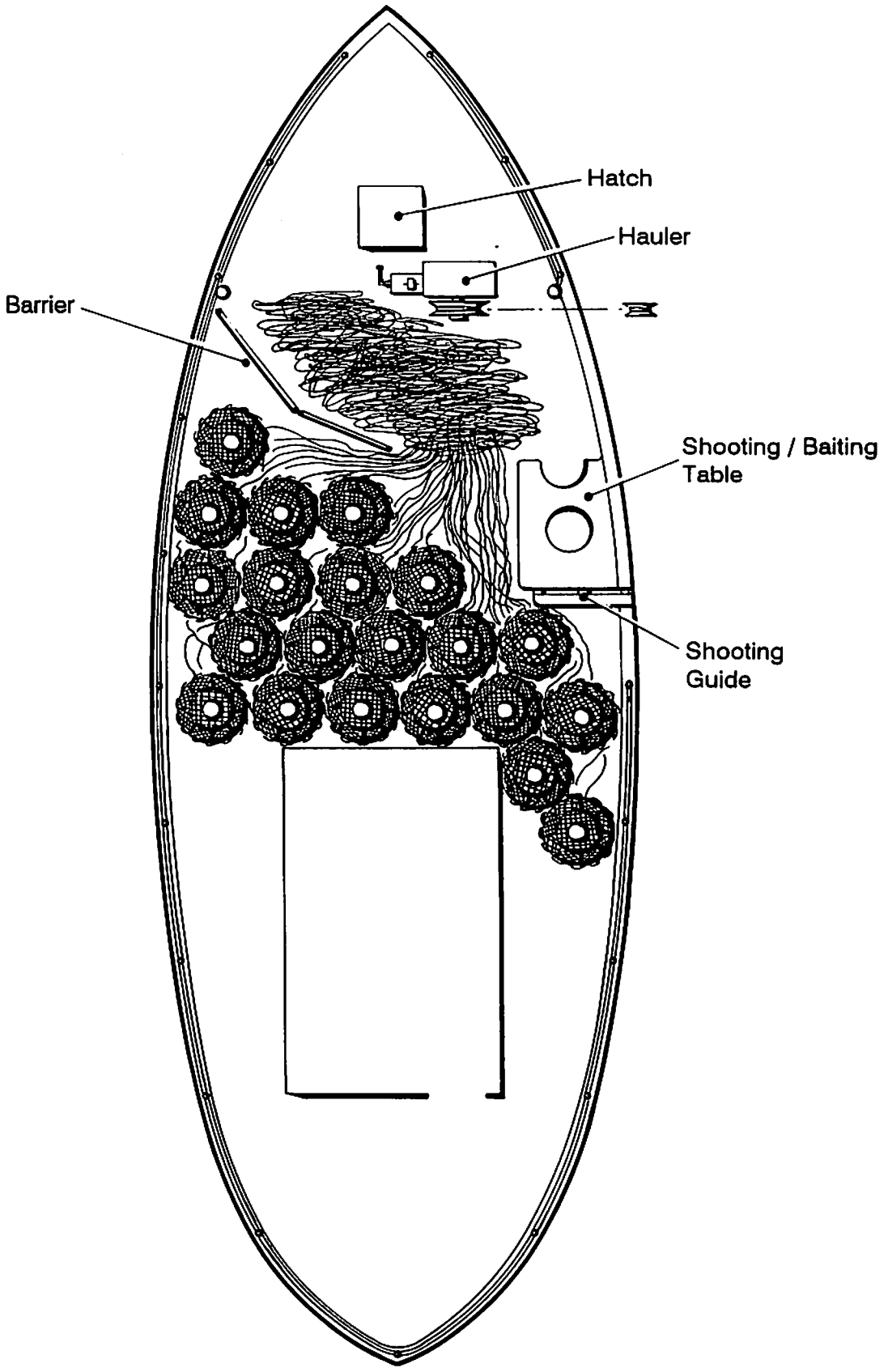


Fig.18

8. Vessel Trip Four M.F.V. 'NEWBROOK'

Vessel: M.F.V. 'NEWBROOK'
Port: Dartmouth
Skipper: Robin Steers
Crew: 3
Date: 4 June 1998

Figure 19 - M.F.V. 'NEW BROOK'

8.1 Vessel Information

The 'NEWBROOK' is a wooden hulled vessel 14m (46') with a 70kW engine. She has a wheelhouse set aft of amidships and a forward mounted vee wheel hauler which is operated from the wheelhouse. The vessel is fitted with a ramp for shooting pots on the starboard side and works inkwell type pots. The vessel is worked by a crew of three.

8.2 Hauling

Hauling is over a davit mounted block with the rope being led around a jockey pulley and then 'under' rather than 'over' the vee wheel hauler. The jockey wheel ensures a good angle of wrap around the hauler and this 'under' hauling arrangement has the advantage that the rope is ejected away from the hauling position. This gives a clear deck space for the person lifting the pots at the davit block (see Figure 20).

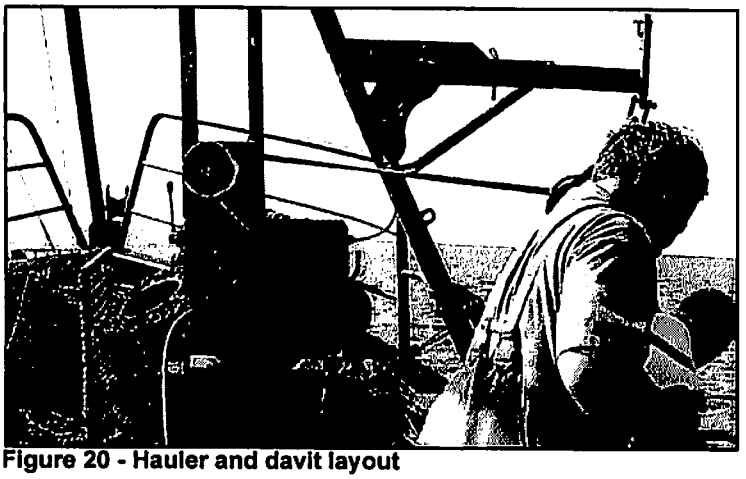


Figure 20 - Hauler and davit layout

The skipper controls the hauling operation from the wheelhouse, stopping and starting the hauler for the man at the davit block to handle the pots. Each pot is brought up to the block and the hauler paused whilst the man lifts the pot up to rest on the rail and flips the leg rope clear of the davit block. The hauler is restarted and the man holds the leg rope out sideways to ensure clear passage of the leg rope splice around the hauler. In lifting the pot up onto the rail, the man swings the pot to give momentum to the lift. Once the pot is resting on the gunwale, the man removes the catch and rebaits the pot, after which the second crewman stacks the pot on the port side of the vessel.

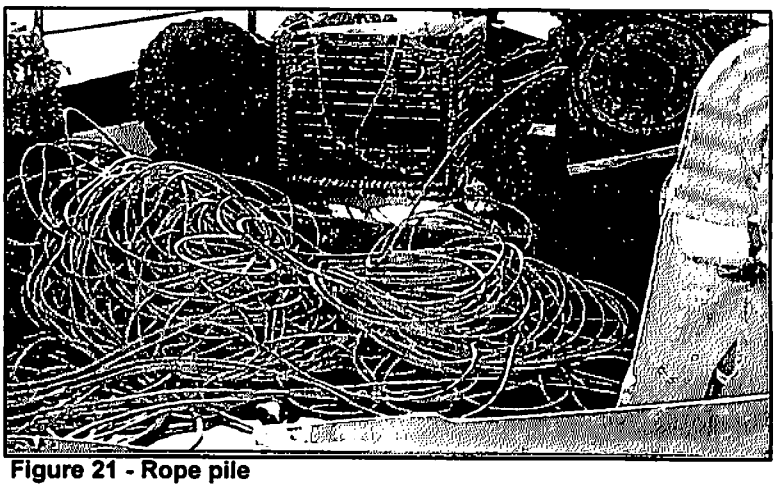


Figure 21 - Rope pile

The stack is built up in columns, with each column being three pots high. As the last pot is added to the top of each column, it is wedged into the vessels side rails. This helps to prevent the column falling over until the next set of pots are stacked alongside and provide support.

Throughout the hauling operation, the rope that builds up at the base of the hauler is moved to port out of the way. However, when nearing the end of the fleet, the rope pile is left to build up, this sometimes results in the coils of rope getting under the feet of the crewman lifting the pots onboard.

The last pot, with additional concrete weighting, to act as an anchor is, cleared, rebaited, and left to stand on the gunwale whilst the vessel is manoeuvred into a position for shooting.

8.3 Shooting

The shooting ramp on the 'NEWBROOK' angles up from deck level and is inset into the top section of the starboard gunwale, alongside the front of the wheelhouse (see Figure 22). The ramp is constructed from plywood on a steel tube frame and set at an angle to the rail. The side and the base have been covered with laminate to give a hard, smooth surface for the pots to be dragged along. The steel frame serves as a shooting post to constrain the back rope inside the ramp.

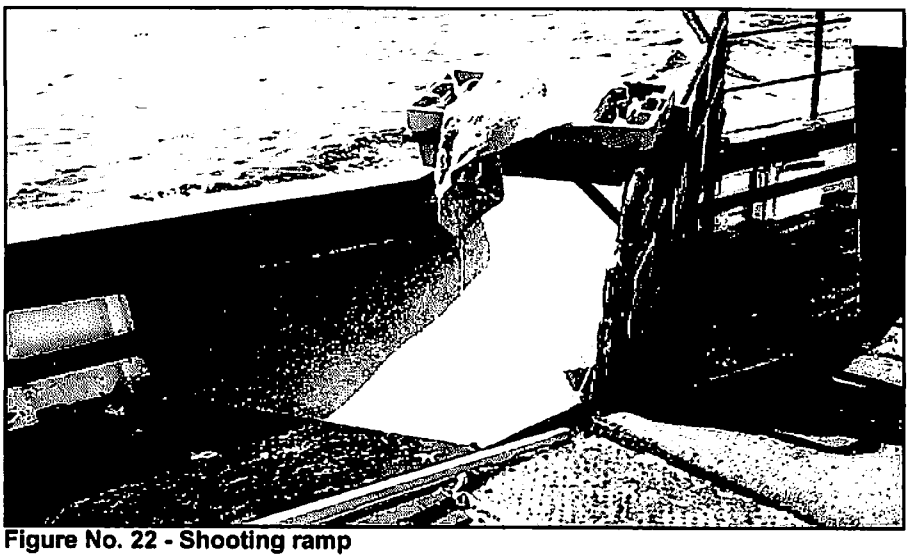


Figure No. 22 - Shooting ramp

The shooting operation commences with the buoys and buoy rope being paid away and once the vessel is position, the last pot hauled, which was left in readiness on the gunwale, is pushed overboard. The back rope is drawn aft by the way of the vessel and into the ramp. The crewmen simply bring each pot in turn and place it at the start of the ramp for it to be dragged up and over the rail into the sea. The crewman placing the pots at the ramp is able to stand close to the wheelhouse where he is away from the moving ropes. The second crewman assists by rolling pots across the deck to the man at the ramp.

MFV Newbrook

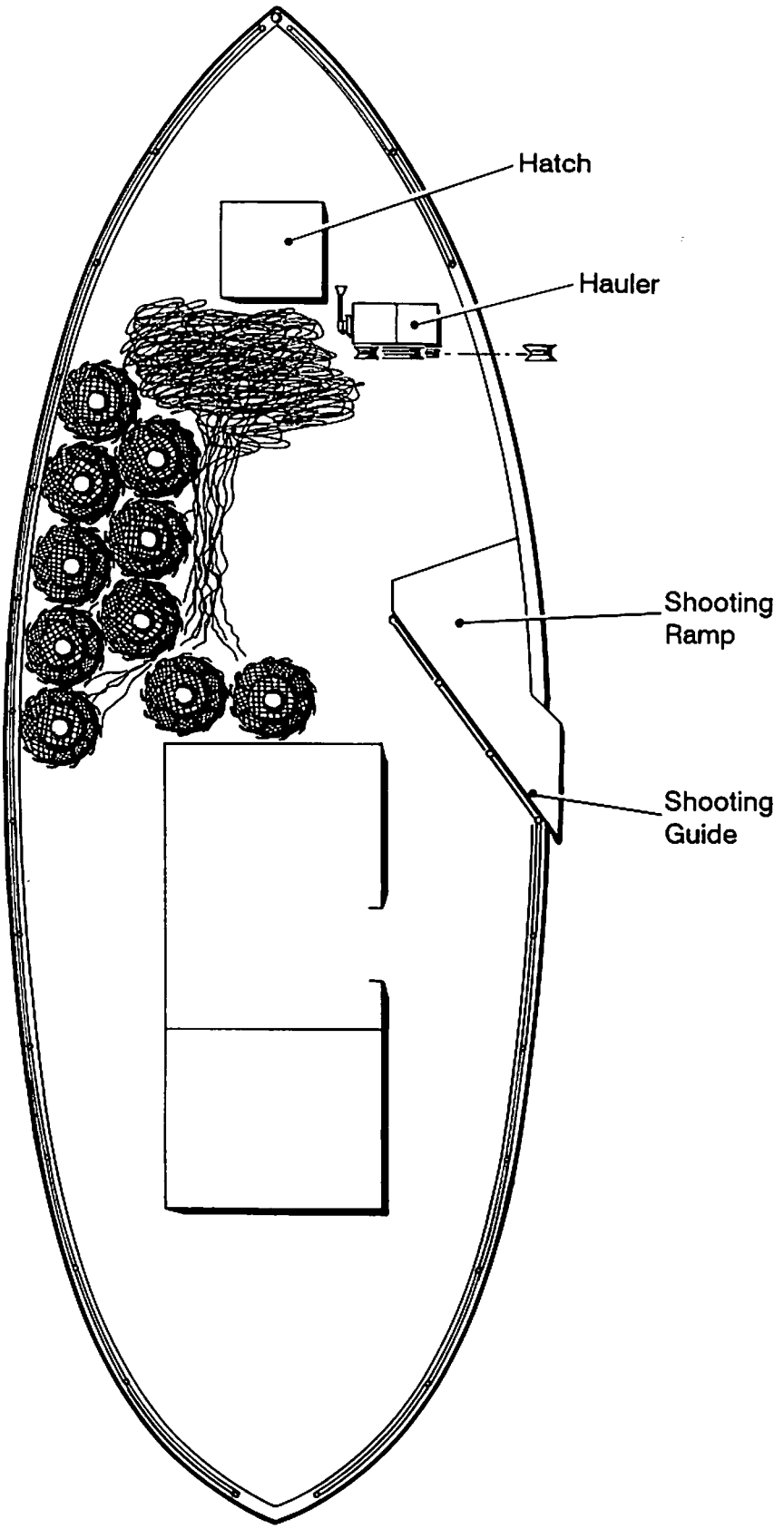


Fig.23

9. Overall Observations

Although all of the four vessels are carrying out the same basic fishing method, each vessel has slight differences in the detail of operation, as is required by the vessel layout, the type of pots worked, the number of crew, and the preference of the skipper. On all of the vessels, the crews were well aware of the dangers in potting and took care to be safe, as well as being efficient.

The two bigger vessels, the 'EXCEL' and the 'NEWBROOK', had the advantage of space to be able to work twice the number of pots as the smaller vessels, the 'ENDEAVOUR' and the 'NICKY V'.

9.1 Hauler Operations

On all the vessels but the 'NEWBROOK' the operation of the hauler was directly at the hauler, where the operator was also able to control the vessel. The 'ENDEAVOUR' and the 'EXCEL' both have full remote control whereas the 'NICKY V' has the hauler located directly adjacent to the wheelhouse entrance, and the vessel controls are immediately to hand for the hauler operator.

On the 'NEWBROOK' the hauler is controlled by the skipper from the wheelhouse where he obviously has full vessel control and a good overview of the operation. He stops and starts the hauler as each pot has been lifted on board, the two crewman concentrate on clearing, baiting and stacking without the concern of the next pot approaching the davit block. It should be noted that a control is fitted at the hauler thus providing an emergency stop and deck control if needed.

A similar situation exists on the 'EXCEL' where the skipper controls both vessel and hauler from the remote controls on the deck. Again, he has an overview of the operation and stops and starts the hauler for the crewmembers to concentrate on clearing, baiting and stacking. He does briefly leave the controls to move the coils of rope across the deck but is able at all time to give close attention to the pots arriving at the davit block.

On the 'NICKY V' and the 'ENDEAVOUR' the man operating the hauler also lifts the pots on board and helps to remove the catch. This does give improved efficiency, but good timing is essential to be ready to stop the hauler as the next pot arrives at the davit block.

9.2 Clearing & Baiting

On all the vessels the task of removing the catch and rebaiting the pots was carried out with the pot at a good working height. The pot is rested on the gunwale adjacent to the davit block and is slid aft, after the catch has been removed, to a baiting position. Keeping the pot at rail height avoids further lifting and bending by the crew although repeated bending is involved if the box of bait is left at deck level.

9.3 Stacking

The pots were stacked in rows up to three pots high, working along each row, building up the levels before commencing on a new row in front. On the 'NEWBROOK' a system of building up columns of pots is used. Two pots are stacked alongside the gunwale and a third pot added, jamming it under the high side rails on the vessel. Columns are built alongside and these form a wall for further columns, built in front, to rest against.

The leg ropes and bights of back rope leading to the pots are kept tight to the base of each row to ensure that there will be no tangles when shooting.

On the 'NICKY V' there was a mixture of inkwell and creel type pots. Where these were worked together on the same string slight difficulties were experienced in stacking them.

On the 'EXCEL' the pots are stacked across the front of the wheelhouse, several rows deep. The steel barrier acts as a division between the pots and the heap of back rope, to ensure that a loop of rope cannot snag on the pots. One drawback observed, is that in order to return to the wheelhouse, to position the vessel for shooting, the skipper has to climb over the stacked pots. This is achieved with the aid of the high sided rails on the vessel.

9.4 Shooting

Both of the bigger vessels had made provision to assist the shooting operation by having a shooting table or, as on the 'NEWBROOK', a shooting ramp. The observed advantage of the table or ramp is that it frees the crewman from having to hold the pot balanced on the gunwale whilst waiting for it to be taken into the sea. It enables him to stand clear and indeed, he is not stood waiting, and can move to collect the next pot. A particular advantage of the ramp is that the pots do not have to be lifted and can simply be rolled into position for shooting. Perhaps, also, when the vessel is rolling heavily, the pots are more stable stood on the deck at the start of the ramp as opposed to being at rail level on a table.

Whether a shooting table/ramp is used, or the pot is simply held on the gunwale, the shooting operation requires each pot to be positioned in the correct sequence for entry into the sea as the back rope becomes tight. The back rope is drawn off the deck by the way of the vessel, with the loops of rope being pulled off the 'heap' of rope. Bights of rope lead to the 'leg' rope of each pot and these bights move rapidly as the rope tightens. The obvious danger is of a crewman becoming entangled in the rope. On all the vessels, care was taken to keep the leg ropes in an ordered fashion and to stack the pots such that the man handling them is clear of the moving rope. Holding the pot on the gunwale does bring the crewman close to the rope which was observed to 'snake' around his feet. However, in this position the man is static with feet firmly placed on the deck and it is highly unlikely that the moving rope will present any danger. Perhaps a much greater danger is present when persons are moving around the deck and can step into a loop or bight of rope.

9.5 Manual Handling

The gear used in pot fishing can be very heavy; weighted end pots may weight 80kg, with normal pots weighing 20kg. Anchors used on sandy bottoms will weight 20kg or more and drag weights can be up to 100kg in strong tidal areas. An under 12 metre vessel may well be working strings of 20 - 30 pots and tend six or more strings a day. On a bigger vessel, up to 100 pots may be on a string and hence it can be appreciated that the crewmen may be handling 200 to 500 pots a day. Lifting each 20kg pot perhaps three times for hauling, stacking and shooting will result in 12 to 30 tonnes being manually handled each day.

In viewing the manual handling aspects, perhaps the most likely cause of back injury is lifting the pot up, at the davit block, to rest it on the gunwale. This is particularly the case with the heavily weighted anchor pots. In lifting the pot, the man has to bend his back to reach over the rail to grip the pot. This is the worse posture for lifting, however, it was observed that the crewmen would utilise the swing of the pot to assist in lifting it onto the rail.

10. Discussion

10.1 Statistics

The table of statistics (section 4.3) quotes 42 incidents that were serious enough to be reported to Marine Accident Investigation Board (MAIB). Ten serious injuries and nine fatalities were reported with sixteen vessels being lost. However, these incidents occurred over a nine year period and must be viewed in that context.

Data from the Sea Fisheries Committees of England and Wales for 1995, gave a total of 1711 vesels under 10 meteres and 176 vessels over 10 metres engaged in potting. Assessment of data for Scotland results in approximately a further 1200 potting vessels under 12 metres making a total of around 3,000 vesels. Crewing on these vessels will vary from one to three or four men but, on an assumption of two men per vessel, it can be estimated that approximately 6,000 fishermen are employed in pot fishing in the UK. Hence it can be seen that the one fatality per year (9 deaths in 9 years) is one death per 6,000 fishermen engaged in potting per year.

Considering the whole UK fishing vessel safety record, there are typically around 22 deaths per year from a total of 15,000 fishermen; a death rate of one per 680 fishermen. Hence, it can be considered that, with a death rate of one per 6,000 fishermen, pot fishing is considerably safer than fishing as a whole, which presumably is largely involved in trawling.

This statistical comparison, based on fatalities is a little surprising as it implies that potting is very safe. However, potting does have a reputation of being hazardous which, to the observer, is well justified by decks crammed with pots and rope, men rapidly handling pot after pot in sequence, whilst coils of rope snake across the deck. Such a situation is unquestionably dangerous and all involved recognise this and act accordingly, taking great care, which perhaps, preversely, results in a 'statistically safe' fishing method.

10.2 Pot Fishing Hazards

The hazards in potting are well known and can be listed as follows:

- **Struck by pot or anchor at the davit block**

Failure to stop the hauler resulting in a pot, or perhaps more likely, an anchor hitting the davit block and possibly swinging over the top to strike the crewman.

- **Injured by the hauler**

Guiding the leg rope around the hauler can result in hands being quite close to the moving vee wheel with a risk of fingers becoming trapped. Perhaps more likely to occur, is the crewman falling against the hauler and a hand or limb being trapped and possibly severed between the rope and hauler wheel.

- **Trips and falls**

The most common accident in any work situtation, but on a fishing vessel it can be fatal if the person falls overboard and in potting, a simple trip and fall could be disastrous during the shooting operation.

- **Manual handling**

Repeated lifting of pots, particularly with the twisting of one's body, is liable to cause back injury. Crews need to be aware of the correct lifting techniques and it should be arranged to have items at a good working height.

When deciding on the lengths of the leg ropes, consideration should be given to how this will effect the height that the pot can be lifted at the davit block and the manual effort required to lift the pot onboard.

- **Snagged in rope when shooting**

A loop of rope caught around a limb during shooting will result in serious injury or death. The limb is likely to be servered or the person will be dragged overboard and, even if wearing a lifejacket, pulled down by the weight of pots.

Accidents have also occurred due to a loop of rope snagging a pot and carrying it overboard, striking a crewman on its passage.

- **Pots out of sequence**

Stacking pots in a rigid sequence is essential and all involved in the shooting operation need to be totally certain of the sequence. Problems can occur if a pot is stacked out of sequence to enable it to be repaired prior to shooting or if the vessel motion causes stacked pots to fall. Should an incorrect pot be selected, the correct pot will be pulled from the stack as the back rope tightens and "fly"across the deck, quite likely striking the man holding the incorrect pot at the rail.

- **Vessel overloading**

The overloading of a vessel with pots, either by having to many on a string or when moving strings to new fishing grounds, can put the vessel at risk of capsize and foundering, and her crew at risk of drowning.

From the statistics and by reading through the summarised incidents, it can be seen that the above hazards do occur and injuries and deaths do result. To reduce these risks, when loading consideration should be given to the size and capabilities of the vessel, the weather conditions, and then to adapt the load as necessary. This may mean moving pots around the vessel to even out the weight of the load, reducing the number of pots on a string, or making two trips to move a load as it may not be safe to carry the whole load in one trip.

10.3 Hazard Reduction Methods

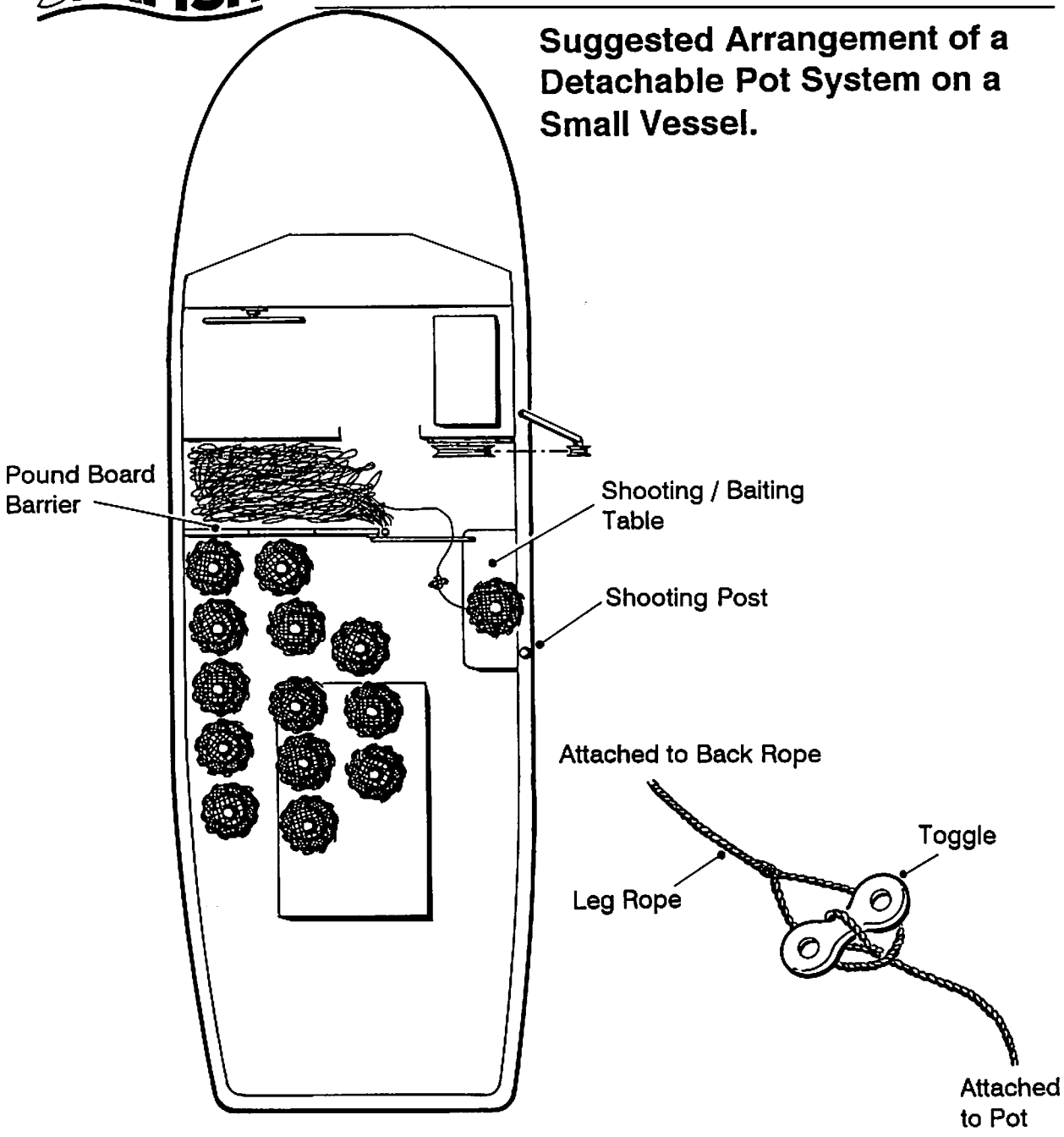
10.3.1 Detachable Pots - Toggle System

This system, devised by Rick Mitchelmore in Devon for use on his 22.5m potter 'WILLIAM HENRY' and now in use on most of the larger potting vessels, is a major advance in pot fishing safety. The key to the system is a toggle clip which connects into a loop to join together the two piece leg rope at a point quite close to the pot. By slipping the toggle clip out of the loop, the pot can be detached from the back rope enabling it to be stored anywhere and without worrying about sequence. On hauling, the pots are lifted on board as normal, but once on board, the toggle is disconnected and the loop, which it fits into, is slipped over a vertical steel pole. The pot, now separate from the back rope is emptied, baited and stacked. The back rope, as normal, is allowed to pile up on deck and the loop, of each disconnected leg rope, is dropped over the pole in sequence. Thus at the end of the haul, the back rope is in a pile on the deck with each leg rope leading to the pole. The pots are stacked 'wherever' on the vessel, as there is no need to keep them in sequence (see Figure 24).

During the shooting operation, the pot is stood on a shooting table and the first leg rope loop removed from the pole. The toggle is slipped into the loop, thus connecting the pot which is pulled into the sea when the back rope tightens. The next pot is placed in position and connected to the next leg rope from the pole. Thus the shoot proceeds with one man connecting the toggles and one or two men bringing the pots to the shooting table.

Aside from the ability to stack the pots out of sequence, the system gives more compact storage of the back rope with all the leg ropes leading to the pole. Because the leg ropes are constrained to a narrow area it is easy to build a division to separate the rope from the deck area where the crew handle the pots. In addition, should a problem occur with the shoot, the leg ropes can simply be slipped off the pole as required to enable back rope to be paid away. The hazard of pots being dragged wildly across the deck has been eliminated by this system.

Suggested Arrangement of a Detachable Pot System on a Small Vessel.



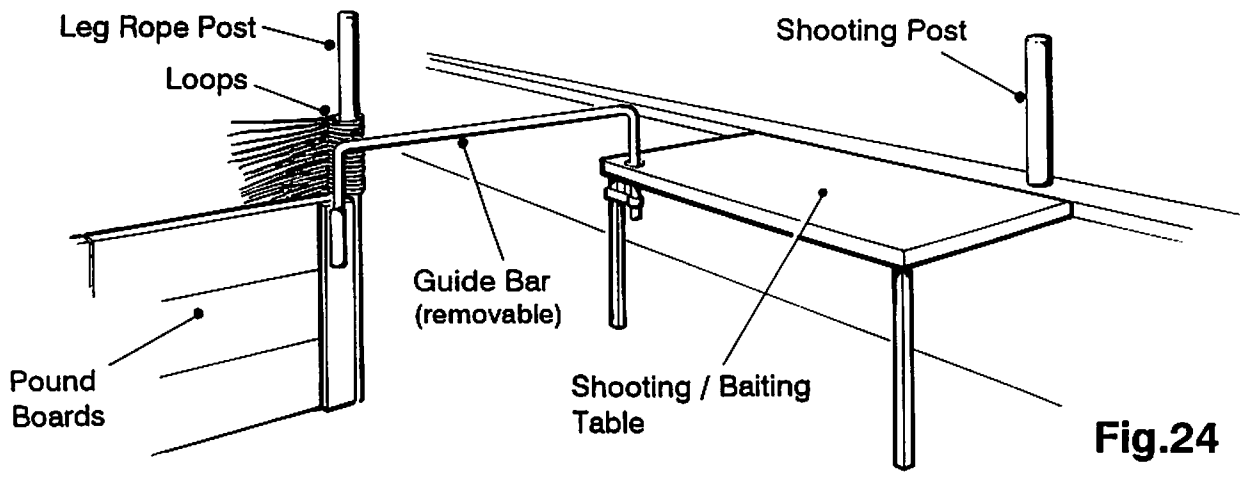


Fig.24

10.3.2 Rope Pounds or Divisions

Separating the crew from the back rope will resolve one of the most dangerous hazards; that of becoming snagged in the rope when shooting. The design of the barrier will depend on the layout of the vessel and the stacking of the pots but, should endeavour to provide protection to all involved in the shooting operation. MAIB have produced a sketch of a separation system devised by an Orkney skipper who introduced the system after the loss of one of his crewmen, who became snagged in the rope.

This system as shown in Figure 25 uses a 600mm (2 ft) high pound board barrier to form a trough between the pound boards and the bulwark to contain all the 'tails' or leg ropes. A high wire mesh screen is set at the end of the pound boards to provide protection for the man who sets each pot in turn on the shooting table. Although the illustration shows a vessel with aft stowage of the pots, the concept can be applied to other layouts in order to keep the ropes clear of the crewmembers.

Orkney Design of a Separation System

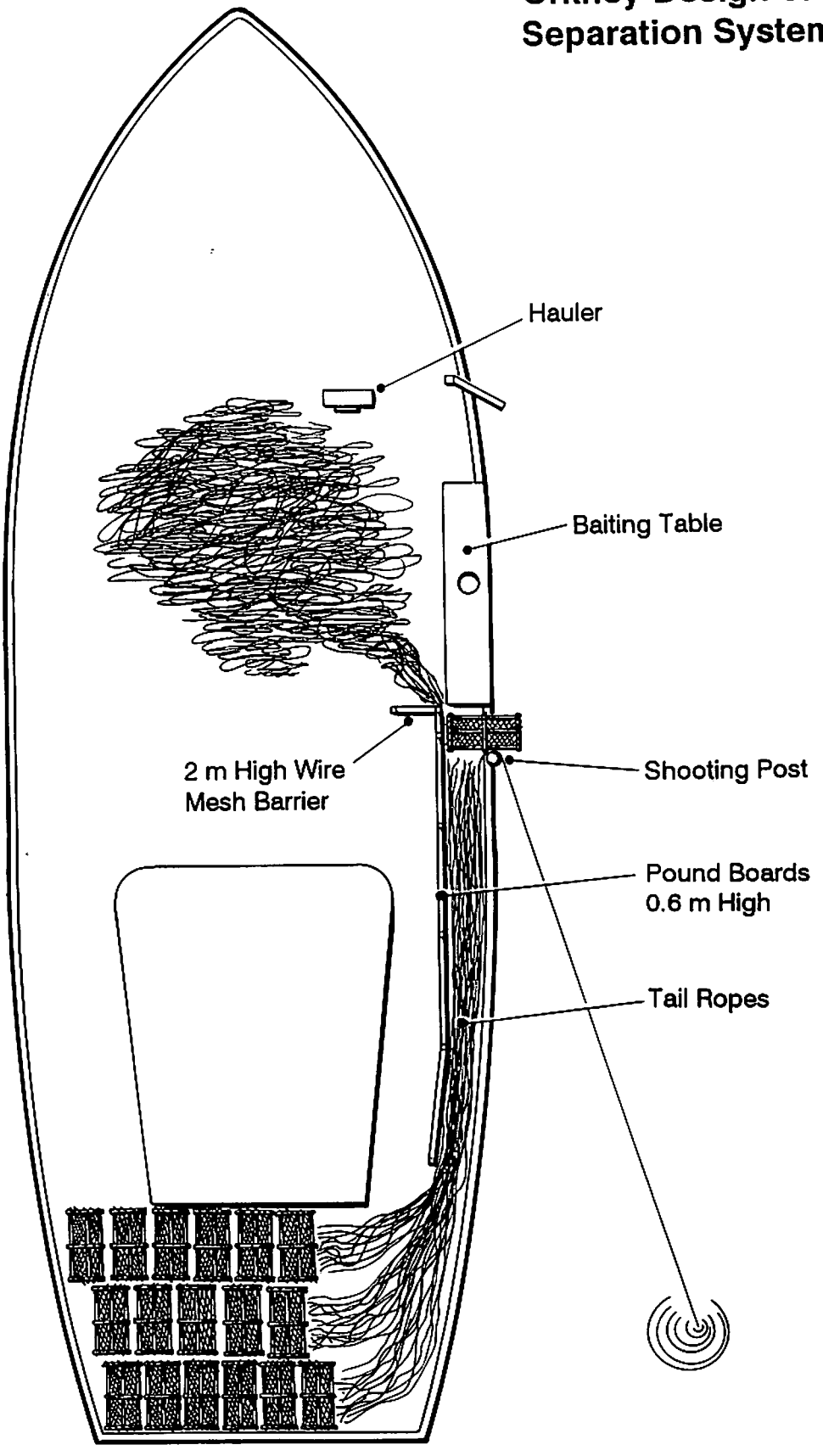


Fig.25

10.3.3 Automatic Hauler Stop

The concept is to have the hauler stop automatically when a pot or anchor comes up to the davit block. Various methods can be used to achieve an automatic stop:

- mechanical
- optical
- proximity
- combined

Mechanical

A spring loaded lever arm mounted on the davit block, such that, the pot or anchor would make contact with it as it neared the block. The lever arm would actuate a cutout valve to stop the hauler. The design of a mechanical stop would have to be such as to allow the free passage of the leg rope over the open side of the davit block.

Optical

An optical sensor would be utilised to detect the approaching pot or anchor. This has the advantage that there will be no possibility of the leg rope fouling but, the reliability of an optical system with all the spray from the rope would have to be proven.

Proximity

The robustness and reliability of a proximity probe switch could be exploited, not to detect the actual pot or anchor, but to detect a marker attached to the back line or leg rope. Stainless steel bands crimped around the rope would act as markers to be detected by the proximity switch mounted such that the rope passed close by it. The switch may well be mounted on the hauler and the distance of the marker from the pot calculated accordingly.

Combined

Perhaps the most advantageous method would be to combine the control possibilities with optical or proximity detection offer to a fail safe mechanical stop. Such a combination would enable the pot hauler to be automated, stopping automatically whenever a pot arrived level with the rail. Indeed, it is possible that a system could be designed to haul the pots and place each one on a table or conveyor totally automatically. Such a system would greatly improve the efficiency of potting as it would enable the crew to concentrate totally on emptying, rebaiting and stacking pots.

Whether the development of such an auto stop system could be justified on purely safety grounds is questionable. Only a few incidents occur from persons being struck by a pot or anchor at the hauler, and some fishermen report that if they are late stopping the hauler, the pot simply jams against the davit block with the rope slipping in the hauler vee wheels. Perhaps the biggest justification for an automated hauler stop would be on the grounds of efficiency, as it could enable attention to be concentrated on the cleaning, baiting and stacking of pots. On those vessels where the hauler operator is also cleaning pots, and has developed the timing to know exactly

when to be at the hauler control, there would be little advantage, other than being able to finish clearing the pot before restarting the hauler. However, in situations where a man is solely operating the hauler it would be a major advance.

Whilst an automated hauler stop does offer benefit, extending the automation further to include lifting the pot in board on to a table would very desirable. Such automation, although certainly possible, would require considerable research and development to achieve a suitable and reliable system able to cope with the marine environment and vessel motion. An essential factor, with any automation, would be how cost effect the system would be to the fisherman.

11. Conclusions

The assessment of the safety statistics has shown that the safety record in pot fishing is good compared to fishing as a whole. Obvious hazards are present which fishemen are very much aware of and take great care to avoid. Even so, work to eliminating or significantly reducing these hazards should be undertaken if at all possible. Methods of achieving reduced hazards are identified as follows:

- Detachable pots using the 'Toggle System'
- Rope pounds or divisions
- Automated hauler stop

The first two, the toggle system and rope pounds are developed concepts which can be applied to vessels if appropriate. However, further development may be necessary to prove the application on smaller vessels and to give 'example'.

The automated hauler stop concept would need total development from basic design, prototype manufacture, testing, modification etc to achieve a system capable of operating in commercial fishing. The industry needs to consider if Seafish effort should be directed into this innovation.

It is intended that this report will be discussed by those involved in pot fishing, and that Seafish will be able to respond to their recommendations.