The Irish Coral Task Force and Atlantic Coral Ecosystem Study (ACES)

Report on Two Deep-Water Coral Conservation Stakeholder Workshops Held in Galway in 2000 and 2002*

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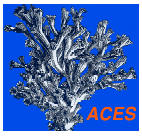

*Held on 23rd June 2000 (Funded by ACES) and June 24th 2002 (Funded by Marine Institute) at the Martin Ryan Marine Science Institute, NUI, Galway, Ireland

FOREWARD

Increasing public and media awareness of the unique nature of European deep-water corals has put the focus firmly on the need for sustainable management of European offshore living resources. The well documented destruction of deep-water corals off Norway and potentially along the entire European margin combined with extremely slow coral habitat recovery rates, has created a sense of urgency to move towards implementation of the appropriate management measures to ensure the long-term survival of this spectacular and important habitat. In the process, deep-water coral conservation has become in many ways a paradigm for a shift away from traditional sectoral driven resource management approaches, towards an inclusive integrated ecosystem approach to the management of European offshore resources.

The EU Fifth Framework Programme, in an effort to increase the socio-economic impact of its R&D projects strongly encouraged the formation of scientist-stakeholder partnerships and development of a suitable research-product delivery mechanism. The major (€2.1 million) European Union funded research project: the Atlantic Coral Ecosystem Study successfully responded to these new challenges in a number of innovative ways. In particular, the establishment of an ACES project-stakeholder partnership through consultative workshops, provided a means for stakeholders to prioritise the scientific research and created a forum for rapid dissemination of scientific results. Complementary initiatives arising from these meetings, such as the formation of the ad hoc Irish Coral Task Force, provided a mechanism whereby scientific findings could be translated into policy advice for the appropriate national authorities.

This report serves as a record of the consultative process undertaken during two stakeholder workshops held in Galway on 23rd June 2000 and 24th June 2002. Section A contains conclusions and summary records of the two meetings. Section B contains a series of papers presented at the workshops to provide detailed information on: cold-water coral research and conservation initiatives; fishing related issues; oil and gas related issues and conservation legislation and legal issues. The 2000 meeting was sponsored by the Atlantic Coral Ecosystem Study, while the 2002 meeting was sponsored by the Marine Institute (Ireland), as part of its support for the Irish Coral Task Force and ACES. Between the first and the second meeting, the need for scientific advice to support the designation of Special Areas of Conservation to protect corals under the EU Habitats Directive became a clear priority.

Finally, it is obvious that much work remains to be done to achieve effective protection of deep-water corals and similarly threatened 'hot spots' of marine biodiversity along the European shelf and slope. It is also clear, however, that successful implementation of conservation measures will require on-going dialogue with stakeholders, and their participation in the decision making process.

Anthony Grehan and Michéal Ó Cinneide December, 2003

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(EVK3-CT1999-00008)

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Martin Ryan Marine Science Institute, NUI, Galway, Ireland

Section A

CONCLUSIONS AND SUMMARY RECORD

23rd June, 2000 Galway

Convenor

Dr. Anthony J. Grehan[1]

(Workshop Funded by ACES)

AND

24th June, 2002 Galway

Convenors

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Conclusions, Summary Record and Discussion of 2000 Stakeholder Workshop

1. STATEMENT OF CONCLUSIONS

A meeting of scientists and principal stakeholders was held in Galway, Ireland to discuss the objectives of the Fifth Framework Project Contract **EVK3-CT-1999-00008**: The Atlantic Coral Ecosystem Study (ACES). Following information exchange, discussions highlighted the following:

Major Outcomes

General

The Atlantic Coral Ecosystem Study was welcomed by Stakeholders who felt that the project would make an important contribution by providing data which could support designation of coral protected areas. Data concerning coral distribution, degree of naturalness and site representativeness where considered important in this regard. Stakeholders also offered access to non-public domain data if required by ACES.

Identification of Threats

- Fishing, particularly demersal trawling is identified as the most obvious threat to coral habitats in European waters. The deliberate adoption of destructive fishing techniques, i.e. rolling of reefs with heavy chain prior to fishing, first documented in Norway, is now alleged to occur off the west coast of Ireland.
- Oil and gas exploration may pose a threat to corals in the future. The activities of the industry need to be carefully monitored when working close to known coral sites.

Conservation Issues

- The adoption of technical conservation measures such as a ban on trawling in favour of long-lining (as in Norway) may lead to other conservation problems (e.g. possible over-fishing of sharks) in more temperate European waters.
- The consensus was that the establishment of coral protected areas would be the most appropriate conservation action.
- Marine protected areas should be chosen using the Precautionary Principal and scientific validation of selection criteria. Designation of marine protected areas will require recourse to both fisheries and conservation legislation.
- Lack of resources for subsequent monitoring, should not hinder the designation of coral protected areas. Additional resources may be required in the future to ensure that protected areas are properly policed.

Actions and Further Work

1. The applicability of the EU Habitats Directive as a legal instrument to enforce coral conservation in offshore areas needs to be tested. Particular attention must be paid to the form in which the Directive is enacted into national law by each EU coastal member.
2. The Irish position in relation to the application of the EU Habitats Directive to the 200-mile limit of the Fisheries Zone needs to be clarified.
3. An Irish Coral Reef Task Force (an ad hoc group) will be formed nationally to co-ordinate additional data gathering on coral distribution and fishing activity, to establish whether coral sites are being impacted and to suggest conservation policy for the protection of corals in Irish waters.

2. SUMMARY RECORD 2000

2.0 Introduction

Anthony Grehan opened the meeting and welcomed everybody to Galway. He gave a short overview of the meeting goals and presented the agenda. The meeting format comprised three sections: introduction of the scientific and management goals of the Atlantic Coral Ecosystem Study (ACES), presentations from principle scientists and finally an open forum discussion.

2.1 The Atlantic Coral Ecosystem Study

Andre Freiwald (Tübingen University, Germany)(Project Co-ordinator and Work Package 1 Leader) gave a short overview of how the ACES project came about. He drew attention to the fact that deep-water corals had recently been found in Brazil and Africa. To date we have not looked long enough or deep enough to build up an accurate representation of the extent and importance of cold water corals
He then went on to introduce the work programme to be carried out under Work Package 1 which will map the structural and genetic variability, the framework-constructing potential, and the longevity of coral along the European NE-Atlantic.

Alex Rogers (DEEPSEAS Benthic Biology Group, UK) continued the introduction of Work Package 1 with a detailed explanation of the molecular genetic work to be undertaken. He also referred to review work he had undertaken on the extent of reef structures in the NE Atlantic for WWF.

George Wolff (University of Liverpool, UK) (Work Package 2 Leader) summarised the scope of Work Package 2 which will assess the hydrographic and other local physical forcing factors affecting benthic boundary layer particle dynamics and particulate organic carbon supply in the vicinity of corals.

Martin White (Martin Ryan Institute, Ireland) continued with an in-depth review of the intended physical oceanographic research.

Murray Roberts (Scottish Association of Marine Science, UK) introduced Work Package 3 (on behalf of John Gage – Work Package 3 Leader). This priority area will focus on the biodiversity, dynamics and functioning of the coral ecosystem, as well as examining coral biology, behaviour and sensitivity to both natural and anthropogenic stresses. He also referred to earlier work on cold water corals carried out in the Dunstaffnage Laboratory, Oban, Scotland.

Anthony Grehan (Martin Ryan Institute, Galway)(Work Package 4 Leader) spoke about the intended goals of Work Package 4, which is devoted to management issues. Fundamental among these is the development of a new scientist-stakeholder partnership, the highlighting of the major threats facing the coral ecosystem and the impartial designation of an ecosystem sensitivity coding together with practical recommendations for the sustainable use of the coral ecosystem. He also introduced the Marine Life Information Network (MarLIN) Internet based database which is an IT management tool which includes ecological sensitivity coding. More information on MarLIN is available at: http:// www.marlin.co.uk.

2.2 Stakeholder Presentations 2000

2.2.1 The impact of Fisheries on *Lophelia* in Norwegian Waters

Paal Mortensen (Institute of Marine Research, Norway) gave an update of the current situation relating to the impact of fisheries in Norwegian waters. Norwegian Authorities have already taken conservation action to protect reefs using new fisheries legislation on protected Slope sites and environmental legislation to establish a new national marine park to protect corals in fjords.

2.2.2 Managing Impacts in the Marine Environment (MIME)

Murray Roberts summarised the work carried out as part of the UK Natural Environment Research Council's Managing Impacts on the Marine Environment (MIME) Programme.

2.2.3 The Rockall Studies Group Tobi Survey

Brian O'Reilly (Dublin Institute of Advanced Studies, Ireland) described work undertaken by the Irish Petroleum Infrastructure Programme (PIP) Rockall Studies Group which commissioned a TOBI (deep towed side-scan) survey in the eastern and, part of the western Rockall Trough off the West of Ireland in 1998. He showed one map, which contained enigmatic structures which are likely to be carbonate mounds. These structures were found along the upper slope (c. 800m) lying parallel to the bathymetric contours. Individual mounds could be seen to rise up to 150 m above the bottom often giving rise to a tear shaped bedform, which may reflect interaction with strong bottom currents.

2.2.4 The Atlantic Frontier Environmental Network Surveys

Gillian Bishop (Atlantic Frontier Environment Network, UK) outlined the survey work of the Atlantic Frontier Environmental Network which had organised a series of environmental surveys in the Atlantic Frontier (Atlantic Margin Environmental Study). Five oceanographic cruises provided the platform for almost 1000 deployments of sampling equipment at a cost of £2.8 million. A stratified sampling strategy was employed which included TOBI side-scan, video and photographic ground-truthing and sediment sampling for biological, chemical and physical analysis.

2.2.5 An overview of the deepwater fisheries in the north-eastern Atlantic

John Gordon (Scottish Association of Marine Science, UK) presented an overview of deep-water fisheries research along the NE Atlantic Margin. He noted that the Porcupine Sea Bight was much poorer than the Rockall Trough in terms of fish abundance and pointed out that there are in fact several deep-water fisheries. In terms of impact on corals he said that demersal trawl fisheries would potentially be the most damaging. He felt that the ACES project could usefully stimulate debate between industrialists, fishermen and conservationists.

2.2.6 Lophelia reefs: a pilot case for off-shore environmental protection.

Sabine Christiansen described the view of WWF that *Lophelia* reefs are a good pilot case for offshore environmental protection. She also gave a summary overview of legal issues relevant to the designation of offshore marine protected areas. She felt that ACES could improve our knowledge of the coral ecosystem by providing comparable data-sets with information about naturalness, representativeness/ uniqueness and inter-site connectivity that could form the basis of site selection for

conservation. She felt that economic understanding is needed to convince fishermen of the usefulness of full protection of coral reef ecosystems.

2.2.7 The situation with Irish off-shore legislation

Liz Sides discussed the available legal instruments available for offshore habitat conservation in Ireland. The EU Habitats Directive (1992) was only enacted into Irish Law in 1997. Ireland has designated a small number of National Nature Reserves under the Wildlife Act (1976) that have marine areas in them and has a relatively large number of proposed Special Areas of Conservation designated under the Habitats Directive but none of these extend beyond Ireland's territorial boundary that is the 12 nautical mile limit. Under the Habitats Directive the definition of reefs includes biogenic concretions so that reefs formed by corals fall into this category. Dúchas, as part of the Department of Arts, Heritage Gealtacht and the Islands has prime responsibility for implementing the Directive, has recently sought a legal opinion as to whether Ireland should apply the Directive to the limit of the EU Fishery Zone. She felt that Annex V of the OSPAR Convention offered another mechanism, which could be used to protect *Lophelia* reefs. She again stressed that ACES should provide good distribution data and assess the degree of natural versus impacted sites. She also drew attention to the fact that any future designation and monitoring of marine protected areas will have financial implications which if not addressed may result in a marine protected area in name only.

3. 2000 Workshop Discussion

3.1 General

Martin Ferguson (Statoil Ltd.) offered the support of the Rockall Studies Group and easy access to non-public TOBI data if required by ACES. He welcomed the fact that information generated by the ACES project would be made readily available at the end of the project both on the Internet and as a DVD product.

Michael Geoghegan (Geological Survey of Ireland) mentioned that the GSI had just begun an ambitious 7 year multi-beam mapping survey of the Irish seabed and that this would create synergies with the ACES project both in terms of ship-time opportunities and in data exchange. He also mentioned that routine sound-velocity profiling which are used to calibrate multi-beam returns are made on a daily basis and could be made available.

Maurice Clarke (Marine Institute) mentioned that both the Marine Institute and the Irish Fisheries Board (Bord Iascaigh Mhara) were conducting deep-water fisheries surveys including long-lining for tusk in the vicinity of mounds.

Vikraim Unnithan (UCD) referred to the Polarstern multi-beam survey of mound areas in the Porcupine Sea Bight scheduled for later in the summer (2001).

3.2 Identification of Threats

Paddy O'Malley (local fisherman) brought in a range of large corals and coral fragments which had been taken during fishing. These consisted of a large piece of dead *Lophelia*, a very large stylasterid, solitary corals and two species of soft coral including a gorgonacean. He alleged that destructive fishing practices similar to those documented in Norway were already occurring off the west coast of Ireland. He said that at least 3 large (>30m), non-Irish trawlers were engaged in this practice. He said that the ground chain dragged between otter doors might weigh as much as 5 tonnes. Evidence of coral destruction needs to be gathered. He stressed that there was an urgent need to stop trawling with chains in areas where coral are known to occur.

It was agreed by all that the major threat to the coral ecosystem in the Irish sector comes from demersal trawling. Oil and gas exploration may pose a threat in the future.

3.3 Conservation Issues

Gill Bishop said that the onus would be on the oil industry in the UK to pick up monitoring costs, if for example, the Darwin Mounds were designated as a Marine Protected Area. She asked why this should not also be the same for the fisheries industry.

George Wolff suggested that developing AUV technology might offer a low cost monitoring solution. Murray Roberts mentioned that long-term monitoring of corals would soon be possible using lander technology.
Michael Geoghegan mentioned that ships of opportunity might provide a cost-effective means to carry out monitoring. Many research vessels carry out work in Irish waters each year.

Paal Mortensen felt that concerns about the cost of monitoring should not stop the designation of protected areas, which needed to be done urgently. Vessel Monitoring Systems are sufficiently sophisticated to determine levels and types of fishing activities in areas that might be protected. In Norway, 40% of reefs have already been impacted which means there is an imperative to act quickly. He said that the power of the media should be fully utilised to focus public attention on the problem. Sabine Christiansen felt that the three-year time-scale of ACES before recommendations would be produced might be too long if damage was already occurring.

Yvonne Shields (Marine Institute) asked what size of area would be required for designation in relation to coral reefs. Anthony Grehan said that Marine Protected Areas could take different forms including multi-user marine protected areas. In the latter, activities are zoned so that activities with the most potential to damage the environment are carried out furthest from a central no-take zone. Liz Sides said that in applying the Precautionary Principal during designation of protected areas, criterion used must be objective and based on good scientific data.

The use of fishing technical conservation measures such as banning trawling in favour of long-lining were also discussed as a support or alternative to the creation of protected areas. John Gordon said that long-lining could also lead to ecological impact due to a propensity of the technique to over-fish shark. He felt that technical conservation measures involving replacement of one type of fishing with another would prove too simplistic. He said that properly regulated marine protected areas offered the best solution.

3.4 Conservation Actions

Anthony Grehan asked what could be done under current Irish legislation if damage was indeed proved to occur. Liz Sides replied that the EU Habitats Directive as enacted into Irish legislation could provide the means to protect coral through the designation of Special Areas of Conservation. She pointed out however, that her organisation, Dúchas, who have legal competence in such an event, would have great difficulty carrying out the necessary work for site designation given the prohibitory expense of offshore research. It was agreed that the official Irish position in relation to the application of the Habitats Directive offshore needed to be clarified.

It was also agreed that an *ad hoc* Irish Coral Reef Task Force would be formed to liase with the relevant Irish Government Agencies (i.e. Fisheries, Oil and Gas Exploration, Naval Service and Natural Heritage). The Task Force would include representatives from ACES and the above Agencies. The goal of the Task Force would be to co-ordinate additional data gathering on coral distribution and fishing activity, establish whether Irish coral reefs are being damaged and formulate conservation policy for the protection of corals in Irish waters.

Conclusions, Summary Record and Discussion of 2002 Stakeholder Workshop

4. STATEMENT OF CONCLUSIONS

The Atlantic Coral Ecosystem Study and the Irish Coral Task Force held a Consultative Workshop, sponsored by the Marine Institute, in the Martin Ryan Institute, NUI, Galway on 24th June 2002, to brief the Irish Fishing Industry on conservation initiatives being undertaken to protect deep-water corals in Irish waters.

Dúchas - The Heritage Service of the Department of Arts, Heritage, Gaeltacht and the Islands informed the delegates that Ireland will be obliged to designate a representative network of deep water coral sites as Special Areas of Conservation (SAC) to comply with the EU Habitats Directive within the next 12 to 18 months.

International experts presented their experiences of managing deep-water fisheries and conservation of coral ecosystems in Australia and the United States. They highlighted the need for an ecosystem approach to fisheries management and the potential benefits of creating non-extraction zones in terms of stock replenishment outside the closed areas.

Irish experts gave a detailed insight into EU and Irish regulatory and enforcement issues relating to the conservation of deep-water corals in waters under Irish jurisdiction.

Four areas of interest as potential reef Special Areas of Conservation were tabled by Dr. Grehan (see section 4.10). A frank exchange of views took place with the Fishing Industry representatives present. The discussions were constructive and while no formal proposals were accepted at the workshop, it was agreed that :

- Dialogue with the Irish fishing industry should be continued.
- Industry and government should be presented with summary proceedings from the workshop incorporating the latest scientific findings and an update on the regulatory and enforcement issues relevant to the Fishing Industry
  and recommended *inter alia* that:
- Additional work would be undertaken to produce comprehensive and accurate maps of coral locations in Irish waters; determine the species and stock densities of fish in these areas; and assess the current levels of fishing impacts.
- Socio-economic studies should be undertaken to assess the impact of any future Special Area of Conservation (SAC) management restrictions on the fishing industry.
- Social flanking measures should be considered including compensation schemes, such as a marine environmental protection scheme to address losses associated with transfer of fishing effort out of future SAC's.
- Assessment of the resource implications relating to increased enforcement responsibilities.

5. SUMMARY RECORD 2002

5.1 Introduction

Michéal Ó Cinneide opened the meeting and welcomed everybody to Galway. He gave a short overview of the meeting goals and presented the agenda. The meeting objectives were:

- To inform stakeholders from the Irish fishing industry and from State agencies such as the Irish Sea Fisheries Board (BIM) about the current research findings and conservation issues in regard to the deepwater corals reefs found off the west coast of Ireland
- Review international developments in deepwater coral conservation
- Discuss the interactions between the evolving Irish deepwater fishery in waters to the west of Ireland and the conservation of deepwater coral ecosystems
- Discuss the legal and enforcement issues in establishing conservation zones and the formulation of a Management Plan for possible Special Areas of Conservation to protect deep-water coral reefs within waters under Irish jurisdiction.

Michéal Ó Cinneide then proceeded to give an overview of the work of the Irish Coral Task Force. The Coral Task Force is an ad hoc group that was established in January 2001 following recommendations arising from the first ACES Consultative Workshop with Principal Stakeholders held in Galway on June 23rd, 2000. The Irish Coral Task Force supplements the work of the EU Atlantic Coral Ecosystem Study at national level. It has the following main objectives: to determine the level of impacts from fishing on coral reefs in Irish waters, to identify the appropriate legal instruments for use in implementing conservation measures to protect corals in Irish waters, and to liase with the relevant policy makers and managers. Membership includes representatives from Dúchas (Heritage Service), the Marine Institute, the Irish Sea Fisheries Board (BIM), the Irish Naval Service, the Department of Marine and Natural Resources, the Heritage Council, the Geological Survey of Ireland, the National University of Ireland, Galway and University College, Dublin.

On 28th January 2002, the Coral Task Force briefed the Irish Common Fisheries Policy Review Group on the importance of the deep-water coral ecosystem and the urgent need for conservation measures. The Common Fisheries Policy Review Group included senior representatives from the Department of Marine and Natural Resources and the Irish fishing industry - Killybegs Fishermen's Organisation (KFO), Irish South and West Fishermen's Organisation (SWPFO), Irish Fish Producers Organisation (IFPO) and the Irish Fishermen's Organisation (IFO). It was agreed at that meeting that closer links should be created with the fishing industry so that they could be included at an early stage in consultations leading to Special Area of Conservation site designations to protect corals. The Irish Common Fisheries Policy Review Group also stated that they strongly believed that coral reefs is an issue that will have continued prominence over the coming years and for that reason should be the focus of continued research.

5.2 The Atlantic Coral Ecosystem Study and Irish Coral Task Force

Anthony Grehan gave a short overview of the work of the EU Atlantic Coral Ecosystem Study (ACES) (see paper by Freiwald *et al.* in Section B and http://www.cool-corals.de) and the current status of deep-water coral conservation in Ireland (see paper by Grehan in Section B).

Dr. Grehan stated that both ACES and the Coral Task Force were working on the identification of sites suitable for possible designation as Special Areas of Conservation (see below).

Stakeholder Presentations 2002 Workshop

5.3 The EU Habitats Directive

Ciaran O'Keeffe provided an overview of the EU Habitats Directive and the multi-steps involved in the designation of Special Area of Conservation. He drew attention to several specific problems facing the establishment of offshore Special Areas of Conservation for the protection of deepwater corals.

- The relative paucity of knowledge concerning the habitat over the full extent of its distribution which is compounded by the distance from shore and the great depth at which the habitat occurs.
- That full protection of deepwater corals in the Irish offshore will only be feasible through the implementation of supporting measures taken by the Common Fisheries Policy.
- Survey and protection of such a remote habitat will require major resources.

He pointed out however that these problems were insufficient reason not to proceed with designation in locations where there was already sufficient scientific information to demonstrate outstanding examples of the coral habitat.

5.4 Deep-water fisheries and marine protected areas: the U.S. experience

Robert Brock described the current situation in relation to fisheries management, coral reef protection and the management of marine protected areas (MPA's) in the United States. Conservation in the United States is largely driven by fisheries management considerations. Specifically, the Magnuson-Stevens Fishery Conservation and Management Act (1976) created eight Regional Fisheries Management Councils around the coast charged with conserving and managing fisheries resources. Recent studies have shown a positive correlation between loss of benthic habitat caused by destructive fishing gear and a reduction in fish biomass and diversity. Dr. Brock concluded that it is essential that a habitat that is extremely vulnerable to disturbance and of great ecological importance (such as coral reefs) be protected from this damage.

5.5 Deep-water fisheries and marine protected areas: the Australian experience
Tony Koslow briefed the meeting on deep-water fisheries and seamount conservation in the Tasmanian Sea and Australia. He drew attention to the fact that seamounts and other deepwater coral environments, so-called 'oases of the deep,' often contain dense stands of deepwater corals and substantial fish aggregations, in marked contrast with the sparse macrofauna generally found over the vast sediment-covered plains of the deep seafloor. Substantial aggregations of commercially fished species, such as orange roughy and redfishes (*Sebastes* spp) are often supported as well in these environments. Such fishes typically have life history characteristics of extreme longevity (in the order of 100 years), low productivity and episodic recruitment, as well as a high degree of aggregation in these environments, which renders them highly susceptible to overexploitation.

He expressed the urgent need to protect threatened deepwater habitats, and a number of deepwater habitats have been set aside in marine protected areas (MPAs) in recent years. A group of seamounts south of Tasmania and around the New Zealand EEZ, have recently been granted protection.

Dr. Koslow drew attention to the fact that while the *Lophelia* mounds off the coast of Ireland are still apparently relatively undisturbed, deepwater fisheries in the North Atlantic are still expanding and seeking out new grounds and stocks, as old grounds are depleted. Dr. Koslow concluded that this is the right time for Ireland and the European Community to take the necessary steps to protect these unique biological communities.

5.6 Deep-water Fish Stocks in Irish Waters
Paul Connolly described the current status of deep-water fish stocks and fish biology in Irish waters. He drew attention to the recent expansion of the Irish deep-water fishery for orange roughy. Dr. Connolly noted that new management measures (quotas for Total Allowable Catch) for deep-water fish species including orange roughy would be implemented in 2003.

Dr. Connolly felt that there was a tendency for modern fisheries management to embrace the marine protected area idea. However, there has been little demonstration of the effectiveness of existing closed boxes already in existence to assist cod and hake recovery plans. There is an immediate need to demonstrate the benefits of closed boxes as management tools to fishermen. Dr. Connolly concluded that proposing closures whether for fisheries management or conservation purposes gave rise to the problem of fishing effort transfer. He suggested that a marine equivalent of the Rural Environmental Protection Scheme (REPS) might be required to give an incentive to fishermen to change current fishing practice.

5.7 The Irish Sea Fisheries Board Deep Water Programme, 2001
Dominic Rihan reported on the Irish Sea Fisheries Board (BIM) Deepwater Programme in 2001. The specific objectives of the programme were to collect data on fishing activity, catches and discards in accordance with best international practices and techniques; to increase the amount of biological data available on deepwater species and to provide this data in an internationally acceptable format to the ICES Advisory Committee on Fishery Management (ACFM) on the biology and assessment of deep-sea fisheries resources.

Dominic Rihan felt that before MPA's could be introduced that they needed to be properly defined and the socio-economic impact of closing areas to fishing would need to be assessed in order to gain industry acceptance. In the European context the question of enforcement needed to be addressed, given that in the Western waters, vessels of Norway, the Faeroese, Iceland, Denmark, UK, Spain, Portugal and France in addition to Ireland actively fish. As not all of these countries are members of the EU, the question of which organisation would have sufficient authority and international mandate to regulate fishing activity needs to be established. Also for such closures to be acceptable to the fishing industry they would have to apply equally to all vessels and include all potentially destructive fleet metiers including passive gears such as gillnets and longlines. This would include an assessment of the effects of "ghost fishing" by lost gillnets, which is reported to be a serious problem in the shelf areas in Western waters.

Dominic Rihan concluded that the above factors coupled with current EU policy, which requires a qualified majority for any new regulation in the Common Fisheries Policy to be brought into effect, means that properly enforced and monitored MPAs around cold coral reefs are unrealistic at this juncture.

5.8 Naval Service Fisheries Enforcement in Irish Waters

Cmd. Mark Mellett introduced the general role and functions of the Naval Service in Ireland including fisheries protection. The advent of the satellite based vessel monitoring system allows for almost real time analysis and tracking of Irish fishing vessels all over the world and foreign vessels when operating in the Irish Exclusive Fisheries Zone. He presented activity statistics looking at demersal activity in the four coral provinces (Belgica, Hovland, Pelagia and Logachev) over the past five years. Cmd. Mellett concluded that protection of corals and deepwater fisheries will present difficulties but these can be overcome if there is an integrated policy supported approach.

Cmd. Mellett was of the view that significant trawling activity in many cases has already caused serious damage to ecosystems including coral areas in the Irish Exclusive Fishery Zone. It is clear that fishing gear developments which use robust rock hopper gear anticipate that contact with the seabed will occur in deepwater fisheries. While not necessarily desired it is expected. Coral areas should therefore be protected under European and International Law.

Cmd. Mellett felt that we should prioritise the areas that require protection and specify the activities to be limited. In this regard from a policing perspective the preferred option was that no fishing activity should be allowed in protected areas.

Tools that will assist in policing include the Vessel Monitoring System - as most vessels capable of fishing in the deep-waters where coral are found would probably be in excess of 24 metres. Tools currently in use will need to be augmented with developing technologies such as Earth Observation (EO) using Synthetic Aperture Radar.

5.9 Current legislation and recommendations for protection of deepwater corals
Ronan Long provided an overview of the legal instruments available to conserve deep-water corals in waters under Irish jurisdiction. He considered two potential risks from human activities: the exploration and exploitation activities of the offshore oil and gas industry and commercial fishing activity. He reviewed existing provisions in the Law of the Sea Convention (UNCLOS) and several other legal instruments and initiatives that could influence the shape of an effective conservation and management regime. He focussed on the application of the EU Habitats Directive as a means to protect deep-water coral in the maritime areas beyond the Irish territorial sea and discussed the interaction between the Habitats Directive and the EU Common Fisheries Policy. Dr. Long suggested a number of actions that could be taken at European and at Coastal State level to protect the unique ecosystems associated with deep-water coral:

- Adoption at Community level of a specific technical conservation measure in the Common Fisheries Policy to protect deep-water coral

- Implementation by the Coastal State of an Ecosystems Management approach to the marine environment

- Improved monitoring and assessment of the conservation and management framework

5.10 Potential Special Area of Conservation for deepwater corals in Irish waters
Anthony Grehan introduced the topic of coral protected areas and referred to the precedent of existing protected areas and marine parks established in Norwegian waters to protect deep-water corals and an inshore coral reef Special Area of Conservation in the Kosterfjord in Sweden. The Darwin Mound area to the west of Scotland has been highlighted as an important coral area and is expected to be put forward as the United Kingdom's first offshore Special Area of Conservation in 2003.

In Ireland, the entire distribution of *Lophelia pertusa* reefs is currently unknown but several outstanding examples of the habitat have been documented in detail during the EU Atlantic Coral Ecosystem Study. All of the known coral reefs occur associated with large surface carbonate mounds. Carbonate mounds have grown up from the seafloor due to a complex interaction between the biosphere, geosphere and hydrosphere. Many have been shown to be coral bioherms formed from accumulated coral skeleton and sediment over many millennia. The mounds rise above the adjacent seafloor up to 300m and can be hundreds of meters wide and kilometers long. The mounds occur in clusters in what can loosely be called 'mound provinces'. Four of these provinces have been the focus of intense study: the Belgica Mounds, the Hovland Mounds, the Pelagia Mounds and the Logachev Mounds. In general, fishing activity in these areas is historically low but may be increasing.

Dr. Grehan was conscious of the fact that Dúchas will be obliged by the European Commission to apply the Habitats Directive and designate outstanding offshore examples of biogenic reef, i.e. *Lophelia pertusa* reefs. He identified the four main areas of the Irish coast where significant research has been conducted. He said that these areas should be assessed as to their potential to fit the criteria necessary to support future selection as candidate Special Areas of Conservation (Figure 1 of

Grehan paper in Section B). These areas encompass the known outstanding examples of deep-water reefs in Irish waters and are of both Irish and European importance.

Dr. Grehan pointed out that the box boundaries shown on Figure 1 enclosed areas of interest for further assessment as to their suitability for Special Area of Conservation status, the boxes do no represent no-take zones. Management plans could support a multi-user approach similar to that favoured in Australia, e.g. a protected area with a core no-take zone and buffer zones where potential reef impacting activities are managed to minimise environmental impact. The likely activities which would require management include: oil and gas exploration and exploitation, commercial fishing, aggregate extraction and scientific research.

All the fishing techniques ranging from demersal trawling (including orange roughy fishing) to the use of static gears such as long-lining, gill and tangle netting (and even potting for deep-water crab) could have a significant physical impact on the deep-water coral ecosystem, as a result of increased siltation, abrasion and selective extraction (by-catch) of coral. Fishing activity will need to be regulated through the appropriate technical conservation measures in the Common Fisheries Policy.
Dr. Grehan proposed a number of questions for general discussion:

- Are the areas of scientific interest important for fishing?
- Are these areas thought to be spawning grounds by the fishing industry?
- What measures should be adopted to prevent damage to corals in these areas?
- If closed areas are proposed - are there important practical considerations for the fishing industry which should be kept in mind?

6. 2002 Workshop Discussion

Frank and constructive discussion with the fishing industry took place. The main points discussed have been grouped and summarised below.

6.1 Design of MPA's or SAC's to Protect Corals

- There is probably sufficient scientific information available to support designation of Special Areas of Conservation for deep-water corals in Ireland, but the information needs to be collated and assessed against the established selection criteria. If SAC's are shown to be required they need to be clearly delineated and realistic.
- Experience of MPA design in other countries indicates that the scale of an MPA is crucial to its success. It must be sufficiently large to have a noticeable effect in terms of habitat conservation, potential for fish stock enhancement and to facilitate enforcement. In the United States, the authorities are looking at creating experimental (interim) MPA's with a time frame of 5 to 10 years. The aim of this is to enable a realistic assessment of whether their original goals and objectives have been met.
- Consultation with the fishing industry is necessary at an early stage. Restrictions must apply equally to vessels from all Member States and should apply to all destructive fleet métiers including passive gears.
- There is a need to separate out biodiversity conservation issues from fisheries management issues. Biodiversity conservation goals need to be achieved in a pragmatic way with minimum cost to the fishing industry.

6.2 Fishing Interactions with Coral

- A degree of impact resulting from the normal pursuit of deepwater fisheries on coral reefs and with soft coral gardens is inevitable. This is particularly the case with the expanding fishery for orange roughy. Roughy fishing gear is robust and makes use of heavy rock hopping gear to traverse coral grounds with little net damage. Significant collateral damage to corals is likely, however, due to crushing/abrasion during passage of the trawl.
- Exploration of new areas to fish with such gear would quickly damage corals even if not leading to the establishment of a new fishery. There is a need to create a number of interim protected areas to allow time for the necessary research to be undertaken and for the Special Area of Conservation designation process to be completed.

6.3 Research and Monitoring Needs

- There is a need for more research to comprehensively map coral distribution in Irish waters
- There is a need to survey candidate areas using fisheries acoustic techniques to assess the abundance of fish stocks over mounds
- There is a need to assess the impacts of ghost fishing caused by lost static gears.
- There is a need for more science to better assess levels of existing impacts
- There is a need for the fishing industry to support monitoring of coral by-catch and to assist in identifying coral areas with minimal fishing interest

6.4 Socio-Economic Considerations

- There is a need to study the potential socio-economic impact to all stakeholders of MPA designation
- The transfer of fishing effort out of SAC areas may require the implementation of social flanking measures such as a compensation scheme similar to that operated in agriculture (Rural Environmental Protection Scheme -REPS), i.e. a marine environmental protection scheme (MEPS).

6.5 Resource Implications

- More funded science is required to underpin the protected area site selection process, to assess the efficacy of management plans and to determine the socio-economic impacts of any proposed closures.
- Additional resources will be required for enforcement related activities to ensure compliance with regulatory measures adopted in coral protected areas.
- Funds may be required to operate a compensation scheme, i.e. a marine environmental protection scheme (MEPS).

6.6 Application of the Habitats Directive

- The case for coral is clear - designation will take place on the basis of the best available scientific information. The EU project's ACES and ECOMOUND are due for completion in early 2003 and will provide the detailed scientific information which can be used to underpin the designation process.
- The time frame for designation of sites for deep-water corals is in the order of 12 to 18 months.
- There is an opportunity in Ireland and Europe to designate pristine coral sites prior to any environmental degradation caused by fishing or other impacts. This will circumvent costly attempts at habitat restoration in the future.

Section B
Workshop Papers

WORKSHOP OPENING ADDRESS 2002

Michéal Ó Cinneide,
Director, Marine Environment Division, Marine Institute, Galway.

This is the second workshop to be held in Galway on the topic of the deepwater coral reefs off the west coast of Ireland. The first workshop with stakeholders was also held in NUI Galway on the 23rd June, 2000. This meeting has been organised by the Irish Coral Task Force, which is an *ad hoc* group that was set up in January 2001.

Membership.
The membership of the Irish Coral Task Force includes representatives from Dúchas (Heritage Service), the Marine Institute, the Irish Sea Fisheries Board (BIM), the Irish Naval Service, Department of Marine and Natural Resources, the Heritage Council, the Geological Survey of Ireland, National University of Ireland Galway and University College, Dublin. The Task Force has met nine times to date.

Objectives. The objectives of this Workshop are:

- Inform stakeholders from the Irish fishing industry and from State agencies such as BIM about the current research findings and conservation issues in regard to the deepwater coral reefs off the west coast of Ireland.
- Review international developments in deep water coral conservation, with the help of experts from the USA and Australia
- Discuss the interactions between the evolving deepwater fishery in the waters west of Ireland and the conservation of deepwater coral ecosystems
- To discuss the legal and enforcement issues in establishing conservation zones and drawing up a Management Plan for possible Special Areas of Conservation in deepwater coral reefs within Irish territorial waters.

Context
The Irish Coral Task Force met with members of the Common Fisheries Policy Review Group in Dublin on 28 January, 2002 to present the case for deep water coral conservation. The CFP Review Group included senior representatives from the Department of Marine and Natural Resources and the Irish fishing industry - Killybegs Fishermen's Organisation (KFO), Irish South & West Fishermen's Organisation (SWPFO), Irish Fish Producers Organisation (IFPO) and the Irish Fishermen's Organisation (IFO).

Following the meeting with the National Strategy Review Group on the Common Fisheries Policy in January 2002, the Chairman of the Review Group, Padraic White, wrote:
"***The National Strategy Review Group on the CFP strongly believes that the protection of Coral Reefs is an issue that will have continued prominence over the coming years and for that reason should be the focus of continued research***".

In accordance with the advice from the National Strategy Review Group on the CFP, the members of the Irish Coral Reef Task Force agreed that it would be beneficial to convene a special workshop for stakeholders from the Irish fishing industry. Invitations were sent to all the deepwater skippers that are currently working with

BIM in the Irish exploratory fishing programme. The national fishing organisations were also invited and we are pleased that representatives of the IFO, KFO, Irish South and West Fishermen's Organisation and BIM have come to this meeting.

I would like to thank our colleagues in the Martin Ryan Institute of Marine Science at NUI Galway for their hospitality in providing the venue and the Irish Naval Service for hosting a reception on board the ***LE Orla*** at Galway docks this evening.

THE ATLANTIC CORAL ECOSYSTEM STUDY (ACES)

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(Presented at the 2000 Workshop)
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Introduction

The Atlantic Coral Ecosystem Study (ACES) is a multi-national, inter-disciplinary project funded for three years (2000-2003) by the EU Fifth Framework Research Programme. It adopts a whole ecosystem approach to the study of the poorly known but widely distributed European deep-water cold coral province. While recent research has clearly shown that *Lophelia* bioherms are extremely rich with respect to diversity, quantity and complexity of life forms, it is clear that great differences occur between geographic locations and that the structure and functioning of these systems are still poorly understood locally, as well as over the geographical range. The pan-European distribution of deep water coral ecosystems found along the continental slope, deep shelf and fjord settings provides an ideal opportunity to study these differences.

The Atlantic Coral Ecosystem Study will provide a margin-wide environmental baseline assessment of the status of Europe's deep-water coral ecosystem and provide recommendations for essential monitoring and methodology requirements to support future sustainable development. The evolution of new management concepts for a sustainable use of deeper-water marine ecosystems on a margin-wide scale is a grand challenge that can only be achieved on a joint European scale (Annex V of the OSPAR Convention).

The ACES project is one of six Fifth Framework funded R & D projects forming a European Ocean Margin Deep-Water Consortium (OMARC). This cluster will increase the value of the individual projects through support of a focused research strategy along Europe's continental margin.

ACES Consortium

The ACES project numbers researchers from 5 European countries (see Appendix 2, this volume) forming a multi-disciplinary group of geologists, physical oceanographers, sedimentologists, biogeochemists, molecular geneticists and ecologists.

Principal Study Locations

In the Northeast Atlantic, the geographic distribution of deeper water coral (hereafter DWC) ecosystems can be traced from the continental slopes and banks off the Iberian Peninsula (Le Danois, 1948) as far north as to the Norwegian Shelf (Dons, 1944, Hovland et al., 1994). Under certain oceanic, topographically-guided circulation patterns, these DWC systems also occur in shallow-water coastal regions along the Swedish Bohuslän coast (Lundalv, pers. comm.) and in Norwegian fjords (Strømgren, 1971). To cover the variation in environmental factors and interactions at ocean boundaries which enable the development of DWC ecosystems, the ACES community will focus on selected key study locations along this latitudinal gradient -

Galicia Bank, Porcupine Slope, Rockall Trough, Skagerrak, Norwegian Shelf (Fig. 1, Table 1). These study sites will be investigated with standardised methods to achieve a high degree of comparability - a major pre-requisition for providing recommendations for the sustainable use of this unique ecosystem.

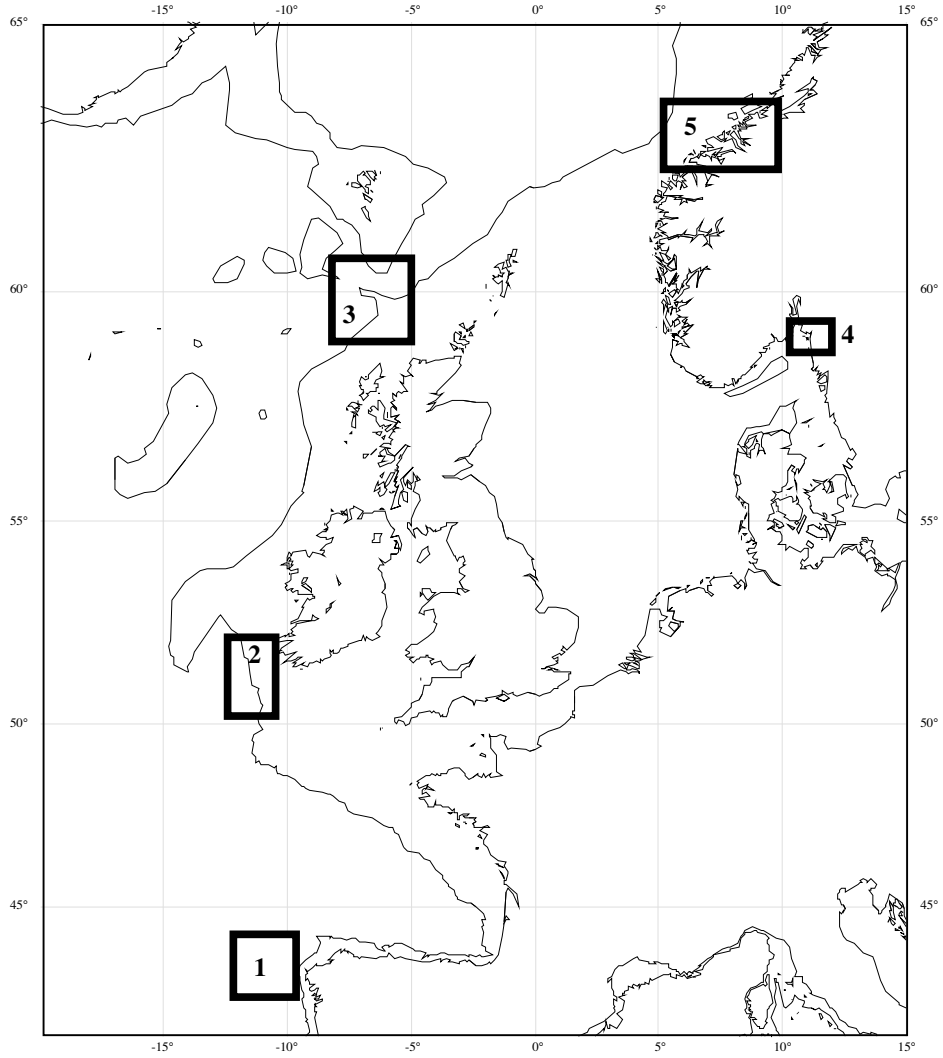

Figure 1 The five key ACES study locations found along the European Margin

Site	Galicia Bank (1)	Porcupine Slope (2)	Rockall Trough (3)	Kosterfjord (Sweden) (4)	Sula Ridge (Norway) (5)
Latitude	43_N	51_N	59_N	59_N	64_N
Water Depth	700 - 900 m	600 - 1200 m	1000 m	85 - 150 m	315 - 248 m
Seabed Structure	Coral thickets on giant pelagic ooze sand waves	Giant thickets on top of large carbonate mounds (up to 300m high)	Complete coral cover of ca. 5m high mounds	Shallowest DWC occurrence ever reported. End member character.	Largest known DWC reef in the NE Atlantic extending to 13 km.

Table 1. Site characteristics of ACES targets along Europe's NE Atlantic Margin.

Scientific Objectives

Objective 1: *To map the structural and genetic variability, the framework-constructing potential, and the longevity of DWC ecosystems*

High-resolution maps of DWC build-ups are essential to determine the spatial distribution and the status of the ecosystem in the various working areas. The framework-constructing potential in DWC largely depends on the annual extensional growth rate, the intensity of secondary thickening of the coral skeleton and the intensity of post-mortem destruction by endolithic borers. We will utilise molecular genetic techniques to assess the spatial genetic structure and population dynamics of *Lophelia* at several scales (between regions, within regions and within individual coral reefs).

Achievements: The outcome will be the first digitised atlas based on acoustic and video imaging of different DWC buildup types along Europe's margin. Detailed growth rate, dating, and ultrastructural studies performed on *Lophelia* and *Madrepora* skeletons will provide results on the longevity of coral frameworks for each of the DWC working areas. The genetic techniques will enable us to identify levels of genetically effective migration between different geographic areas. It will also allow us to identify which *Lophelia* reefs contain the greatest genetic diversity. Both the larger scale imaging data and the detailed studies of the corals themselves will be integrated into a status check of the structural integrity of the DWC ecosystems.

Objective 2: *To assess hydrographic and other local physical forcing factors affecting BBL sediment particle dynamics and POC supply in the vicinity of DWC ecosystems*

DWC ecosystems are often found at or near oceanographic boundaries - even in fjords - but the detailed effect of hydrographic conditions on DWC build-ups remains a matter of speculation. The poleward flowing warm and saline NE Atlantic slope current is a well-documented feature at the shelf break that extends from the Iberian to the Norwegian Sea margin. Predominantly poleward (northward) slope currents at an eastern boundary tend to drive downward near seabed currents in the frictional layer. This has implications for the transport of suspended material in the benthic boundary layer (BBL) and hence for the nutrition and distribution of corals. In addition, the suspected contribution of hydrocarbon enrichment in the vicinity of the coral ecosystem will be assessed.

Achievements: The outcome will be to provide a hydrographic description for the NE Atlantic margin where corals occur, including information on local hydrodynamics (currents) and water mass properties (temperature, salinity, density) at or near DWC ecosystems. The detailed description of suspended particle dynamics in relation to BBL flow and its impact on coral nutrition and feeding (either derived from advected particulates or hydrocarbon venting) is key to understanding the function of the whole DWC ecosystem. This will be achieved by molecular analysis of biologically labile POM fluxes within the coral systems and surrounding surface sediments.

Objective 3: *To describe the DWC ecosystem, its dynamics and functioning; investigate coral biology and behaviour and assess coral sensitivity to natural and anthropogenic stressors*

This objective takes a whole ecosystem approach addressing not only important aspects of coral biology such as reproduction, recruitment and feeding behaviour, but also intraspecific biotic interactions such as the importance of coral stands as refugia (particularly for juvenile commercially important fish species) in promoting the high associated biodiversity of the coral ecosystem fauna. Detailed food web analysis will help elucidate individual species response to local variations in physical forcing and BBL organic carbon characteristics related to the presence of the coral framework. Coral sensitivity to natural and anthropogenic stressors will be determined both *in situ* and in controlled laboratory experiments.

Achievements: A comprehensive understanding of important aspects of coral biology and the elucidation of the role of the coral framework in promoting increased biodiversity when compared with the adjacent seabed. Description of coral ecosystem food web relationships and resource partitioning related to variations in local physical forcing and BBL organic carbon inputs. The identification of coral health indicators in the field and the development of experimental systems and protocols for toxicological and physical stress testing in the laboratory.

Management Objectives

Objective 1*: Identification of the principal conservation concerns and management issues facing sustainable use of the DWC ecosystem and increasing public and political awareness of the urgent need to implement measures to protect and conserve the DWC ecosystem.*

Identification of the principal conservation concerns and management issues facing sustainable use of the DWC ecosystem will be achieved through consultation with the principal stakeholders following the establishment of an ACES-Stakeholder Partnership consisting of:

- Representatives of the national bodies responsible for conservation, and fisheries and mineral/aggregate resource management along the European margin where the DWC ecosystem occurs,
- Representatives of the fishing and mineral/aggregate extraction industries,
- The EU 5FP Research DG (through regular contractual reporting) and the European Environmental Agency (EEA).
- Appropriate non-government environmental organisations (e.g. WWF, IUCN, IOC) and intergovernmental organisations (ICES, OSPAR).

Two consultative workshops will facilitate Partnership exchanges. The first, at the start of the project is intended, to brief stakeholders on the science objectives, to establish the partnership network, to provide a forum for the exploration of opportunities for data exchange (particularly data not held in the non-public domain), to examine potential links to other programmes and to highlight ACES research priorities, through identification of the principal conservation concerns and management issues, as identified by stakeholders and scientists. By having the workshop at the very outset of the project, the project management will have the opportunity to adapt/respond to additional requirements.

The second workshop will take place at the end of the project when a summary of research findings will be presented together with an assessment of the sensitivity of DWC ecosystem to perturbation (see below). Recommendations supporting sustainable environmental management of the DWC ecosystem will be made and the most practical form for the publication of the 'Coral Reef Manual' (see below) will be discussed with end-users.

Increased public awareness of the environmental issues facing the DWC ecosystem will be achieved by permitting public access to parts of the ACES web site, producing an educational DWC ecosystem DVD-ROM 'information pack' in multi-media format featuring video, photographs and graphics, through regular media reportage and through captive display of coral specimens in public aquaria.

Achievements
A new scientist-stakeholder partnership will be formed including offshore industries representatives, environmental and resource managers, legislators and scientists. Public and political awareness of the need to manage the DWC ecosystem will be increased.

Objective 2: *Make recommendations for the sustainable use of the DWC ecosystem*.
This objective will be achieved in two steps:

i) Following synthesis of the research results, gathered under the scientific objectives, the ability of the coral ecosystem to cope with various types of environmental impact will be assessed, through the application of a developing species and ecosystem management IT tool, i.e. the Marine Life Information Network for Britain and Ireland (MarLIN).

   MarLIN is a web based information technology tool currently under development in support of environmental management, protection and education (Hiscock et al. 1999). It has evolved over a number of years and is well supported. It provides a structure for linking available data on marine life around Britain and Ireland as well as providing a rigorous protocol for assessing species and ecosystem sensitivity to natural and anthropogenic perturbations. ACES will add key information to the database on the biology (e.g. taxonomy, general biology, distribution and habitat preference, reproductive biology and species importance) and sensitivity of priority DWC species. The information recorded will then be used to allocate scores of sensitivity and recovery potential for each selected species following assessment of their likely response to a range of specific natural and man-made impacts. More information about the MarLIN database and protocol can be found at http://www.marlin.ac.uk

ii) Publication of an end-user friendly 'Deep Water Coral Reef Manual' on DVD-ROM containing recommendations for the sustainable use of the coral ecosystem.

   A practical 'Reef Manual' will be assembled containing recommendations, 'best practice' methodologies and baseline data to be used as a tool for the sustainable management of the coral ecosystem. Feedback on end-user

requirements from the Stakeholder Partnership will influence the range of information included and the presentation format.

Achievements: This will be the first sensitivity coding of a deepwater ecosystem based on impartial scientific evidence. It will produce guidelines and practical recommendations in the form of a deep-water 'coral reef manual' for future environmental monitoring and the sustainable use of the deep-water coral ecosystem. Production of the DVD-ROM management tool following consultation with the end-users will increase its practicality and applicability. Recommendations for sustainable use of the DWC ecosystem will act as a primer for extending existing EU policy regarding Coastal Zone Management to the deep-sea province.

Conclusions

The ACES project will not only address the sustainable environmental management of the DWC ecosystem, it will stimulate dialogue between industry, conservationists and governments. By focusing attention on the need to clarify the legal basis for implementation of conservation strategies, it can act as a primer for the general development of an integrated off-shore environmental management strategy.

Acknowledgements

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DEEP-WATER CORALS OFF THE WEST COAST OF IRELAND

Anthony Grehan (Presented at the 2002 Workshop)
National University of Galway, Ireland

Introduction

Deep-water coral reefs have been found in Irish waters associated with carbonate mounds (Hovland *et al.,* 1994; Kenyon *et al.,* 1998; Henriet *et al.,* 1998; De Mol *et al.,* 2002) located to the west of Ireland (Figure 2). There are a number of mound clusters fringing the upper continental slope of the Rockall Trough and Porcupine Seabight (Croker and O'Loughlin, 1998). In the Porcupine Seabight two major, complex mound provinces have been identified: the `Hovland-Magellan' mound province on the northern slope of Porcupine Seabight and the `Belgica' mound province on the eastern slope of Porcupine Seabight (Figure 2)(De Mol *et al.,* 2002). In the Rockall Trough, two major mound clusters on the SE and SW margin have been studied: the 'Pelagia' mound province on the southeast Rockall Trough and the 'Logachev' mound province on the southwest Rockall Trough (Haas *et al.,* 2000). These mounds occur in water depths between 500 to 1200 m and vary from small structures of a few meters to over 300 m in height, and occur singly or in large clusters (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.

Conservation Issues

Concerns were expressed about possible damage of the deep-water coral habitat by fishing activity at the first ACES Scientist-Stakeholder workshop held in Galway on 23rd June 2000. It was apparent that little was known 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 corals if threat to the future sustainability of the ecosystem was perceived (Grehan et al., 2001). In January 2001 acting on the recommendation of the ACES Stakeholder workshop, an Irish Coral Task Force was established to assist the ACES project at national level in delivering appropriate advice to policy makers (Grehan *et al.,* 2002). Membership includes representatives from Dúchas (Heritage Service), the Marine Institute, the Irish Sea Fisheries Board (BIM), the Irish Naval Service, the Department of Marine and Natural Resources, the Heritage Council, the Geological Survey of Ireland, the Universities and the Atlantic Coral Ecosystem Study.

Threats to Deep-Water Corals

At present the major activities likely to impact *Lophelia* reefs are: i) deep-sea fishing, particularly trawling, ii) oil and gas exploration, iii) bio-prospecting, iv) neighbouring aggregate extraction, v) scientific research, and vi) the laying of telecommunications cables and oil and gas pipelines. These activities will primarily cause physical disturbance to reefs while climate change will cause temperature and salinity fluctuations. The activities that require immediate regulation in the vicinity of coral reefs are: i) deep-sea trawling, ii) scientific research, and iii) oil and gas exploration.

Fishing Impacts

Irish deep-water fisheries use a variety of trawl and static gears (longline, tangle and gill net and pots for crabs (Grehan et al., 2003). The recent successful expansion of the orange roughy fishery has been due in part to the development of robust trawls fitted with rock hopping gear. While it is likely that all the fishing techniques mentioned above will have some impact if deployed in areas of coral, bottom trawling is undoubtedly the practice with the most potential to cause collateral damage.

Oil and Gas Exploration and Exploitation

Since the beginning of 2003, a new round of oil exploration concessions have been offered in the Porcupine Seabight. A number of these license blocks are in areas of carbonate mounds with well documented thriving deep-water coral communities. Drilling operations are likely to cause local damage to any coral habitat in the adjacent area.

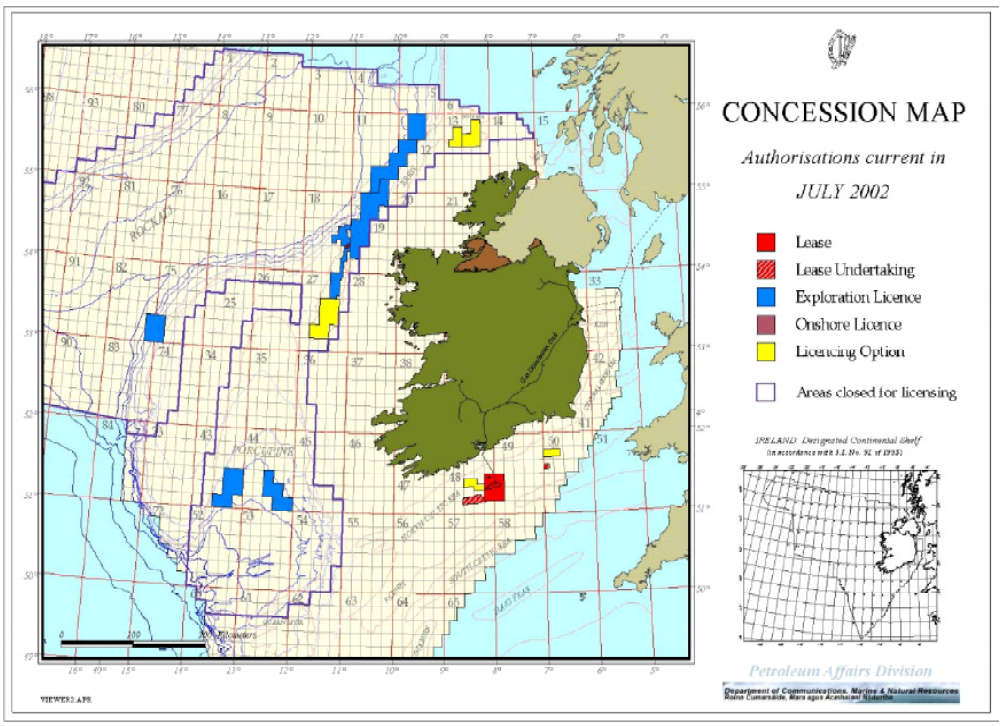

Figure 1. Oil and Gas Concession Map of Irish West Coast

Scientific Research

Irish deep-water corals are among the best studied in the world. Many European nations are now actively pursuing research programmes on deep-water corals in Irish waters. Destructive sampling with corers, grabs and dredges undoubtedly impacts coral reef locations, e.g. substrate scars resulting from scientific dredge sampling which took place in May 1999, were still plainly visible two years later during ROV inspection of locality (Grehan *et al*., 2003).

Assessment of Impacts

During summer 2001, a French-Irish-EU research cruise CARACOLE (Carbonate Mound and Cold Coral Research) visited five deep-water coral locations in the Porcupine Seabight and the Irish parts of the Rockall Trough in summer 2002 (Figure 2.5). Five coral/mound locations were studied in detail during this cruise: Thérèse Mound in the Belgica Mound Province; Propellor and Perserverence Mounds in the Hovland/Magellan Mound Province; the R1 Mound complex in the Pelagia Mound Province and the R2 Mound Complex in the Logachev Mound Province.

High-resolution video and close-up digital stills were taken with the French 'VICTOR' Remotely Operated Vehicle. These observations revealed exceptionally dense and rich coral communities dominated by the two framework constructing species, *Lophelia pertusa* and *Madrepora oculata*, and other suspension feeders, especially sponges, gorgonians and crinoids. Mobile fauna included echinoderms, crustaceans and various fish species. The coral communities covered large areas at some sites (e.g. Thérèse Mound and R2) but show a more patchy distribution and restricted area at other sites (R1, Propeller and Perseverance Mounds). Evidence of fishing activity was confined to imaging of static gears (gill/tangle nets) used to fish for monkfish or anglerfish (*Lophius* spp.) and hake (*Merluccius merluccius*), lost on the side of mounds. Images of impact resulting from scientific dredge sampling two years previously were also visible.

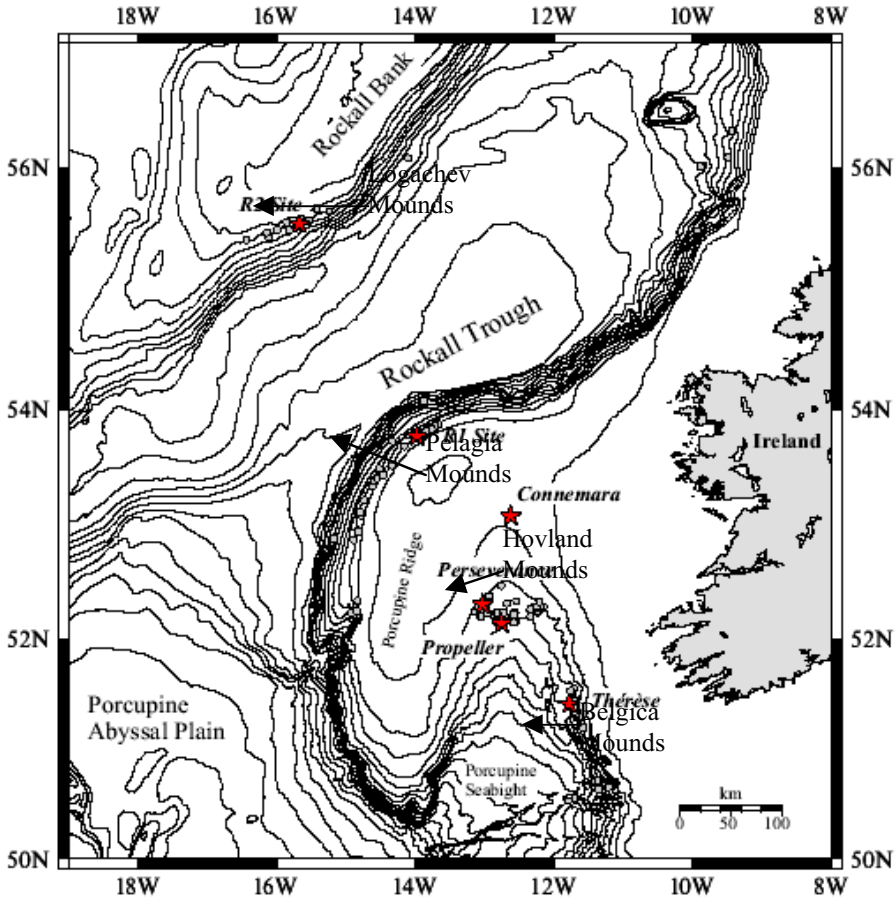

Figure 2. The location of carbonate mound sites investigated during the CARACOLE 2001 cruise (red stars). Circles highlight carbonate mound locations identified on the basis of seismic data (Croker *et al.,* 1998). Bathymetric contour interval 500 m (Grehan *et al*., 2003).

Several examples of lost nets were found during the video survey of the Thérèse Mound (Figure 3), along with evidence of previous scientific dredge surveys.

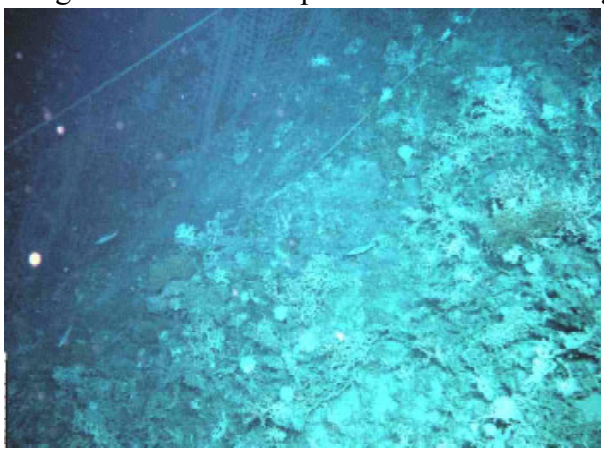

Figure 3.. A video grab image from the forward-looking camera showing a lost gill net on the western side of the Thérèse Mound. Note the abundant *Lophelia pertusa* colonies and large hexactinellid sponge (*Aphrocallistes bocagei),* and small gadoid-like fish (Grehan *et al*., 2003). c. IFREMER, 2001.

Future Concerns

The orange roughy fishery which utilises robust trawl gear is distinctly coral unfriendly. Orange roughy fishing in the Southern Hemisphere, particularly in Australia and New Zealand, 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 places (Koslow *et al.,* 2001). Although, the recent introduction of Total Allowable Catches and quotas for several deep-water fish species in European Community waters (European Community, 2002) will go some way to reducing the potential damage of unregulated fishing, nevertheless, the nature of the orange roughy fishery which puts a premium on the identification and exploitation of virgin stocks, suggests that the capacity for collateral habitat damage during exploratory fishing, by itself, will remain high. In mitigation, many of the mound sites are steep-sided with slope angles in excess of 20 degrees. Successful trawling requires slope angles less than 20 degrees (Andrae, 2002) which means that the mounds themselves may confer a certain degree of 'natural' protection from current trawling impacts. That said, given the fragile and ancient nature of coral reefs (Hall-Spencer et al. 2002), even a relatively short period exposed to this type of fishing impact would be likely to be catastrophic for the long-term viability of the coral habitat in its present physical configuration.

Legal Instruments to Conserve Corals

A review of the legal instruments available to conserve deep-water corals in waters under Irish jurisdiction was undertaken by Long and Grehan (2002)(see also Long, this volume). They recommended three actions that could be taken at European and coastal state level to protect the unique ecosystems associated with deep-water coral:

- Adoption at Community level of a specific technical conservation measure in the Common Fisheries Policy.
- 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.
- Improved monitoring and assessment of the conservation and management framework.

Special Areas of Conservation

The Irish Coral Task Force has begun to gather metadata so that all data may be assessed, prior to selecting areas for designation. This process will include the examination of data from the four areas of scientific interest, the Logachev and Pelagia Mounds either side of the Rockall Trough, the Hovland Mounds and the Belgica Mounds (Figures 2 and 4).

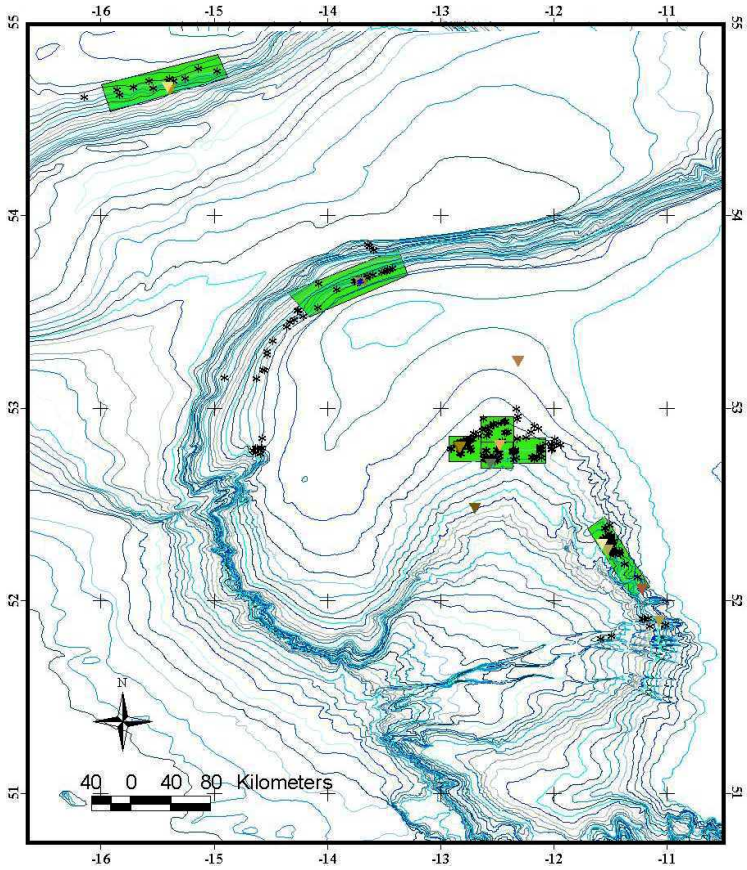

Figure 4. Four areas of scientific interest, the Logachev and Pelagia Mounds either side of the Rockall Trough, the Hovland Mounds and the Belgica Mounds, to the west of Ireland.

Current Status

In January 28th, 2002, the Coral Task Force briefed the Irish Common Fisheries Policy Review Group on the importance of the deep-water coral ecosystem and the urgent need for conservation measures. The Common Fisheries Policy Review Group included senior representatives from the Department of Marine and Natural Resources and the Irish fishing industry - Killybegs Fishermen's Organisation (KFO), Irish South and West Fishermen's Organisation (SWPFO), Irish Fish Producers Organisation (IFPO) and the Irish Fishermen's Organisation (IFO). In June 24th, 2002, ACES and the Coral Task Force held a Stakeholder Workshop for the Fishing Industry to update them on conservation initiatives.

Dúchas (the Heritage Service) have formally asked the Irish Coral Task Force and the Atlantic Coral Ecosystem Study for assistance in drawing up a list of representative sites with the view to designating offshore Special Areas of Conservation for deep-water corals. Commencement of formal designation of coral SAC's is expected to take place within 12 to 18 months.

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CORAL REEFS AND MARINE PROTECTED AREAS (MPA'S): STATUTORY AUTHORITIES THAT PROTECT MARINE HABITAT AND FISHERIES IN THE UNITED STATES*

Robert J. Brock (Presented at the 2002 Workshop)
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The Exclusive Economic Zone (EEZ) of the United States of America (US) begins approximately 5 kilometers (km) from the shoreline (outside state waters) and extends seaward some 320km. The US claims sovereign rights and exclusive fishery management authority over portions of the Atlantic and Pacific Oceans, Gulf of Mexico, Caribbean Sea, and Gulf of Alaska (Figure 1). With 5.4 million km^2 within its territorial waters, the US EEZ is the largest in the world. The marine environment of the US provides vital environmental and economical services to the Nation. As more than half of the US population lives in close (90 km) proximity to the coast, pressure from recreational activities in the form of swimming, boating and fishing continues to increase.

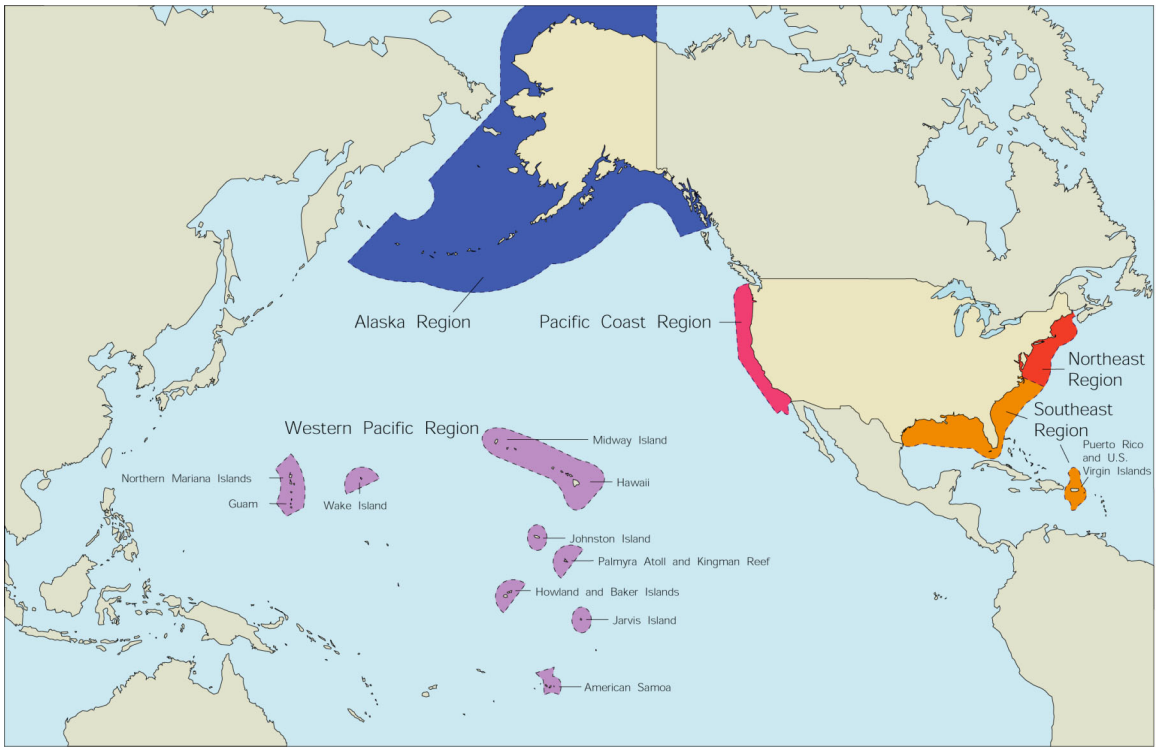

Figure 1. The Exclusive Economic Zone (EEZ) of the United States.

Living marine resources (LMR's) directly and indirectly support extensive industries in the US Commercial and recreational fishing significantly contributes to the economy of the Nation and constitutes a major source of employment to many coastal communities. In 2000, for instance, 20 billion kilograms (kg) of LMR's from commercial landings alone by US fishers were estimated at $3.5 billion. Additionally, it has been estimated that recreational fishers took 76 million fishing trips and caught 429 million fish (NMFS 2002).

Despite this economic and ecological importance, and the enormous financial and logistical effort to effectively manage fisheries, many fish stocks around the world continue to decline. More than 66% of commercially harvested fish stocks worldwide are considered exploited and 22% are considered either overexploited or depleted (Rose, 2000). In the US, most of the stocks under management purview of the National Marine Fisheries Service (NMFS) are unknown (NMFS 2002). Management of marine fish stocks suffers from the fact that many commercially sought after species are long-lived and utilise a variety of habitats throughout their life history stages.

During the waning days of 1973, the **Endangered Species Act** (ESA) was signed into law. The ESA attempts to conserve marine and anadromous species which may be becoming seriously depleted, and in danger of extinction over a significant portion of their range. Importantly, the ESA also seeks to conserve the ecosystems that the listed species depends upon for their healthy existence. These "critical habitats" include specific areas that are found to have the physical and biological features that are deemed essential to the life stages of a listed species.

While the ESA may indirectly provide for protection of some fish stocks and their corresponding habitats, the landmark legislation governing fisheries management in Federal waters of the US was crafted in 1976 with the passage of the **Magnuson-Stevens Fishery Conservation and Management Act** (herein known as the Magnuson Act). The Magnuson Act created eight Regional Fishery Management Councils (FMC) throughout the country that are charged with conserving and managing fisheries resources under their regional jurisdiction. This process involved developing individual fishery management plans (FMP's) and proposing regulations governing the individual species. The national standard for fishery conservation and management strives for conservation and management measures to prevent overfishing, yet equally strives for extracting the maximum sustainable yield (MSY) from each fishery for the US fishing industry. Since the passage of the Magnuson Act in 1976, decisions of the Councils have not always achieved this balance nor reversed the decline of many fish stocks due to competing interests, political pressure, and unreliable scientific data.

This approach in managing fisheries as single species with little regard for species interactions and relationships with habitat has begun to change in the US. Habitats provide critical food and shelter for marine organisms throughout different life stages (Figure 2). Laboratory experiments conducted by Gotceitas et al. (1997) clearly showed that juvenile Atlantic cod (age 0+) hid in the interstitial spaces of eelgrass beds in order to escape predation. Young grass shrimp (*Palaemonetes pugio*) and killifish (*Fundulus heteroclitus*) distribution in Georgia marshes were found almost exclusively among shallow intertidal marsh grass, separated from adults to avoid predation. Food availability and refuge from predators allowed grass shrimp densities in these marshes to reach 800 m^2 (Kneib, 1987). With the aid of beach seines and trawl nets, Deegan et al. (1997) were able to demonstrate that juvenile fishes of Narragansett Bay, Rhode Island, clearly preferred vegetated areas of the Bay compared with adjacent sandy and muddy bottoms. It has long been recognised that reef fish seek refuge from predators within the many crevices of coral reefs (Figure 3). Attempting to manage fisheries with little regard for protecting the habitats that they so closely depend upon has proven to be a costly omission.

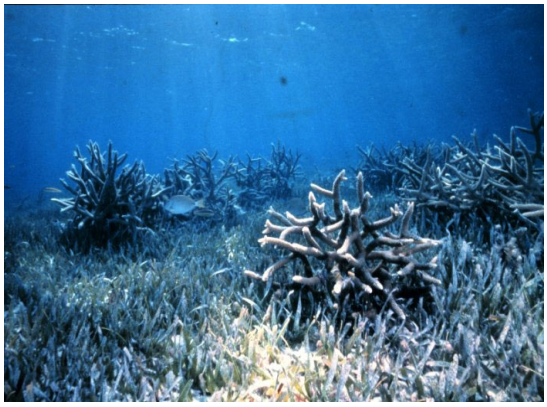

Figure 2. Habitat such as coral and seagrass provide food and shelter for many fish and invertebrates
(photo courtesy of NOAA library)

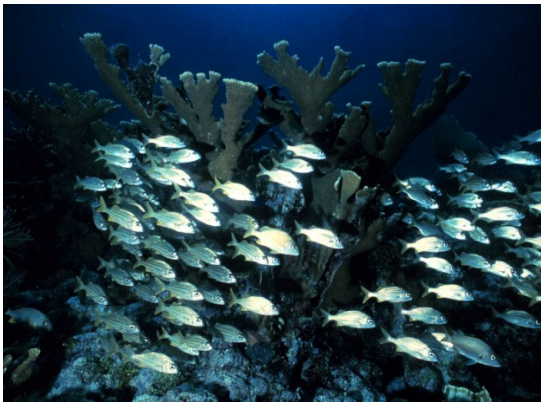

Figure 3. A school of snappers schooling around thickets of branching coral in the Florida Keys
(photo courtesy of NOAA library)

With that in mind, Congress amended the Magnuson Act (now the Magnuson-Stevens Act) and passed the **Sustainable Fisheries Act** (SSA) in 1996. Noting that certain stocks of fish continue to decline and where their survival is threatened if fishing pressure is not reduced and habitat that is important to fish is not protected, the SSA required the Council's to develop FMP's that minimised disturbance to important fishery habitat caused by fishing gear. For the first time since the passage of the Magnuson Act in 1976, the SSA amendments make the duty to protect fish stocks and the habitat that they so closely rely on an enforceable legal obligation. The requirement to manage a fishery throughout its range as mandated to protect fishery habitat, is a very important step in trying to reverse the severe declines of so many important species.

The Congressional record states that one of the greatest long-term threats to the viability of commercial and recreational fisheries is a continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for conservation and management fishery resources of the United States (16 USC. 1801 (A) (9)). The amended Magnuson-Stevens Act requires Federal agencies to minimise damage to **Essential Fish Habitat** (EFH) from fishing practices, to the maximum extent possible (Fluharty, 2000). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding and growth to maturity. The Magnuson-Stevens Act mandated the identification of EFH for managed species as well as measures to conserve and enhance the habitat necessary to fish to carry out their life cycles (Waste, 1996).

It is now being realised that in complex benthic habitats, mobile fishing gear can severely reduce the structural complexity of fish habitat, making it more likely that juveniles will be preyed upon from lack of refuge as well as interfering with important benthic processes (Langton *et al.,* 1996). Recent studies have shown a positive correlation between loss of benthic habitat caused by destructive fishing gear and a reduction in fish biomass and diversity (Waste, 1996 and Rose, 2000). Therefore, it is essential that habitat that is extremely vulnerable to disturbance and of great ecological importance (such as coral reefs) be protected from this damage.

The US uses EFH and **Habitat Areas of Particular Concern** (HAPC) designation to prohibit any fishing gear that is capable of catching groundfish species in areas that possess vulnerable and ecologically important habitat. Several areas in the Gulf of Mexico (e.g., Florida Middle Grounds) and South Atlantic (e.g., Oculina HAPC) prohibit bottom trawling in order to protect the branching *Oculina* corals from being destroyed by bottom trawling. This rationale has been used recently by Canada to designate 424 km^2 of the Northwest Atlantic off the Canadian Maritimes that contain mounds of deep-water coral such as *Lophelia* as marine protected areas where bottom trawling is prohibited (Canada Dept. of Fisheries and Oceans). In 1999, the Norwegian Ministry of Fisheries issued regulations for the protection of deep-water coral reefs and made a 1000 km^2 area closed to bottom trawling (ICES). Scientists in Europe (Gage, 2001 and Gordon, 2001) Canada, and the US continue to discover and describe important deep-water habitat that offers important ecological functions such as EFH for fish species (Figures 4-5).

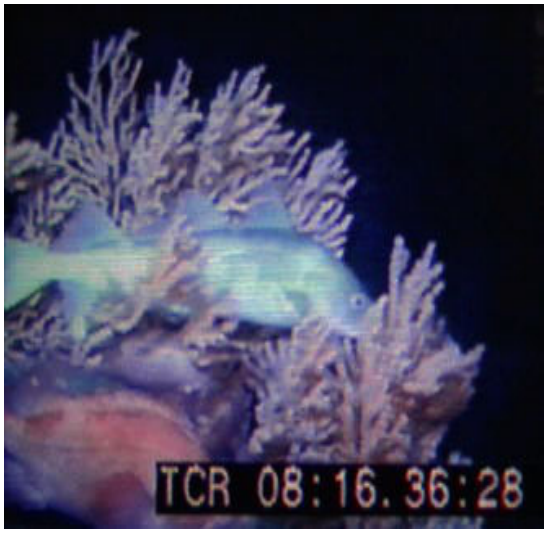

Figure 4. Atlantic cod utilising deep-water coral for food and protection (photo from the Canadian Coral Science Centre)

Figure 5. Deep-water corals are vitally important as nursery areas to juvenile species (photo from the NOAA Auke Bay Laboratory)

In recent years, President Clinton used his authority to add more protection to important habitats. **Executive Order** (EO) **13809** was signed into law in 1998 and seeks to reduce and mitigate coral reef ecosystem degradation and to restore damaged reefs. The EO directs Federal agencies to take measures to ensure reductions in impacts to coral habitat from pollution, sedimentation, and fishing. **Executive Order 13158** (EO) became law in 2000 and seeks to set up a national system of marine protected areas to fully protect biodiversity and important habitat. The EO states that consumptive uses would be prohibited in areas where it is necessary to preserve habitats of the marine environment.

Fishery managers in the US realise that habitat availability and quality are important to any sustainable fishery and are now using some of the statues described above to protect the habitat that fish so closely depend upon. Ongoing scientific research and monitoring seeks to identify the distribution and quality of habitat such as deep-water corals and to minimise damage from anthropogenic sources such as fishing activity. It is no longer possible to manage single species "in a vacuum" and attention must be paid to ensuring water and habitat quality and be part of any FMP.

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* **The views expressed are those of the author and do not necessarily reflect the opinions of the National Oceanic and Atmospheric Administration/National Marine Fisheries Service**

DEEPWATER FISHERIES AND SEA MOUNT CONSERVATION IN TASMANIAN SEA AND AUSTRALIA

Tony Koslow (Presented at the 2002 Workshop)
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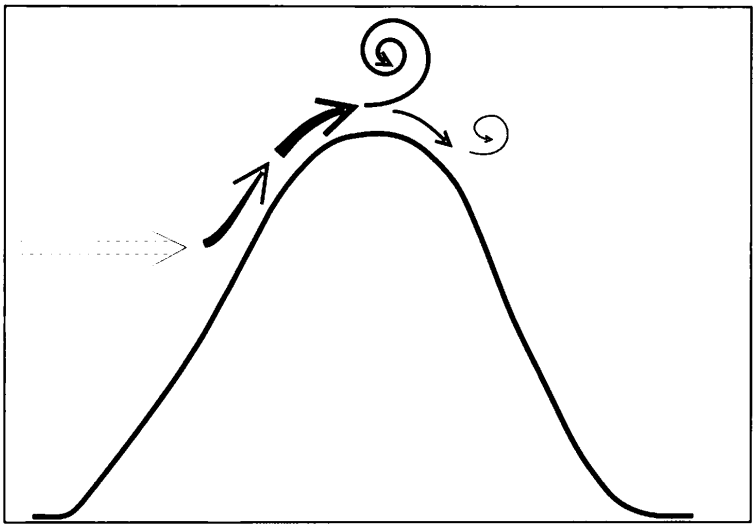
Seamount and deepwater coral environments and ecology

Seamount and other deepwater coral environments, the so-called 'oases of the deep,' often contain dense stands of deepwater corals and substantial fish aggregations, in marked contrast with the sparse macrofauna generally found over the vast sediment-covered plains of the deep seafloor. Topography, physical and biological oceanography are tightly coupled, such that seamounts characteristically enhance current flow, which winnows away the sediment and increases the flux of prey necessary to support the fish and suspension-feeding invertebrate communities.



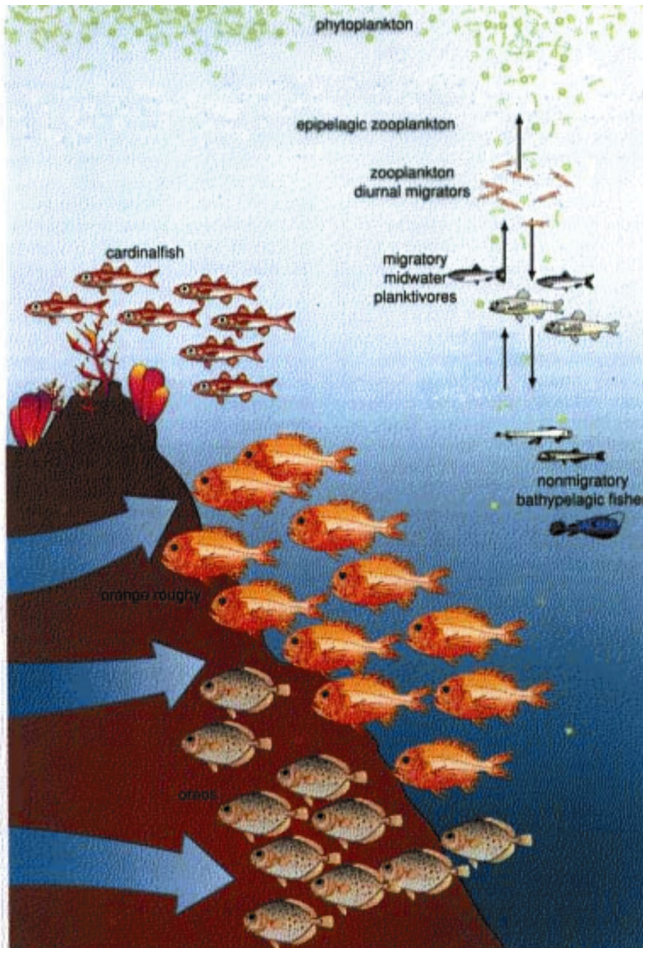
The species associated with seamounts and other deepwater coral environments thus differ substantially from those generally found in the deep sea. The benthos is dominated by a variety of hard and soft corals, sponges, crinoids and brisingid seastars, compared with the deposit feeders associated with the soft sediments over most of the deep seafloor. These benthic communities are often characterised by high species diversity and high levels of endemism (Richer de Forges *et al.,* 2000). This was only recently recognized due to limited sampling of these environments: as late as 1987, 72% of the species known from seamounts were obtained from sampling only 5 seamounts; and these were generally flat-topped, sediment-covered and near continents, such that their faunas were dominated by the nearby continental slope fauna (Wilson and Kaufmann, 1987). Less than 600 species were reported from seamounts worldwide, a mere 27 from the seamount-rich Southwest Pacific. Then in the 1990s, sampling by France and Australia over 24 seamounts in a limited region of the SW Pacific, the Tasman Sea, yielded over 850 species of macro- and megabenthos, a fraction of the species apparently there but substantially more than were previously known from seamounts worldwide (Richer de Forges *et al.*, 2000). Approximately one-third of the species in this study appeared to be endemic to the seamount environment and many had extremely limited distributions. These factors, combined with their extreme longevity (hundreds of years for some species (Vacelet *et al.,* 1992)) renders them at high risk of extinction from persistent anthropogenic disturbance.

To highlight the high diversity of this fauna, more cool and deepwater coral species are now known than of tropical species, and the number of known deepwater corals continues to increase with expanding study of this environment (Cairns, 1999).

Deepwater fisheries

Substantial aggregations of commercially fished species, such as orange roughy and redfishes (*Sebastes* spp) are often supported as well, in these environments. Such fishes are characterised by such life history characteristics as extreme longevity (on the order of 100 years), low productivity and episodic recruitment, as well as a high degree of aggregation in these environments, which renders them highly susceptible to overexploitation. Fisheries for these species typically undergo a marked boom-and-bust cycle. The time from inception of these fisheries to their collapse is often less than 10 years (Koslow *et al.,* 2000). Thus the gain from these fisheries is short-term indeed, in the absence of dedicated assessment and management programs.

Fisheries on seamounts and deepwater coral environments are generally conducted by trawl and may inflict severe damage on these environments, due to the corals and associated benthic species being swept up as incidental bycatch and discarded. Koslow et al (2001) reported that on a heavily fished seamount off Tasmania, >90% of the slopes were reduced to bare rock, compared with >60% being covered by living and dead coral aggregate on a nearby unfished seamount. There are anecdotal reports from the South Pacific and North Atlantic of fishermen deliberately dragging chain between trawl doors over coral bottom to remove the coral and 'prepare the ground' for fishing, in order to avoid net damage.



Deepwater fisheries were not covered as recently as in Gulland's (1971) classic overview of world fisheries and Rowe's (1983) review of deep-sea biology.

These fisheries developed rapidly in recent decades, due to several factors:

- depletion of traditional shelf fisheries;
- advances in electronics and acoustics (e.g. GPS, net sondes, track plotters, broad-swath seafloor mapping) that enable deepwater fishing grounds to be efficiently mapped, isolated features to be located and previously untrawlable ground to be fished;
- and recognition that deepwater topographic features, such as seamounts, banks and canyons, can foster aggregations of commercially valuable species, despite the generally depauperate conditions prevailing in the deep sea.

Deepwater fisheries can be exceptionally intensive: Soviet fishing effort for pelagic armourhead (*Pseudopentaceros wheeleri*) totaled 18,000 trawler days between 1969 and 1975 on a few seamounts in the southeast Emperor-Northern Hawaiian Ridge system (Borets 1975). Deepwater fisheries have now spread from the North Atlantic and North Pacific to virtually all ocean basins, including the Indian and Southern Oceans in recent years (Koslow *et al.,* 2000). Baseline data for benthic communities prior to the onset of fishing are unavailable for deepwater fishing grounds, so it is virtually impossible to assess what habitats and species may already have been lost.

Deepwater conservation

There is now widespread recognition of the urgent need to protect threatened deepwater habitats, and a number of deepwater habitats have been set aside in marine protected areas (MPAs) in recent years. A group of 14 seamounts south of Tasmania, adjacent to an orange roughy fishing ground, was set aside in an MPA in 1999. Nineteen seamounts around the New Zealand EEZ, also in areas of orange roughy fishing, were granted similar protection in 2000. The 2000-km long northwest Hawaiian Islands Coral Reef Ecosystem Reserve was also established in 2000. In the North Atlantic, graphic video footage of the damage inflicted by trawling on *Lophelia* banks off the coast of Norway led that country to set aside the Sula Ridge in a marine reserve.

Australia's approach to MPAs

Multiple use has been the cornerstone of Australia's marine policy, as it has developed since 1996. The guiding principles of this policy have been:

- maintenance of ecosystem integrity, i.e. biological diversity and ecosystem processes,
- sustainable resource use,
- equity, and
- a participatory framework for decision making.

To accomplish this, the Australian government is now committed to developing a national representative system of marine protected areas (NRSMPA) (ANZECC, 1998a). These MPAs are to be nested within a framework of integrated management, to include MPAs ranging from highly protected (IUCN category I) to multiple use (IUCN category IV). The underlying biogeography of the Australian marine fauna is to provide the basis for the NFRSMPA: an ecosystem-based classification of marine and coastal environments, known as the 'interim marine and coastal regionalisation for Australia,' or IMCRA. A bioregionalisation consisting of 8 demersal provinces

and 8 demersal biotones around Australia, along with 2 pelagic provinces and 2 pelagic biotones has been adopted (ANZECC, 1998b). The NRSMPA is intended to include all major ecosystem types within each bioregion.
The process of developing an MPA in Australia is meant to proceed through the following stages:

- identification of a threat and need for conservation
- an initial consultation with industry and scientists to identify industry needs and conservation requirements
- research, as may be required, e.g. to assess fishing impacts and provide baseline surveys of proposed MPAs
- consultation between scientists, industry and managers to define the MPA, and (inevitably)
- compromise between parties

Development of the Tasmanian Seamounts MPA is an example of this process. CSIRO was initially commissioned by the Commonwealth environmental agency (Environment Australia) to conduct a desktop study, which led to recognition of the need to protect the benthic seamount environment. Following consultation between scientists, Environment Australia and the fishing industry, an interim protected area was established that appeared likely to conserve a representative and significant portion of the seamount community and habitat, with minimal impact upon the local fishing industry. Scientific research was then funded to determine the impacts of fishing and whether the proposed MPA in fact would meet its primary conservation objective, which it appeared to do. Subsequent consultation with the fishing industry and environmental NGO's identified a potential conflict between establishing a Category I MPA protected throughout the water column and the pelagic long-line fishery for southern bluefin tuna. Based on the physical and biological structure of the water column, a compromise was reached, whereby the upper 500 m of the water column were defined as a Category IV Managed Resource Zone, which enabled the pelagic fishery to continue, and the deeper waters and seabed were fully protected as a Category I MPA.

In summary the need to conserve deepwater habitats from the effects of trawling is now widely recognised. Many of these habitats, particularly those dominated by deepwater corals and associated species are highly diverse, limited to particular depths and/or topographic features that are targeted by commercial fisheries, and contain a significant proportion of endemic species, often with extremely limited distributions.

The *Lophelia* mounds off the coast of Ireland are still apparently relatively undisturbed, but deepwater fisheries in the North Atlantic are still expanding and seeking out new grounds and stocks, as old grounds are depleted. This seems the right time for Ireland and the European community to take the necessary steps to protect these unique biological communities.

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AN OVERVIEW OF THE DEEPWATER FISHERIES IN THE NORTH-EASTERN ATLANTIC

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Scottish Association for Marine Science, Dunstaffnage Marine Laboratory

What type of fishes are exploited?

In shallow water, fish are generally classed as pelagic or demersal. In the deep water the pelagic fauna are usually divided into three zones. The epipelagic zone includes all those fish living in the surface layers of the ocean, such as the tuna fishes. The mesopelagic zone occupies depths down to about 1000 metres and includes the hatchet and lantern fishes. The bathypelagic fishes such as angler fish and gulper eels, occur from about 1000 metres down to abyssal depths and are generally highly adapted to life in a dark, food-poor environment. The deep-water demersal fishes are generally divided into two categories. Those that have a close association with the seabed are the benthic fishes and include skates and flat fishes. Those that live in the water column just over the seabed are generally known as the benthopelagic fishes. It is the benthopelagic fishes that form the basis of the new deep-water fisheries.

If biomass decreases exponentially with depth how can there be a viable deep-water fishery?

There have been numerous trawl surveys on the continental slopes and rise to the west of Scotland and Ireland. All have shown that in terms of total fish catch there is generally a peak of abundance and biomass at around 1000 m. Below about 1500 m biomass decreases rapidly. To understand the phenomenon of maximum biomass on the mid-slope it is necessary to consider the diets of deep-water fishes. The most comprehensive studies on the diets of deep-water fishes have been carried out by SAMS in the Rockall Trough. The diets of over 70 fish species have been described and the results have been published in a series of 20 scientific papers. The dominant prey of the benthopelagic fish is pelagic or benthopelagic organisms. Relatively little use is made of benthic organisms.

The source of all energy to the deep sea is from surface production of phytoplankton in the euphotic zone, which in turn is consumed by the herbivores, which are then preyed on by the carnivores. A certain amount of the energy from this food chain reaches the deep sea as a continuous rain of dead organisms or their products. Recently it has been shown that there is a rapid seasonal input of organic material directly associated with dead phytoplankton (microscopic plants) to the sediments of the deep sea. The quantities of these materials reaching the sea bed declines with increasing depth and the resulting production of benthic organisms could never support the benthopelagic fish populations. The rapid sinking of large, dead organisms to the seabed can provide a valuable food source for some scavenging fish species. However, there is little doubt that the success of the benthopelagic fishes of the slopes results from the transfer of the energy of surface production downwards, via the mesopelagic fauna of both fishes and invertebrates. One possible pathway is via the overlapping food chains of organisms that occupy specific depths. Many mesopelagic organisms also carry out daily vertical migrations. These organisms, which live at depth during the day, migrate upwards at night to feed close to the surface. Over the slope this vertical migration carries the food source directly down to the seabed. There is also evidence that the daytime aggregations of mesopelagic

organisms at depth can impinge horizontally onto the slope. It is therefore reasonable to assume that the success of the deep-water, bottom-living fishes and their maximum biomass at mid-slope depths is the result of the exploitation of this abundant pelagic food source.

How many fish species are exploited?
At any given depth a trawl catch in the Rockall Trough or Porcupine Seabight might yield 40 to 50 different species of fish. However, in terms of numbers or biomass only about five species will comprise 80 to 90% of the total catch. In terms of biomass it is species such as roundnose grenadier, blue ling, black scabbardfish and deep-water sharks that dominate and comprise the commercially exploited species. At the greatest depth the proportion of unmarketable smoothheads in the catch can be high and increase the already high discard levels in the fishery. The orange roughy is an aggregating species and is generally in low abundance in trawl surveys. Each species has its own depth range and this can be very variable between species. Therefore the catch composition varies continually with depth.

When did the deep-water fishery begin?
The USSR began deep-water fishing for roundnose grenadier in the North Atlantic in the 1960s and in the east this was restricted to the international waters of the Hatton Bank. In the early 1970s the UK and Germany began to explore the potential for developing deep-water fisheries to replace lost fishing grounds at Iceland, Faroe and Norway. However, the only fishery to develop from this was a short-lived German fishery for blue ling around the northern banks of the Rockall Trough. France, which had traditionally fished the outer shelf for species such as ling then began to move into deeper water an exploit blue ling. It was the development in 1989 of markets for previously discarded deep-water species such as roundnose grenadier that led to the present fishery.

Is there a single deep-water fishery?
There are several quite distinct fisheries. The deep-water fisheries around Scotland and Ireland can be divided into two major sectors separated by the Wyville Thompson Ridge which extends between the Shetland Islands and the Faroe Islands at a depth of about 500 m. The fisheries on each side of the Ridge are very different. In each area the fishey an be further divided into demersal trawl, semi-pelagic and static (longline and fixed net). In terms of the impact on corals the demersal trawl fisheries are the most damaging.

The deep-water demersal trawl fishery to the west of Scotland and Ireland initially targetted spawning aggregation of blue ling. This fishery still continues but it appears that some concentrations are now smaller. New aggregations are being discovered and fished, especially in international waters. The main trawl fishery is a mixed fishery in which the main species are roundnose grenadier, blue ling, black scabbardfish and deep-water sharks. The target species varies according to market value, seasonal availability etc. which in turn dictates the depth of the fishery. The blue ling fishery is centred on about 800 m and has a bycatch of black scabbardfish while the fishery for roundnose grenadier is deeper (1000 – 1200 m). The main fishing effort is by France, although the Scottish fleet has had a deep-water presence for several years and Ireland is carrying out exploratory fishing. The Scottish fleet fishes mostly on the upper slope and monkfish is a key species. The fishery for orange roughy is specialised and at

depths >1000 m. In the EU sector the orange roughy is only fished by France and the trawl may not always be on the bottom.

The demersal fishery to the west of Shetland and is centred on depths of about 600 m close to the interface between the warmer Atlantic water and the deeper, colder Norwegian Sea water. The main target species in this fishery is the Greenland halibut. The overall fish biomass decreases greatly in the colder water and these areas are not likely to be commercially fished.
The longline fisheries are mainly to the west of Scotland and Ireland and target ling, tusk and hake on the upper slope areas. Bottom gillnet fisheries in the EU sector are insignificant.

What quantities of fish are landed?
Sometimes the official reported landings are for grouped categories of fish. The ICES Study Group on the Biology and Assessment of Deep-sea Resources has compiled landings data from a variety of sources and these are given in the reports of the ICES Advisory Committee of Fisheries Management (ACFM). The landings for 1998 for combined ICES Sub-areas VI and VII were as follows: roundnose grenadier (6364 t); blue ling (7310 t); black scabbardfish (1967 t); orange roughy (1071 t); sharks (including deep-water) (5590 t).

Are deep-water fisheries regulated?
An overall effort restriction has been in place for the EU sector since 1996, but it is not clear whether it has ever been enforced. The fishery in international waters is unregulated. The most recent (May 2000) overall management advice from ICES is as follows: *Most exploited deep-water species are, at present, considered to be harvested outside safe biological limits. ICES recommends immediate reduction in these fisheries unless they can be shown to be sustainable. New fisheries should be permitted only when they expand very slowly, and are accompanied by programs to collect data which allow evaluation of stock status.*
For blue ling ICES have recommended that there be no directed fisheries for this stock and that catches in the mixed fishery be minimised. They also recommend that fishing effort be reduced by 30% for ling and tusk and by 50% for roundnose grenadier and black scabbardfish.

IMPACT OF FISHERIES ON *LOPHELIA* REEFS IN NORWEGIAN WATERS

Pål Buhl Mortensen and Jan Helge Fosså (Presented at the 2000 Workshop)
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The Institute of Marine Research (IMR) has assessed the effects of fisheries on the *Lophelia*-reef habitat (see Fosså *et al*. 2000). The *Lophelia*-reefs are old, slow-growing biological structures that support a high diversity of benthic species. The reef areas have traditionally been rich fishing grounds for longline and gill-net fisheries. However, anecdotal reports from fishermen indicated that modern trawlers are damaging the reefs. Inspections with ROV and video camera and mapping of the seabed with sidescan sonar verified reports from fishermen that several reef-areas were heavily impacted by bottom trawling off mid-Norway. The documentation included crushed coral-reefs, scars from trawl doors in the sediments and remains of lost fishing gear. At Storegga (62˚ 30' - 63˚ 30' N) destructed corals were observed most frequently at depths between 200 and 300 m. Deeper, down to c. 400 m intact reefs occurred. Fosså *et al.* (2000) estimated that 30 – 50 % of all known reef areas are impacted by trawling activities. These results are dramatic and the damage may not only have consequences for the distribution of large, old reefs, but also on the diversity of associated species and abundance of redfish (*Sebastes* spp.). The most obvious effect from mechanical impact by bottom trawling is increased mortality in coral populations. Crushing of coral colonies changes the spatial arrangement of polyps and damages the polyp tissue. This probably reduces the polyps' ability to catch food particles and increase the risk of microbial infections. Furthermore, trawling over coral-reefs will also lead resuspension of bottom material that may impact the corals negatively.

In order to encourage the government to take action for protection of the reefs, communication of results was essential. Documentation of damaged reefs and information on the potential ecological importance of the reefs for fish were presented to the Ministry of Fisheries. The results were also presented in National television channels and newspapers. It has been important to express the extent of impact from trawling to the fishermen and authorities in an understandable way. The project-report documents the distribution of *Lophelia pertusa* and impacted areas along the Norwegian coast, and now serves as a basis for selecting new protection areas. The communication of scientific results and suggested measures resulted in a general restriction that forbade bottom trawling on known coral reefs. In addition, two areas, the Sula Ridge and the Iver Ridge, were closed to bottom trawling in 1999 and 2000 respectively. In 2000 Norway's first marine national park was provisionally declared at the Tautra Ridge in Tronhjemsfjorden. This is the worlds shallowest occurrence of *Lophelia pertusa* at 39 m depth, and the park has been established to protect the corals from harmful human activities such as anchoring, scuba diving, and dredge sampling. The project has contributed significantly to the challenging task of mapping the deep-water reefs, but a large part of the Norwegian continental shelf is still not investigated. At present, two coral areas are closed on the Norwegian shelf. However, this may be far too little to ensure the future of the reefs and their diverse associated fauna.

6 REFERENCE

Fosså, J.H., P.B. Mortensen and D.M. Furevik, 2000. *Lophelia*-coral reefs in Norway. Distribution and effects of fishing. - *Fisken og havet* No. 2 - 2000, 94 pp.

BIM DEEPWATER PROGRAMME 2001

Dominic Rihan, (Presented at the 2002 Workshop)
BIM, Dun Laoghaire, Co. Dublin

Background

Under the Whitefish Renewal Scheme a number of vessels entered the Irish fleet during 2000 and 2001 with the potential to target deepwater species and have participated in trials with BIM and the Marine Institute to establish fisheries over the last two years. Results have been encouraging and landings have shown a steady increase since 1999.

Nine trawlers and one longliner participated in the deepwater fisheries trials funded during 2000, landing approximately 700 tonnes of non-quota, deepwater species from 340 valid fishing days. Additional tonnage was landed by vessels operating outside the trials, the extent to which is unknown. In 2001 the number of vessels, which participated in the deepwater fisheries increased to eleven. The fleet consisted of ten trawlers and one longliner, of which eight were involved in deepwater trials and an intensive programme of scientific and technical observation.

The specific objectives of the programme were to collect data on fishing activity, catches and discards, throughout the course of fishing operations, in accordance with best international practices and techniques; to increase the amount of biological data available on deepwater species and to provide this data in an internationally acceptable format to the ICES Advisory Committee on Fishery Management (ACFM) on the biology and assessment of deepsea fisheries resources.

Observer Programme

During the course of the deepwater trials 80.7% of the fishing days of 8 newly commissioned boats fishing deepwater species in 2001 were observed by BIM personnel, supported on occasion, by Marine Institute staff. This represented 505 fishing days over the period March-November 2001. Observers measured a total of 43,019 fish at sea and 2,276 fish ashore and collected detailed biological information on 654 hauls.

Fleet Activity and Catch Composition Data

Boats targeting deepwater species concentrated their efforts in four distinct areas of the continental slope off the continental shelf margin of Ireland and the UK. (Fig. 1). Vessels worked waters down to 1294m off the north, west and south west of Ireland using bottom trawls, where catches were dominated by silki shark, black scabbard and roundnose grenadier. A small number of the larger boats targeted aggregations of orange roughy on seamounts to the west and north west of the Irish coast. Following a period of familiarisation with the area and the fishing techniques required, these boats proved successful and accounted for the majority of the orange roughy taken during 2001. A small number of boats worked colder waters of 500m to 600m depth along the continental shelf margin to the north of Scotland. All Greenland halibut and redfish catches came from these vessels with the majority of these landings being made in Scrabster, Scotland.

The total commercial catch and total catch of discards by weight were estimated, by species, using observer data in combination with commercial landings data. The weight of discards relative to that of the retained catch showed a steady increase with

decreasing latitude, ranging from 23% discard in the area West of Shetland to 45% in the Porcupine seabight (Fig. 2).

The composition of the commercial catch also showed latitudinal variation (Fig. 3). Blue ling, redfish and Greenland halibut dominated the catches in the colder waters off Shetland, whereas roundnose grenadier, silki shark (Portuguese dogfish) and black scabbard dominated the more southerly stations. Orange roughy was found in greatest abundance over seamounts within the North Porcupine and West Porcupine areas.

The composition of the discarded catch (Fig. 4) was dominated in the south and west of the areas fished by Baird's smoothhead (33% to 49%). Birdbeak dogfish also formed a significant component of the discards (14% to 33%) in all areas other than that off the west of Shetland. The predominant discard species in this area was argentine (64%) with eelpouts (11%) and rays (12%) constituting the bulk of the remainder.

Age Determination

As well as the biological and catch data, the systematic collection of material for the ageing of deepwater fish was also carried out. The collection of material for the ageing of deepwater fish is an inherent necessity in the responsible management of exploited fish stocks.

A total of 1070 otoliths were removed from 29 species of teleost fish, 135 dorsal fin spines accompanied by vertebral sections, from five species of elasmobranch (i.e. sharks, skates and rays) and 29 dorsal fin spines from two species of chimaera (Rabbitfish).

The central ageing facility in Queenscliff, Australia was selected to process the otoliths of fish species collected during the programme given their comprehensive experience with deepwater species.

The studies found that orange roughy and grenadier are slow growing species and are considered to be periodic rather than annual spawners. Roughy appear to recruit to the fishery at maturity at an age of over 30 years. Roundnose grenadier show a similar pattern. The fact that these populations have a high proportion of old fish, the low fecundities of the species, and slow regeneration and growth make stocks of deepwater species such as orange roughy and grenadier susceptible to overfishing and this has found to be the case worldwide. black scabbard have a much younger age profile reflecting an energetic life history of migration and active predation.

Occurrence of Coral

The bottom topography over the areas fished during the trials differed considerably from area to area. The majority of the work was carried out on fairly level ground to the west and north-west of the Porcupine Bank and further south from 54º 30' N south to 51º00'N. The seabed in these areas is predominantly soft mud interspersed with areas of much harder ground of rock and in certain areas hard and soft coral.

The area to the west of the Shetland Isles, along the Faeroese-Shetland channel is a complex and difficult area to fish due to strong tides and currents. The nature of the bottom on these grounds was very variable, with patches of soft mud, mixed with

areas of stone and siliceous sponges (referred to as "duff" by fishermen) encountered. Damage to belly sheets and codends was considered to be potentially severe and stone traps were fitted to the gear to minimise the risk of gear damage from boulders and sponges taken in the trawl. Due to the prevailing substrates in this area, bridle and door shoe wear, were also excessive.

Several of the vessels also fished on continental seamounts, commonly referred to as "pinnacles", primarily for orange roughy. These features are in reality fairly gentle slopes less than 300m high and the term "seamount" is probably erroneous as hydrographers classify true seamounts as those features that rise more than 1,000 metres, which are generally found coming up from the deep ocean floor. The undersea features fished appear to have variable surfaces with some made up of mud and sand, some largely hard rock and coral, but most a mixture of substrates.

Overall the percentage of observed tows over all areas with any significant by-catch of coral was low, being less than 15 % of the total hauls. Several of the undersea features fished in the area 53º06'N 14º50'W and 53º20'N and 11º30'W yielded the most significant quantities of coral by-catch, almost exclusively *Lophelia*. Interestingly coral by-catch was not exclusive to the trawlers, as the longliner participating in the trials caught quantities of coral, particularly in an area running north-east from 54 30'N, 12º 50'W. In this area there would appear to be large patches of very hard coral, evidenced by the fact that during the trials in 2000 significant trawl damage was experienced in this location and subsequently largely avoided by trawlers in 2001.

Coral Management Measures

The use of Marine Protected Areas (MPAs) have been put forward as a means of managing not only deepwater fisheries but also protecting sensitive habitats such as cold water corals. While there is no doubt that such coral reefs are present in the North Atlantic, their extent and location would seem still largely unknown and the impact fishing activity has had on these habitats up to now even less well defined. Recent reports of deepwater trawlers destroying vast areas of the sea floor in the North Atlantic would appear exaggerated as whilst, some impact is inevitable, from New Zealand experiences in similar fisheries it would appear quite localised. A high proportion of hills and seamounts, where coral is thought to be abundant are either too deep, steep and rough to fish successfully. As has been found some can be extensively fished, but even then large parts of these features have been found too steep or rough, and so only limited tow tracks can be worked. This would appear to provide natural reserves for fish and animal communities on the seamount and consequently most of the area around such features are lightly fished or not at all.

It is felt before MPAs could be introduced therefore not only would they need to be properly defined, but also the socio-economic effects of closing areas to fishing would need to be assessed in order to gain industry acceptance. In the European context the question of enforcement also needs to be addressed, given that in the Western waters, vessels from Norway, the Faeroes, Iceland, Denmark, UK, Spain, Portugal and France in addition to Ireland actively fish. As not all of these countries are members of the EU, the question of which organisation would have sufficient authority and international mandate needs to be established. Also for such closures to be acceptable to the fishing industry they would have to apply equally to all vessels and include all

potentially destructive fleet metiers including passive gears such as gillnets and longlines. This would include an assessment of the effects of "ghost fishing" by lost gillnets, which is reported to be a serious problems in the shelf areas in Western waters. These factors coupled with current EU policy, which requires a qualified majority for any new regulation to be brought into effect, means that a properly enforced and monitored MPAs around cold coral reefs are unrealistic at this juncture.

To date there are only two MPAs for the deepsea environment. The first was established in 1995 under Australian jurisdiction within the 200nm EEZ south of Tasmanian. Concerns about the impacts of trawling on benthic seamount fauna led to the world's first deepwater reserve over an area of 370km^2 on the continental slope. The reserve enclosed 14 seamounts in the vicinity of an orange roughy fishing grounds. This was extended to 19 in 2000/2001 following consultation with industry and Government and involves monitoring of the seamounts over time to assess the impacts of the closure on fish and other benthic organisms. Of these 19 seamounts only 2 or 3 were considered of commercial importance and hence reluctant support from the fishing industry. The other MPA was established in 1999 off the Sula Ridge and Iverryggen area to the West of Norway. This area was established to protect *Lophelia* reefs from the impact of trawling and was on the basis of video evidence showing trawl damage but also lost anchors and nets. This was a hugely contentious closure as it applied only to trawlers, despite clear evidence of lost static gear in the area.

Conclusions

- Experience worldwide has shown deepwater fisheries are susceptible to overfishing and therefore management measures are required
- Responsible utilisation through industry led management systems as used in New Zealand is needed.
- Accurate mapping and definition of cold coral reefs is required
- Assessment of the impact of fishing gear on these areas
- Acceptance that interaction of fisheries with deepwater reefs is unavoidable but the effects are probably localised rather than extensive
- Assessment of the effects of "ghost netting" on reefs is needed
- Legal status of any proposed MPAs within Ireland's 200nm EEZ needs to be clarified
- Enforcement and monitoring of such MPAs remain a serious problem
- Economic assessment of the impact of proposed closures is required
- MPAs need to be monitored to measure the effect of the closed area

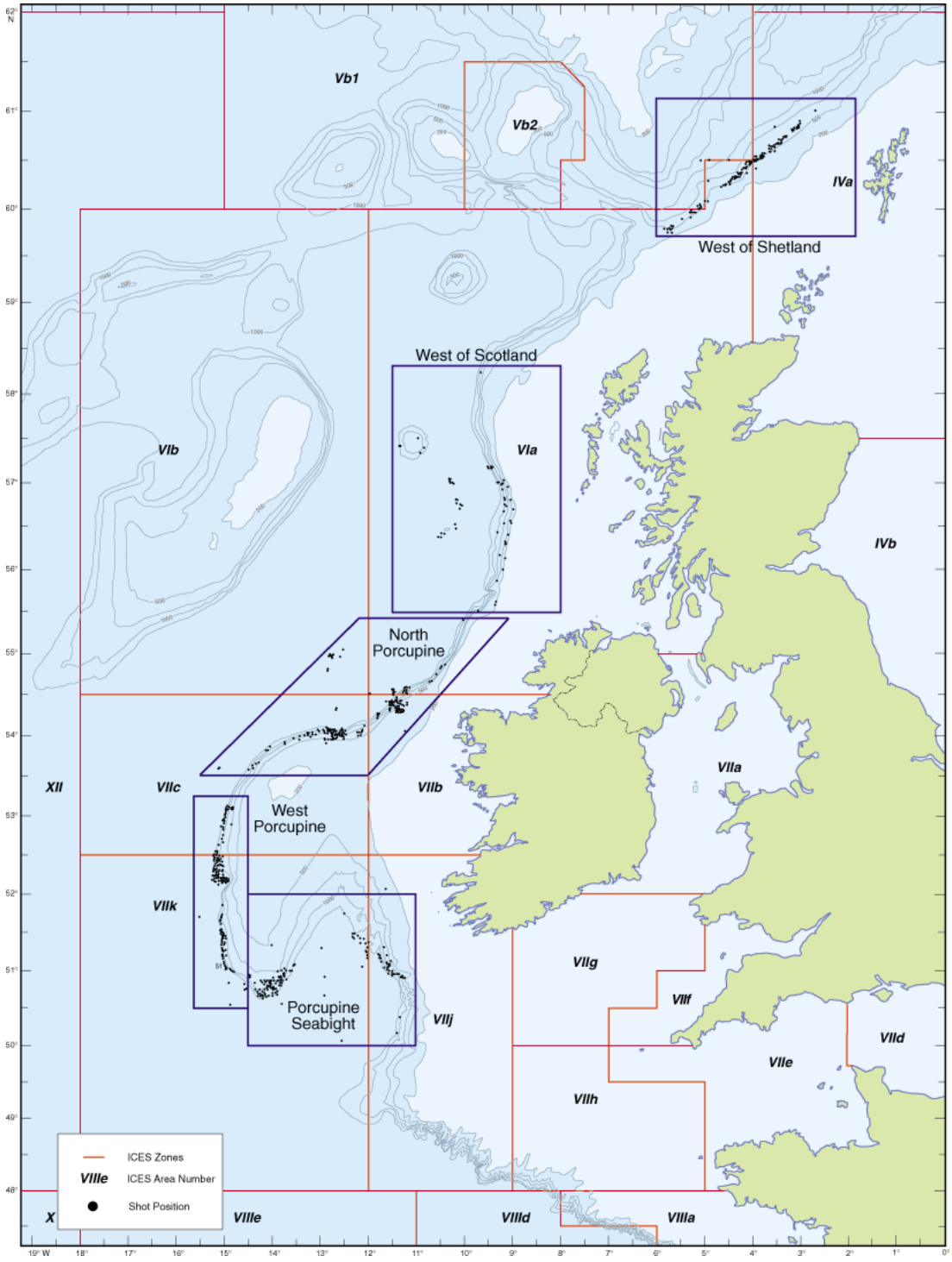

Figure 1. The location of the West of Shetland, West of Scotland, North Porcupine, West Porcupine and Porcupine Seabight areas relative to the deepwater fishing activity in 2001.

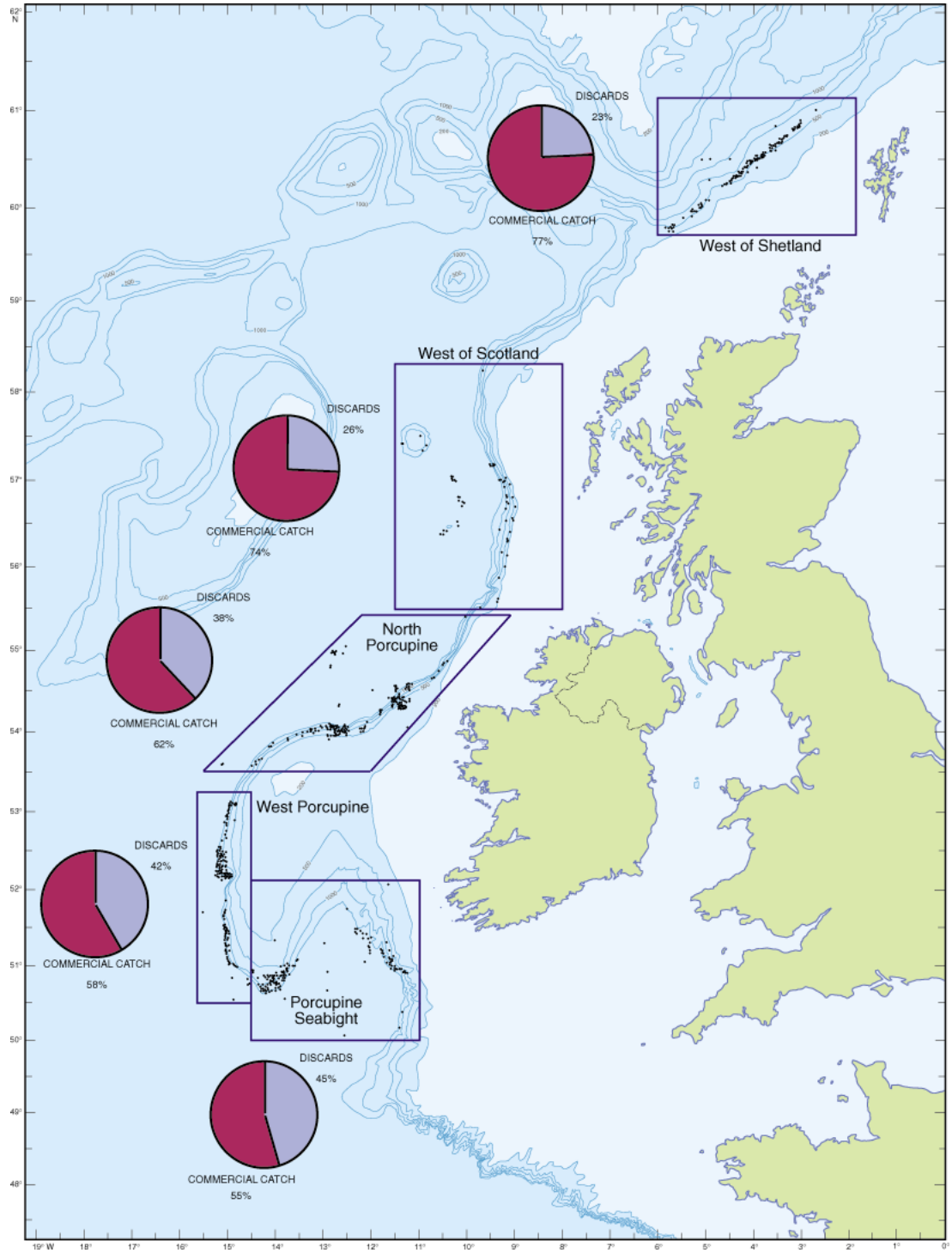

Figure 2. The commercial catch and discard, by area taken by vessels targeting deepwater species in 2001. The pie charts indicate the relative percentages of commercial species to discards in the total catch, by weight. This information was calculated from the random samples taken by on board observers. Data used includes both trawlers and longliners

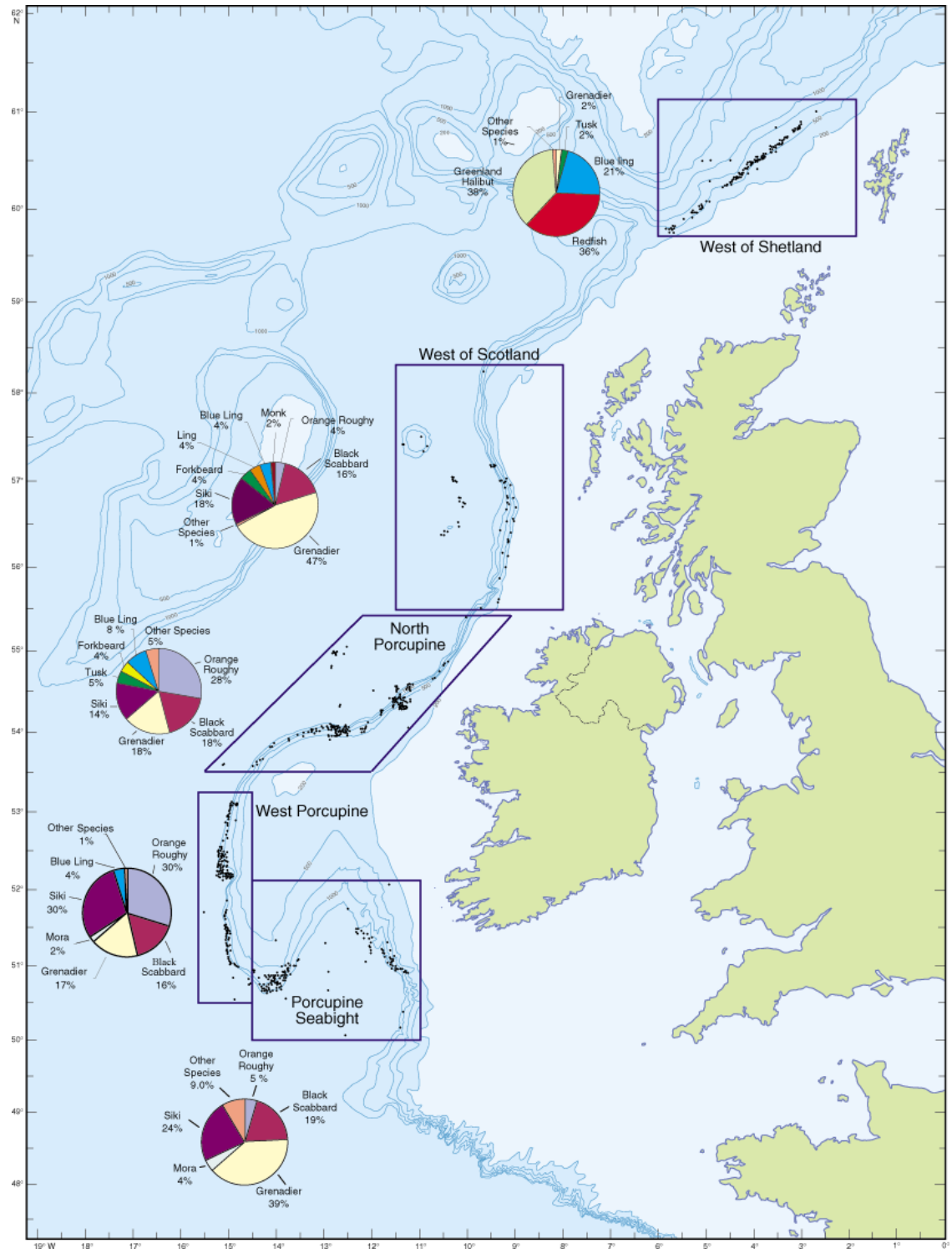

Figure 3. The commercial catch composition by area, taken by vessels targeting deepwater species in 2001. The pie charts indicate the relative proportions of commercial fish species caught in each zone, by weight. Data used includes both trawlers and longliners. “Other species”, which constitute less than 2% of the catch, include bluemouth rockfish, rabbitfish, deepwater cardinal fish and witch.

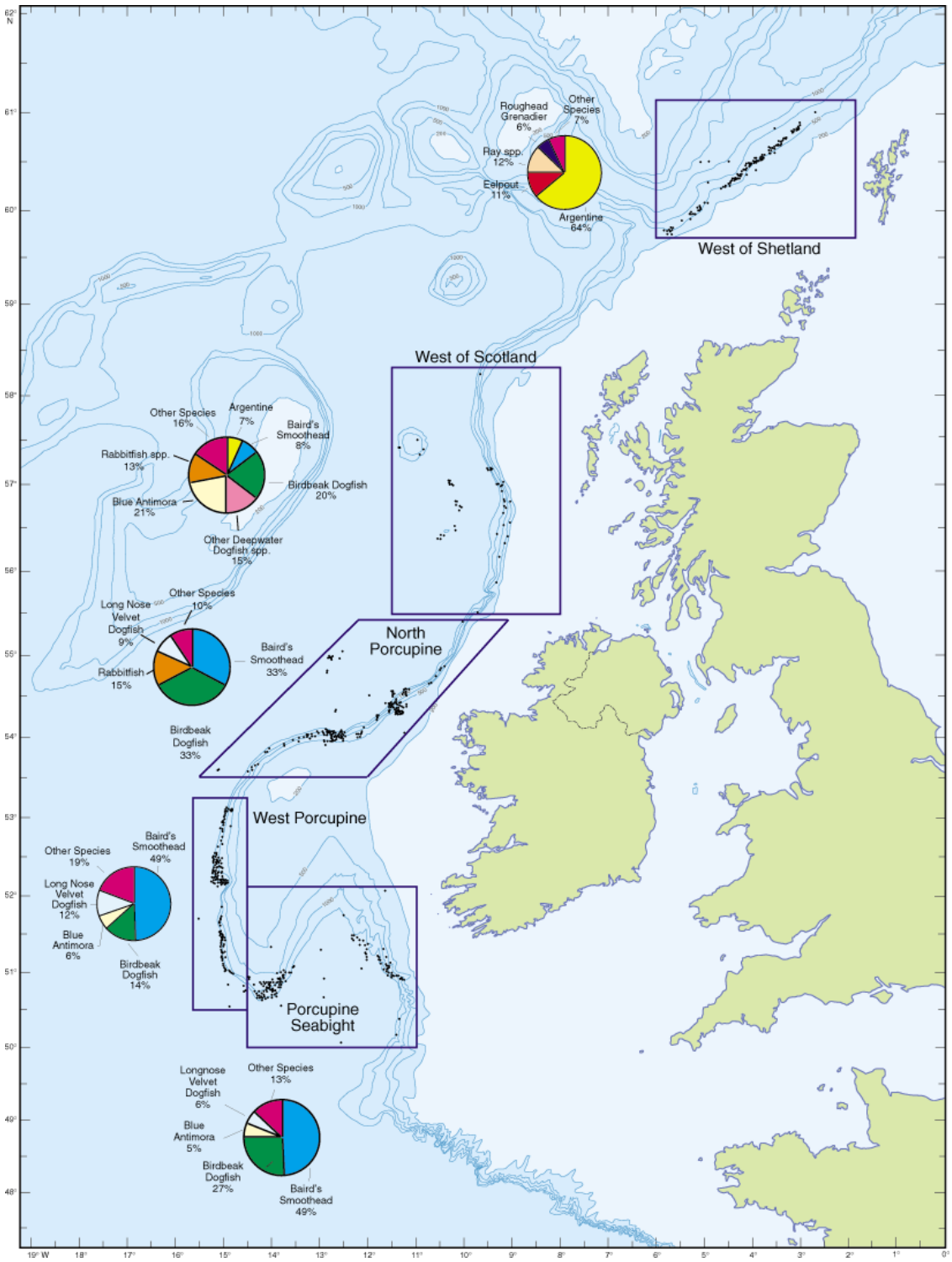

Figure 4. The discard composition, by area taken by vessels targeting deepwater species in 2001. Pie charts indicate the relative proportions of species discarded from the total catch, by weight. "Other species" include catfish species, jelly wolf fish, rabbitfish, blackmouth dogfish, blue antimora, various grenadier, gurnard, ray and shark species, which make up less than 4% of the discards.

THE DEEPWATER FISHERIES OF THE NORTH EAST ATLANTIC WITH PARTICULAR EMPHASIS ON THE EXPLOITATION OF ORANGE ROUGHY (*Hoplostethus atlanticus*).

Paul Connolly (Presented at the 2002 Workshop)
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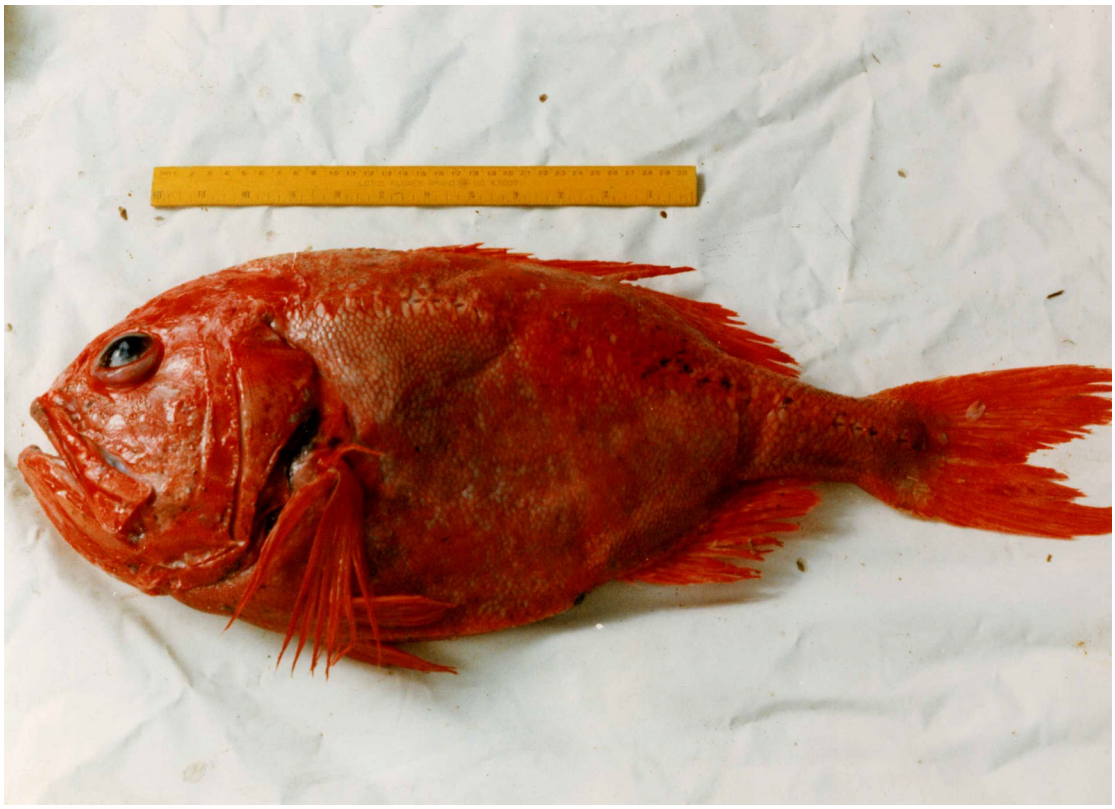
Background

The deep sea environment, being dark and cold, has generally been regarded as a system of low energy and low productivity. Historically, the world's major fisheries have taken place on the relatively shallow continental shelf (<200m). Until the last few decades, there has been little activity of interest in deepwater, apart from the occasional foray by scientists. However, with the decline of traditional shelf fisheries and with advances in technology, deep water fisheries are now an important component of commercial fisheries in a number of countries. The deep water ecosystem is very different from the shelf ecosystem in terms of the species that live there and in terms of their 'way of life'. Deep water fish are long lived, slow to mature and have low reproductive potential. These ecological characteristics make them especially vulnerable to over exploitation and there is currently great debate as to whether deep water fisheries are sustainable or merely 'mining' operations.

The North East Atlantic Orange Roughy Fisheries

In 2001 an estimated 3,779 tonnes of orange roughy were landed from the north east Atlantic (2,442 tonnes in 2000). In the early years of the 21st century, there were four fisheries for orange roughy. The main fishery up to 2000 was conducted by the French trawlers in Sub Area VI and VII (see page 37). In 2001, an Irish fishery rapidly developed in Sub Area VII taking the bulk of the landings (2,200 tonnes). The other fisheries include a Faroes fleet, which mainly operates in Division Vb and in the international waters of the Hatton Bank and the mid Atlantic Ridge. A small Icelandic coastal fleet conducts a fishery in Division Va. The French fishery in Sub Area VI started in 1991 and after an initial peak of 3,500 tonnes, landings declined rapidly to less than 200 tonnes per year. French landings in Sub Area VII peaked in 1992 at around 3,100 tonnes and in recent years have stabilised at around 1,000 tonnes per annum.



Serious concerns have been expressed about the sustainable exploitation of deep sea fisheries and in particular the directed orange roughy fishery off the west coast of Ireland. Orange roughy live on sea mounds at depths of between 600 and 1500 meters. They are known to be long lived (> 100 years), are slow to grow and mature, have low fecundities and aggregate in local concentrations on seamounts. Experience in the Pacific fisheries has shown that these characteristics make them especially vulnerable to exploitation. There is also concern that fleets may exploit local aggregations one after the other. Once the aggregation is fished out, the fleets can explore and harvest other concentrations. In areas where this takes place, catch per unit effort (Kg per hour fished) information is of little help in determining abundance of orange roughy. Furthermore, landings may remain high as the fishery moves from sea mound to sea mound.

Latest EU Scientific Advice

The latest assessments indicate that orange roughy in Sub Area VI continues to be overexploited. The catch has been very low since 1993 and the stock is depleted. The lack of development of the stock in recent years suggest that the stock has not shown any sign of recovery. This fishery was mainly based on one seamount, the Hebrides Terrace Seamount.

The situation in Sub Area VII is less certain. International landings have increased, while catch rates have appeared stable in recent years. However these features may reflect the sequential discovery and substantial fishing of previously unexploited aggregations, as vessels move from area to area.

The latest scientific advice on orange roughy was produced by ICES in May 2002. It states that *orange roughy stocks cannot sustain high rates of exploitation. Newly discovered aggregations are often overexploited before enough information is available to provide timely advice on management. Considering recent observations on the fishery developments, the exploitation of orange roughy should be strictly limited and the stock populations closely monitored. Data obtained should be incorporated into appropriate management measures. These recommendations should also apply to areas where there is currently no exploitation of orange roughy. There should be no directed fishery in Sub Area VI.*

New Management Measures

The Council of Fisheries Ministers in June 2002, agreed TAC's for stocks of black scabbardfish, blue ling, greater silver smelt, ling, orange roughy, red seabream roundnose grenadier and tusk. Once the regulation has been adopted, measures will be also put in place to limit fishing effort on and access to a larger number of stocks. The TAC's for orange roughy are given in the table below.

Country	**Quota - Orange Roughy in VI (tonnes)**
Spain	10
France	58
Ireland	10
UK	10
EC	88
TAC	**88**

Country	**Quota - Orange Roughy in VII (tonnes)**
Spain	10
France	1019
Ireland	300
UK	10
Other	10
EC	1349
TAC	**1349**

Additional measures have also been agreed. Vessels targeting deep-water fish will have to hold a specific licence granted by Member States. The capacity of those vessels must not be greater than that of the vessels which in any one of the years 1998, 1999 or 2000 landing more than 10 tonnes of deep-sea fish. It will be illegal for vessels which do not carry the special fishing permit for deep-sea species to retain on board, land or trans-ship more than a certain amount of those fish.

In order to learn more about these species and their ecosystems, independent scientific observers will be placed on board vessels carrying licences to fish deep-sea fish according to a sampling plan to be submitted by Member States. Fishing activities

will be monitored closely through the vessels satellite monitoring system (VMS). Conditions for the use of this control system will be reinforced for these fisheries. Additional information will have to be recorded in the vessels' logbooks including details of fishing gear used and the time spent in the water. Catches of deep-sea species will only be landed in designated ports.

The management scheme for deep sea fish stocks will be reviewed and adapted as required on the basis of a report to be submitted by the Commission by June 2005.

The New Zealand and Australian Experience

The history of orange roughy fisheries in New Zealand and Australia has shown a rapid development to a relatively high level and then an equally dramatic decline. Substantial and rapid depletion has occurred in most New Zealand fisheries which lead to quota cuts in the 1990's as the most established fisheries became fully exploited. However, New Zealand deepwater fisheries are now well regulated by regional stock quotas and management regimes are more or less in line with scientific advice on sustainable catch levels. For the larger orange roughy stocks, the fisheries have had extensive research and management programmes. There are now positive signals in the fishery that should discount the option of deliberate overfishing and shift the focus to careful and controlled development that these types of fisheries need. The duration of the New Zealand fishery is still too short to be confident that such deep water stocks will have sufficient resilience to commercial fishing pressure. Even though scientists consider catch levels to be at safe levels, monitoring of the stocks remains a high priority for prudent management of the resource.

Final Comments

Scientists have consistently argued that TAC's by themselves are not an effective method of managing deepwater fisheries and that a range of measures need to be applied. The recent council decision has moved in this direction and links TAC's, licensing scheme (effort restrictions) and an observer scheme. Experience of orange roughy fishing in Australia, New Zealand and in Sub-area VI shows that the species is vulnerable to high catch fisheries. Given our present knowledge of the way the species responds to fishing pressure it is imperative that the level of exploitation is sufficiently restricted to prevent stock collapse. This high value species can provide a very profitable fishery but it requires a responsible and sustainable exploitation by the Industry. The jury is still out on the question of whether orange roughy fisheries are sustainable. One thing is clear however, "mining" of the resource for short term gain is not desirable with the long term benefits that can result from these being viable, valuable and sustainable fisheries.

MANAGING IMPACTS ON THE MARINE ENVIRONMENT (MIME)

Murray Roberts (Presented at the 2000 Workshop)
Scottish Association for Marine Science, Dunstaffnage Marine Laboratory

We normally associate corals with warm, shallow tropical waters. Odd as it may seem, one of the world's largest coral structures is to be found off the Norwegian coast. It is these deep-water coral growths that environmental groups have focussed on in their challenge to oil exploration in the deep waters of the 'Atlantic Frontier'. The deep-water coral *Lophelia pertusa* was recently at the heart of a high court battle between Greenpeace and the UK Government. Greenpeace won the case, and the Government must now implement the EU habitats directive beyond our coastal seas into deep waters.

The Atlantic Frontier, the deep waters to the north and west of Scotland, is an area of active exploration for new oil and gas reserves, with some oil production from the waters west of Shetland already on stream. Deep-sea fish stocks are also being exploited in the Atlantic Frontier. With these two major industries now active, there is a clear need to study coral and other biological communities in the UK's deep-water territory.

Deep-sea corals can support and shelter hundreds of other species, including sponges, polychaete worms, echinoderms (starfish, sea urchins, brittle stars) and bryozoans (sea mats). This richness of life, or biodiversity, are key topics for scientific study and a major issue for conservation and environmental management. Some 200-300 species can be found in one of these coral habitats, a number comparable to that found in other important deep-water habitats. Unlike tropical coral reef systems, they are dominated by a very few hard-coral species, and there are far fewer fish species.

A multidisciplinary team of UK scientists have been studying these cold-water corals through the Natural Environment Research Council's Managing Impacts on the Marine Environment, or MIME, programme. Unlike most of NERC's science, the work has taken place in partnership with the oil industry, together with representatives from Department of Trade and Industry, as industry regulator, and Joint Nature Conservation Committee which has responsibilities for marine biodiversity conservation. The team's work has provided the scientific foundation essential to environmental monitoring and impact assessments. Highlights of this research follow here.

The MIME team led by John Gage at SAMS and Simon Chenery at BGS have collated and validated all existing information on the distribution of *Lophelia* in UK waters, and this brought together by David Long at BGS in a new map. *Lophelia* has been found along the shelf edge and on offshore banks of the UK Atlantic Margin. But rather surprisingly, the MIME team have also observed it growing on oil platforms in the northern North Sea. *Lophelia* was also found to have colonised the infamous Brent Spar when it was broken up last year.

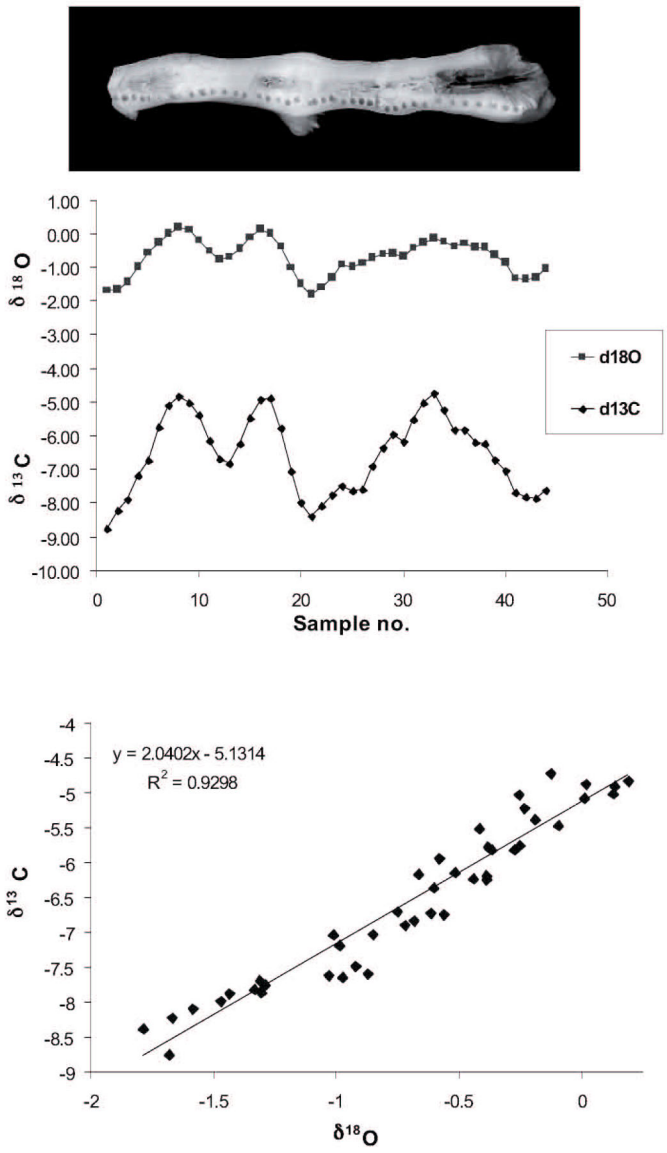


Figure 1. Section through the cold-water coral Lophelia pertusa drilled for stable isotope analysis. The apparent cyclicity in C and O stable isotopes is likely to relate to the rate of coral growth ad is the subject of on-going research. For details see: Spiro B, Roberts M, Gage J & Chenery S (2000) 18O/16O and 13C/12C in: An ahermatypic deep-water coral *Lophelia pertusa* from the North Atlantic: a case of disequilibrium isotope fractionation. Rapid Communications in Mass Spectrometry 14: 1332-1336.

Research on the molecular genetics has examined *Lophelia* samples collected from as far afield as the Galicia Bank off Portugal and the Sula Ridge off Norway. Alex Rogers at SOC has confirmed that *Lophelia pertusa* is a single species, and his work is improving our understanding of gene flow between the various populations present – an important issue for managing the conservation of this slow-growing, but long-lived organism. With further funding from NERC and the Royal Society, Alex Rogers hopes to establish why *Lophelia* does, nevertheless, exhibit significant genetic variation along the European Margin.

The skeletal composition of the corals from the MIME collection and other corals amassed over the last 30 years by deep-water coral expert John Wilson at Royal Holloway University of London, have also been examined. Simon Chenery and Baruch Spiro at BGS have analysed the trace element and stable isotope composition of *Lophelia* skeletons. The carbon and oxygen isotope composition suggests growth takes place in bursts, perhaps related to spring plankton blooms.

The team has also studied the environment around coral banks. Deep-water corals are thought to occur where food particles are carried in strong currents. Using an instrument made by Alex Cunningham and Dave McKee at Strathclyde University, Murray Roberts at SAMS has monitored the optical properties of particles around a Norwegian coral bank and plans to refine this technique and repeat these measurements at other sites in a new EU project, now underway, the Atlantic Coral Ecosystem Study (ACES), which will build on the pioneering work undertaken in the MIME project.

ATLANTIC FRONTIER ENVIRONMENTAL NETWORK SURVEYS

Gillian Bishop (AFEN Chair) (Presented at the 2000 Workshop)

Development of the Atlantic Frontier

The Atlantic Frontier has a longer history than is sometimes appreciated. The UK Department of Trade & Industry (DTI) granted first licences in 1970 - in the 3rd UK licensing round. Large tranches were also licensed in 1991, 1993, 1995 and 1997. Exploration began in 1972, and over 100 exploration wells were drilled between 1973 and 1995. Discoveries to date all lie to the west of Shetland and comprise Clair (1977), Strathmore/Solan (1990), Foinaven (1992), Schiehallion (1993), Loyal (1994) and Suilven (1996).

In 1994, nine operators formed the West of Shetland Group with the aim of co-operating their environmental activities. A year later the number of operators with licences west of Britain increased to 14 and the group became known as the Atlantic Margin Joint Industry Group (AMJIG) which had 5 networking groups: seismic, drilling, Facilities & Infrastructure, environment & safety. The environmental network (known as AFEN) is a consortium of Atlantic Margin Operators & government and currently comprises Agip ~ Amerada Hess ~ BG ~ BPAmoco ~ Chevron ~ Conoco ~ Elf ~ Enterprise ~ Exxonmobil ~ Marathon ~ Phillips ~ Shell ~Statoil ~Texaco ~Veba, DTI ~ JNCC and the Marine Laboratory Aberdeen.

AFEN's remit is

- To review and understand the physical and biological environment
- To identify vulnerable areas and species
- To use and to share 'best practice' environmental management
- To develop links with local communities and interested parties

To achieve these aims, AFEN has developed a number of environmental programmes:

- seabed surveys of 16th & 17th round acreage
- seabird & cetacean monitoring (visual)
- cetacean monitoring with seabed hydrophone arrays & pop-up units
- tarball fingerprinting
- coastal protection strategy
- biodiversity studies; support for 2 PhD students
- *Lophelia* aquarium studies

Seabed Surveys

The planning and results of the seabed surveys are obviously of most interest to the ACES group. Early discussions took place in 1994 and 1995 with the Marine Laboratory Aberdeen (MLA), and these led to a major scoping exercise in1995/96. From an early stage it was felt that management of such a large project should be outsourced and Geotek took this role. Southampton Oceanography Centre, Dunstaffnage Marine Laboratory, BGS, Cordah Ltd and ERT Ltd carried out the survey work, analysis and reporting. The aims of the seabed surveys were defined as

- Collect samples for baseline studies
- Relate samples to regional processes
- Build an understanding of the temporal and regional variations in the environment, and how these could affect environmental monitoring programmes.

Each survey was designed as a two-stage practice using two vessels, with stage 1 being a TOBI survey and stage 2 being a seabed sampling survey. TOBI stands for Towed Ocean Bottom Instrument and is a sidescan sonar device towed 200 - 400m above bottom. It yields fine details of bathymetry and indications of sediment type. The Stage 2 sampling survey was designed as a random stratified sampling programme, with video and photographic groundtruthing, and sediment sampling for biological, chemical and physical analyses.
A total of 5 oceanographic cruises (totalling165 days at sea in 1996 and 1998) have been made by AFEN, at locations between 56^{o} N and 63^{o} N, in water depths 100 - 2200m, and the work constitutes one of the most extensive seafloor environmental surveys yet undertaken on a continental margin. The total cost of the 1996 and 1998 AFEN surveys amounts to £2.8 million.

During Stage 1 cruises, 60 days of TOBI data were acquired (30,000km^{2}), together with 8,500 line km of 3.5kHz profiler data, and 3.6 days (650 line km) of 100kHz sidescan sonar data. Data acquisition from Stage 2 totals 909 deployments of megacorer, box corer and Day grab, sediment samples obtained at >300 stations, 46 deployments of WASP, fish traps and epibenthic sledge.

Major findings
North of the WyvilleThompson ridge, the continental slope has low sediment input, with strongest bottom currents (>75cms^{-1}) present at depths of less than 500m on the upper slope. In this area mobile sand bedforms move over predominantly gravel substrate. There are iceberg ploughmarks on upper parts of slope. On the lower slope there is local deposition of rippled sands caused by slower current speeds (30 - 40cm s^{-1}). There is widespread gravel on the lower slope and on the floor of the Faroe-Shetland channel, again indicating low present day sedimentation rates.

In the Faroe-Shetland Channel, there is a well-developed sponge community at 500m in the northern half of the 1996 survey area. Another major interest is a population of surface dwelling enteropneusts on contourite sand sheet at base of West Shetland slope.

In the Northern Rockall Trough, the most exciting find has been the so-called Darwin Mounds at 1000m depth and at 7^{o}N adjacent to the southern flank of the Wyville Thompson Ridge. These are carbonate mound and tail structures within a large area of mud and muddy sand. The mounds have an elevation of 5m, are up to 200m in diameter and are colonised by a diversity of benthic organisms including *Lophelia pertusa* and various sponges. The tails are aligned with the current direction, have no elevation, no known geological significance and present a sonic signal only, but are also characterised by supporting a relatively dense population of Xenophyophores.

As well as the mounds, there is an area just to the south where pockmarks are abundant. These present as circular or sub-circular features of diameter up to 100m and depths of 1-3m.

There was much evidence of seasonal deposition of detritus - several centimetres during summer months.

General Observations

The abundance of animal life in the deep waters of both the Rockall Trough and the Faroe-Shetland channel is similar to that in shallower waters i.e. there is no decrease in biomass with depth.

The diversity of animal life is strikingly different either side of the Wyville Thompson ridge. Diversity increases with depth in the Rockall Trough, whereas it decreases with depth in Faroe-Shetland channel. Within the Faroe-Shetland channel species diversity peaks at 400m on the west Shetland slope where water masses mix, thus species from both warm and cold water faunas occur.

The direct assessment of the seabed using coring, photographic and video surveys was in part guided by the sidescan sonar data, whose interpretation was in turn assisted by the groundtruth observations. The availability of sidescan data allowed a more confident areal interpolation (and possibly extrapolation) of the necessarily more limited sample data.

Project Deliverables

Samples donated to Royal Scottish Museum for curation. Available for further academic studies as required.

Atlantic Frontier Environmental Network (2000) Atlantic margin environmental surveys of the seafloor 1996 and 1998. CD Rom. Publ. Geotek. (Available from www.geotek.co.uk)

THE DESIGNATION OF AREAS FOR NATURE CONSERVATION IN THE OFFSHORE MARINE ENVIRONMENT

Elizabeth Sides (Presented at the 2000 Workshop)
Dúchas, The Department of Arts Heritage Gaeltacht and the Islands

The destruction of the deep water coral *Lophelia pertusa* through fishing is well documented in Norwegian waters and considerable concern is being voiced that *Lophelia pertusa* and *Madrepora oculata* are similarly being destroyed in deepwater at the edge of the Continental Shelf off Ireland. Thus the questions have arisen, should Ireland be considering designating an offshore area for the protection of deep sea corals and how might this be accomplished.

Over a number of decades the presence of *Lophelia* has been documented at a number of locations off Ireland but little is known about the coral distribution at these locations and if they have suffered any destruction through fishing activities. Current information on destruction is anecdotal but could form the starting point to determine if this is the case.

The designation of areas for nature conservation generally takes place on the basis that there is a known widespread threat to a habitat or species and that the precautionary principle should be applied or that widespread destruction is occurring and a habitat or species is in need of protection. Areas may be designated by National Legislation or through International Conventions.

The territorial boundary of Ireland is currently the 12 nautical mile limit. Ireland has no Exclusive Economic Zone but does have an EU fishery zone that extends out to 200 nautical miles.

Ireland has designated a small number of National Nature Reserves under the Wildlife Act (1976) that have marine areas in them and has a relatively large number of proposed Special Areas of Conservation designated under the Habitats Directive. But none of these extend beyond Ireland's territorial boundary that is the 12 nautical mile limit. The European Commission has recently taken the view that the EU Habitats Directive should be applied within the EU fishery zone. However Ireland is refuting this view and Dúchas, as part of the Department of Arts Heritage Gaeltacht and the Islands, the government department with prime responsibility of implementing the Directive, has sought legal opinion within Ireland on this matter. Under the EU Habitats Directive the definition of reefs includes biogenic concretions and reefs formed by corals fall into this category.

The OSPAR Convention on the Protection of the Marine Environment of the north-east Atlantic has recently added a fifth annex to the convention titled ‘The protection and conservation of the ecosystems and biological diversity of the maritime area’. Under Annex V contracting parties may vote for measures such as Marine Protected Areas to protect habitats or species that are considered to be in need of protection. It is possible that offshore areas with *Lophelia* and *Madrepora* reefs could be designated as Marine Protected areas using this mechanism.

It is hoped that the ACES project will provide information on the distribution corals at the edge of the continental shelf and areas with good coral coverage and little destruction will be identified. Without this information the designation of any area is difficult. In addition it is anticipated that the ACES project will provide ecological information on which conservation management decisions may be based in the future if areas are designated for the protection of corals.

As a word of caution, the designation of an offshore MPA may be relatively easy to achieve but how such an area can be realistically protected and managed needs to be considered. This must include the financial implications in both protecting and monitoring such as area. These considerations are of prime importance if the designation is to be effective and not just a paper exercise.

LOPHELIA REEFS A PILOT CASE FOR OFFSHORE ENVIRONMENTAL PROTECTION: WWF´s position and some legal issues

Sabine Christiansen (Presented at the 2000 Workshop)
WWF North-East Atlantic Programme

1. Framework of WWF´s activities in the NE Atlantic

The world wide strategy of WWF / IUCN focuses on 5 main topics in marine conservation (see *WWF/IUCN (1998). Creating a Sea Change. The WWF/IUCN Marine Policy. Gland, Switzerland*):

- Network of marine protected areas
- Protection of threatened species and habitats
- Sustainable fisheries
- Prevention of marine pollution
- Integrated coastal zone management

These priorities are reflected also in the strategies of the continental, regional and national programmes.

The primary goals to be achieved by **marine conservation** are:

- to maintain the biodiversity and ecological processes
- to ensure sustainable and equitable use of marine resources
- to restore impaired marine and coastal ecosystems.

One of the means to reach these goals is by *the establishment and implementation of a comprehensive, global network of ecologically representative, well managed marine protected areas (MPAs) designed to conserve areas of high biological importance and productivity*.
It is important to note the emphasis on representative and well-managed sites, as most of the marine protected areas already in existence worldwide today, do not offer effective protection due to lack of implementation of management measures. A representative network of MPAs of course also includes areas of low productivity and low biodiversity.

2. Aiming at a network of Marine Protected Areas for the Northeast Atlantic

What is an MPA?
WWF uses the definition by IUCN (1994): A Marine Protected Area (MPA) is:
"... any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment."

This definition includes all types of MPAs, including those for fisheries purposes - provided they have a conservation objective. In terms of management, MPAs range from those where only one particular use is managed or restricted to those which are fully protected from any kind of exploitation.

Cold water coral reefs are regarded as a very good case in need of site protection as the sessile corals provide a habitat for a wealth of species, enriching the whole ecosystem by high productivity and species richness. Site protection is regarded as one very important tool among others for effective ecosystem management:

- because MPAs aim at protecting structure, function and integrity of a segment of the ecosystem
- because MPAs increase knowledge and understanding of marine systems
- because MPAs function as a buffer against human exploitation, mismanagement, pollution and disruption of ecological integrity
- MPAs contribute most to ecosystem-based management if set up as a network, ideally incorporated in an integrated coastal or large marine ecosystem management plan. This may require trans-boundary cooperation of nations

3. Legal issues - possibilities and problems of marine site protection

UNCLOS (1982/94)

The United Nations Convention on the Law of the Sea of 1982/94 (UNCLOS) is a umbrella convention which establishes rules governing globally all uses of the oceans and their resources. It was ratified by 133 states so far, but neither by Canada or the USA. It regulates use in all waters including the High Seas and 'the Area'. Part XII of UNCLOS is an attempt to establish a general framework for a legal system on the rights, obligations and responsibilities of States with respect to the marine environment. Some of the general provisions expressed in part XII are:

- the general obligation of all signatory states to *protect and preserve the marine environment (Art. 192)*
- that all measures taken to prevent ... pollution shall include those *to protect and preserve rare or fragile ecosystems* as well as the *habitat of depleted, threatened or endangered species* and other forms of marine life.

In their Exclusive Economic Zone (EEZ, up to 200 nm, Art. 56), states have the sovereign right to explore and exploit, conserve and manage the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil and with regard to other activities for the economic exploitation and exploration of the zone. States have the full jurisdiction with regard to the establishment of artificial islands, installations and structures, marine scientific research and the protection and preservation of the marine environment.
All non-resource related uses are open to other states. EU States are obliged to grant all nationals of the Member States equal access to the EEZ (Community waters). States shall cooperate with conservation and sustainable use of marine mammals, straddling stocks, migratory species.

The Continental shelf (Art. 76) ... *comprises the submerged prolongation of the land mass of the coastal state* (to the outer edge of the continental margin up to 350 nm, or to a distance of 200 nm) *and consists of the sea-bed and subsoil of the shelf, the slope and the rise but not the deep ocean floor with its oceanic ridges or the subsoil thereof.* States have the exclusive right to explore and exploit its natural resources (seabed and subsoil).

The High Seas (Art. 86, 87) ... *are all parts of the sea that are not included in the EEZ, territorial sea .... of a state.* The High Sea is open to all states, the principle of freedom of the high seas (navigation, overflight, cables and pipelines, constructions, fishing, scientific research) was established. No state may claim any sovereignty.

'The Area' comprises the seabed beyond the continental shelf (part XI of UNCLOS). The Area and its resources are declared to be the common heritage of mankind (Art. 136). Therefore, the right to explore and exploit the resources and thus the sharing of benefits rests solely with the international community. The rights over the resources are administered and managed by the International Seabed Authority (ISBA) - as the representative organ of the international community.

Art. 145 specifies provisions on the protection of the marine environment. However, this protection is so far seen as a reactive measure to be included in management obligations in the event of human exploitation of mineral resources. No proactive protection of sites or habitats is foreseen:

- *Necessary measures shall be taken ... to ensure effective protection for the marine environment from harmful effects which may arise from such activities*. To this end, the Authority shall *adopt appropriate rules*, ... for example:
- *prevention, reduction, control of pollution ... and of interference with the ecological balance ..*
- *protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment*.

The International Seabed Authority (Jamaica, founded 1994), so far has developed only one set of rules applying to the industrial exploitation of managanese nodules ('Mining Code'). Manganese nodules are rich in precious metals and occur in some parts of the deepsea spread out on the sea floor. Due to high costs and low mineral prices today, almost all states formerly interested in mining stopped the further exploration and development of techniques. This is quite different for so called "Seafloor Massive Sulphides" SMS for which a similar "mining code" shall be developed until 2001 on request by the Russian Federation. SMS means the chimneys and other associated crusts arising from hot venting. These precipitates are extremely rich in minerals and exploitation is considered feasible and economically attractive even under today´s conditions. The first licence for exploitation of SMS in the EEZ of Papua New Guinea has been given recently. The legal framework of Papua New Guinea was changed to this end, however, almost no provisions for the protection of the marine environment are foreseen. This could provide a bad example for other states in the region.
New tasks for the ISA are being discussed involving the expansion of its mandate to include the exploitation of living resources (bioprospection/genetic resources, in co-operation with Biodiversity Convention and Climate Convention) and the exploitation of methane hydrates which may become possible in the future.

In summary, under UNCLOS, Marine Protected Areas can be designated under national legislation in the territorial seas, in the EEZs and on the Continental Shelf. Contrary, there are no legislative means yet to establish MPAs in the High Seas and in 'the Area'. At present, there are current efforts to bring the matter of High Seas MPAs to the UN General Assembly (Agenda item 'Oceans and Law of the Sea') in order to improve the legislation on the protection of the marine environment in international waters.

Biodiversity Convention (1992)

The Convention on Biological Diversity (CBD, 1992)was signed by 150 nations at the so-called Earth-summit in Rio 1992. It is the first comprehensive, international, legally binding agreement committing governments to protect the Earth´s biological resources. It applies to national waters in the case of „components of biodiversity" (incl. genetic resources) and to national and international waters in the case of "processes and activities" The Jakarta Mandate (1995), recommendations of a checklist of actions, covers 5 subjects relevant to coastal and marine environmental protection, among these:

- *to establish or consolidate representative systems of marine and coastal protected areas*
- *to emphasise the protection of ecosystem functioning.*

The Biodiversity Convention was not only reflected in the national legislations, but also in regional conventions like the OSPAR Convention.

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), is a regional convention of international environmental law. There are 15 contracting parties, incl. the EU. The OSPAR Maritime Area covers all waters from the coastline to the High Seas (see map). OSPAR´s competence does not cover fisheries management. However, it can give recommendations to the responsible bodies as the working group on IMPACTs did in November 1999 with respect to deep water fishery.

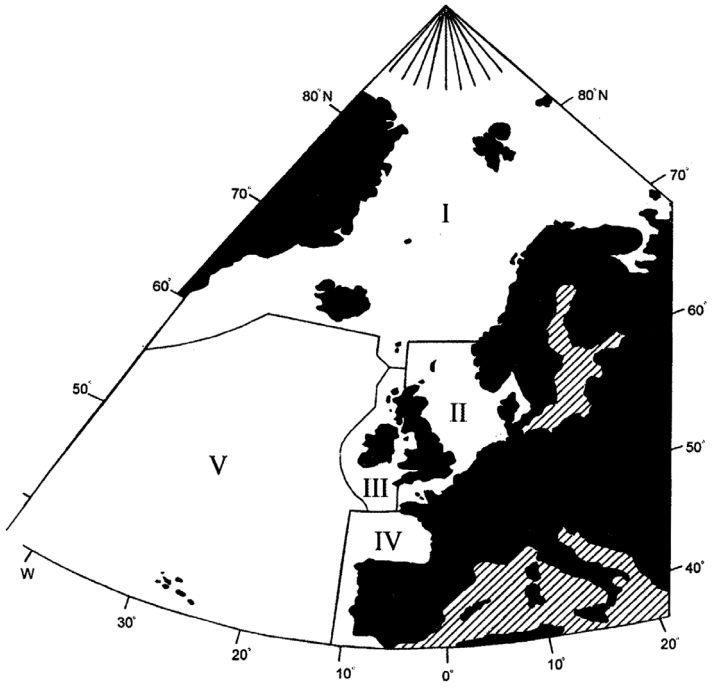


Figure 1. The OSPAR maritime area and its 5 subregions.

The OSPAR contracting parties meet annually at the level of the environmental ministers which in 1998 agreed on a new annex to the convention. The new Annex V 'On the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area' incorporates the obligations of the Biodiversity Convention in the request for:

- *the "protection of the maritime area against the adverse effects of human activities ..., to conserve marine ecosystems and ... to restore marine areas ...."*
- *the development of "strategies ... for the conservation and sustainable use of biological diversity".*

And, more clearly, in the related OSPAR Strategy and Sintra Statement of Environmental Ministers the need is expressed to:

- *promote the establishment of a network of marine protected areas ....*

So far, only 36 offshore areas are registered in the inventory of MPAs in the OSPAR area, 35 of which are fisheries management zones, not strictly fulfilling the criteria for MPAs due to lack of conservation objective. The only "real" MPA is a seamount in the Azorean EEZ. The Norwegian reefs "Sula" and "Ivarryggen" which are protected under national fisheries legislation were not nominated for the inventory, which for many reasons cannot provide an intercomparable and complete dataset on protected areas in the OSPAR area.

In order to support the process of selecting and designation offshore marine protected areas in the EEZs of contracting parties and in international waters, WWF came up with a first list of potential offshore MPAs on the occasion of the OSPAR commission meeting 1998. This list is being updated regularly, lately by proposals for including hot vents, seamounts and deep sea abyssal plains into plans for site protection.

Under OSPAR, a working group on IMPACTS (from 2000 Biodiversity Committee), a set of activities is going on in order to prepare for establishing MPAs. Inventoryisation, mapping and systematic classification of habitats in the OSPAR area should lay the basis for selecting sites to be incorporated in a representative network of MPAs. On the other hand, priority lists of species and habitats shall be derived from systematic selection procedures taking into account *inter alia* the species/habitat´s distribution, state of population, threat, sensitivity, ecological significance. Sites where priority species/habitats occur in significant numbers will automatically be considered for protection. However, sites may qualify for MPAs also according to several other criteria. Generally, OSPAR MPAs individually or collectively aim to:

- Protect, conserve and restore species, habitats and ecological processes which are adversely affected as a result of human activities
- Prevent degradation and damage to species, habitats and ecological processes following the precautionary approach
- Protect and conserve areas which best represent the range of ecological character in the OSPAR area

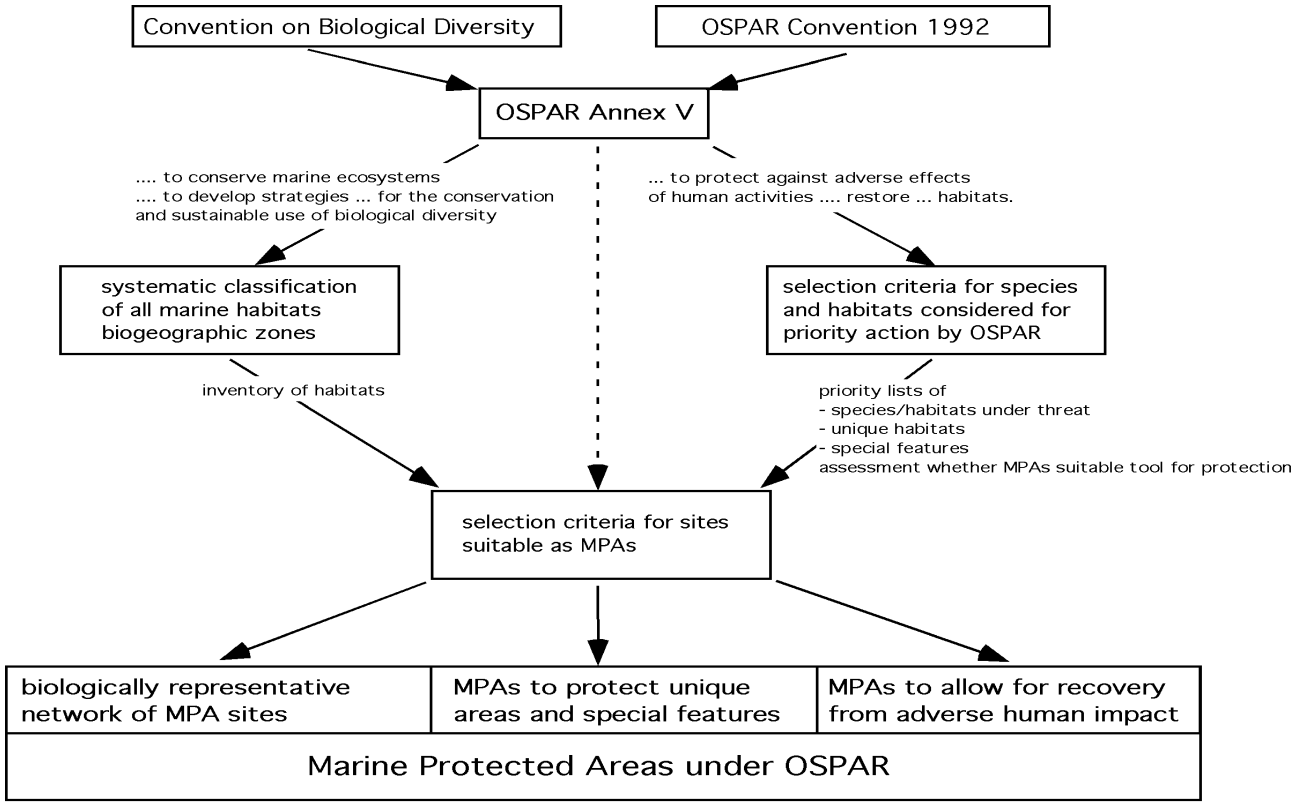


Figure. 2: Scheme of preparatory works at OSPAR/IMPACT with respect to MPA designation (WWF 1999).

Cold water coral reefs do not come out as a top priority for conservation following the still debated schemes of application of selection criteria. This is partly due to their world wide occurrence, but also due to lack of knowledge on the state of destruction.

European Union

The EU Habitats Directive (1992) legally obliges the EU member states to designate and establish protected areas when specified selection criteria are fulfilled. It automatically applies to waters up to 12 nm (territorial waters), but in UK and hopefully in the future also in the other EU states it applies out to 200 nm (corresp. to EEZ or fisheries zone). Sites of european conservation interest (SACs) will be included in a network of protected areas (Natura 2000). The Habitats Directive is a strong legal instrument but the selection criteria for marine habitats and species are not appropriate for the extension into offshore waters. With respect to offshore habitats, only 'sandbanks' and 'reefs', only 2 out of in total 168 habitats listed, can be used for the designation of protected areas at sea.

The EU has the exclusive rights with respect to exploitation and management of fish stocks in the EU Fisheries zone, mostly coinciding with the EEZs of member states (Common Fisheries Policy (CFP)). A mechanism will have to be integrated into the CFP which takes account of the requirements of the Biodiversity Convention and the EU Habitats Directive e.g. with respect to sustainability, by-catch and habitat protection. First progress was achieved during the Interministerial Meeting Bergen, 1997 (meeting of ministers of environment and fisheries of EU and Norway).

WWF promotes the application of the EU Habitats Directive to the 200 nm zone of member states (comparable to the EU Fisheries Zone) and the establishment of a comprehensive network of protected areas under the EU Habitats Directive. As a first step towards a network of MPAs, WWF UK reviewed all European sites qualifying as 'reef' and 'sandbank' according to the EU Habitats Directive (A. Rodgers, SOC). As it is unlikely that all sites will be protected, it is important to choose systematically among comparable sites based on best available knowledge. This is the connecting point to ACES:

4. Importance of ACES for WWF

ACES can provide a comparable, up-to-date dataset of many of the northeast Atlantic cold water coral reefs. Such a dataset opens up the opportunity to develop and test a network approach for one particular type of habitat. ACES could support this process if taking account of possible selection criteria during data collection. Selection criteria for potential MPAs among similar habitats could be:

- naturalness
- representativness /uniqueness (species composition and abundance, location, size etc.)
- connectivity

Defining size, boundaries and connectivity among sites addresses the scientific problems which have to be solved before any MPA or even a network can be established. The other problem concerns the implementation of measures which can best be achieved successfully when involving stakeholders from early on in the discussion. In the case of the coral reefs, in particular trawl fisheries consist a significant physical threat. Arguments are needed to convince fishermen of the usefulness of full protection of coral reef ecosystems in order to safeguard not only such an abstract value as biological richness but very practically their future income.

5. WWF - What information we need?

- Mapping of reefs with respect to their topography, hydrography, sedimentation characteristics, faunal composition
- Assessment of the status of the reefs on a scale from pristine to totally destroyed.
- Location in relation to other human activities (oil and gas drilling etc.)
- Description of human impact (fisheries, cables, pipelines etc.)
- Is the impact of bottom trawling similar in all areas?
- Biological assessment:
- Variability of species compositions
- Sensitivity of reefs and the species associated to disturbance and change in physical conditions
- Which size is reasonable and which size is minimal for effective protection?
- Exchange of populations? - what does this mean for the connectivity of sites in a network? Potential for recovery?
- Importance of the reefs for commercial fisheries

As the preparatory works under OSPAR and the EU are continuing, it would be most useful to exchange information on a continuous basis. This will increase the chance that the input of ACES can be incorporated into the design for individual and networks of MPAs.

References/Further Reading

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COLD WATER CORAL REEFS AND THE EU HABITATS DIRECTIVE

Ciaran O'Keeffe, Dúchas (Presented at the 2002 Workshop)

1. Legislation

The EU Habitats Directive was adopted by the EU Council of Ministers in 1992. It was transposed into Irish law by the EU (Natural Habitats) Regulations in 1997.

2. Habitats

The Directive lists habitats that are considered threatened in Europe and which Member States are required to protect through designation and conservation of particular sites, called Special Areas of Conservation (SACs). The marine habitats requiring SACs are as follows:

- Reefs
- Mudflats & Sandbanks (Not Covered by Seawater at Low Tide)
- Large Shallow Inlets and Bays
- Sandbanks Which Are Slightly Covered by Seawater at All Times
- Submerged or Partly Submerged Seacaves
- Estuaries

At this time there are 364 candidate SACs, of which 84 have some marine interest.

3. Reefs

The Habitats Directive definition of reef includes structures made of rock but also biogenic reefs, i.e. reefs created by marine creatures. The legal requirement for protection thus includes deep-water coral reefs. There was some question at an earlier stage as to whether reefs lying far offshore were covered by the Directive, but it is now generally agreed that the Directive includes all areas of economic interest to the State. In October 2001, the EU Fisheries Ministers encouraged member states to continue their work towards the full implementation of the Habitats and Birds Directives in their exclusive economic zones (doc. 7885/01)

4. Designation of SACs

The body responsible or designation of SACs in Ireland is Dúchas-The Heritage Service, which has recently become part of the Department of the Environment and Local Government.
The procedure followed by Dúchas in designation of any SAC is as follows:
a) Selection of representative sites by experts
b) Notification by the Minister of the site location and habitat interest, and his intention to designate. At this point, legal protection normally begins
c) Sites notified to EU, which approves sites
d) Irish Minister formally designates the SAC

Soon after, Dúchas will commence preparation of a management plan in consultation with parties who have interests on the site.

5. Appeals

At any stage in the process, a person with a legal interest in the site can appeal the designation, but on scientific grounds only.

6. Problems special to coral reef SACs

a) The relative lack of knowledge of this habitat, which lies far offshore at great depth. However this is not a reason not to designate good known examples.
b) Protection is feasible only through measures taken through the Common Fisheries Policy
c) Survey and protection of such a remote habitat would take great resources.

Irish representatives at the earliest opportunity will discuss these matters with the EU Commission.

ENFORCEMENT IN IRISH WATERS

Mark Mellett (Presented at the 2002 Workshop)
Irish Naval Service

Both in the Fisheries Monitoring Centre and Plans and Policy within the Naval Service we have been looking at the question of deepwater fisheries and corals for some time. Ultimately the responsibility for policy in the area of Fishery Protection rests with the Department of Communications Marine and Natural Resources. Accordingly policy guidelines relating to the protection of corals should emanate from there.

The Naval Service is striving for a defence policy strategy match using Naval Delivered services - Defence Policy that should articulate the range of services we provide - It is a matter for the Naval Service then to design a strategy to deliver on that Defence Policy. When using the word "defence" I include all policy areas such as Foreign, Marine etc - that will be delivered by the Defence Forces and in this case the Naval Service in particular.

The Naval Service exists as the maritime element of defence and accordingly maintains a contingent capability to deliver defence services. In the 2000 White Paper on Defence the government decided that the emphasis would be on the utilisation and development of the Naval Service to contribute to the maximum to all of the State's requirements in the maritime domain.

In trying to distil the State's requirements the Naval Service classify its general functions under four broad headings:

- Underpinning State Rights,
- Policing State Seas,
- Part of an Integrated Ocean Management Strategy,
- Furthering National Interests as an Instrument of Policy.

The advent of the Seabed Survey and the manner in which it will shape marine related policy into the future will bear directly on these four areas.

General Naval Functions

Underpinning State Rights and upholding obligations:

Ireland exercises varying degrees of rights over the sea area that surround the island.

Ireland exercises complete sovereignty out to 12 nautical miles from the coast where for all intents and purposes the same laws that apply on land are applicable in out territorial seas. In the case of sovereign rights, under International Law, Ireland within the area known as the Exclusive Fishery Limits (EFL) which extends to 200 NM from the coast enjoys sovereign rights over the seabed and its resources, and the sub sea bed resources. In addition it enjoys sovereign rights over the sea fisheries in the water column above but has agreed to be bound by the EU Common fisheries policy. Beyond the exclusive fisheries limits Ireland enjoys sovereign rights over the seabed and its resources and sub seabed resources out to the edge of the continental shelf. In all Ireland could potentially exercise sovereign rights over seabed resources encompassing in excess of a 250,000 square nautical miles although it is likely that some areas will be the subject of competing claims by our neighbours. (Plate 1)

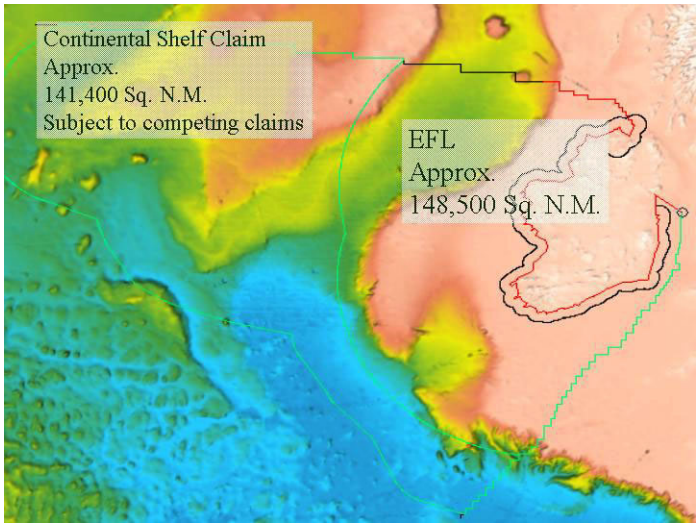

Plate 1 Irish Exclusive Fishery Limits (EFL) and Continental Shelf Claim

The Government is currently undertaking the largest Seabed Survey project ever undertaken by any country which is focussed on mapping and assessing our seabed resources in the area over which we have or may have sovereign rights.

As a sovereign state, Ireland also has a range of responsibilities some of which it has defined, like the SAR (Search And Rescue) designated area where it has agreed to provide a SAR service within that area covered by the SHANNON Flight information region. In addition it has responsibilities with regard to the Pollution Control Zone which equates to the EFL. In the final analysis sovereignty and sovereign rights mandate a state with the right to make choices and it is in support of those choices that the State calls on the Naval Service to act as the underpinning authority from time to time.

Following on the Defence White Paper, the Minister for Defence approved a five year implementation plan for the Naval Service. The plan is built on a philosophy for quality service delivery. It acknowledges that in peacetime the primary activity of the Naval Service will be fishery protection. The multi role capacity of Naval Service vessels is such that while undertaking fishery protection Naval Service vessels are simultaneously poised to undertake, offshore surveillance, counter-drugs operations, environmental security tasks, search and rescue, maritime policing duties and a wide range of other services. It can achieve this range of service delivery because of its configuration as the maritime element of defence. The White Paper acknowledges that there are important effectiveness and efficiency benefits obtained through the single agency approach. It also acknowledges that to move away from a single agency policy would have significant ramifications for defence provision. The Naval Service Implementation plan is built on four main strategies:

- Strategy One: Creating the circumstances which will facilitate increased capacity for delivery of services. The Naval Service is committed to increasing the number of ship patrol days by up to 44% by 2005. In the past two years the Naval Service has already achieved an increase of over 20% in patrol days.
- Strategy Two: Establishing the requirements of our various external stakeholders necessitates the Naval Service to examine the services it currently delivers and assess services it may be expected to deliver in the future. The stakeholders

include numerous government departments, agencies, NGOs and miscellaneous organisations that are or could potentially depend on the Naval Service. (Figure 1)

- Strategy Three: Formalising the mechanism that will convert increased capacity into actual service delivery with measurable outcomes. The formalisation of service level agreements and where appropriate, MOUs (Memoranda of Understanding), with our various stakeholders is currently underway within the Naval Service. It is intended that this process will result in better delivery of service by the Naval Service with more measurable outcomes.
- Strategy Four: Formalising Joint Delivery of Defence Services with the Army and Air Corps is currently under review. It is important to ensure that the Naval Service capabilities in support of the delivery of defence services are maintained and developed from a joint perspective. Delivery of defence services must be considered in the context of the three environments, land, air and sea. Irelands support for UN missions has necessitated the Naval Service supporting these operations with personnel and re-supply missions. In 2002 the LE NIAMH as part of the ASIAN deployment carried out a re-supply mission to Eritrea.

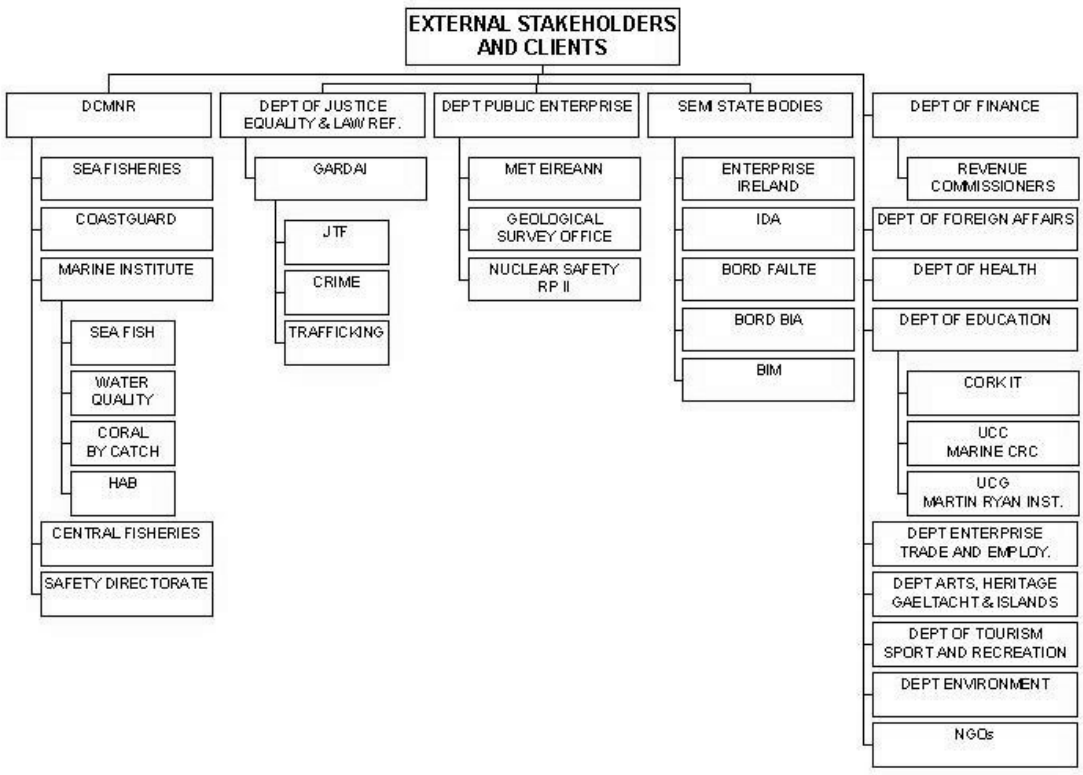

Figure 1. Stakeholders that are or could potentially depend on the Naval Service.

Fishery Protection

Duties of the Naval Service as part of our obligations to the EU include countering the stress being experienced by our fisheries with the:

- Targeting of white fish quotas, primarily being headed by the French, UK, and Spanish fleets.
- Targeting of pelagic quotas, besides the domestic fleet, is headed by the fleets of north western Europe.
- Targeting of tuna, being headed by the Japanese Blue Fin Tuna and Spanish fleets.

The Naval Service must also deploy in fishery protection duties from time to time as part of the NAFO and NEAFC structures. The rising incidence of squabbling between users in the fisheries arena is likely to continue to increase. The possibility of increased inter nation tensions as Ireland comes to grip with dwindling stocks is real. It is not that long since the Cod War brought the UK and ICELAND into direct confrontation and more recently the stand off between Canada and Spain over fisheries policy in the Grand Banks. With the increase of users that will inevitably arise as a consequence of the knowledge gleaned from the seabed survey there will be scope for increasing conflict between users.

GIS Applications

The success of GIS type technology is now being revolutionised with initiatives such as the Vessel Monitoring System (VMS) specified and operated by the Naval Service.

The Patrol Vessel Geographic Information system has proved to be a remarkable tool to assist in decision making. The data collected and the analysis of historical trends all contributes to a more focussed delivery of service. This is just one year's activity report (Plate 2). The advent of the satellite based vessel monitoring system allows for almost real time analysis and tracking of Irish fishing vessels all over the world and foreign vessels when operating in our EFL. All vessels over 24 metres should have a transponder system.

The information includes registration number, position and activity including speed and course and history. The service is going to be further enhanced with the progressing of Lirguard Phase 2. This will see the information collected by satellite being re-transmitted out to our ships and to DOCMNR offices around the country. It will in effect allow de-centralised over the horizon observation.

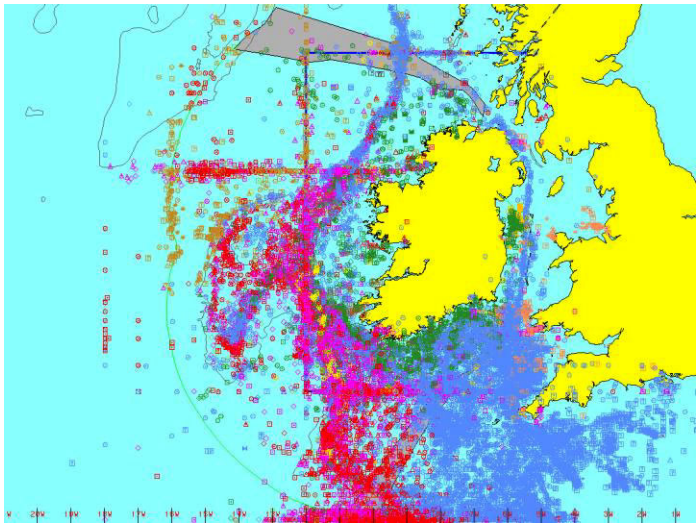

Plate 2. The Patrol Vessel Geographic Information System

Coral and Fishing Activity.

Examination of the concentrations of coral associated areas has resulted in a number of areas of interest being identified by Dr Grehan *et al*. I would now like to compare these areas with the noted activity of the last number of years.

In 1992 we did not have the CASA maritime patrol aircraft so observations were primarily by our Naval Vessels supported by Beechcraft air surveillance. In the late 1980's the incidence of noted activity within coral areas of interest is modest. As we move towards 1991 activity begins to increase.

This continues in 1992 and by 1995 - the activity appears to have increased significantly - but this can be explained by virtue of the more intense air patrols. In 1996 it is very intensive - you should note that I have not separated pelagic from demersal fisheries in these slides accordingly some of this activity may have no impact on the corals.

Looking at the demersal activity in each of the areas of interest over the past five years we can see that by far the greatest stress is on the area known as the coral ground. The least level; of activity noted appears to be in the NW coral on the SE slope of the Rockall Plateau. Once again it is important to say that these are not referenced to any datum - clearly the closer to shore the more activity that will be noted by nature of our patrol pattern with observations en route out and on return through the near shore areas being common. In terms of the type of demersal fishery, it is clear that the main activity in all areas is trawling followed by gill netting and longlining.

It is my view that there is obviously significant trawling activity and in some cases it has already caused serious damage to ecosystems in our Exclusive Fishery Limits. It is my view that damage includes coral areas that should be protected under European and International Law. When one looks at the fishing gear developments with particular focus on rock hopper gear, it is clear that contact with the seabed in deepwater fisheries while not necessarily desired is expected

We must prioritise the areas that we wish to protect and specify the activities to be limited. In this regard from a policing perspective it would be our preferred option that no fishing activity should be allowed in the protected areas. Tools that will assist in the policing include the Vessel Monitoring System - for most vessels capable of fishing in the deep-waters where coral abounds would probably be in excess of 24 metres. There is also a case to augment VMS with Earth Observation (EO) technology such as Synthetic Aperture Radar and possibly in the future unmanned air vehicles (UAVs) operating from Offshore Patrol Vessels.

There is a need for policing of coral areas to be prioritised from a policy perspective. To date in 2002 there has been no priority given to either deepwater fisheries or coral monitoring. In support of the ACES programme the Naval Service is carrying out observations in the course of routine Fishery Protection for coral by catch.

Observers will assist in policing this fishery for our experience of logbook catch reporting has not been good. The acquisition of an ROV to assist in monitoring potential damage would be important. Difficulties presented as a result of fishermen trying to misuse the VMS must also be addressed.

Conclusion

- We are moving towards a dynamic and effective navy working within the available envelope of resources.
- Fishery protection is our main day to day activity - it facilitates general service delivery in many areas not least of which is to be ready to deliver defence services.
- Protection of corals and deepwater fisheries will present difficulties but these can be overcome if there is an integrated policy supported approach.
- Ultimately this must be done in the context of an Integrated Ocean Management framework.

Huge challenges face us.

THE LEGAL CASE FOR THE PROTECTION OF DEEP-WATER CORAL IN IRELAND[1]

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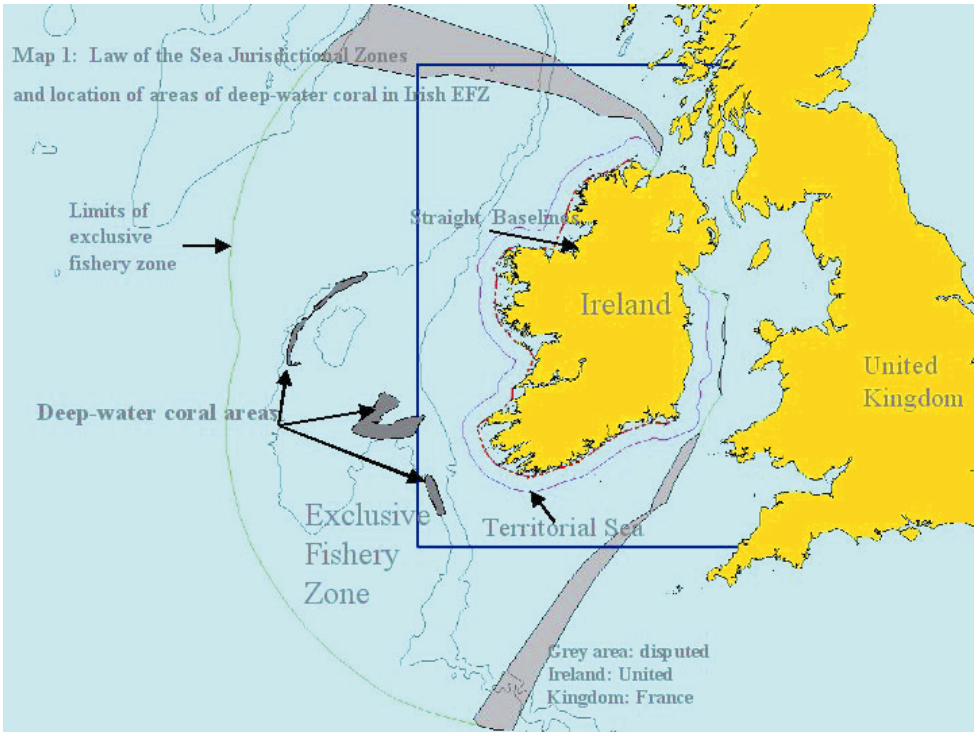
Introduction

Deep-water corals are a relatively new discovery in the sea area west of Ireland.[2] There are no legal safeguards in place to protect the structural integrity and bio-diversity associated with the reefs from human activities. This paper reviews the options available under existing management and legislative regimes at a national and European level. At the outset it should be emphasised that municipal law in Ireland, in contrast to the United States and Norway,[3] does not provide the legal framework for the establishment of marine protected areas (MPAs) *sensu strictu* either within or beyond national jurisdiction.[4] The absence of MPAs and the fact that Ireland is a Member State of the European Union means that several important issues pertaining to the scope of application of international law, European law, and municipal law have to be kept in context when reviewing potential conservation measures.

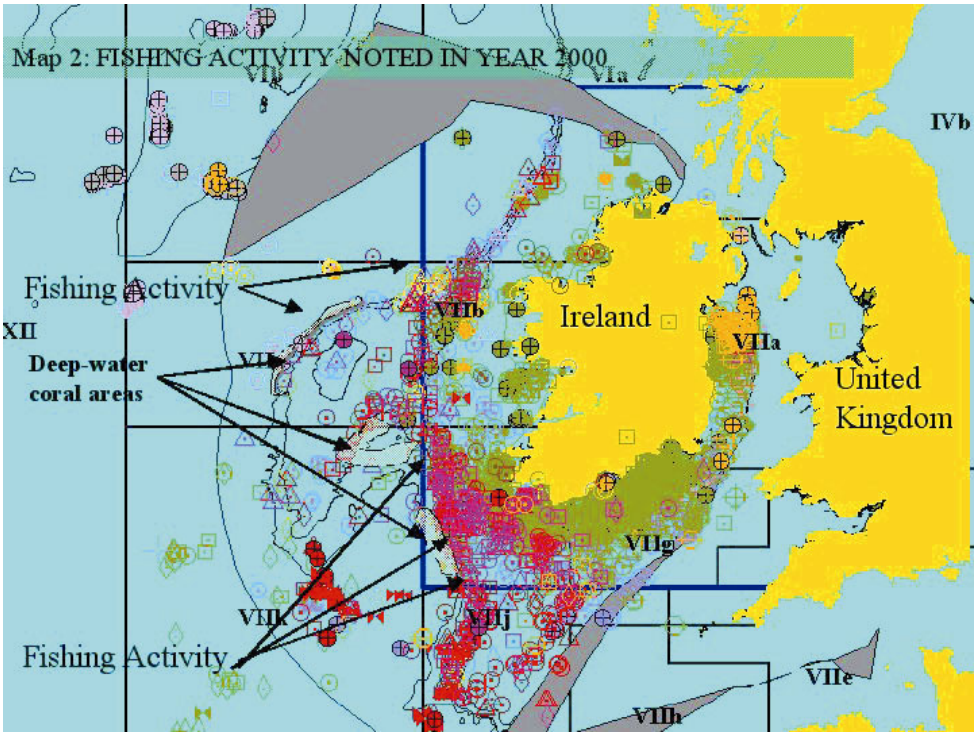
Deep-water coral

Deep-water coral is found along the European continental margin at depths down to 1,100 meters. The marine scientific community has been aware of the existence of the corals since the last century.[5] The extent and importance of the corals to the deep-water biotope has only become apparent with recent advances in sonar and sea-bed mapping technology.[6] Three significant areas for corals have been identified in the sea area outside the territorial sea of Ireland but within the 200-mile exclusive fishery limits of the state (see Map I). The corals are reef-forming structures that support a rich and diverse fauna that rivals those found in tropical waters. Corals have been discovered near the summits of enigmatic underwater hills (up to 300m high) that are called carbonated mounds. The principle coral species found in the north–east Atlantic are *Lophelia pertusa* and *Madrepora oculata* and the coral matrix is estimated to be 4550 years old. The bio-diversity associated with the corals is extraordinary both in terms of abundance and diversity with over 800 recorded species re-occurring in the sea areas associated with the coral reefs. Associated species include populations of commercially exploited fish such as redfish, saithe, ling, blueling, tusk and monkfish. Deep-water corals form an ecosystem where diverse marine life flourishes. Attached to the corals are a range of animals including sponges, bryozoans and hydroids. It is also believed that the corals act as a sanctuary from predators for smaller fish species and other animals that are dependant on waterborne food (referred to as "suspension feeders"). Scientific studies indicate that corals grow at about 6-20 mm per year and reefs are slow to recover from damage by human activity.[7]



The risk from human activities to deep-water coral ecosystems

The first step towards conservation of deep-water coral ecosystems is to identify potential risks to the sustainability of the coral ecosystems from human activities. There is considerable data available on the level of fishing activity and hydrocarbon exploration in the sea areas over which Ireland exercises sovereign rights. Recent surveillance data from the sea fisheries enforcement agencies in Ireland indicates that a variety of fishing vessels operate in the same areas associated with the reefs (see Map 2).



Vessel types include trawlers, long-line vessels and vessels deploying passive gear such as fixed gill nets. Fishing vessels do not harvest coral for commercial purposes but adversely impact on the structural integrity of the coral reefs by utilising bottom trawls and other ground gear to catch deep-water species in reef areas. There is also a danger to the biodiversity associated with the reefs as a result of "ghost fishing" by lost or discarded fixed nets and long-lines. The damage to corals by fishing activity in waters under Irish jurisdiction has not been quantified in any great detail, but there is evidence from other coastal states that destructive fishing practices may damage coral reefs and that management measures are required to ensure conservation.[8]

The existence of deep-water coral may be linked to the seepage of methane and other gases from mineral reserves beneath the sea-bed.[9] Significantly, the Atlantic margin represents a new frontier for the hydrocarbon industry with the depletion of resources in the North Sea and with advances in deep sea-bed drilling and hydrocarbon recovery technology. Gas reserves have been discovered in the Corrib gas field 55 miles west of Ireland with production due to commence on completion of onshore facilities and a satisfactory outcome to the environmental impact assessment process. The Corrib gas field is not located in the vicinity of coral reefs. However, the Department of Marine and Natural Resources in Ireland which is responsible for offshore hydrocarbon development has in the past issued exploration licenses for areas adjacent to the coral reefs. Exploration activities are on-going and may impact on the marine ecosystem as a result of the test drilling of the sea-bed, the construction of offshore platforms as well as the laying of pipelines and other sea-bed infrastructure to bring the resources ashore. The environmental impact on deep-water coral will be dependent upon the location of the production platforms and the routes followed by the pipelines. Accidental discharges from the platforms also present a threat and experience in the United Kingdom suggests that the full effects of offshore oil and gas rigs on corals are not fully known.[10]

The coral reefs are not located near major shipping routes and do not face a threat from vessels anchoring because of the depth of water (600-1,100 meters), nor is there a threat from eco-tourism because of the inclement nature of the north-east Atlantic and the distance of the reefs from the coast (over 50 nautical miles). However, coral reefs, similar to other marine ecosystems, face a threat from bioprospection, pollution from vessel and land-based sources, climate change as well as ozone depletion. Little research has been undertaken on the impact of these threats to the biodiversity and sustainability of deep-water coral in Ireland. It is submitted, however, that the two most imminent risks to the conservation of deep-water coral are commercial fishing activity and the exploration and exploitation activities of the hydrocarbon industries. Conservation action to manage these risks needs to be taken by identifying both the appropriate legal instruments and management scheme to regulate these sector activities. The framework for legislative action is thus multifaceted and embraces international law, European law and the law of the coastal state.

The legal framework for conservation measures.

(i). International Law of the Sea

Ireland, the Member States of European Community (EC) and indeed the EC itself are parties to the LOSC.[11] The LOSC provides for three important jurisdictional zones: the territorial sea, the exclusive economic zone (EEZ) and the continental shelf.

In accordance with the LOSC, the sovereignty of the coastal state extends beyond its land territory and internal waters.....to an adjacent belt of sea, described as the territorial sea.[12] This sovereignty extends to the air space over the territorial sea as well as the sea-bed and subsoil. Ireland has a territorial sea of twelve nautical miles and exercises jurisdiction in this area in accordance with the rules of the LOSC and the other rules in international law.[13]

In common with other Member States of the EC, Ireland extended its fishery limits to 200 miles in 1976.[14] While Ireland has not declared an EEZ, it has applied the fisheries provisions in the LOSC dealing with the EEZ to the area that is legally defined in Irish municipal legislation as being within the 200 mile exclusive fishery limits of the state.[15] This zone is referred to as the exclusive fishery zone (EFZ).

The LOSC defines the EEZ as

> "an area beyond and adjacent to the territorial sea, subject to the specific legal regime....under which the rights and jurisdiction of the coastal state and the rights and freedoms of other states are governed by relevant conventions"[16]

Within this area, the coastal state has

> "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone" [17]

Concurrent with sovereign rights in relation to the EEZ/EFZ, coastal states also have responsibilities in relation to the protection of the marine environment. [18] Specifically, the sovereign rights of the coastal state pursuant to the LOSC to "explore, exploit, conserve and manage" the natural resources, whether living or non-living, within its EEZ/EFZ, is balanced by the duty to take conservation measures in relation to "living resources",[19] coupled with the more general environmental protection obligation to protect the marine environment and to exploit natural resources pursuant to environmental policies.[20] As noted by the leading authority on law of the sea in Ireland, the cumulative effect of these provisions is that the coastal state has LOSC based *potential* (if not presently actual) jurisdiction in the EEZ in relation to nature conservation including non-commercial animal and plant species jurisdiction therein.[21]

One other important concept in the LOSC that is relevant to our review is the continental shelf. Ireland signed but did not ratify the 1958 Convention on the Continental Shelf. It is however bound by the continental shelf provision (Part VI) of

the LOSC since ratification of the latter in 1996. The continental shelf of the coastal state comprises:

> "the sea-bed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance". [22]

Ireland, as a coastal state, exercises over the continental shelf "sovereign rights for the purpose of exploring it and exploiting its natural resources".[23] The sovereign rights attaching to the coastal state cover all the resources of the shelf, that is:

> "the mineral and other non-living resources of the sea-bed and subsoil together with living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the sea-bed or are unable to move except in constant physical contact with the sea-bed or the subsoil".[24]

While Ireland did not ratify the 1958 Convention it nevertheless enacted specific legislation pertaining to the continental shelf in 1968. This legislation states:

> "Any rights of the State outside the territorial waters over the sea-bed and subsoil for the purpose of exploring the sea-bed and exploiting their natural resources are.....hereby vested in the Minister and shall be exercisable by the Minister"[25]

In practice the sea-bed rights on the continental shelf become exercisable when the Government designates a particular area by order. In the period between 1968 and ratification of the LOSC in 1996, Ireland designated 652,000 square kilometres of shelf, and at the time of writing has an additional amount of sea-bed still to designate.[26] All the known areas of corals discovered to date are located in areas designated as part of the Irish continental shelf.

An issue of fundamental importance in relation to deep-water coral conservation is that the general conservation duties under the continental shelf regime are much more limited as compared to the EEZ/EFZ regime where there is an explicit duty under the LOSC to conserve and manage natural resources. There is no such duty under the continental shelf regime. Furthermore, the exercise of sovereignty by the coastal state for the purpose of exploring and exploiting the resources of the continental shelf is distinguished from the regime that applies to the EEZ in so far as the former applies only to "mineral and *other non-living resources* of the sea-bed and subsoil together with living organisms belonging to sedentary species…" (emphasis added). The only living component of "natural resources" which fall within the continental shelf regime are sedentary species, examples include oysters, clams and abalone.[27] Deep-water coral reefs are comprised of both living and non-living resources. The physical structure of a reef is composed of a base of dead coral skeletons in various states of decomposition to which living corals are attached. Cycles of growth and mortality lead to increases in the sizes of the reef over time and variations in what may

constitute living or non-living resources under the continental shelf regime. Deep-water coral straddle the distinction made in the LOSC between living and non-living resources. The limitation regarding both the subject matter of the continental shelf regime (*the ratione materiae*), as well as the distinction between the EEZ/EFZ and the continental shelf regimes in terms of conservation,[28] may curtail the options available to Ireland to protect deep-water corals on the outer continental shelf beyond the outer limits of the EFZ and is discussed below.

It is clear nonetheless that the LOSC vests Ireland with sovereign rights and responsibilities in relation to the conservation and management of deep-water coral which occurs on the sea-bed of the EFZ. It needs to be emphasised, however, that the exercising of these rights and responsibilities must accord with the principles of the Convention and the rules of international law including those in Part XII of the LOSC. This sets out detailed provisions and obligations on States for the protection and preservation of the marine environment. In particular the sovereign right of states to exploit natural resources is limited by the duty to protect and preserve the marine environment.[29] Measures taken under Part XII of the LOSC "shall include those necessary to protect and preserve rare and fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life".[30]

(ii). Other International Legal Instruments and Initiatives.

The LOSC provides the obvious jurisdictional framework for coastal state action to protect deep-water coral. It is however complemented by several other international conventions and initiatives which aim to protect wildlife and habitats. In this regard it is important to point out that European law to protect the marine environment does not evolve in a vacuum and is heavily influenced by the legislative norms in international agreements and conventions that aim to protect and preserve the natural environment. It is not possible to canvas the entire legal landscape to identify every instrument that binds the Community to protect the marine environment. However, the general thrust of several international conventions and indeed non-binding legal instruments is to place an express obligation on the EC and the Member States to use marine resources in a sustainable manner and to preserve the structural and functional integrity of the marine ecosystem(s). [31]

Arguably, the most important convention that has influenced the application of EC law to the environment is the Biodiversity Convention of 1992 (the Rio Convention).[32] The Convention, requires parties to develop, *inter alia*, national strategies for the conservation and sustainable use of biological diversity, both on land and sea, which should include as appropriate, the establishment of protected areas, the protection of ecosystems and habitats, and the protection of threatened species. At the second Conference of the Parties to the Convention in 1995 it was agreed that marine biodiversity should be a priority area for action. The Jakarta Mandate on Marine and Coastal Biological Diversity was subsequently adopted and this sets out a strategy for marine biodiversity with special emphasis on integrated marine and coastal area management and the precautionary approach.[33]

Another Convention influencing the development of EC law to protect the marine environment is the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).[34] Among the objectives of this Convention

is the provision of a legal framework for concerted action at all levels to manage human activities in such a manner that the marine ecosystem will continue to sustain the legitimate uses of the sea and meet the needs of present and future generations.[35] While the OSPAR Convention is ostensibly focused on marine pollution it contains important provisions in Annex V aimed at the protection and conservation of the ecosystems and biological diversity of the maritime area. Both Article 4 of Annex V and the penultimate recital of the Convention stipulate that measures pertaining to the management of fisheries shall not be adopted under the Convention but shall be referred to the attention of the authority or international body competent for such issues. Thus, questions pertaining to the management of fisheries impinging on fishing vessels flying the flag of Member States of the EC must be taken under the instruments constituting the common fisheries policy. This provision in effect means that measures to control the activities of fishing vessels that adversely impact on deep-water coral can only be taken through the medium of EC fishery law. There is little scope under the OSPAR Convention for a coastal Member State of the European Union to adopt unilateral national measures to protect deep-water coral. This is a direct consequence of the exclusive competence that the Member States have vested in the European institutions to regulate and manage sea fisheries.

Other than treaty/convention law, there are several international initiatives that are specifically aimed at protecting the marine environment. These instruments are not legally binding and are sometimes referred to as soft law. An example of such an initiative that is relevant to the conservation programme for the protection of deep-water coral is the FAO Code of Conduct for Responsible Fisheries.[36] The Code sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources with due respect for the ecosystem and biodiversity. While the Code is voluntary it nevertheless provides a blueprint regarding the general principles that need to be adopted in managing the marine environment.

In particular, the Code places an express obligation on States and users of living aquatic resources to conserve aquatic ecosystems.[37] The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources. Moreover, management measures should not only ensure the conservation of target species but also of species in associated ecosystems. Management decisions for fisheries should also be based on the best scientific evidence available, taking into account traditional knowledge of the resources and their habitat, as well as the relevant environmental, economic and social factors.[38] Furthermore, the Code places an express obligation on States and regional fisheries management organisations to apply a precautionary approach to the conservation, management and exploitation of living aquatic resources in order to protect them and to preserve the aquatic environment.[39] In this regard, the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target species and their environment. One other provision in the Code of Conduct for Responsible Fisheries that is particularly pertinent to the establishment of a deep-water coral conservation programme is the recommendation for all parties to develop and apply selective and environmentally safe fishing gear and practices in order to maintain biodiversity.[40] Moreover, in cases where proper selective and environmentally safe fishing gear and practices exist, they should be recognised and

accorded a priority in establishing conservation and management measures for fisheries.[41]

(iii). European Law

The LOSC vests coastal states with certain sovereign rights and responsibilities in relation to the EEZ/EFZ and the continental shelf. Ireland in common with other Member States of the EC has ceded a degree of legislative and treaty-making competence to the Community in relation to certain matters regulated by the LOSC. The EC, for example, has almost exclusive competence (both legislative and treaty-making) for the conservation and management of sea fishing resources and has limited treaty-making competence in the prevention of marine pollution. In relation to the latter, the Community has competence only to the extent that provisions of the LOSC or legal instrument adopted in implementation thereof affect common rules established by the Community.[42] To understand the potential application of the common rules which have been adopted at EC level such as the Habitats Directive to protect deep-water coral, it is first necessary to mention some important EC Treaty provisions which underpin Community legislative interventions to regulate the marine environment.

a. EC Treaty Law

The EC is committed to the preservation, protection and improvement of the quality of the environment. This commitment has a solid legal basis in the EC Treaty, which states:

> "Environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities.....in particular with a view to promoting sustainable development"[43]

This EC Treaty obligation to integrate environmental considerations into the elaboration and implementation of Community policies is based on the conceptual premise that environmental policy requires specific measures in sector policies such as fisheries, transport and energy in order to achieve the global objectives of environmental protection and sustainable development.

The EC Treaty states in the substantive provisions dealing with the environment that:

> "Community policies on the environment shall aim at a high level of protection taking into account the diversity of the situation in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventative action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay".[44]

While the principles enunciated in this EC Treaty provision are generally considered to lack legal clarity and are seen as statements of political intent,[45] they do offer useful guidance on the nature of the measures that ought to be taken to protect the marine environment. These measures are examined below.

b. EC Secondary Legal Instrument - The Habitats Directive- Geographical scope of application - Application to deep-water coral.

While the EC Treaty provides a solid legal basis for the regulation of the environment there is nevertheless a very limited range of secondary legal instruments specifically aimed at protecting specific habitats in the marine environment. One legal instrument whose scope of application extends to the marine environment is the Habitats Directive.

The Habitats Directive[46] is a sophisticated instrument for the maintenance of biodiversity and contributes to the general objective of sustainable development in EC law. The Habitats Directive seeks to preserve and restore the natural habitats, the wild fauna and flora by obliging Member States to establish a comprehensive network of special areas of conservation for endangered and vulnerable species and habitats. The nature network established by the Habitats Directive in conjunction with the Birds Directive is known as NATURA 2000 and consists of sites of international importance. Special areas of conservation are generally designated by Member States but there is also provision for EC designation in exceptional circumstances where a site hosts a priority natural habitat type or priority species. The Annexes of the Directive list the broad categories of natural habitat types and the specific animal and plant species of Community interest. The directive incorporates some aspects of the Berne Convention on the Conservation of European Wildlife and Natural Habitats into Community law.

The aim of the Habitats Directive is

> "to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European *territory* of the Member States to which the Treaty applies (emphasis added)".[47]

The first issue that needs to be addressed is whether the scope of application of the Directive extends beyond the territorial seas of the Member States. A strict construction of Article 2 of the Directive, from the perspective of classical international law, suggests that the instrument is limited in application to the territory of the Member States. The LOSC does not define term *territory* but utilises the term *sovereignty*.[48] In marine areas the territorial sovereignty of the Member States only extends as far the outer limit of the territorial sea, which in the North-east Atlantic is twelve nautical miles measured from the baselines of the coastal Member States.[49]

However, according to the Communication from the Commission (*Fisheries Management and Nature Conservation in the Marine Environment)*:[50]

> "The provisions of the Habitats Directive automatically apply to the marine habitats and marine species located in territorial waters (maximum 12 miles). However, if a Member State exerts its sovereign rights in an exclusive economic zone of 200 nautical miles (for example, the granting of an operating licence for a drilling platform), it thereby considers itself competent to enforce national laws in that area, and consequently the Commission considers in this case that the "Habitats Directive" also applies, in that Community legislation is an integral part of national legislation".

This interpretation is supported by the decision of the High Court in the United Kingdom which concluded that the geographical scope of application of the Habitats Directive is not limited to the territorial sea but "applies to the United Kingdom's continental shelf and to the superjacent waters up to a limit of 200 nautical miles from the baselines, from which the territorial sea is measured". [51] Mr. Justice Kay who delivered the judgement partly based his decision on the grounds that a Directive which includes in its aims the protection of *Lophelia pertusa* and cetaceans will only achieve those aims, on a purposive construction, if it extends beyond the territorial waters. Interestingly, the learned Judge noted:

> "Although much of the concern of the Directive and some of its language can be properly described as land based, it also specifically deals with some habitats which are sea based and, to a large extent flourish beyond territorial waters".

The Judge placed reliance on the wider context of international law to which the United Kingdom and the EC are parties, noting that various treaty obligations impose environmental duties beyond the territorial waters, including the LOSC, the 1992 Rio Convention on Biodiversity, as well as the OSPAR Convention. The decision of the High Court in the United Kingdom is consistent with the findings of the European Court of Justice in several fisheries cases that have held that the scope of Community law extends as far as the rule making authority remit of Member States under public international law.[52]

The second critical issue that needs to be taken into consideration is the significance of the omission of *Lophelia pertusa* in the Habitats Directive. The list of natural habitat types in Annex I of the Habitats Directive does, however, include the term "reefs". It is thus significant that Mr. Justice Kay, on the basis of the published scientific evidence submitted in the case for judicial review proceeded on the basis that *Lophelia pertusa* is a reef forming coral. As noted by the Judge this interpretation of "reefs" accords with the definition in the *Interpretation Manual of European Union Habitats* published by the European Commission.

The decision in the *Greenpeace II* case has major implications for offshore conservation in the United Kingdom. Since the decision in this case, the Department of the Environment, Transport and the Regions in the United Kingdom has undertaken a considerable amount of work to develop mechanisms to protect and manage marine wildlife in sea areas under United Kingdom jurisdiction.[53] The United Kingdom environment minister recently announced that the deep-water coral reefs in the Darwin Mounds would be the first marine special area of conservation outside the territorial waters of the United Kingdom.[54]

c. State practice in Member States other than the United Kingdom.

Several Member States of the European Union have taken initial steps to apply the Habitats Directive to protect marine habitats in the sea areas outside the territorial sea where they exercise sovereign rights. The following Table presents an overview of the measures undertaken by Member States in establishing Natura 2000 sites within the framework of the Habitats and Birds Directive in their respective EEZ/EFZs.[55]

Coastal Member States of the European Union	BELGIUM	DENMARK	GERMANY	SPAIN	FRANCE	IRELAND	NETHERLANDS	PORTUGAL	FINLAND	SWEDEN
First legal steps for the realisation of NATURA 2000 inside EEZ or 200 nautical mile zone	Y	Y	Y	?	Y	?	Y	Y	Y	?
First scientific steps for the identification of NATURA 2000 inside EEZ or 200 nautical mile zone	?	Y	Y	?	N	Y	Y	Y	Y	Y
First announcement of NATURA 2000 sites inside EEZ or 200 nautical mile zone	N	Y	N	?	N	N	N	Y	N	N

Table 1.

From the data displayed in Table 1, it is evident that Denmark and Portugal have announced the designation of special area of conservation in sea areas outside their territorial seas and within the outer limits of their EEZs. The dilatory progress of Member States in implementing the Habitats Directive outside the territorial sea may be attributed to a number of factors that are peculiar to the marine environment. These include, *inter alia*: the lack of knowledge regarding the nature and extent of habitats in offshore and deep-water areas; difficulties in site selection and delimitation in sea areas outside the territorial sea; the absence of transposition legislation in some Member States for implementing the Directive in the EEZ; as well as inadequate lists of marine species and habitat types in the Directive. [56]

The slow application of the Directive in the marine environment may be ameliorated as Member States exchange information and learn from the practical experience of site selection and designation in the United Kingdom, Portugal and Denmark. In this regard, it may be argued that there is sufficient state practice in Member States to support the case for site designation by Ireland to protect deep-water coral.

(iv). Municipal Law in Ireland

Ireland has responsibility under international law and European law to protect the marine environment. In response to these obligations, Ireland selected 28 coastal and marine sites for protection under the scheme set out in the Habitats Directive. All the sites are located within 3 nautical miles of the coast and there are no legal indicators from the relevant Government Department of their intent to apply the Directive outside the territorial sea to protect habitats such as deep-water coral.

Ireland's recalcitrant response to its environmental responsibilities was compounded by delay between the adoption at EC level of the Habitats Directive in 1992 and the enactment of the European Communities (Natural Habitats) Regulations 1997 that transposes the provisions of the Directive into municipal law.[57] Ireland's failure to transmit to the European Commission the list of sites for protection (both marine and land) resulted in enforcement proceedings in the European Court of Justice and a ruling that Ireland did not fulfil its obligations under Community law.[58] Further procrastination, or indeed failure to protect deep-water coral under the scheme provided for in the Habitats Directive, may result on the imposition of a fiscal penalty.[59]

There is a persuasive case to support the view that the geographical reach of the Habitats Directive extends beyond Ireland's territorial sea to all sea areas where Ireland exercises sovereign rights, including the continental shelf and superjacent waters. This interpretation of the application of the Directive is important because marine scientific research to date indicates that deep-water coral only exists in the sea area outside the territorial sea. Any future application of the Habitats Directives to protect deep-water coral will only be of value if this interpretation of the geographical scope of the Directive is accepted.

The Irish legislation (the European Communities (Natural Habitats) Regulations 1997) which transposes the regulation into Irish law offers evidence that it is the intention of the regulatory authority to apply the Habitats Directive up to the outer limits of the 200 nautical mile exclusive fishery zone. This is evident from Part I of the Regulations where one of the definitions in the interpretation section states:

> "operation and activity" means any use of-
>
> (a) land (including foreshore and the sea-bed out to the exclusive fishery limits of the State)[60]

It is thus clearly foreseen that the implementation Regulations will be used for controlling "operations and activities" which impact on any marine special area of conservation designated in the sea area out to the 200 nautical mile exclusive fishery limits. Furthermore, the Regulations state that "a word or expression that is used in these regulations and is also used in the Habitats Directive shall, unless the contrary intention is expressed, have in these Regulations the meaning it has in the Habitats Directive". Thus, if the term *territory* in the Habitats Directive is interpreted as including sea areas under the sovereignty and jurisdiction of the Member States then it may be argued that this interpretation should have the same meaning under the transposition regulations. This interpretation that the provisions relating to special area of conservation will apply to the marine environment and that implementation of the Directive in Ireland extends to the exclusive fishery limits is supported by a number of specialist commentators.[61]

The application of the Habitats Directive seaward of the EEZ/EFZ.

The Irish legislation (the European Communities (Natural Habitats) Regulations 1997) only applies to the outer limit of the exclusive fishery zone. Furthermore, as the *Greenpeace II* case demonstrated in the United Kingdom the precise geographical scope of the Habitats Directive is not clear from the text of the Directive. This question is of practical significance in so far as the complete range and extent of deep-

water coral on the Atlantic margin is not known. Ireland has continental shelf beyond the outer limits of the EEZ/EFZ and future discoveries of deep-water coral may require Ireland to apply the Directive to those areas of the continental shelf over which the state purports to exercise sovereign rights which extends beyond the 200 mile fishery limits.

The authors of this paper contend that there is a strong case to support the view that the scope of the Habitats Directive should extend to the outer limits of the continental shelf over which Ireland exercises sovereign rights in accordance with international law. Elements to support this view are firstly, the geographical extent of the European Communities' legal competence to adopt measures such as the Habitats Directive as set out by the EC treaties is not limited to the territories of the Member States but extends to all maritime zones under the jurisdiction or sovereignty of the Member States.[62] The EC Treaty does not contain any provisions that expressly exclude the Irish continental shelf from the scope of application of Community Law. Ireland is responsible for the exercising of sovereign rights over the continental shelf and *ipso facto* Ireland must be subject to Community law in such areas. Any other construction would make the Irish continental shelf, in Community law terms, a lawless zone.[63] Secondly, there is a considerable body of jurisprudence from the European Court of Justice in the context of the common fisheries policy that supports the view that the scope of Community law (*ratione loci*) extends to where a Member State exercises functional jurisdiction under public international law.[64] Thirdly, Ireland has transposed into national law other Community laws which impinge on the exercise of sovereign rights in relation to the continental shelf and which regulate activities outside the territorial sea.[65] Fourthly, judicial practice in other Member States indicates a willingness to consider the scope of application of Community legal instruments as extending to the outer continental shelf.[66]

The utility of the Habitats Directive to protect the biodiversity associated with coral reefs beyond the 200 nautical mile EEZ/EFZ is however curtailed by the LOSC. As already mentioned, under the continental shelf regime the sovereign rights of the coastal state for the purpose of exploring and exploiting the continental shelf are limited to the mineral and other non-living resources of the sea-bed and subsoil together with living organisms belonging to sedentary species.[67] This means, paradoxically, that the application of the Habitats Directive by the coastal state to protect deep-water coral is limited by the definition of natural resources in the LOSC and will not extend to protect living natural resources such as commercially exploited free swimming fish species which are associated with the coral reefs.

Putting a legal and management framework in place for deep-water coral.

There are a number of actions that may be taken at European and national level to protect the unique ecosystems associated with deep-water coral. As is evident from the discussion above, there is a solid Treaty basis for legislative intervention to protect the natural environment supported by a range of secondary instruments including environmental directives and fisheries regulations.[68]

The authors of this paper contend that deep-water corals may be protected from human activities if the Member States and European institutions adopt a three-strand approach to the management problem. The first strand is the adoption of a technical conservation measure in the common fisheries policy to regulate fishery activities that

have an adverse impact on coral ecosystems. This element will not of course protect deep-water coral from the impact of other sector activities such as the oil and gas industry. The coastal state, through the medium of municipal law, can regulate the latter. To address this issue, the second strand entails the coastal state implementing an ecosystem management approach to the sea areas where deep-water coral exists within national jurisdiction. This requires the designation of areas where there is deep-water coral as special areas of conservation by the coastal state in accordance with the requirements specified in the Habitats Directive. The third strand implies the implementation of a comprehensive enforcement and compliance scheme to ensure that the future legislative regime pertaining to deep-water coral will be properly implemented and will contribute to a sustainable ecosystem. It is now proposed to say a little more about each of the elements in the suggested framework.

(a) Strand One - Adoption of a technical conservation measure in the common fisheries policy.

The existing common fisheries policy does not have specific measures for the management and conservation of ecosystems in the Atlantic that contain deep-water coral.[69] There is a valid case for the adoption of a specific technical conservation measure at European level to protect deep-water coral. Technical conservation measures is the term used to denote the series of conservation provisions which regulate the type of fishing gear allowed in a particular fishery as well as the size of marine organisms which may be landed and seasonal/area restrictions for particular fisheries. [70] The proposed measure to protect deep-water coral may entail the prohibition of the utilisation of bottom trawls and perhaps restrictions on the use of long-line and passive gears in coral areas. The impact of mid-water and pelagic trawls on the corals and their associated biodiversity would have to be assessed. The precise range of measures and their geographical scope could be worked out by the Scientific, Technical and Economic Committee for Fisheries that advise the European Commission on the formulation of policy.

There are several advantages in adopting a Community regulation to protect deep-water coral. Firstly, it would resolve competing jurisdiction issues in Community legal instruments in so far as the responsibility on the Member States to protect marine habitats under the LOSC and the Habitats Directive has to be reconciled with the competence of the EC to regulate and manage sea fisheries. Fishing activity within the Irish exclusive fishery limits is governed by the common fisheries policy and Community competence to prescribe conservation measures in this regard is almost exclusive.[71] Ireland, in common with other Member States, retains the right to enforce Community fishery law. Consequently, any conservation regime for deep-water coral that impinges on the activities of fishing vessels (whether they fly the flag of the Member States of the EC or third countries) within the Irish exclusive fishery limits can only be adopted at Community level on the basis of Article 37 EC Treaty.[72]

Secondly, within the Community legal order, regulations are directly effective and directly applicable in the Member States. Unless expressly stated otherwise, regulations have the force of law from the date of publication and do not require transposition by the legislatures in the Member States. Regulations provide a uniform standard that applies to all EC vessels, which operate in the northeast Atlantic. This is an important element given that the majority of vessels, which operate within the Irish

200 exclusive fishery limits, do not fly the flag of the coastal state but sail under the flags of the United Kingdom, France and Spain. The enforcement and compliance of any such technical conservation measure could be linked with the operation of the EC satellite vessel monitoring system.[73] This would allow coastal state enforcement authorities to assess whether fishing vessels are operating in areas with deep-water corals.

The third advantage of this approach is that it integrates environmental principles into the common fisheries policy and establishes environmental protection as a guiding norm for fishery regulation. This approach accords with the strategy proposed by the European Commission in their Communication from the Commission to the Council and the European Parliament entitled, *Elements of a strategy for the integration of environmental protection requirements into the common fisheries policy*.[74] It is also consistent with the scheme proposed by the European Commission in their Green Paper on the future direction of the common fisheries policy.[75] A fisheries technical conservation measure to protect deep-water coral will demonstrate the commitment of Member States and the European institutions to an ecosystem-based approach to fisheries management as outlined in the recently published Biodiversity Action Plan for Fisheries.[76]

One other point to support this approach is that there is considerable precedent for EC regulatory intervention through the medium of technical measures to protect the marine environment. Specific examples include: the technical conservation measure which prohibits the use of certain types of towed fishing gear such as St. Andrew's crosses for harvesting coral in the Mediterranean Sea;[77] the prohibition on the use of large-scale driftnets by all EC vessels other than those that operate in the Baltic sea, the Belts and the Sound;[78] as well as the active role played by the EC in the dolphin conservation programme in the Eastern Pacific Ocean.[79]

The principle disadvantage of this approach is that a technical conservation measure must be based on a European Commission proposal, which would have to secure the support of the majority of the Member States in the Council of Ministers. However, the common fisheries policy is under review and one of the outcomes of the review process could perhaps be the adoption of such a measure.[80] In the absence of legislative action by the EC there may be sufficient residual legislative competence for Ireland to adopt a unilateral measure to protect deep-water coral.[81] While the scope for a Member State to adopt unilateral conservation measures is clearly limited by the jurisprudence of the European Court of Justice,[82] a national measure would have to accord with the general thrust of Community law and be in conformity with the rules of the common fishery policy. Ireland could argue that the purpose of such a measure is to address an obvious lacuna in Community legislation and as a coastal state Ireland has a duty pursuant to the LOSC, the Biodiversity Convention, the Berne Convention and the Habitats Directive to take protective measures for deep-water coral reefs.

The second disadvantage of this approach is that it exposes the cumbersome division of legislative competence between the EC and the Member States. The EC legislative competence to prescribe management measures for fisheries is limited to the "exploitation activities involving living aquatic resources".[83] This prescriptive legislative competence does not extend to include the mineral and other non-living

resources of the sea-bed and subsoil of the continental shelf under the jurisdiction of the Member States. As noted above, coral reefs are partly comprised of non-living resources. Ireland has legislative competence under the LOSC to prescribe conservation and management measures for those parts of the reefs which are considered to be part of the non-living resources of the continental shelf under Irish jurisdiction (within the 200 mile EFZ).[84] The absence of EC legislative competence over the non-living resources of the sea-bed and subsoil may make it more difficult to reconcile the sovereign rights and duties of Ireland as a coastal state under the LOSC with those of the European institutions in the formulation and adoption of fisheries regulatory measures.

Finally, it must be borne in mind that, in the broader context of safeguarding the entire marine ecosystem(s), a technical conservation measure will not guarantee the long-term sustainability of deep-water fisheries which require a comprehensive framework for the management of all living marine resources.[85]

(*ii) Strand Two – Implementation by the coastal state of an ecosystems management approach to the marine environment*

A Technical Conservation Measure will only reconcile the fishery management issues and will not resolve difficulties with other ocean uses that may impact on the conservation of deep-water coral. In this regard, the only realistic legal management option available to Ireland is to designate sites of deep-water coral under the Habitats Directive as special areas of conservation. This will provide the legal framework for a management programme to protect the structural and functional integrity of deep-water coral ecosystems from deterioration and disturbance. It will also ensure that the environmental impact on deep-water coral is assessed and taken into consideration prior to the commencement of exploration and exploitation activities by the hydrocarbon industries.[86]

Designation by the coastal states is important because it would be inherently unfair to regulate the fishing industry through the medium of European fishery law while the biodiversity of coral ecosystems continues to be put under threat by other sector activities such as oil and gas exploration and exploitation. Designation would also allow the coastal state to take appropriate management measures in relation to specific risks and would be a direct application of the Treaty obligation to adopt precautionary and preventative measures.

(iii). *Strand Three - Improved monitoring and assessment of the conservation and management framework*

The adoption of a technical conservation measure for fisheries and the designation of the sites as special conservation areas will not ensure a sustainable eco-system for deep-water corals without appropriate enforcement and compliance mechanisms in the Member States.

Enforcement entails a range of operations including surveillance, inspection, detention and formal application of the law by judicial process. In the context of the proposed scheme for the protection of deep-water coal a distinction is made between coastal state enforcement jurisdiction and flag state jurisdiction. The LOSC vests the

coastal state with considerable enforcement jurisdiction and vessels fishing in the Irish exclusive fishery zone will have to adhere to any conservation measures established to protect deep-water coral.[87] The enforcement agencies in Ireland will be responsible for ensuring that there is compliance in the exclusive fishery zone with the provisions of any technical conservation measure adopted by the EC to protect deep-water coral. In order to discharge this enforcement function the Irish authorities will have to board and inspect vessels in the vicinity of coral areas. Vessels suspected of non-compliance with the regulations may be detained and escorted to an Irish port and be subjected to judicial proceedings. Violations of fishery conservation regulations are penalised by fiscal penalties, forfeiture of catch and gear, withdrawal of licence and suspension of licence. An example of the severity of the penalties may be appreciated when it is considered that a Japanese bluefin tuna vessel had to pay a penalty of £800,000 in 1995 for illegal entry and fishing in the Irish exclusive fishery zone without authorisation.[88] In exceptional circumstances the Court in Ireland may order sequestration of the vessel. In line with international law,[89] penalties for the violation of fisheries law in Ireland do not include imprisonment.[90] Outside the Irish exclusive fishery zone responsibility for enforcement will rest with the flag state.[91] In this regard there are a considerable number of provisions in the European fishery enforcement regulations that oblige Member States to exchange information and to prosecute vessels that violate fishery conservation measures in the sea area under the maritime jurisdiction and sovereignty of another Member State.[92]

Violation of the management regime established under the Habitats Directive constitutes a criminal offence and may attract a fine of £1,500 and /or 6 months imprisonment under the transposition regulations.[93] The penalties under this scheme appear to be derisory in comparison with the sanction regime that pertains to fishery law in Ireland. There is provision in the regulation, however, that the Minister of the Environment has the power to require the restoration of a damaged site (special area of conservation) by the party who does the damage or the compensation of the Minister for the cost of restoration.[94] One leading environmental commentator has suggested that this provision may be invalid because of a drafting error.[95] It is also difficult to foresee how a deep-water coral habitat could be restored after damage.

It is clearly evident nonetheless that the sanction regimes that pertain in the fishery conservation regime and the habitat regime are disproportionate and may have to be reviewed should the suggested course of action outlined in this paper be followed.

Conclusions

Deep-water coral and associated biodiversity are vulnerable to damage from commercial sea fisheries and the development activities of the offshore hydrocarbon industries. The current legal regime has a number of instruments that prescribe general and specific duties to protect the marine environment. In order to manage the risk to deep-water coral from human activities it is necessary to adopt forthwith a technical conservation measure for fisheries at European level and to designate coral areas as special areas of conservation under coastal state legislation (ie. implement the Habitats Directive in all sea areas under the sovereignty and jurisdiction of the Member States). This approach would be the first steps towards addressing the problem of conservation of deep-water coral in the Irish exclusive fishery zone in an integrated way and would ensure that environmental considerations are clearly evident in the corpus of law that regulates the utilisation of marine resources at both a national and European level.

Postscript

Since this paper was published in 2002,[96] there have been a number of developments in international law and European law which indicate that the protection of deep-water coral and the creation of MPAs for this purpose are very much a contemporary legal issue. While it is difficult to identify the precise reason for the rapid evolution of international and European law in this area, it is nevertheless much easier to enumerate several contributory developments which are briefly mentioned below.[97]

Firstly, one of the principle objectives pertaining to marine resources emanating from the World Summit for Sustainable Development held in Johannesburg in 2002 is the establishment of a representative network of MPAs by 2012. This objective is further elaborated in the Plan of Implementation which calls for the:

> "Development of …diverse approaches and tools including …….. the establishment of marine protected areas consistent with international law and based on scientific evidence..".[98]

Secondly, this commitment in the Declaration of the World Summit for Sustainable Development was subsequently approved by the United Nations in a General Assembly Resolution which, specifically:

- Called upon States to co-operate and to take measures to implement Part XII of the Law of the Sea Convention to protect the environment and living resources;
- Endorsed the need for a…network of marine protected areas by 2012
- Highlighted requirement for international programmes to halt the loss of marine biodiversity;
- Called upon States to take measures for protection of coral reefs;
- Called for urgent ……action to improve the management of seamounts and other underwater features.[99]

Thirdly, there have been a number of developments at a regional level which will have significant impact on the development of a coherent regional policy such as the statement emanating from the Joint Ministerial Meeting of OSPAR and HELCOM in Bremen in June 2003 which noted the following:

> "…….The third line of action to protect marine biodiversity and ecosystems is to protect specific areas. For this purpose, we endorse the Recommendation on a Network of Marine Protected Areas. Working with HELCOM and the European Community, we shall identify the first set of such areas by 2006, establish what gaps then remain and complete by 2010 a joint network of well-managed marine protected areas that, together with the Natura 2000 network, is ecologically coherent.
>
> We are particularly concerned about the status of vulnerable cold-water coral reefs, many of which are threatened with destruction. Bearing in mind the ecological importance of these reefs and the practical irreversibility of their damage, we shall take immediate measures to protect coral reefs from further damage due to use of active fishing gear on the reefs. Furthermore, we shall ensure that steps are taken by 2005 to identify additional threats to the cold-water reefs and that measures are taken to protect the reefs against these threats."

Fourthly, the report of an ad hoc Technical Expert Group on Marine and Coastal Protected Areas was presented at the eight meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), Convention on Biological Diversity, held in Montreal, March 10-14, 2003. SBSTTA welcomed the report of the Expert Group and endorsed a global goal for the Convention in regards to marine and coastal protected areas and the establishment and maintenance, by 2012, of marine and coastal protected areas that are effectively managed, ecologically based and contribute to a permanent representative global network.[100] The network should include areas with different uses/degrees of protection, including representative areas where extractive uses are excluded, and other significant human pressures are removed or minimised. The recommendation of SBSTTA will be brought forward for consideration at the seventh meeting of the Conference of the Parties of the Convention on Biological Diversity in 2004.

Fifthly, one of the primary issues on the agenda of the United Nations Open-ended Informal Consultative Process in June 2003 was the protection of vulnerable marine ecosystems. There have also been a number of international workshops which have examined the issues of biological diversity on the high seas and have identified marine protected areas as a suitable management tool to protect vulnerable ecosystems within and beyond national jurisdiction.[101]

Finally, European fishery law has evolved considerably with the adoption of Council Regulation No 2371/2002 in December 2002.[102] This regulation provides a new regime for the management of European fisheries and specifically includes within its scope the adoption of measures to limit the environmental impact of fishing.[103] Furthermore, in accordance with the regulation one of the express objectives of the common fisheries policy is to protect and preserve living aquatic resources and to minimise the impact of fishing activities on marine eco-systems.[104] The regulation also states that the policy ought to be guided by principles of good governance and that the management regime is to be consistent with other the environmental protection policy.[105]

Endnotes

[1] A draft version of this paper was presented by Ronan J. Long and Anthony Grehan at an Expert Workshop on the Marine Environment at the International Academy for Nature Conservation, Isle of Vilm, Germany, June 2001 and subsequently published under the title "Marine habitat protection in sea areas under the jurisdiction of a coastal Member State of the European Union: the case of deep-water coral conservation in Ireland" in *The International Journal of Marine and Coastal Law*, Vol 17, No 2, pp. 235-261. The authors wish to acknowledge comments from C. Symmons, E. Moleenar, P. Curran, L. Cashman, M. O'Cinnéide, A. Astudillo.

[2] For press coverage of recent marine science research cruises investigating the reefs, see, *inter alia*: http://www.ireland.com/newspaper/science/2001/0802/sci3.htm; http://www.ireland.com/newspaper/science/1999/0913/sci3.htm; http://www.science.ie/news_info/articles_offshore.htm. For information on scientific research programmes on deep-water coral, see, http://www.ecoserve.ie/projects/coral/; http://www.ucc.ie/ucc/research/crc/Pages/projects/aces.htm.

[33] See, for example, the United States Executive Order for Marine Protected Areas, May 26, 2000, which aims to protect natural and cultural resources within the marine environment. Norway has adopted conservation measures for the protection of the Sula Reef in its EEZ by utilising the Norwegian EEZ Act in conjunction with the Salt Water Fisheries Act. The Sula Reef is one of the world's largest known cold-water coral reef complexes and is closed to bottom trawling since 1999. In 2000 an additional area, north of Haltenbanken, was also closed to this type of fishing gear. The prohibition extends to the utilisation, by Norwegian vessels and vessels that fly foreign flags, of fishing gears that are dragged and may come in contact with the sea floor as well as the intentional destruction of coral reefs in the Norwegian EEZ. See, http://www.eu-seased.net/seabed/issue1.

[4] Ireland has, however, declared a whale and dolphin sanctuary for all sea areas under Irish jurisdiction. One commentator has argued that the legal effect of this is only symbolic, see, C. Symmons, *Ireland and the Law of the Sea*, (Dublin, Round Hall Sweet and Maxwell, 2nd. Ed., 2000), pp. 270-277. It should also be pointed out that the proposed course of action advocated in this article to protect deep-water corals does not preclude the establishment by Ireland of MPAs in the sea areas under national maritime jurisdiction in accordance with the relevant provisions of the LOSC at some future date. On the protection of special areas in the marine environment, see, R. R Churchill, A.V. Lowe, *The Law of the Sea*, (Manchester, Manchester University Press, 3rd Ed., 1999), pp. 392-395. For a discussion of the application of MPAs on the high seas, see, R. Warner, "Marine protected areas beyond national jurisdiction - existing legal principles and a future international law framework", paper presented at the expert workshop on managing risks to biodiversity and the environment on High Seas, including tools such as MPAs, scientific requirements and legal aspects, Federal Agency for Nature Conservation, Isle of Vilm, Germany, February 2001. For the application of MPAs in the Netherlands, see, H.M. Dotinga, E.J. Molenaar and C. Backes, *Beschermde Gebieden in de Nederlandse Exclusieve Economische Zone* (Protected Areas in the Netherlands Exclusive Economic Zone), in: 'Duurzaam Ruimtegebruik. Opstellen vanuit Juridisch en Bestuurswetenschappelijk Perspectief' (Sustainable Use of Space. Essays from a Legal and Policy Science Perspective), P.P.J. Driessen, L.M. Michiels en E.J. Molenaar (eds.), (in press). See also T.S. Agardy, *Marine Protected Areas and Ocean Conservation*, Environmental Intelligence Unit, (Academic Press, 1997). For the application of MPA's to the high-seas, see A. C. de Fontaubert, "Legal and political considerations", (Eds. XXF/IUCN/WCPA), *The status of natural resources on the high-seas*, (WWF/IUCN, Gland, Switzerland, 2001). For a practical guide to the utility of applying MPAs to the marine environment, see, K.H.Brink, E. Houde, *Marine Protected Areas: Tools for sustaining ocean ecosystems*, (United States National Research Council, National Academic Press, 2001).

[5] See, E. Danois, *Le Profondeurs de la Mer*, (Paris, Payot, 1993)

[6] See, *inter alia*: J.B. Wilson, "The distribution of the coral *Lophelia pertusa* (L.)(L. *prolifera*) (Pallas) in the north-east Atlantic", *Journal of the Marine Biological Association of the United Kingdom*, Vol. 59, pp. 149-164; D. Long D, J.M. Roberts & EJ Gillespie, Occurrences of *Lophelia pertusa* on the Atlantic margin, (1999) British Geological Survey Technical Report WB/99/24C

[7] A.D. Rogers, "The biology of *Lophelia pertusa* (Linnaeus, 1758) and other deep-water reef-forming corals and impacts from human activities", (1989) 84 *International Review of Hydrobiology*, pp. 315-406

[8] See, J. Hall-Spencer, V. Allain, J.H. Fossa, "Trawling damage to Northeast Atlantic ancient coral reefs", (2001) *Proceedings*, The Royal Society. In the United Kingdom, it is reported that there is damage by fishing vessels to fields of mounds of *lophelia pertusa* in the sea area north-west of Cape

Wrath in Scotland, see, www.theherald.co.uk/news/archive/3-10-19101-0-44-20.html. Examination of sonar records on another scientific research programme in the United Kingdom demonstrated that bottom trawling is a potentially destructive agent of *Lophelia pertusa* , see, D. Long, Mapping coral distribution, Report on the Managing Impacts on the Marine Environment, (April, 2000), http://www.marinetech.co.uk/projects/MIME.htm. The Canadian Ocean Habitats Protection Society have also reported damage to deep-water coral in the Georges Bank fishery in North America, see, http://cohps.atlantisforce.org.

[9] See, *inter alios*, J.P. Henriet, B. De Mol, S. Pillen, M. Vanneste, D.Van Rooij, W. Versteeg, P.F. Crocker, P.M. Shannon, V. Unnithan S. Bouriak. and P. Chachkine , " Gas hydrate crystals may help build reefs", (1998) *Nature* 391, 64-649; M. Hovland, P.B. Mortensen, T. Brattegard, P. Strass, and K. Rokoengen, " Ahermatypic coral banks off mid-Norway: evidence for a link with seepage of light hydrocarbons", (1998) *Palaios* 13, 189-200.

[10] See, J.M. Roberts, " Full effects of oil rigs on corals are not yet known", *Nature* 403: 242.

[11] Ireland deposited its formal instrument of ratification of LOSC on June 21, 1996. The EC deposited its instrument of formal confirmation, as provided for in Article 3 of Annex IX of the Convention, on April 1, 1998. All the littoral Member States of the European Union, other than Denmark, are contracting parties of the LOSC. Denmark signed but to date has not ratified the LOSC. It is bound however by those provisions in the LOSC which are considered to be customary international law.

[12] LOSC Article 2(1)

[13] Maritime Jurisdiction Act 1959, section 3, as amended by Maritime Jurisdiction Act 1988 . For a commentary on the regime which applies to the Irish territorial sea, see, C. Symmons, *Ireland and the Law of the Sea*, Chapter 3, *passim, op.cit.* fn 4.

[14] Maritime Jurisdiction Act (Exclusive Fishery Limits) Order 1976.

[15] The rights under the EEZ regime differ from those under that of the continental shelf regime on which Ireland has specific legislation. In the EFZ Ireland has sovereign rights in relation to the exploring, exploiting, conserving and managing living resources, the non-living resources are covered by the regime applicable to the continental shelf. Ireland's failure to declare an EEZ may have been motivated by uncertainty regarding the status of the EEZ regime in customary international law prior to coming into force of the LOSC. It has been argued that the sovereign rights and jurisdiction under customary international law for states that have not declared an EEZ are the same as for those parties that have declared an EEZ in so far as the International Court of Justice has stated that the concept of the EEZ "may be regarded as part of modern international law", *Tunisia-Libya Continental Shelf* case, ICJ Reports (1982) 18, p 74, paragraph 100. A view subsequently supported in the *Libya-Malta Continental Shelf* case, ICJ Reports (1985) 13, p. 33, paragraph 34. See, D. Owen, "The application of the Wild Birds Directive beyond the territorial sea of European Community Member States", (2001) 13 *Journal of Environmental Law*, 39 at pp. 58-59. For the Irish viewpoint on the status and content of the EEZ regime, see, C. Symmons, *Ireland and the Law of the Sea*, pp. 169-172, *op. cit.* fn 4.

[16] LOSC Article 55

[17] LOSC Article 56 (1)

[18] LOSC Article 193

[19] LOSC Article 61. "Living resources" may include non-commercially exploited resources such as deep-water coral. This point is not free uncertainty or controversy. For a discussion of the meaning of the LOSC terms "natural resources" and "living resources", see D. Owen, "The application of the Wild Birds Directive beyond the territorial sea of European Community Member States", (2001) 13 *Journal of Environmental Law*, 39 at 49-56. The author argues that the terms "living resources" and "natural resources" are equivocal. Strong arguments may be advanced for both an interpretation which limits the terms to those species of marine fauna and flora which are (commercially) exploited on the one hand, and on the other hand for a broader meaning encompassing species of fauna and flora which are not exploited.

[20] LOSC Articles 192 and 193

[21] See C. Symmons, *Ireland and the Law of the Sea*, Chapter 4 (especially at pp. 173-174 on the conservation duties in the EEZ), *op.cit*., fn 4.

[22] LOSC Article 76 (1)

[23] LOSC Article 77 (1)

[24] LOSC Article 77(4), Continental Shelf Convention Article 2(4)

[25] Continental Shelf Act 1968, Section 2

[26] The current areas designated extend as far as the maximum 350 nautical miles limits or 100 nautical miles from the 2,500 metre isobath provided for in Article 76 of the LOSC. For a discussion of the

issues pertaining to the continental shelf and delimitation, see C. Symmons, *Ireland and the Law of the Sea,* Chapters 5 and 7, *op.cit,* fn 4. It should also be pointed out that the term 'designate' is predominantly relevant for Irish municipal law, but of course under international law such rights exist *ipso facto* Article 77(3) of the LOSC.

[27] See , R. R Churchill, A.V. Lowe, *The Law of the Sea*, p. 151, *op. cit*. fn 4.

[28]For a detailed discussion of the differences in the regimes, see L. Kimball, "The United Nations Convention on the law of the Sea: A framework for Marine Conservation", in *The Law of the Sea: Priorities and Responsibilities in implementing the Convention*, (Gland, IUCN, 1995)

[29] LOSC Article 193

[30] LOSC Article 194 (5)

[31] There are several conventions, while not directly aimed at protecting the marine environment, have influenced the development of EC law to protect and preserve natural habits. In this regard, particular reference may be made to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which prohibits, *inter alia*, trade in corals. The EC has adopted regulations which apply CITES but has not received sufficient number of ratification from contracting parties to become party to the Convention. Ireland signed CITES on November 1, 1974 but has only recently committed itself to ratification, see press statement, Ireland, Department of Arts, Heritage, Gaeltacht and the Islands, August 19, 2001. The Convention on the Conservation of European of European Wildlife and Natural Habitats of 1979 (the Berne Convention) has also had a major influence on the development of Community law on the protection of ecosystems and biological diversity. The latter is a Council of Europe Convention which aims to safeguard endangered habitats and species throughout Europe. For the EC perspective on the obligations in this convention, see Council Decision 82/72/EEC of 3 December 1981, OJ L 38/1, 10 February 1982. It may also be relevant to point out that the EC and the Member States have signed the Arhus Convention on access to information, public participation in decision-making and access to justice in environmental matters.

[32] The EC is party to the Rio Convention which entered into force on 29 December 1993. Ireland signed the Convention on June 13, 1992 and ratified on March 22, 1996.

[33] See, M. Goote, "The Jakarta Mandate on Marine and Coastal Biological Diversity, (1997) 12 *International Journal Marine and Coastal Law* (*IJMCL*) , 377-389.

[34] The OSPAR Convention has been signed and ratified by Ireland and came into force in 1998. OSPAR refers to Oslo and Paris, the cities in which previous conventions to the 1992 Convention were adopted. The Convention maritime areas are those parts of the Atlantic and Arctic Oceans and their dependent seas defined in Article 1. Within that particular area the Convention applies to the internal waters and the territorial seas of the Contracting Parties, the sea beyond and adjacent to the territorial sea under the jurisdiction of the coastal state to the extent recognised by international law, and the high seas, including the sea of all those waters and its sub-soil.

[35] Third recital of the Convention.

[36]For further details of the Code and developments in implementation, see, ww.fao.org/fi/agreem/codecond/codecon.asp; A useful introduction to the Code is provided by W. R. Edeson, "The Code of conduct for Responsible Fisheries, An Introduction", (1996) 11(2) *IJMCL*, 233-238

[37] FAO Code of Conduct for Responsible Fisheries, Article 6.1

[38] Article 6.4, *id*.

[39] Article 6.5, *id.*

[40]Article 6.6, *id.*

[41] *Ibid*

[42] The formal instrument of confirmation deposited by the EC on the 1 April 1998 lists relevant Community acts governed by the LOSC and the Implementation Agreement. One of those Acts that is on the list pertaining to the LOSC provisions on marine pollution is the Habitats Directive.

[43] EC Treaty, Article 6

[44] EC Treaty, Article 174(2)

[45] See L. Kramer, *EC Environmental Law*, (London, Sweet & Maxwell, 4th ed., 2000), pp. 9-20

[46] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, Official Journal L 206 , 22/07/1992 p. 0007 – 0050; as last amended by Council Directive 97/62/EC of 27 October 1997**,** Official Journal L 305 , 08/11/1997 pp. 0042 - 0065

[47] Council Directive 92/43/EEC, Article 2

[48] LOSC Article 2

[49] In this jurisdictional zone the sovereignty of the coastal state is not absolute and is subject to important international law right of innocent passage, LOSC Articles 17-26. In the Mediterranean Sea,

Greece claims a territorial sea of 6 nautical miles, whereas Italy, France and Spain claim 12 nautical miles.

[50] COM(1999), 363 final, Brussels 14.07.1999

[51] *The Queen* v. *The Secretary of State for Trade and Industry ex parte Greenpeace Limited*, High Court of Justice Queen's Bench Division, 5th November 1999. Hereafter referred to as *Greenpeace II*.

[52] For the European Court of Justice cases see fn 65 *infra*

[53] See, *inter alia*, D.d'A. Laffoley, D.W. Connor, M.L. Tasker, & T. Bines, "Nationally important seascapes, habitats and species. A recommended approach to their conservation and protection", English Nature Research Report 392; D.d'A. Laffoley, J. Baxter, T. Bines, M. Bradley, D.W. Connor, M. Hill, M.L. Tasker, & M. Vincent, "An implementation framework for the conservation, protection and management of nationally important marine wildlife in the United Kingdom", English Nature Research Report 394.

[54] Press Release, United Kingdom, Department of the Environment, Transport and the Regions, October 24, 2001.

[55] Legend: Y indicates action by Member States;
? indicates that no information on Member State activity;
N indicates no action by Member States .

This Table is reproduced from data presented at the Expert workshop on the application of NATURA 2000 in the marine environment, Isle of Vilm, Germany, 27 June – 1 July, 2001. It should be noted, however, that Italy, France, Spain and Greece have not declared EEZ/EFZs in the Mediterranean Sea. For this reason Italy and Greece have been omitted from the Table.

[56]See, Report of the Expert workshop on the application of NATURA 2000 in the marine environment, Isle of Vilm, Germany, June 2001, especially pp. 16-17 for a list of the difficulties encountered in implementing NATURA 2000 in the marine area.

[57] The Directive and the implementation regulations in Ireland are reviewed by Y. Scannell *et al*., *The Habitats Directive in Ireland*, (Dublin, Centre for Environmental Law and Policy, Trinity College, 1999). See also S. Dillon, "The Mirage of EC Environmental Federalism in a Reluctant Member State Jurisdiction", *N.Y.U. Environmental Law Journal*, Vol. 8, pp. 1- 73 (for a critical assessment of the operation of the Habitats Directive in Ireland see especially pp. 59-68).

[58] Case C-67/99, *Commission of the European Communities* v. *Ireland*, September 11, 2001. See also enforcement proceedings taken against Germany and France for a similar infringement of Community law, Case C-71/99, *Commission of the European Communities* v. *Germany*, September 11, 2001; Case C-220/99, *Commission of the European Communities* v. *France*, September 11, 2001.

[59] EC Treaty Article 228

[60] European Communities (Natural Habitats) Regulations 1997, Regulation 2(2)

[61] See, Y. Scannell *et al*., *The Habitats Directive in Ireland*, p. 29, *op. cit*. fn 57.

[62] For a discussion of the geographical scope of EC Treaties and maritime jurisdiction as it pertains to the EC see, *inter alia*: R.R. Churchill, *EC Fisheries Law*, (Dordrecht, Martinus Nijhoff, 1986), pp. 56-72, especially 67-71; Churchill R.R., "EC Fisheries and an EZ- Easy!", (1992) 23 *Ocean Development and International Law*, pp. 143-16; D. Freestone, "Some institutional implications of the establishment of the exclusive economic zones by EC Member States", 23 *Ocean Development and International Law*, pp. 97-114; E.Franckx, "EC Maritime Zones: The Delimitation Aspect", 23 *Ocean Development and International Law*, pp. 239-258 .

[63] A point noted by Judge Kay, in the context of the application of the Habitats Directive to the United Kingdom continental shelf, in the *Greenpeace II* Case, *op. cit*., fn 51.

[64] Joined Cases 3,4 and 6/76, *Kramer* [1976] ECR 1279, paragraphs 11-14; Case 61/77, *Commission* v. *Ireland* [1978] ECR 417.

[65] See, *inter alia,* European Communities (Hydrocarons) Prospection, Exploration and Production Regulations SI No 77 of 1988. Directive 95/21/EC which concerns shipping and working conditions on ships and extends to offshore installations on or over the continental shelf of a Member State.

[66] It is not clear from the *Greenpeace II* case in the United Kingdom whether the scope of application of the Habitats Directive extends beyond 200 miles to areas of the continental shelf over which the United Kingdom claims sovereignty.

[67] LOSC Article 77(4), see discussion *supra.*

[68] The relevant EC Treaty provisions include, *inter alia*: Article 3(f), which provides a legal basis for the common fisheries policy; Article 6 which requires the integration of environmental concerns into community policies such as the common fisheries policy; Article 174 which requires the application of the precautionary principle and preventative measures in the Community's approach to the environment. An example of the secondary instruments include Council Regulation (EEC) No 3760/92

of 20 December 1992, OJ L 389, 31.12.1992, p. 1, Article 2 states the common fisheries policy shall take account of the impact of the policy on the marine ecosystem.

[69] There are however specific measures for conservation of coral in the Mediterranean Sea, see Council Regulation 1626/94, OJ L 171, 06.07.1994, pp. 1-6.

[70] See, R. Long, P. Curran , *Enforcing the Common Fisheries Policy*, (Oxford, Blackwell Science, 2000), Chapter 5.

[71] *Ibid.,* pp. 58-65

[72] As noted above a similar limitation exists in the establishment of MPAs under the OSPAR Convention. There is however limited scope for Ireland to adopt unilateral measures in the absence of Community measures provided they conform with EC law. Furthermore, Ireland may have exclusive competence in relation to adoption of measures to protect the "non-living" element of coral reefs under the LOSC continental shelf regime. See discussion *infra.*

[73] For a discussion of the operation of this system see, R. Long, P. Curran , *Enforcing the Common Fisheries Policy,* Chapter 11, *op. cit*. 70.

[74] COM(2001) 143 final, Brussels, 16.03.2001. The European Commission sets out proposals for action in "Communications" referred to as "COM" documents. The Commission also makes use of "Green Papers" in order to consult on future policy in specific areas and firm proposals are prepared as "White Papers". Communications, Green Papers and White Papers are not legally binding but are a helpful indicator of the European Commission's perspective on the future direction of the law and policy of the EC.

[75] COM(2001) 135 final, Brussels, 20.3.2001. The Green Paper pays particular attention to the environmental dimension of the policy and suggests that more should be done to integrate in a proactive manner the environmental dimension into policy making in the common fisheries policy.

[76] A copy of the Biodiversity Action Plan for fisheries is available at, europa.eu.int/comm/fisheries/faq/manage_en.htm#2. For an opinion on the operation of the plan in practise, see report of J. Rizo-Martin to the expert workshop at the International Academy for Nature Conservation on the Isle of Vilm, Germany, June 2001, *op cit*. fn 56, pp. 30-32. In EC Law, "Action Plans" or "Action Programmes" do not lay down mandatory legal rules but provide a framework for defining and implementing policy.

[77] Council Regulation No (EC) 1626/94 of 27 June 1994 laying down certain technical measures for the conservation of fishery resources in the Mediterranean, OJ L 171/1, 06.07.1994

[78] See, R. Long, P. Curran , *Enforcing the Common Fisheries Policy,* Chapter 10, , *op.cit.*, fn 70

[79] For a discussion recent developments in this fishery, see C. Hedley, "The 1998 Agreement on the International Dolphin Conservation Program: recent developments in the Tuna-Dolphin Controversy in the Eastern Pacific Ocean, (2001) 32 *Ocean Development and International law*, pp. 71-92.

[80]Member States are actively participating in the debate regarding the redirection of the policy. For example, in Ireland a National Strategy Review Group was established in 1998 with a view to developing a national strategy in the negotiations leading to a revised common fisheries policy. The Review Group published a report on fisheries management and nature conservation that endorses the Communication from the Commission on a Community Biodiversity Strategy. The report urges the Commission to implement a comprehensive action plan for fisheries management and nature Conservation, see, Report of National Strategy Review Group on the Common Fisheries Policy, July 2000 (copy with the authors). The report does not raise any issues pertaining to deep-water coral.

[81] See, *inter alia*, R.R. Churchill, *EC Fisheries Law*, pp. 87-110, *op. cit.*, fn 61; R. Long, P. Curran , *Enforcing the Common Fisheries Policy*, pp. 103-107, *op. cit.* fn 70.

[82] The European Court of Justice held in Case 804/79, *Commission* v. *United Kingdom,* [1981] ECR 1045 that national measures are permissible, in the absence of Community rules, in cases of need arising from the development of technical and biological facts. See also Case 86-87/84, *Criminal proceedings against I. Bout en Zonen BV* [1985] ECR 0941. National measures cannot discriminate against vessels flying the flag of other Member States on the basis of nationality as this is contrary to some fundamental provisions of the EC Treaty, including Articles 12, 39-42, 43-48, 49-55. National measures in the United Kingdom and Ireland to control the activities of vessels engaged in the phenomenon of "quota hopping" in the 1980s were found contrary to Community law, see R. Long, P. Curran , *Enforcing the Common Fisheries Policy*, Chapter 7, *op. cit.* fn 70.

[83] Council Regulation No 3760/92 of 20.12.1992, establishing a community system for fisheries and aquaculture, OJ L 389, 31.12.1992, article 1.

[84] This legislative competence is derived from the sovereign rights vested in the coastal state over the continental shelf by the LOSC, Article 77. The exercise of this competence is of course subject to the

rights and freedoms of other states under the LOSC such as the freedom of navigation, LOSC Article 78(2).

[85] The EC is currently formulating a comprehensive management scheme for deep-water species that is expected to come into force in 2003.

[86] Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (85/337/EEC), OJ L 175, 5.7.1985, p.40, as amended by Council Directive 97/11/EC of 3 March 1997, L 73, 14.3.1997, p.5. Transposed into Irish legislation by European Communities (Environmental Impact Assessment) Regulations, 1989, as amended by European Communities (Environmental Impact Assessment)(Amendment) Regulations, 1998

[87] LOSC Article 62(4), especially Article 62(4)k; Articles 73,

[88] This is over one million US dollars and is equivalent to 1.1 million Euro. The fine had two components, £100,000 penalty for the fishery offence and the catch and gear was valued at £700, 000.

[89] LOSC 73(3)

[90] There is provision in the Irish Consolidated Sea Fisheries Acts 1959 as amended for imprisonment in cases where a sea fisheries officer is obstructed or impeded from exercising their powers under section 233 of the Act.

[91]LOSC 92(1) and Geneva Convention on the High Seas Article 6(1)

[92] Council Regulation No 2847/93 of 12.10.1993 establishing a control system applicable to the common fisheries policy, OJ L 261, 20.10.1993, as amended by Council Regulation No 2846/98, OJ L 358, 31.12.1998. Title VIIIa of the latter regulation provides a legal basis in European law for the establishment of special inspection programmes and information exchanges between the enforcement authorities in the different Member States.

[93]European Communities (Natural Habitats) Regulations 1997, Regulation 39

[94] *Ibid,* Regulation 19

[95] See, Scannell Y. *et al*., *The Habitats Directive in Ireland,* pp. 136-138, *op. cit*. fn 57.

[96] See, *op. cit*. fn 1.

[97] The author presented a paper on recent developments in international and European law on marine protected areas, at a meeting of the Irish Branch of the International Law Association in Trinity College Dublin on May 1, 2003.

[98] World Summit for Sustainable Development Plan of Implementation, paragraph 31.

[99] United Nations General Assembly Resolution no A/57/L.48, 10 December, 2002.

100 Subsidiary Body on Scientific, Technical and Technological Advice. Recommendation VIII/3 section B.

[101] See, in particular, K. M. Gjerde, "Towards a Strategy for High Seas marine Protected Areas", Proceedings of the IUCN, WCPA and WWF Expert Workshop on High Seas Marine Protected Areas, 15-17 January 2003, Malaga, Spain. The Government of Australia hosted an international workshop on high seas biodiversity in Cairns, June 2003.

[102] Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy, OJ L 358/59, 31.12.2002.

[103] Article 1(2)(b)

[104] Article 2(1)

[105] Article 2(2)

CONCLUDING REMARKS OF 2002 WORKSHOP

Micheal Ó Cinneide,
Director, Marine Environment Division, Marine Institute, Galway.

This has been a very useful workshop. We had very relevant presentations from Tony Koslow and Robert Brock on the experiences in managing deepwater fisheries and seeking to conserve coral ecosystems in Australia and in the USA. The talks by Mark Mellett, Ronan Long and Ciaran O'Keeffe have given us a detailed insight into the Irish and EU regulatory and enforcement issues. In particular, the feedback from BIM and from the fishing industry representatives has been frank and constructive.

While no formal proposals have been accepted, we envisage that the next steps will be:

The Irish Coral Task Force will continue its work, with funding from the Marine Institute and other member agencies. We will seek to incorporate new scientific research, the seabed survey output, socio-economics and legal aspects into our discussions.

The Irish Coral Task Force will circulate a document based on today's workshop to industry and government. This will seek to provide a basis for informed discussion on the conservation challenge posed by deepwater coral reefs.

APPENDIX I WORKSHOP PARTICIPANTS

1) 2000 Workshop Participants

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