

Exploratory Fishing for Deep Water Shrimp to the North and West of Scotland

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Summary

An exploratory fishing survey was carried out in July and August 2001 to investigate the potential for a deep-water shrimp fishery in Scottish waters. A 40 mm mesh shrimp trawl with rigid separator grid (to reduce fish bycatch) was used. The total catch was small and shrimp were not caught in commercially viable quantities (although this may have been a result of the timing of the survey). Two groups of shrimp were identified as being potentially marketable. The separator grid appeared to be effective at reducing bycatch, most of which was fish. It is suggested that it would be worth carrying out further trials earlier in the year.



The fishing vessel Alison Kay (LK 57) used in this project.

Introduction

Valuable fisheries for deepwater shrimp (of various species) exist in a number of areas of the North Atlantic, including areas to the north (Norway, Færoe and Iceland) and east (Denmark) of Scottish fishing grounds. Fisheries also take place off Portugal, the Azores and North Africa, and off Canada and Greenland.

Shrimp have been reported as a bycatch in other deepwater fisheries in Scottish waters and they have also been caught during research surveys. For several years demersal trawlers (generally targeting monkfish,

Greenland halibut and redfish) and semi-pelagic trawlers (generally targeting greater argentines) fishing in deeper water to the west of Scotland have reported catches of red-coloured shrimp. On occasions considerable quantities of these shrimp have been seen washing out of nets during hauling.

Despite these observations, little is known about which species of shrimp are present in Scottish waters, or about their distribution or abundance. Due to their relatively small size, most shrimp will escape from the nets normally used by Scottish fishing vessels working in deeper waters. The shrimp reported as bycatch have usually been trapped in the meshes of these nets, but such observations do not provide a reliable indication of either the species present or of their abundance.

However, the presence of commercial fisheries in adjacent areas does suggest the potential for a deepwater shrimp fishery in Scottish waters. If such a fishery were possible, it could provide a valuable new fishing opportunity for Scottish vessels capable of fishing in the necessary depths, allowing them to diversify away from more traditional (and currently over-exploited) fisheries.

A few Scottish vessels have attempted to target shrimp but all attempts have been short-lived (a few hauls only) and unsuccessful. The main reason for this lack of success was large bycatches of blue whiting and greater argentines which caused significant damage to nets. To date no commercial fishery has developed for deepwater shrimp in Scottish waters.

A targeted fishery for shrimp requires specialist fishing gear, in particular a light, small-mesh (typically ~40 mm) extension and cod-end to retain the shrimp. However, such a small mesh also retains large quantities of fish, the weight of which can damage the relatively light shrimp net. A large bycatch of fish (especially of juveniles) would also pose a threat to deepwater fish stocks. To reduce the bycatch of fish, shrimp trawls are usually fitted with a rigid separator grid which sorts the catch as it passes into the cod-end. These grids are designed to deflect most larger fish and other organisms out of the net, while allowing the (smaller) shrimp to pass through into the cod-end.

The primary purpose of this project was to investigate the potential for a deepwater shrimp fishery in Scottish

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waters by exploratory fishing with a suitably equipped vessel in waters to the west and north of Scotland.

Methods

The exploratory fishing was carried out by the Shetland fishing vessel *Alison Kay* (LK 57), a 24 m, 578 kW demersal stern trawler which had recently equipped with shrimp nets with a view to pursuing the deep-water shrimp fishery. The *Alison Kay* was equipped with two Cosmos 'Grenadier' shrimp trawls that could be fished in either single or twin-rig configurations. The 'Grenadier' trawl is widely used in Scandinavian deepwater shrimp fisheries.

To reduce the bycatch of fish and other larger organisms a rigid separator grid was fitted in the extension, as shown in the picture below. The grid was constructed of stainless steel with 22 mm gaps between the bars and was hinged in the centre to allow it to be wound onto a net drum. It had a rearward tilt of about 45°, and its weight was supported by floats attached to the top edge.



The extension of the *Alison Kay*'s net showing the separator grid in its operating position. The cod-end is to the left of the grid in this view and the direction of tow is towards the right. The triangular escape opening in the top of the net can be seen in front of the grid.

Shrimp and other organisms small enough to pass between the bars of the grid pass back into the cod-end. Larger organisms are deflected upwards by the grid and out of a triangular opening in the top of the net in front of the top edge of the grid. An opening across the top of the grid itself is intended to allow roundfish to pass through the grid and be retained in the cod-end; a square-mesh panel behind the grid providing an opportunity for smaller roundfish to escape.

The rigging of the *Alison Kay*'s shrimp nets, and initial fishing operations were supervised by an experienced Danish shrimp fisherman who had been contracted by the vessel to provide expert advice.

Exploratory fishing was undertaken by the *Alison Kay* in a variety of locations and water depths in an area stretching from St. Kilda to north of Shetland. All catches were sorted and weighed using a motion-compensated balance. Individual organisms were identified as far as possible at sea with unidentified

specimens being preserved for later identification in the laboratory.

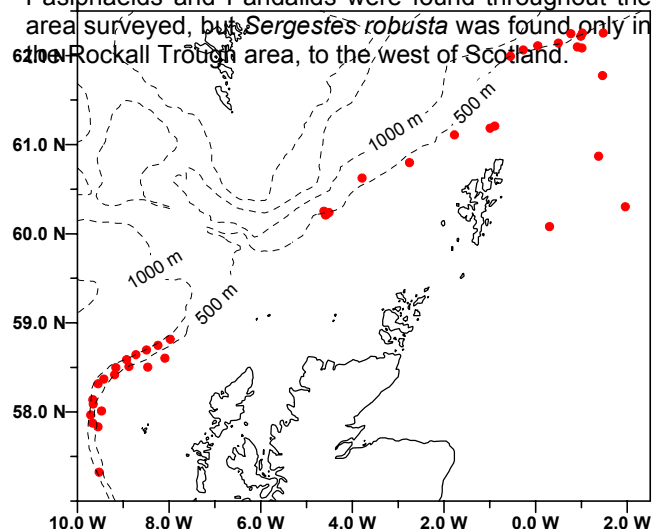
Results

Initial fishing trials were carried out between 18th and 23rd July 2001, but due to problems with the *Alison Kay*'s net monitoring equipment the remainder of the survey was delayed until the period from 12th to 28th August.

A total of 47 hauls were made (three in July and 44 in August) in an area stretching from west of St. Kilda to north and east of Shetland, as shown on the map below. Most hauls were made in water depths of between 400 and 600 metres, although depths ranged from 102 to 923 metres.

It had initially been intended to use the *Alison Kay*'s twin-trawl system to compare the catches taken with cod-ends with and without a separator grid. In the event, the light small-mesh netting of the shrimp trawls proved to be vulnerable to damage and time consuming to repair. In order to have a spare net available for use while repairs were being carried out, a single trawl (with a separator grid) was used for most of the survey. Four hauls were rejected because of gear damage or other problems leaving a total of 43 valid hauls (two with the twin-rig).

The total catch from the valid hauls was only 4,260 kg, the majority of which was fish bycatch, as shown in the Table opposite. Catches of shrimp were very small, but included two potentially marketable groups of small shrimp (see photographs opposite): Pasiphaeid shrimp (mainly *Pasiphaea tarda* and *P. multidentata*) and Pandalid shrimp (mainly *Dichelopandalus bonnieri*). Another species of small, red-coloured shrimp (*Sergestes robusta*) might also be marketable. (Scientific names are used here, and elsewhere in this Note, as many of the shrimp and other species encountered have no common names). The Pasiphaeids and Pandalids were found throughout the area surveyed, but *Sergestes robusta* was found only in the Rockall Trough area, to the west of Scotland.



Location of hauls made by the *Alison Kay* during these trials. Points indicate the mid-point of each haul.

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Pasiphaeid shrimp: Pasiphaea tarda (20-50 mm carapace length).

Total catch weight from all valid hauls with the separator grid.

	Wt. (kg)	% Wt.
Shrimp (potentially marketable)	30	0.7 %
Shrimp (other)	6	0.1 %
Bycatch (fish)	3,906	91.7 %
Bycatch (invertebrate)	319	7.5%
	4,260	

In addition to these groups of shrimp, a soft-bodied, red-coloured shrimp (*Hymendora glacialis*) was conspicuous in catches taken to the north of Shetland, but was not recorded elsewhere. Small numbers of about 10 other shrimp species were also caught.

The bycatch of invertebrates consisted mainly of euphausiids (krill) and various cephalopods (squid and octopuses; about 10 species). The fish bycatch included over 100 different species, of which blue whiting was the most abundant (see Table below). Haddock and Norway pout were only caught in shallower tows.

As discussed earlier, only two hauls were made with the twin-rig configuration, allowing a direct assessment of the effectiveness of the separator grid at reducing bycatch (it had been intended to carry out further twin-rig tows when suitable shrimp fishing grounds were identified). Although it is based on a very small number of tows the comparison of the catches taken in the twin-rig suggests that the separator grid is effective at reducing bycatch (see Table overleaf), especially of fish. However, the results also suggest that the grid results in a significant loss of potentially marketable shrimp.

Discussion

The catch of shrimp in this survey was disappointingly small and does not indicate any potential for a commercial shrimp fishery in the area surveyed, at least



Pandalid shrimp: Dichelopandalus bonnierii (14-20 mm carapace length).



Segestes robusta (17-28 mm carapace length).

The top 10 fish species (by weight) taken as bycatch.

Species	Wt. (kg)	% Wt.
Blue Whiting	1664.8	42.6%
Haddock	271.6	7.0%
Norway Pout	242.2	6.2%
Bluemouth	168.0	4.3%
Longnose Velvet Dogfish	167.1	4.3%
Roundnose Grenadier	129.3	3.3%
Rabbitfish	120.0	3.1%
Black Scabbard	122.1	3.1%
Lantern Fish	118.2	3.0%
Saithe	106.7	2.7%
Total Fish Bycatch	3,905.6	91.7%

at the time of year when the survey was carried out (late summer). Shrimp fisheries in other areas tend to be seasonal in nature (off Færoe shrimp are fished in the spring), so it is possible that better results might have been obtained had this survey been carried out earlier in the year. (The timing of this survey was dictated by external factors, primarily the availability of project funding).

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Comparison of the catch weights (kg) with and without separator grids in the twin-trawl.

	Without Grid	With Grid	Diff. % Wt.
Shrimp (potentially marketable)	9.5	6.5	- 32%
Shrimp (other)	0.1	0.1	- 17%
Bycatch (fish)	20.9	17.2	- 18%
Bycatch (invertebrate)	288.5	104.3	- 64%
	319.1	128.1	- 60%

With such small quantities of shrimp it was not possible to make any assessment of the market demand for the species caught. It is not thought that either the relatively soft Pasiphaed shrimp or the slightly yellow-tinted *Sergestes robusta* are likely to be of high value. The most common Pandalid shrimp caught (*Dichelopandalus bonnierii*) is similar to the 'prawn cocktail shrimp' that is fished off Denmark and Norway. This species could probably be sold to this market and may provide the best potential for a commercial shrimp fishery in Scottish waters.

The soft, red-coloured shrimp *Hymendora glacialis* was often found caught in the meshes of the trawl net when fishing north of Shetland. This is probably the shrimp species frequently reported as being taken as a bycatch by demersal trawlers in this area. Due to its softness, catches of this species were usually in very poor condition and it seems unlikely that it has any market potential.

A wide variety of other shrimp, cephalopod and fish species were caught during this survey; about 175 in total. The identification of many of these proved to be difficult and time-consuming, often requiring detailed examination of specimens in the laboratory. Some specimens have been distributed to experts for identification. A reference collection of the species caught has been assembled by NAFC.

Again due to the small quantities of shrimp caught, and due to the decision to operate a single trawl for most of the survey, it was not possible to make a detailed assessment of the effects of the separator grid on catches. Nevertheless, the two hauls that were made with the twin-trawl, as well as general observations of the catches taken with the single trawl, suggest that the grid was effective at reducing bycatch, especially of larger fish. The grid proved to be relatively easy to

shoot, bring aboard, and to haul onto the net drum. The fish bycatch could probably be reduced further by dispensing with the opening in the top of the grid which is not necessary in this fishery.

The trawl and grid used by the *Alison Kay* in this survey were designed specifically for the Pandalid shrimp fishery. It is possible that the spacing of the bars in the grid was too narrow to retain some of the larger and potentially more valuable shrimp that might have been expected to occur in this area.

Fishing with the shrimp trawl proved to be relatively difficult, although the *Alison Kay* had only recently fitted out with this gear and the crew were still gaining experience. The net is very light and was difficult to work in strong currents. Its light construction also made it vulnerable to damage and the small-mesh size meant that repairs were time consuming.

The biggest problem was uncertainty about whether or not the net was performing properly, and in particular whether it was actually on the bottom. Effective fishing with this gear requires it to be placed accurately, and lightly, onto the sea-bed, with care being required to avoid excessive ground contact which could damage the net. Effective net monitoring equipment to monitor the position, height and status of the net is probably essential for the shrimp fishery.

Overall, the results of this survey were disappointing in terms of demonstrating the potential for a deep-water shrimp fishery in Scottish waters. However, it would be worth carrying out further exploratory fishing earlier in the year, and with a modified separator grid (with a larger bar spacing) before the prospects for such a fishery are dismissed altogether. The project did provide a substantial amount of information on the operation of a shrimp trawl in deep water, and did demonstrate that the separator grid is effective at reducing bycatch in the shrimp fishery.

Acknowledgements

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