2. MARINE BIODIVERSITY

Brittlestars. *Ophiothrix fragilis*, Red Bay, Co Antrim

Key messages

- More than half of Northern Ireland's biodiversity is found beneath the sea.
- Northern Ireland has a rich marine biodiversity due to its position at a junction of cold northern and warm southern waters.
- Many of our marine species and habitats are considered to be in a good state.
- Some important marine habitats have been damaged by mobile fishing gear.
- The Northern Ireland Government Departments have a responsibility to restore damaged habitats to favourable condition.
- Enhanced protection of marine biodiversity will be delivered through the Northern Ireland Marine Bill by designating Marine Protected Areas.
- More marine monitoring and research is required to understand the complex marine environment fully.
- There is an important role for coastal communities in biological recording; research is not solely the preserve of government agencies and can be carried out in partnership with volunteers.
- The effects of climate change may be detected through monitoring changes in species composition and distribution.

What is biodiversity?

Biodiversity (biological diversity) is a term used to describe the variety of life found in the environment including plants, animals and micro-organisms, the genes that they contain and the ecosystems that they form.

It is a little known fact that approximately 50% of Northern Ireland's biodiversity lies below the sea, largely regarded as out-of-sight and out-of-mind [(1)]. Simply put, marine biodiversity concerns the whole variety of life found in our seas and oceans, from the largest whales to the smallest bacteria. Most importantly, marine biodiversity plays a fundamental role in maintaining the balance of life on our planet.

What do we know about marine biodiversity in our own seas?

The first recorded survey of Northern Ireland's rich marine biodiversity dates back to 1790 when systematic dredging of the seabed was being conducted by the naturalist John Templeton. Many other notable local scientists followed in his footsteps forming institutions such as the Belfast Natural History and Philosophical Society. In the 1980s diving surveys were carried out by the Ulster

Museum, supported by the DOE. These showed that the seas around Northern Ireland support a very diverse range of seabed habitats and associated biological communities.

Northern Ireland is located at a junction between southern warm water 'Mediterranean Lusitanian' species and cold water 'Arctic Boreal' species. These range from the very diverse Rathlin sponge reef communities to fantastic large underwater sand formations just off the Giant's Causeway and from tide-swept gravels adjacent to Torr head at the north entrance to the Irish Sea to the Red Bay maerl *Lithothamnion* and *Phymatolithon* species (coralline seaweed) beds through to the sheltered mud communities in the upper reaches of our unique sea loughs.

The offshore gravels of the North Channel and deep muds of the north-west Irish Sea have been monitored by NIEA and AFBI for over 15 years. Over 700 invertebrate taxa have been recorded and analysis of the results indicates that the area has remained stable over recent times. Furthermore, the Atlantic oceanic waters influenced by the Gulf Stream and the variable water types of the Irish Sea, have contributed to the diverse range of habitats found in these waters. This makes Northern Ireland an important site for monitoring the impacts of climate change, particularly in relation to changing seawater temperatures (http://www.mba.ac.uk/marclim/index.php?sec=info).

Rathlin Island is renowned for its nesting seabird colonies which may be witnessed with a visit to the Royal Society for the Protection of Birds (RSPB) West Light Seabird Observatory. Our sheltered sea loughs host internationally important flocks of overwintering wildfowl as well as important tern colonies. Around most of the coast it is possible to have an encounter with seals, whales and sharks. Occasionally, rare marine turtles are also observed in our waters.

Over recent years there has been much press interest in the apparent increase in observations and migrations of rare warm water species such as trigger fish *Balistes capriscus*, spiny crayfish *Palinurus elaphus*, sun fish *Mola mola*, and jellyfish such as the mauve stinger *Pelagia noctiluca*. As yet, it is not clear whether these events are attributable to warming seas or simply a reflection of enhanced reporting.

One of the main natural factors influencing the range of habitats and species are the strong tidal forces that sweep our local waters. These present considerable challenges for marine biologists engaged in research and monitoring at sea. Strangford Lough Narrows, for example, has currents as strong as 9 knots which can only be dived for a short period in every 12 hour tidal cycle. At this location, the habitat is mainly tide-swept bedrock which is extremely biologically diverse.

Human activities, even those which are well regulated, may have the potential to impact on marine biodiversity. These include marine aggregate extraction, aquaculture, dredge-spoil disposal, outfalls, marine renewable energy devices, marine construction,

The biological diversity of a rocky reef- Rathlin Island

The sponge, *Axinilla dissimilis*- Rathlin Island

Sea asparagus at Dundrum Bay

commercial fishing, sub-sea cables, oil and gas. Unregulated activities include sea angling, marine eco-tourism, boating (anchoring), diving, shoreline shellfish gathering, bait digging, horse riding and seaweed harvesting. The introduction of non-native invasive species is also important - (Chapter 3). NIEA has the lead role in marine nature conservation and delivers protection through site designation. It delivers this function through close co-operation with other organisations such as DARD Fisheries, DCAL, AFBI, Loughs Agency, local universities and other non-governmental organisations.

What is the current state of our seabed communities?

NIEA, in partnership with the Ulster Museum, continues to monitor the state and condition of our marine biodiversity through a scientific dive survey programme. Using technology such as high definition digital video, Remotely Operated Vehicles (ROVs), extended range diving techniques and GPS navigation systems it is possible to record the state of marine biodiversity in greater detail than was the case in the early 1980s.

The first comprehensive diving survey of the Northern Ireland seabed [2] reported the results of 999 dives, detailing 730 sites and a total of 957 different species of plants and animals.

The results were used to identify 3 marine Special Areas of Conservation (SAC)- Strangford Lough, Murlough Bay (Dundrum) and Rathlin Island. The most recent sub-littoral survey of Northern Ireland, a repeat diving survey, [3] focused on the 46 Northern Ireland marine invertebrate priority species using the original survey to select sites. A total of 322 dives were carried out. The survey found that while most priority species still exist within Northern Ireland, some key sites have lost species.

While it is reassuring to note that many of the sites surveyed 30 years ago are relatively unchanged, several habitats within protected sites have been damaged and degraded. The destruction of horse mussel biogenic reefs in Strangford Lough resulted in warnings from the European Commission. A ban was introduced on the use of mobile bottom fishing gear within the Lough. Furthermore this has been accompanied by a £1 million research project to explore methods to restore the site.

Lion's mane jellyfish, *Cyanea capillata*

Further details of the project can be found at http://www.qub.ac.uk/research-centres/ModiolusRestorationResearchGroup/

Similar damage has also been recorded at Rathlin Island reefs which may warrant further action. Dives adjacent to the Skerries (Portrush), have shown that horse mussel beds that were present 30 years ago have now disappeared. Ireland's only known living fan mussels, *Atrina fragilis*, were rediscovered during 2007 off the east coast of Rathlin Island but have not been recorded since. Northern Ireland departments are now considering what further actions are required to give further protection to marine features.

In other less disturbed areas of Rathlin Island, 27 species of sponge, new to science, were discovered in 2006. Maerl beds, a European priority species and habitat, have been recorded at several sites around Northern Ireland, notably in Red Bay and have recently been discovered off Rathlin and the Maidens Islands. Dense colonies of sea pens *Virgularia mirabilis* have been found in areas adjacent to aquaculture sites in Carlingford Lough.

The Atlantic spider crab *Maja brachydactyla*, previously recorded on the west coast of Ireland, was not seen in Northern Ireland during the first sub-littoral survey but was recorded in significant numbers off Portrush in 2006. It has now apparently moved south, reported in Red Bay by Seasearch divers in 2009 and in Mill Bay, Larne Lough in 2010 [4]. Seasearch Northern Ireland is a project which is grant-aided by NIEA and encourages amateur divers to be trained in marine biological recording and reporting http://www.seasearch.co.uk/northernireland/Index.htm.

In addition to dive and video surveys, both NIEA and AFBI study seabed communities using 'grabbing' techniques. This is where a fixed quantity of sediment is collected using a 'grab' from a boat, sieved and sorted to allow the identification of the animals present.

Seabed communities are relatively immobile and are therefore subject to the environmental conditions in the surrounding water and sediment. The type, abundance and diversity of animals living on or in the seabed can be related to the pressures of the environment [5,6]. Environmental pressures can be natural, for example, the changing salinity in a rock pool or estuary. They can also be manmade, like an effluent from an outfall pipe. As some animals have a relatively long lifespan they can integrate the effects of the environmental conditions over time, not just at the time of sampling. These animals are an integral part of the food web and provide the food source for many commercial fish species (Chapter 4).

The biodiversity of sediment dwellers is one of the key biological tools used to assess the health of the marine and estuarine waters around our coast. This is a requirement under the EC Water Framework Directive. Methodologies are presented at http://www.wfduk.org/bio_assessment/bio_assessment/trac_iqi http://www.ni-environment.gov.uk/infaunal_quality_dec09.pdf

Approximately 100 samples are analysed annually from our waters. Our sediments are some of the most diverse in the UK, with some samples returning over 200 species with up to 10,000 individuals in 0.1m^2 of seabed.

The results from inshore sites have been used in the classification of water bodies under the Water Framework Directive. The classification in Figure 2.1 is based on an Infaunal Quality Index www.wfduk.org/bio_assessment/trac_iqi, which is not suitable for all sediment types. This is why some water bodies have not been classified. Full results are available at: http://www.ni-environment.gov.uk/ne-coastal along with the overall classification.

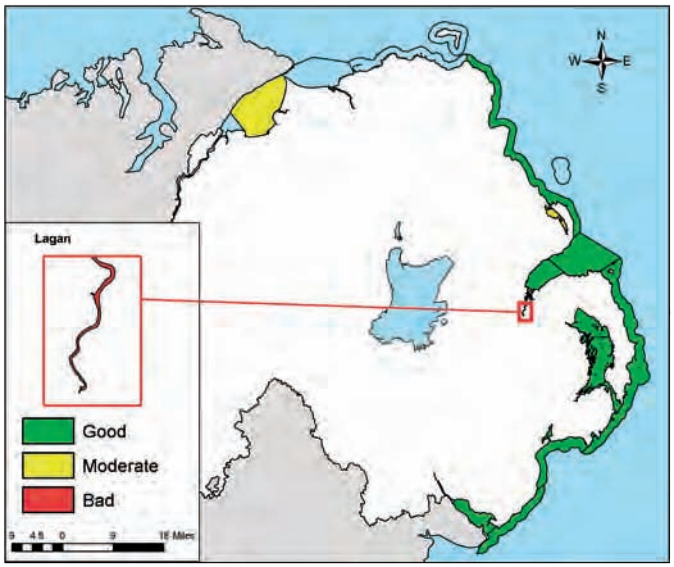

Figure 2.1 Classification of waterbodies for EC Water Framework Directive using sediment dwelling animals only. Source – NIEA.

What is the current state of our marine plants?

Northern Ireland has a rich flora of intertidal seaweeds and eelgrass (*Zostera* species), in addition to kelp forest and seaweed communities below low tide. Eelgrass beds provide an important food resource for birds and have a role in stabilising sediments and nutrient cycling. Declines in eelgrass areas were previously reported due to a wasting disease in the 1930s. More recently in some sites they have been smothered by opportunistic green seaweeds which bloom in high nutrient conditions [7]. An NIEA survey programme to assess the extent of eelgrass and opportunistic algae is underway. Results from this will highlight problem areas and also identify areas where eelgrass beds have expanded.

Seaweed communities are part of Northern Ireland's rich marine biodiversity as they thrive in our temperate waters. Some rocky shores in Northern Ireland have over 100 different seaweed species present. The species of seaweed present in surveys also provide information on the state of the environment as they have different tolerances to pollutants and nutrient pressures. Further information can be obtained at the following website: http://www.wfduk.org/bio_assessment/bio_assessment/macro_rockyshore

What is the current state of our large marine animals?

The diversity of marine mammals in Northern Ireland waters compares relatively favourably to that in the Republic of Ireland and UK waters with at least 2 species of seal and 17 species of whale, dolphin and porpoise (cetaceans) recorded to date.

Despite the European and national protection afforded to these animals, monitoring such highly mobile marine species and identifying critical habitats is complex and challenging. In order to understand their ecology better and to facilitate conservation measures such as local management and site designation, NIEA has developed seal and cetacean monitoring programmes. NIEA also supports practical training initiatives, such as the innovative WiSe (Wildlife Safe) Scheme (www.wisescheme.org) which endeavour to reduce disturbance to marine wildlife.

The harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus* are both listed on Annex II of the EU Habitats Directive (1992) as species whose conservation requires the designation of SAC. In Northern Ireland, harbour seals qualify as features of Strangford Lough and Murlough SAC.

Harbour and grey seals are also 'protected at all times' under the Wildlife (Northern Ireland) Order 1985 and the Environment (Northern

Left: Killer whale *Orcinus orca* cruising at the entrance to Belfast Lough, and Right: Basking shark, *Cetorhinus maximus*

Ireland) Order 2002. They may not be 'killed or taken by certain methods' or 'sold alive or dead at any time'.

NIEA co-ordinates the Northern Ireland seal monitoring programme, which is carried out in conjunction with the National Trust. An independent review of information collected from October 1992 to January 2009 in Strangford Lough found that the data broadly reflect the widespread declines in harbour seal populations and increases in grey seal populations observed throughout the United Kingdom. In Strangford Lough, the harbour seal numbers have declined by approximately 3% per annum whilst the grey seal population appears to be increasing by about 9% per annum. The reasons for the decline in harbour seal numbers are not understood but competition with grey seals or the decline in food species such as sand eels are possible factors.

In 2002, an outbreak of Phocine Distemper Virus (PDV), led NIEA to establish a national seal mortality database and hotline number (028 4461 5520) at the Quoile Countryside Centre in Strangford Lough. Although the virus had very limited impact, all seal strandings throughout Northern Ireland continue to be recorded and fully investigated.

In 2009, NIEA undertook a review of the seal post mortem reports generated through the environmental monitoring programme required for a trial Marine Current Turbine in Strangford Lough. The review did not find evidence of turbine strikes. However, it did find evidence of 'unnatural' mortality, possibly resulting from a combination of targeted persecution, illegal fisheries interactions or strikes from shrouded propellers. Co-operative measures by the relevant departments are now in place to establish and address the cause of these deaths.

In Northern Ireland, encounters with cetaceans have traditionally been viewed as exceptional events both in the public consciousness and among conservationists. Cetaceans had a low profile; consequently, biological records were sparse and management and protection had until recently been constrained by a lack of baseline information. Despite this, 17 species of cetacean have been recorded, either as live sightings or stranded animals, about 8 of which are consistently observed every year. Overall, records from the region indicate relatively low abundance but high diversity.

An Irish Whale and Dolphin Group (IWDG) review of all cetacean sighting and stranding records for Northern Ireland prior to 2007 showed that the harbour porpoise *Phocoena phocoena* represented almost 80% of all records. Porpoises occur around the whole coast but especially in inshore waters, with apparent concentrations around Portrush, Strangford and Newcastle. Minke whales *Balaenoptera acutorostrata* were the second most frequent, representing 5% of records. Bottlenose dolphins *Tursiops truncatus* share a similar inshore distribution to harbour porpoises and their sightings comprised 4% of sighting records but have recently been much more frequently recorded. Killer whales *Orcinus*

Recovering an injured Leatherback Turtle, Strangford Lough

orca were occasionally recorded (2%) with aggregations of records from the Copeland Islands. The additional sightings may be a reflection of the increased boat traffic at Bangor and Carrickfergus marinas. This species may be observed inshore or offshore and typically occurs singly or in small pods.

All cetaceans are listed on Annex IV of the EC Habitats Directive, as species of European interest in need of strict protection and monitoring. The harbour porpoise and bottlenose dolphin are listed under Annex II as species of European interest whose conservation requires the designation of SAC. However, to date there has been no scientific basis to designate any areas for these species in Northern Ireland.

In 2008, NIEA initiated a formal cetacean monitoring programme in order to provide validated data on the distribution and relative abundance of cetaceans in Northern Ireland waters and to enable future selection of marine protected areas for cetaceans. In order to deliver the monitoring programme, NIEA works closely with IWDG (www.iwdg.ie) which provides the technical support necessary to validate, process and publish the cetacean data.

In recent years, NIEA has used 'photo-identification' to track the long distance movements of bottlenose dolphins and to study associations within their groups. High resolution images of the animals' dorsal fins can capture unique patterns of scars and notches which then allow 'matches' to be sought with images of animals photographed from other parts of Ireland. For example, photographs of a pod of bottlenose dolphins observed off Ballycastle in May 2009 revealed matches to animals seen off Galway, Donegal, Cork and Dublin. The images and subsequent analysis provide evidence that the coastal dolphins which migrate seasonally into and out of north Antrim waters are highly transient and undertake extensive movements throughout Irish waters [8].

Marine turtles are also species of European interest (EC Habitats Directive Annex IV) and are occasionally recorded in Northern Ireland waters. In 2006, a review of all records [9] collated accounts of 36 sightings and strandings, 80% of which were for the leatherback turtle *Dermochelys coriacea*. Reported encounters come from all parts of the Northern Ireland coast but with clusters of records from Portrush and Strangford Lough.

The review identified lobster pots, drift nets and mid-water trawls as all being implicated in the by-catch of marine turtles in Northern Ireland waters but acknowledged the sometimes considerable efforts made by fishermen to release turtles without harm, often cutting nets in the process.

Basking sharks *Cetorhinus maximus*, the second largest fish in the sea, are seasonally present in Northern Ireland waters with an annual peak in reports of surface sightings during the month of June each year. Concentrations of activity are regularly recorded off the north Antrim coast, particularly in the Portrush area.

Historically, basking sharks were heavily fished for their liver oil, meat, fins and cartilage. This combined with their slow growth and low reproductive output has resulted in them being listed as endangered in the North East Atlantic. Whilst this species is no longer hunted commercially in the United Kingdom or Ireland, basking sharks are still adversely affected by man's activities. These huge sharks frequently display scars from boat collisions, propellers and entanglement with fishing gear. The animals' tolerance to

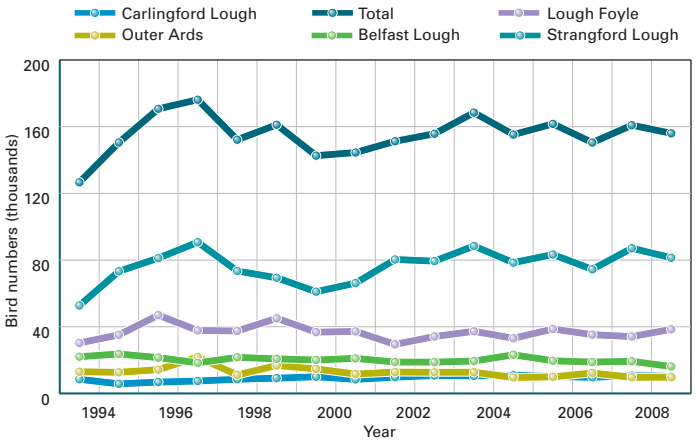

Figure 2.2 Maximum waterbird populations at main coastal wetlands sites in Northern Ireland. Source WeBS (The Wetland Bird Survey).

approaches by boats and divers also brings added potential for disturbance, particularly when they are feeding near harbours and recreational beaches.

NIEA advocates that boat users should adhere to the 'basking shark code of conduct', produced by the Shark Trust and available online at www.baskingsharks.org. The code of conduct aims to ensure a safe, positive interaction between human and shark – safe for both sharks and humans. Whilst basking sharks are not normally referred to as dangerous, their sheer size and potential

Arctic tern, *Sterna paradisea* pictured by Laurie Campbell

power makes them creatures to be treated with respect and caution.

What is the current state of our seabirds?

Northern Ireland hosts internationally important populations of birds that are dependant on the sea in one way or another. The significance of a number of areas used by these birds has been recognised through their classification as Special Protection Areas (SPA) under the European Birds Directive.

Indeed, 12 of Northern Ireland's 16 current SPAs have been classified because of their important coastal and nearshore bird populations. The overall trends in maximum coastal waterbird populations are displayed in Figure 2.2. The data underpinning this graph is collected via the WeBS website (www.bto.org/webs). WeBS is a partnership arrangement between the British Trust for Ornithology, the Royal Society for the Protection of Birds, the Wildfowl and Wetlands Trust and the UK Countryside Agencies (including NIEA). The principal aims of WeBS are to identify population sizes, determine trends in numbers and distribution and to identify important sites for waterbirds.

During the breeding season a range of bird species move inshore or migrate to our shores to breed. Our cliffs offer nesting opportunities for species including fulmar *Fulmaris glacialis*, kittiwake *Rissa tridactyla*, guillemot *Uria aalge*, razorbill *Alca torda* and puffin *Fratercula arctica* which all occur in internationally important numbers on Rathlin Island SPA but are also present in smaller numbers elsewhere around our coast.

These species rely on adjoining and distant waters to provide food for adults and young alike. The apparent reduction of food in places during the breeding season appears to have had an impact on a number of species with recent declines of some 50% recorded for puffin, razorbill and fulmar on Rathlin over the period 1999 to 2007. Studies have also noted declines in numbers of young being produced in recent years which may also be related to food availability[10].

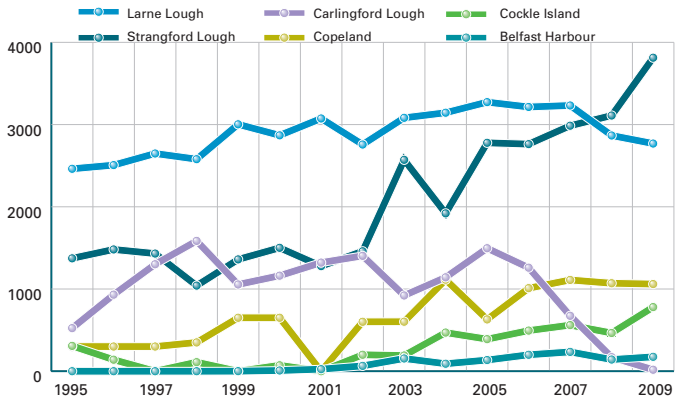

Figure 2.3a Total tern populations.

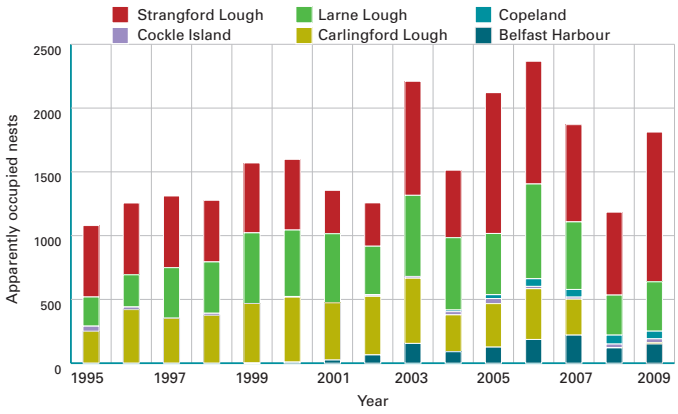

Figure 2.3b Sandwich tern population

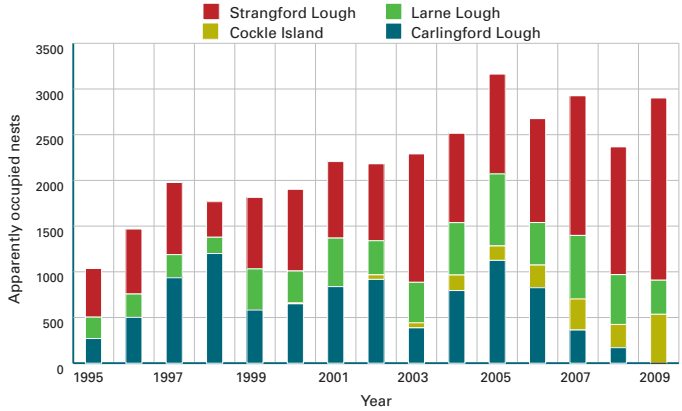

Figure 2.3c Common tern population

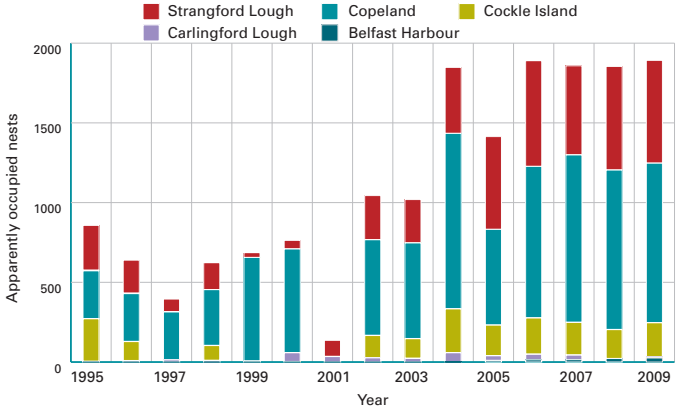

Figure 2.3d Arctic tern population

All tern data provided by National Trust, Royal Society for the Protection of Birds, Copeland Bird Observatory and NIEA.

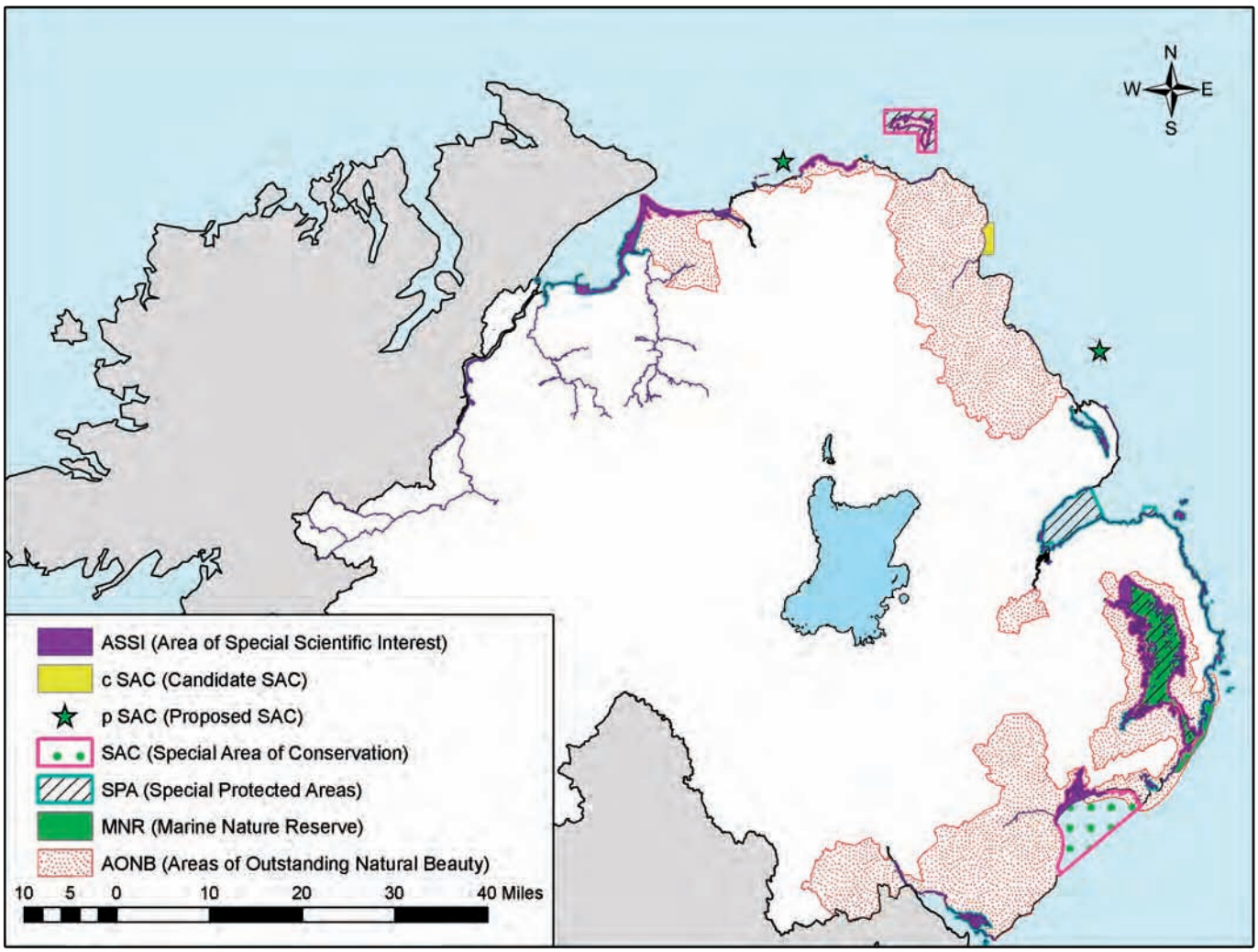

Figure 2.4 Coastal and marine areas of conservation importance.

The other offshore islands around our coast also support internationally important populations of seabirds including the population of Manx shearwater *Puffinus puffinus* on the Copeland Island SPA. Major tern colonies are found on a number of the islands in Strangford Lough, on the Copeland Islands, in Larne Lough and around Belfast Lough.

Tern populations are generally doing well with the Northern Ireland sandwich tern *Sterna sandvicensis* population increasing almost three-fold between 1995 and 2009. Populations of common tern *Sterna hirundo* and Arctic tern *Sterna paradisea* have experienced increases of more than 40% and 100%, respectively over the same period. Our rarest tern, the roseate tern *Sterna dougallii*, has not fared so well and the current population is the lowest recorded in recent years with just 2 pairs. However, production of young terns at some sites has given cause for concern; again it is thought that food availability is a key factor although human disturbance has been an issue at least at some sites. Patterns in the tern populations are displayed in Figures 2.3a-d.

Outside the breeding season, our coastline and especially our estuaries become important for waterbirds migrating from as far away as eastern Canada, Iceland, Scandinavia and northern Russia. Strangford Lough is of particular note with over 90% of the world's light-bellied brent geese *Brenta bernicla hrota* passing through this site each autumn. Intertidal habitats in our sea loughs provide the food which regularly supports more than 120,000 birds in total each winter including internationally important populations of light-bellied brent geese, shelduck *Tadorna tadorna*, redshank *Tringa totanus*, bar-tailed godwit *Limosa lapponica*, golden plover *Pluvialis apricaria* and knot *Calidris calidris*.

The range of birds present around our coast is dependant on a healthy and varied environment to provide them with food and suitable habitats. When ashore for breeding or during winter, absence of disturbance and persecution are also of importance. Both the extent of routine feeding ranges and migratory nature of these species mean that international conservation measures are necessary, at land and at sea, to ensure their future wellbeing.

Key considerations include marine and coastal pollution, overfishing and changes to the marine environment that can result in loss or redistribution of food species. The effect of the renewable energy technologies increasingly sited along our coasts or in our seas is unknown.

Monitoring of seabird trends is based on annual or periodical colony counts carried out either by scientifically trained personnel or by volunteers following standardised methodology. These counts cover a very high proportion of the populations. Manx shearwater numbers are estimated from annual sampling. All major sites for wintering waders and waterfowl are covered by the wetland bird survey.

Where are our designated sites?

Sites of national importance are designated under the Environment (2002) (NI) Order and are known as areas of special scientific interest. Due to ease of access, our intertidal shores have been well studied and the highest quality examples are declared as areas of special scientific interest. A direct comparison of photographs taken in the 1980s with more recent images show changes in substrate and a general decrease in the abundance of certain intertidal seaweeds.

Under the European Habitats Directive, Northern Ireland is required to identify and protect a series of SAC for habitats and species of European importance. Important bird sites are designated as SPAs under the European Birds Directive. Sites identified and accepted by the European Commission will contribute to a Europe-wide network of nature conservation protected areas known as Natura 2000.

There are currently 6 coastal and inshore SAC in Northern Ireland located at Magilligan, Bann Estuary, North Antrim Coast, Rathlin Island, Strangford Lough and Murlough. Within Northern Ireland, marine areas of special scientific interest only extend to the low water mark i.e. the intertidal zone. Consequently the marine SAC are not underpinned by national legislation as is the case for the terrestrial environment. Future national protection for marine sites will be delivered through the establishment of marine conservation zones under the proposed Northern Ireland Marine Bill.

The maerl beds in Red Bay are a candidate SAC. Two further SAC are proposed, at the Maidens and Skerries/Causeway. This will complete the European suite of SAC by 2012. By 2020 Northern Ireland will have in place an ecologically coherent network of marine protected areas. All of these sites are shown in Figure 2.4.

What more needs to be done?

With the exception of some features in Strangford Lough, around Rathlin Island and the Skerries, Northern Ireland's marine biological diversity is generally considered to be in a good state. However, wider monitoring and surveillance will inform us better on the overall status. We must continue to work together to ensure that the damaged features are restored to favourable condition. The introduction of marine protected areas where sites are actively managed for their unique fishery and conservation features will assist in this process.

It is not possible to dive every square metre of seabed but through use of high resolution mapping and an appropriate level of ground-truthing, we can now gain a better understanding of the status and condition of our marine habitats and species.
As development of the marine environment increases, we will require a fuller knowledge of our marine ecological assets in order to fully mitigate any negative effects. This will require closer cooperation and a sharing of resources among all those departments and agencies in which have a role in protecting Northern Ireland's marine environment.

Legislation	
Marine Strategy Framework Directive Descriptor 1 'Biological diversity is maintained. The quality and occurrence of habitats and the distribution of species are in line with prevailing physiographic, geographic and climatic conditions'	
Other relevant EC Directives (full references and corresponding regulations – Appendix II)	
Habitats Directive	To promote biodiversity by requiring measures to maintain or restore natural habitats and species of European importance, in favourable conservation status
Birds Directive	A framework for the conservation and management of wild birds
Water Framework Directive	Driving overall improvements in the water environment.
International Agreements	
OSPAR Convention for the protection of the marine environment of the North-East Atlantic	Biodiversity and ecosystems strategy
ASCOBANS Convention	To conserve small cetaceans in the Baltic, North East Atlantic, Irish and North Seas
Local legislation	
Wildlife (Northern Ireland) Order 1985	Affording national protection measures to certain species
Environment (Northern Ireland) Order 2002	The principal measure for site protection in Northern Ireland

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