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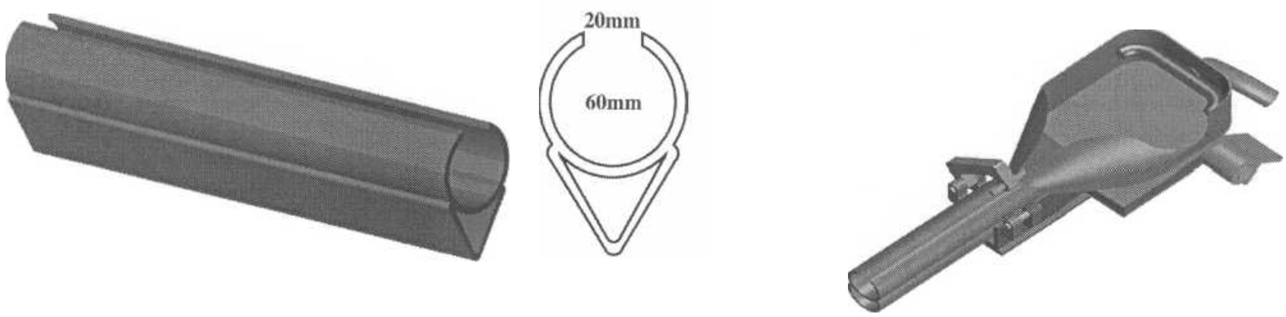

FIGURE 6. (ABOVE LEFT) CHUTE DESIGN AND (RIGHT) TROUGH USED ON F.V. *BRENDA KAY*.

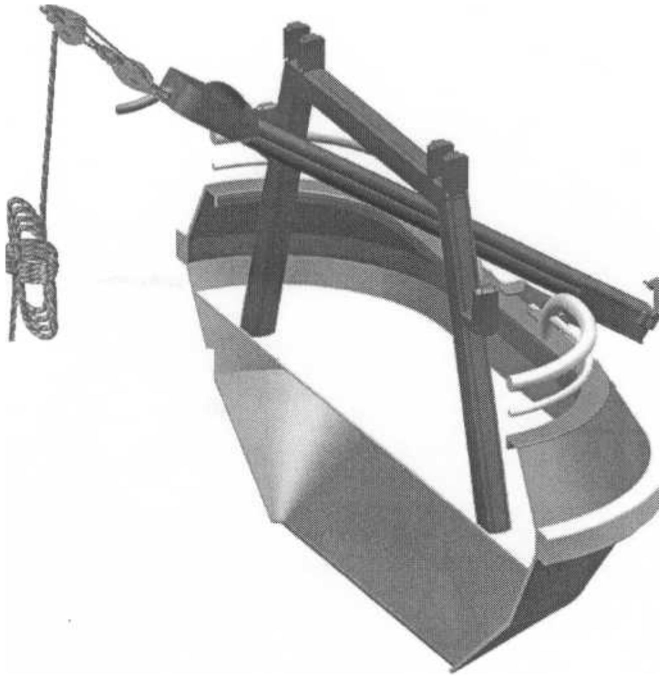

FIGURE 7. DEPLOYMENT AND RETRIEVAL SYSTEM USED ON F.V. *BRENDA KAY*. THE HOISTING GEAR WAS ATTACHED TO THE MAST ABOVE THE WHEELHOUSE AN EXISTING GANTRY ON THE VESSEL CAUSED SOME OBSTRUCTION TO THE CHUTE.

FIGURE 8. CHUTE IN USE ON F.V. *BRENDA KAY*. THE HANDRAIL HAD TO BE RECESSED TO ALLOW FOR IT.

then attached to the wire strop at the third attachment point from the front. The strop attachment to the chute was checked and the shackle tightened if necessary.

The single block was attached to the lug at the feed trough and the chute was hoisted above the deck to about a thirty degree angle. The paravane was then deployed over the stern of the vessel and allowed to trail just below the sea surface in the vessel's wake; at this point the vessel was idling into or with the weather.

One person controlled the descent of the chute with the down haul length of rope from the "Handy Billy" block assembly. Up to three persons would assist by pushing from various positions along the chute length. It was difficult to get the chute moving through the pivot arm, as the steel seemed to bite and grip with friction, due to the paravane's downward pull on the chute.

The position of the stern gantry and the height that the chute was mounted at the stern meant that to haul the chute above the gantry would scrape the bottom of the chute over the gantry surface. It was decided to go under the gantry, which meant that the chute's angle of entry was less than 45 degrees. This made it even more difficult to deploy and retrieve because the paravane was trying to keep the chute at a 45 degree angle.

Once the chute was fully deployed and the pivot arm guide bar had positioned itself between the two brackets welded to the base of the chute feed trough, the locking pin was inserted through all three and secured with a small clip. The chute was now completely secured to the pivot arm and the retaining collar of the pivot arm could be unpinned and folded out of the way. While the pivot arm retaining the collar was in place, it was impossible to apply baited snoods through the chute, as the collar obstructed the snood groove.

Fishing procedure using the chute

Because the first few snoods in the bin were often tangled, it was decided to set the first two or three baskets by throwing the baited snoods out on the port quarter, as would normally be done. This also allowed the crew to get into a routine. The skipper would then fine-tune the vessel's course to see that the chute was running at the correct angle and was towing well. Once these first baskets had been set, the crew started placing the baited snoods into the feed trough and allowing snoods to be set through the chute. This would continue until the completion of the set or until the skipper determined otherwise.

The total number of hooks trialed through the chute was calculated by counting the total number of hooks in the snood bins, and subtracting ten plastic lures (always thrown clear), total numbers of floats set, and total number of baited snoods not deployed through the chute. On occasion, due to problems with the snood tangling on the chute, only a portion of the total available snoods were set through it. An estimation was made of the total snoods remaining and back-calculated for a total set.

Trial location and timing

There were two one day shake-down sea trials with the F.V. *Brenda Kay's* skipper, crew and chute developer, Paul Barnes, on board. The developer was present to install the chute, fine-tune paravane settings, and answer any questions or concerns the skipper or crew might have. These trials took place on 26 November 1997 and 4 December 1997 and four to five nautical miles seaward of the port of Tauranga. On the second shake-down trial, baited snoods were trialed through the chute.

Commercial fishing trials took place around an area called the Colville Ridge, 100 miles north-east of the port of Tauranga, where the F.V. *Brenda Kay* was based. It was envisaged that two trips of up to five days' fishing would be required to complete the trial requirements of 4000 hooks (through the chute). However, the fishing was considerably better than expected and the longest trip was only three fishing days due to the number of tuna landed and the relatively small hold. The three trial trips took place on: Trip One: 27 November to 1 December 1997; Trip Two: 6-9 December 1997; Trip Three: 11-14 December 1997.

The weather and sea conditions encountered during the two shake-down trials are summarised in Table 4. Both of these trials occurred during daylight hours.

During the trials, setting was conducted at night between 2040 and 0523 hours-in accordance with accepted fishing practices developed to minimise sea bird capture. Table 5 summarises weather and sea information recorded during the commercial fishing sea trials. Weather conditions during the trial sets were more settled than would have been preferred, with only one of the five trial sets undertaken in wind and sea conditions of over 25 knots.

TABLE 4. WEATHER AND SEA CONDITIONS DURING SHAKE-DOWN TRIALS OF THE CHUTE.

DATE	WIND DIRECTION	WIND SPEED (kt)	SWELL DIRECTION	SWELL HEIGHT (m)	CLOUD COVER (%)
26.11.97	SW	25	SW	0.5	90
04.12.97	SW	15	NE	0.5	100

TABLE 5. WEATHER AND SEA CONDITIONS DURING COMMERCIAL FISHING SEA TRIALS OF CHUTE ON F.V. *BRENDA KAY*.

START DATE	TRIAL SET NO.	WIND DIRECTION	WIND SPEED (KT)	SWELL DIRECTION	SWELL HEIGHT (M)
28.11.97	1	NW	15	NW	0.75
07.12.97	2	SW	18	SW	1.5
07.12.97	3	NE	10	SW	0.75
13.12.97	4	ESE	25	ESE	2.5
13.12.97	5	NE	10	NE, SE	1.0-0.5

Performance of the chute

Entanglements

Hook entanglements on the chute occurred during four of the five trial sets. Table 6 shows the number of entanglements recorded and, if known, how the entanglement occurred.

TABLE 6. NUMBER AND CAUSES OF ENTANGLEMENT.

TRIAL SET NUMBER	TOTAL SNOODS THROUGH CHUTE	NUMBER OF ENTANGLEMENTS	REASONS FOR ENTANGLEMENTS AND POSITIONS OF ENTANGLEMENTS ON THE CHUTE
1	0	2	Incorrect tail float fitted to paravane making the paravane run at a shallow setting. Two float lines tangled.
2	683	3	1. Snood tangled on paravane wire
			2. 360 degrees snood wrap round chute tube
			3. Hook-up on exit cowling
3	817	2	1. Unknown
			2. Hook-up on exit cowling
4	648	7	1. Float line entanglement
			2. Snood hook-up - unknown, cut away
			3. Snood hook-up - unknown, cut away
			4. 360 degrees snood wrap around chute tube
			5. Snood hook-up - unknown, cut away
			6. Snood hook-up - unknown, cleared itself. Snood cleared itself
			7. Snood hook-up - unknown, cut away.
5	876	0	No hook-ups during this set

In order to confirm where a snood was caught, the chute was retrieved back on board the vessel with the snood still attached to the mainline and the hook still connected to the chute at the fouling point. Because of the time involved and the number of crew required (at least two) it was deemed easier to haul the mainline back to the vessel until the offending snood could be reached. On a number of occasions, particularly with rougher sea conditions, hauling the mainline back removed the pressure from the hook, and the hook came free. On the two occasions when hooks were observed in the entangled position, calm conditions would have contributed to the hooks remaining connected to the chute throughout the chute retrieval operation. The setting operation resumed once the hook was freed and the vessel was up to speed.

Chute

On the first fishing trip while retrieving the chute, a weld three metres from the feed trough joining two lengths of chute tube together parted. The two lengths continued to be held by the angle-steel backing. The cracked weld prevented any further trials on this first trip. On arrival back at the port of Tauranga, arrangements were made through Moana Pacific's workshop to repair the weld. Alterations were also made to the retaining collar and the pivot arm and base of the feed trough to make alignment a simple operation.

Once these alterations were made, no further problems were experienced with the chute's durability. On the return to the port of Tauranga after completion of trial trip number two, cosmetic alterations were required to the exit cowling and snood groove at the base of the chute tube, where observed hook-ups were taking place.

On the third fishing trip, during set six, under heavy weather conditions, the vessel was required to reverse back on the set gear five times, responding to individual hook-ups on the chute. During one of these reversals the extension bar of the vertical hinging was bent down about fifteen degrees at the point where the pivot arm's horizontal hinging attached to the extension plate. This in no way damaged the chute or affected its performance during the final set.

On completion of trial trip three and the return to Tauranga, the entire chute was removed from the vessel, including the base plate. No structural damage was noticed around the four bolt holes linking the chute to the vessel, or any surrounding steel work on board.

The chute angle, when fully deployed, was consistently recorded at forty-five degrees to the stern of the vessel, using a plastic angle measuring device taking the form of a protractor with a central measuring arm.

Trough

Sufficient water flow from the vessel's deck hose through the connection at the back of the feed trough was required to deliver baited snoods to sea level. The water flow was directed towards the point where the chute tube joined the neck of the feed trough. However, there was not enough water flushing around the sides of the trough, and baits stuck to the trough base. This was compounded by an additional difficulty of the chute being placed too far to port, requiring the crew person baiting to twist their torso from snood bin and bait to the chute trough. The distance between snood bin and the chute encouraged the crew to lightly toss baited snoods at the chute feed trough rather than placing them in it, allowing the possibility of baits missing the feed trough altogether. While no baits were observed missing the feed trough, this situation cannot be ruled out as a possible cause of entanglement.

Paravane

Only one type of paravane, the Flexiwing, was used during these trial sets. No damage was sustained by the paravane during these trials.

No difference was observed to the effectiveness of the paravane during differing weather conditions. During set six, when the most extreme weather conditions were encountered and the most snood hook-ups recorded, it is possible that the considerable movement of the vessel, both vertical and horizontal, through the sea-way affected the chute and snood interaction and the paravane performance.

During the trials, when the chute was fully extended in the deployed situation, it was noticeable that it had a 10 to 15 degree offset angle to starboard. This was also observed with the chute trialed on the F.V. *Daniel Solander,* and was presumed to have been created by the propeller wash. The skipper of the F.V. *Brenda Kay* was uncertain which way his vessel's propeller turned, as it was difficult to tell from observing the propeller wash. However, as the direction of the offset angle was the same as for the previous F.V. *Daniel Solander* trials, it is assumed that the F.V. *Brenda Kay's* propeller had a clockwise rotation.

Performance of the deployment and retrieval system

The F.V. *Brenda Kay* was an ideal vessel for these trials, with a large uncluttered stern-deck, an uncluttered mast area with good height, and a hull of steel construction allowing for easy, clean attachment of the chute. There was also an ideal area above the deck to stow the chute when not in use. However, a number of difficulties were experienced during the trial sets.

1. An old, poorly maintained double-block was secured to the mast with a large shackle and then lashed into position pointing aft. A single-block (new) was laced to the double-block with 8 mm polypropylene rope to complete the "billy tackle". Had the double-block been in good working order, this block and tackle would have aided the speed and ease of the chute retrieval and deployment operation.
2. Another problem resulted from the force of the paravane pulling the chute down during deployment and retrieval. The problem arose when the chute feed-trough passed under the stern gantry. With the paravane forcing the chute to a 45 degree angle, the feed-trough had to be pulled down by one of the crew for the chute to clear the overhead gantry as it passed beneath it. During calm sea conditions this was not a problem, but when the vessel was influenced by any sea, the chute became difficult to control, even though it was contained by the pivot arm and collar. Retrieving or deploying the chute above the gantry would have been dangerous in anything but calm seas.
3. After repeated settings, it appeared that there was an increase in friction between the steel of the pivot arm and the angle steel of the chute backing. This increase in friction was possibly due to rust build-up or loss of paint, and was worsened by the loading caused by the paravane. This resulted in the chute "sticking" to the pivot arm during deployment and retrieval.

Performance of bait types used

Squid

Squid are an ideal bait for the chute as they are incredibly flexible, moulding themselves to any shape without being damaged or affecting the hook placement. Squid baits have the added ability, should they jam at the neck of the trough, to block the water flow, allowing build-up to a volume where the water then forces the bait through the neck of the trough. Owing to the size of the squid, they seemed to stay within the chute until being expelled at the exit point and would not readily clear the chute prematurely through the snood groove.

Sanmar

Sanmar are an imported, elongated bait fish resembling a garfish. Because of their long and slender shape, difficulties were experienced in getting the baits to move through the feed trough. If the baits were placed either side of the main water flow they had a tendency to remain where they landed because of insufficient water flow. Sanmar were hooked between the eyes and would land with the tail facing towards the neck of the trough. Because of their elongated shape and relative firmness, water would not build up behind them, requiring the person baiting to jerk the snood to reposition the fish into the trough's water flow. If the sanmar landed directly into the main water flow through the trough, the sharp angle of the trough neck narrowing to meet the same diameter as the chute tube would cause these fish to often jam across the narrow neck, again requiring the snood to be jerked to realign the bait with the water flow. On occasions, three or four attempts would be required to align a bait.

Discussion

Entanglements

From observations of the trial sets, a number of reasons for the baited snood entanglements came to light:

1. It was assumed that a minimum snood length of ten metres would be trialed. However, snood lengths of approximately six metres and possibly less were present in the snood bins. Snoods are continually cut back because of shark damage or general wear and tear. The shorter snoods created tension on the hook while the hook was still in the chute tube, dragging the eye and shank out through the snood groove, the point, barb and kerb of the hook remaining inside the chute groove. The hook then dragged down the groove edge because of tension in the snood from the pull of the mainline and the vessel's forward momentum, with the hook then jamming on the flaring of the exit cowling at the base of the device.

2. Sanmar baits, being long and thin, were able to wash out of the snood groove if tension came on to the snood before the baited hook had cleared the exit point. If this occurred near the surface, there was a possibility that the forward wash of the vessel's wake could wash the baited hook around the chute tube in a 360 degree turn. This bight of snood could then slide down the chute tube to the flaring and hook up or slide further on to the paravane wire and hook up there. A similar snag would occur if there was too much water from the deck hose travelling down the chute and washing the sanmar baits out of the snood groove.

3. A loop of snood nylon may occur through the snood groove above the point where the chute entered the water. As it is dragged under the water surface this loop is pinned to the underside of the chute tube by water pressure, slides the length of the chute tube and hooks up on the exit cowling or on the paravane wire.

4. During trial set four, with winds of 25 knots or more and an estimated swell of 2.5 metres, five snood hook-ups were recorded. All of these hook-up points in or on the chute were unobserved and can only be guessed at. It is possible that the increased movement of both vessel and the chute, because of the size of the swell, were involved in these additional hook-ups.

5. A factor that influenced the results from these trials was the relative inexperience of the crew. It was their first season with the surface longline fishery. In contrast, trip number three had an experienced crew member who did a relief trip. This person's understanding of timing, baited snood placement and all-round knowledge of the setting operation, had a direct effect on the lack of entanglements and successful outcome of the final set.

Safety issues

The use of the chute, including deployment and retrieval, its use while deployed, and the need for it to be securely stowed on board on completion of each trial set uncovered a number of safety-related issues:

1. During these trials, retrieval and deployment required three people; one controlling the rope through the blocks and two pushing and straining on the chute tube to move it through the pivot arm and collar. This should be a one-person operation, as other tasks required the crew's attention at this time.
2. For installation of the device on the F.V. *Brenda Kay,* the stern railing had to be removed. It was considered important that adequate railing "surround" the work area at the stern and that minimum amounts of railing be removed.
3. Concern was expressed that, with the chute in the deployed position and with five metres of chute tube and attached paravane trailing in the vessel's wake, the chute would interfere with the rudder or propeller should the skipper want to reverse or stop suddenly. During the trial setting operations, it was necessary for the vessel to be stopped quickly due to snood entanglements on the chute. With reverse momentum, the vessel was pushed back along its own wake, therefore pushing the chute against the vessel's stern. No problems were in fact encountered at these times, although the possibility of damage to the rudder or propeller was constantly considered.

5. There were few hand holds on the wheelhouse roof, and while the chute was being hauled on to the roof with the block and tackle, it could swing from side to side across the deck. This operation was potentially dangerous.

Recommendations

1. Entanglements

It is imperative that baited snoods should not miss the feed trough when placed into it. Should this occur, it is possible for the baited snood, on falling into the vessel's wake, to tangle at some point on the chute. The feed trough could be redesigned with higher sides that would catch wayward baits and reposition them into the feed trough.

Shorter snoods result in tension between the snood clip on the mainline and the baited hook in the chute. The tension drags the hook shank out over one side of the snood groove, allowing a hook-up on the snood exit cowling.

Too much water through the feed trough and chute may expel baits where the trough water flow meets the sea surface water level in the chute. The water is forced out through the snood groove, forcing baits out with it. The narrowing of the snood groove would prevent baits being flushed out prematurely.

There needs to be good co-ordination between the person clipping snoods on to the mainline and the person deploying baited snoods through the chute. This prevents strain being applied on the baited snoods in the chute, which has been identified as a cause of entanglement. Floats also need to be deployed in a controlled way to prevent float lines snagging on the device.

2. *Positioning of the chute*

The chute should be positioned on the stern so that the crew person does not need to stretch or twist their body in order to place baited snoods into the feed trough from their baiting position.

3. *Water flow through the feed trough*

A consistent, evenly spread water flow must cover the entire base of the feed trough. This would prevent the baits sticking to the base or jamming in the neck of the trough.

4. *Paravane Performance*

With the exception of one trial set in rough sea conditions, only calm sea trials have taken place. The effects of high sea conditions on the paravane's action and the relationship between the paravane and increased hook-ups at the base of the chute under high sea conditions are still not known. The increased vessel movement by large swells may adversely affect the paravane's performance in some way.

5. *Deployment and retrieval of the chute*

The use of appropriate blocks is necessary to control speed and the ease with which the chute can be controlled through deployment or retrieval. Some form of frictionless pads or rollers positioned on the pivot arm, allowing free movement of the chute backing through the pivot arm and collar, would assist in deployment and retrieval of the chute.

6. *Varying vessel configurations*

Chute storage, deployment and retrieval systems, and position of deployed chute will need to be tailored to particular vessels because of the existence of aft wheelhouses, canopies, stays, masts, rigging, and additional fishing equipment on different vessels.

3.3 TRIAL NO. 3 - F.V. *ATU S*

by D O'Toole

The objective of trial number 3 was to set a minimum of 4000 hooks through the modified chute under the normal fishing conditions on a commercial fishing vessel, and evaluate its seaworthiness and ease of use. The trial was undertaken on the domestic longline fishing vessel F.V. *Atu S*, owned by Moana Pacific Ltd.

Vessel specifications

The F.V. *Atu S* specifications are provided in Table 7, together with a summary of its fishing gear.

TABLE 7. VESSEL SPECIFICATIONS FOR FISHING VESSEL F.V. *ATU S.*

LENGTH	BEAM	DRAFT	GROSS WEIGHT
32 metres	6.4 metres	4 metres	181 tonnes

Summary offishing gear

Mainline	3.5 mm nylon with 450 kg breaking strain - Brand "Tolilon"; 74 km of line on board and about 65-70 km used per line.
Snoods	2.02 mm nylon with 215 kg breaking strain - Brand "Shogun" (Japanese type), each 14.4m long.
Hooks	Three types: 17/0 Eagle claw, Japanese 3.6, and Mustad 16/0 DR Tuna Circle hooks. An armour spring and crimp used to attach each hook to its snood.
Clips	2.6 mm x 100 mm with a 6/0 barrel swivel.
Floats	25 kg buoyancy, 360 mm in diameter. Float line = 14.4 m of 5 mm rope.
Line shooter	LS4 monofilament line setter (Lindgren-Pittman). Usually sets at 10.5 knots or 325 rpm (main wheel Im circumference).
Light sticks	100 mm Big light.
Setting details	Speed of vessel normally 8.5 knots. Normally 1320 hooks per line; one snood every eight seconds, 12 per basket with 1.5 empty baskets by beacons; 3 beacons per set.

Description of the chute

A number of new design features were incorporated into the chute constructed for the F.V. *Atu S* to overcome problems experienced on earlier trials. The changes are described below. The chute was attached to the stern at the centreline (Figure 9).

Chute

The main section of the chute was 9.5 m long, and tapered along its length. The slot width was milled to two different widths along the length of the chute: 11 mm above the water line and 20 mm below the water line. The decreased width above water level was to help constrain the water flow and trace within the device above sea level. A 3.5 metre length of RHS, a 12 mm x 50 mm M/S flat bar and two 12 mm rounds were welded on the lower side of the chute (Figure 10) to aid deployment and retrieval of the device through the new roller carriage section (see description below) and to increase the strength of the chute.

Two horizontally opposed and partially overlapping brushes were added to the top section of the chute (Figure 11) to retain the snood inside the chute until the force from the mainline pulling the other end of the snood released it from the chute.

A conical trough was used. This had a piece of pipe around the top edge to carry the water to a series of holes placed at 50 mm intervals around the inside perimeter (Figure 11). This was designed to ensure an even water flow inside the trough to help align the bait for entry into the neck of the chute. Unlike earlier designs, this trough was detachable from the chute. A slight curve on the mainline side of the trough was to prevent the traces becoming snagged on any corners.

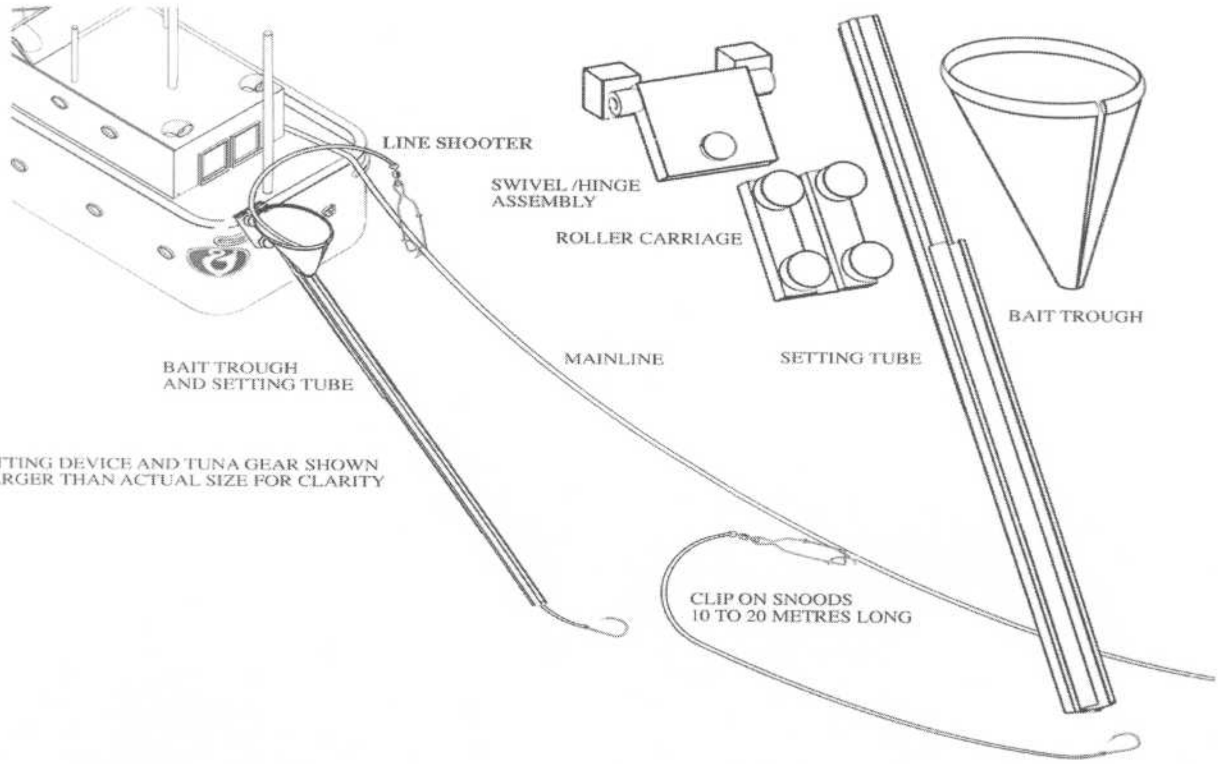

FIGURE 9. UNDERWATER SETTING CHUTE IN USE ON F.V. *ATU S.*

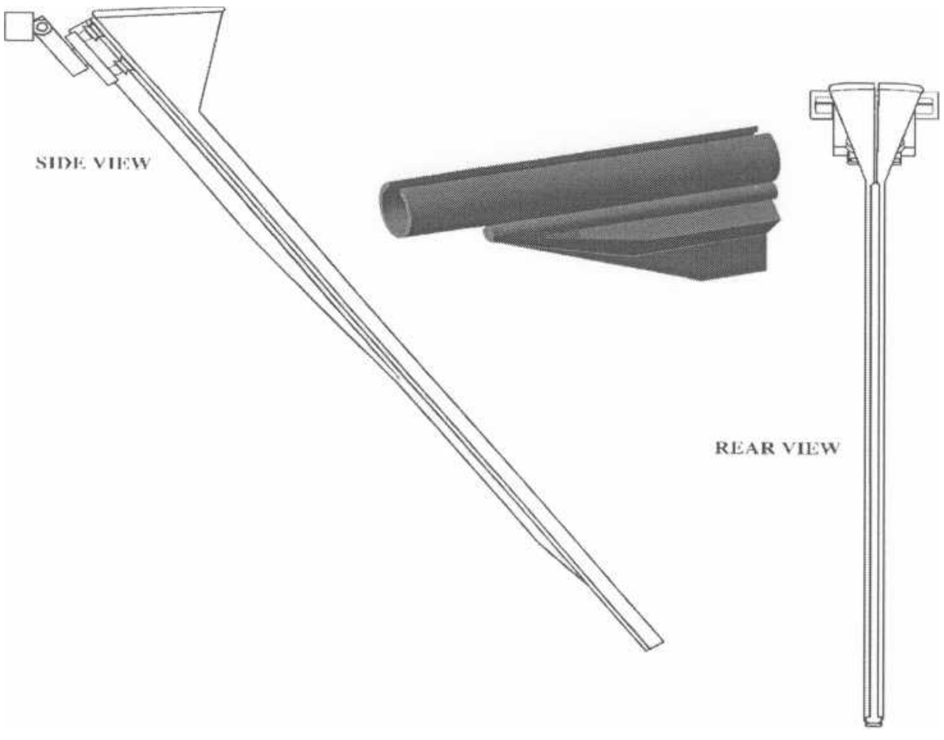

FIGURE 10. VIEWS OF THE CHUTE.

Deployment and retrieval system

A roller carriage system which significantly improved the ease with which the chute could be retrieved and deployed was developed (Figure 12). The nylon rollers constrained the chute during recovery and deployment without the jamming that occurred with the previous slide system or any need of a locking arm.

On the first trial on the F.V. *Atu S* the chute was fitted in the centre of the stern gunwale. Recovery and deployment were achieved by fitting a pulley system to the top of the stern mast with a locating bracket mounted further down the mast (Figure 14).

Strop attachment

Because of problems with the paravanes, an alternative system for maintaining the chute at the required angle in the water was devised. This involved a chain and shock absorber system joining the tube to the transom of the fishing vessel (Figure 13). The length of chain dictated the angle of the chute and consequently the setting depth.

Results

On 17 February 1989, while F.V. *Atu S* was steaming to the fishing grounds, the chute was deployed. Deployment was simple and took less than five minutes. The chute was set at an angle of forty degrees from vertical, the angle being measured using a suspended vertical spirit level and adjustable protractor it performed well during the two hours of steaming at approximately ten knots.

The chute was then deployed and used during a normal setting procedure. After 13 minutes of setting, the mainline carried across the transom to the chute and become tangled around the shackles connecting them. The skipper removed the chute and continued shooting in the normal manner. Details of the trial conditions are provided in Table 8.

Discussion

During setting, the mainline is ejected from the stern, via a line shooter, at a faster rate than the vessel is steaming. This allows a greater sag in each basket. As a result of this there is an excess of mainline floating in the water just behind the stern during setting. When combined with the propeller wash, wind and swell, it is an easy matter for the line to become tangled around the strop connector.

TABLE 8. DETAILS OF TRIAL OF CHUTE ON F.V. *ATU S.*

Date	Start time	Finish time	Start position	Finish position	Wind speed	Wind direction	Swell height	No. of hooks	Vessel speed	Line speed
17/2/98	1950	2320	35° 17' S 172° 14' E	35° 24' S 172° 26' E	15 kt	N	2.5 m	840	8.5 kt	12.5 kt

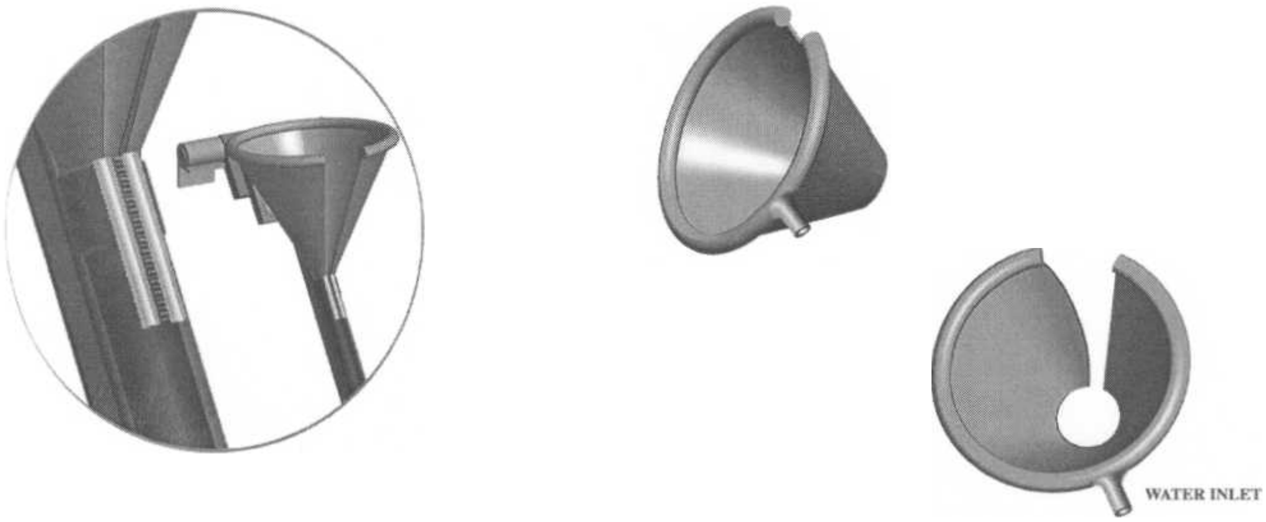

FIGURE 11. (LEFT) VIEW OF BRUSHES AT TOP OF CHUTE AND (RIGHT) DETAIL OF TROUGH.

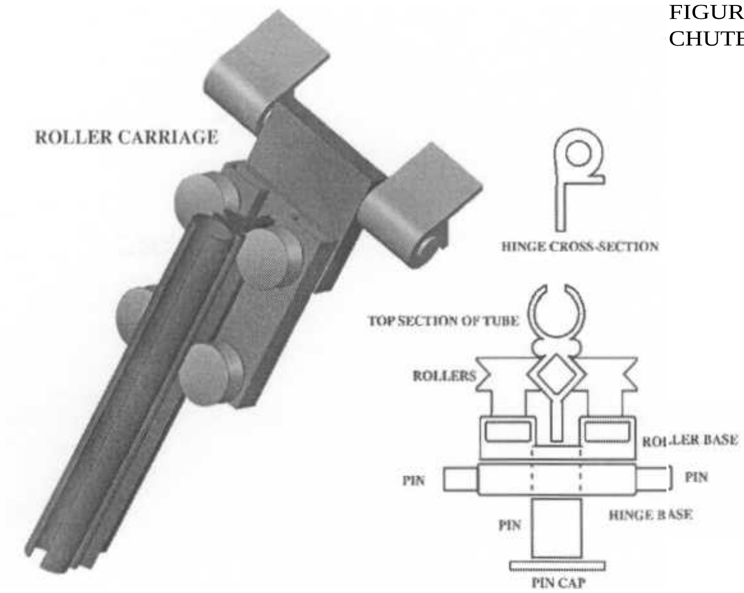

FIGURE 12. DETAIL OF ROLLER CARRIAGE SYSTEM FOR DEPLOYING AND RETRIEVING THE CHUTE.

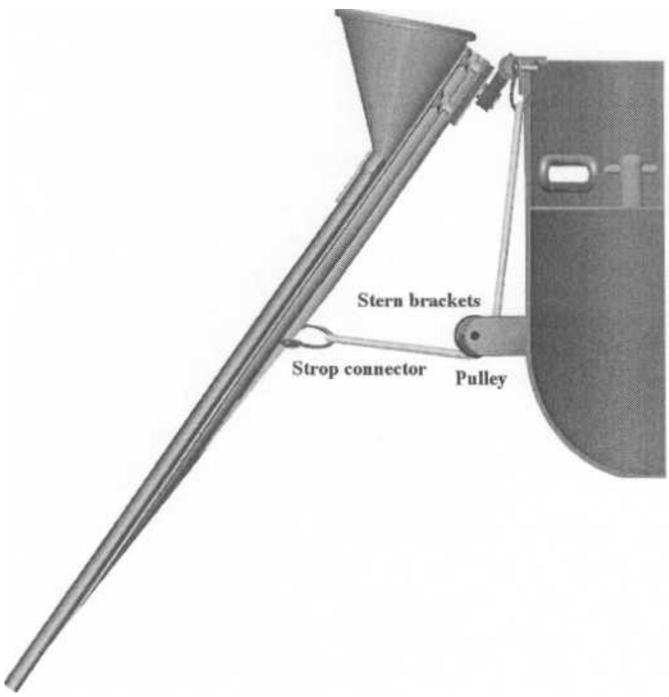

FIGURE 13. STROP ATTACHMENT USED TO CONTROL THE ANGLE OF THE CHUTE.

FIGURE 14. FIRST DEPLOYMENT AND RETRIEVAL SYSTEM USED ON F.V. *ATU S*.

Design modifications

The skipper on the F.V. *Atu S* suggested the following modification to the chute.

1. *Attachments at and below the waterline.*
Nothing should be in the water at all except the chute, especially if the chute is operating along the vessel's centreline. Any attachments at the base of the transom or on the chute beneath or near the waterline increase the chances of foul-ups.

2. *Streamlining*
With the current design, force on the chute is created by drag through the water. This is exacerbated by its proximity to the prop wash. A potential way to minimise this would be to increase the streamlining of the leading edge of the chute.

3. *Chute backbone*
The square metal support which makes up the leading edge may need to be strengthened.

4. *Position*
The chute would have much less chance of foul-ups if placed on the port side of the vessel. This also minimises the chances of bait loss through the force of the propeller wash. In normal setting circumstances, baits are thrown off the port side. This is to minimise both foul-ups and bait loss. The F.V. *Atu S* has a three-person setting team (minimum) which allows for setting the chute up on the port side.

Conclusion

During the short period the chute operated, the device successfully deployed bait under the water. The device achieved its purpose and the design performed that function well. What remained to be done was implementation of a deployment method based around the port side and stronger simpler points of attachment. These points should not be construed as a major problem. The chute was very close to achieving its initial objective of a successful 4000 hook trial.

3.4 TRIAL NO. 4 - F.V. *ATU S*

by D. O'Toole

On the previous trial, shackles and chain that coupled the device to the boat tangled with the mainline. To overcome these problems, the connection point was moved 1.5 m up the chute, so that it was well clear of the waterline. A rubber shock absorber system was incorporated into the connection to minimise direct and sudden impact on the device while maintaining it at an angle which enabled the bait delivery depth of 3 m to be met. This consisted of a size 4 Forsheda mooring compensator spliced on to 24 mm nylon rope. With these devices, one turn on the rope around the compensator gives 200 mm of stretch, two turns give 335 mm of stretch, and three turns (as shown in Figure 15) give 470 mm. Tension of 1100 ft lb was required to achieve full stretch with three turns.

Methods

One double sheave and one single sheave block were used for recovery and deployment of a 9.5 m device (see Figure 16). The lifting jib was mounted on top of the stern cabins. It was positioned to be as in-line as possible with the streaming position of the setting tube. This allowed the chute to be drawn up to a point beyond the balance point of the tube on the roller carriage/hinge assembly. Once the tube had been drawn up past the section that located the chute in the rollers, it could be lifted clear of them. The quick-release clip attaching the shock connector to the chute was released during recovery and connected during deployment. The trough clipped on and off during these procedures.

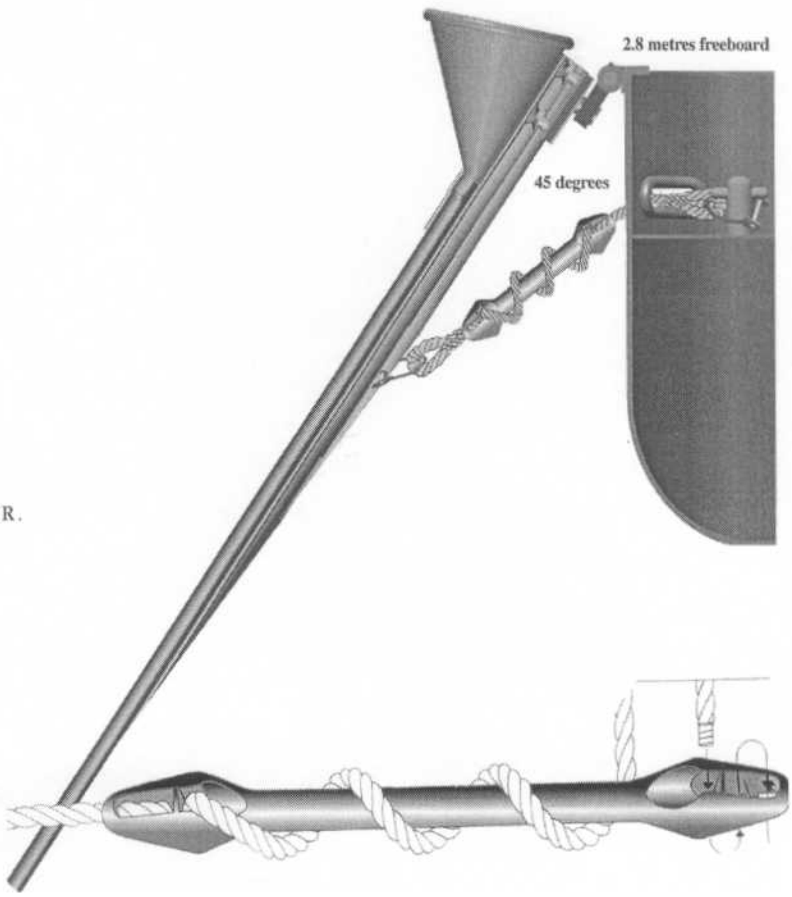

FIGURE 15. VIEW OF THE SHOCK ABSORBER.

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