The Evaluation of Ghost Fishing Preventors for Shellfish Traps

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THE EVALUATION OF GHOST FISHING PREVENTORS FOR SHELLFISH TRAPS

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December 2002

The evaluation of ghost fishing preventors for shellfish traps

A study commissioned by DEFRA under their programme MF07: 'Impact' of Fishing' which was reviewed in February 2001. Project no. MF0724

Executive Summary

Introduction and objectives

This report describes an investigation into the phenomenon of 'ghost fishing' by shellfish traps. Ghost fishing can occur when fishing gear is lost from the control of its owner and continues to produce fishing mortality. The work came about through an initiative of the largest fishermen's association representing this sector in the UK. There were four objectives:

1. to investigate the extent and nature of problems associated with ghost fishing by shellfish traps that have become permanently lost,
2. to identify the range of materials and devices available to resolve the problems identified,
3. to identify the range of conditions under which the devices would have to operate, and
4. to perform field trials, with appropriate controls, in order to evaluate the performance of the devices.

Materials and methods

The project team undertook a survey of fishermen's experiences of gear loss in the Southwest and Northeast of England and on the West Coast of Scotland. The survey quantified effort levels, identified the main reasons for losing shellfish traps and looked at fishermen's perceptions of the phenomenon.

The team then identified devices used in other fisheries in order to disable lost traps. A range of these devices were obtained and evaluated. This process involved trials under controlled conditions in a Scottish sea loch and the use of the devices by commercial fishermen. These trials were to evaluate both the reliability of the devices and their practicability under commercial conditions.

Results

The survey showed that most fishermen do not believe that lost traps pose a threat to stocks. Many of those interviewed had recovered traps lost for varying periods of time and they seldom contained any catch. In most cases they were damaged and had no residual fishing capability. A more significant source of unaccounted mortality on shellfish species was claimed to be from netters, beam trawlers and scallop dredgers. There are some objective catch data which support these assertions.

The disabling devices ranged from simple lengths of sisal twine to purpose-made corroding links that can be supplied calibrated for given immersion times. All of these worked but not always in a predictable way. Cost-effectiveness is also a major consideration given the number of traps that may now be worked by shellfish vessels.

Conclusions

1. Most trap fishermen surveyed did not consider that there was a conservation problem associated with lost traps. All the anecdotal evidence (backed by some data) supports the view that most lost traps become disabled over a period of some months.
2. If areas or fisheries are identified as being particularly susceptible to loss then a range of technical measures are available which will mitigate any ghost fishing that might result. Samples of these were obtained and examined.
3. Further field work identified the operating conditions that the devices would need to withstand in the main trap fishing regions.
4. In field trials all the devices were found to perform satisfactorily but other factors also had to be taken into account. These included the ease of renewing them at sea, their cost and their life to failure. The most widely applicable device was a 'drop-out panel' held in place by mild steel rings.

Recommendations

Where trap loss is a cause for concern there is a case for fitting some device to limit any subsequent fishing activity. Drop-out panels can also incorporate escape gaps, and it is recommended that further work should look at the design and fitting of panels incorporating escape gaps.

The design work should be followed by sea trials to evaluate effectiveness.

Some attention should also be paid to the techniques for the retro-fitting of drop-out panels to existing parlour and inkwell traps.

The evaluation of ghost fishing preventors for shellfish traps

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The evaluation of ghost fishing preventors for shellfish traps

1. Introduction

This report describes an investigation of the phenomenon of *ghost fishing* by shellfish traps. The aspects covered include a limited scoping exercise to identify the scale and nature of any problems, a review of technical measures that could be used to mitigate the effects of ghost fishing, and trials of the most promising measures under controlled and commercial conditions.

The work was initiated by South Devon and Channel Shellfishermen Ltd (SDCS) which is the largest association of its kind in Europe. They approached Seafish with concerns that:

- effort levels were increasing in the shellfisheries in terms of the number of traps being used per vessel,
- the effective effort was also rising because of the increasing use of parlour traps (these can retain the catch over a longer period, allowing vessels to fish more traps by leaving them in the water for longer),
- incidents of conflict between the static and towed gear sectors were resulting in gear loss, and
- because of these factors the sector should review its performance to head off any potential criticism.

Seafish has developed the view that sectoral associations should be prepared to enter into a process of assessing the range of unintended impacts that they may have upon the marine environment. This is a precautionary approach that would demonstrate a responsible attitude towards the resource base as a whole. The initiative from SDCS was consistent with this view. Seafish had considerable experience in the field of investigating ghost fishing by gill nets and saw the potential to build upon this for the benefit of the shellfish sector. That work – some of which ran in parallel with this study – has involved surveying fishermen's experiences of gear loss, identifying areas where loss is relatively high, simulating loss and monitoring the evolution of the 'lost' gear, and investigating measures that could be used to mitigate the impacts of lost gear where this may be a cause for concern.

In the case of shellfish traps it was recognised that funding would be limited and that the research tasks would need to be prioritised. Discussions between SDCS and Seafish agreed that priority should be given to the area of impact mitigation with the need for a modest scoping exercise also being accepted. This plan was endorsed by the Shellfish Association of Great Britain. A funding proposal was then made to MAFF which was successful.

2. Objectives

There were four scientific objectives set out for this study:

1. To investigate the extent and nature of problems associated with ghost fishing by shellfish traps that have become permanently lost.
2. To identify the range of materials and devices available to resolve the problems identified.
3. To identify the range of conditions under which the devices would have to operate.
4. To perform sea trials, with appropriate controls, in order to evaluate the performance of the devices.

3. Methods

The objectives were achieved by a combination of literature surveys and other searches; initial investigations of the likely types of gear loss; detailed surveys of fishermen's experiences of loss; and a series of field trials.

3.1 Study Objective 1: Determination of the extent of the problem

This project built upon a previous JNCC-commissioned study which reviewed the use of shellfish traps in British waters (Jacklin *et al*, 1995, *A review of potting and creeling in coastal waters around Great Britain)*. The study and the larger study of which it was a part, provided information on shellfish fleet structure, gear composition and methods of gear deployment, and the benthic impacts of potting, including ghost fishing.

Based upon the information provided by that study, port visits were made to the shellfishing areas of Western Scotland, Southwest England and Norfolk. These visits enablrd an updating of estimates of shellfish trapping effort in those areas. They also resulted in an identification of the kinds of conditions in which traps are worked, and information about fishermen's work regimes, together with the kinds of loss problems experienced by fishermen and the timescales involved. It became clear that the reasons for losses could be divided into 5 broad groups: (1) *bad weather and tide*, (2) *other sea traffic*, (3) *other fishing activities,* (4) *own fault,* and (5) *something else* – usually theft.

Questionnaires on trap losses and fishing effort were constructed, based on the information obtained from the port visits, and released to three UK regions: Cornwall Sea Fisheries Committee District, Northeast Sea Fisheries District (Yorkshire and Lincolnshire Coast) and the Fishermen's Association of Wells and District, Norfolk.

Scottish inshore fisheries do not have the same local Sea Fisheries Committee administrations that are found in England. Because of this, it was not possible to mail questionnaires to trap fishermen using SFCs as a postbox, as was done for the surveys in NE and SW England. This necessitated visits to various Scottish ports.

The study area covered in Scotland was from Mallaig and Arisaig in the south to Loch Erribol in the north, including the Isle of Skye. A separate visit to the Hebrides, where effort levels are known to be high, was considered, but ruled out because of time constraints. Many of the characteristics found in the mainland shellfish trap fisheries were known to be replicated in the Hebrides.

The combination of port visits with the use of questionnaires enabled a large number of UK shellfishermen to be consulted on this objective.

3.2 Study Objective 2: Finding the range of materials available

A literature search, an internet search and personal contacts resulted in the identification of some materials and techniques that could be used to disable lost shellfish traps (see, for example, Blott, 1978; Smolowitz, RJ., 1978; and Pecci *et al*, 1978). Other fisheries institutes and various commercial fishing gear manufacturers were contacted. Three categories of disabling device were defined as a result of this:

1. Commercially available calibrated galvanic timed release devices (GTRs). These are manufactured from an alloy of specific composition, and are intended to corrode at a pre-determined rate in sea water
2. Biodegradable twine materials that decay over time
3. Drop-out panels held in place with corrodable iron rings

3.3 Study Objective 3: Establishing the range of operating conditions

It was anticipated that some of the operating conditions might not have become known until actual experiments had been conducted at sea, therefore this study objective was expected to be achieved, in part, with objective 4.

According to comments made on the questionnaires, together with advice given by fishermen and fishery officers, any release device for use in preventing ghost fishing must satisfy the following conditions:

1. It must not prevent the trap from working as it would be expected to
2. It must have low unit cost
3. It must be quick and simple to renew at sea
4. It must work reliably, and be rugged enough to withstand commercial conditions and shellfish attack until the appropriate release time is reached
5. It must be easy to determine that it is installed correctly, if fitting is made a legal requirement in a fishery.

3.4 Study Objective 4: Evaluating the performance of release devices at sea

In order to address this objective, three different kinds of trial were set up:

1. Different types of traps were fitted with the disabling devices and set for two long-term soak tests on the seabed, in a sheltered area of Loch Ceinn Tragha at

Ardtoe in Western Scotland. These trials were intended to test shellfish reactions to the presence or absence of release devices in a simulated 'lost' situation. They were also intended to identify any possible mechanical problems with the devices that could have been overlooked.

2. A range of galvanic timed releases in various release time values were set up in shore-based tanks at the Seafish facility at Ardtoe. These were set up at the same time as the 'lost' simulation and under the same ambient water conditions. Sea water was continually circulated through these tanks. The accuracy of these timed releases could then be related to both water salinity and temperature. This trial was intended to provide an indication of the condition of the GTRs in the seabed trial, and also provide possible information about the consistency of operation. GTRs were sourced from the USA and were available in 75 day, 30 day, 10 day and 5 day expected release times. These devices were selected for use under the expected range of ambient water temperatures and salinities off western Scotland, which was the chosen location for field work. Temperatures there normally reached a maximum of about 12°C in summer, and salinities are about 3.2%. However, for fisheries that experience a different range of water temperatures and salinities it would be necessary to obtain GTRs that are calibrated, by the manufacturer, for use under those conditions.
3. Fishermen were given traps fitted with a range of the above devices, and evaluated them under commercial conditions.

3.5 Field Trials

The area chosen for the field trials was Loch Ceinn Tragha, a relatively sheltered sea inlet at Ardtoe, Ardnamurchan, in Western Scotland. The area had varied seabed topography, and contained a wide range of shellfish species usually caught with traps. Other considerations were that the area was relatively free of trawlers that could interfere with the long-term field trials, and that Seafish had a nearby research facility at Ardtoe (Seafish Aquaculture).

In the experimental design, there were 4 trap types, all baited initially:

Type 1: Traps with galvanic timed releases (GTRs).
Type 2: Traps with rot-outs (biodegradable twines of untreated sisal)
Type 3: Traps with drop-out panels fixed in place with wire fastenings that corrode (also known as '*hog-rings*')
Type 4: Control traps. These were unmodified traps representative of the various fisheries under consideration. A table of all the gear types deployed is provided in Appendix II.

Procedures for Deployment

27 traps were deployed on varied ground types in two strings, one string of 20 traps and the other of 7 large traps, separated for ease of handling. Ground types chosen were appropriate for velvet crabs, lobsters and brown crabs. The traps were rigged and deployed in a manner that reflected as near standard commercial practice as the experiment would allow. One end of one of the strings was fitted with prawn

creels, and this was sited as close as was possible to grounds thought to be suitable for prawns. A local fishing vessel, MFV *Curlew* OB108, was chartered to deploy and subsequently recover these traps. The experimental gear was deployed for the first time on 13 January 2000 to be hauled in May. The gear was hauled for the first time on 25 May 2000 and re-deployed for a second time later on the same day. The gear was hauled for the second time on 02 August 2000 and removed from the water.

Time of first soak:	133 days during winter & spring seasons
Time of second soak:	62 days during summer season

Monitoring

Diver observations and a video record were made at the end of both soak periods: (1) underwater, immediately prior to hauling, and (2) of the hauling and emptying procedure. The condition of each trap, together with the progress of each release device, were then recorded on digital videotape, and subsequently transferred to CD-ROM in MPEG1 format, for easy reviewing with a PC.

Attributes that were noted comprised:

1. Catch (if any)
2. condition of the release devices
3. any marine growth
4. any trap damage
5. any obvious trap movement

A 75 day GTR was used with some of the traps initially. The chosen value of 75 days reflected the opinion of fishermen who were questioned about a possible timescale for using GTRs in a commercial fishing situation. It would therefore be about 2 months before these 75 day GTRs would need replacing (50 day devices were used for the second time).

The temperature and the salinity of the water were monitored on a daily basis by colleagues from the Seafish Aquaculture team at Ardtoe.

3.6 Galvanic release trials

A range of galvanic timed releases in various release time values (10, 30, 50 and 75 days), were set up as a control in ambient water conditions at the same time as the 'lost' simulation. An indication of the likely expiry of the GTRs on the traps set on the seabed could then be given. In addition, the accuracy of the control timed releases could be related to both the water salinity and temperature. The control release devices were set up in tanks of water containing a free flow of seawater at the nearby Seafish Aquaculture facility at Ardtoe. The water in the tanks was pumped ashore from a seabed location very close to the position of the 'lost' simulation of traps set on the seabed.

3.7 Fishermen's trials

Three skippers were given a range of the anti-ghost fishing devices identified under Objective 2 to incorporate into their own gear and try out in a commercial fishing situation. One skipper was based at Kingsbridge, Devon, using an 8m vessel in a brown crab and lobster fishery, and working from 1 to 6 miles offshore with 600 pots. 120 of these were parlour pots, and the remaining 480 were inkwell pots with rubber skirts around the entrances Another skipper was based at Arisaig in western Scotland, using a 9m vessel in a velvet crab fishery, and working inside 1 mile of the shore with about 500 creel style traps, each with two soft-eyed entrances. A third skipper was based at Bridlington, using a 13m vessel in a brown crab and lobster fishery, and working usually outside 6 miles of the coast with about 1200 parlour traps.

4. Results

4.1 Questionnaires

The returns from the questionnaires were better than had been expected. Where this was the case the questionnaires had been distributed via the local Sea Fisheries Committees mainly to those vessels working within their respective jurisdictions. Returns from the Devon, Cornwall and Northeast Districts were around 45% whereas the returns from Norfolk (via a fishermen's association) were only 2%. In Western Scotland the questionnaires were filled in during interviews with fishermen.

These sampling techniques were neither stratified nor randomised, so the respondents do not necessarily reflect the full fleet profile. This should be borne in mind particularly for the data describing potting effort in Southwest England. South Devon contains the ports of Salcombe, Dartmouth/Kingswear and Paignton which between them have the highest concentration of vivier crabbers in the UK. These boats are generally 12-15m in length and work predominantly on the mid-Channel grounds. A number also work to the west and north of Scotland on a seasonal basis. The activities of this sector are under-represented in the survey returns. This applies particularly to the number of pots worked per vessel and the trends in use of parlour pots.

4.2 Trap types and changing fishing strategies

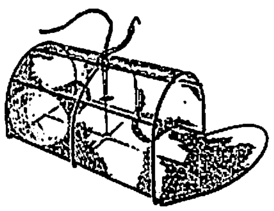
The information in the returned questionnaires gave details about the different trap types used in the principal shellfish fisheries of the three main study regions of Southwest England, Northeast England and Western Scotland. The shellfish species that was being targeted determined the type of trap used:

The evaluation of ghost fishing preventors for shellfish traps

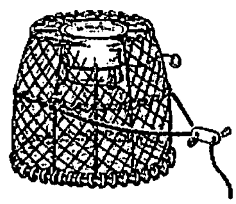
1. Traps for prawns *(Nephrops norvegicus)* and velvet crabs *(Necora puber)* with rigid hard-eyed entrances used mostly in Western Scotland. These traps are very light in construction, often without the heavy rubber reinforcing found on other kinds of trap. They are usually referred to as *creels.* (See also figure 5: *Prawns entering a hard-eyed creel.*)

2. Traps that have only a smooth plastic 'funnel' entrance to limit the escape of shellfish, such as the inkwell pots used mostly in south-west England. This kind of trap is usually heavily protected against seabed abrasion with rope and strips of rubber as reinforcement. They are usually used to target brown crabs *(Cancer pagurus)*, spider crabs *(Maia squinado)* and lobsters *(Homarus gammarus).*

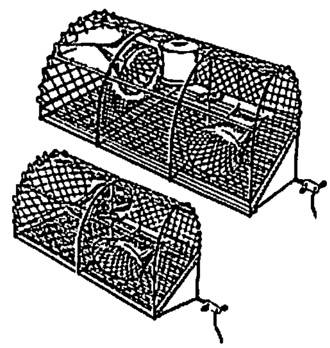
3. Traps that have a *parlour* section, used mostly in south-west and north-east England. The parlour is divided from the rest of the trap by a cone-shaped entrance *(soft-eye).* These traps are often heavily protected against seabed abrasion in the same way as inkwell traps, and used to target the same range of species. The parlour trap design has evolved from a similar, but smaller trap that had two cone-shaped (soft-eye) entrances made of taut netting, but no separate parlour section. This kind of trap is used to target all demersal crustacean shellfish except prawns. These two trap types can be grouped together, because they capture shellfish in a similar way by use of these cone-shaped entrances. (Diagrams from Jacklin *et al,* 1995.)



(1) Prawn & velvet crab creel



(2) Inkwell pot



(3) Parlour trap and soft-eyed trap

For South West England (chart 1), the two most common types are parlour pots and inkwell pots; many vessels used 50% of each type. Most of the shellfish vessels in the Southwest of England work inshore (inside 6 miles). For North East England (chart 2) the two most common types of trap used are parlour pots and soft-eyed traps, with soft-eyed traps being worked in small numbers (<400). However, there is one very significant class of vessel that does not stand out in either chart - large vessels that used more than 1000 traps. Because the questionnaires were circulated by Sea Fisheries Committees who had inshore jurisdiction, there was a risk that a proportion of large vessels working with large amounts of gear for long periods offshore would not be included in the survey. To attempt to reduce this bias, direct contact was made with some of the skippers of this class of vessel.

Chart 1 Trap use in the SW Region

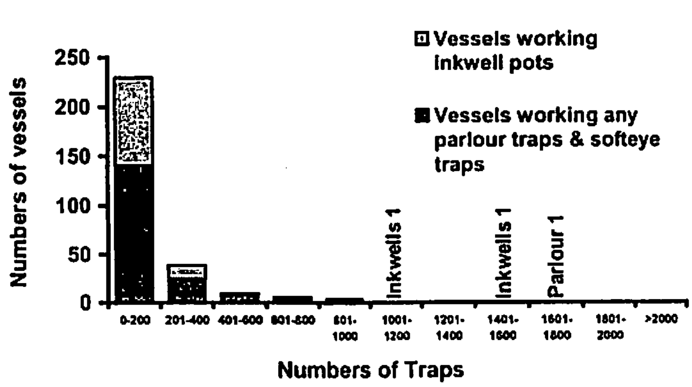


Chart 2 Trap use in the NE Region

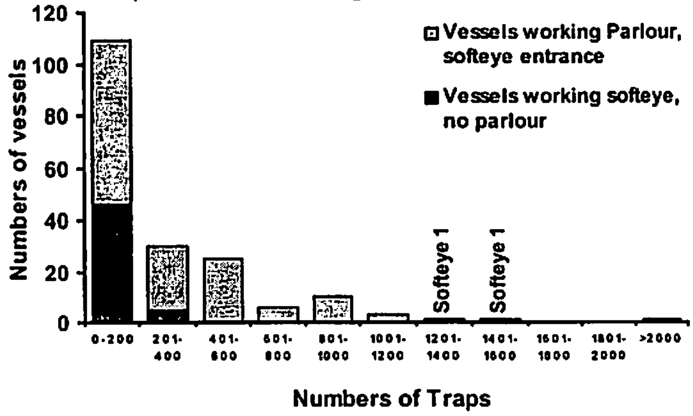
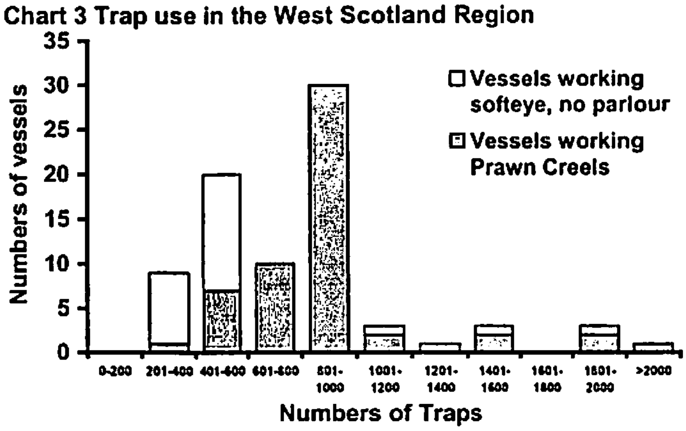


Chart 3 shows the numbers of soft-eyed traps (without parlour sections) and hard-eyed *Nephrops* traps worked by different vessels in the study area for Western Scotland. The soft-eyed traps are set to target brown crabs, velvet crabs and lobsters. The chart shows that it is common for a combination of both types of trap to be used in the same fishery. The chart also shows that most traps used in this region are set to target prawns, and that few vessels work less than 400 traps.

Chart 3 Trap use in the West Scotland Region



Changing fishing strategy

From the information in the returned questionnaires, it was found that there had been a general increase in the numbers of parlour pots used by English fishermen over a 5 year period. Charts 4 and 5 illustrate this change over the period 1995-1999. The greatest increase in parlour pot use occurred with those fishermen using less than 200 pots in 1995, with about a 30% increase in the Northeast of England, and about a 15% increase in the Southwest of England, but note the caveat concerning the effort from larger vessels (see *Questionnaires*).

Chart 4 Changes in parlour trap use 1995-1999 in Northeast England

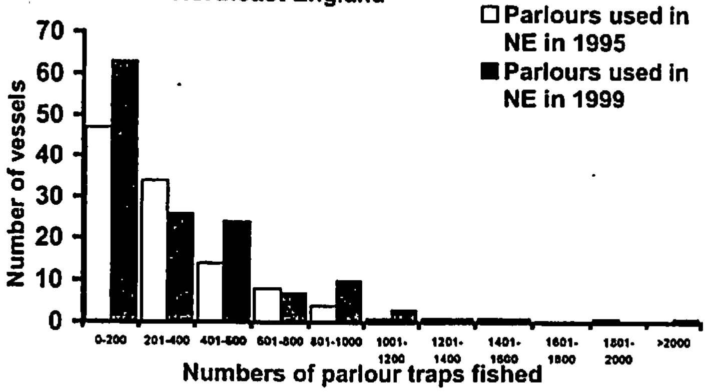
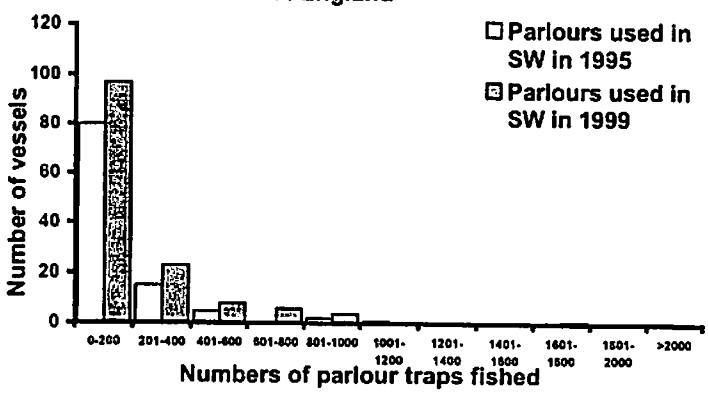


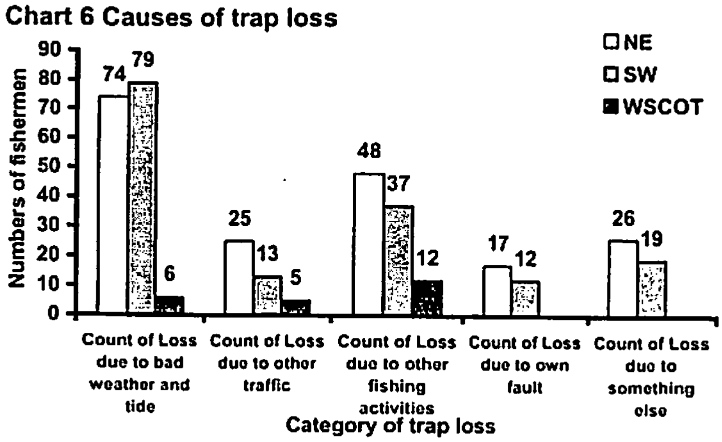
Chart 5 Changes in parlour trap use 1995-1999 in Southwest England



4.3 Examination of the reported causes of trap loss

Chart 6 shows the different causes of trap loss expressed by fishermen in the questionnaires. Bad weather was the primary cause of loss, (43%), while the secondary cause of loss was due to other fishing activities (26%). It is interesting to note that 12% of losses were reported under the *Something else* category. For these cases, when it was asked what the cause of loss was, most fishermen reported incidents of theft and piracy. Shellfish traps left on the seabed unattended appear vulnerable to this kind of loss in some areas. This can encourage fishermen to mark their traps discreetly, using small, low-profile surface markers that are almost certainly illegal under UK navigation law. Unfortunately, improperly marked gear can become either damaged

Chart 6 Causes of trap loss



In the questionnaire, the perception of ghost fishing as being a problem for fishermen was established by asking the question: *'Do you think that the problem of ghost fishing is a problem anywhere in your fishery, where pots or traps continue to fish after becoming lost?'*

Chart 7 shows the responses to this question divided into 5 graded groups, ranging from *No, it is never a problem*, through to *Yes, it is definitely a big problem*, with *Don't Know* as a separate category. For Chart 7, even when the group *Yes, it is definitely a big problem* is combined with the group *Don't know* to make the more robust comparisons that are shown in Chart 8, the difference is still very significant ($P<0.004$). When the opinion of fishermen as to whether ghost fishing was a problem was related to the numbers of pots that they have lost (chart 8), a pattern emerged.

Chart 7 Perception of ghost fishing

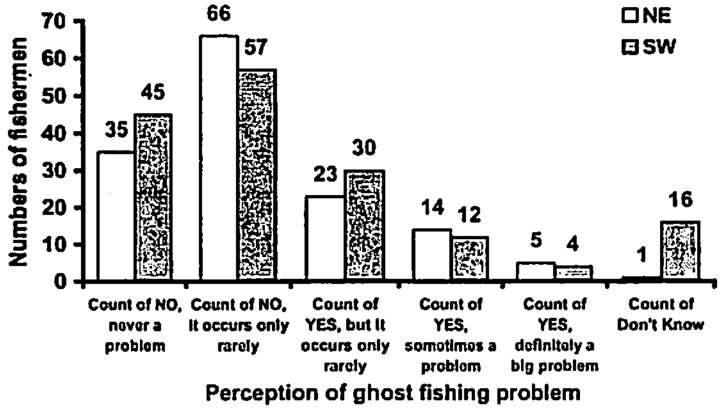
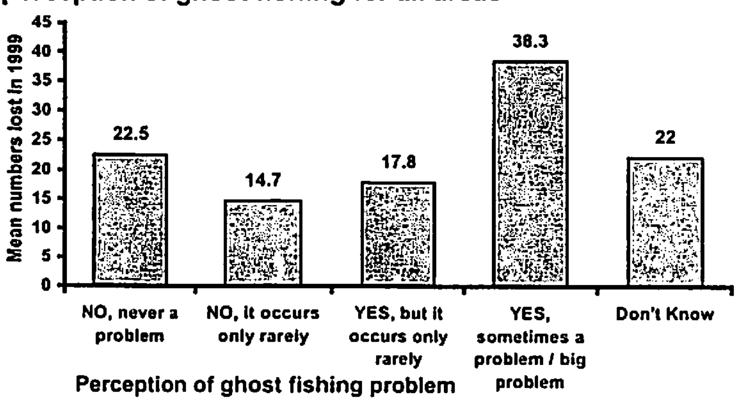


Chart 8 shows the mean losses of traps related to the perception of ghost fishing as being a problem, for all sampled areas combined. There is a higher belief that ghost fishing is a problem among those fishermen that had lost higher numbers of pots, compared with those who had reported few, or no, losses. Analysis shows that there is a significant difference between the mean number of pots lost when the 4 different levels of perception of the problem were examined.

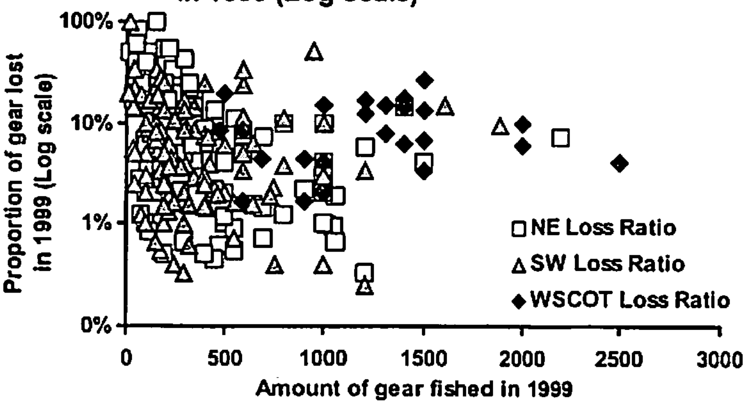
Chart 8 Mean losses of traps related to perception of ghost fishing for all areas



The responses *Don't know* are therefore similar to *No problem,* and those who thought that ghost fishing was a problem did so in proportion to their lost pots. The data sets that were used for this analysis were from North East (NE) and South West (SW) England.

Chart 9 shows the proportion of gear lost by trap fishermen in 1999 related to the numbers of pots used (the *loss ratio* in the legend), by area. There are 3 broad métiers that can be identified from the groupings of data points on the chart: those who use less than 500 pots, those who use 500-1000 pots and those who use more than 1000 pots. There is least variation in losses among those using more than 1000 pots. This is consistent with large vessels such as the crabbers that are based along the south coast of England which work on a 24 hour basis, and are able to maintain a guard over their fishing gear.

Chart 9 Proportion of gear lost for each vessel in 1999 (Log scale)



It is also consistent with small vessels working large numbers of prawn creels in areas that may be inaccessible to trawlers and/or relatively sheltered from bad weather. There is greatest variation among those working less than 500 pots. This is consistent with smaller boats working inshore (less than 6 miles from the coast) and who have experience of incidents with towed gears and other sea users.

The results from the questionnaires and port surveys indicated that ghost fishing was certainly not perceived as being a problem to shellfish stocks by the majority of industry members working in shellfish trap fisheries in the UK. Most losses were reported as being caused by bad weather, with trawling being the next biggest reported cause of loss. Traps that were lost in either of these ways were reported to become damaged quickly, and unable to retain shellfish. Observations of traps that had been located and brought ashore by divers and by trawler skippers supported that argument. In addition, traps were observed to be under a continual state of repair, due to damage inflicted by trapped shellfish on the mesh coverings. The questionnaires enabled a good estimate to be made of the levels of trap loss when related to the amount of gear deployed. Statistical analysis demonstrated that the responses made by fishermen were reasonable and consistent.

4.4 Information from the West Coast of Scotland

The main target species for the majority of vessels in the study area was found to be *Nephrops* (prawns). Some vessels were found to take part in a seasonal fishery for velvet crabs and lobsters using exactly the same traps as for *Nephrops* - usually lightweight creels equipped with two *hard-eyes*. Other vessels were found to use a slightly different kind of trap for velvet crabs and lobsters – usually a creel similar to those used for *Nephrops*, but equipped with two soft-eyed entrances and heavier mesh. A common practice was for fishermen to use only half their full amount of gear, storing the rest in deep water, unbaited, until needed again. Some fishermen reported that they left the doors unfastened to prevent any ghost fishing, but this was not universal. However, fishermen who engaged in this practice explained that the easiest place to leave the traps was in the water, and that there was never anything caught in the traps when they were hauled up to be put into use. Bringing the gear back ashore would take up space on the boat, would take time to accomplish and would use fuel. From a fisherman's viewpoint, all this time and effort were much better spent in fishing on the grounds.

The vast majority of trap losses in this area were reported as being caused by trawlers and scallop dredgers towing through strings of traps. There have been some changes in trawler activity in recent years in these regions. The reported trend was for large trawlers to work progressively further offshore than in the past, leaving only the small, and usually local, trawlers to work the inshore grounds. Most of the gear towed through by trawlers was either recovered by the trawler and returned to its owner, or was returned to the sea and the new gear position given to the owners. In general, the trawler fleets appeared to be now co-operating more favourably with the shellfish trapping boats than was the case several years before.

There had been very little scallop dredging activity in this area over the previous two years compared with earlier times. This was a result of certain Government restrictions imposed on scallop fishing due to a detected excess of certain organisms that could cause shellfish poisoning in humans. When there were scallop dredgers working, losses to shellfish fishermen were reported as being considerable, as scallop dredgers tended to tow over the same type of seabed that the trap fishermen needed to use. The skippers of many of the scallop dredgers had, meanwhile, been forced to find new scallop grounds elsewhere that were free of restrictions. In this way, the problem of trap loss due to gear conflicts had been exacerbated in other places. This was certainly the case in Cornwall, to where many of the Scottish scallop dredgers had migrated because of restrictions on catching scallops at home.

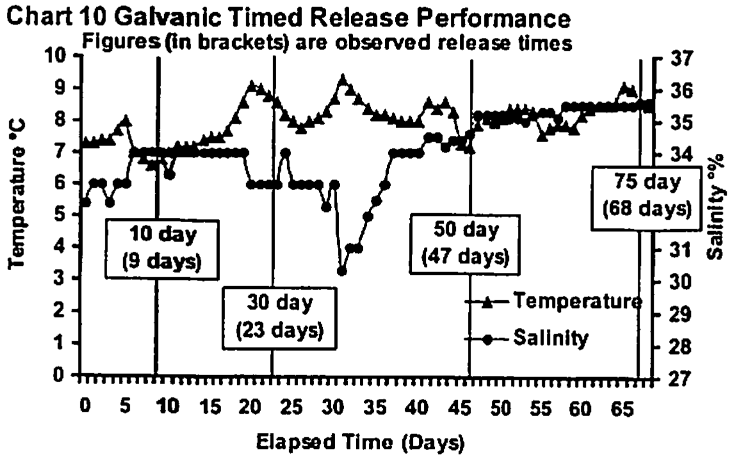
Visiting shellfish fishermen from the South Coast of England appeared to be very good at co-operating with local Scottish trawlers. Vessels of this type – which were usually referred to as *Channel boats* – deployed large numbers of mainly inkwell pots, and progressively moved them to fresh grounds on a daily basis. Co-operation with locals involved giving local trawlers the co-ordinates of strings of pots, and also informing the locals in which general direction the strings of pots were being progressively moved. In this way, gear conflicts were kept to a minimum.

4.5 Galvanic timed release trials

Chart 10 shows the performance of the galvanic timed releases (GTRs) held under monitored conditions in tanks containing seawater that was constantly being pumped ashore. The figures (in brackets) represent the time at which the GTRs finally corroded through.

The control galvanic releases in the tanks all corroded through close to their rated time values. In one case during the Ardtoe seabed field trial, a pair of identical 50 day galvanic releases were fitted at the same time to the same trap *(B07)*. After two months only one of the pair had corroded through (figure 3). The reasons for this are a likely to be a combination of variation in the construction of the devices, the local effects of metal in the frame of the trap, and other possible local effects of metals in the sea bottom. Quantifying this and establishing confidence limits was identified as being very difficult and possibly unnecessary, because it was found that, from the reports by fishermen, there were more practical and beneficial ways of achieving a timed-release solution, such as drop-out panels that incorporate escape gaps (figure 2).

Chart 10 Galvanic Timed Release Performance



There were limited replicates in the GTR tank tests (one of each value) because of a lack of availability of suitable GTRs.

4.6 Seabed field trials results

A full set of results for the seabed trials is contained in Appendix II. In addition, a video record has been made of each trap, (a) underwater, prior to hauling, and (b) being hauled and emptied. These are available as MPEG1 files on CD-ROM, for reference. Of the traps set under experimental conditions in the seabed trial at Ardtoe, catches were found only in the parlour type, during both the winter and summer seasons. Figure 6 shows dead brown crabs being removed from such a parlour trap *(see Appendix II, table of results; trap A16, 62 days, Summer).* Figures 2 and 3 *(traps A13 and B07)* show parlour traps containing a combination of dead and alive brown crabs. Note that parlour traps have a separate compartment that is designed to enhance the retention of shellfish until such time that the trap is hauled and emptied. The Ardtoe seabed experiment further demonstrated that the commercially available galvanic timed releases which were used tended to be both unreliable and inconsistent *(traps B02, B04, A17 summer 62 day soak; also traps A05, B02 winter 133 day soak).* Drop-out panels that were secured with the iron hog-rings were slow to operate, and needed an estimated 5-6 months to release *(trap B07, winter and summer seasons).* Sisal twine appeared to work well, but in some cases *(traps B06, A18, 62 day soak)* it was found that it had been prematurely cut through by shellfish in their preference to attacking the synthetic mesh covering on the traps. It was shown that, to perform as rot-outs, the positioning of the twine in a trap was very important in order to keep it out of reach of captive shellfish.

No lobsters *(Homarus gammarus)* or prawns *(Nephrops norvegicus)* were caught during these trials. In the winter season (133 day soak), 19 brown crabs *(Cancer pagurus)* and 7 velvet crabs *(Necora puber)* were caught with 18 traps. In the summer season (62 day soak), 49 brown crabs and 6 velvet crabs were caught in the same traps. For velvet crabs at Ardtoe, the winter mean catch rates were just 1 per 346 trap-days and in summer 1 per 186 trap-days, indicating that once the bait had decomposed, the traps had become unattractive.

4.7 Fishermen's trials results

The results from commercial trials with escape devices suggested that galvanic timed releases would be too expensive to use in the numbers that would be required in UK fisheries, and too labour-intensive to replace regularly. Drop-outs were reported as very difficult to retro-fit in a mesh covered trap, but could be used in rigid steel wire mesh traps and for mesh covered traps designed with specific attachment points for drop-out panels. Sisal twine rot-outs were well regarded of the three options as they cost so little, but concerns were raised over the ease with which shellfish could cut through them in some circumstances.

Fishermen's trials in Southwest England (Devon)

The skipper in south Devon, who volunteered to try out some of the anti-ghost fishing measures, reported that the 30 day galvanic releases he was given to try had corroded through within about 30 days, as predicted, plus or minus about 2 days. The sisal twine was laced across a parting in the mesh, and had rotted through in a fishing time of about 2.5 months (January to March 2000). The sisal had therefore provided a means of escape over a realistic time scale, and the trap had worked well up to the point of release. The skipper said that the cost of working with galvanic releases effectively ruled out their use. In addition, the fact that sisal twine as a rot-out device worked just as well, and cost next to nothing, made the use of galvanic timed releases unrealistic and largely irrelevant. The skipper reported that new parlour pots covered with mesh of double strand 3mm twine often required mending after about 3 months, due to shellfish cutting escape holes in the mesh of the parlour section of the traps. This time could be extended by using thicker, stronger twine to cover the traps.

Two drop-out panels were tried; one secured with 13 gauge (2.3mm) soft iron wire hog rings; the other was secured with nylon as a control. It was reported that fitting them snugly in nylon diamond mesh was very difficult. The soft iron rings were still secure after 2.5 months fishing, with no sign of failing. It was estimated that it would be about 6 months before these corroded through. It was remarked that, although the panels had not yet functioned as anti-ghost fishing measures, they had provided a useful selectivity tool. This, in turn, had provided the operational benefit of a reduced time spent in sorting undersize brown crabs on deck. It was thought that could be a possible benefit to undersized crabs by eliminating an unnecessary haul up to the surface, and reducing possible injuries and mortality (as reported by Smolowitz, 1978).

Fishermen's trials in Western Scotland (Arisaig)

The skipper based at Arisaig commented that both the galvanic release and the sisal twine ideas were impractical for his operation in an inshore velvet crab fishery. Drop-out panels had potential, but great care would be needed in choosing an appropriate shape and size of aperture in the drop-out panel in order to avoid loss of target species.

Fishermen's trials in Northeast England (Bridlington)

Two parlour pots were fitted each with a drop-out panel secured with 13 gauge (2.3mm) iron hog rings, a 50 day galvanic release, and a bio-degradable sisal twine laced across a parting in the mesh coverings of the traps. Each parlour pot had two soft-eyed entrances. These were first deployed off the Yorkshire coast in a commercial fishing situation by a shellfish vessel working from Bridlington on January 25, 2000. After a soak time of 49 days the traps were hauled and re-deployed. Both galvanic releases were corroded through (rated at 50 days), and both sisal twines were intact. There was no catch, as to be expected. After 91 days of operation, one of the sisal twines had parted, and after 134 days the other sisal twine was observed to have parted. At 134 days, both drop-out panels were still in place. After 163 days the iron rings securing the drop-out panels were observed to have corroded through and the panels were open. The skipper of the vessel estimated that they had corroded through within a week of hauling. This time period of 5.4 months is consistent with the information provided by fishermen and gear manufacturers.

On 14 June 2000, another trap was deployed in the same area, This trap was fitted with bio-degradable sisal twine in three levels of thickness: normal 3-stranded twine, 2-stranded and single-stranded twine. After 24 days the traps were hauled and all twines were found to be intact. After 51 days the traps were hauled again and all twines were found to be still intact. After a total of 64 days, all three grades of twine were found to have parted. This indicated that there was relatively little to be achieved by using twine of varying thickness, because (i) all three strands in the twines could be expected to rot at similar rates, and (ii) any shellfish caught during the last part of this trial could effect an escape by cutting through the part-rotted twines.

Figures

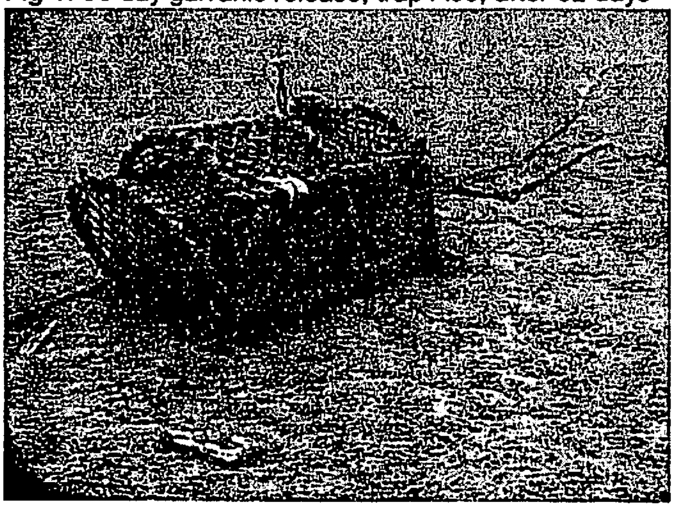


Fig 1: 30 day galvanic release, trap A05, after 62 days

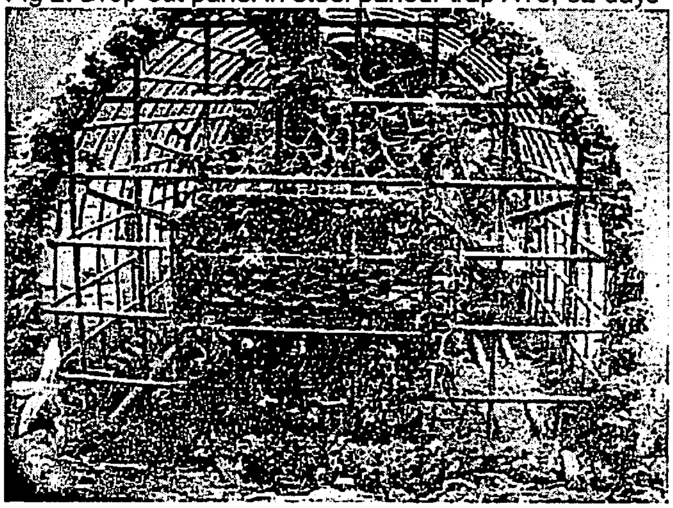


Fig 2: Drop-out panel in steel parlour trap *A13*, 62 days

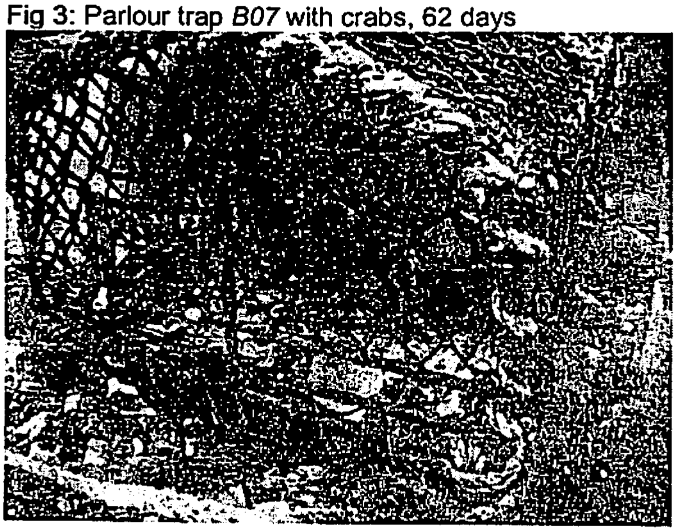


Fig 3: Parlour trap *B07* with crabs, 62 days

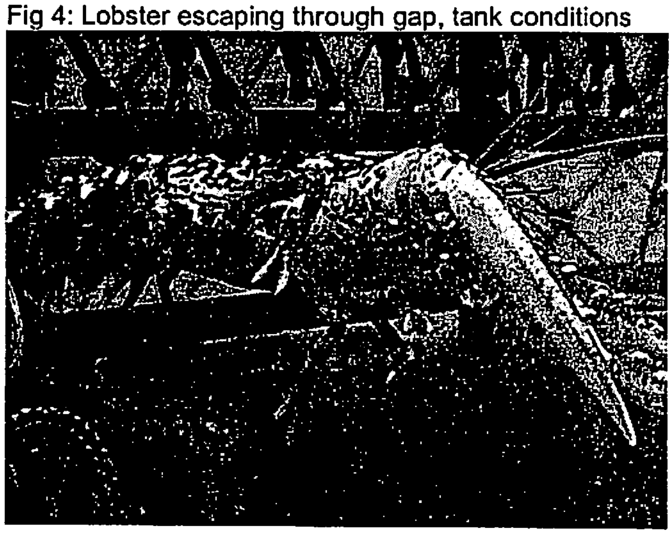


Fig 4: Lobster escaping through gap, tank conditions

Fig 5: Prawns entering hard-eyed prawn creel

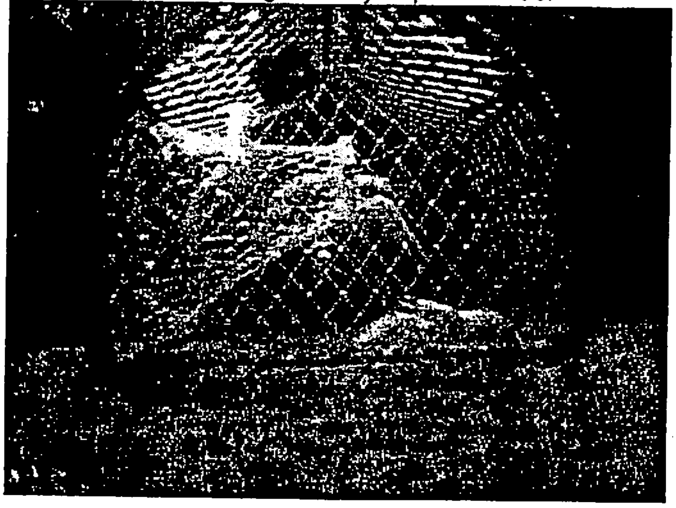


Fig 6: Dead crabs in parlour pot *A16* after 62 days

Fig 7: Intact 50 day galvanic release, trap *A17*, 62 days

Fig 8: Sisal rot-out twine missing, trap *B06*, 62 days

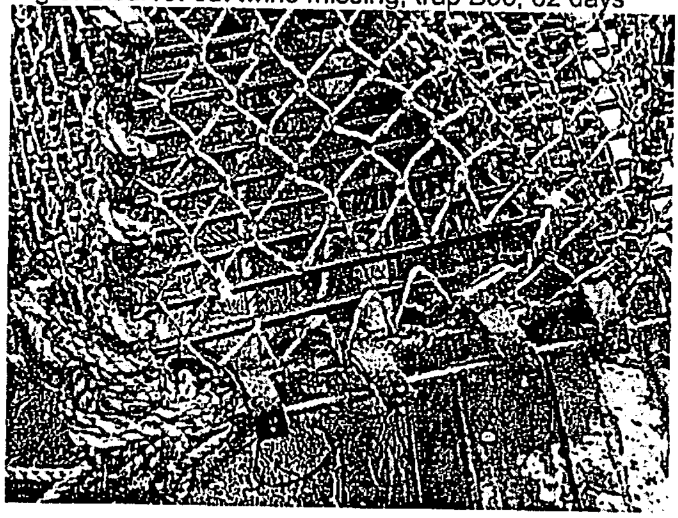


Fig 9: Drop-out panel still in place, trap *B07*, 62 days

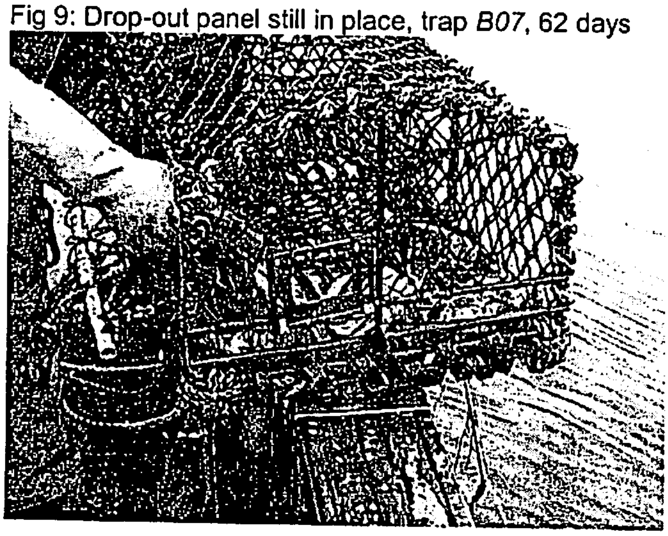


Fig 10: Sisal twine gone in inkwell pot *A18*, 62 days

5. Discussion

The results of this work make it clear that the way in which a trap becomes lost, and the type of trap lost, are both factors that influence the likelihood of any ghost fishing occurring. A combination of fishermen's opinions, sea trials and underwater observations has enabled a picture of the escape characteristics of a range of shellfish traps to be made.

5.1 Parlour pots

Parlour pots are regarded by certain sectors of the fishing industry as being a cause of ghost fishing problems. Indeed, this was one of the main factors that prompted shellfishermen to request this study. This is because parlour pots are designed with retention of catch in mind. Parlour pots were the only type to exhibit any evidence of ghost-fishing during the Ardtoe seabed trials (both winter and summer periods). Because parlour pots have a better retention characteristic than inkwell pots, fishermen exploit this by deploying more traps than the capacity of their boat will allow in one trip. This allows soak times that are longer than those used with inkwells, and so even a small vessel can exert a considerable fishing effort.

Escapes do occur from parlour pots – but take a longer time, when compared with an inkwell pot. This is because, in order to escape from a parlour pot, shellfish have to cut their way out through the mesh covering. This characteristic also applies to soft-eyed traps, whose entrances retain shellfish in the same way as the parlour separator in a parlour pot (see Appendix I, Glossary of terms.) Once a set of parlour pots becomes subject to regular shellfish attacks (and other wear-and-tear) through continual use, escapes are commonplace, and the fisherman then has a continual job of mending new holes. This was observed to be the case in several UK fisheries.

5.2 Inkwell pots

Inkwells did not appear to exhibit the same ability to retain shellfish to the same extent as parlour pots. Most fishermen that were interviewed were of the same opinion that inkwell pots will lose catch when left for a period of more than three days. This inevitable escape is being prevented, to some extent, by fishermen who choose to fit devices that are especially designed to hinder the escape of shellfish from an inkwell pot. Devices that are commonly used can be the commercially available, spring-loaded *pot-loks*™, or they can be simple home-made rubber skirts around the bottom end of the entrances. These devices might not be used all the time, but restricted to those occasions when fishermen either expect the gear, or want the gear to have a longer soak time than usual. The disadvantage of using such devices is that they are reported to reduce the catches of lobsters.

5.3 Prawn creels

The escape characteristics of inkwell pots were found to apply to prawn creels; after soak times greater than about three days they become uneconomic, as for inkwells. Most prawn creels have a *hard-eye* fitted in each of two entrances – usually a plastic ring which holds open the conical netting of the entrance (see figure 5). This would allow catches of prawns to find their own way out. Retention devices fitted in the entrances (as with inkwell pots) could not be used with prawn creels, because they were reported as deterring prawns from entering. The relatively light construction of prawn creels means that, in cases of severe weather and ground seas, their mesh coverings will be damaged easily, and this is an additional inherent anti-ghost fishing attribute in the basic prawn creel design.

For all pot designs covered with steel mesh (see figure 1), escape by shellfish cutting through the mesh would not be possible. For traps of these types it would be logical to use some kind of release device to limit any potential for ghost fishing.

5.4 Advantages and disadvantages of timed releases

Galvanic timed releases are relatively expensive. They cost about US$1 each and that would be nearly £1 each by the time they are imported into the UK. They were shown to tend to be unreliable when used in a simulated 'lost' condition (see figure 7 and also the following table).

A comparison of the performances of galvanic timed releases

Ardtoe tank test		Devon Fisherman		Ardtoe field test: Winter 133d		Ardtoe field test: Summer 62d	
Rated time (days)	Release time (days)	Rated time (days)	Release time (days)	Rated time (days)	Release time (days)	Rated time (days)	Release time (days)
10	9	30 (x6)	28-32	75	intact @ 133 - redeployed	75	released between133&195
30	23			75	released between 0&133	50	released between 0&62
50	47			75	released between 0&133	50	intact @ 62
75	68			75	intact @ 133 - redeployed	75	intact @ 195
				75*	released between 0&133	50*	intact @ 62
				75*	released between 0&133	50*	released between 0&62

***pair of releases on the same trap**

With sisal twine there was an observed variability in performance, and it appeared prone to being prematurely cut through by strong captive shellfish species such as brown crabs, velvet crabs and lobsters (see figures 8 and 10). Reasons for variation in performance are related to the way in which the twine is incorporated into the trap. For example, a sisal twine that is accessible to shellfish will be cut through in preference to any other part of the covering mesh. If the twine is rigged with little exposed surface area – for example, to secure an edge of the mesh covering to a bar – then it will endure for longer than for the previous case described. This was observed to occur during the Ardtoe seabed trials and during the evaluations under commercial conditions. Drop-out panels secured with iron rings needed a relatively long time for the rings to corrode through. For the 13 gauge (2.3mm) iron rings that were used, this time was estimated to be about 6 months, according to the reports from fishermen who had tried them as part of this study. (Bullimore *et al* demonstrated that ghost fishing can occur for up to about 270 days – about 8 months, so iron rings with drop-out panels would limit the time for which any ghost fishing could occur.) Drop-out panels offer an immediate selectivity advantage, and can be secured with either bio-degradable twine or with hog-rings, to offer a secondary and additional advantage of an anti-ghost fishing measure (see figure 9). Figures 3 and 4 show that escape gaps that were built in to the construction of the trap were capable of releasing small crustaceans. The objective in designing escape gaps would be to refine the degree of selectivity that could occur so that they would be acceptable to the industry.

There is evidence to suggest that losses in shellfish trap fisheries due to ghost fishing could be much less significant when compared with the losses of shellfish that are known to occur as a result of other fishing methods. These losses include shellfish by-catches taken with inshore static nets, and losses arising as a result of heavy demersal trawl gear being used on favoured shellfish grounds – occasionally in contravention of regulations. Some of these losses have been quantified in other studies. These other losses may prove difficult to prevent, but remain a major grievance of the shellfish industry nation-wide. There is evidence to suggest that in certain circumstances, static nets set for fin-fish species have a significant by-catch of crustacean shellfish – notably brown crabs and lobsters. This is a common complaint amongst inshore shellfish fishermen throughout England. In a previous MAFF commissioned study, an attempt was made to quantify by-catches of brown crabs in tangle nets used off Cornwall (Swarbrick, 1991). A mean figure of 28 crabs caught per day soak time per 10,000 metres of net used was reported, with a peak value of 133 crabs per day soak time per 10,000 metres of net used (summer season). The figures seem low, but become much more significant when the soak times of the nets and the numbers of fishermen working them are taken into account. This is an indication that the losses that occur due to ghost fishing in shellfish traps could be insignificant when compared with other losses such as these. (See *'Seabed field trial results'* for an estimation of losses due to ghost fishing.)

6. Conclusions and recommendations

1. *Ghost fishing* is not generally regarded by the UK shellfish industry as being 'a problem'. It is a phenomenon that is reported by the industry as occurring only very rarely, and then, only for limited durations.

2. Trap loss is an experience most shellfish fishermen are likely to have at some time. However, the probability of trap loss does not appear to be simply related to the amount of gear worked, as there are other operational factors that also influence the likelihood of loss. The variation in losses for vessels that work more than 1000 traps is low when compared with vessels that work less than 500 traps. Note the caveat concerning the effort from larger vessels (See results section: *Questionnaires*).

3. In most reported cases of lost shellfish traps of any type, there is evidence to suggest that the condition of *ghost fishing* will stop eventually, and the general assumption that there is always an endless cycle of capture and subsequent mortality is a misplaced one.

4. Inkwell pots and prawn creels are trap types that, due to their design, allow their contents to escape after about 3 days, if left unattended. Escapes will eventually occur from parlour traps and soft-eyed traps by shellfish gradually cutting their way through twine mesh coverings, although this might not occur until after about 3 months.

5. Most shellfish trap fisheries face other, more significant losses than from *ghost fishing*. These losses are sometimes preventable, and include include losses of traps from other fishing activities and other sea traffic, and also from theft.

6. The commercially available galvanic timed releases (GTRs) that were tested were found to be inappropriate for use in UK shellfish trap fisheries. Fishermen's opinion was that they would certainly not be cost-effective in the numbers required and that they could be difficult to renew at sea. They were also found to be inconsistent in operation during sea trials.

7. The use of bio-degradable sisal twine as a time-dependant release device was found to be inappropriate. The effectiveness of the twine as a functional release depended upon both its location in the trap and the method of attachment used. In addition, sisal twine proved to be most vulnerable to attack by shellfish, allowing premature escapes.

8. The use of drop-out panels that incorporate an appropriate escape gap could bring the immediate benefit of increased size selectivity. It would, simultaneously, provide a pre-defined time limit on the duration over which any *ghost fishing* could occur, in the case of total trap loss. This solution could be made to be cost-effective and last for a length of time acceptable to most fishermen before the

securing wire needs replacing. Trap manufacturers would be quick to incorporate such a device into their trap designs, if they were made a legal requirement.

7. Possible further work

1. Establish the most appropriate size gaps for incorporation into drop-out panels, with respect to different target shellfish sizes and species. Some work on this has already been done in the UK (Lovewell, 1989). A more recent (and unpublished) English Nature funded study by CEFAS has been done off Yorkshire. In that study, the critical dimensions for a potential escape gap (with respect to a known shellfish carapace dimension) were established for two commercially important shellfish species.

2. Demonstrate the benefits, if any, that could be achieved by fitting drop-out panels that incorporate size-selective escape gaps. This could be done through a sea trial.

3. Establish a means of retrospectively fitting drop-out panels in existing mesh-covered parlour traps and in round, inkwell style traps.

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Towne Shipriggers, Hull
International Fishing Devices, Inc. (source of timed galvanic releases)
The Shellfish Association of Great Britain
South Devon & Channel Shellfishermen Ltd.
Wells & District Inshore Fishermen's Association
Eastern Sea Fisheries Joint Committee
Cornwall Sea Fisheries Committee
North Eastern Sea Fisheries Committee

The skippers and crews of:
MFV *Galwad-Y-Mor* H116 for equipment and advice
MFV *Curlew* OB108 for trap monitoring at Ardtoe

Volunteer skippers who tested escape devices in their traps, by vessel:
MFV *Artful Dodger* SE156
MFV *Shooting Star* OB135
MFV *Christel Star* H56

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Appendix I

Glossary of terms

Creel
Name used mainly in Scotland to describe any small shellfish trap, but especially 'D' shaped traps with two entrances and set to catch prawns *(Nephrops norvegicus)* or velvet crabs *(Necora puber)*.

Drop-out panel
A *panel* held in place by corrodable metal or bio-degradable fastenings in the wall of a shellfish trap. It is designed to fall out after a period of time to prevent *ghost fishing* from occurring. *Drop-out panels* are often used in conjunction with *escape gaps* to increase the selectivity of the trap by allowing undersized shellfish to escape.

Escape gaps
A fixed aperture in a shellfish trap designed to increase selectivity by allowing the escape of small shellfish. *Escape gaps* are often used in drop-out panels, but can be incorporated into traps without drop-out panels. Mandatory for shellfish traps used in the States of Jersey, British Isles.

Galvanic Timed Release
A device designed to prevent *ghost fishing.* It is made from two dissimilar metals and is used in conjunction with a door closing mechanism on a shellfish trap. The action of sea water causes the device to gradually corrode through over a pre-determined period of time, allowing the door to open.

Ghost fishing
Ghost fishing is the phenomenon that is said to be 'The ability of fishing gear to continue fishing after all control of that gear is lost by the fishermen' (Vining *et al* 1997, after Smolowitz 1978.)

Hard-eye
A rigid entrance to a trap that is kept open by a fixed circular ring or funnel. This kind of entrance differs from a *soft-eyed* entrance in that its main function is to allow easy ingress of shellfish that would otherwise find it difficult. It is used in prawn *creels, inkwell pots* and in some *parlour pots.*

Hog ring
An iron ring used to secure *drop-out panels* in shellfish traps. It is designed to corrode over time, thereby allowing the panel to drop-out completely and release any captive shellfish. Often used in conjunction with *escape gaps.* In this study, *hog rings* were made from 13 gauge (2.3mm diameter) iron wire.

Inkwell pot
Inkwell pots are round shellfish traps that are shaped like an old fashioned inkwell - as the name implies. They are covered in netting and almost always have a rigid

plastic funnel entrance in the top. This kind of entrance differs from a soft-eye entrance in that its main function is to allow easy ingress of shellfish. In an *inkwell pot,* the shape of the trap, rather than the design of the entrance, makes the escape of shellfish difficult. *Inkwells* usually begin to lose catch after about three days fishing.

Parlour pot
Parlour pots are traps that are divided into two sections. A baited section attracts the shellfish into the trap; shellfish subsequently enter the *parlour* section where they are retained. The two sections are separated by a cone-shaped tunnel of netting that acts as a non-return valve. These traps are usually 'D' shaped in cross section, with the flat of the 'D' being the base of the trap. A rigid plastic funnel entrance can also be incorporated into a *parlour* pot, which is a common practice in Southwest England.

Pot-locks (or Pot-loks™)
A trade name for devices that are commonly fitted in the entrances to inkwell pots. These devices might not be used all the time, but restricted to those occasions when fishermen either expect the gear, or want the gear to have a longer soak time than usual, and want to prevent the escapes of shellfish from the entrances of inkwell pots. They are manufactured by EF Ashworth Ltd. of Kingsbridge, Devon.

Soft-eye
A *soft-eye* is a cone-shaped entrance made of netting and used in shellfish traps. It is made in a similar way to the parlour tunnel. *Soft-eyed* entrances can be used either in conjunction with a parlour section in a trap or used on their own as is common practice in Scotland. The *soft-eye* is designed to prevent the escape of shellfish, whilst still allowing relatively easy ingress into the trap.

Appendix II

Gear types deployed for the Ardtoe sea trials,
Winter & Summer 2000

	Twine covered traps				Metal meshed traps			
	2 Softeyes & parlour section				Parlour - Softeye, USA style			
Brown crab / Lobsters	T1	T2b	T3	T4	T1	T3	T3	
	Smooth entrance & parlour				Smooth entrance & parlour			
Brown crab / Lobsters	T1	T2b	T3	T4			T3	T4
	Inkwell pot; smooth entrance				Modification Types: T1 = Galvanic release in door release T2 = Biodegradable twine 'rot-out' T2a = Attachment of netting to frame T2b = Weak link in netting panel T2c = Drawstring closure T3 = Drop-out panel attached by wire hog-rings (with selectivity gaps) T4 = Standard trap as a Control, unmodified			
Brown crab / Lobsters		T2a	T3	T4				
	Softeyes - no parlour section							
Brown crab / Lobsters	T1			T4				
Velvets		T2b	T3					
	Hardeyes - no parlour section							
Velvets	T1	T2	T4	T4				
Nephrops		T2c	T4	T4				

27 traps deployed in total

Two separate strings were deployed, one containing 7 large traps, for ease of handling on the charter vessel, and the other containing 20 smaller traps. Each observation is available as an individual MPEG1 video file on CD-ROM. Video files are identified according to the following convention:

A04us.mpg = string 'A'; trap no. 4; underwater observation; summer season
B02sw.mpg = string 'B'; trap no. 2; surface observation, winter season

The next page contains two tables that provide all the details of the results using these 27 traps.
Key to terms used:

USA wire mesh = trap made of welded square mesh sheet, plastic dipped, of a type commonly used in North America
GF = Ghost Fishing
Rot-out = biodegradable sisal string closure, designed to decay over time
Galvanic = Galvanic Timed Release or GTR.
Y = 'Yes'
N = 'No'

Table of results for the Ardtoe sea trials, Winter & Summer 2000

Winter-Spring soak: Ardtoe, Jan13-May25, 2000; 133 days. 2 strings, A&B; A has 20 traps; B has 7 traps										
Trap ID	**Target**	**Entrance**	**Type**	**Parlour**	**Device1**	**Device2**	**Device3**	**Cover**	**Live Catch**	**Comment**
A01	*Nephrops*	2hardeyes	creel	n	Rot-out	n	n	PE	0	Rot-out intact. Redeployed
A02	*Nephrops*	2hardeyes	creel	n	n	n	n	PE	0	-
A03	*Nephrops*	2hardeyes	creel	n	n	n	n	PE	3starfish	Possible evidence of GF. On its side
A04	velvet crabs	2hardeyes	creel	n	n	n	n	PE	0	-
A05	velvet crabs	2hardeyes	creel	n	galv75	n	n	PE	0	Galvanic intact; redeployed
A06	velvet crabs	2hardeyes	creel	n	n	n	n	PE	1*C.pagurus*	-
A07	velvet crabs	2hardeyes	creel	n	Rot-out	n	n	PE	2velvets	Rot-out intact in panel
A08	velvet crabs	2softeyes	creel	n	Drop-out	n	n	PE	0	Drop-out intact
A09	*C. pagurus*	2softeyes	creel	n	galv75	n	n	PE	1*C.pagurus*	Galvanic released. door closed
A10	*C. pagurus*	1smooth	creel	y	Drop-out	n	n	PE	2velvets	Drop-out intact
A11	velvet crabs	2softeyes	creel	n	Rot-out	n	n	PE	2velvets	Rot-out intact on bar
A12	Lobs/Crabs	1smooth	wire trap	y	n	n	n	metal	0	-
A13	Lobs/Crabs	1smooth	wire trap	y	Drop-out	n	n	metal	0	Drop-out intact
A14	*C. pagurus*	2softeyes	creel	n	n	n	n	PE	1*C.pagurus*, 1velvet	-
A15	*C. pagurus*	1smooth	creel	y	n	n	n	PE	4C pagurus	-
A16	*C. pagurus*	1smooth	creel	y	Rot-out	n	n	PE	0	Rot-out parted
A17	*C. pagurus*	1smooth	creel	y	galv75	n	n	PE	0	Galvanic released 1 dead starfish + 1 cancer shell Evidence of GF?
A18	*C. pagurus*	1smooth	inkwell	n	Rot-out	n	n	PE	0	Rot-out intact
A19	*C. pagurus*	1smooth	inkwell	n	n	n	n	PE	0	-
A20	*C. pagurus*	1smooth	inkwell	n	PotLock	galv75	Drop-out	PE	0	Galvanic securing drop-out panel by twine Galvanic released, drop-out jammed. Galvanic replaced with a rot-out
B01	*C. pagurus*	2hardeyes	USA wire mesh	y	Drop-out	escape frame	n	metal	0	-
B02	*C. pagurus*	2hardeyes	USA wire mesh	y	galv75	Drop-out	escape frame	metal	0	Galvanic intact, escape frame dislodged
B03	*C. pagurus*	2softeyes	USA wire mesh	y	Drop-out	escape frame	n	metal	0	Drop-out intact
B04	Lobs/Crabs	2softeyes	Yorks	y	galv75	galv75	n	PE	0	Galvanics both released. replaced with 50d galvanics
B05	Lobs/Crabs	2softeyes	Yorks	y	n	n	n	PE	7*C.pagurus*	Battery flat in underwater camera
B06	Lobs/Crabs	2softeyes	Yorks	y	Rot-out	n	n	PE	0	Rot-out parted
B07	Lobs/Crabs	2softeyes	Yorks	y	Drop-out	n	n	PE	5*C.pagurus*	Drop-out intact but nearly parted Redeployed

Summer soak: Ardtoe, May25-Aug02, 2000; 62 days. 2 strings, A&B; A has 20 traps; B has 7 traps										
Trap ID	**Target**	**Entrance**	**Type**	**Parlour**	**Device1**	**Device2**	**Device3**	**Cover**	**Live Catch**	**Comment**
A01	*Nephrops*	2hardeyes	creel	n	Rot-out	n	n	PE	0	On its side. Rot-out intact after 195 days
A02	*Nephrops*	2hardeyes	creel	n	n	n	n	PE	1*C.pagurus*	Brown crab grown too big to exit GF?
A03	*Nephrops*	2hardeyes	creel	n	n	n	n	PE	1*C.pagurus*	On its side. Crab caught had grown too big to exit. Starfish outside trap. Evidence of fish GF?
A04	velvet crabs	2hardeyes	creel	n	n	n	n	PE	1*C.pagurus*	Brown crab outside entrance
A05	velvet crabs	2hardeyes	creel	n	galv75	n	n	PE	0	Galv75 released 133-195days
A06	velvet crabs	2hardeyes	creel	n	n	n	n	PE	1velvet	-
A07	velvet crabs	2hardeyes	creel	n	Rot-out	n	n	PE	1*C.pagurus*, 1velvet	Heavy growth of sea squirts. Rot-out only just intact
A08	velvet crabs	2softeyes	creel	n	Drop-out	n	n	PE	3*C.pagurus*	Drop-out intact
A09	*C. pagurus*	2softeyes	creel	n	galv50	n	n	PE	0	Galv released <62d
A10	*C. pagurus*	1smooth	creel	y	Drop-out	n	n	PE	3*C.pagurus*	On end. door blocked. Drop-out intact
A11	velvet crabs	2softeyes	creel	n	Rot-out	n	n	PE	3*C.pagurus*, 2velvets	Rot-out intact on bar
A12	Lobs/Crabs	1smooth	wire trap	y	n	n	n	metal	2*C.pagurus*, 1velvet	-
A13	Lobs/Crabs	1smooth	wire trap	y	Drop-out	n	n	metal	1*C.pagurus*	Drop-out intact
A14	*C. pagurus*	2softeyes	creel	n	n	n	n	PE	4*C.pagurus*, 1velvet	Weeded
A15	*C. pagurus*	1smooth	creel	y	n	n	n	PE	4*C.pagurus*	1 dead cancer
A16	*C. pagurus*	1smooth	creel	y	Rot-out	n	n	PE	1*C.pagurus*	Rot-out intact. 8 dead crabs = possible evidence of GF
A17	*C. pagurus*	1smooth	creel	y	galv50	n	n	PE	7*C.pagurus*	Galvanic intact (50d rated, after 62d)
A18	*C. pagurus*	1smooth	inkwell	n	Rot-out	n	n	PE	0	Rot-out parted. Weeded
A19	*C. pagurus*	1smooth	inkwell	n	n	n	n	PE	0	Weeded
A20	*C. pagurus*	1smooth	inkwell	n	PotLock	Drop-out	Rot-out	PE	2*C.pagurus*	Weeded. Drop-out panel held in place by intact rot-out
B01	*C. pagurus*	2hardeyes	USA wire mesh	y	Drop-out	escape frame	n	metal	0	Drop-out intact. Accidentally omitted from underwater observations
B02	*C. pagurus*	2hardeyes	USA wire mesh	y	galv75	Drop-out	escape frame	metal	0	Drop-out intact, 75day galvanic still intact after 195days
B03	*C. pagurus*	2softeyes	USA wire mesh	y	Drop-out	escape frame	n	metal	0	Drop-out intact
B04	Lobs/Crabs	2softeyes	Yorks	y	galv50	galv50	n	PE	5*C.pagurus*	1 galvanic intact; 1 galvanic released. Door still shut
B05	Lobs/Crabs	2softeyes	Yorks	y	n	n	n	PE	4*C.pagurus*	
B06	Lobs/Crabs	2softeyes	Yorks	y	Rot-out	n	n	PE	0	Rot-out parted
B07	Lobs/Crabs	2softeyes	Yorks	y	Drop-out	n	n	PE	6*C.pagurus*	Drop-out intact but very corroded after 195 days

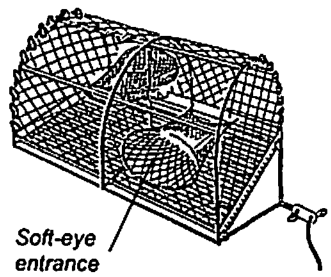
Appendix III

Voluntary opinions from the Industry

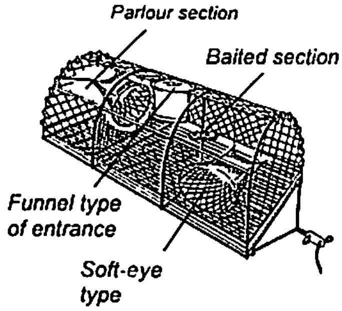
This document is a compilation of opinions expressed by shellfish fishermen from Southwest and Northeast England during 1999-2000 in response to a questionnaire on *ghost fishing* in shellfish traps. Ghost fishing is the phenomenon that is said to occur after fishing gear becomes lost, and when it continues to catch animals outside the control of fishermen. Wherever possible, these opinions are direct quotations. Any amendments are placed [within square brackets].

Terms used

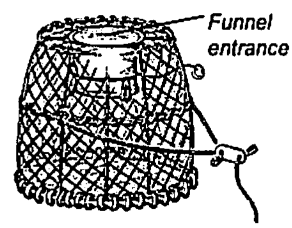
A *soft-eyed* trap has two cone-shaped entrances made of netting. The *soft-eye* entrance is designed to prevent the escape of shellfish whilst still allowing relatively easy ingress into the trap. They are usually set to target velvet crabs and brown crabs, and occasionally, lobsters.



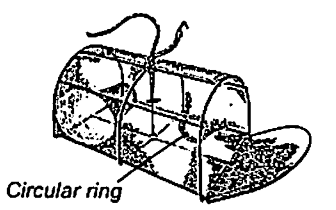
Parlour pots are an evolution of the *soft-eye* trap. Parlour pots are divided into two sections. A baited section attracts the shellfish into the trap, and a *parlour* section, which retains them and prevents escape. The two sections are separated by a cone-shaped entrance of netting that acts as a non-return valve. These traps are often 'D' shaped in cross section, with the flat of the 'D' being the base of the trap. A rigid plastic funnel entrance can also be incorporated into a *parlour pot,* which is common in Southwest England.



Inkwell pots are round shellfish traps that are shaped like an old fashioned inkwell - as the name implies. They are covered in netting and almost always have a rigid plastic funnel entrance in the top. This kind of entrance differs from a *soft-eye* entrance in that its main function is to allow easy ingress of shellfish. In an *inkwell pot,* the shape of the trap, rather than the design of the entrance, makes the escape of shellfish difficult. *Inkwells* usually begin to lose catch after about three days fishing.



Prawn creels are traps developed specifically for *Nephrops* prawns. These traps also have two cone-shaped entrances. Circular plastic rings hold the entrances wide open to allow easy ingress of prawns. The mesh covering these traps is much smaller and made from smaller diameter twine than in any of the other kinds of UK shellfish trap.



Opinions expressed by shellfish fishermen from Southwest England

1. 'The majority of pots are lost due to beam trawlers and [bottom] trawlers towing through them and, as a consequence, are squashed or destroyed, therefore they no longer fish.' (Cornwall; works 50 parlour pots).

2. 'We find pots left down for any length of time tend to get holed, so I don't believe ghost fishing of pots to be a serious problem. Anyway, they are such an expensive item of kit that they are rarely left to be abandoned without an effort to recover them – unlike a [bottom set] net that is perhaps considered to be on its last legs anyway. Also, of course, pots will only fish whilst bait remains.' (Cornwall; works 50 parlour and 10 inkwell pots).

3. 'Parlour pots are the major problem with ghost fishing – this year [1999] we found 10 lost parlour pots that had been lost for 4 months – there were remnants of dead shellfish and dogfish, as well as fresh live shellfish.' (South Devon; works 1600 inkwell pots).

4. 'During our diving operations, we have often found lost pots, but never with crabs or lobsters inside. On sandy areas, they seem to 'sand up' and we have had difficulty even retrieving them. In shallow areas they seem to become wedged in and damaged by the rocks.' (Cornwall; diving charter boat, working no traps).

5. 'Most losses [of shellfish traps] are due to scallop boats [that are bottom dredgers] and French trawlers, who I feel are trying to keep us inside the 6 mile limit.' (Cornwall; works 1100 inkwell, 20 parlour, and 70 soft-eyed traps).

6. 'For parlour pots, most losses are due to bad weather. Pots found afterwards are not in a fit state to retain [shell]fish due to the external netting being damaged, allowing shellfish to escape. For inkwell pots, although we used 'pot-locks' up to a few years ago, we no longer use them. This is because we [now] target spider crabs. With no pot-locks, any [shell]fish, ie crabs and lobsters, usually get out [of an inkwell pot] within a few days.' (Cornwall; works 360 parlour and 400 inkwell traps).

7. 'Keep beam trawlers out of the 6 mile limit, and police [the inshore area] more.' (Cornwall; works 300 parlour, 20 inkwell and 50 soft-eyed traps).

8. 'I feel that pots that are lost will [continue to] fish, depending on the age of the pot. Older pots will release fish very shortly after loss, as the meshes are considerably weaker [than in a new pot], and conger eels, lobsters and cock crabs will force meshes and make their escape (with smaller species following). Newer pots present more of a problem; however, the rubber locking mechanism would surely fail, eventually releasing catches. If the pots have been lost due to trawling, then the pots usually have been damaged and will therefore release

their contents quite quickly. Perhaps a study of various traps on the seabed would enhance your [and my] understanding. ROVs and time-lapse cameras could be employed.' (Cornwall; works 300 parlour pots).

9. 'I retrieved a string of 40 inkwell pots in 1980 that had been lost in the sea for 3 years. All the pots were empty of [shell]fish.' (Cornwall; works 200 parlour and 200 inkwell pots).

10. 'Gear manufacturers need to make stronger strops, since most [become] parted from backlines. [*ie*, pots becoming lost due to attachment rope failure].' (Cornwall; works 120 soft-eyed and 100 wooden-necked pots).

11. 'The major cause of lost pots seems to be inshore trawling and theft.' (Devon; works 4 parlour pots).

12. 'I believe that after a parlour pot has been lost through bad weather, any lobsters will get out after a time.' (Cornwall; works 160 parlour pots).

13. 'Lost pots break up very quickly. Steel pots become corroded. Plastic pots are rolled around and soon lose their netting. After 3 to 5 days of bad weather, [when] my gear is hauled [it contains] virtually nothing. Lobsters are capable of nipping out the netting at the ends of pots, and escaping.' (Cornwall; works 500 unspecified pots).

14. 'The pots I use will break up in 10-12 months, so the problem is very small [in this example].' (Cornwall; works 150 wooden traps).

15. 'The loss of pots in my area (Lundy and north Cornwall coast) is due to French and Belgian trawlers 95% of the time, [operating] inside the 12 and 6 mile limits at night.' (Cornwall; works 1700 parlour and 180 inkwell pots)

16. 'People should not work more pots than they can tend in one day. Too many pots usually end up as losses to [bottom] trawlers and beam trawlers, because the skipper cannot contain all his gear to an area free of trawling.' (Cornwall; works 300 soft-eyed traps with no parlour).

17. 'After 15 years of fishing with pots for brown crabs, velvet crabs and lobsters, I see no detrimental effects to the environment and stocks as a result of lost pots. Velvet crabs can swim in and out of inkwell pots at will. Brown crabs can eat themselves out, or climb out.' (Cornwall; works 100 soft-eyed traps with no parlours).

18. 'Over the last 10 years, most of my gear losses [of pots] have been due to the activity of scallop dredgers, and nothing else. This fishery is the most harmful of any I have seen in my 25 years of fishing. It has done untold damage to stocks of shellfish *etc.* and the grounds on which they live.' (Cornwall; works 180 parlour and 100 inkwell pots).

19. 'We are forced to overfish the inshore grounds, because of the beam trawlers, [as there are] no grounds now [over which] they will not tow.' (Cornwall; works 300 parlour and 300 inkwell pots).

20. 'Generally, crabs and lobsters wear their way out of pots after about a month, if those pots are not hauled. In recent years, the introduction of large-scale *vivier* [live-holding] crab vessels which work more gear [than used before] around the clock, prices have not improved. Small vessels have found it necessary to increase the amount of pots they fish by up to 300% in order to compete [with the *vivier* vessels]. This further contributes to deflated prices on the [European shellfish] markets. In winter, 4 or 5 'super-crabbers' that are full to capacity sell their catch in Scotland, delivery paid to France, for [the same amount that] our merchants will pay us at the quayside [in Cornwall].' (Cornwall; works 350 parlour and 50 inkwell pots).

21. 'I think [that] a corrosion bar [a device that corrodes through over time and disables a trap] fitted in parlour pots would overcome ghost-fishing.' (Cornwall; works 500 parlour, 400 inkwell and 50 soft-eyed creels).

22. 'For inshore gear, divers are generally happy to recover pots. They see it as helping their image.' (Cornwall; works 80 parlour pots).

23. 'I feel that there is very little problem with ghost fishing, as any pots that are lost [are few in number], and those that I have recovered have almost invariably been empty, and required mending. Of losses occurring through bad weather, sea conditions have ensured that any gear recovered is virtually unusable until completely overhauled. The conclusion [is that] the only way to work efficiently with minimum losses is to bring it in before you lose it.' (Cornwall; works 450 parlour and 100 inkwell pots).

24. 'Once the bait is gone the pots will stop fishing; what is trapped will chew its way out in time, or when winter storms [damage] the pots.' (Cornwall; works 50 parlour and 50 inkwell pots).

25. 'Small beam trawlers [have begun] breaking into and towing on new grounds that were [formerly] traditional crabbing grounds. This is one reason [as to why] I have lost pots this season.' (Cornwall; works 250 parlour and 100 inkwell pots).

26. 'I have often dived to recover lost parlour pots, and sometimes, months after the loss, I have found such pots to be full of life, [containing] fish, crabs, lobsters, etc.' (Cornwall; works 60 parlour and 60 inkwell pots).

27. 'I feel strongly that shellfish boats should not work any more pots than they can haul in one day. I don't agree with boats working huge numbers of parlour pots.' (Cornwall; works 300 inkwell pots).

28. 'In my opinion, beam trawling is killing the shellfish industry in the area in which I work. Not only do they destroy our gear, but they destroy [shell]fish and their habitat.' (Cornwall; works 500 parlour and 100 inkwell pots).

29. 'If you could stop trawlers towing away gear, there would be virtually no pot losses! Of pots that are recovered later, it is usual to find that crabs have chewed the mesh and escaped. I notice that there is a recent trend to cover a pot with very heavy, braided netting. Maybe more attention should be focussed on this [type of] netting, which would make the escape of crabs much more unlikely.' (Cornwall; works 250 parlour and 400 inkwell pots).

30. 'In my experience, any pots recovered after long periods are always empty due to the fact that the [shell]fish have eaten their way out.' (Cornwall; works 650 parlour pots).

31. 'Scallopers are the main offenders in the loss of pots.' (Cornwall; works 300 parlour pots).

32. 'I do not consider lost pots and ghost fishing a problem at all, as the netting on the lost pot very quickly becomes [abraded due to] crabs inside, or from a rough bottom or object.' (Cornwall; works 1000 parlour pots).

33. 'I do not accept that ghost fishing [in shellfish traps] is a problem. The possibility [that it could be a problem] clearly is a logical assumption. However, I have been a diver for over 20 years and have come across scores of old pots. However, I have never found one that has been down for longer than 2-3 weeks that had anything in it.' (Cornwall; works 100 parlour, 100 inkwell and 100 wire mesh traps).

34. 'Pots do not fish when the bait is gone.' (Cornwall; works 105 parlour and 40 inkwell pots).

35. 'After 1 week, shellfish will eat their way out of a parlour pot.' (Cornwall; works 400 parlour and 50 inkwell pots).

36. 'My biggest problem is to stop the catch from cutting their way out [through] the netting [that covers the trap].' (Cornwall; 180 parlour and 240 inkwell pots).

37. 'It [becomes] very expensive when you lose a whole *tier* [string of pots].' (Cornwall; works 600 parlour pots).

38. 'I am a keen diver, and often come across lost pots. They are rarely in a condition such that they [are able to] retain shellfish that enter them. I assume that this is due to a combination of the effects of ground sea [poor weather] and corrosion. I don't expect that this process of degradation occurs quite so quickly in deeper water, where [lost pots] are less vulnerable to poor weather conditions.' (Cornwall; works 80 parlour and 20 inkwell pots).

39. '[I would like to see] a limit on numbers of pots per boat.' (Cornwall; works 10 parlour, 20 inkwell and 120 unspecified types of pots).

40. 'I do not consider this to be a major problem. Crabs will eventually chew their way out of most pots.' (Cornwall; works 10 parlour and 15 inkwell pots).

41. 'Along the north Cornwall coast, we can rarely tend our pots daily, owing to tide and weather, hence the need in this particular area for the [requirement] to use parlour pots – especially for vessels under 10m in length.' (Cornwall; works 220 parlour, 25 inkwell and 25 unspecified type of pots).

42. 'Working in Falmouth Bay, the number of yachts with cutting equipment to protect propellers can be a significant [pot loss] problem, and scallopers working too close inshore can also cause problems [with loss of pots].' (Cornwall; works 225 parlour pots).

43. 'In the past, I have retrieved some pots that had been lost previously, and discovered that the netting had been eaten through, so I don't consider ghost fishing [in shellfish traps] to be a problem.' (Cornwall; works 300 parlour pots).

44. 'Most of our pot losses are due to beam trawlers. We would like to see beam trawlers and scallop dredgers kept outside the 6 mile limit. We do not believe 'ghost fishing' is a problem because once the bait is gone, the pot will not continue to fish. After a week or two, [trapped shellfish] will cut or wear their way through a netted pot and therefore escape. This has been proved many times; after spells of prolonged bad weather we have hauled many pots with no shellfish inside, due to holes worn in the netting.' (Cornwall; works 800 parlour pots).

45. 'If this is the first step into banning parlour pots and pot locks, please think again. A living could not be made if small boats like myself were made to fish pots without traps *[devices fitted that prevent the escape of shellfish]*. Limited to where we can fish, and often kept in port for many days at a time due to bad weather, parlour pots are essential for retaining catches. Over the past few years, minimum lobster and crab sizes have increased but market prices have not, with the result that incomes have fallen. I earn less now than 6 years ago. Potting is one of the most environmentally friendly forms of fishing [that] there is. Inshore crabbers get a raw deal. Sole netting *[using static nets set on the seabed]* is on the increase, and if this fishery is not checked soon, we will all be out of a job. Inshore sole netting [in Cornwall] catches everything that moves, and shellfish is an unfortunate bycatch; I suggest you do a survey on them. Scallop dredging boats have made some of our crabbing areas barren. This form of fishing wrecks all forms of marine life. Nursery areas are a thing of the past; how can anything reproduce when [there are] 40 foot boats each towing 12 dredges close to the shoreline? I can see a time when the majority of boats fishing [in] inshore waters will be of the 'super' type, all super-efficient, [built] just under the [maximum] legal lengths, working thousands of pots and nets and not missing many days due to

[bad] weather. The coves and small ports that once gave a living to the smaller boats of the industry will be consigned to the history books.' (Cornwall; works 350 parlour and 50 inkwell pots).

Opinions expressed by shellfish fishermen from Northeast England

1. 'My biggest loss of potting equipment is due to [uncooperative] trawler skippers. I think that there should be a discussion set up for a no-go area for certain trawlers.' (NE; works 600 parlour traps)

2. 'I don't think that ghost fishing [in shellfish traps] is a problem at all. Lost pots soon have holes in the netting, which allows escape [of crabs and lobsters]. More importantly, lost pots that are retrieved with holes in them still [contain] crabs and lobsters, as the holed pots are obviously seen as a home for them.' (NE; works 2200 parlour pots).

3. 'The main cause of pot losses is trawling activity within the 3 mile limit.' (NE; works 400 parlour pots).

4. 'Teesmouth is busy with other shipping. Ships [deviating from the] fairway take markers off.' (NE; works 100 parlour pots].

5. 'Most pots lost in bad weather are mainly flattened and smashed. Steel pots may still fish if the meshing is not ripped.' (NE; works 200 parlour pots).

6. 'A lot of pots are lost off the Durham coast. [The] cause for this has always been trawlers.' (NE; works 150 parlour pots).

7. '[Losses are caused by] trawlers coming closer inshore, mostly at night, and fishermen who [do not use proper markers].' (NE; works 140 parlour pots).

8. 'The quicker [that] escape exits are introduced, the better all round!' (NE; works 300 pots).

9. 'Pots with wooden bottoms which are lost will soon rot away. As a diver, I've witnessed this.' (NE; works 100 soft-eyed pots).

10. 'After pots become lost, during bad weather the pots will more than likely be smashed up.' (NE; works 500 parlour pots).

11. 'Lost parlour pots will probably continue to fish.' (NE; works 60 soft-eyed pots).

12. 'With modern ropes and [strong] pots, the amounts of losses [have become] very small.' (NE; works 400 parlour pots).

13. 'The problem of ghost fishing [in lost shellfish traps] is caused by trawlers because they trawl within three-quarters of a mile of the coast. Yes, ghost fishing is a problem.' (NE; 400 parlour pots).

14. 'Usually when pots are lost due to weather, 90% are washed up along the coast, and 10% are smashed to pieces and tangle with other pots at some point.' (NE; works 50 parlour and 22 soft-eyed traps)

15. 'I feel very strongly that we should adopt some of the regulations applied in Canada, the USA and Australia.' (NE; works 130 soft-eyed traps).

16. 'From my experience of over 20 years as a fisherman and a diver, I have learned that any unattended pots soon develop holes, mainly due to crabs chewing the meshes, which allows any captive crustacea to escape. I would therefore conclude that shellfish mortality due to ghost fishing is virtually non-existent, certainly in this part of the North Sea.' (NE; works 900 parlour pots).

17. 'Lobster pots lost close to shore don't cause a problem as they are soon destroyed by [the] sea.' (NE; works 15 parlour and 100 soft-eyed traps).

18. 'The only times I lost pots, apart from bad weather, is when trawlers tow them away.' (NE; works 220 soft-eyed pots).

19. '[Ghost fishing in lost shellfish traps is] no problem. As a diver for many years, [I have] found many pots [that] were empty. [Shellfish] always seem to get out.' (NE; works 200 parlour pots).

20. 'In my opinion, the main cause of damage to shellfish stocks [are losses] of trammel and gill nets, which continue to fish indefinitely. Lost (baitless) pots do minimal damage [to stocks].' (NE; works 200 parlour pots).

21. 'Old pots [which] we haul after a 2-3 week lay usually have holes in them, and all the catch has escaped!' (NE; works 1000 parlour pots).

22. 'This study is [being carried out] by somebody attempting to destroy a fishery who has no understanding of pot fishing or sufficient experience to undertake such a job.' (NE; works 1053 parlour pots).

23. 'Most losses of pots and gill nets in my area are down to the trawling activities of larger boats.' (NE; works 300 parlour and 50 soft-eyed traps).

24. 'Pots lost in our area are usually destroyed by the weather and tide, so [there is] probably not a problem of ghost fishing.' (NE; works 100 parlour pots).

25. 'In the shallow water where I work, any pots lost due to tide or bad weather get smashed up and don't cause a problem with ghost fishing. They wash up on a beach.' (NE; works 70 parlour and 70 soft-eyed traps).

26. 'A lot of pots are usually lost each year, due to big trawlers...trawling them away and dumping them at sea.' (NE; works 1500 parlour pots).

27. 'Most pots are lost due to bad weather or trawlers and are damaged and [so] don't continue to fish.' (NE; works 100 parlour and 100 soft-eyed traps).

28. 'I usually fish close inshore in relatively shallow water. If caught out by bad weather, the gear becomes badly damaged and is soon unfishable.' (NE; works 20 soft-eyed traps).

29. 'Pots, once the bait has deteriorated, will generally not attract a lobster. Old pots in our area usually get washed up or get broken up. Lobsters will eventually find their way out of a pot if they are left a long time.' (NE; works 80 parlour pots).

30. 'More pots are stolen on the quay than are lost at sea.' (NE; works 60 pots).

31. 'I had 8 lobsters [with their claws held closed by rubber bands] put in a parlour pot for storage. The next day they had all escaped. During the following week I caught all but one of them [still with bands on their claws]. So I think that lobsters will eventually escape even from a parlour pot.' (NE; works 90 parlour pots).

32. 'Shellfishing looks after itself.' (NE; works 950 parlour and 60 soft-eyed traps).

33. 'With regard to ghost fishing, pots [that have been] lost more often than not get washed ashore or broken up.' (NE; works 100 parlour pots)

34. 'The only major problem with losses of pots and nets is trawlers towing pots away.' (NE; works 200 parlour pots).

35. '[I am] in a constant worry of trawlers towing gear away.' (NE; works 500 parlour pots).

36. 'A colleague brought back 3 pots that I had lost 2 years ago. Each pot had holes in the netting and had no crabs in captivity.' (NE; works 700 parlour pots).

37. 'Dredgers could be more aware of pots.' (NE; works 250 parlour and 200 soft-eyed traps).

38. 'Any pots lost will lose the ability to 'ghost fish' after a short period, i.e. 1 month, due to damage sustained by not being attended to. Meshes break releasing any trapped crustaceans. Strings of pots [that are] lost ball-up in the tide and self destruct.' (NE; works 500 parlour pots).

39. 'Trawlers could take more care when working in areas where there is static gear.' (NE; works 600 parlour pots).

40. 'Most of my lost pots get washed ashore.' (NE; works 60 soft-eyed traps).

41. 'Our pots are netted in 3mm braided twine which does not last more than 3 years. Lost pots that we have recovered after a few months are always empty, due to holes in the netting.' (NE; works 550 parlour pots).

42. 'I think that pots lost for any amount of time deteriorate, so not holding catches.' (NE; works 100 parlour pots).

43. 'Pots lost to weather conditions usually end as up what we term 'balled', *i.e.* all together in a big bunch. This makes lifting them impossible with the equipment we have on our small boats (*i.e.* under 10m).' (NE; works 50 parlour pots).

44. 'Any pots lost within 8-10 fathoms [15-18m] would be flattened by heavy sea or swell. In 10-15 fathoms [18-27m] [the pots] may be scrubbed up [rolled around and damaged] by the sea, so allowing the catch to escape.' (NE; works 100 parlour pots). (NE; works 100 parlour pots).

45. 'Trawlers should mark the spot where pots were cut from their gear [in the event of pots being snagged by a trawl] in order that the owner of the pots has a reasonable idea of their location, and can attempt to retrieve them later.' (NE; works 80 parlour pots and 160 soft-eyed traps).

46. 'Ghost fishing can be a problem with steel pots lost. Wooden pots will tend to smash up.' (NE; works 300 parlour pots).

47. 'Over the past 15 years I have lost hundreds of pots, all due to the *[named port]* trawlers. Nothing ever gets done about it as they never accept responsibility.' (NE; works 300 parlour pots).

