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Evidence of major fisheries impact on cold-water corals in the deep waters off the Porcupine Bank, west coast of Ireland: are interim management measures required?

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Abstract
Measures to conserve representative examples of cold-water coral reefs in Ireland through the designation of sites as Special Areas of Conservation (SACs) under the EC Habitats Directive are underway. However, evidence of damage to corals by fishing obtained during the RV Polarstern expedition ARK XIX Leg 3A to the Porcupine Sea Bight and Bank during summer 2003 suggest that more immediate management measures are required. A total of 9 dives were carried out with the IFREMER deep-sea 'VICTOR 6000' Remotely Operated Vehicle (ROV) on carbonate mound and deep-water coral locations in the study area. High resolution video and close-up digital stills were used to document the impact of fishing activity and the presence of lost gears. A series of mounds and scarps investigated along the western edge of the Porcupine Bank, in water depths of 600-1000m, were most severely impacted. One double mound system, named the Twin Mounds, appeared to be heavily trawled, as evidenced by the presence of trawl scars, barren sediment and flattened coral rubble. On the nearby Giant Mound, images of lost trawl gear filled with coral (some of it still living), provided clear evidence that reefs are being destroyed by present fishing activities. The results presented provide irrefutable proof of a serious threat from current fishing practices to the physical integrity of the pristine and physically complex deep-water coral ecosystem. The need for interim measures to protect deep-water corals in the period before SAC designation becomes effective is discussed.

Keywords: deep-water corals, fishing impacts, ecosystem management, Common Fisheries Policy

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Objectives of Paper

1. Provide a background to cold-water coral conservation efforts in Irish waters
2. Present evidence of recent fisheries related impacts to cold-water coral habitats in Irish waters

3. Discuss the need for an ecosystem approach to the management of deep-water fisheries in Irish waters.

Background to Conservation Efforts

Irish waters contain many outstanding examples of the cold-water coral habitat. The best developed of these are usually found close to the summit of 'giant' carbonate mounds. Several mound provinces exist in the Porcupine Seabight and Rockall Trough (Croker and O'Loughlin). Typically, they occur in water depths between 500 to 1200 m and vary from small structures of a few meters to over 300 m in height (Kenyon *et al.,* 1998; De Mol *et al.,* 2002). Densest living coral cover occurs on the summits of mounds where current flow is generally highest. Intensive study of mounds during a number of EU funded research programmes, particularly the Atlantic Coral Ecosystem Study (ACES) in each of these mound provinces has shown that coral associated biodiversity is rich (over 1300 species recorded) and varies from province to province (Freiwald *et al.,* 2004) but trophic relationships particularly for commercial species (fish and decapods) are still poorly understood (Grehan *et al.,* 2003).

Cold water coral habitat formed by the framework-building corals, e.g. *Lophelia pertusa* and *Madrepora oculata,* within the Exclusive Economic Zones (EEZs) of European nations may be protected under Annex I of the EU Habitats Directive (Natura Code 1170) (Long and Grehan, 2002). At the OSPAR/HELCOM Ministerial Meeting in Bremen in June, 2003, the Irish government made a commitment to designate a number of offshore Special Areas of Conservation (SAC) sites under the Habitats Directive, to protect cold-water corals under Irish jurisdiction. The Department of Environment, Heritage and Local Government, the competent Irish authority, has begun the process of SAC designation by gathering all relevant scientific data. Identification of potential SAC sites is expected by the end of 2004.

Fisheries Related Conservation Issues

In Norway, between 30 and 50% of known reefs have been impacted and anecdotal reports claim that trawlers have used gear, wires, chains and trawl doors to deliberately crush corals prior to fishing (Fosså *et al.,*2002). In the Southern Hemisphere, particularly in Australia and New Zealand, orange roughy fishing has had a major impact on seamount coral ecosystems (Probert *et al.,*1997, Koslow *et al.,*2000; Koslow *et al.,*2001). Almost 90% of corals have been removed in some areas (Koslow *et al.,*2001) which has prompted both Australia and New Zealand to create a network of seamount marine protected areas (Koslow, 2003).

In Ireland, coral by-catch has been recorded from deep-water trawl fisheries (BIM, 2001; Hall-Spencer *et al.,* 2002). Allegations of the deliberate damage of coral habitat similar to the practice described above in Norway were made at an ACES Scientist-Stakeholder workshop held in Galway in 2000. It quickly became apparent that little was known at that time about the distribution of deep-water corals in Irish waters, whether they were being damaged by anthropogenic impacts, or indeed, what legal instruments could be used to protect them if a threat to the future sustainability of the ecosystem was perceived (Grehan *et al.,* 2003).

An initial ROV survey of several mound locations supporting living coral habitat in the Porcupine Seabight and Rockall Trough in 2001 found no evidence of destructive trawling although lost static gears were imaged on some mounds (Grehan *et al.,* in press). It was thought that the steep sided slopes of many of these mounds made trawling difficult or impossible and

therefore conferred a degree of natural immunity from major disturbance by fishing. Since then however, deep-water fishing activity off the west coast of Ireland has intensified, particularly for orange roughy (Connolly, 2003).

Evidence of Recent Fisheries Impacts

Here we present some results from the RV Polarstern expedition ARK XIX Leg 3A to the Porcupine Sea Bight and Bank in June 2003. A total of 9 dives were carried out with the IFREMER deep-sea 'VICTOR 6000' Remotely Operated Vehicle (ROV) on carbonate mound and cold-water coral targets (Foubert *et al.*, in press; Wheeler *et al.*, in press; Fig. 1). High resolution video and close-up digital stills were used to document the impact of fishing activity and the presence of lost gears. A series of mounds and scarps investigated along the western edge of the Porcupine Bank, in water depths of 600-1000m, showed most evidence of fisheries related impacts.

Surveys of two mounds serve to illustrate the nature of these impacts. A double mound system, named the Twin Mounds, had been fished immediately prior to the ROV survey. ROV images revealed areas of barren sediment, trawl tracks and areas of flattened coral rubble (Fig. 2). Although coral rubble occurs naturally, close inspection of the Twin Mound rubble revealed sharp breaks in coral branches consistent with mechanical damage. Also in the natural situation, coral rubble tends to have irregular micro-relief and have an aged appearance whereas the Twin Mound coral rubble had a uniform flat relief and appeared relatively fresh. There was a striking absence of epifauna, particularly soft corals.

On the nearby Giant Mound, images of lost static gears (tangle nets) filled with coral were recorded. The nets appear to have been dragged from the north of the mound where corals were plentiful to the south side where corals were generally absent. The presence of an epifauna encrusted rope suggests that more than one net has been lost at this location (Fig. 3). Close inspection of the coral bycatch showed that some of the polyps were still alive, indicating that the impact may have been a relatively recent event.

Implications for Fisheries Management

The above examples provide clear evidence that cold-water corals are being impacted by present fishing activities, both trawl and static-gear fisheries.

Long and Grehan (2002) in a review of the legal instruments available to conserve deep water corals recommend three actions at European and coastal state level to protect the unique ecosystems associated with deep-water coral:

i) Adoption at Community level of a specific technical conservation measure in the Common Fisheries Policy.

ii) Implementation by the coastal state of an ecosystem management approach to the marine environment through designation of sites of deep-water coral under the EU Habitats Directive as special areas of conservation.

iii) Improved monitoring and assessment of the conservation and management framework.

In Ireland, as mentioned above, the process of Special Area of Conservation (SAC) designation has already begun but is proceeding slowly. Further expansion of the orange roughy fishery provides a potential threat to pristine *Lophelia* habitat prior to SAC designation. A number of

well developed *Lophelia pertusa* sites have already been documented in detail during three major ROV surveys off the west coast of Ireland since 2001. Some of these locations are likely to figure in the final short-list of sites put forward for SAC designation, It would appear prudent therefore to provide these sites with interim protection until such time as the final SAC candidate list is drawn up.

Currently the Irish Marine Institute are funding a project to assess the strength of orange roughy spawning stocks with the aim of better constraining the limits of the stock to help conserve the species. Spawning stocks are known to aggregate on the side of seamounts (Koslow *et al.,* 2001) and may also make use of smaller topographical features such as carbonate mounds. Juvenile roughy ecology is largely unknown but it is not inconceivable that they avail of the physical habitat complexity of cold-water coral habitat as refuge against predators. Sustainable management and conservation of roughy stocks may ultimately require seasonal or total closures in some areas. Conservation of cold-water corals may require similar measures. Special Areas of Conservation designation must be accompanied by management plans indicating the measures required to maintain/or restore the ecological integrity of the target habitat or species. It is clear that fishing activity will require regulation in cold-water coral SACs.

There is a real opportunity in the Irish situation, to apply an integrated ecosystem approach to the management of both the deep-water fishery and the conservation of deep-water corals (Grehan *et al.*, 2002). Better integration of environmental considerations into fisheries management is one of the stated goals of the re-ramped Common Fisheries Policy (EC, 2002).

Conclusions

Ireland has a number of pristine, well-studied, deep-water coral sites of European and (probably) global importance. While measures to protect representative sites are in train, the process is slow. Recent research has provided evidence of a demonstrable threat to coral from contemporary fishing activity, i.e. trawling and static gear fisheries. Therefore, at the earliest opportunity, the Irish authorities should move to protect intended SAC sites from any potential impacts from these activities through the implementation of appropriate interim and permanent technical conservation measures under the Common Fisheries Policy. Adoption of an integrated ecosystem approach to the management of deep-water fisheries should include and support cold-water coral conservation requirements under the EU Habitats Directive.

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Figures

Figure 1. The location of the carbonate mound and cold water coral sites investigated during the RV Polarstern ARK XIX/3A VICTOR ROV investigations in 2003. Note: Twin Mounds is located at 6 while Giant Mound is located at 7.

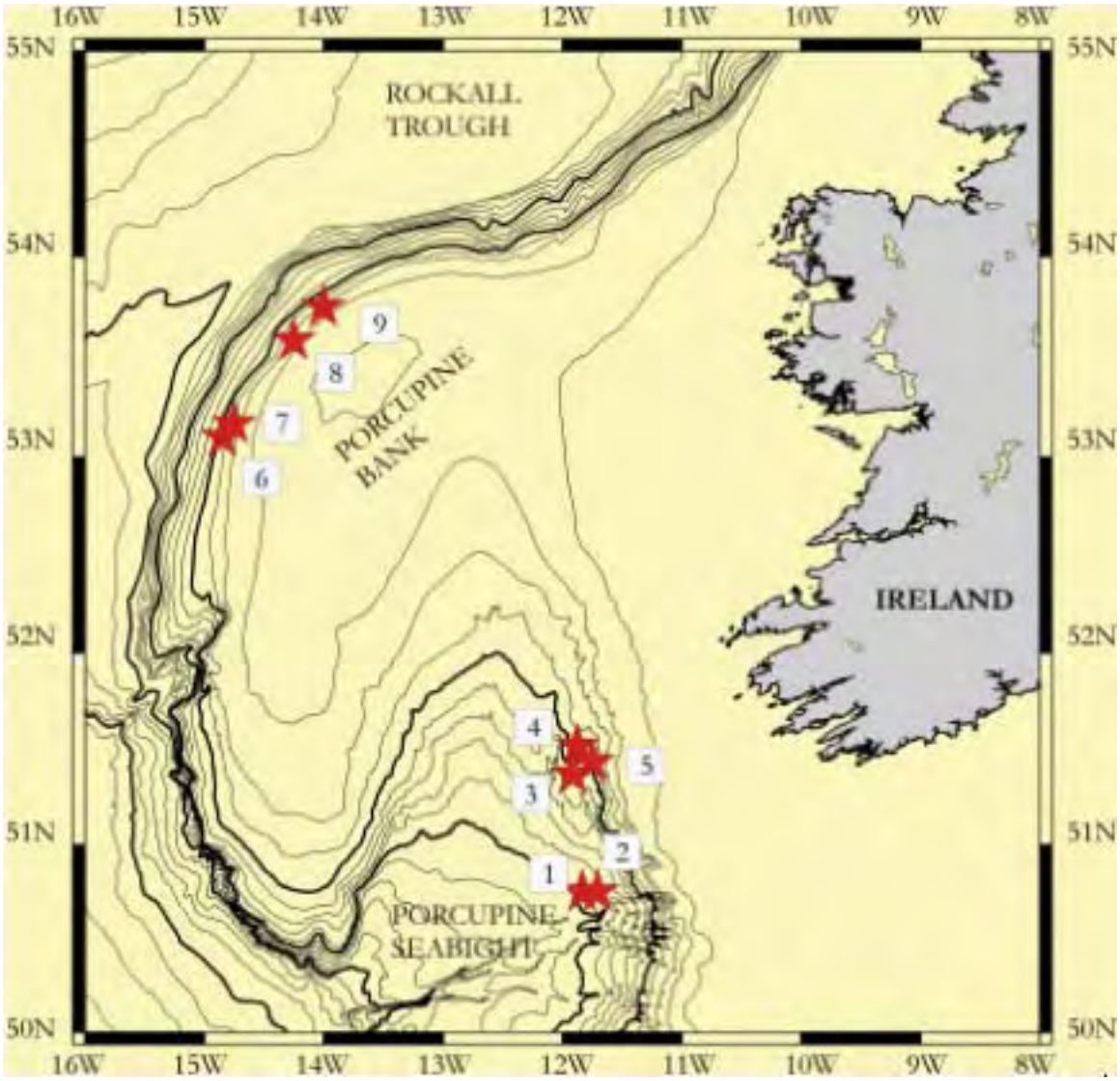

Figure 2. ROV taken digital stills of the seafloor at the Twin Mounds site, west Porcupine Bank margin. Note the flat uniform appearance of the coral rubble, the absence of epifauna, and the clean breaks (arrows) across coral branches. The white colouration of the skeletal *Lophelia pertusa* branches indicates that death was relatively recent. *Lophius* sp. were occasionally seen in the area. (Images copyright of IFREMER, 2001).

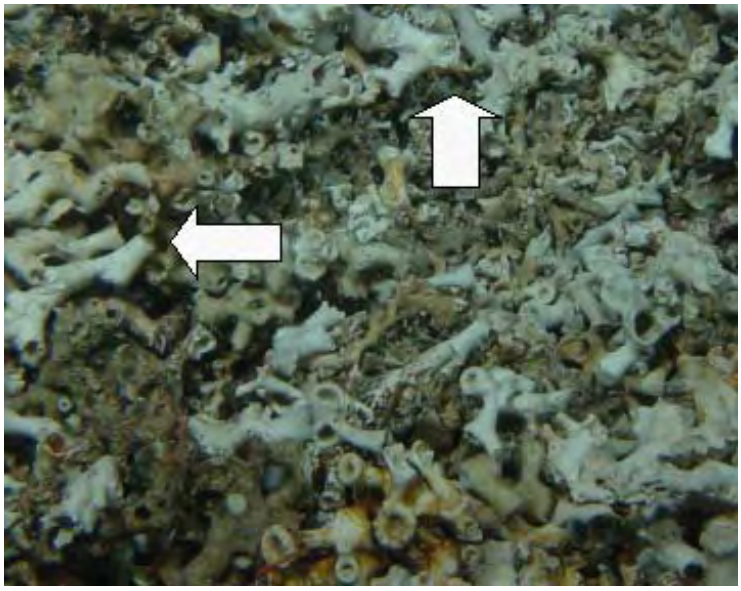

Figure 3. ROV taken digital stills of the seafloor at the Giant Mound, on the western margin of the Porcupine Bank, showing lost fishing gear (probably a tangle net). Note the presence of epifauna (Epi) on one rope indicating it has been in the water for some time and that the nets seen here may have accumulated from more than one snagging event. In the same image, a *Chaceon affinis* (red crab) and *Cidaris cidaris* (pencil urchin) is visible. The image on the bottom left shows a living orange polyp of *Lophelia pertusa* (stone coral). Images copyright of IFREMER, 2001.