The Clean Fishing Competition 2007

Obtaining widespread industry acceptance of the benthos release panel

Final report (July 2007)
Version 2

Cefas project code C2598

Cefas project code C2598 funded by FIFG grant No 06/ENG/46/01 (FGE 326) and Defra R & D project M 0738

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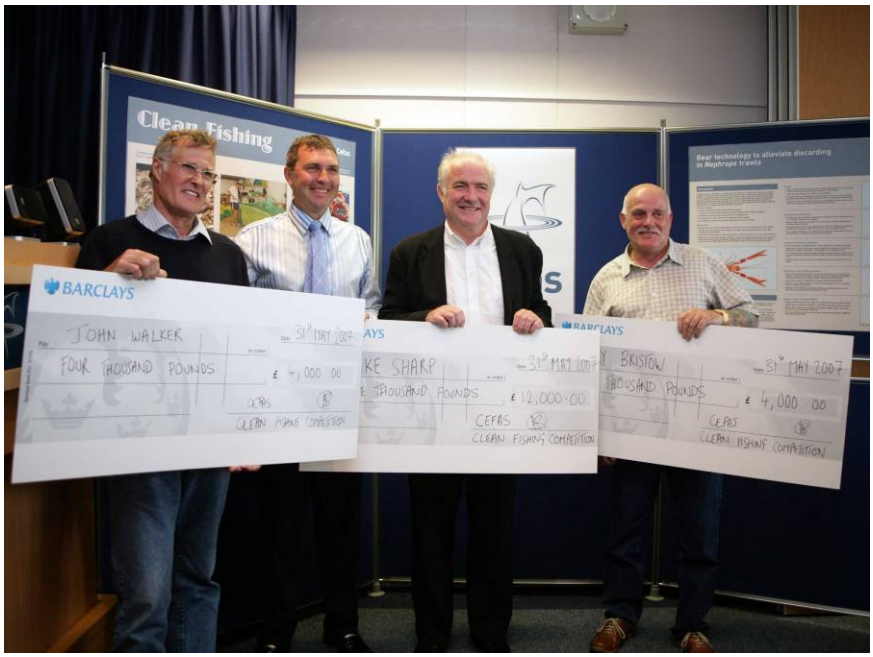

Left to Right: Skipper John Walker, Skipper Mike Sharp, Rick Stein, Skipper Terry Bristow

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Executive Summary

A competition (known as the 'C*lean Fishing*' competition) was held between August 2006 and May 2007. The aim of this competition was to encourage south-west beam-trawlermen to develop their own technical solutions to reduce unwanted by-catch and discards in their fisheries.

The rules of the competition stipulated that the skipper's designs must be commercially acceptable and effective in reducing discards. Skippers were encouraged to build on the successful work already undertaken in this field by Cefas scientists (i.e. the benthos release panel). The competition was initiated and administered by Cefas (Lowestoft).

Three competition entrants registered for the competition in August 2006 and subsequently developed their ideas over the following six months. In May 2007, the judging and awards ceremonies took place in the Weymouth laboratories of Cefas. All three finalists had experimented with different fishing-gear modifications and achieved varying degrees of success in terms of discard reduction.

The judging panel, which consisted of invited experts, assessed each of finalists ideas based on evidence provided from three separate sources. These sources of evidence were:

a) Evidence provided by each skipper on his gear modification

b) Evidence provided by an independent evaluator (John Hingley).
(*Mr Hingley had visited the entrants in port and been onboard during fishing operations throughout the six-month competition period. As an experienced ex-beam trawler skipper and owner, he had particular knowledge and expertise relating to the SW beam-trawl fisheries*).

c) Evidence provided by Cefas observers, who periodically sailed with the vessels during fishing operations throughout the six-month trials period. The observers quantified the levels of discards and catches from the entrants vessels.

The judging was held in an open and constructive session (May 30th 2007). All three competition finalists were in attendance during all of the presentations and discussions for each entrant. This allowed skippers to learn about the other's work. Similarly, observers from fishermen's organisations (South West Fish Producers Organisation) and other interested parties were present and were able to contribute to the discussions.

The judges were Andy Revill (Cefas, Lowestoft), Dominic Rihan (BIM, Dublin), Phil MacMullen (Seafish, Hull) and Han Polet (Belgian Fisheries Institute, Oostende). The judges' decisions were unanimous and were as follows (overleaf).

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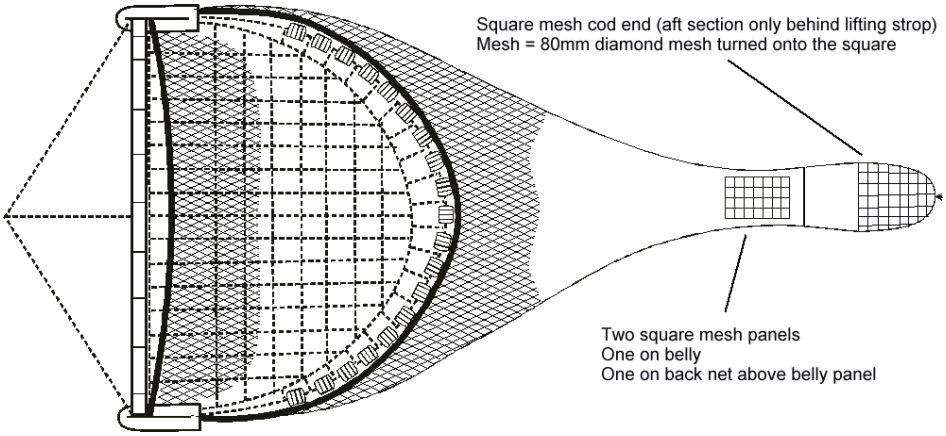
First Prize: Skipper Mike Sharp

Vessel – Lady T Emiel (BM 2000)
Vessel length 32.8m, main engine power 747 kW, beam length 2 x 12m

Winning idea:
A standard beam trawl was fitted with a square mesh cod end in combination with two strategically placed square mesh exit windows. This gear modification successfully reduced discards by around 60% in number. Both discards of unwanted fish and invertebrates were reduced. The skipper (Mike Sharp) reported improved catch quality and received favourable comments on this issue from fish buyers. Mike successfully developed the square mesh cod-end and panel combination throughout the six-month period and broke the port landings record during this period. He stated that he was very pleased with the discard reduction and improved catch quality resulting from this gear modification. He continues to use it after the competition has closed and there are reports that other skippers may be interested to use this winning gear modification.
Gear modification successfully developed and used on the Lady T Emiel

Square mesh cod end used on Lady T Emiel

Belly square mesh panel (200mm mesh size)



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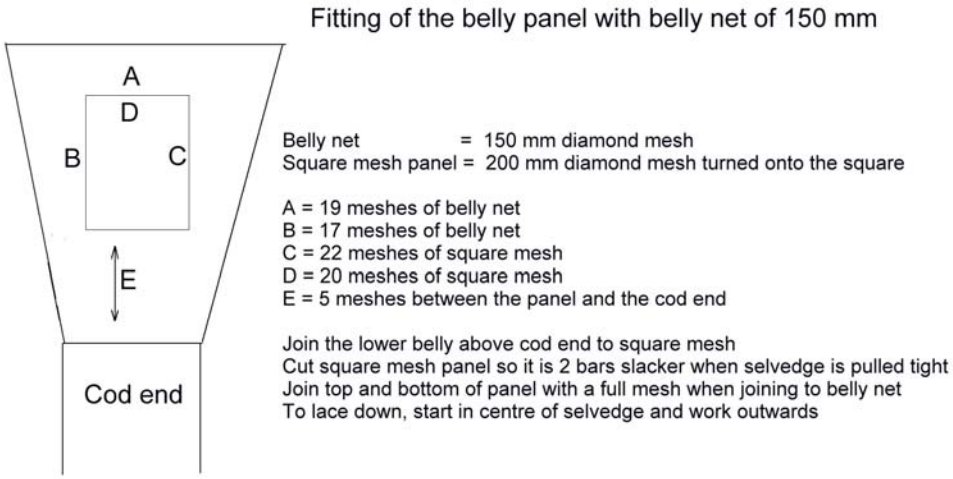
Belly panel specifications



Upper panel specifications

The upper square mesh panel is fitted onto the back net and is simpler to fit than the belly panel. This panel essentially allows weed to pass out of the trawl. It consists of a section of back net turned onto the square. It is fitted directly above the belly square-mesh-panel and covers approximately the same area as the lower belly panel. Typically this would be around 25 x 25 meshes (dependant upon mesh size of back net). It is joined at the top and bottom (1 bar of square mesh to 1 diamond of back net), while the sides are laced up tight when fully stretched.

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Runner up (1): Skipper Terry Bristow

Vessel – Twilight III (PZ 137)
Vessel length 29.1m, main engine power 597 kW, beam length 2 x9 m

Skipper Terry Bristow fitted a square mesh benthos release panel to the belly of his beam trawl, and successfully reduced discards of unwanted invertebrates by around 40%. Terry struggled at times with bad weather and panel chafe but worked hard to make the panel effective throughout the six month competition period. He has since expressed an interest in trying out the modified gear used by Mike Sharp (competition winner) to see if this particular design would work well in the Cornish monkfish and megrim fishery. An opportunity will be provided for Terry to test the design of Mike Sharp during the summer of 2007 under the auspices of the Defra Fisheries Science Partnership (FSP) programme.

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Runner up (2): Skipper John Walker

Vessel – Miss Patty (E 58)
Vessel length 9.9m, main engine power 88 kW, beam length 1 x 3m

Skipper John Walker developed and engineered a novel new design of beam trawl which used 'rakers' instead of the usual ground chains. John was plagued with bad weather throughout the competition period, which particularly affected his under 10m vessel. John had made some progress in developing this gear, but was unable to demonstrate its commercial viability at the time of the judging. John has reiterated his commitment to further developing more environmentally responsible fishing methods and he currently continues to work on the development of his 'raker' trawl.

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Background information on the competition and discarding

Cefas has been working with various SW beam-trawler skippers, owners and net makers in recent years to develop simple trawl modifications that reduce discard levels of unwanted fish and invertebrates, etc. These modifications were designed to ensure "cleaner" catches, with far fewer discards of untargeted species. Considerable progress was made using a simple square-mesh "drop-out" panel fitted to the aft belly of the beam trawl. Although this panel produced much cleaner catches, several skippers found some practical problems: weed build-up, stone entrapment, etc. This competition was seen as a novel and practical way with which to continue the good progress already made in this area.

The '*clean fishing*' competition encouraged competition entrants to build on this existing work and develop modifications to resolve such panel problems. Alternatively, entrants could develop completely new ways to produce cleaner catches by altering the ground gear or the cod-end, etc. The competition was supported by both Defra and an FIFG grant and was restricted to entrants with access to an operational and fully licensed SW whitefish beam trawler.

Economically and environmentally it is desirable to fish by cleaner methods, whereby discarding is kept to an absolute minimum. Cleaner fishing could potentially result in higher-quality catches and better prices at market. Reducing discards also has many conservation benefits, as it lessens the overall environmental impact of the fishery on the supporting marine ecosystem. Beam trawling is known to reduce productivity and diversity within the marine ecosystem. This type of fishing often means that fish and invertebrate discards are at a high level. Keeping discards to a minimum, consequently, will help to conserve precious stocks.

A recent scientific paper summarising historical levels of discards in the South west fisheries (ICES sub-area VII) is detailed in section 1.9.

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Conclusions

It is concluded that this competition was a successful and worthwhile undertaking. The competition served to further raise the profile of the growing issue of discarding in commercial fisheries, particularly within the industry itself. It subsequently engaged and challenged industry to develop practical solutions which could mitigate discarding, thereby reducing the overall environmental impacts of their fisheries. Several members of the industry responded positively and registered for the competition. The entrants showed commitment and resourcefulness in developing technical solutions to resolve the issue.

The winner (Mike Sharp) of the Lady T Emiel demonstrated that his trawl modifications could be used successfully on a commercial basis and would reduce discard levels by around 60%. Importantly, skipper Mike Sharp continues to use these trawl modifications, long after the competition has closed. The other finalists also worked hard to develop their technologies and their efforts are to be commended. The constraints faced by skippers during commercial fishing operations, generally permits little time to experiment with modified gears. It is therefore a credit to all of the finalists that they persisted with their endeavours throughout this competition.

In itself, the end result of this competition (i.e. Skipper Mike Sharp's winning gear modification) renders this project a success. There have however, worthwhile additional benefits arising from this competition, namely:

- *Closer collaboration between industry and Cefas*
- *The practical engagement of industry in developing solution to fisheries management problems*
- *International interest in the project (i.e. see judges)*
- *Interest in the project from Fishermen's Organisations (i.e. SWFPO, CFPO, NFFO)*
- *Interest in the project results from other fishermen (i.e. enquiries)*
- *Interest in the project from fish buyers*
- *Interest in disseminating the winning idea through demonstration charters i.e. Defra funded Fisheries Science Partnership (FSP) charters in 2007*

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Appendices

Cefas project code C2598 funded by FIFG grant No 06/ENG/46/01 (FGE 326) and Defra R & D project M 0738

1.1. News coverage of the competition

14 July 2006 www.fishing

CLASSIFIED

COMPETITION

Clean Fishing

COMPETITION

£20,000 prize money

Cefas are launching a new competition for good ideas that reduce discards. Named the "Clean Fishing" competition, the aim is to encourage SW beam trawler men to modify their trawls to avoid netting unwanted species.

Competition prize monies totalling £20,000 will be awarded for the best ideas. First prize will be £12,000; two runners-up prizes of £4,000 are also up for grabs. The competition begins in September 2006 but entrants must register by 31 August 2006.

Competition rules
Registered entrants must demonstrate their idea works, specifically by using it onboard a UK-registered SW-based beam trawler under commercial fishing conditions for a period of around six months. The entrants will be expected to provide documentary evidence of their success to a judging panel in April 2007.

Full instructions on how to register and competition details are detailed in the competition pack, which can be obtained from:

'Clean Fishing Competition 2006'
Cefas , (Samsu office), Pakefield Road, Lowestoft, Suffolk, NR33 0HT

Cefas

21 July 2006 www.fishing

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Cefas

PRAISE FOR FISHERMEN: Chef Rick Stein handed out awards to fishermen under a scheme to cut the number of unwanted fish caught ■ Full story: Page 4
Picture: JOHN GURD/JG1697

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Rick Stein to present 'Clean Fishing' award

Fishing News
25th May 2007

INTERNATIONALLY famous chef Rick Stein will visit the CEFAS fisheries laboratory in Weymouth on 31 May to award the top prize in a 'Clean Fishing' competition, launched by CEFAS in July 2006 to encourage South West beam-trawlermen to design novel modifications to their fishing gear to reduce by-catch.

Dr Andrew Revill, senior scientific officer at CEFAS and key instigator of the competition said: "At CEFAS, we are constantly looking for new ways to work more closely with fishermen so their undoubted skills and experience can be harnessed for the common good. We all agree that there is a need to develop robust solutions for reducing unwanted bycatch.

The Clean Fishing competition is one simple mechanism that fully engages the fishermen in the development of those solutions."

Fisheries minister Ben Bradshaw said: "Discarded fish is a waste that no one wants to see, so I welcome the enterprising efforts of fishermen that tackle the problem of threatened species being caught up in other catches. We all want more sustainable fisheries and to cut bycatch and discards, and I want to work with fishermen to achieve that."

John Hingley, a former skipper and the independent evaluator who assessed the competition entrants' ideas during six months of sea trials, said: "I think this is a worthwhile and positive idea from CEFAS and means that fishermen will be involved and proactive. Potentially, there may be benefits for catch quality, reduced wear and tear on the trawls, and possibly even fuel savings. I am pleased to be involved with this competition."

Short-listed commercial fishermen working out of Brixham, Newlyn and Weymouth will find out who wins the top prize at the special lunchtime event.

Invited guests, including those from fisheries organisations, will also be given a tour of CEFAS' laboratory and aquarium facilities, and CEFAS staff will meet Rick Stein at an afternoon session.

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WESTERN MORNING NEWS MONDAY JUNE 4 2007 www.thisisdevon.co.uk FISHING 21

Brixham skipper's idea is chosen to receive 'Clean Fishing' award

● **INNOVATION:** An award-winning initiative to reduce discards onboard the Lady T Emiel has already resulted in higher prices

System which reduces by-catch is a winner

PHIL LOCKLEY

A WESTCOUNTRY beam trawler fisherman has developed an innovative way to fish "cleaner" and greatly improve the quality of his catch.

Michael Sharp, part-owner and skipper of one of Brixham's biggest beam trawlers, the Lady T Emiel, received an award last Thursday from the Centre for Environment, Fisheries and Aquaculture Science (Cefas) after winning its "Clean Fishing" competition.

Presented by celebrity chef Rick Stein, the award celebrates a modification in beam trawl design that can reduce the by-catch of unwanted fish by 60 per cent, and also greatly improve the quality of the catch, and there was a large crowd at Cefas's Weymouth laboratory for the presentation.

Cefas launched its Clean Fishing competition in July last year to encourage South West beam trawler fishermen to design novel modifications to their fishing gear. Three South West skippers were shortlisted for the final, each having put considerable work into making their fishing less damaging to by-catch species.

Dr Andrew Revill, senior scientific officer at Cefas and key instigator of the competition, said: "At Cefas, we are constantly looking for new ways to work more closely with fishermen so that their undoubted skills and experience can be harnessed for the common good.

"We all agree there is a need to develop robust solutions for reducing unwanted by-catch. The competition fully engages the fishermen in the development of those solutions."

'We found a reduction in by-catch of over 60 per cent'

Mr Sharp, with Lyme Regis inshore skipper John Walker and Newlyn beam trawler skipper Terry Bristow heard how Fisheries Minister Ben Bradshaw agrees that discarded fish "is a waste no one wants to see".

Ben Bradshaw recently told Cefas that he welcomes the enterprising efforts of fishermen to tackle the problem of threatened species being caught up in other catches.

Mr Walker developed a novel dredge mechanism and Mr Bristow experimented with square mesh panels in his trawl nets to allow small fish and shellfish to fall through. Mr Sharpe's trials of square mesh panels really paid off, and eight other South West beam trawler skippers have already turned to that method.

The use of square instead of diamond meshes in critical parts of a trawl net is not new, until now the technique has been alien to beam trawling.

Mr Sharp told the WMN: "By using a square mesh panel in the belly of the nets and similar but stronger panels in the lower part and 'back' of the cod ends, we found a reduction in by-catch of over 60 per cent and a lot of that was undersized marketable fish, those normally discarded dead. The quality of our catch has greatly improved.

"The practical aspect of using square mesh panels is no different to using traditional diamond meshes – it's simply the same net hung by the square so mending is no problem. A square mesh panel is just as strong, it doesn't wear out any faster, and I think the idea will become very popular."

Conference combats salmon decline

THE Atlantic Salmon Trust (AST), based in Perth, Scotland, is celebrating its 40th anniversary and has organised a major international conference on freshwater habitat management for salmon and trout.

Held in conjunction with the Game Conservancy Trust and University of Southampton, the four-day conference starts on September 18 at the university campus.

It will consider what can be done to stem the 30-year decline of wild salmon and sea trout and review freshwater habitat management techniques, identifying those that have worked and those needing further investigations.

Field trips will enable delegates to view management work on contrasting chalk streams and investigate the surface water-fed catchment of the Lymington River in New Forest National Park.

■ Details can be found at the conference's website – www.salmonidhabitat.com

Guide gives information on skates and rays

SEAFISH has created a guide to skates and rays and a supporting website for chefs, fish processors and even fishermen to gain more information about those elusive members of the shark family.

Identification guides to help them recognise various species, plus a database to collect landing data on these unique fish, may reveal more information to help monitor their quantity and geographic availability, Seafish claims.

The guide, available as a handy A4 or an A2 poster, is being sent out to industry organisations like fish markets, harbour offices and fishermen's groups and federations. Fish processors, fish selling agents and fishery offices will also receive laminated versions, which are also being made available for fishermen and can be obtained directly from Seafish.

A Seafish spokesman said: "The guide aims to help them correctly label the species commonly caught around the British Isles. There are specific differences between the various species, yet often they are all generically labelled either skate or ray, or there is confusion regarding regional variations in the naming of species.

"The guide has been produced with the assistance of the Shark Trust and the Skates and Rays Producers' Association. The website, a collaborative effort between Seafish and these two bodies, contains versions of the guides for printing or to keep electronically."

The website also features a database for processors to enter data regarding their purchases of skates and rays.

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4 DORSET ECHO Friday, June 1, 2007 www.dorsetecho.co.uk

Biker paramedics take to the roads of district

NEW paramedic motorcyclists are hitting the streets of West Dorset today to beat the summer traffic.

Three medics have completed their training at Hendon Police College in London – a three-week intensive course – and will be based in Dorchester, but can cover the whole of the district.

Ambulance operations locality manager for West Dorset Mick Barnes believes medics on two wheels will be invaluable in the summer season.

He is warning that drivers will have to be aware that when they hear a siren it could mean a motorcycle

By HARRY HOGGER

speeding past. Mr Barnes said: "The paramedics have been on the best course in the country but they are a bit more vulnerable.

"This is an additional resource as we are building up to a busy period of heavy traffic and will offer a speedier response to life-threatening emergencies.

"The bikes are fully equipped and carry all the drugs an ambulance carries. They can carry out lifesaving treatment and stabilise patients before assistance arrives."

RIDING TO THE RESCUE: Paramedics riding motorcycles will be on duty in West Dorset from today. The paramedics here were pictured elsewhere in the South West (S)

Awards made for boats with best record of avoiding non-target catches

Chef presents prizes to cleanest fishermen

By HARRY HOGGER

harry.hogger@dorsetecho.co.uk

CELEBRITY chef Rick Stein visited Weymouth to present fishermen from the South West with awards for clean fishing.

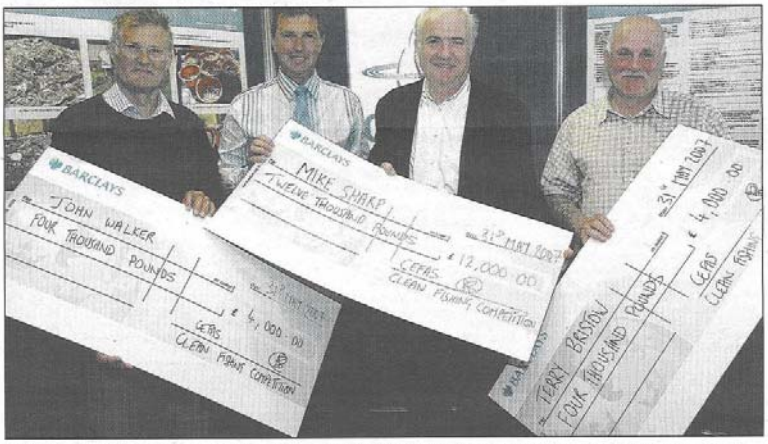
The prize-giving at the Centre for Environment, Fisheries and Aquaculture Science (Cefas) recognised fishermen who had made special adaptations to avoid catching 'non-target' marine species.

Mr Stein presented the top award of £12,000 to Mike Sharp, from Brixham, Devon, skipper of the beam trawler Lady T Emiel.

Runners up were Terry Bristow, of the Cornish-based Twilight, and John Walker, from Weymouth, skipper of Miss Pattie. They each received a £4,000 cheque.

Mr Stein: "These innovations with seriously successful commercial fishermen must rub off on the rest of the industry."

Mr Stein went on to tell guests at the awards ceremony that he was happy to be involved in something that would promote more environmentally friendly fishing techniques.



WONDERFUL WORK: Chef Rick Stein, centre, hands out awards to fishermen under a scheme to cut the number of 'non-target' fish caught. Also pictured are John Walker, Mike Sharp and Terry Bristow Picture: JOHN GURD/JG1697

He said commercial fishing and everyone involved were often falsely portrayed to the public as not caring about the side effects of their practices.

"I have got a real interest in fish conservation and restaurants are becoming increasingly under pressure from pressure groups and journalists.

"People criticise me for putting species of fish on the menu which I have had on the menu since I started 30 years ago.

"I'm afraid fishing and fish conservation is getting to the same area as carbon footprints. As somebody intimately involved in the industry I have got an interest in separating the truth from the fiction.

"As far as I'm concerned greater understanding about what is going on in the industry and with Cefas is very important.

"One of the things we all want is that people should appreciate how wonderful fish and shellfish are in this country and introduce people to lesser known species."

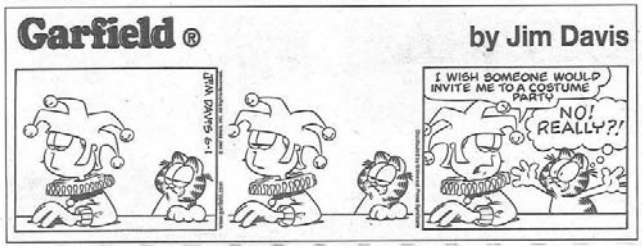
The three beam trawlers in the competition were monitored over six months as they implemented new techniques to avoid 'unwanted bycatch'.

Senior Scientific Officer at Cefas Dr Andrew Revill said that the trawlers continued to succeed commercially there after eco-friendly alterations, sending out a strong message to the industry.

He added: "What is really nice about this competition is that we have created a mechanism where the experts, the fishermen who have got the real knowledge, have become involved.

"There has been a lot of work undertaken and I'm very grateful."

COMMENT ONLINE www.dorsetecho.co.uk



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FISHING NEWS
THE VOICE OF THE INDUSTRY SINCE 1913 www.fishingnews.co.uk

8 June 2007 £1.30

'Clean Fishing' award winners

PICTURED presenting the awards at the finals last week of the CEFAS' Clean Fishing competition for South West beam trawlers at the CEFAS laboratory in Weymouth is internationally famous chef Rick Stein (second from right).

The winner was Skipper Michael Sharp of Brixham (second left), and runners up were Skipper John Walker of Lyme Regis (left) and Newlyn Skipper Terry Bristow.

■ Report – page 2.

Picture: Phil Lockley.

ZERO COD FOR 2008

ICES repeats advice yet again – and wants big cuts in NS whiting and herring – report page 3.

Shellfish tops in Scotland

THE PRAWN creel boat *My Amber* moored at Dunvegan on the Isle of Skye. Latest figures show that shellfish have now become the most valuable sector in the Scottish fleet for the first time, and in the Western Isles shellfish account for 98% of the catch.

■ Scottish figures – page 5. Skye feature – pages 8/9. FISHING Inshore Forum – page 13.

Picture: David Linkie.

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COMMENT

No change on cod

The annual routine of setting fishing opportunities for the year to come has begun to take shape already in respect of 2008 – and it is taking on the depressing formula to which fishermen have become wearily resigned in the last decade or more.

Despite the fact that fishermen in the northern North Sea cannot avoid catching cod because it is so abundance, there is no change whatsoever in the position of the scientists.

For the last few years an international exercise has been carried out in which fishermen's views on the state of all the major stocks have been collected by the national federations and passed on to ICES via the national scientists. But looking at the advice for next year, it seems as if they have been wasting their time.

For while fishermen have been saying for some time, and particularly so this year, that cod stocks are improving rapidly, for all the notice the scientific establishment takes of their views this is a dialogue with the deaf.

Certainly the commission has spelled out that there will be no change to the cod recovery plan until the year after next, following its revision of the plan. But this should not mean that the TAC must be cut yet again, when there is abundant evidence that the stock is recovering well. All a reduced TAC will achieve when fishermen find it difficult not to catch cod will be even more discards – something the commission is now trying to reduce.

The news that the SFF is to become a part of the official Scottish team at next week's Fisheries Council in Luxembourg (when discards are on the agenda), and presumably at all future councils, is welcome and an indication that the new minister is as good as his word in his promise to make a fresh start in Scotland.

But he will have his work cut out to make an impression on the ICES/Brussels juggernaut as it rolls remorselessly onwards to its Holy Grail of 'saving the cod', judging by the early advice from the scientists published this week. This is a system that has a life and a momentum all of its own and whether the new combined forces of a fresh, keen and committed minister and a newly optimistic SFF will be able to make any difference remains to be seen.

FISHING NEWS

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an informa business

Scapa suitable for lifeboat maintenance

A TRIAL to test the suitability of the slipway at Scapa Pier to carry out maintenance work on the RNLI Kirkwall lifeboat has proved successful, reports Craig Taylor.

Lifeboat surveyor Andrew Redden, who is responsible for surveying the hulls of all of Scotland's lifeboats, travelled to Orkney from RNLI Scottish HQ in Perth along with technician Willie Lowe to carry out work on the lifeboat and see how the trial use of the Scapa slip went.

"We are here to try it and see how it goes because using the slip here at Scapa will save the RNLI money in both fuel and the charges for using the slipway in Buckie where this type of work is normally carried out," said Mr Redden. "As well as the bottom of the hull being cleaned, we have also done a propeller change, carried out work on the rope cutter as well as changing anodes."

Mr Redden also said that although the slip may not be used every time maintenance is carried out on the lifeboats, it may be possible that Stromness and Longhope lifeboats could use the facility when required.

Picture: Craig Taylor.

Lifeboat surveyor Andrew Redden, technician Willie Lowe and Kirkwall lifeboat mechanic Dupre Strutt pictured at the Scapa slipway.

'Clean Fishing' prizes

TOP chef Rick Stein visited Dorset fisheries laboratory in Weymouth last Thursday (31 May) to award the three top prizes in CEFAS' Clean Fishing competition, reports **Phil Lockley**.

Brixham beam trawler skipper Michael Sharp was the winner after his use of square mesh panels on the beamer *Lady T Emiel* resulted in a major reduction in by-catch, encouraging many more Brixham skippers to try his method.

CEFAS launched its Clean Fishing competition in July last year to encourage South West beam trawlermen – those on either big vessels or inshore boats – to design novel modifications to their fishing gear to reduce by-catch.

Finalists like Skipper John Walker of Lyme Regis, who designed a by-catch adaptation for a 32ft boat, said that he found considerable success in extensive trials over a period of six months.

Equal runner-up Skipper Terry Bristow of the Newlyn beam trawler *Twilight* and Cleaner Fishing's winner, Mike Sharp, had both experimented using square-mesh panels.

By reducing his by-catch limit by up to 60% and greatly increasing the quality of beam trawl-caught fish, Michael Sharp (nicknamed Sharpie) was presented with a cheque for £12,000 to offset the costs incurred during the six-month trial. Runners-up were each awarded £4000.

After the awards were made, Rick Stein told the crowd he wasn't there just to view the day's events, but had a real interest in fish conservation.

"We in the restaurant trade are increasingly under pressure from conservation groups and more so with me, as my business is obviously an easy target for the media," he said.

He told the finalists: "As people who are as intimately involved in the fish industry as you are, I know you will help toward sorting out facts from fiction to help the conservationists make a positive step toward a better future and not simply attack almost the entire fishing industry."

Dr Andrew Revill, senior scientific officer at CEFAS said: "Capture of non-target marine species is a major fisheries management problem.

"At CEFAS we are constantly looking for new ways to work more closely with fishermen so their undoubted skills and experience can be harnessed for the common good.

"We all agree that there is a need to develop robust solutions for reducing unwanted by-catch. The Clean Fishing competition is one simple mechanism that fully engages the fishermen in the development of those solutions," he said.

■ **Full details of Clean Fishing competition soon.**

Solway group to meet on scallops

CLIMATE change and sustainable scallops are the focus of the next Solway Fish Forum meeting, which takes place on 11 June in Kirkcudbright Town Hall, at 6.30pm.

Speakers confirmed on the evening include Bill Turrell from the Fisheries Research Services' Marine Laboratory in Aberdeen, who presented this year's Buckland Lecture on 'Climate change and Scottish Fisheries' at FISHING 2007 in May, and Bryce Beukers-Stewart from the Marine Conservation Society (who also made a presentation at FISHING) will make a presentation on 'Seeking sustainable scallops – Can marine protected areas really work? Lessons from the Isle of Man'.

The meeting is open to all and provides the opportunity for everyone to get involved by participating in one of the limited soap box sessions or contributing in the open discussion part of the meeting.

There is a free buffet from 6.00pm and funding is available to cover the transport costs of those employed within the Solway fisheries sector who live 25 miles or more from the venue. (Contact the SFP before the meeting to arrange help).

The Solway Firth Partnership, which co-ordinates Solway Fish, says the Solway Fish Forum meeting will provide "the platform by which the voice of the Solway Fisheries sector can be heard. It is important that those involved in the sector attend to enable Solway Fish to take forward actions of importance to it."

■ **Anyone wishing to attend the meeting or who wants more information or wishes to book a soap box session should contact Jeremy Roberts on 01387 247543, e-mail jroberts@solwayheritage.co.uk**

EU duties to favour imported fish

THE EUROPEAN Commission has unveiled plans to create three-year, duty-free or low-duty trade quotas that will encourage imports into the EU of species in direct competition with British and Irish fishermen, reports Keith Nuthall.

Notably, Brussels is proposing liberal quotas that have not existed before for fillets of cod, sole and hake, as well as an increase in existing low-duty quotas for whole cod and shrimp.

Joe Borg, EU fisheries commissioner, said: "We need to ensure that our processing industry has access to the necessary fisheries products for its activities. In recent years, there has been a shortage of some raw material due to depletion of... stocks."

The new quotas include 20,000t of duty-free frozen cod fillets; 5000t of duty-free frozen sole fillets; and 15,000t of frozen hake fillets at 4% duty. These will be backdated to January 1 2007 and last until December 31, 2009.

Regarding expanded import quotas, which replace low-duty openings for 2004-6, they include 80,000t of duty-free cod for processing and 20,000t of 6% duty shrimp and prawns. The commission is also proposing quotas for 15,000t of hake duty free; and 20,000t of herring (duty free), both for processing.

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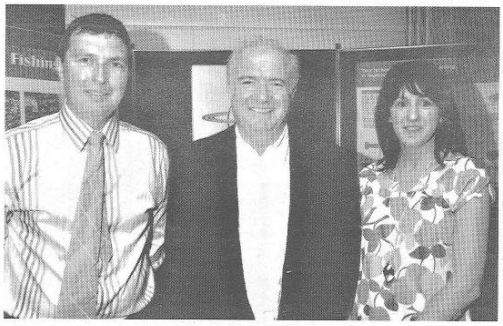
Clean Fishing awards bring real technical advances



(L-R) Michael Sharp, winner of CEFAS' clean fishing competition, with celebrity chef Rick Stein and his wife Claire Sharp.

A Westcountry beam trawler fisherman has developed an innovative way to fish more 'cleanly' and greatly improve the quality of his catch.

Michael Sharp, part owner and skipper of one of Brixham's biggest beam trawlers, *Lady T Emiel*, received an award on 31 May from CEFAS after winning its Clean Fishing competition (*FN* 8 June), which was launched in July last year to encourage South West beam trawlermen to design novel modifications to their fishing gear.

Presented by the world famous chef Rick Stein, the award celebrates a modification in beam trawl design that can reduce the by-catch of unwanted fish and other benthos by 60% and also, Skipper Sharp says, greatly improve catch quality.

Three South West skippers were short-listed for the final, each of whom had put considerable work into making their fishing less damaging to by-catch species.

Dr Andrew Revill, senior scientific officer at CEFAS and key instigator of the competition said: "The capture of 'non-target' marine species is a major fisheries management problem.

"Reducing unwanted by-catch lessens the overall environmental impact of the fishery on the supporting marine ecosystem and helps to conserve precious stocks. Cleaner fishing methods potentially result in higher-quality catches and better prices paid at fish market."

Skipper Michael Sharp, together with Lyme Regis inshore skipper John Walker and Newlyn beam trawler skipper Terry Bristow (who operates the WS&S vessel, *Twilight*), heard how fisheries minister Ben Bradshaw agreed that discarded fish "is a waste that no one wants to see".

Ben Bradshaw told CEFAS that he greatly welcomes the enterprising efforts of fishermen to tackle the problem of threatened species being caught up in other catches.

While runners-up Skipper John Walker developed a novel dredge mechanism and Newlyn Skipper Terry Bristow experimented with square mesh panels in his nets to allow small fish and shellfish to fall through, Skipper Sharpe's trials of square mesh panels – traditional diamond meshes hung by the square – has really paid off and eight other South West beam trawler skippers have already turned to that method.

Although the use of 'square' instead of diamond shaped meshes in critical parts of a trawl net is not new, until now that technique has largely been alien to beam trawling, *FN* was told.

Skipper Sharp said: "By using a square mesh panel in the belly of the nets and similar, but stronger, panels in the lower part and back of the codends, we found a reduction in by-catch of over 60% and a lot of that was undersized marketable fish, those normally discarded dead, so the use of square mesh panels has to be the way forward.

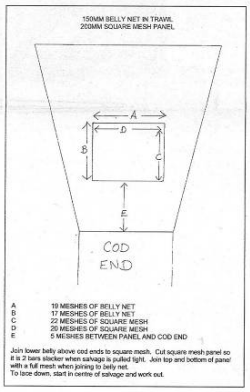
"The quality of our catch has greatly improved; so much so that Mitch Tonks of FishWorks – a firm owning restaurants, fish cookery schools and a fish sales business at Brixham – recently sent me a letter saying he owes me (and other beam trawler skippers using square mesh panels) an apology.

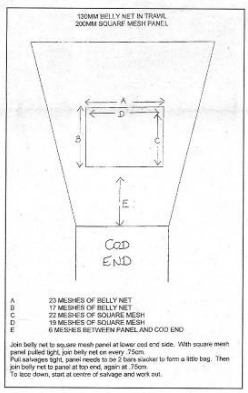
"His letter was a bit of fun but said something rewarding about our work. He commented how his first choice has always been fish from day-boats – those landing their catch within 24 hours of capture – but now he has to think again because the quality of beam trawled fish using nets with square mesh panels is so good.

"The practical aspect of using square mesh panels is no different to using traditional diamond meshes, it's simply the same net hung by the square so mending is no problem. A square mesh panel is just as strong, it doesn't wear out any faster and I think the idea will become very popular; we certainly won't go back to the old method. Discards are a fraction of what they were before and the quality improvement can be seen on the first use. We were amazed."

Former Brixham beamer skipper and independent evaluator John Hingley, who during six months of sea trials often sailed aboard each boat to gauge the entrants' ideas, said: "I think this is a worthwhile and positive idea from CEFAS and because fishermen were involved and proactive, the results of the trials have opened-up a new world of possibilities.

"Potentially, there may not only be benefits for catch quality, but also reduced wear and tear on the trawls and possibly even fuel savings. I am pleased to be involved with this competition," he said.





Square mesh panels make a difference

"There's nothing special about the square mesh panels that were used, it's just 200mm diamond mesh (made of single 6mm diameter strand) hung square, each bar measuring 100mm," said Skipper Sharp, winner of CEFAS' Clean Fishing competition.

Independent assessor John Hingley explained: "On the times I was present on *Lady T Emiel* we took data from using a traditional net on one side and one with square mesh panels on the other and immediately saw clear differences in both the discard rate and the quality of the fish retained.

"We also looked at similar data when using square mesh panels on both sides. Data from all of the Cleaner Fishing trials on all boats that took part will be so important to the future of beam trawling.

"I was very impressed with what I saw with the square mesh panel trials and will not be surprised if it sets a trend and many other beamer skippers follow suit."

Runner-up in the competition, Newlyn Skipper Terry Bristow, was making ready to begin a trip on *Twilight II* when he told *Fishing News*: "We were all pleased to have taken part in the competition and I am already making plans to use the panels that proved their worth on *Lady T Emiel*. It's the way to go, improving the quality of fish can only be a good thing."

Skipper Sharp added: "From the very first tow we could see a great reduction in the amount of rubbish coming out of the codend, like shells, benthos of all sorts, and a reduction of discards of about 60% is bound to make a difference in the final quality of the fish.

"It took quite a lot of work trying different types of rigs and where best to put the panels; and we may well try different combinations at a later date. I know that eight more beam trawler skippers in Brixham are now using square mesh panels.

"The Cleaner Fishing competition was a real boost for the beam trawling industry, which has had so much bad press for so long.

"Statements made by people who are ill-informed have done a lot to hurt to what remains of the core of the South West fishing industry. Anything that helps to bridge any gap between the industry and its opponents is always a major step forward."

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Chef lambasts greens and media

CELEBRITY chef Rick Stein has hit back at criticism of restaurateurs and fishermen by green groups and the media.

Speaking at CEFAS' Clean Fishing awards ceremony (see page 12) in Weymouth, he said: "In the last few months the press has accused us of calling one species another, like calling thornback ray skate, for instance, a species they say is under pressure.

"However, I have called ray skate for 30 years, ever since I started, and it's not just me and my restaurants but most fish restaurants.

"We have all tried so hard to explain that, but have to accept that this kind of pressure from conservationists is not going to go away. As people who are as intimately involved in the fish industry as you are, I know you will help toward sorting out facts from fiction to help the conservationists make a positive step toward a better future and not simply attack almost the entire fishing industry."

Rick Stein talked of the greens' and media's attacks about many other species, and claims that cod is almost extinct. He said he prefers to take advice from those at the cutting edge of stock assessment like CEFAS and fishermen, especially as conditions very so widely from area to area.

He said the truth is that "fishermen and the boffins are working closely together" and that the Clean Fishing awards are a great step forward, one where it is to be hoped the conservationists will get on the same side.

He also talked to finalists about discards to see if a market for those animals might be developed, such as the dragonette, a small fish similar to monkfish in both texture and taste.

MCA pyrotechnics warning

THE large number of time-expired pyrotechnics (TEPs) that have been handed in to coastguard stations has prompted the Maritime & Coastguard Agency (MCA) to repeat its warning that only small quantities of out-of-date pyrotechnics can be accepted by the coastguard and only when storage space is available locally.

Dave Jardine-Smith, head of search and rescue at the MCA said: "Large quantities of time-expired pyrotechnics cannot be accepted, nor can commercial stock. These should be disposed of by approved hazardous waste disposal companies or via the pyrotechnic manufacturer or supplier if they provide a disposal service."

The coastguard also reminds people that it is an offence to fire distress signal pyrotechnics unless actually in distress, and it is an offence to dump pyrotechnics at sea.

Clear guidelines on the disposal of TEPs may be found in MGN 287 (M+F), available at http://www.mcga.gov.uk by following the links under Guidance & Regulations to M Notices and MGNs.

SFC's persistence pays off after two-year prosecution

AFTER several previous hearings in the past two years, a Newbiggin by the Sea man finally pleaded guilty earlier this month to charges brought in a prosecution by Northumberland Sea Fisheries Committee.

The man, John Robert Dawson, pleaded guilty to charges of landing three octopuses, 21 undersized codling and two undersized ling at South Harbour, Blyth on 5 June 2006.

In his defence, Mr Dawson told North Tyneside Magistrates Court that he had been given the fish and that they were dead. He admitted they were all undersized but said he was only using them for pot bait.

The court found Mr Dawson guilty of landing undersized fish and in summarising said it was no excuse that the fish were dead. He was fined £500 for the offence and ordered to pay £1500 towards prosecution costs.

Irish salmon bait anger

COMMERCIAL shrimp fishermen and numerous salmon angling groups in Ireland are outraged that shrimp is still being collected during their closed season for bait on several salmon fisheries, reports **John Rafferty**.

Shrimp fishermen are calling for this practice to be stopped altogether because it ruins the commercial shrimp fishery later in the year and diminishes catches the following year.

Bait collectors using nurseries as a basis for their supply have been highlighted over the last couple of years and now shrimp fishermen and the majority of salmon anglers want to see all forms of bait fishing banned on Irish rivers to help preserve what's left of the salmon stocks.

Irish shrimp pot fishermen catch approximately 400t of shrimp annually and last season shrimps reached €16 (£10.50) per kg making this a very important fishery.

Out-rigging for sole: if at first you don't succeed...

Picture: W.M.van Heijer.

Skipper Marco Elle's *Arie Senior* TX-5 entering Den Helder after her fifth trip.

IN January this year Skipper Marco Ellen of the 41m Dutch beamer *Arie Senior* TX-5 decided he wanted to try out-rigging (towing otter trawls) instead of his usual beam trawling, reports **Willem den Heijer**.

Despite receiving no response from the Dutch fisheries ministry to his request for financial support, he decided to buy special trawl doors and out-rig trawl nets anyway, and by the first week of April his boat was ready.

Marco Ellen contacted Skipper Hein Nentjes of *Iede Kornelis* UK-47, who made four fairly reasonable trips last year with the out-rig system. He also consulted the skipper of the German-flagged beamer *Jurie van den Berg* NG-1, who has a lot of experience because he has been out-rigging for quite a long time.

Both skippers were able to provide some information and explain some technical matters, but it was still difficult to pick up this fishing method because Skipper Ellen wants to catch sole. Both vessels caught hardly any sole last year; nephrops and plaice were the main species they caught.

Skipper Ellen put more weight on to the gear and also tried fishing different areas. For the first three weeks he made no progress, but on the last two trips he finally caught some sole and last week landed around 3800kg of fish of which 196kg was sole and 140kg nephrops.

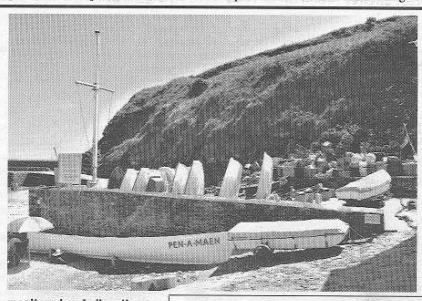
The other species were dab, plaice, horse mackerel, turbot and brill. Although the grossings were poor the skipper remains optimistic and hopes that he will catch some soles.

"The boat used about 14t of fuel, which is half the amount we use when beam trawling. That means we do not need a lot of fish [for out-rigging for sole to be viable], but we want to find out if it is possible to catch at least 500kg of sole during a four-day trip. If that catch includes some brill and turbot it could become a reasonable way to fish and one that would earn us some money," Skipper Ellen said.

In comparison to beam trawling, the spread of one trawl of the out-rig concept is from 16m up to and including 20m; it depends on the sediment of the ground and the number and weight of the tickler chains.

Skipper Ellen also found that heavy gear doesn't always result in more fish. When the gear is heavy and the ground muddy, the spread will decrease to less than 16m. Without any experience it is difficult to keep the balance, but even after six trips the skipper of *Arie Senior* is still willing to continue.

CCTV for small Cornish port



Left: The small 13th-century Cornish fishing village of Gorran Haven, home to 12 registered fishing boats is to fight crime with a new CCTV system.

THE small 13th-century south Cornish coast fishing village of Gorran Haven is to install closed circuit television (CCTV) to fight growing vandalism.

In the past few years the village, which is home to 12 registered fishing vessels, has been increasingly vandalised with the harbour, its fishing vessels and fishing gear being prime targets.

Gorran Haven Fishermen's Society (GHFS) has been awarded an Objective 1 Fisheries grant of nearly £2000 to install the system at the port.

It will provide accurate coverage of all the fishermen's facilities and enable intruders to be identified, the behaviour of individuals using the facilities to be closely monitored and allow the police to view tapes to provide evidence.

GHFS member and skipper of *Fulmar* FY4 Joe Hocking said the system "will be a great asset in protecting our equipment from vandalism and theft.

"We recently had an attempted theft of the RNLI collection box on the quay since the cameras were installed which we are currently investigating. This system provides excellent quality colour images which the police can use to prosecute those involved in acts of vandalism and theft.

"We are very grateful to South West Pesca and the Objective One funding for enabling us to install such a fantastic system."

Cefas project code C2598 funded by FIFG grant No 06/ENG/46/01 (FGE 326) and Defra R & D project M 0738

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BUOYANT BRIXHAM'S BRIGHTER FUTURE

– all change in a positive direction

Report and pictures by **Phil Lockley**

Brixham's future as one of the most hi-tech fishing ports in the UK is forging ahead.

Building and civil engineering contractor Dean & Dyball, which has its headquarters in Bristol, has won the contract to build the port's new fishing complex and was recently given the go-ahead to begin the initial stages of its work.

The multi-funded Brixham development project has given both south Devon fishermen and fish merchants another shot of confidence. Over the past few weeks several local beam trawling companies and new investments from recently formed skipper/owner businesses have paved the way to a brighter future.

Rick Smith, chairman of the port's sole auction company, Brixham Trawler Agents (BTA), said that fishermen and merchants are preparing for "considerable challenges while the building work is in progress, but in the end it will all be well worth it".

"Our offices will end up in Portakabins mounted on stilts at what is presently the outer quay, with a cuttlefish market temporarily sited underneath, but we have already made plans to put up with what will only be short-term inconvenience.

"The BTA has great confidence in Brixham's future. So have the port's fishermen and boat owners. So far it has been a very good year and we all hope that will continue.

The trend towards Eurocutters – small beam trawlers with limited power but able to move easily to demersal stern trawling or midwater trawling – is now a wise move, many say, and two Eurocutters recently purchased from Holland have just joined the Brixham fleet.

"For fuel economy reasons, many are moving towards, or considering a move towards, Eurocutters. As far as the port is concerned, the boats that have left have been replaced by other, smaller boats, as well as a couple more. And there may be more to come.

"So Brixham's tonnage remains the same, but the big boats are certainly dwindling. Since nobody expects fuel to get any cheaper, it will remain a major factor in the way things go from now on; not just in Brixham, but all around the South West."

Rick Smith said the media, together with some supermarkets, are at present attacking beam trawling, of which they have very little understanding. But he praised the work of Westcountry beam trawlermen involved with the CEFAS' Clean Fishing competition (see page 12).

"The success of the *Lady T Emiel's* square mesh panel trials is a real shot in the arm for the UK's beam trawling industry; an industry that is so heavily attacked by bodies like the Marine Stewardship Council and many others, wrongly-so in my opinion. These organisations have little science to support their claims," Rick Smith said.

"We have been to many meetings on this and all of the eco-warriors present seemed ill informed, so people like Skipper Michael Sharp (skipper and part-owner of the *Lady T Emiel*) have done a lot to address that lack of understanding.

"However, it's not just beam trawling that is in the firing line, it is all trawling, and the greens are a major force that the fishing industry must face. They aren't going to go away."

Weather set fair for BTA

Brixham Trawler Agents (BTA), the port's sole auction company, has had "an outstanding year so far", according to its chairman, Rick Smith

He said the value of fish auctioned by the BTA from 1 January until the end of May this year is more than £2m higher than for the same period last year.

"Over a five-month period we have auctioned £8,425,000 worth of fish compared with £6,336,000 last year, and as 2006 was a record year for BTA, we are of course delighted.

"A rise like this for the first five months of this year equates to just over a 1000t increase in the weight of fish landed.

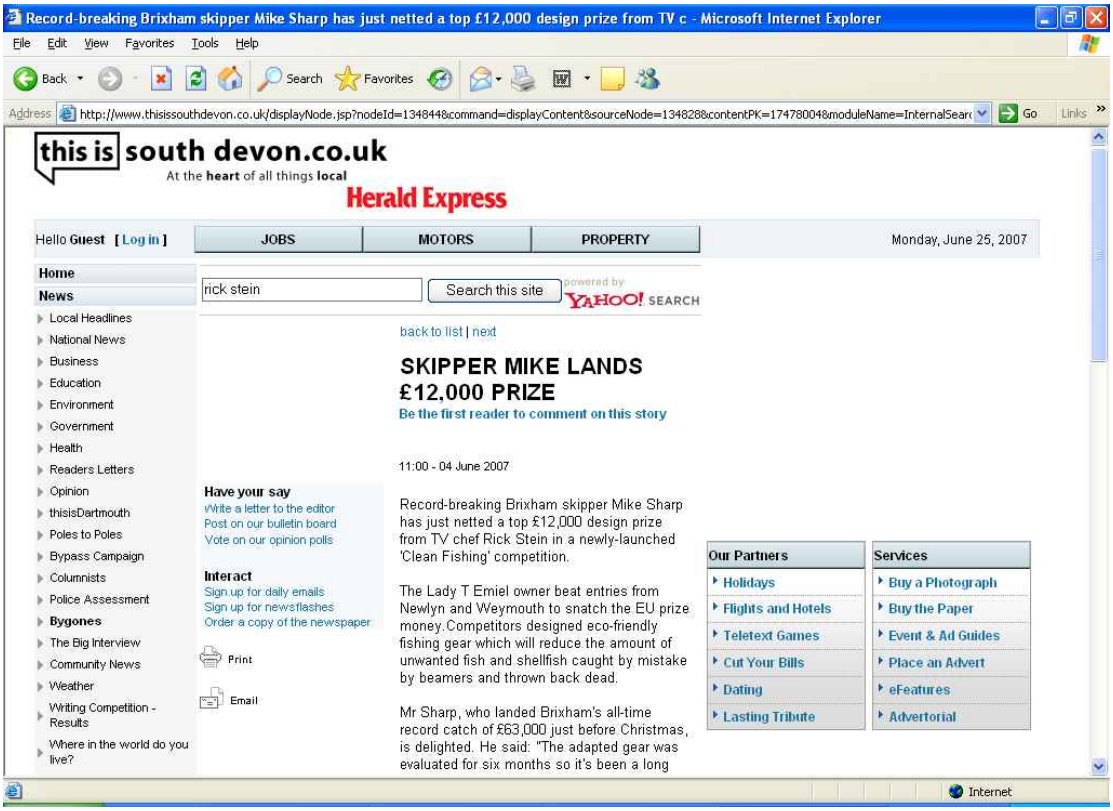
"A lot of that increase is due to having had a very good cuttlefish season over the winter, but most other species have also been up in quantity; there's plenty of fish out there and the prices have been high.

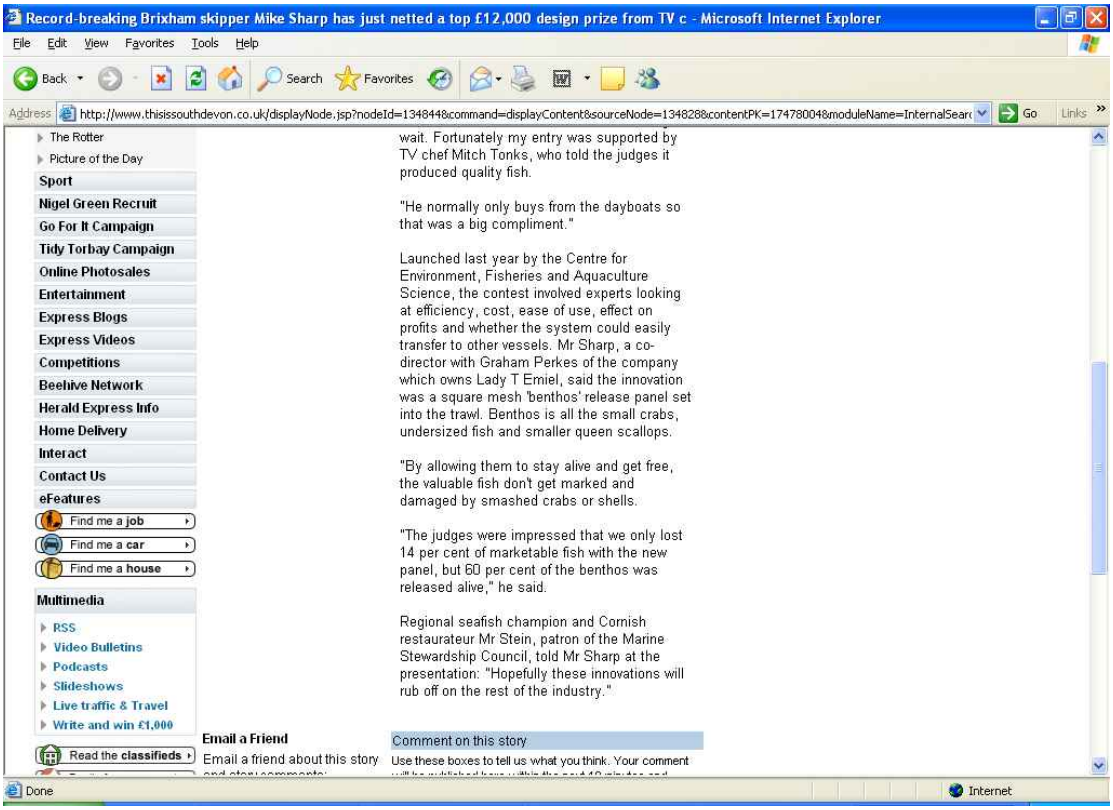
ing a slab (platform) mounted on piles on which the new market will be built.

"Having the latest computerised market technology once the new market is in operation, the whole development programme, in my opinion, will bring us into the 21st century. At first there was some opposition to having a computerised market, but that has already waned somewhat as most see it as a good move.

"Our auctioneers were sceptical at first, but after visiting similar hi-tech fish markets on the continent they are more at ease with the plan. They were impressed with the speed of grading and auctioning and how a computer-based system removes the drudgery of paper work.

"The new market will, in the fullness of time, be open to remote buying, but not right away. But once the buyers trust the system and know that our quality standards remain high, they will, I'm sure, lean toward remote buying."





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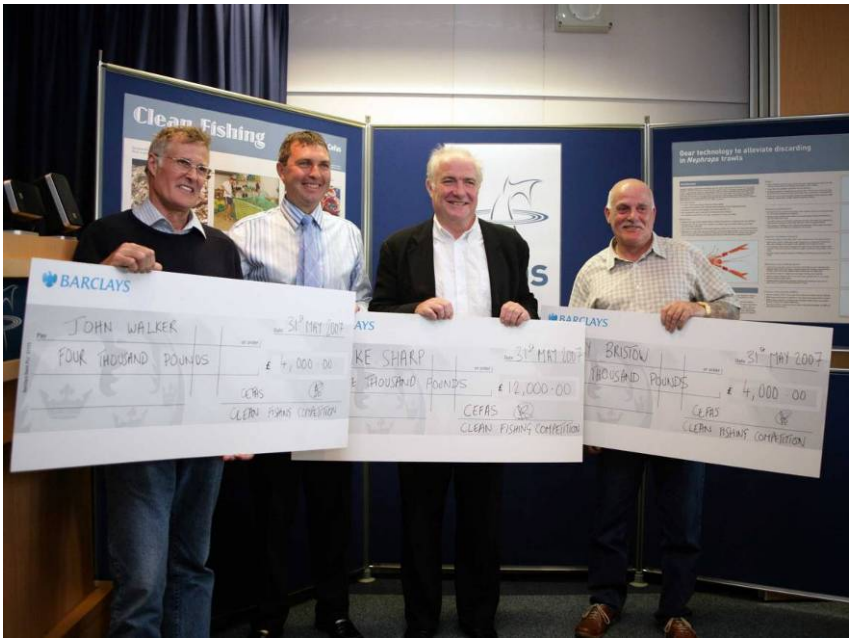
1.2. The awards ceremony



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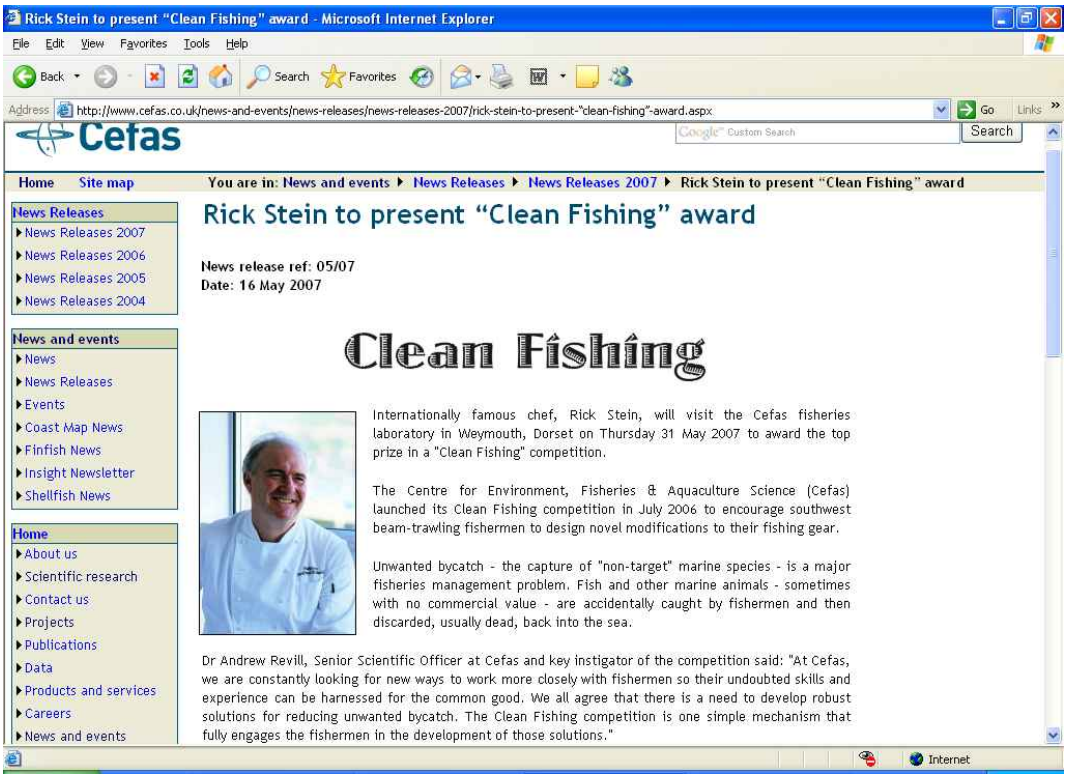
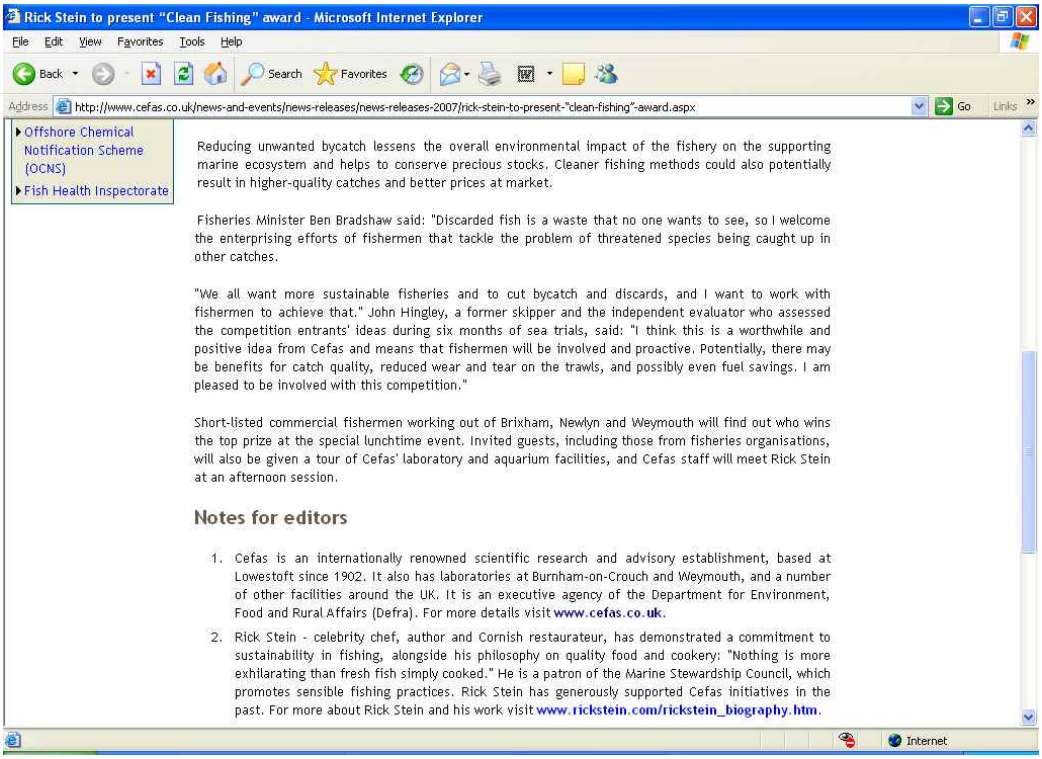
1.3. Cefas press release





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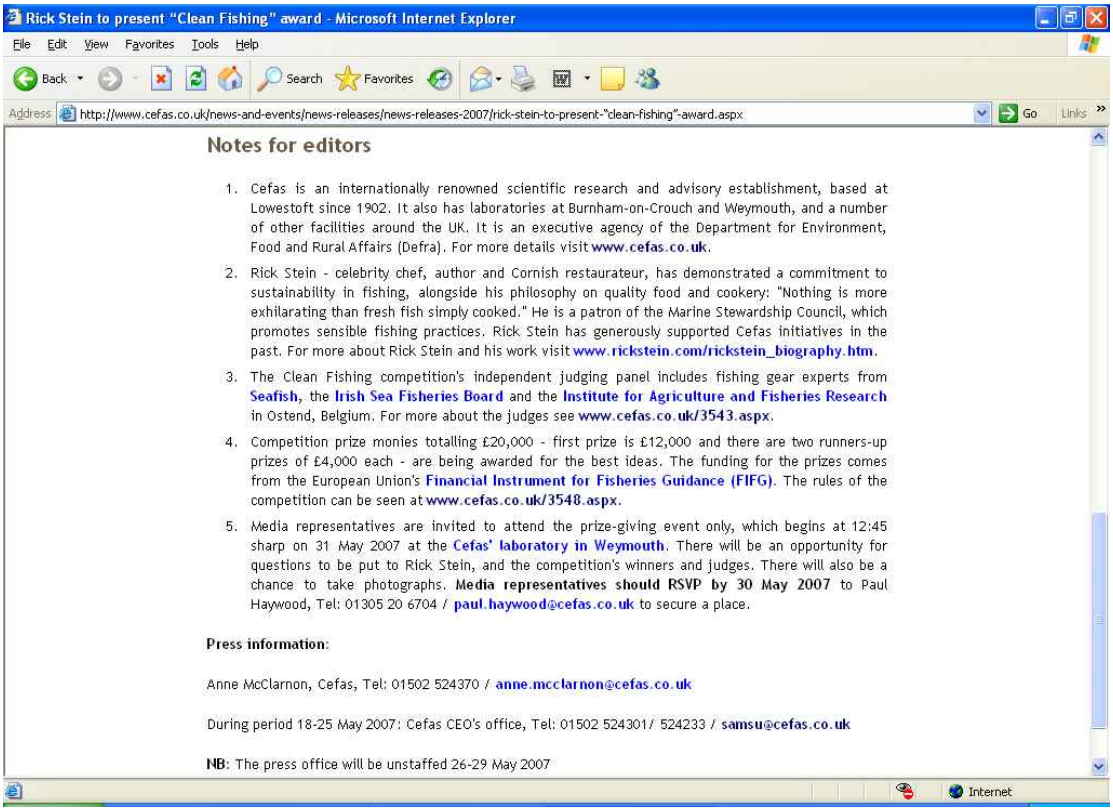
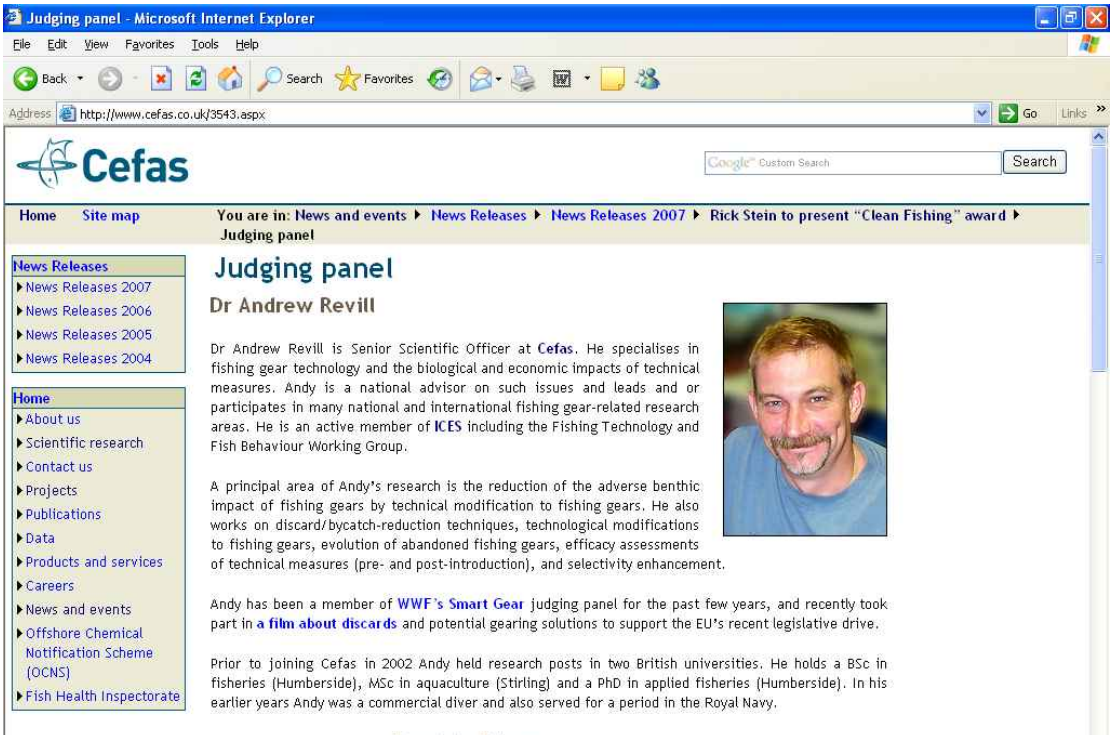


1.4. Judging panel



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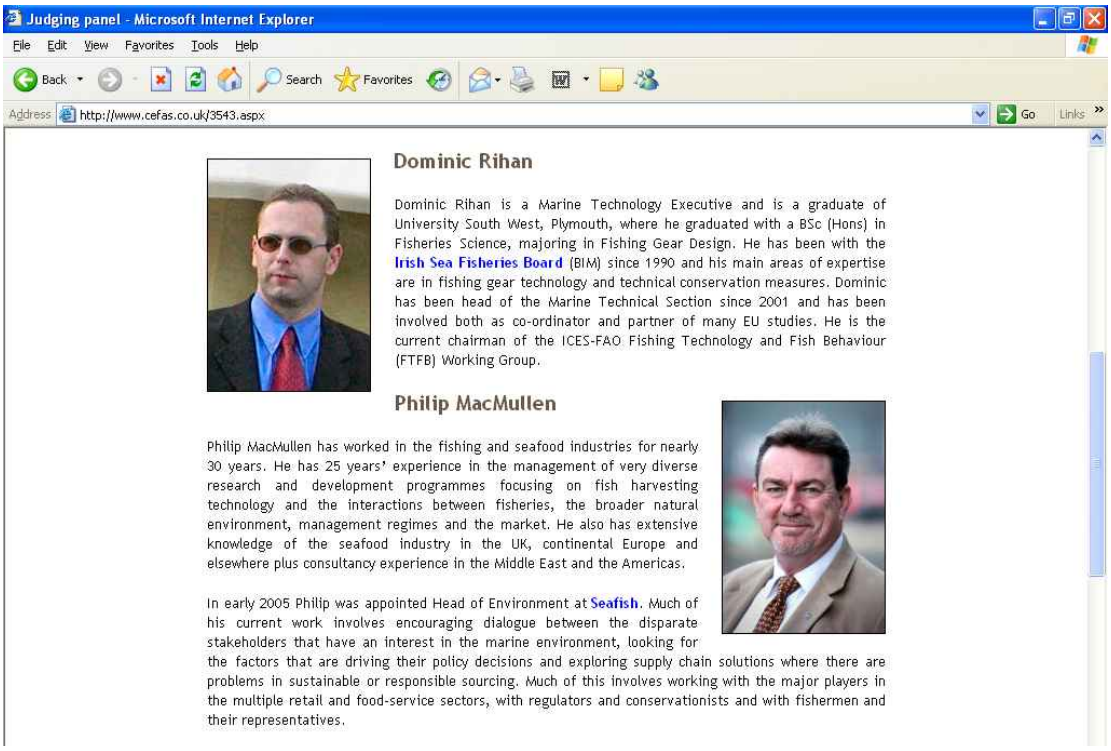


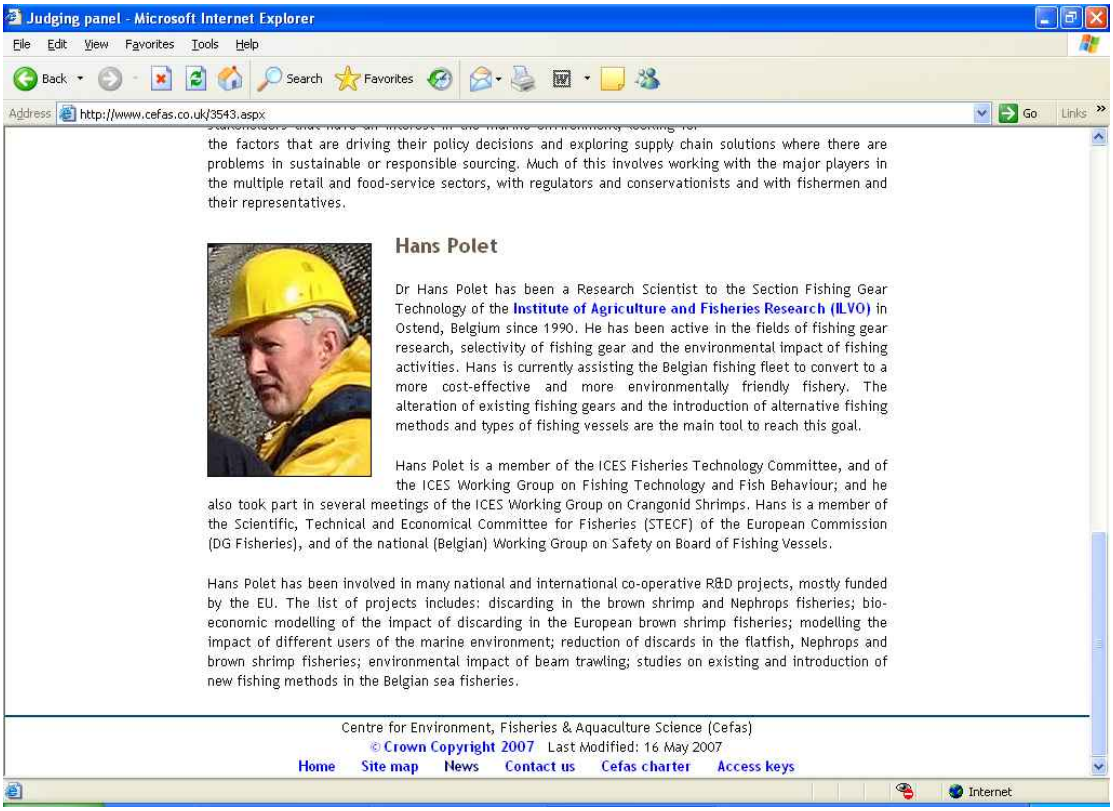
Dominic Rihan

Dominic Rihan is a Marine Technology Executive and is a graduate of University South West, Plymouth, where he graduated with a BSc (Hons) in Fisheries Science, majoring in Fishing Gear Design. He has been with the **Irish Sea Fisheries Board** (BIM) since 1990 and his main areas of expertise are in fishing gear technology and technical conservation measures. Dominic has been head of the Marine Technical Section since 2001 and has been involved both as co-ordinator and partner of many EU studies. He is the current chairman of the ICES-FAO Fishing Technology and Fish Behaviour (FTFB) Working Group.

Philip MacMullen

Philip MacMullen has worked in the fishing and seafood industries for nearly 30 years. He has 25 years' experience in the management of very diverse research and development programmes focusing on fish harvesting technology and the interactions between fisheries, the broader natural environment, management regimes and the market. He also has extensive knowledge of the seafood industry in the UK, continental Europe and elsewhere plus consultancy experience in the Middle East and the Americas.

In early 2005 Philip was appointed Head of Environment at **Seafish**. Much of his current work involves encouraging dialogue between the disparate stakeholders that have an interest in the marine environment, looking for the factors that are driving their policy decisions and exploring supply chain solutions where there are problems in sustainable or responsible sourcing. Much of this involves working with the major players in the multiple retail and food-service sectors, with regulators and conservationists and with fishermen and their representatives.



the factors that are driving their policy decisions and exploring supply chain solutions where there are problems in sustainable or responsible sourcing. Much of this involves working with the major players in the multiple retail and food-service sectors, with regulators and conservationists and with fishermen and their representatives.

Hans Polet

Dr Hans Polet has been a Research Scientist to the Section Fishing Gear Technology of the **Institute of Agriculture and Fisheries Research (ILVO)** in Ostend, Belgium since 1990. He has been active in the fields of fishing gear research, selectivity of fishing gear and the environmental impact of fishing activities. Hans is currently assisting the Belgian fishing fleet to convert to a more cost-effective and more environmentally friendly fishery. The alteration of existing fishing gears and the introduction of alternative fishing methods and types of fishing vessels are the main tool to reach this goal.

Hans Polet is a member of the ICES Fisheries Technology Committee, and of the ICES Working Group on Fishing Technology and Fish Behaviour; and he also took part in several meetings of the ICES Working Group on Crangonid Shrimps. Hans is a member of the Scientific, Technical and Economical Committee for Fisheries (STECF) of the European Commission (DG Fisheries), and of the national (Belgian) Working Group on Safety on Board of Fishing Vessels.

Hans Polet has been involved in many national and international co-operative R&D projects, mostly funded by the EU. The list of projects includes: discarding in the brown shrimp and Nephrops fisheries; bio-economic modelling of the impact of discarding in the European brown shrimp fisheries; modelling the impact of different users of the marine environment; reduction of discards in the flatfish, Nephrops and brown shrimp fisheries; environmental impact of beam trawling; studies on existing and introduction of new fishing methods in the Belgian sea fisheries.

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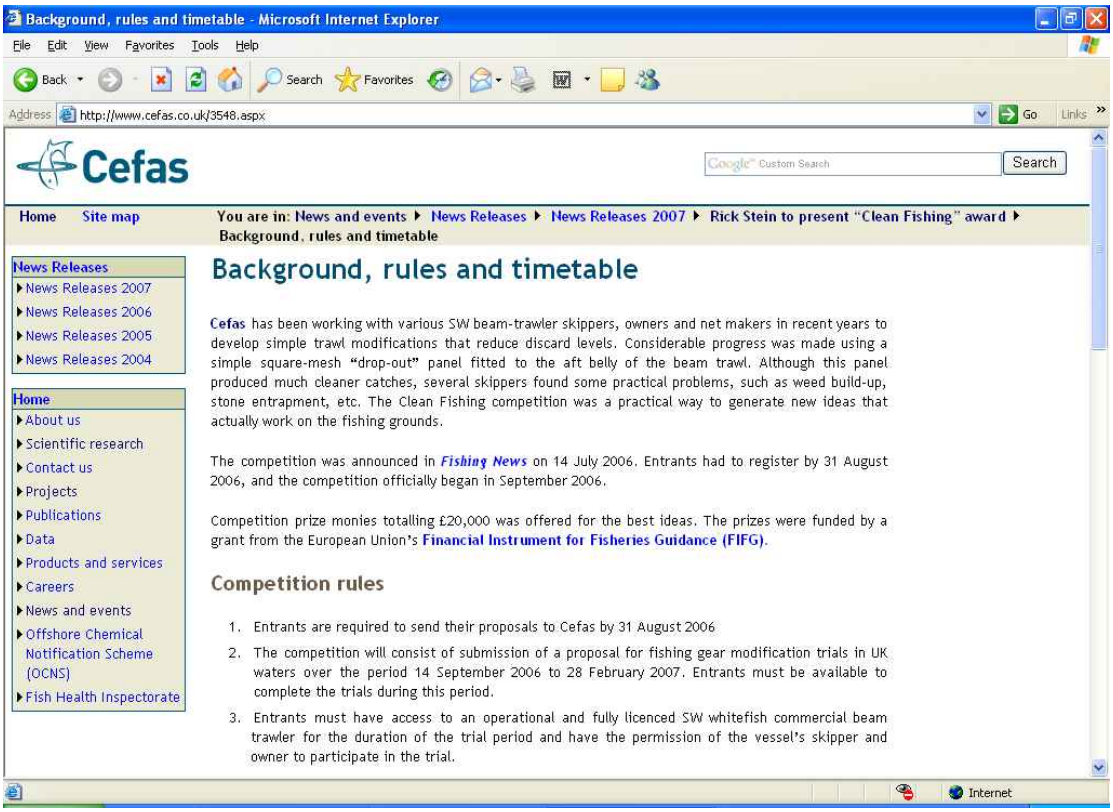
1.5. Competition background, rules and timetable



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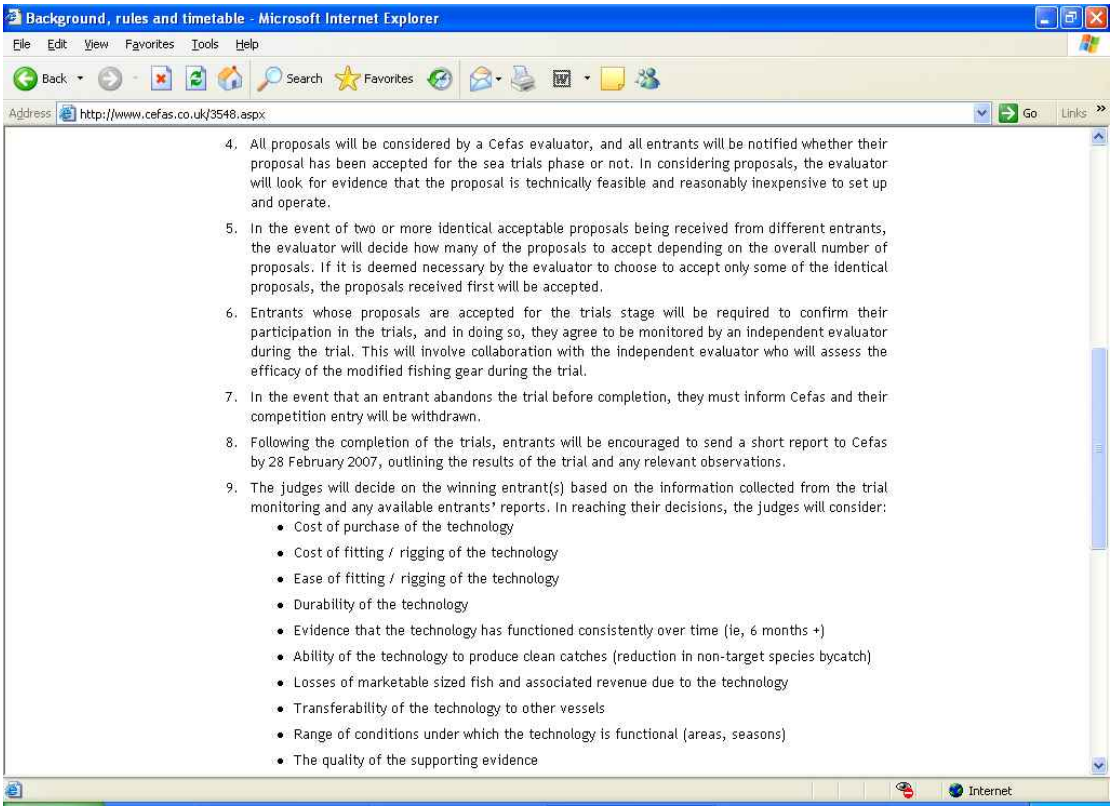

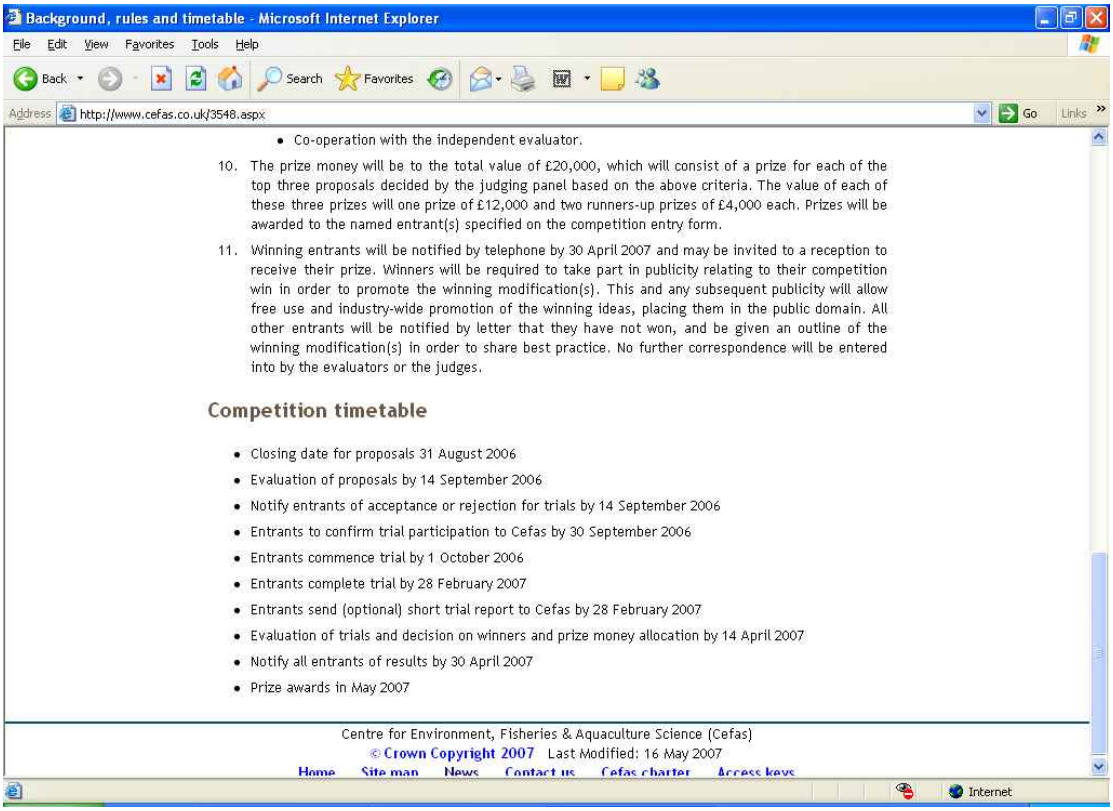

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1.6. The independent evaluators report (A narrative by John Hingley)

Background

Initial trials with benthos release panels were undertaken by Cefas on the beam trawler Jacoba BM77, off the Southwest coast of England during 2003/2004. The fitting of square mesh panels in the belly net of a beam trawl to release benthos seemed to work very well. More extensive trials were commissioned in 2004. Seven Brixham beam trawlers were supplied with trawls with square mesh panels fitted. Up to 70% of benthos was released through the square mesh panels, but problems were encountered by all vessels to varying degrees:

1. Square mesh panels wearing out before the rest of the trawl.
2. Sagging of belly net in front of the panel, caused by joining square mesh to diamond net.
3. Stones lodging above panel, causing belly net to wear out.
4. Build up of weed above panel.
5. Loss of commercial fish, i.e. Dover sole, whilst working in Lyme Bay, (tongue and slip, Dover sole fishery).

The Clean Fishing Competition was a follow up to these previous trials. Running a competition would hopefully prove an incentive to get wider participation from the beam trawler fishing fleet. To solve problems previously encountered, or to come up with new ideas which would have the same end result. The owners of three fishing vessels applied for the competition and are detailed below:

Participating vessel No	1
Vessel Name	Miss Patty
Port Letter and Number	E58
Overall Length	9.9m
Engine Power (kW)	88
Home Port	Lyme Regis
Owner	John Walker
Fishing Gear	1 x 3m beam

Participating Vessel No	2
Vessel Name	Lady T Emiel
Port Letter and Number	BM2000
Overall Length	32.80m
Engine Power (kW)	747
Home Port	Brixham
Part Owner & skipper	Mike Sharp
Fishing Gear	2 x 12m beams

Participating Vessel No	3
Vessel Name	Twilight III
Port Letter and Number	PZ137
Overall Length	29.10m
Engine Power (kW)	597
Home Port	Newlyn
Skipper	Terry Bristow
Owner	Stevenson & Sons
Fishing Gear	2 x 9m beams

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Entrant No1 John Walker (Miss Patty)

Dr Andrew Revill and I met owner John Walker prior to the start of the trials in September 2006. He showed us his innovative idea to replace the chain matrix in a beam trawl. The chain matrix had been replaced with hinged steel arms, each fitted with a tooth on the end. (The teeth are normally used on spring loaded scallop dredges.) The fact that the arms are hinged should allow the teeth to follow the contours of the seabed, in much the same way as the chain matrix. Due to extremely poor weather over the six month trial period, combined with poor demersal fishing over the same period, only one trip to sea was completed by me with the vessel.

November 9 2006, departed from Lyme Regis at 08.00hrs. Shot Beam Trawl on the inshore fishing grounds just off Lyme Regis. The weather was fine, with calm seas and variable winds.

HAUL 190 minutes

FISH CAUGHT	BENTHOS
6 cuttlefish	3 handfuls of small crabs
1 lemon sole	
1 plaice	

HAUL 2 100 minutes

FISH CAUGHT	BENTHOS
1 Dover sole	1 handful of small crabs
1 cock crab	2 sea mouses
	2 thick back sole

HAUL 3 90 minutes

Full up with brittle stars - no fish.

After clearing trawl, returned to harbour at Lyme Regis.
In discussion with John Walker, we decided that the lack of fish on the fishing trip could be put down to one or more combination of factors.

- The inshore areas we fished in had been heavily fished for cuttlefish in the previous few weeks, by bigger Brixham stern trawlers and beamers, catching or displacing the fish normally found there. (On the same day vessels working a similar area with stern trawls reported very little fish).
- Lack of ground contact by the 'teeth' (maybe more weight needed).
- Lack of speed through the water. (With a small beam there was a good chance that even if disturbed by the teeth, a low towing speed would allow fish to swim clears.)

Because of the size of the vessel and the adverse weather conditions, John Walker was only able to try the beam trawl on a number of other occasions. John Walker reported that on a following trip a higher towing speed did seem to increase the amount of fish caught. Just before the end of the trials John Walker did offer to take me to sea for another trip, but admitted that the inshore fishing was very poor and the chance of getting good commercial results were very slim. After discussion with Dr Revill it was decided that little would be achieved by such a trip.

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In future months when the weather finally settles down John Walker intends to fit a camera to his beam trawl to investigate exactly how his design is working. He seems confidant that with a little more work his design could be commercially viable. Unlike the trials partaken by the other vessels John W only tows one beam trawl and no comparison can be made to the efficiency or not of benthos reduction and commercial fish caught.

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Entrant No2 Mike Sharp (Lady T Emiel)

Mike Sharp was already using a square mesh panel (SMP) in the belly of one of his beam trawls before the start of this competition. He fitted it initially to the specifications of the panel used on the FV Jacoba BM77 in earlier trials.

He experimented with various ways of fitting the panel to try and eliminate some of the problems found in the earlier trials. He found no loss of commercial fish and a reduction in benthos caught in the trawl with the experimental panel. He eventually put more slack in the SMP to try and improve the flow of net and hopefully eliminate the sag in the belly net above the SMP.

Mike was pleased with the results but felt he was losing less benthos with the new way of fitting the SMP. On 5 November square mesh cod ends were fitted to one of the beam trawls, along with SMP in the back net directly above the SMP in the belly net. Mike reported a marked reduction in the amount of benthos caught and no loss of commercial fish.

At the end of November Mike replaced the 150mm SMP in the belly of the trawl with 200mm SMP. He reported a significant reduction in the amount of queen shells being caught in the modified trawl.

At the beginning of December Mike put an identical panel in the other trawl along with SMP in the back net and square mesh cod ends. During December Mike continued to use the same combination in both trawls and beat the port record of £62.000.00 just before Christmas. He puts this down to, (apart from good prices) the clean fishing of his trawls, allowing him to tow longer in normally quite dirty fishing grounds, and the good condition of his fish due to the lack of benthos and shell in his trawls.

2 January 2007
Mike Sharp replaced starboard trawl with the normal belly and back net and standard cod ends. Left Brixham aboard vessel, port trawl with SMP in belly and back net, and square mesh cod ends.

Tuesday
(SW severe gales heavy swell)
All 4 hauls showed a marked reduction in the amount of benthos being caught, compared with the standard trawl. Average 12 - 24 kilos of Dover sole being caught each haul. Average length of tow, 120 - 150 minutes. Sole was counted every haul, and no difference in catch was recorded between the standard and the modified trawl.

Wednesday
(Westerley force 6 - 7 heavy swell.) Towed around Start Point towards Plymouth, looking for more Dover sole. Mixed bags of fish, mainly cuttlefish. Dover sole, in small numbers. Modified trawl visibly catching less benthos, at least half the standard trawl. Mike gets the crew to clean the weed from the SMP when he feels the efficiency of the panel is being affected and more benthos is being retained. The following haul the amount of benthos being caught is again reduced.

Wednesday evening and night
(SW 8, rough seas, heavy swell.)
Dover sole catches slightly better, but amount caught varied in both trawls. Sometimes the modified trawl lost sole and sometimes the standard trawl (which we put down to the severe weather). Fishing very clean both sides but the modified trawl still fishing cleaner.

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Thursday
(SW 8, rough seas, heavy swell.)
Mainly catching cuttlefish, Dover sole in low numbers. Modified trawl consistently fishing cleaner, the comparison of the condition of the fish was very apparent in the modified trawl. This was put down to a better flow of water through the square mesh cod ends, and the fact that there was less benthos and shell being churned around in the cod end while the fishing conditions were so severe. Vessel returned to land late Thursday night, for the Friday market.

Mike was concerned that the Dover sole being caught on the last three hauls of the fishing trip was significantly down in the modified trawl. On the first day at sea on his next trip he telephoned me to report they had found a large hole just above the joining round from the belly to the cod end. After repair he reported both sides were fishing identically again.

12 - 16 January 2007
Went to sea with Rob Forster from CEFAS, to measure fish and compare benthos. We measured fish from both sides for the duration of the trip. Approximately 4 hauls on deck measuring fish, 2 hauls off. On the whole the fish being caught in the 2 trawls seemed to be roughly identical. The benthos being caught in the modified trawl was always less than the standard trawl. There was no apparent wear to the SMP, there was some weed collection above it, but any stones seemed to end up in the cod end. The weather was rough particularly at the start of the trip, with one day where conditions were more favourable.

Summary comments on the Lady T Emiel trials

Apart from 2 weeks at the beginning of February I have been aboard the Lady T Emiel every time she comes in to land and most days she goes to sea. Talking with the skipper and the crew the general consensus is that the 200mm SMP combined with the square mesh cod ends significantly reduce the amount of benthos caught, particularly queen shells.

Since December 2006 the skipper has only had square mesh cod ends fitted aboard his vessel and they and the 200mm SMP in the belly have only been removed when the CEFAS scientists or myself have been aboard the vessel.

The panel does suffer with some wear, but is replaced if necessary and any weed that builds up in or above the panel is shaken out by the crew. Since the start of the trials I have visited Brixham fish market when the Lady T Emiel lands and looked for any apparent difference in quality of his fish compared with other beamers working the same area with similar fishing gear.

In December when the Lady T Emiel started using 200mm SMP in both trawls combined with square mesh cod ends there seemed to be a difference compared with the fish landed by other beam trawlers. Various fish buyers have commented on the improvement in the condition of his fish.

As far as I can judge the skipper has been very committed to making the SMP and square mesh cod ends work well, and has changed the way the panel is fitted to try and overcome the problems we encountered in earlier trials. During January and February several other beam trawlers put 200mm SMP in their trawls so they could work the same shelly grounds that Mike Sharp was working so successfully. Since the end of the trials Mike has continued using the panels and cod ends in both trawls and says he will continue to do so in the foreseeable future.

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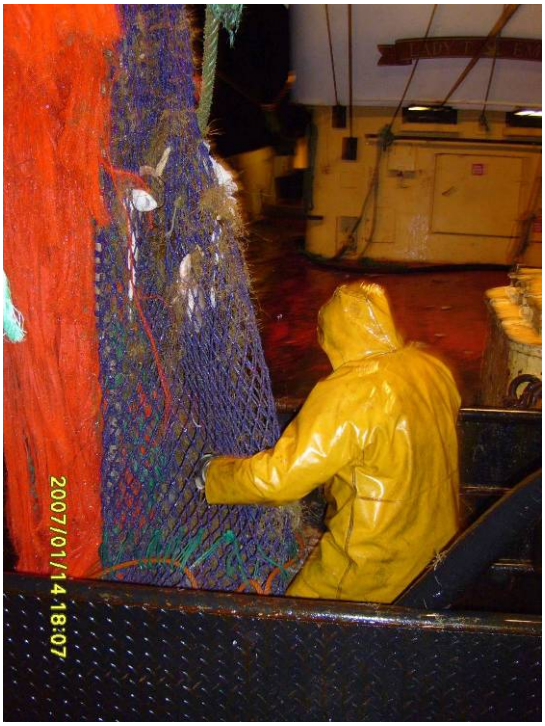

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Entrant No3 Terry Bristow (Twilight III)

Dr Andrew Revill and I met the skipper of the Twilight III in September 2006. I fitted a 150mm SMP to one of his beam trawls the same as in previous trials on FV Jacoba BM77. For the first few weeks I had a lot of contact with skipper. He was very pleased with the panel, and reported cleaner fishing and no loss of commercial fish. During November and December it was not easy to contact the skipper, but when I did speak to him he was still very happy with the SMP.

In January 2007 a new skipper 'Terry Bristow' took over as skipper of the vessel, unfortunately the previous skipper had taken all his records of the trials so far. Terry reported that the SMP was still in but much worn.

Skippers Report

5 January 2007
150mm panel came adrift a couple of times during the trip, which cost the crew time and money.
14 January 2007
150mm panel much worn and was replaced during the trip with the standard 130mm diamond mesh.

On completion of this trip a 200mm SMP was put in. It was a combination of half 200mm square mesh and half 130mm square mesh.

22 January 2007
Not losing any fish, very clean fishing on the side with the panel in. The crew were very pleased with the clean fishing on one side, but reported they were losing scallops.

5 February 2007
The panel was changed to a combination of 130mm square mesh (1/3) and 200mm square mesh (2/3). On this trip he reported that there was no loss of commercial fish and the fishing was still very clean.

16 February 2007
Still fishing very clean, still losing scallops. 26 hauls and no trouble with the panel.

1 March 2007
All the 130mm square mesh was taken out and replaced with a full panel of 200mm square mesh. No loss of fish was reported on the following trip, but reported that the reduction in benthos was much the same as before.

8 March 2007
Loss of commercial fish on side fitted with 200mm SMP. After 2 days the panel was removed and replaced with a standard 130mm diamond mesh. Both sides immediately fished the same.

21 March 2007
I took a trip aboard the vessel with a CEFAS scientist to measure and compare fish and benthos. I cut out a 150mm SMP which the crew fitted as we steamed to the fishing grounds. Once fishing commenced there was a noticeable reduction in the amount of benthos being caught in the side fitted with the SMP.

Within the first 6 hauls there was wear to the belly net above the SMP. The crew had to repair the belly net a few times. On 23 March the trawl was hauled aboard and a chafer net

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was placed just above the SMP. This alleviated the problem but over the next few days small holes were repaired in the chafer net.

Consistently throughout the trip there was a noticeable reduction in the amount of scallops being caught in the side fitted with the SMP.

Subsequently Terry removed the SMP, the difference in the amount of scallops caught by each trawl remained. The following trip Terry replaced the fishing line and foot rope and the amount of scallops caught by that trawl now exceeded the amount caught bt the previous standard trawl.

Although Terry has tried various combinations of panels he has been very hampered by the severe weather of the SW approaches since Christmas. The fact that he has only just taken over as skipper of this vessel means he is under a lot of pressure to do very well and he cannot afford to lose any fishing time. At the present time he is fishing without a SMP fitted but is willing to try again in the future.

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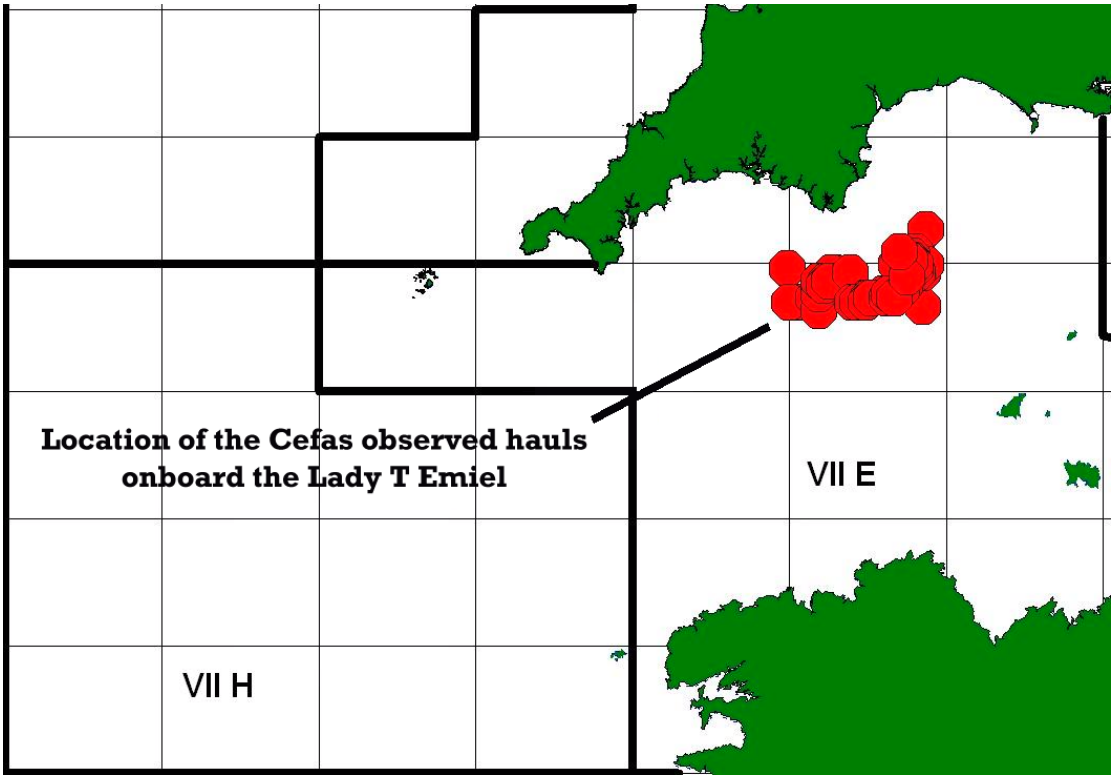
1.7. Cefas observers data

Lady T Emiel

Lady T Emiel
Location of the Cefas observed hauls onboard the Lady T Emiel



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Lady T Emiel

Summarised fish totals from the catches from the paired hauls (as sampled by Cefas onboard observers)

Retained Fish

SPECIES	Number caught in standard trawl (S)	Number caught in modified trawl (M)	M/S (%)
Major high-value species			
CUTTLEFISH	1,257	1,327	106%
DOVER SOLE	282	243	86%
LEMON SOLE	173	164	95%
SQUID	122	22	18%
PLAICE	97	86	89%
MONKFISH	96	86	90%
BRILL	20	34	170%
RED MULLET	18	29	161%
SAND SOLE	16	9	56%
TURBOT	14	4	29%
HADDOCK	4	7	175%
SEA BASS	4	4	100%
Total	2,103	2,015	96%
Lesser value species			
RED GURNARD	773	213	28%
POUT	208	372	179%
TUB GURNARD	146	112	77%
SCALLOP	40	6	15%
WHITING	39	32	82%
POLLOCK	27	5	19%
OTHER SPECIES	14	6	43%
BLOND RAY	13	11	85%
STRIPED GURNARD	5	0	0%
Total	1,265	757	60%

Discarded Fish

SPECIES	Number caught in standard trawl (S)	Number caught in modified trawl (M)	M/S (%)
RED GURNARD	1912	469	25%
CUTTLE	1062	266	25%
POUT	997	951	95%
DOGFISH	798	217	27%
COMMON DRAGONET	309	18	6%
IMPERIAL SCALDFISH	193	167	86%
POOR COD	159	5	3%
BROWN CRAB	119	10	8%
RED MULLET	80	11	13%
WHITING	58	10	17%
SPIDER CRAB	46	29	63%
THICK BACK SOLE	37	6	16%
LONGFINNED GURNARD	21	0	0%
TUB GURNARD	18	8	46%
GREY GURNARD	16	0	0%
JOHN DORY	14	0	0%
MONKFISH	14	9	63%
LEMON SOLE	13	3	23%
HADDOCK	9	0	0%
BLOND RAY	7	2	29%
OTHER SPECIES	32	64	200%
Total	5,911	2,242	38%

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Lady T Emiel

Summarised totals (baskets) of discards (invertebrates and fish) caught from the paired hauls (as sampled by Cefas onboard observers)

Discards: Number of baskets caught (Fish and invertebrates combined)

Haul Number	Standard trawl (S)	Modified trawl (M)	M/S (%)
1	1.0	1.0	100%
2	5.0	2.0	40%
6	13.0	6.0	46%
7	13.0	8.0	62%
8	6.0	2.5	42%
9	7.0	4.0	57%
13	4.0	1.0	25%
14	4.0	2.0	50%
17	4.0	1.0	25%
18	4.0	1.0	25%
19	7.5	2.0	27%
20	11.0	2.0	18%
23	14.0	6.0	43%
24	8.5	3.0	35%
25	7.0	4.0	57%
26	6.0	3.0	50%
29	7.0	6.0	86%
30	7.0	2.0	29%
31	6.0	3.0	50%
32	3.5	1.0	29%
35	9.0	3.0	33%
Total	147.5	63.5	43%

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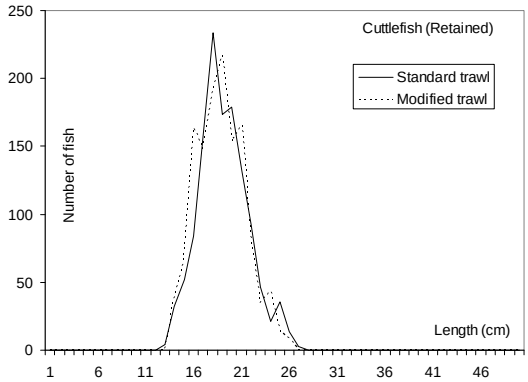
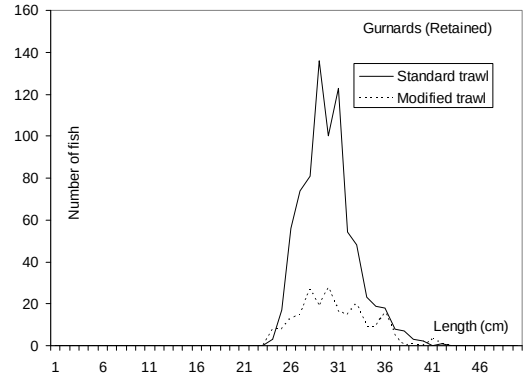
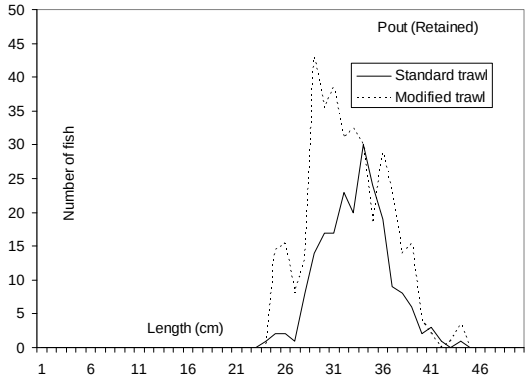
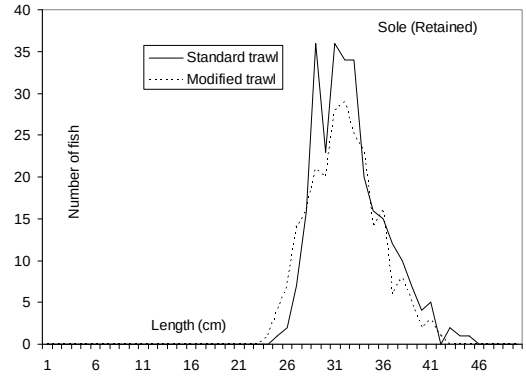
Lady T Emiel

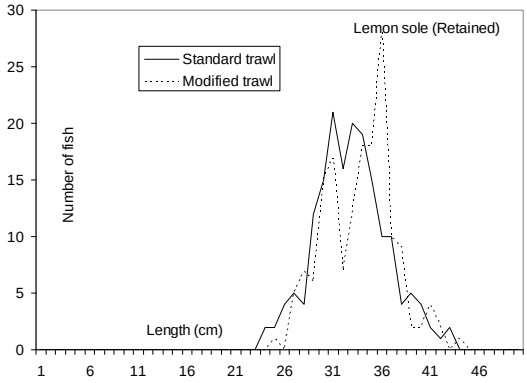
Example length – frequencies of ***retained*** fish caught during Cefas observed trips











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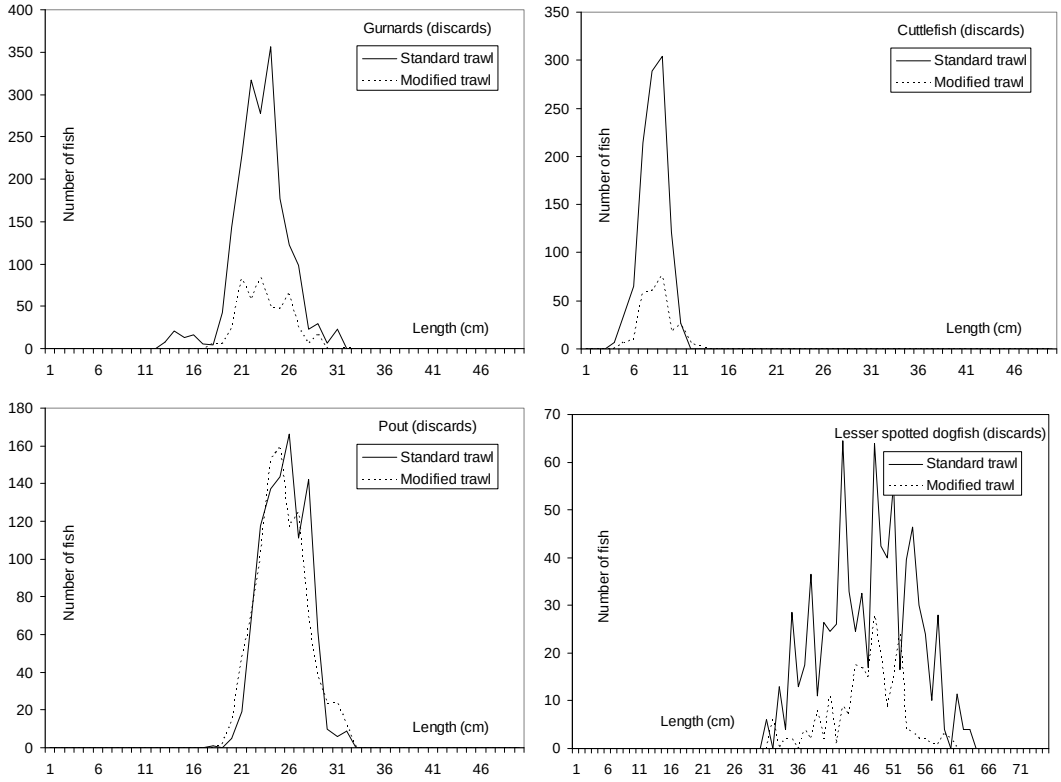
Lady T Emiel

Example length – frequencies of ***discarded*** fish caught during Cefas observed trips



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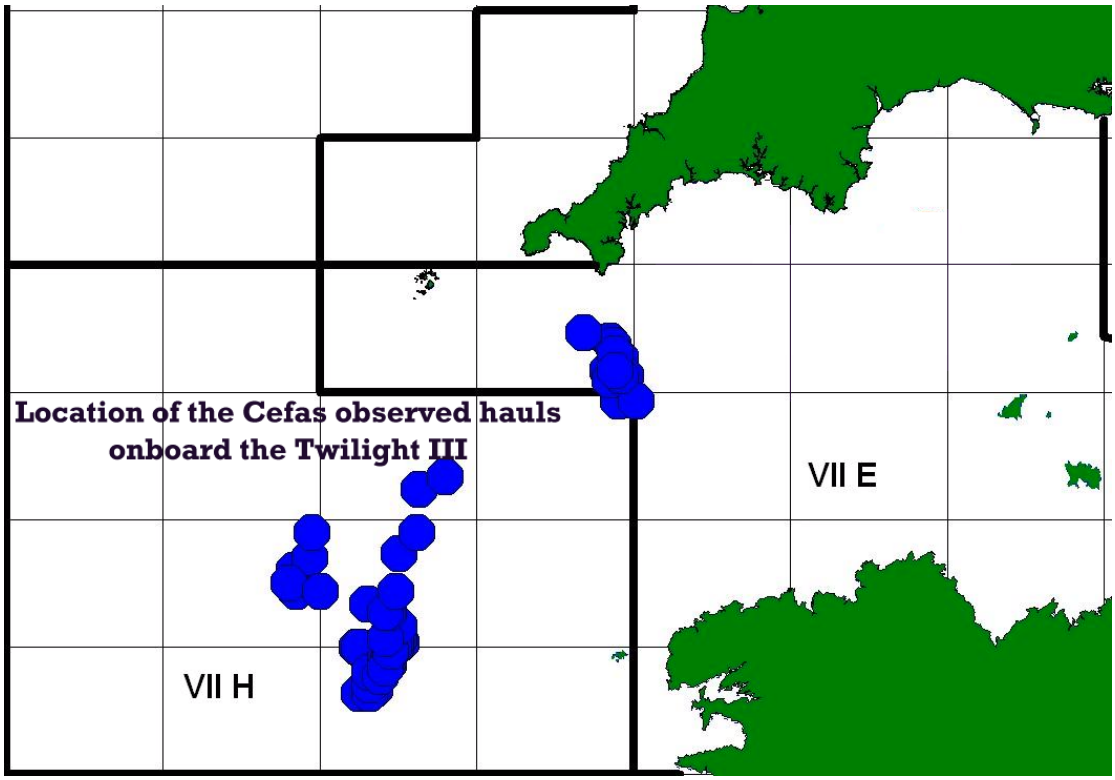
Twilight III

Twilight III
Location of the Cefas observed hauls onboard the Twilight III



Cefas project code C2598 funded by FIFG grant No 06/ENG/46/01 (FGE 326) and Defra R & D project M 0738

Twilight III
Summarised fish totals from the catches from the paired hauls (as sampled by Cefas onboard observers)

Retained Fish

SPECIES	Number caught in standard trawl (S)	Number caught in modified trawl (M)	M/S (%)
Major high-value species			
CUTTLE	2,681	3,005	112%
SCALLOP	2,610	1,297	50%
MEGRIM	1,982	1,792	90%
MONKFISH	1,910	1,730	91%
LEMON SOLE	747	613	82%
RED MULLET	642	637	99%
SQUID	231	137	59%
WHITE ANGLER	151	100	66%
DOVER SOLE	126	104	83%
HADDOCK	77	77	101%
SAND SOLE	65	61	94%
JOHN DORY	60	48	80%
BRILL	37	20	54%
Total	11,318	9,621	85%
Lesser value species			
RED GURNARD	762	529	69%
CUCKOO RAY	364	303	83%
BROWN CRAB	84	62	74%
TUB GURNARD	62	27	44%
POUT	60	67	112%
POLLOCK	57	25	44%
LING	50	37	74%
OTHER SPECIES	141	93	66%
Total	1,579	1,143	72%

Discarded Fish

SPECIES	Number caught in standard trawl (S)	Number caught in modified trawl (M)	M/S (%)
RED GURNARD	4,161	2,486	60%
BOARFISH	3,533	2,089	59%
CUTTLEFISH	2,068	823	40%
DOG FISH	1,763	942	53%
IMPERIAL SCALDFISH	1,218	779	64%
POOR COD	1,150	1,232	107%
COMMON DRAGONET	863	694	80%
SCALLOP	338	105	31%
MEGRIM	211	78	37%
CUCKOO RAY	187	160	86%
SQUID	179	75	42%
MONKFISH	136	93	68%
HADDOCK	105	106	101%
ARGENTINE	103	33	32%
BLUE WHITING	92	71	77%
THICK BACK SOLE	81	8	10%
LEMON SOLE	76	67	88%
POUT	63	61	97%
MACKEREL	60	51	85%
RED MULLET	48	41	85%
OTHER SPECIES	213	149	70%
Total	16,646	10,143	61%

Cefas project code C2598 funded by FIFG grant No 06/ENG/46/01 (FGE 326) and Defra R & D project M 0738

Twilight III
Summarised totals (baskets) of discards (invertebrates and fish) caught from the paired hauls (as sampled by Cefas onboard observers)

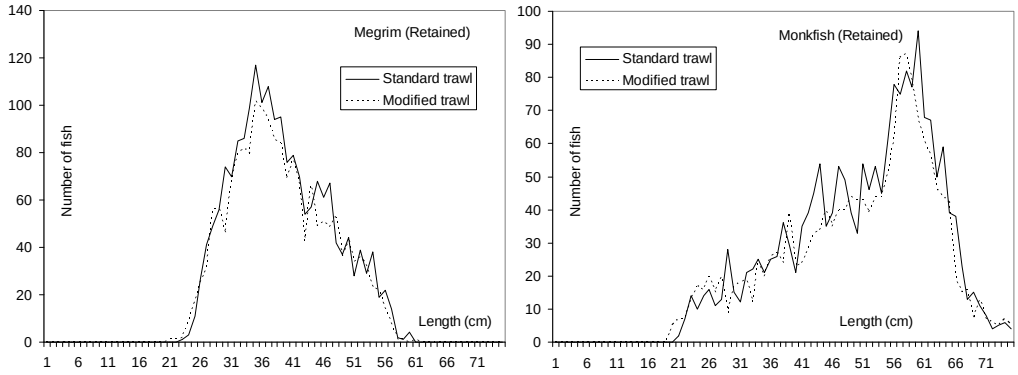
Discards: Number of baskets caught (Fish and invertebrates combined)

Haul Number	Standard trawl (S)	Modified trawl (M)	M/S (%)
1	7	4	57%
2	4.5	5	111%
3	7	4	57%
4	4	4	100%
5	4.5	4	89%
6	4.5	3	67%
7	3.5	2	57%
8	3.5	2	57%
9	4	2.5	63%
10	2.5	2	80%
11	4	1.5	38%
12	4	2	50%
13	3	1.25	42%
14	2	1.25	63%
15	2	1	50%
16	2.25	1.25	56%
17	3	1.25	42%
18	3	1.5	50%
19	3	2	67%
20	2	2	100%
21	3	3	100%
22	4	3	75%
23	3	2	67%
24	3	2.5	83%
25	4	2.5	63%
26	2	1	50%
27	2	1	50%
28	3	2	67%
29	3	2	67%
30	2.5	1	40%
31	2	1	50%
32	2.5	1.5	60%
33	3	1.5	50%
34	4	1.5	38%
35	5	2	40%
36	3.5	1.5	43%
37	4	2	50%
38	5	2	40%
39	3.5	1.5	43%
40	4	2	50%
41	3	2	67%
42	4	2	50%
43	5	4	80%
44	3.5	3	86%
45	3.5	2.5	71%
46	4	2.5	63%
47	4.5	2.5	56%
48	4	2.5	63%
49	3.5	2	57%
50	2	1.5	75%
51	3.5	2	57%
52	4	2	50%
53	2.25	1.5	67%
54	3	1.5	50%
55	2.5	0.5	20%
56	3	2	67%
57	3	1.5	50%
58	3	1.5	50%
59	3	2.5	83%
60	3.5	3	86%
61	3	2	67%
62	2.5	1.75	70%
63	2.25	1.5	67%
64	3	2.5	83%
65	3.5	2	57%
66	3	1.5	50%
67	2.5	1.75	70%
68	2.25	1.75	78%
69	2.25	2	89%
70	2	1.5	75%
71	2.75	2	73%
72	2	1.5	75%
73	2.5	2	80%
74	2.5	2.25	90%
75	2	1.25	63%
76	3	1.75	58%
77	2.5	1.1	44%
Total	250.5	156.6	63%

Twilight III

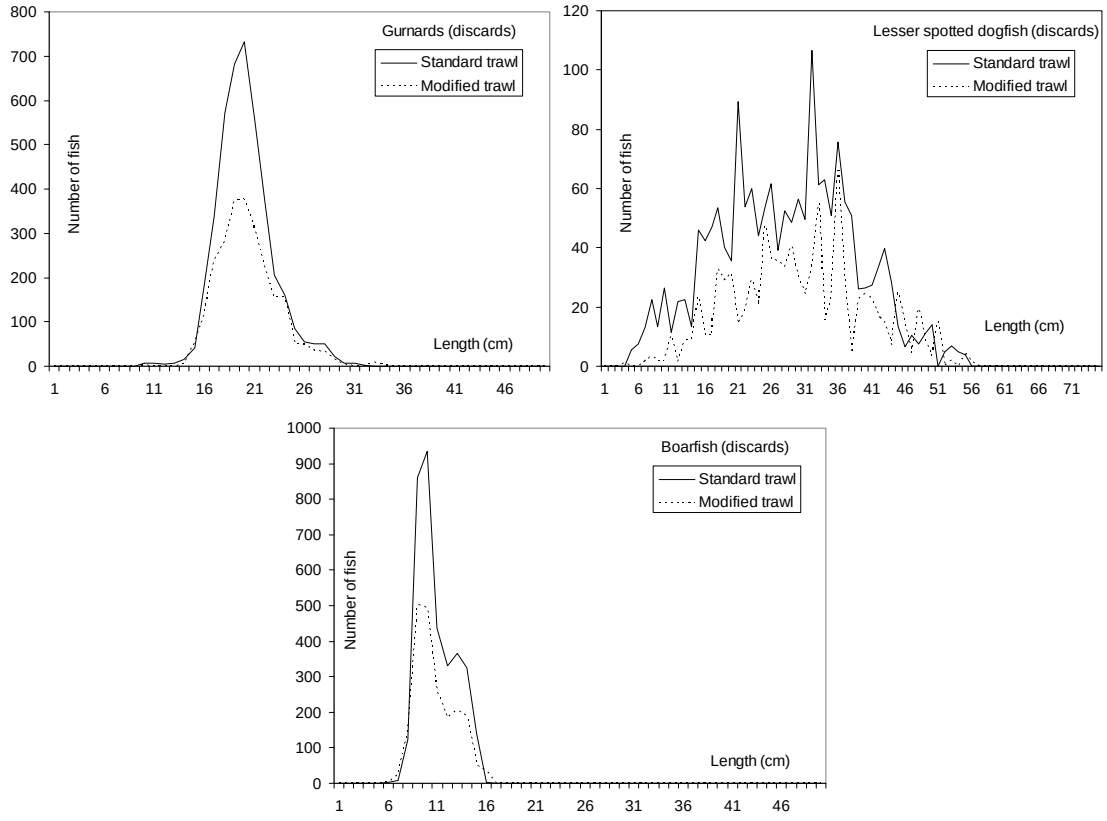
This competition was jointly funded by an FIFG grant No FGE 326 and the Defra funded R & D project MF 0738

Example length – frequencies of ***retained*** fish caught during Cefas observed trips

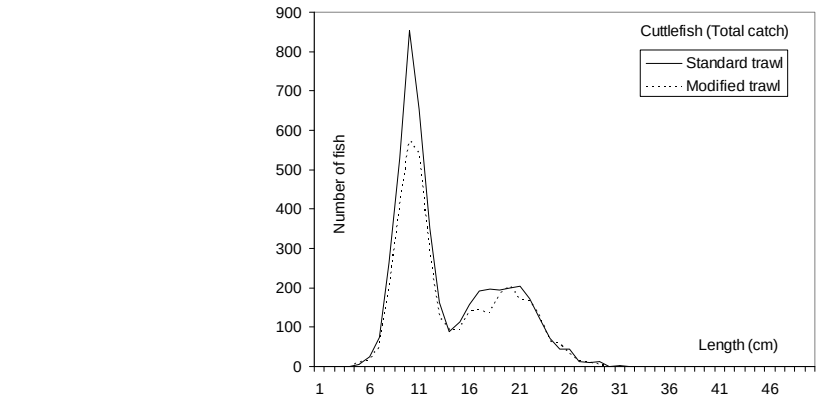


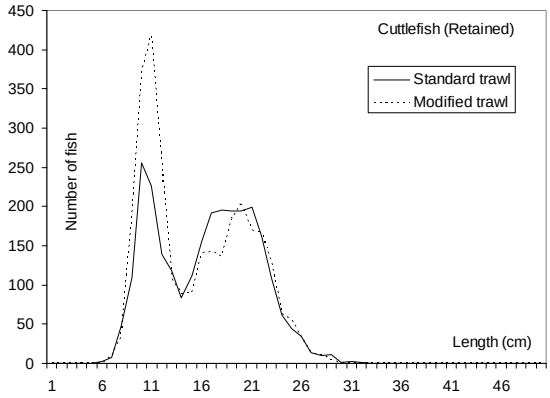
Twilight III

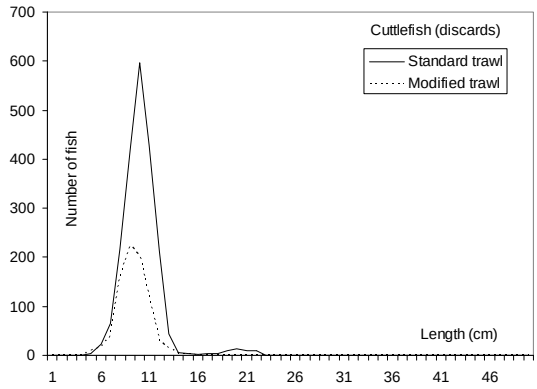
Example length – frequencies of ***discarded*** fish caught during Cefas observed trips



Twilight III
Length – frequencies of ***cuttlefish*** caught during Cefas observed trips







1.8. Competition rules and entry pack

Clean Fishing

COMPETITION

Competition entrant instructions

a. Your entry pack should contain the following information:

1. **Entry instructions**
2. **Press release about the competition**
3. **Entry form and competition rules**
4. **Clean fishing competition leaflet**
5. **Competition timetable**
6. **Report on fleet trials with the benthos release panel (Mar 2005)**

b. Please read the rules and all other information supplied carefully

c. If you wish to enter the competition, please complete your entry form with your idea(s) and send it to:

Clean Fishing Competition 2006 Cefas (Samsu office), Pakefield Road, Lowestoft, Suffolk, NR33 0HT

d. Please make sure the entry form is signed by the entrant, skipper and vessel owner. These may be the same person in some cases. Only fully completed forms can be accepted.

e. Completed entry forms must reach Cefas by no later than 5pm 31st August 2006.

f. We will inform you as whether your entry idea has been selected for the trialling in the sea-trials phase of the competition by 14th September 2006.

Thank you for your interest in this competition

Kind regards -Andy Revill (Cefas)

Press release

"Clean fishing" methods could net £20,000 prize money

Andy Revill writes about Cefas' new competition for innovative trawling gear

Cefas are launching a new competition for good ideas that reduce discards. Named the "Clean Fishing" competition, the aim is to encourage SW beam trawler men to modify their trawls to avoid netting unwanted species.

Competition prize monies totalling £20,000 will be awarded for the best ideas. First prize will be £12,000; two runners-up prizes of £4,000 are also up for grabs. The competition begins in September 2006 but entrants must register by 31 August 2006.

Progress already made
Cefas has been working with various SW beam-trawler skippers, owners and net makers in recent years to develop simple trawl modifications that reduce discard levels of unwanted fish and invertebrates, etc. These were designed to ensure "cleaner" catches, with far fewer discards of untargeted species. Considerable progress was made using a simple square-mesh "drop-out" panel fitted to the aft belly of the beam trawl. Although this panel produced much cleaner catches, several skippers found some practical problems: weed build-up, stone entrapment, etc. This competition is seen as a novel and practical way with which to continue the good progress already made in this area.

Competition entrants are encouraged to build on this existing work and develop modifications to resolve such panel problems. Alternatively, entrants could develop completely new ways to produce cleaner catches by altering the ground gear or the cod-end, etc. The competition is supported by an FIFG grant and will be restricted to entrants with access to an operational and fully licensed SW whitefish beam trawler. However, if this competition is successful, further competitions could be held in the future for other fleet sectors where cleaner fishing is also more desirable.

Benefits
Economically and environmentally it is desirable to fish by cleaner methods, whereby discarding is kept to an absolute minimum. Cleaner fishing could potentially result in higher-quality catches and better prices at market.

Reducing discards also has many conservation benefits, as it lessens the overall environmental impact of the fishery on the supporting marine ecosystem. Beam trawling is known to reduce productivity and diversity within the marine ecosystem. This type of fishing often means that fish and invertebrate discards are at a high level. Keeping discards to a minimum, consequently, will help to conserve precious stocks.

Judges
Former skipper/owner, John Hingley, will act as an independent evaluator throughout the competition and make formal assessments of the entrants' ideas during the sea trials phase of the competition. An independent judging panel will ultimately make the awards for the best ideas. These judges will be drawn from organisations such as Seafish, fishermen's organisations, Defra as well as an international expert fisheries scientist

John Hingley said: "I think this is a worthwhile and positive idea from Cefas and means that fishermen will be involved and proactive. Potentially, there may be benefits for catch quality, reduced wear and tear on the trawls, and possibly even fuel savings. I am pleased to be involved with this competition."

Competition rules
Entrants need to register for the competition by 31 August 2006. They then must demonstrate their idea works, specifically by using it onboard a UK-registered SW-based beam trawler under commercial fishing conditions for a period of around six months. The entrants will be expected to provide documentary evidence of their success to the judging panel. The independent evaluator (John Hingley) will also provide his own assessment of the entrants' ideas. John will have gained his insight by keeping up regular contact with the entrants and by spending time at sea onboard the entrant's vessels during the sea trials.

The judging panel will decide the winners and award the prizes when they meet in April 2007.

Cefas must receive completed entry forms by no later than 31 August 2006. Full instructions on how to register are detailed in the competition pack, which can be obtained from:

Clean Fishing Competition 2006
Cefas
(Samsu office)
Pakefield Road
Lowestoft, Suffolk
NR33 0HT

Entry form and competition rules

CLEAN FISHING COMPETITION ENTRY FORM

(to be returned to *Clean Fishing Competition 2006* Cefas (Samsu office), Pakefield Road, Lowestoft, Suffolk, NR33 0HT by 31 August 2006)

For office use only: ***Date received:***

Entrant name	
Address	
Telephone number	
Email	
Vessel name, home port and registration number	
Proposal (outline of proposed modification to be tested). Continue on a separate sheet if required.	
Skipper's signature*	
Owner's signature*	
Entrants signature*	
Date	

By signing this form you are accepting the attached Terms and Conditions. Owners/skippers are giving permission for the vessel to be used for the duration of the competition.
Your contact details will only be used for this competition and not passed on to any third parties.

Clean Fishing Competition Rules:

1. Entrants are required to send their proposals on the attached form to Cefas by 31 August 2006.

2. The competition will consist of submission of a proposal for fishing gear modification trials in UK waters over the period 14 September 2006 to 28 February 2007. Entrants must be available to complete the trials during this period.

3. Entrants must have access to an operational and fully licenced SW whitefish commercial beam trawler for the duration of the trial period and have the permission of the vessel's skipper and owner to participate in the trial.

4. All proposals will be considered by a Cefas evaluator, and all entrants will be notified whether their proposal has been accepted for the sea trials phase or not. In considering proposals, the evaluator will look for evidence that the proposal is technically feasible and reasonably inexpensive to set up and operate.

5. In the event of two or more identical acceptable proposals being received from different entrants, the evaluator will decide how many of the proposals to accept depending on the overall number of proposals. If it is deemed necessary by the evaluator to choose to accept only some of the identical proposals, the proposals received first will be accepted.

6. Entrants whose proposals are accepted for the trials stage will be required to confirm their participation in the trials, and in doing so, they agree to be monitored by an independent evaluator during the trial. This will involve collaboration with the independent evaluator who will assess the efficacy of the modified fishing gear during the trial.

7. In the event that an entrant abandons the trial before completion, they must inform Cefas and their competition entry will be withdrawn.

8. Following the completion of the trials, entrants will be encouraged to send a short report to Cefas by 28 February 2007, outlining the results of the trial and any relevant observations.

9. The judges will decide on the winning entrant(s) based on the information collected from the trial monitoring and any available entrants' reports. In reaching their decisions, the judges will consider:
    - Cost of purchase of the technology
    - Cost of fitting / rigging of the technology
    - Ease of fitting / rigging of the technology
    - Durability of the technology
    - Evidence that the technology has functioned consistently over time (i.e. 6 months +)
    - Ability of the technology to produce clean catches (reduction in non target species bycatch)
    - Losses of marketable sized fish and associated revenue due to the technology
    - Transferability of the technology to other vessels
    - Range of conditions under which the technology is functional (areas, seasons)

- The quality of the supporting evidence
- Co-operation with the independent evaluator

10. The prize money will be to the total value of £20,000, which will consist of a prize for each of the top 3 proposals decided by the judging panel based on the above criteria. The value of each of these 3 prizes will one prize of £12,000 and two runners up prizes of £4,000 each. Prizes will be awarded to the named entrant(s) specified on the competition entry form.

11. Winning Entrants will be notified by telephone by 30 April 2007 and may be invited to a reception to receive their prize. Winners will be required to take part in publicity relating to their competition win in order to promote the winning modification(s). This and any subsequent publicity will allow free use and industry-wide promotion of the winning ideas, placing them in the public domain. All other entrants will be notified by letter that they have not won, and be given an outline of the winning modification(s) in order to share best practice. No further correspondence will be entered into by the evaluators or the judges.

Leaflet

Clean Fishing

COMPETITION

£20,000 prize money

Cefas are launching a new competition for good ideas that reduce discards. Named the "Clean Fishing" competition, the aim is to encourage SW beam trawler men to modify their trawls to avoid netting unwanted species.

Competition prize monies totalling £20,000 will be awarded for the best ideas. First prize will be £12,000; two runners-up prizes of £4,000 are also up for grabs. The competition begins in September 2006 but entrants must register by 31 August 2006.

Competition rules
Registered entrants must demonstrate their idea works, specifically by using it onboard a UK-registered SW-based beam trawler under commercial fishing conditions for a period of around six months. The entrants will be expected to provide documentary evidence of their success to a judging panel in April 2007.

Full instructions on how to register and competition details are detailed in the competition pack, which can be obtained from:

'Clean Fishing Competition 2006'
Cefas , (Samsu office), Pakefield Road, Lowestoft, Suffolk, NR33 0HT

Cefas

Timetable

Clean Fishing

COMPETITION TIMETABLE

- **Closing date for proposals 31 August 2006.**
- **Evaluation of proposals by 14 September 2006.**
- **Notify entrants of acceptance or rejection for trials by 14 September 2006.**
- **Entrants to confirm trial participation to Cefas by 30 September 2006.**
- **Entrants commence trial by 1 October 2006.**
- **Entrants complete trial by 28 February 2007.**
- **Entrants send (optional) short trial report to Cefas* by 28 February 2007.**
- **Evaluation of trials and decision on winners and prize money allocation by 14 April 2007.**
- **Notify all entrants of results by 30 April 2007.**
- **Prize awards in May 2007**

**Clean Fishing Competition 2006* Cefas (Samsu office), Pakefield Road, Lowestoft, Suffolk, NR33 0HT

1.9. Background paper on discarding in the South west (ICES sub-area VII)

Available online at www.sciencedirect.com
ScienceDirect
Fisheries Research xxx (2007) xxx–xxx
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www.elsevier.com/locate/fishres

Discarding in the English Channel, Western approaches, Celtic and Irish seas (ICES subarea VII)

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Abstract

Discarding is a common feature throughout global fisheries and of widespread management concern. The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) catch and discard data collection programme has been conducting sampling operations on English and Welsh registered fishing vessels in the International Council for the Exploration of the Sea (ICES) subarea VII since 2002. Within this subarea, these vessels were found to mainly operate in the English Channel, Western approaches, Celtic and Irish sea. We present the findings of this work and estimate the annual quantities of discards (fish and cephalopods) in terms of numbers and weights between 2002 and 2005. Our analysis was conducted on 3643 hauls from 306 trips aboard commercial fishing vessels (142 different boats). An estimated 186 million (72,000 t) fish and cephalopods were caught every year of which 117 million (24,500 t) were discarded. Beam trawlers and otter trawlers were together responsible for more than 90% of these discards. In all, 182 fish and cephalopod species were caught, yet just 10 species constituted more than 50% (61.5 million) of the annual discards. We estimate that discarding levels in the region are higher (1.5×) than recently reported by the FAO.

Keywords: Discards; By-catch; English Channel; Western approaches; Celtic sea; Irish sea

1. Introduction

Discards (or discarded catch) is defined as that portion of the total organic material of animal origin in the catch, which is thrown away or dumped at sea for whatever reason (Kelleher, 2005). Discarding is a global phenomenon commonly acknowledged by fishers, the scientific community and public as a waste of natural resources. The most recent estimate of annual global discarding was 7.3 million tonnes (Kelleher, 2005). In addition to contributing towards significant unwanted mortalities (Alverson et al., 1994; Alverson, 1998; Kelleher, 2005), studies have shown that discards may cause a range of wider ecological impacts. These include alterations in predator–prey relationships in many seabird communities (Furness, 2003; Votier et al., 2004) and changes in benthic community structure (Brown et al., 2005; van Marlen et al., 1998) and marine mammal feeding habits (van Opzeeland et al., 2005).

The importance of quantifying discarding and integrating the data into sustainable management programmes is becoming more widely recognised. The United States Sustainable Fisheries Act, 1996 (Magnusun-Stevens, 1996), and European legislation EC 1639/2001 (Anon, 2002) both identify the need to collect accurate discard data and lay out guidelines for their subsequent collection. The work presented in this paper is a result of the latter EC legislation.

The majority of European Union (EU) waters lie within the Food and Agriculture Organisation (FAO) major sea-area 27, recently reported by Kelleher (2005) to generate one-fifth of the worlds discards annually. ICES subarea VII (English Channel, Irish sea, Celtic sea and Western approaches) is contained within FAO area 27 (Fig. 1). In total the area covers over 700,000 km^2 (twice the size of Germany), encompassing >9000 km of coastline and borders with the UK, Ireland and France. It supports diverse marine habitats that range from abyssal depths in the North-eastern Atlantic Ocean (the Porcupine Abyssal Plain) to the shallow waters of the Irish sea.

The fisheries in the area are diverse and, in the past 32 years, vessels originating from 27 nations have landed more than 300

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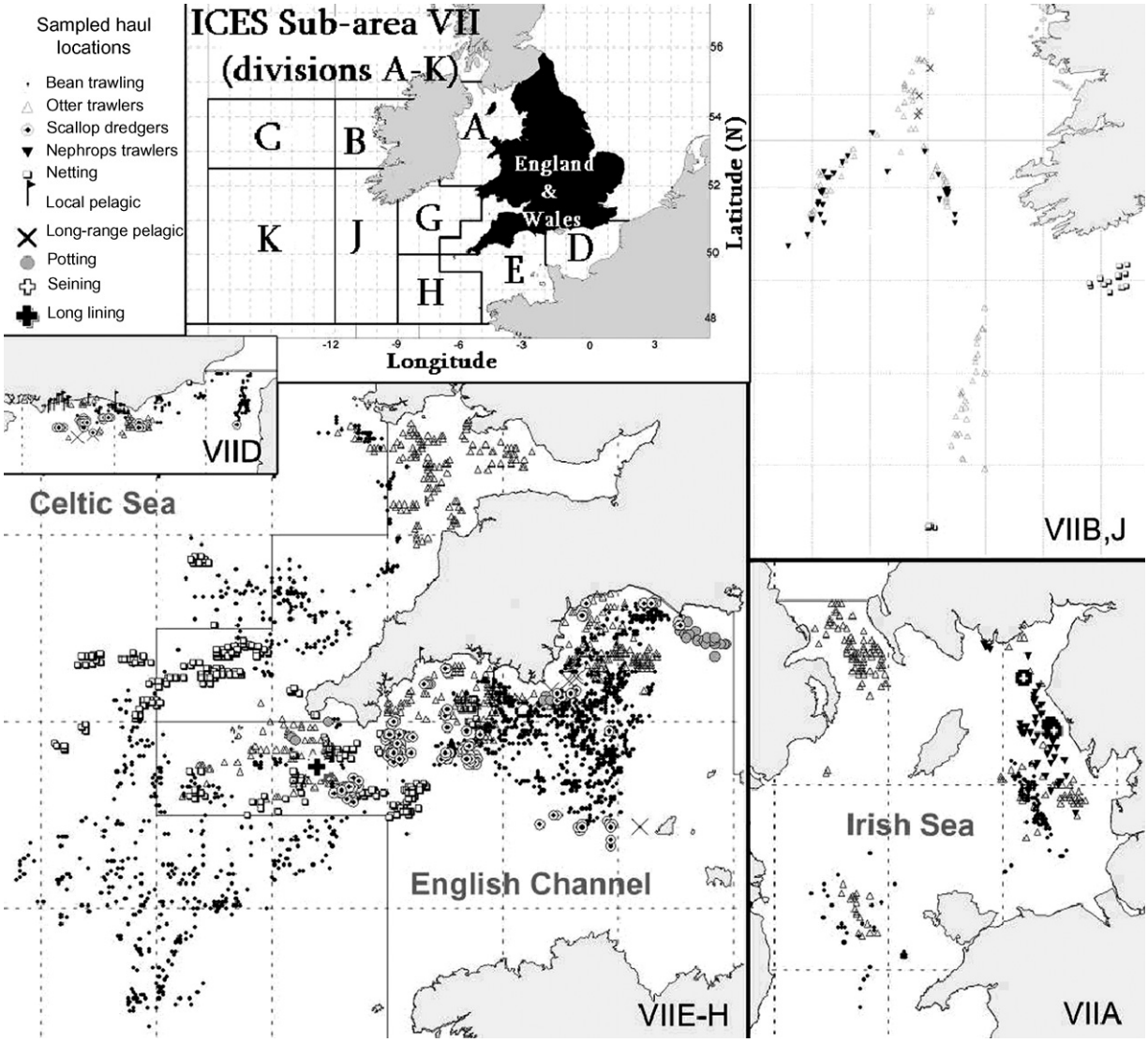

Fig. 1. Map of ICES sub-area VII (divisions A–K) and plots of haul sample locations by gear group.

commercially important species. Species targeted have ranged from primary producers such as marine plants, to top predators, including mako (*Isurus oxyrhinchus*) and porbeagle (*Lamna nasus*) sharks.

From 2002 to 2005, 14% of the total fish and cephalopod landings (by weight) in ICES subarea VII were caught by fishing vessels registered in England and Wales (the study fleet), with an average value of €98 million per year. This work describes catch and discard data collected in subarea VII over a 4-year period (2002–2005) onboard fishing vessels registered in England and Wales and ≥10 m in length overall. We quantify the scale of discarding that has occurred and describe the spatial, temporal and gear relationships to these discards.

When considering discarding, fisheries managers are primarily concerned with the following three issues:

(a) Does it occur?
(b) Does it matter?
(c) What can be done about it?

In this work, we focus on answering the first question. Subsequent papers will directly deal with the remaining issues.

2. Materials and methods

2.1. The CEFAS catch and discard sampling programme

In accordance with EC data collection regulation (1639/2001), the CEFAS catch and discard data collection programme has been monitoring catch components of vessels registered in England and Wales conducting fishing operations in ICES subarea VII since 2002 (Figs. 1 and 2).

Vessel sampling was stratified by gear type proportional to effort corresponding to the same quarter from the previous year. Effort data were taken from the official statistics held by the Department for Environment, Fisheries and Rural Affairs (DEFRA) Fishing Activities Database (FAD). Each quarter, a list of vessels fulfilling the sampling criteria (English/Welsh registered and ≥10 m registered length) was drawn from FAD and a

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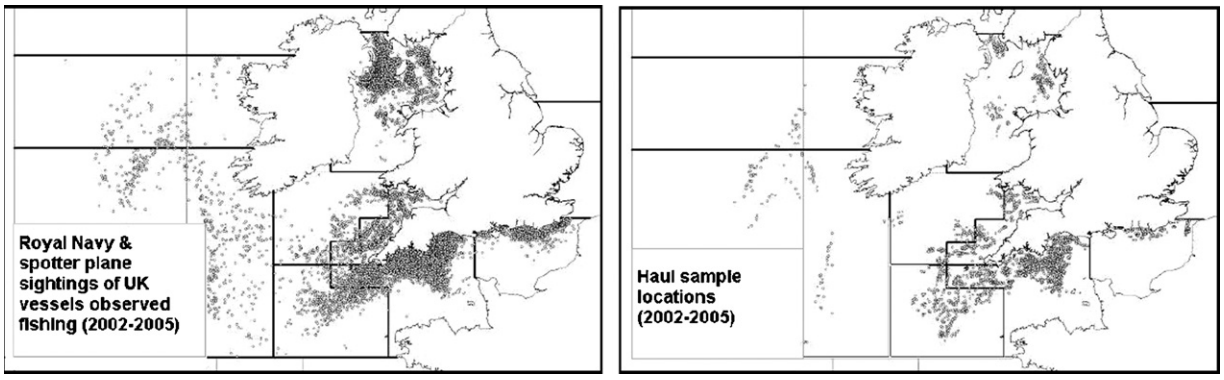

Fig. 2. Map of ICES sub-area VII showing comparisons between sightings data (2002–2005) of UK vessels observed fishing by Royal Navy vessels and DEFRA spotter planes and the CEFAS catch and discard sample locations.

list of vessels for sampling was randomly generated. Vessel participation in the discard programme has been on a voluntary basis and if a vessel was unavailable for sampling, the next vessel on the list was selected. When observers are onboard they do not interfere with fishing operations or influence fisher behaviour and so the data obtained reflects commercial reality. Comparisons between CEFAS catch sampling effort and UK fishing effort (observed between 2002 and 2005 by Royal Navy vessels and DEFRA spotter planes) are given in Fig. 2. These figures give a visual indication that the sampling coverage reflects that of the fleet's activities.

We classified the gear type of the fishing vessel in accordance with the DEFRA classification scheme. Since 2002, 19 gear types have been sampled in ICES subarea VII, which we have aggregated into ten gear groups for the purpose of this study (Table 1).

A minimum of 60% of hauls have been sampled by trained CEFAS observers on every trip and both the discarded and retained components were recorded. Haul sampling was conducted through a rolling period of 24 h to provide day and night coverage. For each haul, environmental conditions (sea state, wind strength/direction), physical conditions (depth, position, haul duration and gear properties) and the biological composition of the retained and discarded catch were recorded. Fish and cephalopods, herein referred to as fish, were measured to the nearest centimetre below (fish were measured to total length and cephalopods to mantle length). Observers aimed to get a representative length–frequency distribution (LFD) for each species on all sampled hauls.

2.2. Length–weight conversion

Fisheries data and studies therein are widely presented in terms of weight. Length data in this study were converted into weights to facilitate broader comparisons with other studies. In this study 182 species were caught and identified, of which length–weight conversion factors for 60 were available. These 60 species represent 98% of the total number of the fleet-raised fish. In total, 28 length–weight relationships were derived from weight-at-length data collected during CEFAS research vessel cruises in ICES sub-area VII between 2002 and 2005 (>40,000 weight-at-length records from 13 cruises). Weights were measured using a POLS marine balance (±2 g) and lengths measured to the nearest centimetre below. Where possible, mean weights for given lengths from the raw cruise data were used. For other lengths, length–weight regression curves were estimated as $W = aL^b$ where W is the estimated mean weight at a given length L using Sigma plot V8.0 software.

A further 32 length–weight relationships were sourced from scientific literature (Coull et al., 1989; Deniel, 1984; Dorel,

Table 1
Annual sampling effort by gear group and gear type

Gear group	Number of trips (number of sampled hauls)					Gear type
	2002	2003	2004	2005	Total	
Beam trawling	11 (306)	19 (569)	29 (776)	17 (448)	76 (2099)	Beam trawl
Otter trawling	18 (130)	33 (192)	55 (294)	40 (140)	146 (756)	Single, twin, triple, light, and heavy rigged demersal otter trawlers
Scallop dredging	–	9 (101)	9 (178)	4 (70)	22 (349)	Unspecified dredge
Nephrops trawling	2 (11)	3 (39)	7 (22)	1 (3)	13 (75)	Single, twin, triple rigged demersal trawls in a *Nephrops* directed fishery
Seining	1 (4)	–	1 (9)	–	2 (13)	Purse, pair fly, Scottish fly and Danish anchor seine
Local pelagic	–	3 (3)	2 (10)	2 (3)	7 (16)	Bottom pair trawl, mid-water trawl, mid-water pair trawl
Factory pelagic	–	1 (5)		1 (11)	2 (16)	Mid-water pair trawl (factory), mid-water trawl (factory)
Netting	3 (42)	8 (97)	12(119)	5 (60)	28 (318)	Trammel, tangle and unspecified gill nets
Potting	2 (N.A.)	3 (N.A.)	4 (N.A.)	–	9 (N.A.)	Top opening, side opening, parlour and mixed pots
Long-lining	–	–	1 (1)	–	1 (1)	Long-lines
Total	37 (493)	79 (1006)	120 (1409)	70 (735)	306 (3643)	

N.A.: data only available by trip for this gear group; –: no data.

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Table 2
Mean raising factors for sample to haul, trip and fleet by gear group

Gear group	Sample to haul raising factors		Haul to trip raising factor	Trip to fleet raising factors			
	Discarded	Retained		2002	2003	2004	2005
Beam trawling	8.7 (0.07)	1.6 (0.01)	1.53 (0.02)	257	149	87	141
Otter trawling	4.8 (0.09)	1.7 (0.02)	1.09 (0.01)	538	303	188	225
Scallop dredging	1.6 (0.05)	1.3 (0.03)	1.42 (0.06)	–	308	310	906
Nephrops trawling	9.7 (0.56)	1.4 (0.1)	1.03 (0.02)	72	21	4	119
Seining	4.4 (0.71)	3.1 (0.67)	1.00 (0.00)	24	–	22	–
Local pelagic	1.3 (0.09)	1.1 (0.01)	1.56 (0.17)	–	81	65	45
Factory pelagic	140.2 (62.22)	1390.0 (218.00)	1.30 (0.30)	–	9	–	17
Netting	1.4 (0.46)	1.1 (0.12)	1.09 (0.02)	630	219	146	336
Potting	4.2 (0.20)	5.1 (1.03)	1.27 (0.11)	2370	1540	1246	–
Long-lining	1.0 (N.A.)	1.0 (N.A.)	1.00 (N.A.)	–	–	91	–

Figure in parentheses refer to standard error of estimate. N.A.: insufficient data for estimation of S.E. –: no data.

1986; Froese and Pauly, 2006). Where possible, these were selected to match closely the ICES subarea and period of this study. They do not take into account variations in sex or season.

For the remaining 2% of fleet-raised fish numbers, an estimator for length–weight relationships is calculated by assuming $b = 3$ (Houghton and Flatman, 1978) and taking the mean value for the condition factor a from all the other species, i.e. $W = 0.041L^3$.

2.3. Raising raw catch data to fleet level

Catch and discard data have limited use at the sample level, so multipliers were used to raise the data to fleet level in order to provide more useful management information. Retained and discarded fish numbers for each species were initially raised to haul level as a proportion of the total catch using volume-based raising factors. The haul-raised data were further raised to trip level by multiplying against the haul sampling coverage (i.e. total hauls in trip/sampled hauls in trip). Annual trip numbers were extracted for each gear group from the FAD and divided by the numbers of trips sampled to generate the fleet raising factors (Table 2). The sampling unit (trip) was chosen as advised by Borges et al. (2005a). FAD data relating to pair trawlers were carefully treated to prevent double counting.

2.4. Catch per unit effort

Raw data were raised to haul level (see Section 2.4) and the total fish numbers obtained were divided by the haul duration to determine the numbers of fish caught per hour or catch per unit effort (CPUE). This unit allowed the catch data to be standardised and used for comparative analysis.

3. Results

3.1. Numbers and weights

An estimated annual-average of 186 million fish (72,000 t) was caught by English and Welsh commercial fishing vessels operating in ICES subarea VII. Of this total catch, 117 million fish (63%), equating to 24,500 t (35%), were subsequently discarded (Tables 3 and 4). The inter-annual variation of the estimated total number discarded/retained were most precise for the beam trawl and otter trawl gear groups (<±25%) and

Table 3
Mean annual estimates of fish numbers discarded in ICES sub-area VII by English and Welsh fishing vessels

Rank	Gear group	Number of fish ($\times 10^6$)				% discarded
		Discarded		Retained		
		Range	Mean	Range	Mean	
1	Beam trawling	55.1–81.3	68.5	23.5-37.3	28.2	71(1.6)
2	Otter trawling	31.4–47.7	41.6	19.4-28.0	22.8	64 (1.6)
3	Factory pelagic	0.4–13.6	7.0	8.9-46.5	27.7	14 (9.0)
4	Netting	0.4–2.2	1.2	1.2–3.7	2.1	36 (9.6)
5	*Nephrops* trawling	0.1–2.7	1.2	<0.1–0.3	0.1	*
6	Scallop dredging	0.3–3.1	1.2	1.2–0.3	0.9	*
7	Local pelagic	<0.1–1.4	0.6	0.1–2.0	0.8	34 (21.2)
8	Seining	<0.1–0.1	0.1	0.2–0.3	0.2	24 (6.8)
9	Potting	<0.1–<0.1	<0.1	<0.1–<0.1	<0.1	*
10	Long-lining	<0.1–<0.1	<0.1	<0.1–<0.1	<0.1	33 (N.A.)
Total		109.7–129.2	117.4	54.9–92.7	68.5	63 (3.1)

Ranking according to mean annual discard numbers. Figure in parentheses refer to standard error of annual estimate. N.A.: insufficient data for estimation of S.E. *Shellfish/crustacean targeted fisheries (shellfish/crustaceans not analysed in this work).

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Table 4
Mean annual estimates of fish weights discarded in ICES sub-area VII by English and Welsh fishing vessels

Rank	Gear group	Weight (t)				% discarded
		Discarded		Retained		
		Range	Mean	Range	Mean	
1	Beam trawling	11,152–12,938	12,356	12,888–24,290	17,905	42 (3.5)
2	Otter trawling	6,148–11,135	8,931	7,688–27,332	17,362	36 (5.4)
3	Netting	1,521–2,940	2,013	4,553–10,644	7,624	22 (1.8)
4	Factory pelagic	42–1,634	838	3,034–5,892	4,463	12 (10.2)
5	Scallop dredging	137–2,050	829	695–1,746	1,129	*
6	*Nephrops* trawling	9–411	206	2–230	87	*
7	Local pelagic	2–167	66	59–90	389	17 (14.2)
8	Potting	7–63	32	14–579	254	*
9	Seining	7–15	11	49–69	59	15 (3.2)
10	Long–lining	3-3	3	23–23	23	10 (N.A.)
Total		21,507–27,334	24,628	36,238–55,027	46,572	35 (3.0)

Ranking according to mean annual discard weight. Figure in parentheses refer to standard error of annual estimate. N.A.: insufficient data for estimation of S.E.
*Shellfish/crustacean targeted fisheries (shellfish/crustaceans not analysed in this work).

least precise for other gear groups such as factory pelagic, netting and *Nephrops* trawling.

Beam trawlers contributed 58% to the total number of the discards generated (68.5 million fish, 12,500 t) and otter trawlers, 35% (42 million fish, 9000 t (Tables 3 and 4)). Factory pelagic trawlers contributed 3% by number and the remaining gear groups (netters, *Nephrops* trawlers, scallop dredgers, local-pelagic trawlers, seiners, potters and long-liners) together contributed less than 4%.

Beam trawlers and otter trawlers discarded the highest proportion of their catches, which was 71% and 65%, respectively (Table 3). Factory pelagic vessels had the lowest discard rate (14%).

3.2. Species

Since 2002, 182 fish species have been recorded by observers during commercial fishing operations. Of these, 177 were subject to some discarding. Otter trawlers discarded 159 species, beam trawlers 139 species, *Nephrops* trawlers 67, netters 56, scallop dredgers 54 and all other gear groups fewer than 50 species. Otter trawlers discard on average 11 species per haul, beam trawlers and *Nephrops* trawlers 10 species per haul and the remaining gear groups, fewer than 10 species per haul (Table 5).

The 10 most discarded species (by number) and selected commercially important species were estimated for beam trawlers (Table 6), otter trawlers (Table 7) and all other gear groups (Table 8). In all, 53% (61.5 million) of ICES subarea VII total discards caught by beam and otter trawlers from 2002 to 2005 were just 10 species, gurnards [five species] (*Triglidae*), European plaice (*Pleuronectes platessa*), dab (*Limanda limanda*), lesser-spotted-dogfish (*Scyliorhinus canicula*), poor cod (*Trisopterus minutus*) and whiting (*Merlangius merlangus*).

Mackerel (*Scomber scombrus*), caught principally by pelagic fishing methods, is the dominant discard species in the "other" gear groups (Table 8). Other pelagic species, horse mackerel (*Trachurus trachurus*), pilchard (*Sardina* (*clupea*) *pilchardus*)

Table 5
Relative proportion of annual discards in each gear group

Rank	Gear group	Annual discards (%)		CPUE discarded (fish h^{-1})	Species per haul
		Number	Weight		
1	Beam trawling	58 (4.7)	50 (2.6)	313 (7.3)	10 (0.1)
2	Otter trawling	35 (3.4)	36 (3.8)	180 (12.4)	11 (0.2)
3	Factory pelagic	3 (5.6)	2 (3.0)	78,209 (68,027)	6 (0.6)
4	Netting	1 (0.4)	8 (1.2)	3 (0.7)	6 (0.2)
5	*Nephrops* trawling	1 (0.4)	<1 (0.5)	398 (63.5)	10 (0.3)
6	Scallop dredging	1 (0.8)	3 (2.3)	8 (0.5)	3 (0.1)
7	Local pelagic	<1(0.4)	<1(0.2)	194 (95.7)	6 (1.7)
8	Seining	<1 (0.0)	<1(0.0)	246 (57.1)	6 (0.4)
9	Potting	<1(0.0)	<1 (0.1)	0 (0)	1 (N.A.)
10	Long-lining	<1 (N.A.)	<1(N.A.)	0 (N.A.)	1 (N.A.)
Total		100	100		

Ranking according to percentage of fish numbers discarded by gear group. Figure in parentheses refer to standard error of estimate. N.A.: insufficient data for estimation of S.E.

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Table 6
Top 10 most discarded species and significant commercial species by English and Welsh registered beam trawlers

Rank	Common name	Latin name	Numbers ($\times 10^6$)		% discarded
			Annual mean	Range	
1	Gurnards	*Trigla* spp.	9.9	6.4–14.9	82 (4.6)
2	Common Cuttlefish	*Sepia officinalis*	7.9	1.4–13.4	58 (5.0)
3	European plaice	*Pleuronectes platessa*	7.2	0.6–23.4	43 (11.4)
4	Dab	*Limanda limanda*	6.8	2.7–15.2	97 (1.1)
5	Lesser-spotted dogfish	*Scyliorhinus canicula*	6.4	5.0–8.5	99 (0.6)
6	Poor cod	*Trisopterus minutus*	5.2	3.8–6.8	100 (0.0)
7	Dragonets	*Callionymidae*	4.9	3.2–6.1	100 (0.1)
8	Whiting-pout (Bib)	*Trisopterus luscus*	4.7	3.4–6.3	75 (5.2)
9	Whiting	*Merlangius merlangus*	2.2	0.6–3.4	83 (2.7)
10	Megrim	*Lepidorhombus whiffiagonis*	1.5	0.4–2.4	30 (3.0)
11	Anglerfish (Monk)	*Lophius piscatorius*	1.1	0.6–1.5	48 (2.9)
14	Lemon sole	*Microstomus kitt*	0.9	0.5–1.2	37 (1.2)
15	Cuckoo ray	*Raja naevus*	0.8	0.2–1.2	82 (2.7)
21	Red mullet	*Mullus surmuletus*	0.4	0.1–0.7	47 (4.1)
22	Spotted ray	*Raja montagui*	0.3	0.1–0.7	80 (4.5)
23	Sole (Dover sole)	*Solea solea* (*s. vulgaris*)	0.3	0.2–0.3	5 (0.6)
Rest (114 species)			8.0	6.4–10.8	80 (1.4)

Ranking according to annual mean discard numbers. Figure in parentheses refer to standard error of annual estimate.

and sprat (*Sprattus* (*clupea*) *sprattus*) are also discarded in large numbers.

3.3. Length–frequency distributions of retained and discarded fish

The length–frequency distributions (of all species combined) were derived from a total of 706,015 measured fish and are presented for beam trawlers, otter trawlers and all other gear groups (Fig. 3). These LFDs demonstrate that both the retained and discarded fish span a broad length range, and are indicative of the multi-species nature of these fisheries. The majority of discarded fish arising from beam and otter trawling are however, less than 30 cm in length.

3.4. Spatial trends using CPUE data

Mean CPUE data indicated that factory pelagic trawlers had the highest discard rate >78,000 fish per hour. However, haul-to-haul variation for this gear type was high (SE 68 027) and was mainly due to one haul, in which the discard CPUE was 1,103,409 fish/h. Variation in CPUE data for the other gear groups was considerably less (Table 5). *Nephrops* trawlers, beam trawlers, seiners, local-pelagic trawlers and otter trawlers on average discarded 398, 313, 245, and 180 fish/h, respectively. Netters, scallop dredgers, potters and long liners all discarded, on average, <10 fish/h (Table 5). Fish and cephalopods were discarded throughout most of area VII, however discarding 'hot-spots' where identified in the English Channel and Irish Sea

Table 7
Top 10 most discarded species, and significant commercial species by English and Welsh registered otter trawlers

Rank	Common name	Latin name	Numbers ($\times 10^6$)		% discarded
			Annual mean	Range	
1	Dab	*Limanda limanda*	6.2	3.0–14.0	96 (1.0)
2	Gurnards	*Trigla* spp.	5.2	1.3–11.1	70 (5.1)
3	European plaice	*Pleuronectes platessa*	3.6	1.8–6.3	60 (3.4)
4	Lesser-spotted dogfish	*Scyliorhinus canicula*	3.5	2.3–5.1	75 (7.3)
5	Whiting	*Merlangius merlangus*	3.1	1.1–4.6	68 (3.1)
6	Boar fish	*Capros aper*	2.4	0.1–6.0	100 (0.0)
7	Gt Silver Smelt	*Argentina silus*	2.8	0.0–8.3	100 (0.0)
8	Poor cod	*Trisopterus minutus*	2.0	0.8–3.3	100 (0.0)
9	Horse-mackerel (Scad)	*Trachurus trachurus*	1.8	0.5–3.5	81 (8.3)
10	Dragonets	*Callionymidae*	1.6	0.2–3.3	100 (0.1)
11	Megrim	*Lepidorhombus whiffiagonis*	1.2	0.0–4.3	33 (16.2)
15	Lemon sole	*Microstomus kitt*	0.6	0.0–1.0	23 (6.8)
17	Haddock	*Melanogrammus aeglefinus*	0.4	0.0–0.8	36 (10.5)
20	Thornback ray	*Raja clavata*	0.3	0.1–0.7	38 (6.2)
21	Greater Forkbeard	*Phycis blennoides*	0.4	0.0–1.1	53 (23.5)
Rest (144 species)			7.2	3.4–14.3	35 (5.5)

Ranking according to annual mean discard numbers. Figure in parentheses refer to standard error of annual estimate.

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Table 8
Top 10 most discarded species, and significant commercial species by all other gear groups registered to England and Wales

Rank	Common name	Latin name	Numbers ($\times 10^6$)		% discarded
			Annual mean	Range	
1	(European) Mackerel	*Scomber scombrus*	3.7	0.5–11.3	67 (19.5)
2	Common Cuttlefish	*Sepia officinalis*	0.8	0.0–2.3	82 (16.8)
3	Horse mackerel (Scad)	*Trachurus trachurus*	0.4	0.0–1.5	49 (26.7)
4	Whiting	*Merlangius merlangus*	0.4	0.1–1.1	62 (12.7)
5	Dab	*Limanda limanda*	0.4	0.1–1.1	100 (0.2)
6	European plaice	*Pleuronectes platessa*	0.3	0.1–0.7	58 (13.1)
7	Gurnards	*Trigla* spp	0.2	0.0–0.5	79 (7.8)
8	Lesser spotted dogfish	*Scyliorhinus canicula*	0.2	0.1–0.3	91 (8.6)
9	Sprat	*Sprattus* (*clupea*) *sprattus*	0.1	0.0–0.5	100 (0.0)
10	Pilchard	*Sardina* (*clupea*) *pilchardus*	0.1	0.0–0.4	75 (28.9)
13	Black seabream	*Spondyliosoma cantharus*	0.1	0.0–0.2	11 (4.8)
15	Anglerfish (Monk)	*Lophius piscatorius*	0.1	0.0–0.1	13 (4.1)
16	Cod	*Gadus morhua*	0.0	0.0–0.1	25 (14.2)
23	Pollack	*Pollachius pollachius*	0.0	0.0–0.1	6 (3.1)
26	European Hake	*Merluccius merluccius*	0.0	0.0–0.1	5.1 (0.5)
Rest (97 species)			0.9	0.4–1.9	37 (6.0)

Ranking according to annual mean discard numbers. Figure in parentheses refer to standard error of annual estimate.

(Fig. 4). The CPUE of discarded and retained fish were closely related and, in general, when retention of fish was high so was discarding. However, high discard rates were observed in regions of the Irish Sea, English Channel and Celtic Sea (Fig. 4).

3.5. Temporal trends using CPUE data

Aggregated by month, the discarded and retained CPUE data for beam trawlers and otter trawlers are presented in Fig. 5. Beam trawler monthly discards ranged from 162 to 610 fish per hour (Fig. 5a). Discard levels were highest during winter (November–February) due to large quantities of cuttlefish (*Sepia officinalis*), lesser-spotted dogfish, gurnards, dab and bib-pout (*Trisopterus luscus*) being discarded. Otter trawl monthly discards ranged from 64 to 318 fish/h (Fig. 5b). The rate of discarding was highest in summer (May–July) when high numbers of low-value species (dab, plaice, gurnards, dragonets (*Callionymidae*), horse mackerel, poor cod, lesser-spotted dogfish, whiting bib-pout and boar-fish (*Capros aper*)) were discarded. The discard CPUE for the other gear groups (aggregated together) was much lower (2–58 fish/h).

Seasonality was shown to have little effect on overall discard rates (amongst the 10 studied gear groups) when examining all species together. However, temporal patterns of discarding were observed using individual species CPUE data and gear types. Most notably, mackerel discards were highest for beam trawlers, otter trawlers and factory pelagic vessels during February and November, cuttlefish discards by beam trawlers peaked in December, and lemon sole discards were most prevalent in summer.

4. Discussion

The results of this study show average annual discards (2002–2005) of fish by English and Welsh >10 m LOA vessels as 24,500 t (117.4 million fish) and a discard rate of 35% by weight and 63% by number (Tables 3 and 4). Raising discard data to fleet level can be problematic and prone to uncertainty. However, in this work we have been able to gauge the accuracy of our estimates by contrasting them against the official landings statistics. More specifically, we compare our estimates of the total landings of non-quota species (raised from

Table 9
Comparisons between official landings figures for English and Welsh registered vessels (2002–2005) and those estimated by the catch sampling programme for a range of commercial non-quota species

Common name	Latin name	Estimated landings (t) as derived from catch sampling programme	Official reported landings (t)	% difference
Whiting-pout (Bib)	*Trisopterus luscus*	3,114	2,503	19.6
Dab	*Limanda limanda*	320	353	−10.1
John Dory	*Zeus faber*	707	807	−14.3
Lemon sole	*Microstomus kitt*	3,926	3,608	8.1
Ling	*Molva molva*	3,468	3,595	−3.6
Red mullet	*Mullus surmuletus*	660	615	6.8
Turbot	*Scophthalmus maximus*	940	1,189	−26.5
Black sea bream	*Spondyliosoma cantharus*	875	822	6.1
Total		14,010	13,492	3.7

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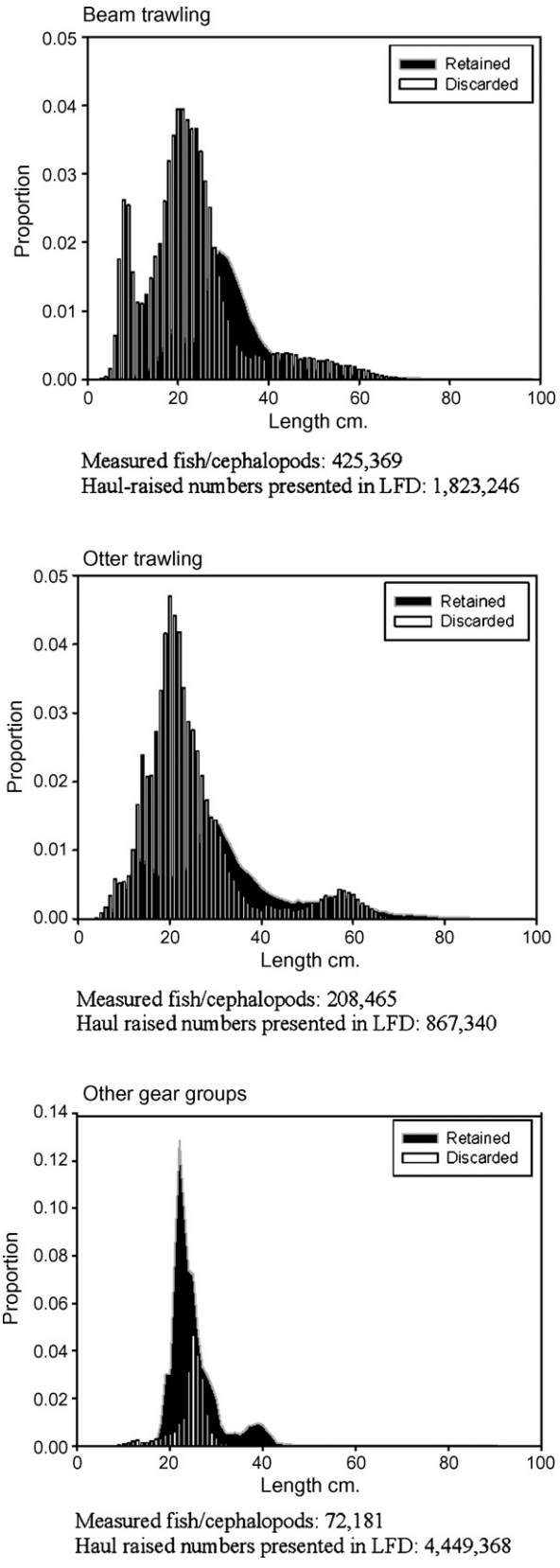

Fig. 3. Haul raised length–frequency distributions (2002–2005) for English and Welsh registered beam trawlers, otter trawlers and all other gear groups combined.

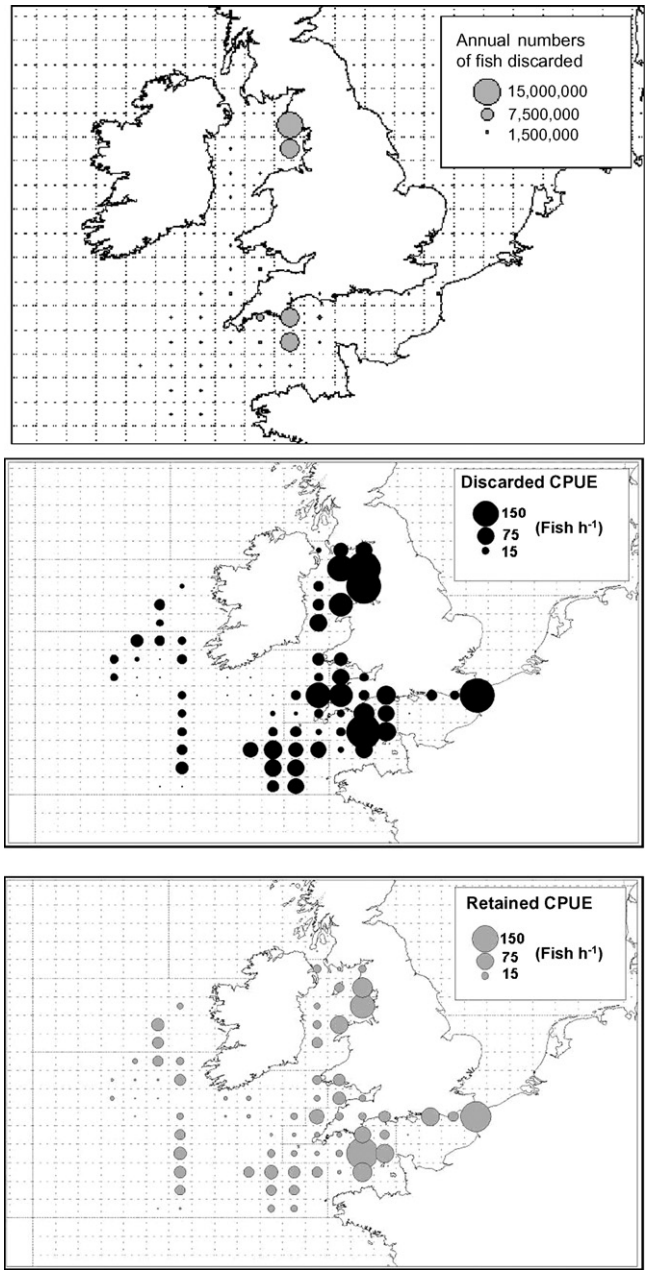

Fig. 4. Spatial distribution (top), discard CPUE (center) and retained CPUE (lower) of discarded fish and cephalopods by English and Welsh registered fishing vessels (2002–2005) in ICES sub-area VII.

the sampling programme) to the equivalent official landings. We use non-quota species for this comparison, as the official landings statistics for these species are likely to be the most accurate and the least prone to mis-reporting. Our comparison of the data from these two sources for the most commonly caught non-quota species ($n = 8$) shows close agreement (<4% difference for all the species pooled), while for individual species the differences range between 4 and 27% (Table 9). Having contrasted our sampling programme in this way against this independent data source (official landings statistics) leads us to conclude that our estimates are acceptably accurate.

Landings data from all countries exploiting stocks in ICES subarea VII show English and Welsh landings in this area to

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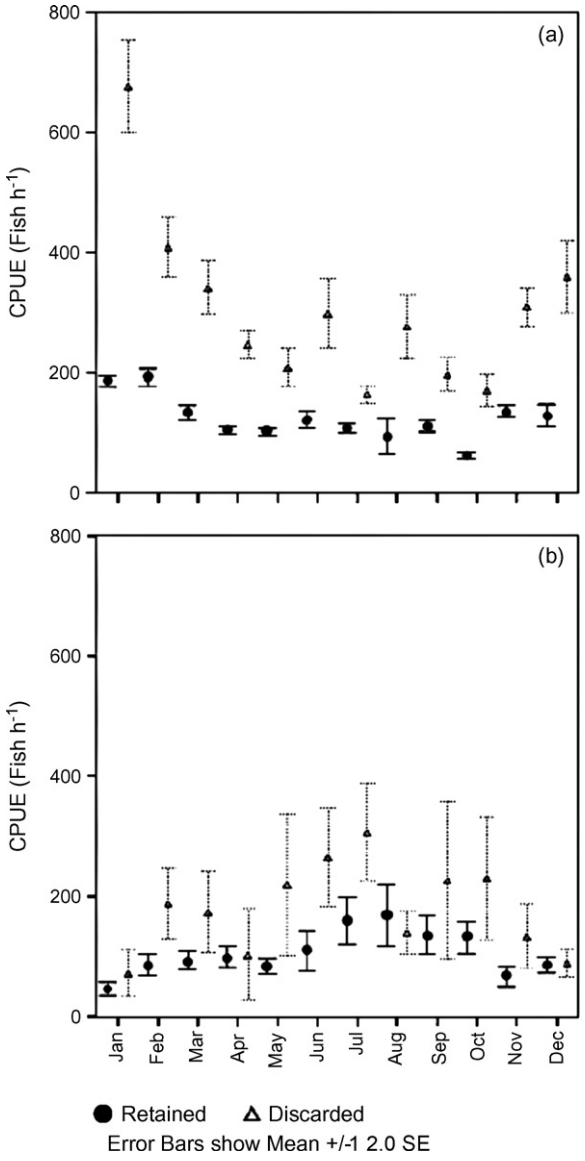

Fig. 5. Aggregated monthly CPUE data for retained and discarded fish and cephalopods caught by English and Welsh registered beam trawlers (a) and otter trawlers (b).

account for 6% of pelagic species and 24% of demersal fish species (11% in total). A figure for discarding for all of ICES subarea VII can be inferred. We use landings as the basis to produce multipliers for raising our discard data to all fleets operating within ICES subarea VII. This raising procedure assumes that the non-English and Welsh vessels operating in ICES subarea VII have comparable discard patterns to those identified in this study. This assumption is somewhat supported by other discard studies in the same regions (Melnychuk et al., 2001; Rochet et al., 2002; Borges et al., 2005a,b). Our estimate for annual fish and cephalopod discards within ICES subarea VII between 2002 and 2005 is 152,000 t. Kelleher (2005) presented data for discards in large marine ecosystem (LME) 24 (Celtic Sea, Bay of Biscay, Irish Sea, Western approaches, English Channel and Hebrides) at 100,893 t. Our estimate (which precludes information on <10 m vessels, shellfish, deepwater fleets and data for discarding in the Bay of Biscay and Hebrides fisheries) suggests that Kelleher (2005) may have under estimated discarding in LME 24 by at least 50%. If we are correct and Kelleher (2005) data for other areas is also correct, LME 24, previously ranked as 15th in the world for generating discards (Kelleher, 2005), would be ranked 7th. With the addition of the <10 m fleets, shellfish, deepwater fleets and data for discarding in the Bay of Biscay and Hebrides fisheries the ranking would be higher still.

Regional discard studies have presented comparable results. For example, Rochet et al. (2002) reported that French fleets fishing the Celtic Sea discard 32% of their catch by weight, compared with 35% by the English and Welsh fleets. Borges et al. (2005b) reported Irish beam trawlers to discard 67% of their catch by weight in ICES division VIIa (Irish Sea) against 42% presented in this study. Unlike most of ICES subarea VII, the Irish Sea is a shallow shelf sea fishery, supporting large numbers of juvenile fish (Dunn and Pawson, 2002; Borges et al., 2005a,b). To this end, the higher discarding levels observed by Borges et al. (2005a,b) may be accounted for by the aggregation of these data into ICES subarea level rather than division. *Nephrops* trawlers in ICES subarea VII predominantly fish in division VIIa (Fig. 1). Although effort by English and Welsh vessels is low (Table 1) *Nephrops* trawlers discard an average of 398 fish per hour, which is the highest rate observed by any of the demersal gear groups in this study (Table 5).

Although this study uses data collected from many trips and numerous fisheries around England and Wales, it has some limitations. Sampling coverage on longliners has been low, but reflects the relatively low effort of this gear group. Sampling aboard potters was discontinued in 2005 because data from the nine trips completed demonstrated a consistently low level of fish discards. The deep-water fleet (operating off the continental slope) has not been sampled owing to logistical restrictions. Although sampling coverage (Table 2) on factory pelagic vessels has been the greatest of all gear groups (as a proportion of fleet effort), the haul-to-haul variation in this gear group has produced the most variable estimates. Catch and discard data from the <10 m sector has not been collected to date. However, in 2006, the CEFAS catch and discard sampling programme started an assessment of this sector to address this issue.

Accurate information on discarding plays an integral role in establishing an ecosystem approach to fisheries, which has become a widely accepted approach to managing sustainable fisheries (FAO, 2003). Discarding has been shown to affect the dynamics of marine food-webs (Anker-Nilssen et al., 1997; Wright, 1996; Mangel and Switzer, 1998), leading to subsequent ramifications on recruitment and productivity of fish stocks (Sparre, 1991; ICES, 1997; Duplisea, 2005). Pascoe and Revill (2004) estimated that discards in the North Sea brown shrimp (*Crangon crangon*) fishery equated to losses of future landings of plaice of around 10–25% of the 1998 total allowable catch for plaice. Kell and Bromley (2004) demonstrated that if plaice discards in the North Sea could be eliminated or the survival of small fish increased, then recovery from low stock levels and/or high yields could be more readily achieved.

Fishers are not always in a position to reduce discarding and are often cautious of the short-term losses and poor

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incentives that can be associated with such practices (Jennings and Revill, in press). The LFDs of the catches (Fig. 3) indicate that fish are both retained and discarded across a wide length range and are typical of multi-species fisheries. It also demonstrates the complexity associated with developing discard mitigation measures (such as more selective fishing gears for example).

However, the growing climate of adverse public opinion on discarding may well force that situation to change. In any event, this work in ICES subarea VII has highlighted the fact that discarding may be higher than previously anticipated.

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