

**An atlas of fishing and some related activities in Ireland's territorial sea
and internal marine waters with observations concerning
their spatial planning.**

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necessarily reflect the positions or policies of the Marine Institute.**

Summary

This Atlas was initiated as part of Ireland's preparation for the Water Framework Directive (WFD) which, *inter alia*, required mapping the distribution of mobile fishing gears in coastal waters (inside 1 n mile outside the base lines). The Atlas subsequently expanded the geographical extent of the review out to 12 n miles. The history, descriptive terminology and extent of subdivisions of the territorial sea are provided.

The Atlas is a collection of 1,885 polygons showing the distribution of fishing and fishery-related activities, including aquaculture and mariculture within the Republic of Ireland's territorial sea and internal marine waters.

The Atlas demonstrates that the greatest range and intensity of fishing and related activities are undertaken in the internal waters of the State. Hook and line fishing emerged as the most widely used métier and a combined array of mobile gears, ranging from pelagic otter trawls to hydraulic dredges, took second place. The total area occupied by fishing and fishing-related activities was just under 125,000 km². The principal métier groupings within 12 n miles were: hook and line occupying 57,000 km² (45% of the total), mobile gears (towed enclosing nets and dredges) accounting for 27,530 km² (22%). Passive nets (static tangle and gill nets and the now defunct salmon drift nets) made up 18,000 km² (14%). Pots targeting crustaceans and molluscs occupied 13,250 km² (11%). Aquaculture and mariculture occupied 172 km², some 0.4% of the area within 12 n miles.

To supplement the polygons, a table of métier and species combinations in internal and territorial waters opposite each county with a long shoreline is supplied. The table includes fisheries whose existence is known but not their extent. The consequences for benthic community structure of the use of a particular métier, the purpose of the exercise for the WFD, are considered. "Community" refers to fish or invertebrate species assemblages.

Applications for the data are discussed in the context of a growing appreciation of the need to plan the use of inshore waters for fishery conservation and to accommodate a wide range of stakeholder interests and to embrace the ecosystem approach to maritime governance. Difficulties inherent in conserving fish species rather than biological communities are illustrated by reference to a case history.

Data presented in the document were sourced from the tacit knowledge of stakeholders. Planning jurisdiction in the Republic of Ireland is described with reference to inshore waters. Recent thinking by fishery commentators is reviewed.

Finally, current thinking on inshore spatial planning within the EU and particularly among our nearest neighbours is discussed and the possibility of implementing ICZM is briefly considered.

This document is presented as Version 1 of a continuing exercise. Governmental departmental arrangements and collected data refer to the period up to 2006. The Atlas should be periodically revised as more information becomes available.

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INTRODUCTION

Background to the Atlas

The Atlas was initially to be a preparatory exercise for the Water Framework Directive (WFD) (2000/60/EC), which is an ambitious blueprint for the protection of all waters, inland, transitional (estuarine) and coastal (marine, territorial – Article 1) by the year 2015 when they would achieve “good status”. Coastal waters are defined as those within 1 n mile seaward of the baseline (Article 2).

Coastal waters were to be included in the framework because “their equilibrium is strongly influenced by the quality of inland water flowing into them” (para 17). In Article 2 the terms chemical status and ecological status are identified as indicators of water quality. The association of water chemistry and pollution is straightforward; long term chronic levels of contamination can alter the fauna and flora of a water body. But other human activities can also bring about ecosystem changes and fishing activity is one of these.

The WFD requires a number of innovations to secure its objectives including administrative changes involving stakeholder participation and cross-border co-operation. One of the first technical objectives was to complete an analysis of pressures and impacts – a Risk Analysis - on waters by December 2004. Mobile gears (nets, particularly those using fixed beams and chains) are regarded as the fishing activities most likely to prevent a water body achieving good ecological status. Providing the spatial extent of any such activity is only a first step in assessing its impact. The intensity with which it is practised is likely to be crucial. However, such data are not yet available in UK waters (Cefas, 2004) which to date have been more closely monitored than Ireland’s waters.

Certain aquaculture activities are also likely to affect the environment. Expansion and intensification of aquaculture have revealed a broad spectrum of environmental problems associated with finfish and shellfish farming (deterioration of the quality of effluent water leading to eutrophication, smothering of the seabed with fish faeces and uneaten food, transfer of disease organisms, reduction of biodiversity and the introduction of exotic organisms) qualifying aquaculture as a potential polluter of the marine environment (European Environment Agency, 2003). It was appropriate to include the locations of licensed aquaculture sites which the Department of Marine, Communications and Natural resources (DCMNR), the government department responsible for fisheries matters at the time, supplied.

In 2003, the European Commission, in recognition of the need for a complementary approach to the WFD for the marine environment, adopted a *Thematic strategy on the protection and conservation of the marine environment* (European Commission, 2005). The objective of the strategy is to protect and restore Europe’s ocean and seas, to ensure that human activities are carried out in a sustainable manner and to achieve good environmental status for all EU marine waters by 2021. Combined implementation of the WFD and the marine strategy should ensure good water quality throughout the EU.

In June 2006, the European Commission adopted a green paper on future maritime policy; its purpose was to initiate debate on managing marine waters in a holistic manner within the EU (European Commission, 2006^a). The ambition was an integrated, inter-sectoral and multidisciplinary policy rather than a series of vertical and sectoral policies (European Commission, 2006^b). The green paper visualises the thematic strategy for the marine

environment as the centrepiece of future maritime policy and it introduces the concept of *ecosystem-based spatial planning*. Responding to the green paper, Ireland welcomed the EU's proposals for an integrated maritime policy and reiterated the need for it to incorporate the ecosystem approach. Ireland also expressed the need for marine spatial planning and support for the development of a European Atlas of the Seas (Ireland's response to EU maritime green paper).

The requirement to provide details of mobile fishing gear activity in the coastal zone as defined here was the stimulus to gather more comprehensive details of fishing gears in use around the coast of the Republic of Ireland; such a publication is not currently available. The extent of recent fishing activities (within the five years preceding 7 September 2006 approximately, although this is extended in some instances) is reported according to information received from a number of people who work as fishers, processors and scientific and technical staff with State agencies. Some of the information might be described as "tacit" in the sense defined by Michael Polanyi (Polanyi, 1967). It is likely that the majority of fishing activities have been identified, though possibly not represented to their full extent.

Some fisheries reported to us, such as local gill net fisheries for herring which had not been pursued for a number of recent years, have not been included.

The Atlas is, and would probably always remain, incomplete. We are aware of the existence of fisheries whose precise location has not been mapped, directed fisheries for green crab (*Carcinus maenas*) are a case in point. Information on draft net positions was sought but not provided and eventually it was decided to press ahead with such data as had been assembled. This Atlas is therefore version 1 of an effort which is likely to be revised and extended as more information becomes available. In this version legislation and government departmental arrangements are as in 2006. The variety and distribution of fishing gears is constantly altering, as are regulations and ecosystem changes as a result of human and climatic influence and the Atlas will have to be updated and reviewed continuously to reflect the dynamic nature of the marine environment and activities carried on in it.

Geographical definitions and fishing rights

Before the 1958 Geneva Convention, territorial waters had, since 1703, been defined as within 3 n miles of the coast. It was common in legislation which applied in Ireland, to specify geographical boundary limits, such as bays or lengths of coastline between headlands when referring to local regulations. According to these definitions, territorial waters were less extensive than defined by the 1958 Geneva Convention.

The 1958 Geneva Convention on the Territorial Sea and the Contiguous Zone provided that the normal baseline from which the width of national boundaries would be measured is the low-water line along the coast. Baselines however, should be straight and parallel to the coast and, in places where the coast is deeply indented, appropriate points, such as islands, might be joined to obtain the desired effect. Waters on the landward side of the baselines are part of the **internal (inland) waters** of the State. Waters from the baselines out to 12 n miles constitute the **territorial sea**. **Coastal waters** as defined in the WFD extend landwards from 1 n mile outside the baselines.

The definitions of the 1958 Geneva Convention formed part of the United Nations Convention on the Law of the Sea which Ireland signed up to in December 1982. Further

negotiation followed before it entered into force on 16 November 1994. One of the provisions was the establishment of an Exclusive Economic Zone (EEZ) out to 200 n miles.

The EU's Common Fisheries Policy applies to all waters within its EEZ except, by derogation, within 12 n miles, whose administration is left to the nation in question. Traditional access by other nations is permitted up to 6 n miles from the baselines. In Ireland's case this access is allowed to France, Belgium, Germany, UK and the Netherlands (Figure 1, Table 1) to fish certain species.

In 1964, Ireland, together with a number of other states which are members of the EU, became signatory to the "voisinage" convention (Fisheries Convention, 1964) which entered into force two years later. The convention in Ireland allowed reciprocal fishing rights to boats of certain dimensions (less than 75 feet (22.68 m)), registered in Northern Ireland, to fish inside 6 n miles outside the baseline in their neighbours' territorial sea.

The extent of territorial and internal waters in the Republic of Ireland

The area of the territorial sea under the Republic of Ireland's jurisdiction is 27,487 km².

The band from 6 to 12 n miles has an extent of 13,824 km².

The area of waters from the baseline to the 6 n mile limit is 13,662 km².

The area of the internal waters is 13,650 km².

The total area of the internal waters and the territorial sea of the Republic of Ireland is 41,137 km².

Table 1. Access and entitlements of other E.U. nations to the territorial sea between 6 and 12 nautical miles

Country	VIIIb	VIIj	VIIg	VIa
France	<i>Nephrops</i> , demersal	<i>Nephrops</i> , demersal, mackerel	all species	all species except shellfish
Netherlands			Mackerel, herring	
Germany			Mackerel, herring	
Belgium			Demersal	Demersal
U.K.			Demersal, herring, mackerel, <i>Nephrops</i> , Scallops	Demersal, herring, mackerel, <i>Nephrops</i> , Scallops

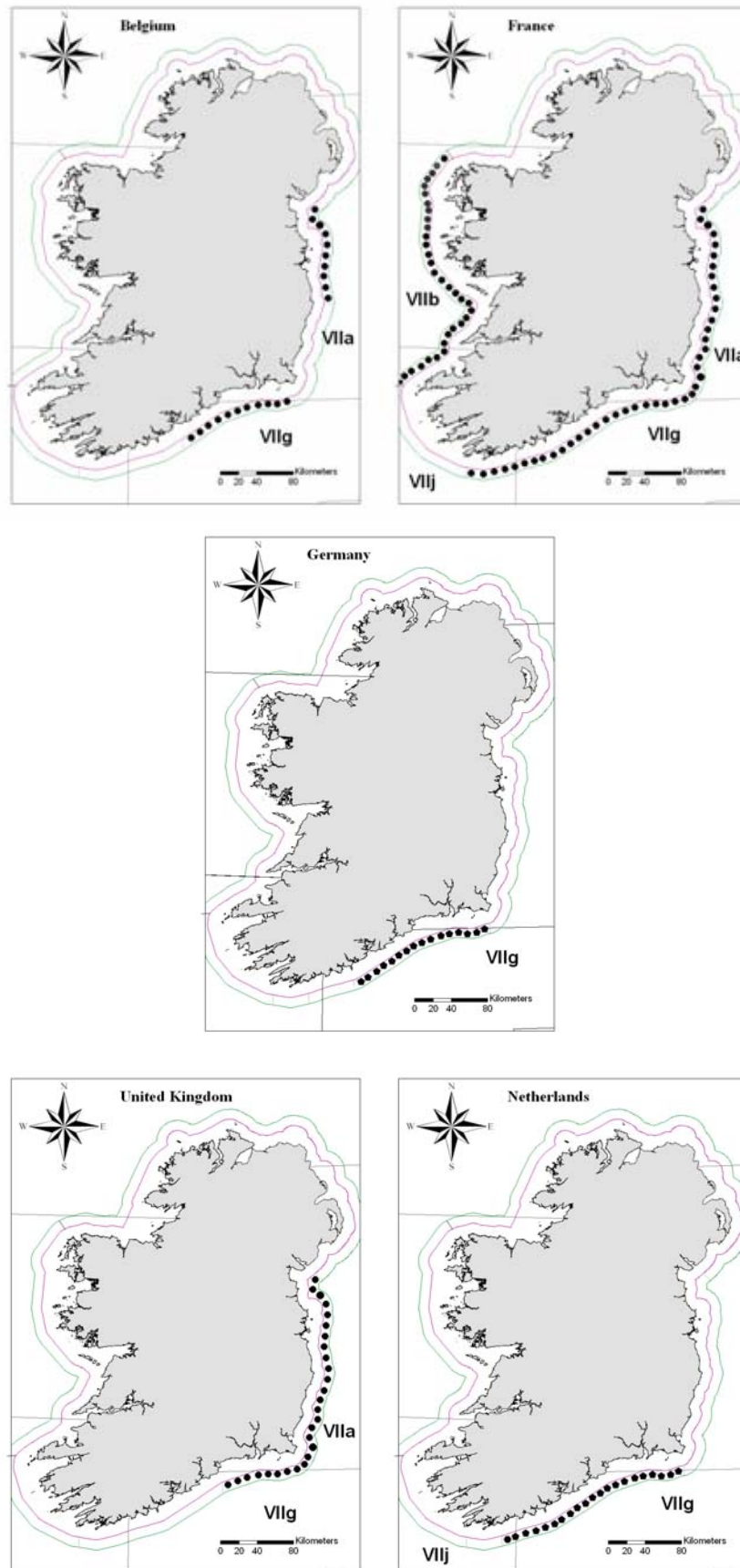


Figure 1. Traditional access by other nations to the Republic of Ireland's territorial waters.

THE ATLAS

Mapping fishing-associated activities within the territorial sea

Data were collected from a variety of sources on the current extent of inshore fishing and associated activities from fishers and individuals involved in marine fisheries research and management. Some data were gleaned from reports in the grey literature (e.g. Crummy, 2001). One of the CLAMS series of reports on fishing activities inside the baselines provided appropriate data on Lough Swilly (CLAMS, 2001).

The extent and location in which a métier¹ is used or in which any described activity takes place was approximately outlined by a shape file². The Atlas is composed of 1,885 polygons, component parts of a shape file. The total area of the territorial sea occupied by the métier is the sum of individual shape files; there may be overlap in the information provided by contributors which can conflate the area attributed to a métier. The percentage of territorial and internal waters occupied is therefore expressed as an index rather than a precise measurement. This is particularly well illustrated, for instance, in the case of charter boat angling where the geographical range of individual vessels is described as a circle of 15 n miles from its base port and adjacent circles overlap.

Table 2 is set out to facilitate the extraction of individual or combinations of shape files from the database. In the first column (left) (Area Usage) type of coverage provided by shape files is set out: the majority describe fishing activities, the largest category being provided by aquaculture/mariculture. In the second column the principal categories of fishing activity are listed and in the third gear types are described in more detail. Column 4 lists the principal target groups (for example, crustaceans) and Column 5 identifies target species (for example, shrimp). Individual métiers and species combinations are coded in the last column (Code).

The total area occupied by fishing and fishing-related activities was just under 125,000 km². The principal métier groupings within 12 n miles were: hook and line occupying 57,000 km² (45% of the total), mobile gears (towed enclosing nets and dredges) accounting for 27,530 km² (22%). Passive nets (static tangle and gill nets and the now defunct salmon drift nets) made up 18,000 km² (14%). Pots targeting crustaceans and molluscs occupied 13,250 km² (11%). These and other groupings will be examined in greater detail below.

The percentage of waters within 12 n miles occupied by these métiers is shown on Table 3.

Areas occupied by certain activities

Hook and line

To illustrate the spatial extent of hook and line fishing, the distribution of the legally compliant recreational charter angling fleet is shown in Figure 2. The range of each vessel is shown as a circle with a radius of 15 n miles from its base port. These vessels fished out of ports on all coasts with the exception of parts of the east. Leisure angling probably takes place in all parts of the territorial sea and internal waters. Some instances of commercial trolling for pollack (*Pollachius pollachius*) and other gadoids are shown. Hook and line fishing appears to be the most widespread gear in use inside 12 n miles (Table 3).

¹ The use of one fishing gear in a particular season in a particular area (Source: Ifremer)

² A shape file is the ArcView format for storing geometry and attribute information for a coverage.

Table 2. Shapefiles describing the extent and location of fishing and associated activities within 12 nautical miles, grouped under various headings for ease of extraction from the database.

Area usage		Method	Gear/Other grouping		Harvest activity	Specific Target	Code
Extraction	Dredge	Dredging	Aggregate	Aggregate	Aggregate	AGR	
Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Mussels	Mussels	Aqm	
Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Oysters	Oysters	Aqo	
Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Salmon	Salmon	Aqsa	
Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Escallops	Scallops	Aqsc	
Aquaculture/mariculture	Aquaculture/mariculture	Aquaculture/mariculture	Other species	Other species	Other species	Aqoi	
Fishing	Bottom set gill net	Static nets	Fish	Fish	Gadoids; Spurdog	BSG	
Fishing	Digging	Gathering	Clams species	Clams species	Clams species	D	
Fishing	Dredge	Dredging	Box dredge	Box dredge	Clams species	DB	
Fishing	Suction dredging	Dredging	Cockles (specific)	Cockles (specific)	Cockles (specific)	DC	
Fishing	Hydraulic dredging	Dredging	Clams species	Clams species	Clams species	DH	
Fishing	Dredge	Dredging	Mussels	Mussels	Adult harvest	DMh	
Fishing	Dredge	Dredging	Mussels	Mussels	Seed transplantation	DMs	
Fishing	Dredge	Dredging	Oyster	Oyster	Oysters	DO	
Fishing	Draft nets	Mobile nets	Salmon	Salmon	Salmon	DRAFT	
Fishing	Drift net	Passive nets	Herring	Herring	Herring	DRh	
Fishing	Drift net	Passive nets	Salmon	Salmon	Salmon	DRs	
Fishing	Dredge	Dredging	Escallops	Escallops	Scallops	DS	
Deposition	Dumping grounds					DUMP	
Fishing	Gathering	Gathering	Paracentrotus	Paracentrotus	Paracentrotus	GA	
Fishing	Gathering	Gathering	Periwinkles	Periwinkles	Periwinkles	GE	
Fishing	Line fishing	Hook and line	Charter angling	Charter angling	All finfish species	LA	
Fishing	Line fishing	Hook and line	Bluefin target areas	Bluefin target areas	Bluefin	LB	
Fishing	Line fishing	Hook and line	Jigging	Jigging	Fish of Molluscs	LJ	
Fishing	Line fishing	Hook and line	Jigging	Jigging	Pollack	LJp	
Fishing	Line fishing	Hook and line	Jigging	Jigging	Squid	LJs	
Fishing	Loop net	Mobile nets	Salmon	Salmon	Salmon	LN	

Fishing	Line fishing	Hook and line	Trolling	Gadoids	LT
Fishing	Trawl	Mobile nets	Bottom	Nephrops	OTBn
Fishing	Trawl	Mobile nets	Bottom	Whitefish	OTBw
Fishing	Trawl	Mobile nets	Midwater	Pelagics	OTP
Fishing	Pot	Crustacean pot	Green crab	Green crab	PG
Fishing	Pot	Crustacean pot	Large crustaceans	All crustacean species	PLC
Fishing	Pot	Crustacean pot	Large crustaceans	Brown crab	PLCb
Fishing	Pot	Crustacean pot	Large crustaceans	Crawfish	PLCc
Fishing	Pot	Crustacean pot	Large crustaceans	Lobster	PLCl
Fishing	Pot	Crustacean pot	Large crustaceans	Spider crab	PLCs
Fishing	Pot	Crustacean pot	Large crustaceans	Velvet crab	PLCv
Fishing	Pot	Crustacean pot	Nephrops	Nephrops	PN
Fishing	Pot	Crustacean pot	Shrimp	Shrimp	PS
Fishing	Pot	Crustacean pot	Velvet crab	Velvet crab	PV
Fishing	Pot	Mollusc pot	Whelk	Whelk	PW
Fishing	Rake	Gathering	Cockles	Cockles	R
Fishing	Trawl	Mobile nets	Beam	Fish or Molluscs	TB
Fishing	Tangle net	Static nets	Fish or crustaceans	Target not identified	TN
Fishing	Tangle net	Static nets	Crawfish	Crawfish	TNcaw
Fishing	Tangle net	Static nets	Crustaceans	Crustaceans	TNcus
Fishing	Tangle net	Static nets	Flatfish	Ray or turbot	TNf
Survey	Resource survey	Underwater television	Underwater television	Nephrops	UWT

Table 3. An index of the area of territorial and internal marine waters occupied by fishing and related activities. The larger groupings are in bold italics. The area of the territorial sea and internal marine waters combined is 41,137 km². Areas have been calculated as a combination of shapefiles and many of these overlap. The index is calculated as: (x/y)*100 where 'x' is the area occupied by a métier and 'y' is the combined area of internal and territorial waters

Activity	Area (Km ²)	An index of area occupied
All fishing-related activities mapped	125,000	303.9
Hook and line	57,000	138.6
Towed gears	27,530	66.9
Passive nets	18,000	43.8
OTB for Nephrops and whitefish	17,490	42.5
Pots targeting crustaceans and molluscs	13,250	32.2
Static nets	13,200	32.1
Beam trawling	7,080	17.2
Pelagic otter trawling	5,250	12.8
Drift nets for salmon	4,720	11.5
Tangle nets	2,402	5.8
King scallop dredging	2,356	5.7
Shrimp pots	1,335	3.2
Tangle nets for fish	248	0.6
Nephrops pot fisheries	205	0.5
Aquaculture	172	0.4
Tangle nets for crustacean species	163	0.4
Razor clam beds	148	0.4
Mussels	147	0.4
Tangle nets for crawfish	129	0.3
Oysters	119	0.3
Green crab	70	0.2
Mussel dredging for seed	64	0.2
Suction dredging for cockles	59	0.1
Box dredging for clams	17	0.0
Territorial Sea and internal waters	41,137	

Mobile gears

This grouping of gears is of particular interest to the WFD and it includes a variety of métiers which impact on the substratum in varying degrees. The impact of hydraulic dredging for razor clams is probably the most dramatic because the dredge blade penetrates the seabed to a depth of 30 cm. Exploited razor clam beds totalling 148 km² were mapped in the study (Figure 3). King scallop (*Pecten maximus*) dredges are equipped with tines to agitate the upper 5 cm of the sea bed. Within 12 n miles, 2,356 km² were fished in this way. Beam trawling for flat fish involves the use of tickler chains which also disturb the substratum and the area inside 12 n miles fished by this method was 7,080 km². Suction dredging for cockles (*Cerastoderma edule*), which can cause damage to discards of the target species, was recorded on 59 km² although this is believed to be a low estimate. Damage to mussel (*Mytilus edulis*) reefs is an inevitable consequence of seed mussel harvest for on-growing. Seed mussel harvesting was recorded on 64 km² and box dredging for clams on 17 km². Bottom otter trawling for *Nephrops* and whitefish were recorded on 17,490 km² (Figure 4). While it does not usually interact with the substratum, pelagic trawling takes place in very shallow

water and sprat (*Sprattus sprattus*) are frequently netted in small bays and close to headlands. The area attributed to pelagic otter trawling was 5,250 km². Draft netting for salmon (*Salmo salar*) takes place in estuarine waters; in the course of this work we obtained reports of it on 66 km² which we know to be an underestimate of the total area it occupies.

Passive nets

The first of the two categories of passive nets consist of those that are free to drift. In recent years this métier has been fished for salmon and its use has recently been discontinued. In providing a map of their principal occurrence, there will always be questions about where the illegal use of this fishing method took place. Drift nets for salmon were reported to occupy 4,720 km² (Figure 5).

Static (fixed) nets can be rigged in two principal ways. When the meshing is taut they operate by “gilling” the fish which is wedged in a single mesh; this gear is selective and is currently employed to target spurdog (*Squalus acanthias*) and gadoids. More loosely rigged, the meshing operates by “tangling” with the target which is restrained by several meshes. Tangle nets are used to capture large flat fish (turbot (*Scophthalmus rhombus*) and rays) and crustaceans, most notably crawfish (*Palinurus elephas*). In the course of this work we attempted to identify the target species, but that was done in a minority of cases only. In fact distinguishing between tangle and gill nets of similar mesh size requires more than casual examination. Static nets occupied 13,200 km² (Figure 6). Reported targets for the 2,402 km² of tangle nets were: crawfish on 129 km², crustaceans generally on 163 km² (these might have been crawfish and/or spider crab (*Maja brachydactyla*) and fin-fish on 248 km². Some reports on the extent of bottom set gill nets originated from the spurdog fishery of the late 1980s and early 1990s. The effort in those years has considerably diminished since and the fishery is likely to be less intense now than it was then.

Pot fisheries

Pots for a mixture of decapod crustacean species were set in an area of 8,920 km² (Figure 7). Approximately 730 km² had a single target species identified (224 km², brown crab (*Cancer pagurus*), 64 km², lobster (*Homarus gammarus*), 360 km², spider crab (*Maja brachydactyla*) and 85 km², velvet crab (*Necora puber*)) but the probability is a that this métier is used for a mixture of species in inshore waters. Shrimp pots (*Palaemon* species), which are of a different design, occupied a narrow coastal band in an area of 1,335 km², while a small pot fishery for *Nephrops* occurred in 710 km². The largest of these pot fisheries was in the Irish Sea in the 1960s and 1970s and it has since been replaced by a trawl fishery. Five pot fisheries for *Nephrops* occurred along the western seaboard, inside the base lines. They ranged in size from 9 to 115 km² and averaged 41 km² (Figure 8a). Five green crab pot fisheries were identified although more are known to exist. They ranged in size from 1 to 61 km² and averaged 14 km² (Figure 8b).

Fisheries for whelk *Buccinum undatum* occupied approximately 2,000 km², 1,800 km² of which is in the south west Irish Sea (Figure 9a). The distribution of the south west Irish Sea whelk fishery and the dredge fishery for seed mussel are shown on Fig 9b.

Mariculture and Aquaculture

The total area occupied by mariculture and aquaculture included designated areas which might or might not have been occupied in 2005 when the data were made available by DCMNR totalled 172 km² (Table 4). Individual sites are small and they are numerous where the coast is indented but they are not visible on the national map size used here. Instead a small length of coastline, at Corraun in Co Mayo is shown to demonstrate the high density

and small areas of these designations (Figure 10). Mussels were the most extensively cultured species, although they were also harvested from wild fisheries located in areas which had not been designated for mariculture. In all, mussels were estimated to have occupied 147 km², a figure which includes 64 km² from which seed mussels for relaying had been collected, approximately over the previous decade.

The area occupied by harvested oyster beds measured 119 km². Areas designated for scallops accounted for 13 km² but the wild scallop fisheries were considerably larger and in south east Ireland, commercial exploitation of the species has been extending in recent years (Tully *et al.*, 2006). Wild scallop fisheries are approximately 180 times more extensive than areas in which the species is being cultured.

Finally, Table 5 lists combinations of métier and species, not all of which have been mapped, which occur in the territorial sea and internal waters of counties with long shore lines.

Table 4. Estimated areas occupied by fisheries or culture areas for certain species.

	Area devoted to managed culture (km ²)	Total area over which these species are harvested (km ²)
Mussels	71	147
Oysters	58	119
Salmon	13	4,786
Scallops	13	2,369
Other species	17	
Total	172	

Gathering

As used here, the term gathering embraces a number of activities, carried out on the coast, in which specialised gear is not necessarily used for the collection of marine organisms. Raking of cockles, which does not require the use of a boat, digging of clams (various *Tapes* and *Venus* species), the collection of periwinkles (*Littorina littorea*) from the shore or of sea urchins (*Paracentrotus lividus*) from rock pools are included. It is a category which is not well documented in this exercise and only 38 km² have been associated with these activities. One of several problems was to determine how wide a band of shoreline should be included when mapping was undertaken. More detailed information will be required to accurately report this category.

Some consequences of métier use for community structure.

The initial purpose of the WFD survey of fishing gears in inshore waters was to identify areas in which the biological community might be altered by fishing activities. The methodology for this was set out in Cefas (2004) which was based on the work of Collie *et al.*, (2000). Collie *et al.* carried out a meta-analysis of 39 published fishing impact studies which attempted to generalize the consequences arising from the use of certain types of gear on shelf invertebrate communities. They concluded that inter-tidal dredging and scallop dredging had the greatest initial effects on benthic biota while bottom trawling was less influential. They also recognized that fauna in stable gravel, mud and biogenic habitats are more vulnerable than fauna in less consolidated coarse sediments. Fishing methods which penetrate the substratum are likely to be more injurious to the benthic community and hydraulic dredging which can penetrate to 30 cm or scallop dredging which involves the use of dredges bearing tines to agitate the upper 5 cm of the sea bed are more damaging than, for example, a *Nephrops* trawl passing over the substratum which leaves less physical trace.

Table 5. Métier and target species combinations inside 12 nautical miles alongside counties with long marine coastlines. Not all have been included in the Atlas. Codes are explained in Table 2.

Code	Donegal	Sligo	Mayo	Galway	Clare	Kerry	Cork	Waterford	Wexford	Wicklow	Dublin	Meath	Louth
BSG	•	•	•	•	•	•	•	•	•	•			•
D				•		•	•						
DB	•			•				•					
DC					•			•					•
DH			•	•	•						•	•	•
DMh	•					•		•	•				•
DMs						•			•	•			•
DO				•		•							
DRAFT	•		•	•				•				•	
DRh						•			•				
DRs	•	•	•	•	•	•	•	•					
DS	•		•	•	•	•	•	•	•	•	•		
DUMP									•				
GA			•				•						
GE	•						•	•	•		•		•
LA	•	•	•	•	•	•	•	•	•		•	•	•
LB	•												
LJ	•												
LJp			•	•									
LJs					•								
LT	•												
OTBn	•	•	•	•	•	•	•	•			•	•	•
OTBw	•	•	•	•	•	•	•	•	•	•			
OTP	•		•			•	•	•	•		•		
PG	•					•	•	•		•			•
PLC	•	•	•	•	•	•	•	•	•	•	•		•
PLCb	•	•	•	•	•	•	•	•	•				
PLCc							•						
PLCI	•	•	•	•	•	•	•	•	•	•	•		•
PLCs		•	•	•		•			•				
PLCv	•					•					•		•
PN	•		•				•						
PS	•		•	•	•	•	•	•			•		•
PV	•										•		
PW	•								•	•	•		
R	•							•					•
TB									•				
TN			•	•		•	•	•	•				
TNcaw	•					•	•						
TNcus			•										
TNf	•					•	•	•					

However, Collie *et al.* also considered the frequency with which a fished area is revisited. It is possible to calculate the period required for recovery of a benthic community, depending on the species concerned. Collie *et al.* estimated that in the case of an area being fished eight times a year, the period of recovery would not be sufficient for the benthic community to restore itself and the end effect would be “a resident community that is not representative of the fauna that originally occurred in the area”.

Using Collie *et al.*, Cefas (2004) devised their own table in which the impact on the benthic invertebrate community in territorial and coastal waters and on the fish community in territorial waters were considered. The Table is presented in modified form (Table 6). In addition to the benthic invertebrate community, their work measured consequences for fish community structure.

Table 6. Likely impact of various gear types on invertebrate and fish communities in territorial (TW) and coastal (CW) waters (modified from Collie *et al.*, 2000).

Gear grouping	Metier	Impact on benthic invertebrate quality elements in TW and CW*	Impact on fish quality elements in TW
Static gear	Pots	Minimal	None
Static gear	Nets	Minimal	Potential
Passive gear	Hook and line	None	Minimal
Mobile gear	Pelagic trawl	None	Potential
Mobile gear	Nephrops trawl	Minimal	Minimal
Mobile gear	Shellfish dredge	Potential	Minimal
Mobile gear	Otter trawl	Potential	Potential
Mobile gear	Beam trawl	Potential	Potential

*Scale, none -> minimal -> potential.

APPLICATIONS FOR THE DATA

The greatest variety of fish harvesting, gathering and organism culture methods are practised closest to shore. The Atlas demonstrates that the greatest range and intensity of fishing and related activities are undertaken in the internal waters of the State. These waters have species and fisheries peculiar to them and they are spawning and nursery areas supporting commercial and fodder fishes and invertebrates. Currently, harvesting by non-selective methods of fishing are permitted and practised very close to land. Some of the largest 10% of the fishing fleet harvest within the 6 n mile zone and sizeable pelagic vessels work very close to headlands, inside the baselines, in their pursuit of sprat. There are historical precedents for adopting a more rigorous regulation of fishing activities in these sensitive areas.

Regulations for inshore waters have, typically, been dealt with under various enactments since 1842 in order to solve local problems of fisheries administration and conservation which could not be dealt with under parliamentary statute. Until recently they were formulated under the 1959 Fisheries (Consolidation) Act which had been amended by subsequent legislation to accommodate them. This function of the 1959 Act is now provided by section 15 of the Sea-Fisheries and Maritime Jurisdiction Act (2006).

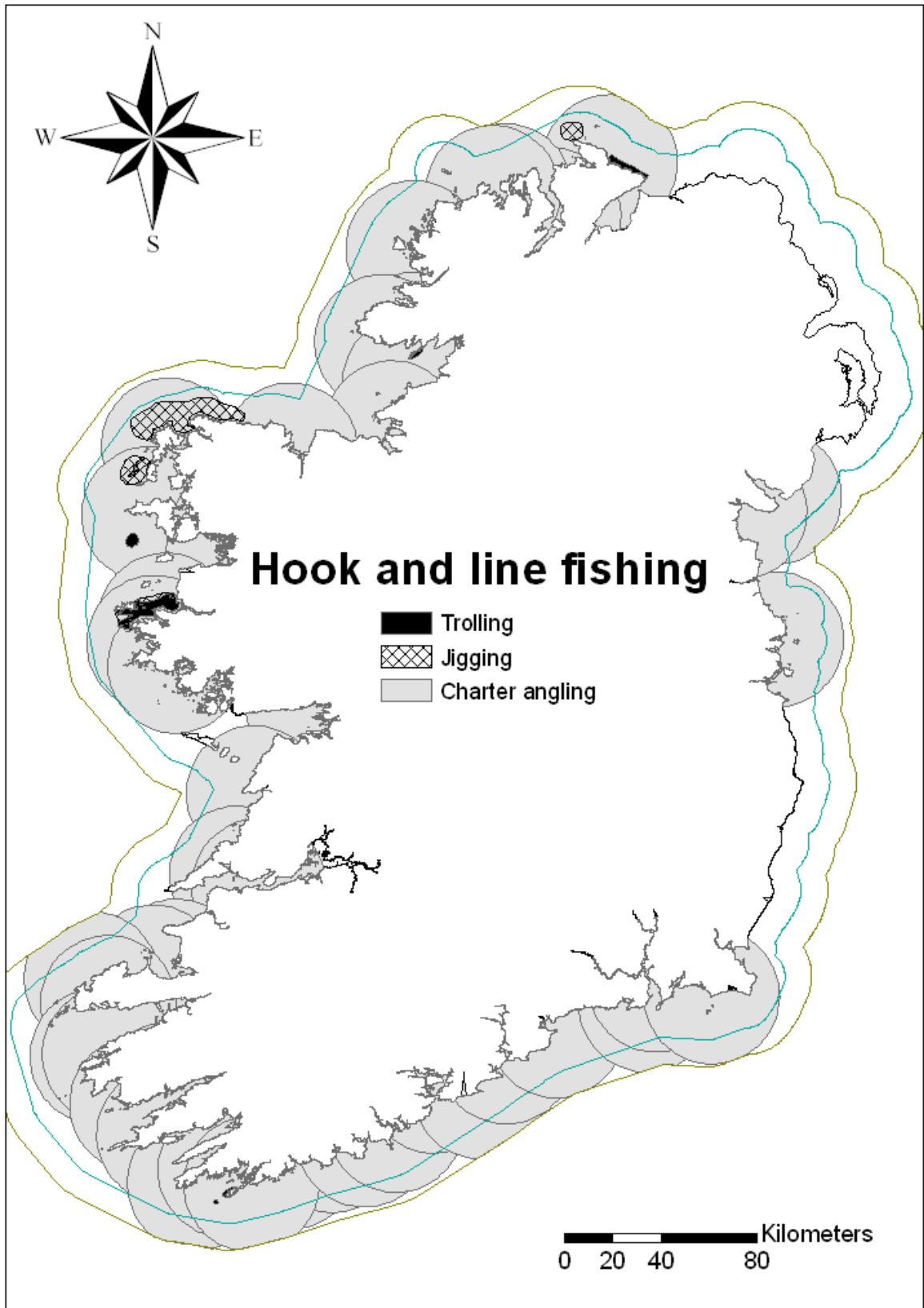


Figure 2. Hook and line fishing,

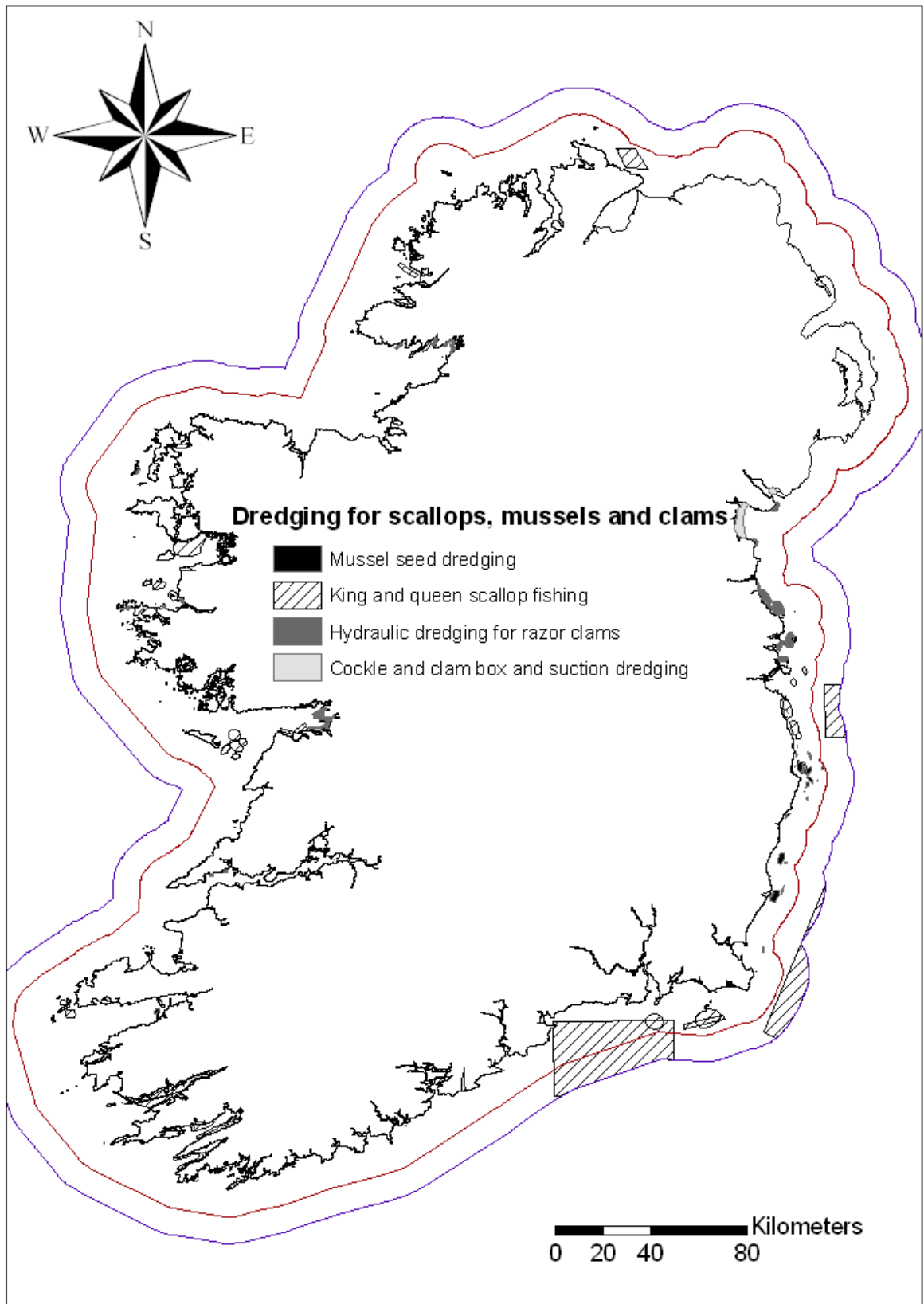


Figure 3. Dredging for various species.

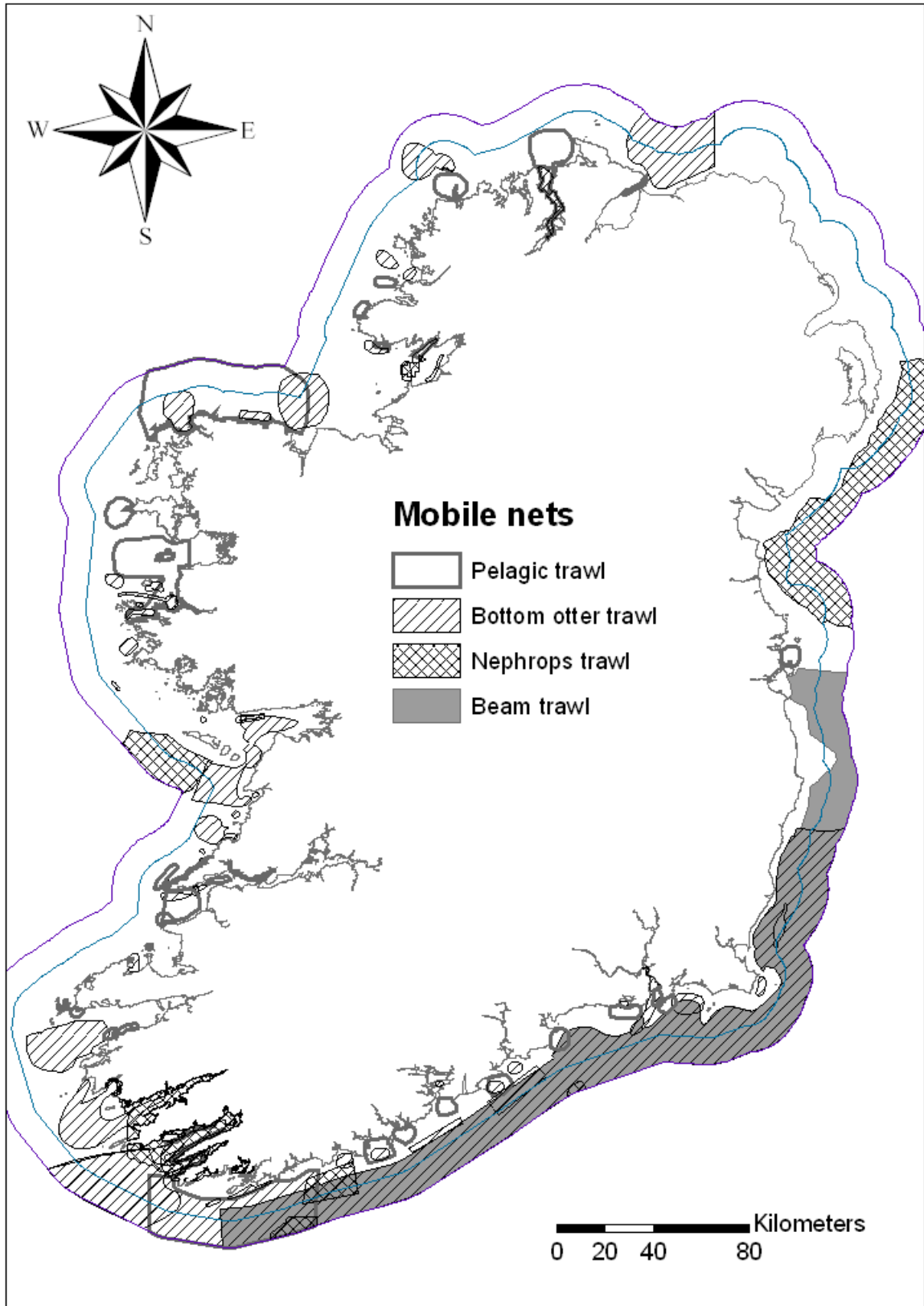


Figure 4. The use of Mobile Nets. Underwater surveys confirmed the distribution of *Nephrops* in Co Kerry and in the northwest Irish Sea. Trawling takes place over both distributions.

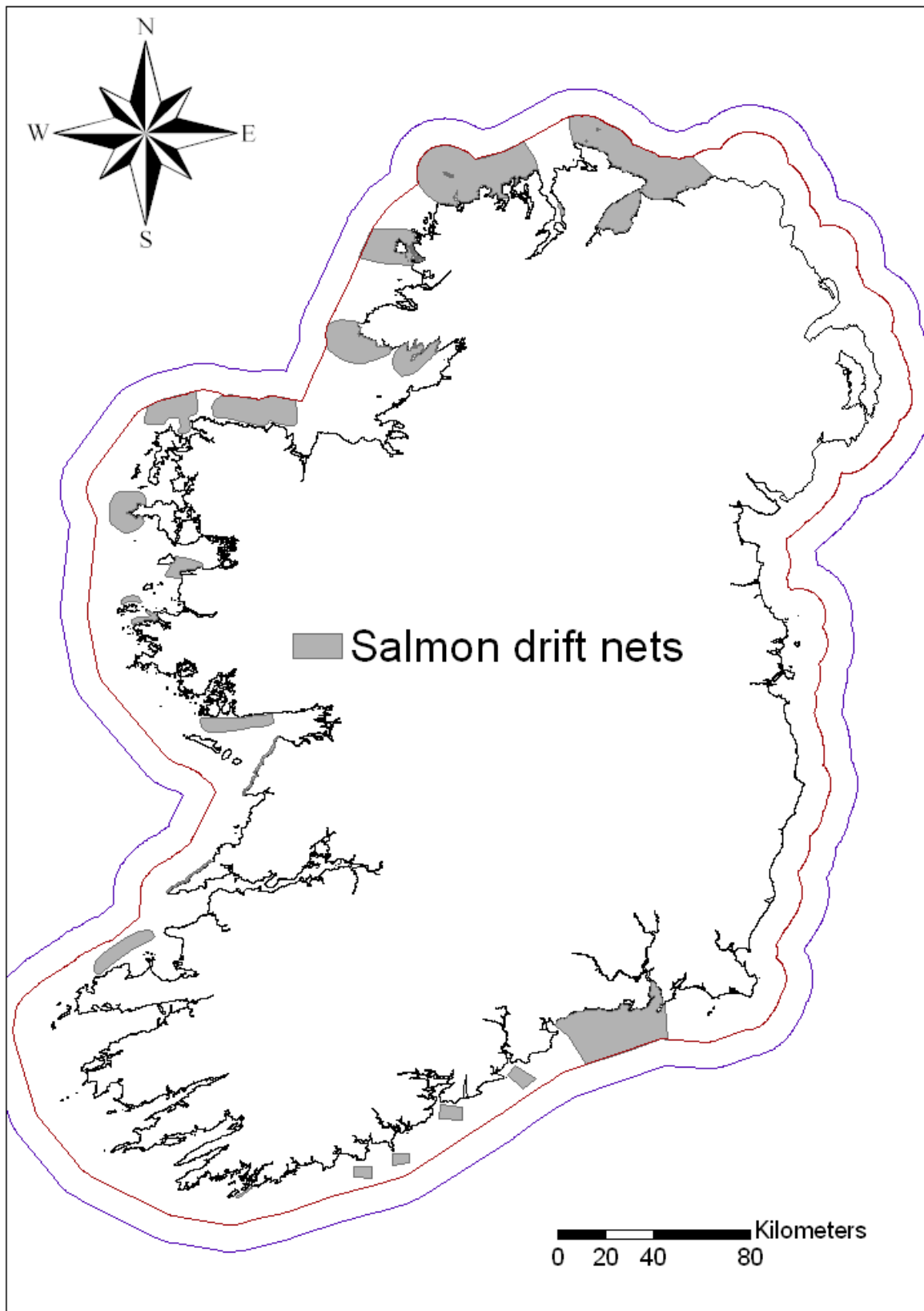


Figure 5. Salmon Drift Nets, the now defunct fishery.

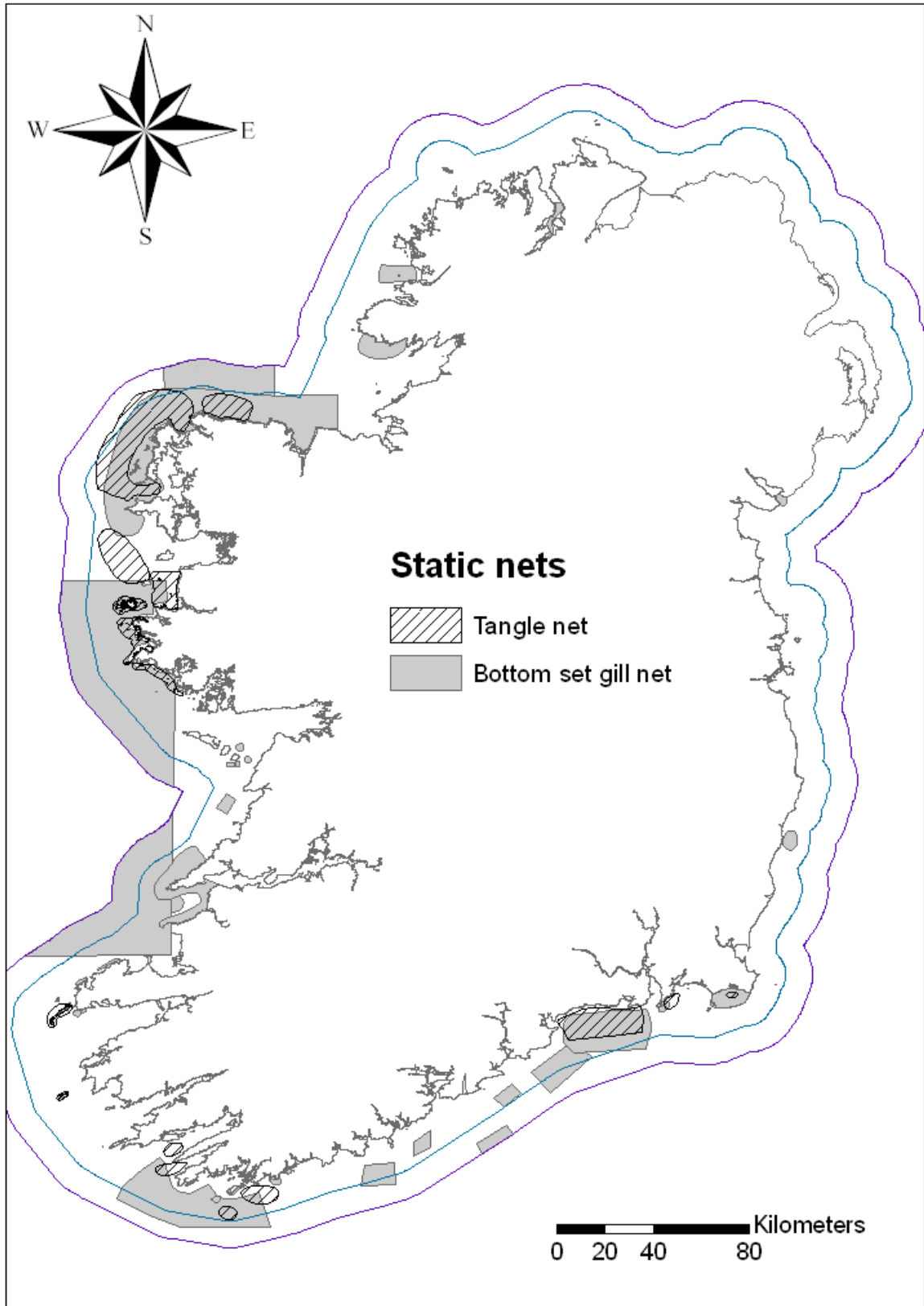


Figure 6. The location of static nets.

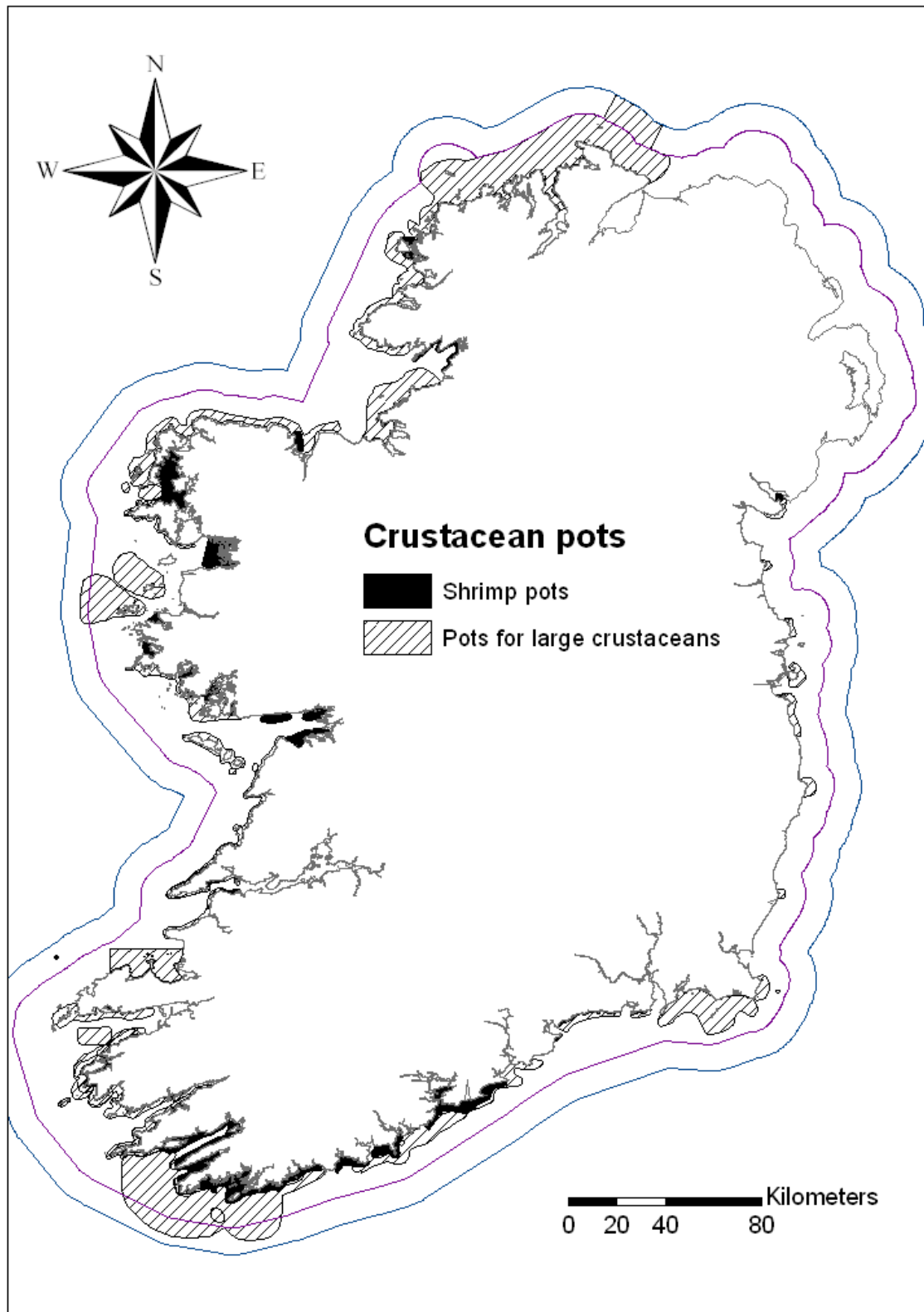


Figure 7. The distribution of crustacean pot fisheries.

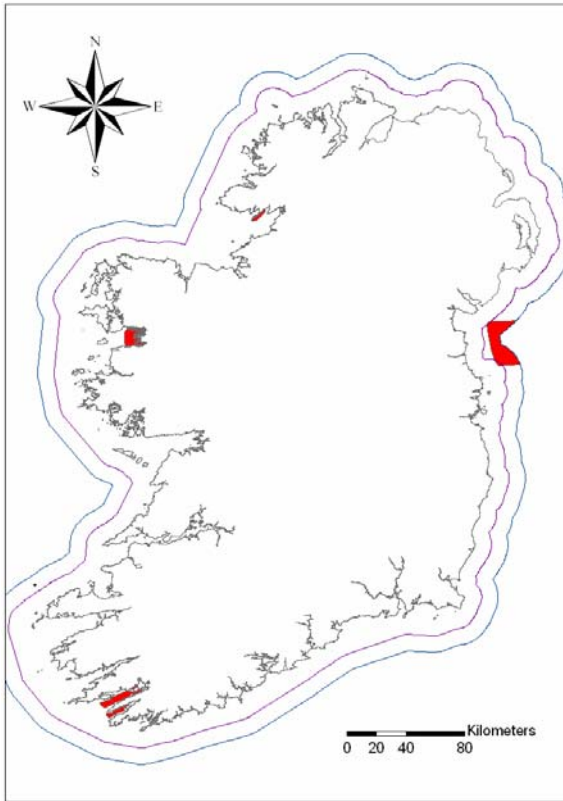


Figure 8a. Nephrops pot fisheries.

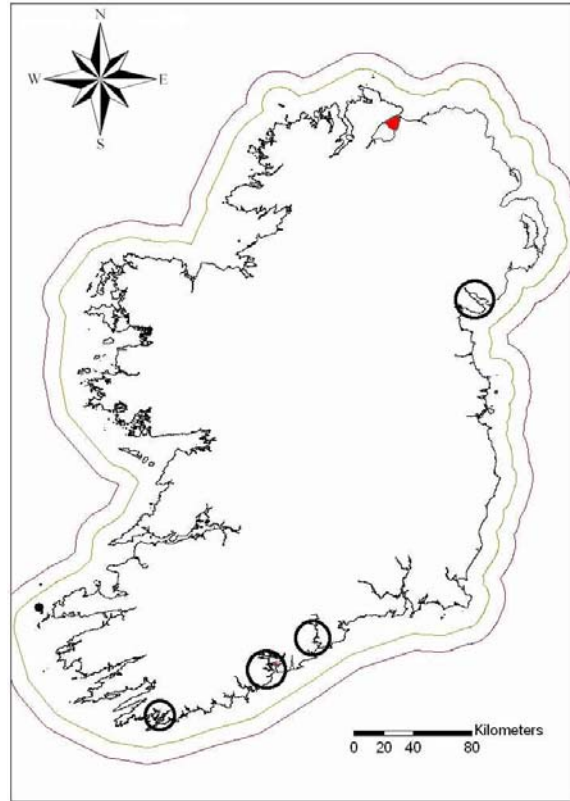


Figure 8b. Green crab pot fisheries.

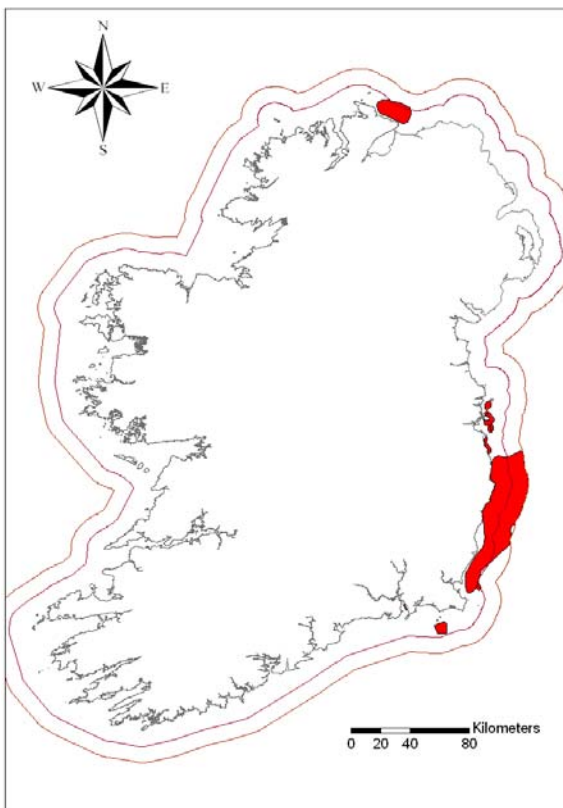


Figure 9a. Whelk pot fisheries.

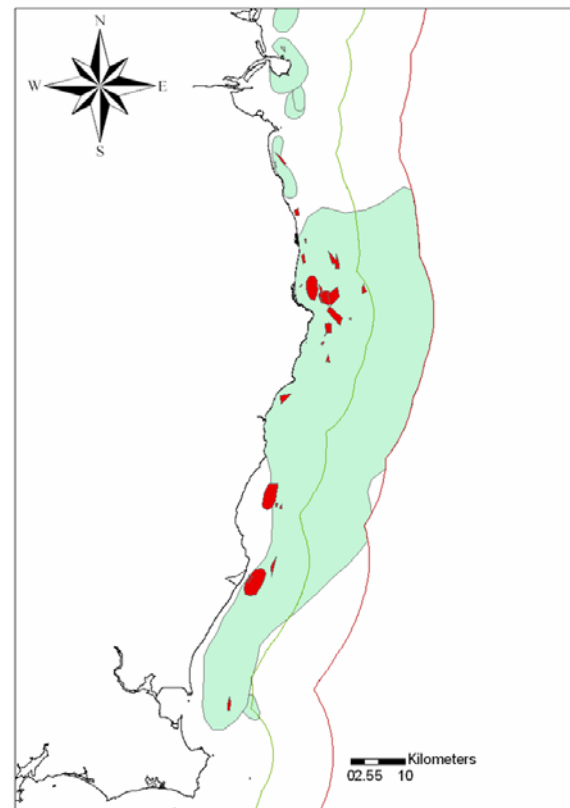


Figure 9b. Whelk fishery (green) and dredged seed mussel patches (red) in the south west Irish Sea.

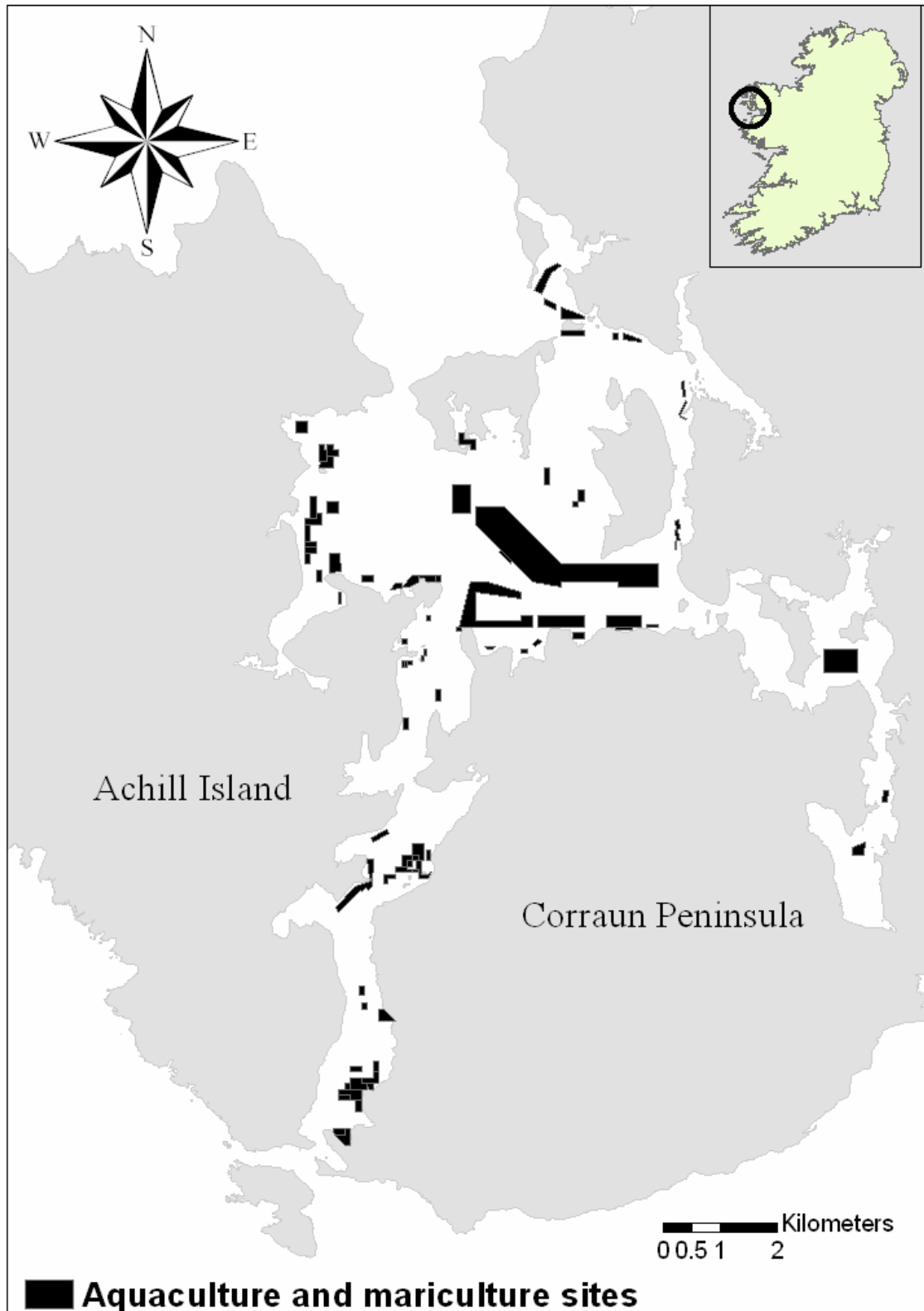


Figure 10. An example of the small and numerous nature of aquaculture and mariculture sites (black rectangular sites) along an indented coastline. The area selected in the Corraun Peninsula where it adjoins Achill Island, Co. Mayo. (Location inset).

Trends in inshore fisheries regulation in the Republic of Ireland: from the precautionary to the specific

In 1976, a review of fisheries bye-laws was undertaken by Went (1978). It was, in Went's own words, an incomplete exercise because he did not consider the Foyle Fisheries Commission which is administratively separate from the State. Nor did he consider bye-laws which had been revoked. The first group of bye-laws Went reviewed related to steam trawling. They had come into existence at the end of the nineteenth century. He did not know their full background, but supposed they were to conserve inshore fisheries and to restrict inshore grounds to smaller boats. The distribution of these regulations is indicated in Figure 11. In 1976, when the review was carried out, steam trawling had ceased to exist so the bye-laws referring to it were inoperative. However, Went felt that they might be resurrected to regulate motor-trawling to secure the same objectives. He also referred to excluding vessels of a certain size from inshore grounds by specifically licensing them in those terms. In the meantime many fishery practices have become commonplace very close to shore, but the evolution of WFD, the requirements of the Habitats (1992) and Birds (1979) Directives, the Marine Thematic Strategy (European Commission, 2005), the Green Paper on a Maritime Policy for Europe (European Commission, 2006^b) and the draft Marine Strategy Directive (European Commission 2006^a; European Parliament reports) taken in association with the current status of inshore fishing generally must prompt a major re-think on whether there should be an initiative here, similar to that in the UK (see Spatial planning in the wider EU context, below).

There are two broad approaches to conservation and the sustainable development of living resources. One approach is the protection of a habitat whose status would, under those circumstances, improve conditions for all fauna and flora within it. This concept is central to the creation of Marine Protected Areas (MPA) or Marine Conservation Zones (MCZ). An alternative approach must be adopted for wide ranging species like cetaceans, to offer protection by designing measures to protect the species whether it occurs within the borders of MPS or MCZ or not. However, while such methods are appropriate to large, spectacular mammal species, they have limitations for smaller ones as the following case history shows.

Difficulties associated with planning for sustainable biological conservation on a small scale: the case of the Dingle, Co. Kerry, flatfish fishery

In his review of "all trawling" Went (1978) considered a number of bye-laws some of which dated from 1857, but which were still relevant to motor trawling (Figure 12). The majority of those he recommended revoking. Went interpreted these regulations as having been enacted to promote "good order among the people engaged in fisheries". In the meantime the activity they were intended to protect had been discontinued, hence the need for the bye-laws also ceased. In one case however, Bye-law No 12 dated 23 August 1860, the regulation prohibited all trawling in Brandon Bay, Co. Kerry. Went referred to the bye-law as being

..made at a time when trawling was thought to be harmful to fish stocks, particularly in small bays, which were then regarded as recruitment or nursery areas.

Went apparently did not share the now more common view that trawling could be injurious to juvenile fish stocks. He recommended Bye-law No 12 be revoked.

In 1988, development work commenced on the enlargement of Dingle Harbour. The port was revitalised and the local fleet expanded. In 1999, it was estimated that 200 people worked in the catching sector in Dingle and each of these supported six jobs onshore. Twenty years after Went's review was published, inshore trawler fishers in Co. Kerry experienced a considerable depletion of high value flat fish species. (Mark Norman, pers. comm.).

In 1999 Colm Lordan (pers. comm.) reviewed the status of flatfish fisheries in the vicinity: relevant TACs cover the western Celtic Sea, divisions VIIIh, j and k. During the 1990s Ireland reported plaice landings of 340-500 t, sole landings of 100-300 t and turbot landings of 30-60 t from the western Celtic Sea. In fact, most flatfish landings were sourced in division VIIj and the flatfish fishery was localised and inshore rather than evenly distributed throughout the TAC area. Landings were made by smaller vessels rather than large beam trawlers as happened in the Irish Sea, so Ireland benefited to a greater extent in Co. Kerry because a larger proportion of the TAC was harvested by Irish boats (78% of plaice and 67% of sole in 1997). The combined value of sole, lemon sole, plaice, turbot and brill landings to Dingle in 1996 exceeded £1m (€1.27 m).

An expanding fleet and apparently declining resource prompted proposals to increase the yield or promote the recovery of depleted or collapsed fish stocks. Sometime between 1997 and 1998 a scheme to restore flatfish stocks to earlier levels of productivity began to take shape. Various elements of a whitefish enhancement programme were considered. These included hatchery rearing juveniles and closing bays to trawling and gill netting. Four bays were selected, Smerwick Harbour, Ventry Harbour, Dingle Bay and Brandon Bay (to which Bye-law no 12 had applied).

Enhancement of the kind envisaged requires support from commercial fishers, thus enabling legislation and enforcement to operate effectively. In order to ensure investment is effective, bench marks against which progress can be measured must be identified. Since 1999, a series of beam trawl and beach seine surveys have been undertaken to establish population densities of key flatfish species. Plans to introduce hatchery reared flatfish were put into effect on a very small scale. Activities such as these are expensive. Lordan in 2001 observed that there was a need to rigorously assess the objectives of proposals in terms of the ecological potential for success and the economic costs of putting an enhancement programme of the kind envisaged into operation. He went on to pose a number of reasonable and fundamental, but probably unanswerable questions: Was the population size depleted to below the carrying capacity of the target area? Was natural recruitment reduced or insufficient to return the population to earlier carrying capacity? In addition there were a number of other imponderables. Would stocking adversely affect other species or the environment? What risks did it bring? Would it introduce disease? Would it dilute the genetic integrity of the existing stock? There was also a series of questions about how best hatchery-generated stock should be handled, and when released, how to produce the best returns and what level of restocking would be desirable or effective.

These and other questions have preoccupied scientists wholly engaged on research on single species enhancement over a long period. When the species in question is charismatic, plentiful and nationally or internationally valuable, such as striped bass (*Morone saxatilis*) or Atlantic salmon (*Salmo salar*), the effort can be justified. Indeed the consequence of not taking remedial measures would cause serious disquiet, but where a number of a locally valuable but smaller and less spectacular species are concerned there must be serious questions about the economic return from targeted enhancement because it is impossible to quantify its success or failure. When the species is just one of several and the number of biological and environmental factors and factor combinations which might influence any outcome is unlimited, a strategy of enhancement is open to doubt. When any such scheme is predicated on a voluntary and therefore unenforceable agreement of fishers not to trawl likely nursery areas, it becomes impossible to evaluate. There is a strong case for precautionary closure of inshore bays, restoring the *status quo* of the late nineteenth century and re-introducing the rationale of that time which, in recent years, has been widely accepted as the way ahead.

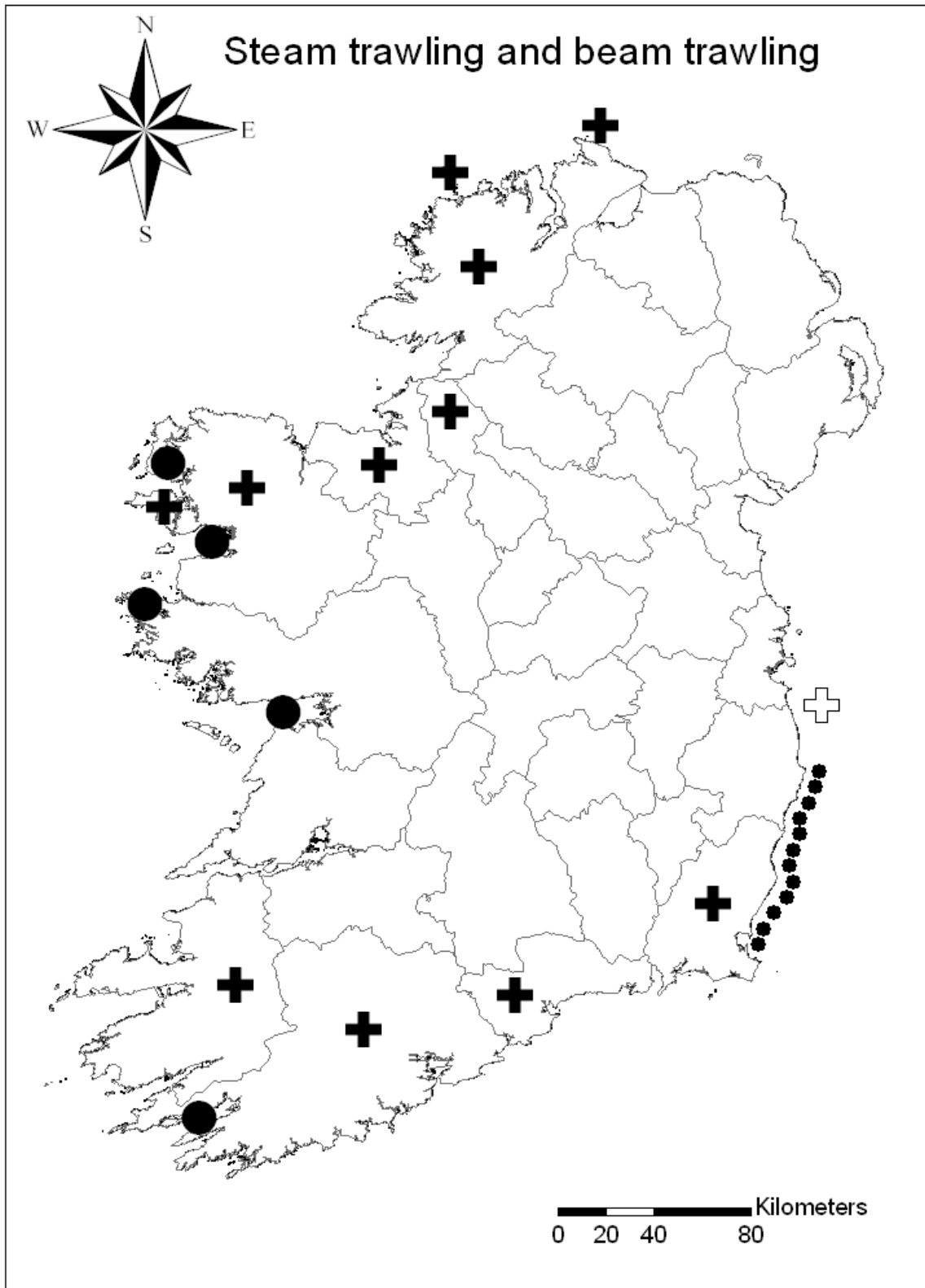


Figure 11. Summary of steam and beam trawling regulations enacted between 1897 and 1917 which controlled these methods of fishing in inshore waters: solid crosses indicate counties whose inshore waters were to some degree protected; large solid dots indicate bays in which the practice of steam trawling was curtailed. The open Cross indicates the shore line in its vicinity had been regulated and the small solid dots indicate that beam trawling was prohibited along the adjacent coast. The Bays, working clockwise, are: Bantry Bay, Galway Bay, Ballynakill Bay, Clew Bay and Blacksod Bay.

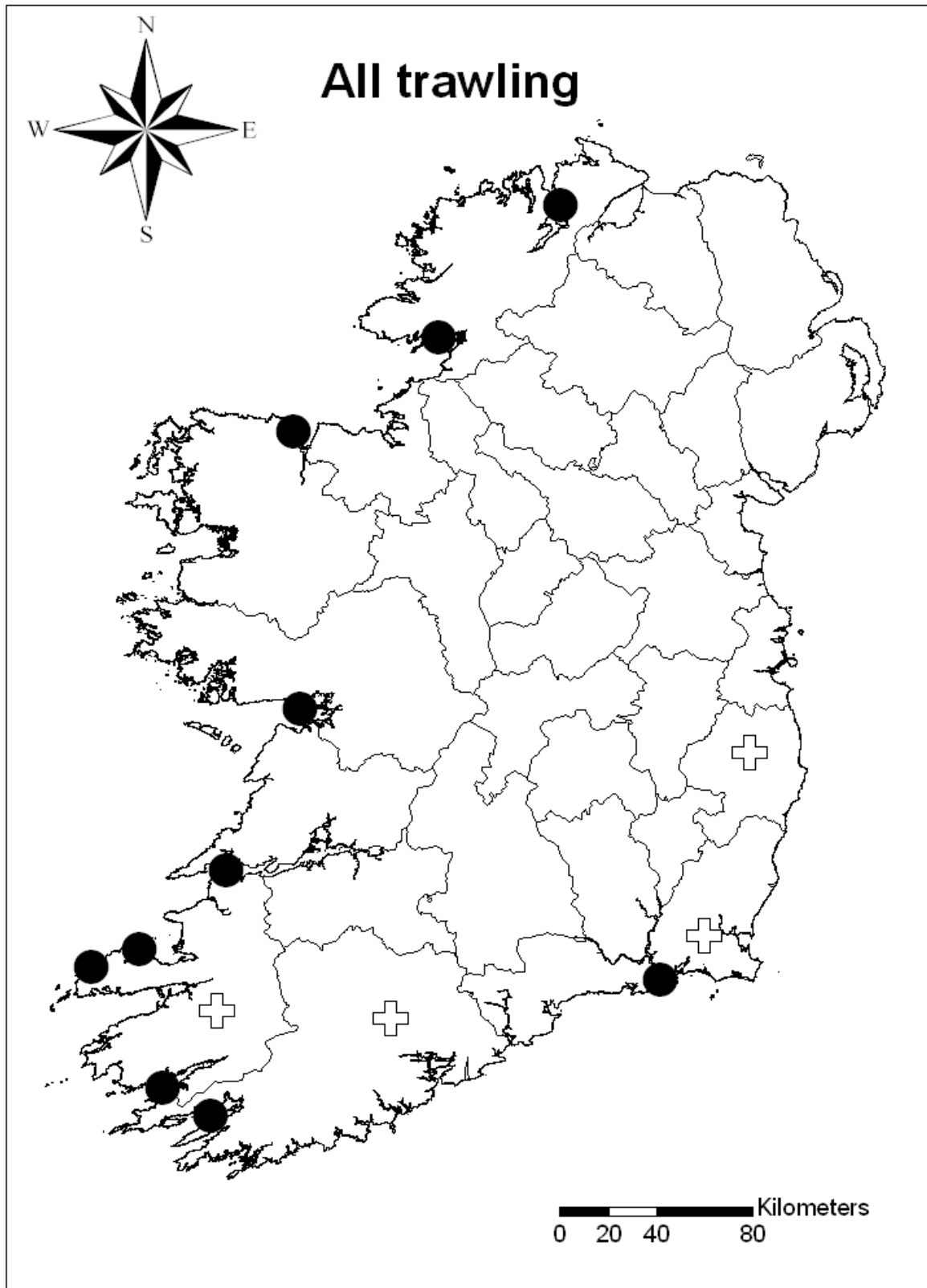


Figure 12. Regulations enacted between 1857 and 1944 on the curtailment of all trawling in coastal waters: large solid dots identify bays in which such regulations existed and open crosses the counties which had regulations for their coastal waters. The bays, working clockwise, are: Waterford Harbour, Bantry Bay, Kenmare River, Smerwick Harbour, Brandon Bay, Mouth of the Shannon, Galway Bay, Killala Bay, Donegal Bay and Lough Swilly.

Planning jurisdiction in the Republic of Ireland

The “foreshore” is defined in the Foreshore Act, 1933 as:

The bed and shore, below the line of high water of ordinary or medium tides, of the sea and of every tidal river and tidal estuary and of every channel, creek and bay of any such river or estuary.

The power to grant licences and leases of the foreshore is, in 2006, vested in the Minister for Communications, Marine and Natural Resources.

The Maritime Safety Act, 2005, sets, for the first time, an outer limit to the foreshore and amended the Foreshore Act, 1933, to the effect that the foreshore

shall be deemed always to have been and to be, coterminous with the seaward limit of the territorial seas [that is to 12 n miles beyond the baselines]

Terrestrial planning in Ireland is, for the most part, the responsibility of the local authority but, although the Planning and Development Acts 1963-2002 apply to coastal land covered by water, the Foreshore Acts 1933 – 2003 effectively control planning on the foreshore (O’Hagen and Cooper, 2002).

Current thinking in the Republic of Ireland on fishing regulation within the territorial sea.

While it did not go as far as formally recommending the discontinuation of trawling in inshore waters a number of conclusions and recommendations in the report: *Steering a new course: strategy for a restructured, sustainable and profitable Irish seafood industry 2007-2013* (Cawley, 2006) pointed in that direction. Recommendation 5.4 on updating fleet management policies advised that as part of the overall review of fleet policy specific coastal areas should be designated with exclusive or priority access for inshore vessels (P 117); it probably arose from the related submission on Pp 162-163. While that statement did not exclude mobile gears, the Cawley report identified pots and creels as “inherently environmentally friendly fishing methods” and they were also recognized as typical inshore fishing methods (P 78). Appendix 1, the high level implementation roadmap, prioritized developing management strategies that specifically aim to reduce discarding in fisheries (P 150). The largest discards accrue in non-selective mobile gears and they frequently consist of the juvenile and immature of species which have their nursery areas close inshore. The Cawley report endorsed the creation of an extensive and coherent network of protected areas through Natura 2000 (P 77). Currently cSAC and SPA in Ireland have commercial fishing within their boundaries even when that conflicts with the purpose of their creation (Fahy *et al*, 2005). There are cSACs and SPAs within 12 n miles, close to the coast (Figure 13). Among many submissions to the group one (P 167) recommends closing areas to fishing and the creation of artificial reefs.

Recommendation 8.2 (P 132) urges the promotion of local area management strategies and the Coastal Zone Management approach. Integrated coastal zone management (ICZM) is a planning process involving key stakeholders who would include tourism interests and anglers both of whom are opposed to inshore trawling.

The Cawley report recognizes that environmental issues are becoming more prominent and observes that because of other distractions, the industry has been unable to focus on the development of environmental policies and their potential impact on the industry (P 130) The industry is urged to take initiatives to “demonstrate (its) engagement with (its) environmental obligations” (P 78).

Among the many comments included as an appendix to the Cawley report, one, under the heading Compliance (P 172) states: “Self-regulation should be avoided”. The government Department overseeing fisheries is responsible for the enforcement of rules and regulations which require policing; the powers may be sub-contracted to an agency but, compliance requires that sanctions are exercised. Nor can competing private interests be relied upon to initiate conservation programmes which curtail their immediate financial gains. The drive must come from government.

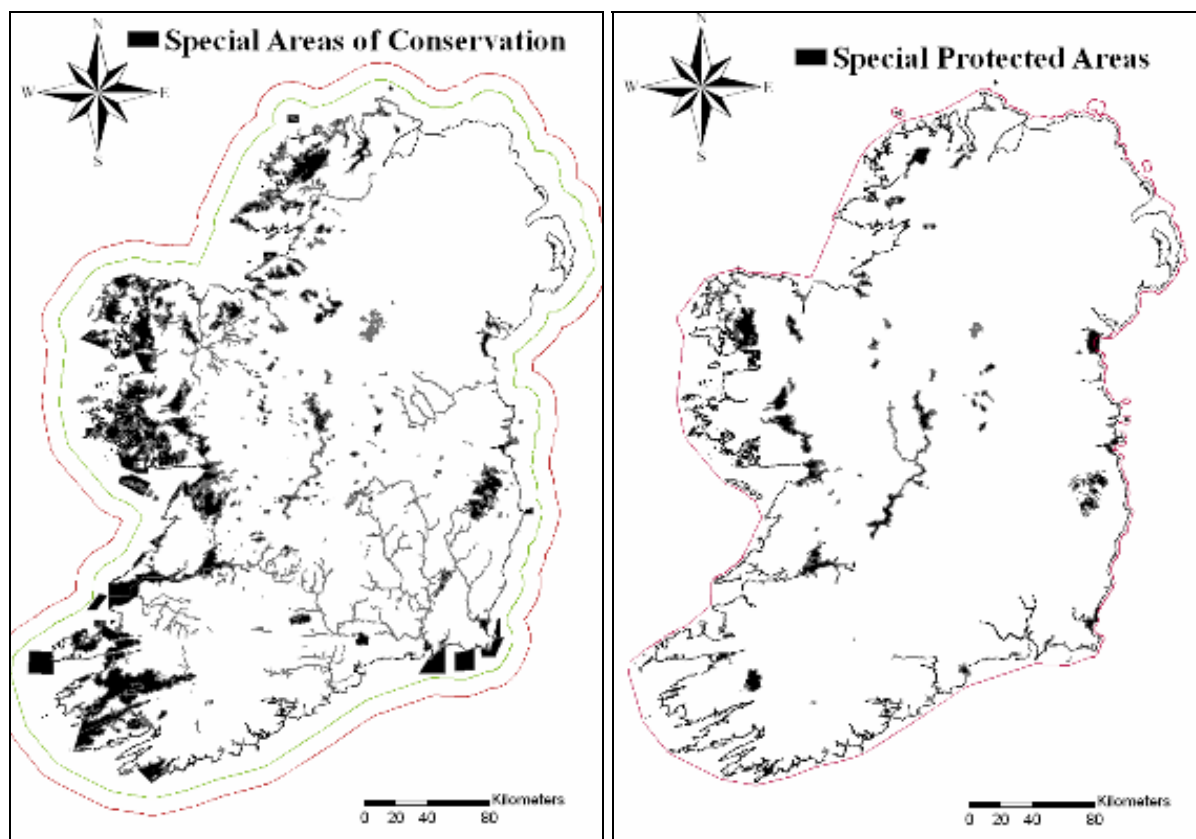


Figure 13. Special Areas of Conservation and Special Protected Areas. The 12 and 6 n miles bands are marked on the SAC map and the base lines on the SPA map.

SPATIAL PLANNING IN THE WIDER EUROPEAN CONTEXT

Current thinking on inshore spatial planning within the EU

There are significant differences in planning jurisdiction among EU member states. In Ireland, local authority development plans, regional plans and the national spatial strategy effectively extend to the mean high water mark which is the boundary for terrestrial planning. In the Netherlands local authority jurisdiction extends 1 km seawards into the North Sea (Integrated management plan for the North Sea 2015). In Sweden, Finland and Germany the regulatory framework extends to 12 n miles offshore, the extent of the territorial sea and spatial plans for this area can be prepared by local or regional planning authorities (Baltcoast, 2005).

Outside territorial waters but within the 200 n miles Exclusive Economic Zone (EEZ), international maritime law prevents states from placing restrictions on navigation and laying submarine cables and pipelines (United Nations convention on the law of the sea, 1958).

Recent thinking on the future of spatial planning in the United Kingdom, which is in keeping with, and possibly even ahead of, European Community intentions, will be of relevance to any developments in this area in the Republic of Ireland. The contents of two recent publications are briefly examined: one of them, by the Prime Minister's Strategy Unit (2004),

contributed to the formulation of policy for forthcoming marine legislation in the UK (Defra, 2007); the rationale of the other, by the Royal Society of Edinburgh (2004), is in many respects similar.

In January 2003 the British Prime Minister's Strategy Unit was tasked with carrying out a review of options for a sustainable UK fishing industry in the medium and long term. The (Blair) report which was published in March 2004 was a packet of reform measures designed to stabilise yield and return the industry to profitability. The report recognized commercial fishing as just one of many stakeholders competing for the same resource and it identified commercial fishing as having the largest single negative impact on its environmental sustainability. The annual value of landings by the catching sector was stated to be £st540 m which generated from £st800 to £st1,200 m in economic activity; £st90 - £st100 m was spent annually on its administration. The strategy unit estimated recreational anglers spend £st1 bn annually on their sport. Coastal tourism, especially in south-west England, relied on fishing to sustain the character of villages. However, management to maximise opportunities for species favoured by sea anglers meant reducing commercial fishing pressures. Sea fishing, it was observed, is one among many uses of the marine environment and many of the other uses, such as amenity and the location of wind farms, are more economically significant. A number of the Blair report's recommendations referred to fisheries management in the inshore, including the development of an experimental programme of Marine Protected Areas (MPAs) focusing initially on places which provide benefits to multiple users (commercial fishing, tourism, environment, recreational fishermen etc) (Recommendation 31). Such areas are more likely to be located in territorial or internal waters than offshore. Approval and encouragement were given to the development of an angling sector and mention was made of re-designating commercially caught species for wholly recreational sea angling; bass (*Dicentrarchus labrax*) was alluded to in this regard.

The Royal Society of Edinburgh (RSE) (2004) also conducted an enquiry into the future of the Scottish fishing industry. Its goals were similar to those of the Blair report. In support of the ecosystem-based approach to fisheries management within the Common Fisheries Policy, the authors enquired why, when other industries were required to conduct an Environmental Impact Assessment of their activities beforehand, the fishing industry should be exempt.

The establishment of MPAs was also supported, more explicitly in this instance, to ensure (among wider objectives) ...

that currently depleted fish species are restored to levels where they play their historic functional role within the wider food webs of which they are part.

The RSE report gave even greater emphasis to MPAs than did the Blair document. The 1992 Convention on Biological Diversity emphasised site-based approaches to marine conservation. Under international law, enshrined within the OSPAR Convention (1992), MPAs would be established in Scottish waters during the next decade.

These will include representative networks of MPAs involving time/area closures of fisheries for the protection of nursery grounds, marine habitats for non-target species and spawning grounds. They could lead to the cessation of fishing within some of the richest fishing grounds.

The report also observed that certain fishing methods removed old and large fish which contribute significantly to spawning and that these individuals should receive protection in MPAs, rather than relying on smaller individuals which produce lower quality eggs.

Special consideration was given by the RSE report to inshore waters which are more extensive along the indented western Scottish coastline than elsewhere in these islands and are among the most extensive in EU nations; they were also considered to contribute significantly to tourism-related industries and to be the repository of much of heritage value. Inshore waters were considered to be under greater potential pressure because the decommissioning of whitefish boats would result in an influx of smaller boats which, because of their size, are constrained to operating within the territorial sea and internal waters. The RSE report noted that nowadays shellfish are the principal target of inshore fishers who usually work full-time rather than part time. This, together with a greater number of vessels, would increase pressure on coastal fisheries. The question of whether the 6 and 12 n mile zones should remain open to vessels of all sizes, or be reserved for smaller boats originating in local ports was raised. The RSE report anticipated that increasing pressure on inshore waters arising from switching effort from whitefish to shellfish would in time cause conflict with the Water Framework Directive and the Habitats Directive. The authors identified three guiding principles for inshore fisheries management in Scotland in the future: it should be conducted on a local scale, be stakeholder led and it should be based on an integrated approach to fisheries and the marine environment.

The Blair Report, along with many others, contributed to the framework on which *A sea change: a marine bill white paper* (Defra, 2007) was constructed. Within the document a proposal is formulated that the UK government and the Northern Ireland Administration require a new Marine Management Organization (MMO) to deliver revised marine policies. However, the review of environmental governance in Northern Ireland, launched in June 2007, recommended:

Northern Ireland should delay decision-making concerning the proposals set out in the recent marine white paper until it has determined the region's priorities concerning its marine environment. Northern Ireland's MMO should not be sponsored by Defra and consideration should be given to the creation of an all-island or "Celtic Seas" MMO. (Foundations for the future, 2007).

However, whatever geographical/administrative combination is decided on, it is the intention that future legislation will give priority to marine conservation and biodiversity issues and safeguarding marine heritage and that it will adopt a greater role in managing recreational marine angling:

.....we want to be proactive in achieving nature conservation objectives.....

It is envisaged that both commercial and recreational marine fisheries will share the costs of management, the latter through the administration of a chargeable rod licence.

Accepting that man's greatest interaction with the sea takes place within the zone from 6 n miles to shore *A Sea Change* (Defra, 2007) goes on to state:

A future maritime policy has to build instruments and methods for ensuring consistency between land and marine systems in order to avoid duplication of regulations, or the transfer of unsolved land-planning problems to the sea. One idea would be to associate as closely as possible the same stakeholders in the planning processes of each. A common vision in the

form of an overall coastal and marine spatial development plan could provide a coherent set of policy objectives and principles.

The objectives of the revised marine policy would be secured through the preparation of a number of individual plans. Such plans would be agreed, published, monitored and revised every six years. The plans would be formulated to cover all UK waters, from mean high water spring tide level to the fullest extent of the UK's marine jurisdiction (the UK continental shelf and fisheries limits). Specifically, the plans will refer to marine waters out to the seaward limit of the UK territorial sea adjacent to England, Wales and Northern Ireland, UK offshore waters from 12 to 200 miles or, to the median line between countries and the UK continental shelf including areas beyond 200 nautical miles. (The white paper points out that for cetaceans, marine turtles and sturgeon protection must extend over a wider area.)

A Sea Change (Defra, 2007) identifies current conservation responsibilities under European law as the protection of a number of species and habitats considered of European importance. The introduction of a parallel mechanism to designate and manage Marine Conservation Zones (MCZ) is intended for species considered to have national value which cannot otherwise be protected as part of the Natura 2000 programme which is due to be completed in 2008 with 78 SPAs and 65 SACs. *A Sea Change* is an enterprising plan intending to establish an ecologically coherent network of well managed Marine Protected Areas (MPA) by 2010.

Within *A Sea Change* the greater value of habitat over individual species conservation is appreciated. The following observation is made:

some fishing activities threaten the integrity of the marine environment

An ecosystem approach to the management of MPAs is intended, which suggests that fishing by mobile gears would be severely curtailed in such areas. By-catch of non-target species is reckoned to be harmful and *A Sea Change* recommends steps to reduce and minimise it. The full range of biodiversity in UK waters will be included in the plan, as will be areas which are important for key life cycle stages of mobile species. Highly protected MCZ would serve as benchmarks of healthy marine communities. Currently practised fisheries technical conservation measures (gear controls and closed areas) would be used to safeguard the values of sites but additional powers would be provided to enforcement agencies to control activities like bait digging. Other activities which are currently unregulated, such as diving, would also be controlled.

ICZM, a mechanism for implementing change?

While there is variability in the status of planning in territorial and internal waters throughout EU member states, there is an evolving convergence of approach and adoption of standards to attain sustainable planning in inshore waters. An important mechanism which has been identified to achieve this is Integrated Coastal Zone Management (ICZM) which is also at an early stage of development. The process has been defined as:

A dynamic and continuous process of administering the use, development and protection of the coastal zone and its resources towards common objectives of national and local authorities and the aspiration of different resource user groups (Knecht and Archer, 1993).

What can be achieved by ICZM has yet to be seen. Within what geographical boundaries and distance from shore it will operate has not been agreed everywhere, but it is likely that it will be more influential in coastal than territorial waters, that more stakeholders will be involved than was traditionally the case when reaching decisions on the environment closer to shore and that the various issues and data sources identified in the course of this review will contribute to the decision making process. Throughout the EU, and beyond (in Norway), representative demonstration projects in ICZM have been undertaken, two of those in Ireland: on Bantry Bay coastal management in Co Cork and on sand dune management in Co Donegal. The interdisciplinary and holistic approach to ICZM is formulated on eight principles of best practice (Cummins *et al.*, 2004) which emphasise the importance of devising plans for the long term, on the basis of as wide a range of inputs as can be achieved; that the perspective be broad and holistic; that it takes due account of local and specific characteristics and requirements and that it uses a management approach which is adaptive. ICZM should also work with natural processes, take a long term view, involve a full spectrum of stakeholders and ensure the support and involvement of all relevant agencies. Finally, ICZM should use all available incentives (such as economic rewards), instruments (legal measures) and technical solutions to secure the desired objectives. Establishing comprehensive ICZM will not be achieved overnight. In the meantime the development of planning regulations described here and the compilation of resource surveys and assessments, like the Atlas, will contribute to the process. While ICZM remains an aspiration, it is crucial to safeguard and actively conserve inshore living resources by whatever means are available.

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Ben Dallaghan	BIM	Mussel fisheries
Colm Lordan	MI	<i>Nephrops</i> resource survey
Declan Nee	BIM	Co Mayo fisheries
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Dominic Gallagher	DCMNR	South Kerry
Eamonn Hayes	Charter boat skipper	Kilmore Quay
Herbie Denis	BIM	Mussel fisheries
Jennifer Doyle	MI	<i>Nephrops</i> resource survey
Kevin Flannery	DCMNR	North Kerry
Leo Whelan	Fisher	Clifden
Mark Norman	Taighde Mara Teo	North Galway
Michael Connors	Regional Fisheries Board	Waterford
Oliver Tully	BIM	Crab and lobster fisheries
Owen Doyle	BIM	North Co Donegal fisheries
Paddy Gallagher	DCMNR	South Co Donegal fisheries
Peter Tyndall	BIM	South Galway Bay-Co Clare
Seamus O'Grady	Fisher	Magharees vicinity
Sean Murran	DCMNR	Irish Sea fisheries
Tom Roche	Fisher	Co Wexford
Vera O'Donovan	BIM	Co Mayo fisheries
Vincent Roantree	Taighde Mara Teo	West Cork
Peter Green	Central Fisheries Board	Charter angling fleet

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