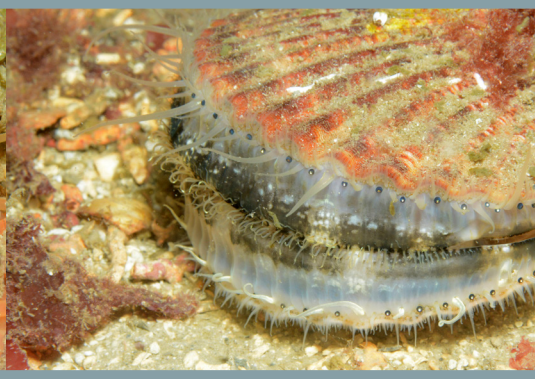
IRISH WILDLIFE TRUST

Report May 2018
By R. Classen





Marine Protected Areas

Restoring Ireland's Ocean Wildlife

Graphic Design by Ina O'Connor - ina@inaoconnor.com

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Contents

1. INTRODUCTION

Well-functioning marine ecosystems provide invaluable services to humankind. From the creation of jobs in fishing and tourism industries to food supply and the incredible role in climate regulation through the capture and storage of carbon, the importance of ocean health is now better acknowledged than ever. Human impacts have taken their toll on the marine environment however and it has become apparent that our heavy usage of the sea has left its marks[1].

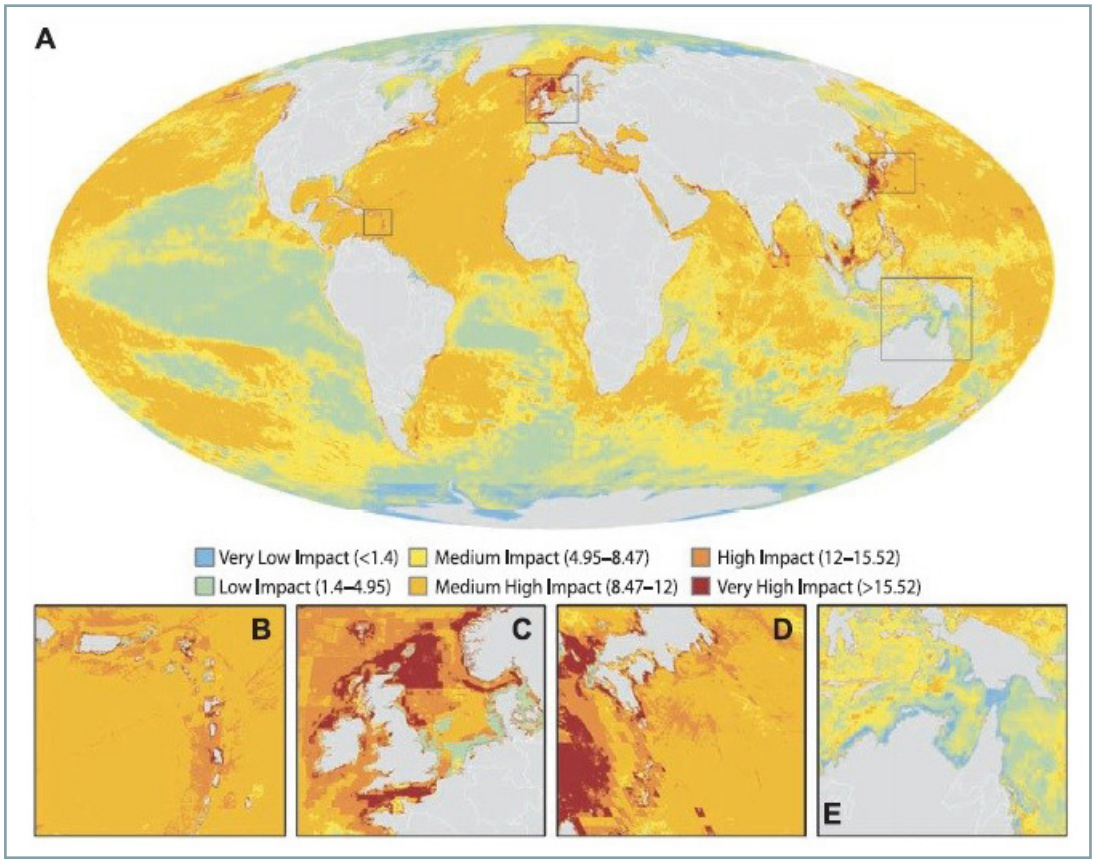

Figure 1: Global map of cumulative human impact on the marine environment. Insets show the eastern Caribbean (B), the North Sea (C), Japanese waters (D) and northern Australia (E). Figure taken from Halpern et. al (2008)[1].

National and international legislation is beginning to address the problem of overexploitation by enforcing the ecosystem approach in all marine developments. In addition to this, marine protected areas (MPAs) have been put in place to safeguard the most vulnerable habitats from human destruction. The definition of MPAs given by the European Commission is ***'geographically defined marine areas, whose primary and clearly stated goal is nature conservation and which are regulated and managed through legal or other effective means to achieve this objective'*** [2]. In order to increase the number of MPAs in the world's oceans, international agreements call for countries to designate at least 10% of their marine areas as MPAs by 2020.

Different types of MPAs exist, some of which allow some level of extractive activities to take place and some that prohibit all types of fishing depending on the vulnerability of the ecosystems under protection. The International Union for the Conservation of Nature (IUCN) defines six types of MPA management categories[3], but for the purpose of this report MPAs will be referred to either as multi-use MPAs which allow some form of fishing or other extractive activities, or no-take-zones which allow no extractive activities to take place.

IUCN Management Categories
(from highest to lowest level of protection)

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: National Park

III: Natural Monument

IV: Habitat/Species Management

V: Protected Landscape/Seascape

VI: Protected Areas with Sustainable Use of Natural Resources

The following sections will summarise the environmental legislation currently in place in support of marine spatial protection, the scientific background to the need for protected areas, as well as the current state of MPAs around the world followed by a future vision of marine protection in Ireland.

2. MARINE ENVIRONMENTAL LEGISLATION

2.1. United Nations Convention on the Law of the Sea

The United Nations Convention on the Law of the Sea (UNCLOS) was agreed upon in 1982. In the treaty, nations agree on their rights and responsibilities concerning the use of the marine environment in the high seas (areas beyond national jurisdiction) and within their national waters. A nation's marine region is divided into the territorial sea which spans 12 nautical miles from its baseline, and the exclusive economic zone (EEZ) which spans no more than 200 nautical miles from the baseline.

With regard to environmental protection, UNCLOS describes the need for conservation within a nation's EEZ as well as the high seas. It describes very clearly the duties of all nations to avoid adverse impacts on the environment through pollution and to maintain a sustainable level of fishing. Article 192 proclaims that '*states have the obligation to protect and preserve the marine environment*'[4].

2.2. Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is a treaty signed and ratified by all UN member states with the exception of the United States. The Convention has laid out a Strategic Plan for Biodiversity 2011-2020 with a clear vision: that '*by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.*' Along with this plan, the convention has created the so-called Aichi Biodiversity Targets. A total of 20 targets were identified relating to different strategic goals. Strategic Goal C ('*improve the status*

of biodiversity by safeguarding ecosystems, species and genetic diversity') includes Aichi Target 11, which states the following:

*'By 2020, at least 17 per cent of terrestrial and inland water, and **10 per cent of coastal and marine areas**, especially areas of particular importance for biodiversity and ecosystem services, are conserved through **effectively and equitably managed, ecologically representative and well-connected systems of protected areas** and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.'*

At the 2014 IUCN World Parks Congress and the 2016 IUCN World Conservation Congress the goal was set even higher – it has been recommended that at least 30% of each marine habitat is protected with the ultimate aim to have a fully sustainable ocean with at least 30% coverage of no-take-zones by 2030. It has been further noted that overall 50% of habitats should be protected with 100% of the land and water managed sustainably[5].

2.3. Other international conventions with reference to MPAs

Many other international treaties have been signed and ratified with the aim to improve global conservation efforts in the marine environment. Many of these treaties are transposed into EU law through the Habitats and Birds Directives mentioned below. The Ramsar Convention on the conservation of wetlands of international importance especially as waterfowl habitat is a treaty which calls for the designation of protected sites for wetland birds. Many important bays around Ireland have been protected in response to this treaty which now form a part of the Natura 2000 network[6].

2.4. European legislation

2.4.1 Habitats and Birds Directive

The Habitats Directive was adopted in 1992 ensuring the protection of endemic or endangered animal and plant species as well as rare and characteristic habitat types. The Birds Directive was adopted in 1979, amended in 2009 and together with the Habitats Directive forms the cornerstone of the EU's environmental conservation policy. Both directives state the importance of protected areas for the conservation of threatened or rare habitats and species as well as for the continuous supply of valuable ecosystem services. The annexes in the directives list important habitats and species in need of special protection. These habitats include estuaries, large shallow inlets and bays, mudflats and sandflats not covered by sea water at high tide, reefs, sandbanks that are slightly covered by seawater at all times and submerged or partly submerged sea caves. Between the Habitats and Birds Directives, Special Areas of Conservation (SACs) and Special Protected Areas (SPAs) build a network of protected areas across Europe called Natura 2000 sites.

In order to ensure proper management of Natura 2000 sites and to avoid the creation of so-called '*paper-parks*' (protected area designations with little or no enforcement), the Habitats Directive clearly defines how protected areas should be managed. Article 6 states that appropriate conservation measures should be taken to '*maintain and restore the habitats and species for which the site has been designated to a favourable conservation status; Avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types.*'[7] The Directive does therefore not automatically exclude any economic activities within the Natura 2000 network, but ensures that any marine development within the site has no adverse impacts on the habitats and species for which the site was designated.

2.4.2 Regional Sea Conventions

European countries are broadly divided into four marine regions – the Baltic Sea, the North-East Atlantic Ocean, the Mediterranean Sea and the Black Sea. For each of these regions a Regional Sea Convention has been put in place which encourages cooperation in marine environmental protection between countries which share the same marine waters. Ireland falls into the region of the North-East Atlantic Ocean and is therefore a signatory member of the Protection of the Marine Environment of the North-East Atlantic Ocean (or OSPAR) Convention and has agreed to establish an '*ecologically coherent network of MPAs in the North-East Atlantic that is well managed by 2016*'[9].

2.4.3 Marine Strategy Framework Directive

The Marine Strategy Framework Directive (MSFD) is a long-term policy vision providing the legal frame for marine environmental protection in the EU. It was adopted by the European Commission in June 2008. The objective of the Marine Directive is to achieve Good Environmental Status (GES) of marine waters by 2020. In order to safeguard the marine environment, all maritime activities should be managed according to an *'ecosystem-based approach'*. The Directive foresees a regional approach to implementation, with the four existing Regional Sea Conventions forming the basis for cooperation of neighbouring countries.
The MSFD defines GES as '*the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive*'. Annex 1 of the Directive identifies eleven descriptors of GES:

- Descriptor 1 - Biodiversity is maintained
- Descriptor 2 - Non-indigenous species do not adversely alter the ecosystem
- Descriptor 3 - The population of commercial fish species is healthy
- Descriptor 4 - Elements of food webs ensure long-term abundance and reproduction
- Descriptor 5 - Eutrophication is minimised
- Descriptor 6 - The sea floor integrity ensures functioning of the ecosystem
- Descriptor 7 - Permanent alteration of hydrographical conditions does not adversely affect the ecosystem
- Descriptor 8 - Concentrations of contaminants give no effects
- Descriptor 9 - Contaminants in seafood are below safe levels
- Descriptor 10 - Marine litter does not cause harm
- Descriptor 11 - Introduction of energy (including underwater noise) does not adversely affect the ecosystem

As laid out in the MSFD Programmes of Measures, the designation of MPAs is an important step towards achieving GES. Particularly descriptors 1, 3, 4, and 6 would be a direct result of a successfully managed and coherent MPA network.
The MSFD builds on other EU policies such as the Habitats and Birds Directive and the Water Framework Directive, but addresses specific elements which were not yet covered in existing legislation. On an international level, the above mentioned UNCLOS and Convention on Biological Diversity, of which the EU is a signatory, call for legal protection of the marine environment and therefore require legislation such as the MSFD[10].

2.4.4 The Common Fisheries Policy

The Common Fisheries Policy (CFP) was first introduced in the 1970s in order to manage European fishing and aquaculture in a way that is environmentally, economically and socially sustainable. A reform of the CFP in 2014 allowed EU

countries greater control at national and regional level. The policy is based on controlling fishing effort, access to waters, gear usage and limiting the amount of fish caught through total allowable catches (TACs). The policy also states that fisheries management should be supported by scientific advice and stocks should be fished at or below maximum sustainable yield.

2.5. Irish Environmental Legislation

The EU Habitats and Birds Directives are transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations (2011). This law forms the legal basis for the selection and designation of SPAs and SACs in Ireland, and is currently the only legislative instrument providing protection for marine habitats. Unlike SACs and SPAs, MPAs do not yet have any legal status in Ireland and are therefore not protected under any legislation. All MPAs currently overlap with either SPAs or SACs and are therefore protected under the European Communities (Birds and Natural Habitats) Regulations 20118.

The National Biodiversity Action Plan Ireland 2017-2020 highlights several objectives which are of importance to the marine environment:

- Objective 1: Mainstream biodiversity into decision-making across all sectors.
- Objective 2: Strengthen the knowledge base for conservation, management and sustainable use of biodiversity.
- Objective 3: Increase awareness and appreciation of biodiversity and ecosystems services.
- Objective 5: Conserve and restore biodiversity and ecosystem services in the marine environment.
- Objective 6: Expand and improve management of protected areas and species.
- Objective 7: Strengthen international governance for biodiversity and ecosystem services.

3. JUSTIFICATION FOR THE NEED OF MARINE PROTECTED AREAS

According to archaeological evidence, commercial fishing in England began around 1000 AD as evidenced by large increases in catches of herring and cod and later joined by haddock, ling, hake and saithe. This trend can also be observed elsewhere in Europe with increases in the capacity of cargo ships from 20t in 1000 AD to around 60t by 1025 AD, marking the beginning of trade of marine fish[11]. Commercial exploitation of the marine environment has therefore been practised for over 1000 years. This has caused an extraordinary decline in bottom-dwelling fish and unprecedented changes to benthic habitats especially since the industrialization of fishing in the nineteenth century. It has been estimated that predatory fish biomass has declined by 90% compared to pre-industrial levels which is thought to have caused immense shifts in benthic ecosystem structure and function[12;13;14].

Decades of fishing with trawls and scallop dredges have resulted in widespread destruction of benthic habitats. Many epifaunal species (those which live on the sea bed) are extremely vulnerable and slow-growing and some have the ability to form complex habitats which in turn harbour a wide array of biodiversity. One such example

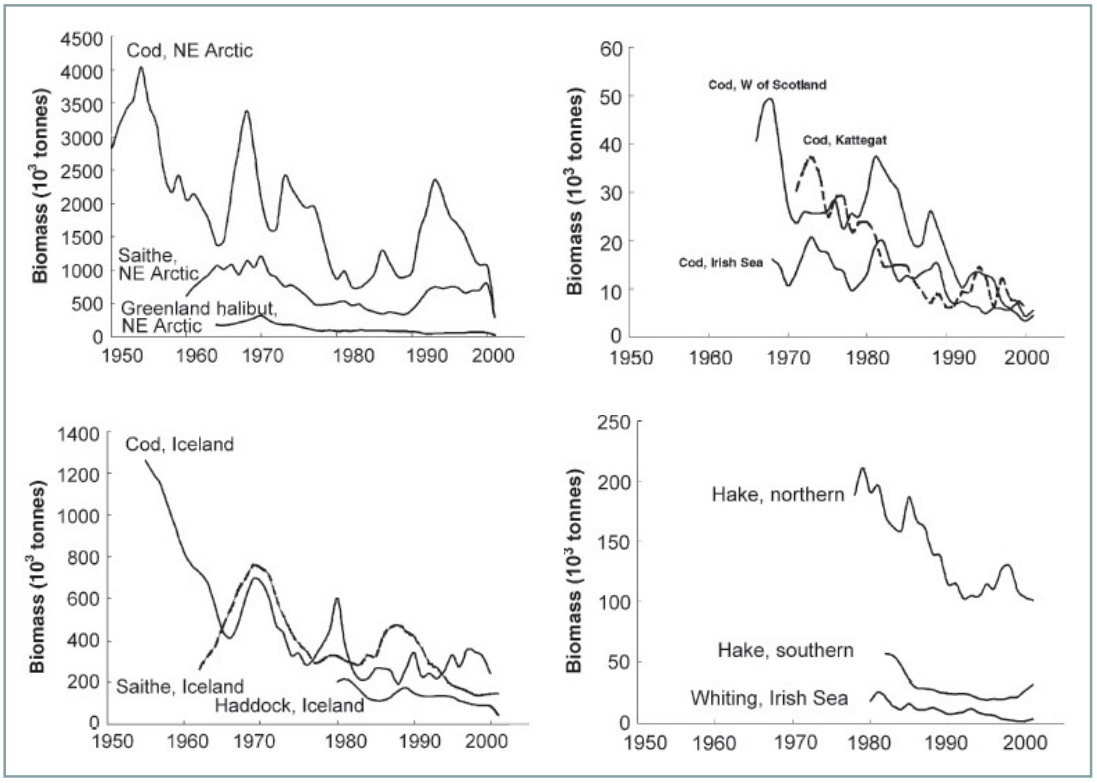

Figure 2: Biomass trend over time of some high-trophic fish stocks in the North Atlantic. Figures taken from Christensen et. al (2003)[13].

is the calcifying algae maerl which is often associated with the vulnerable bivalve *Limaria hians* or the horse mussel *Modiolus modiolus*. One study tested the impact of scallop dredging on sensitive maerl beds and found that live maerl was reduced by 70% after dredging took place, with no sign of recovery after four years. The authors also note that studying the long-term effects of fishing is difficult because of a lack of unmodified communities which would serve as control sites[15]. Other habitats impacted by structural damage from trawling include seagrass beds and coral reefs, but even on sandy or muddy sediments, trawling can significantly reduce biodiversity. Cold water corals are particularly vulnerable to structural damage due to extremely slow growth (2-25mm year-1 for *Lophelia pertusa*). They can be found all around the world at depths of around 50 to 4000 metres and are often caught as bycatch by trawls for deep water fish species[16;17]. West Ireland is home to particularly diverse and ancient coral reefs along the Porcupine Seabight which are at least 4500 years old[16].
In an effort to reduce the impact on deep water corals, bottom trawling has been banned in the EU below 800m depth and below 400m depth in areas with vulnerable marine environments.

With the extraction of resources taking place over such a long period of time and with ever increasing efficiency of fishing vessels which have access to deeper and previously out of reach fishing grounds, it can only be concluded that truly pristine marine habitats no longer exist. Centuries of biomass extraction in the form of fishing has altered marine ecosystems too significantly to say with certainty whether there are any untouched habitats left[18].

Fishing is but one of the many stressors that marine ecosystems face today. The marine environmental legislation mentioned in section 2 is the political response to decades of research into the many anthropogenic impacts that are threatening marine habitats. Scientists worldwide agree that a coherent network of MPAs under strict management can be a helpful tool to combat environmental degradation caused by fishing and other extractive activities, as well as increase the resilience of marine habitats to better cope with other stressors which lie beyond MPA boundaries[19;20;21].

3.1. Multi-use MPAs as tools for sustainable fisheries management

Many studies have investigated the potential of MPAs to increase fisheries yield. There are two ways in which this can be achieved, namely through larval dispersal in ocean currents and subsequent settlement on fishing grounds beyond MPA boundaries, or though density dependent spillover of juvenile and adult fish[22]. In particular, the protection of complex benthic habitats such as maerl beds or coral reefs can benefit local fishermen by protecting the nursery grounds of commercially valuable fish. Such ecosystems are of particular importance as they form the structural basis of the habitat upon which other vulnerable species depend. One example is the provision of brood-stock habitat for many bivalve species. It has been suggested that the protection of small areas of maerl habitat therefore has the potential to greatly enhance recruitment of juvenile scallops[23]. MPAs in Norway which offered complete protection to shellfish were surveyed over a period of four years after designation. They showed an increase of 245% in catch per unit effort of lobsters as well as an increase in body size of 13%. Furthermore, tagged lobsters from the MPA were later caught up to 22 km away from the site, showing that MPAs can help replenish nearby fishing grounds[24]. Significant changes were also observed in an MPA following the ban of benthic trawls and dredges in Lyme Bay, UK. The epi-benthic fauna showed substantial signs of recovery after three years of protection with measurable changes in species richness and abundance. Indicator species including the king scallop *Pecten maximus* and the bryozoan *Pentapora fascialis* were also recovering inside the MPA. *P. fascialis* is an important reef forming species which is known to increase the survivorship of juvenile fish in a similar manner to maerl[25].

Spatial protection by definition offers the most benefits to species with low mobility and high fishing mortality[24]. MPAs have been shown however to benefit highly mobile species as well. Maerl segments mixed with dead shells and rock crevices offer shelter to many prey organisms which in turn attract predator species. Shoals of juvenile cod have been observed feeding on Scottish maerl grounds where mortality of 0-1 year old fish was reduced significantly owing to the structural complexity of their surroundings[23]. One concern of size-selective fishing is that it can have evolutionary impacts on target species by altering growth and behaviour over time. Moland et. al (2013)[24] have shown however that MPAs can counter this trend and found a significant increase in size and density of cod after four years of protection.

Examples of maerl and cold water coral reef habitats. Images from Heriot-Watt University dive team and Roberts et. al (2006)[17].

3.2. No-take marine reserves as tools for sustainable fisheries management

The above mentioned success stories of marine protected areas are all examples of partial protection where some fishing activity is still allowed. Globally, 94% of all MPAs follow this model of a multi-use site. The most profound changes however can be observed in so-called no-take-zones or marine reserves which allow no extractive activities[26;27]. Any form of biomass extraction through fishing can have an effect

on ecosystem function through modification in fish assemblages. Fishing for the largest animal species, as is most often the case, results in changes of age structure, population size, abundance of predator and prey and ultimately in changes of whole food webs and ecosystems[14].

In the absence of fishing pressure, numbers of large predatory species would be expected to increase, which in turn would cause a decline in smaller prey species due to increased predation. Interestingly, this is not the case. Instead, the biomass of all trophic fish groups has been shown to increase significantly (between 40%-200%) in no-take marine reserves[28]. Spatial protection leads to changes in population structure in ways that promote replenishment. As the animals within the reserve grow larger over time, they also produce more eggs, are more successful at reproduction and produce fitter young[29]. Target species with low mobility such as scallops and lobsters were also shown to profit substantially from no-take zones in the UK. Dive surveys carried out in Lamlash Bay, a community-led marine reserve, showed significant increases in catch per unit effort (109%), weight per unit effort (189%) and carapace length (10-15 mm) of the European lobster *Hommarus gammarus*. Furthermore, scientists found twice as many berried lobsters within the reserve compared to outside, which shows that the reserve has a positive impact on productivitiy[30].

In a direct comparison of multi-use MPAs and no-take marine reserves, Lester and Halpern (2008)[25] found that no-take reserves had higher biomass, organism density, species richness and organism size in relation to partially protected areas. A meta-analysis of different studies found that the biomass of the whole fish assemblage is 343% greater within marine reserves compared to partially-protected MPAs[27]. A different study investigated the recovery of cod in an MPA where only hook-and-line fishing was allowed. While the annual survival of the species increased after MPA designation, they estimate that a full closure of the fishery would further increase survival of smaller individuals by 100% and that of larger individuals by 44%.
Few studies have directly compared partially protected MPAs to no-take-zones and any such comparison is always difficult due to a lack of comparable 'before' data. The studies that have compared the two MPA models however all come to the same conclusion which suggests that no-take marine reserves really do provide the best means of protection for biodiversity and are hence a good tool to help achieve sustainable fisheries management as well as Good Environmental Status under the MSFD[19].

In terms of non-target species, successful conservation through spatial protection measures depends on thorough scientific understanding of the species' distribution and life cycle. In order to tailor MPA performance to the protection of sharks, for example, more studies on habitat suitability are needed[31].

'*Only complete and permanent protection from fishing can protect the most sensitive habitats and vulnerable species. Only reserves will allow the development of natural, extended age structures of target species, maintain their genetic variability and prevent deleterious evolutionary change from the effects of fishing.*'[18]

4. MARINE PROTECTED AREAS IN A GLOBAL CONTEXT

In order to comply with legislation and international treaties, countries have increased the amount of protected areas within their waters substantially in recent years. The spatial extent of MPAs has increased from 2 million km² in 2000 to 25 million km² in 2018, or from only 0.7% to almost 7% of the world's oceans. The progress results mainly from a few very large MPAs being created or expanded. Examples include the Ross Sea Region Marine Protected Area with over 2 million km² in size, Marae Moana in the Cook Islands with nearly 2 million km² in size, and Papahānaumokuākea Marine National Monument in the USA which increased to just over 1.5 million km². Due to these large MPAs, much of the growth is also limited to very few countries. MPAs of the USA, France and the UK along with their overseas territories make up over 50% of the total protected area, with Australia, Cook Islands, New Zealand and Mexico covering an additional 30%[32].

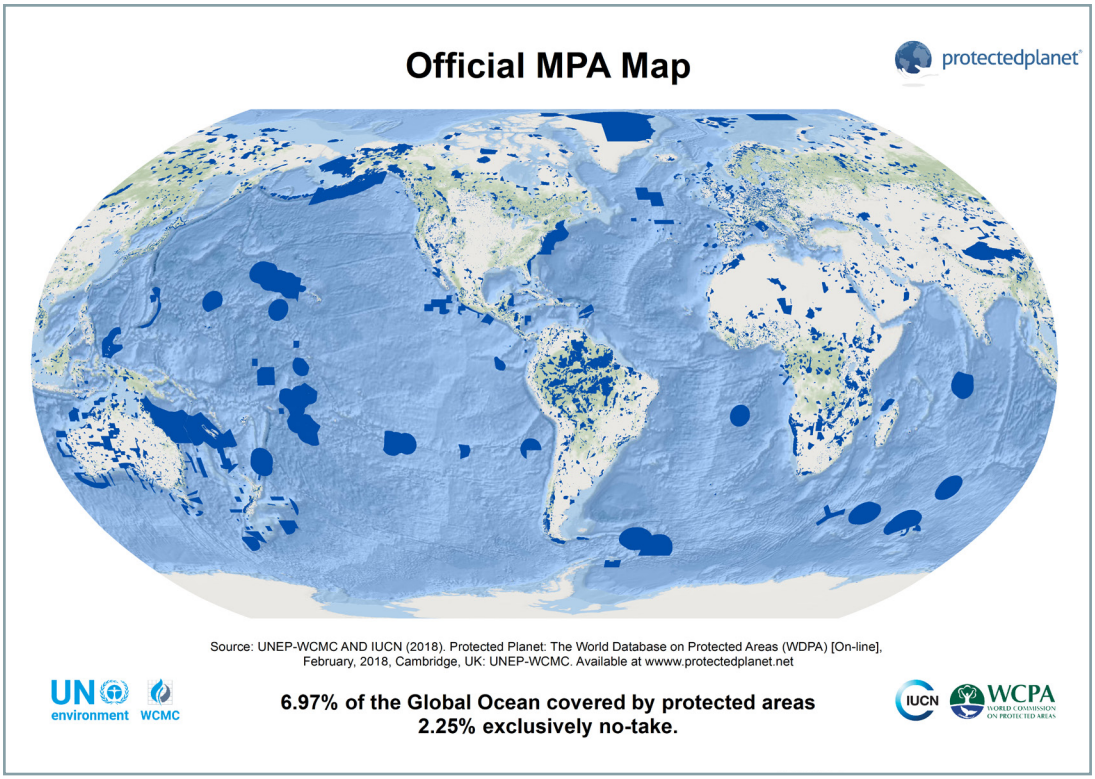

Figure 3: Official MPA Map published by UNEP-WCMC and IUCN (2018)[32].

Furthermore, most of the recent growth in MPA coverage is focused on national waters, where they can be more easily created by governments. Areas beyond national jurisdiction (ABNJ) make up 61% of the global ocean of which only 1.18% are protected, a figure which has not changed much in recent years. National waters represent the remaining 39% of global ocean, of which 16.03% are currently protected[32].

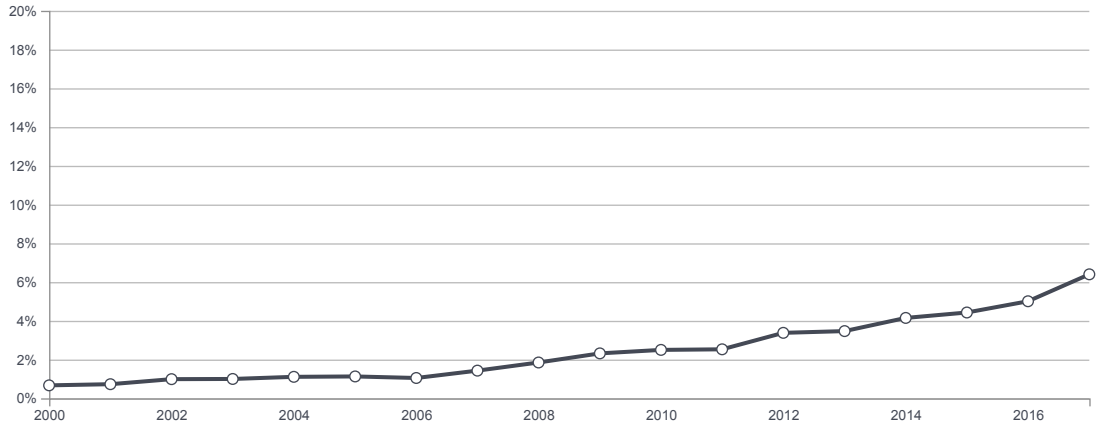

Figure 4: Total growth in MPA coverage from 2000 until 2016.
Taken from https://www.protectedplanet.net/marine

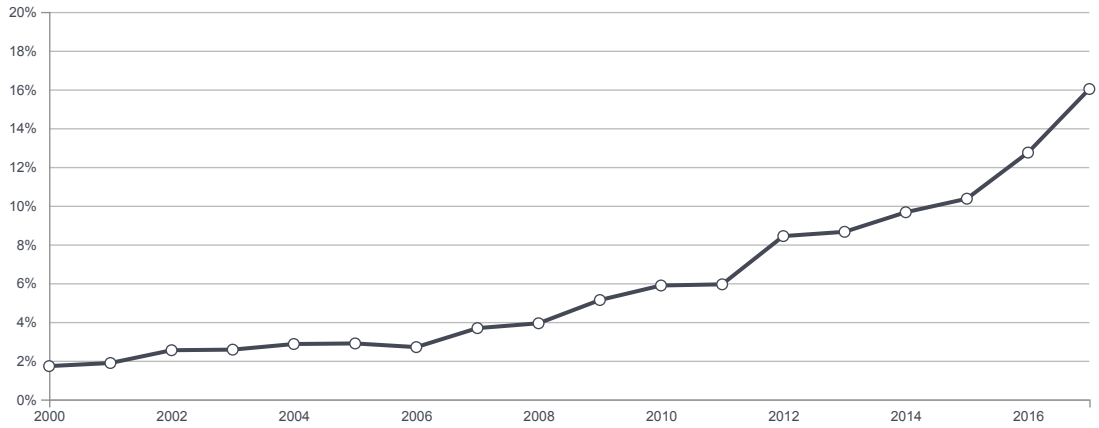

Figure 5: Growth of MPA coverage within national jurisdiction from 2000 until 2016.
Taken from https://www.protectedplanet.net/marine33

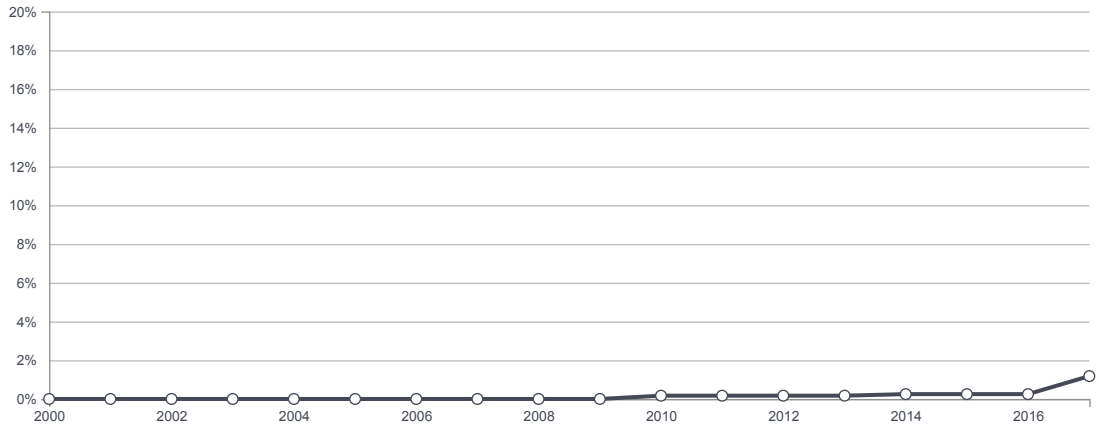

Figure 6: Growth of MPA coverage outside national jurisdiction from 2000 until 2016.
Taken from https://www.protectedplanet.net/marine

Table 1 shows the MPA coverage in several temperate marine regions sorted by percentage cover of total marine area. Many of those countries have already achieved the Aichi Target 11 of 10% MPA coverage of total marine area, with Germany, USA and Australia at the forefront with over 40% of protected area coverage. Ireland has protected a total of 2.33% of its' marine area, which includes SACs (Habitats Directive), SPAs (Birds Directive), MPAs (OSPAR), Ramsar Sites and UNESCO-MAB Biosphere Reserves however none of these is a no-take zone and none fulfils the EU definition of areas where nature conservation is the '*primary and clearly stated goal*'.

Table 1: Marine protected area coverage within national jurisdiction of several temperate marine regions as of April 2018[33].

No	Country	Total Marine Area (in km²)	Protected Areas (in km²)	Protected Areas (in %)
1	Germany	56,358	25,563	45.36
2	USA	8,591,493	3,526,708	41.05
3	Australia	7,432,133	3,014,345	40.56
4	Belgium	3,465	1,270	36.66
5	France	343,866	105,548	30.69
6	New Zealand	4,106,954	1,221,749	29.75
7	Netherlands	64,205	17,126	26.67
8	UK	723,405	192,756	26.65
9	Poland	31,946	7,211	22.57
10	Mexico	3,284,660	714,180	21.74
11	Estonia	36,346	6,768	18.62
12	Denmark	100,470	18,312	18.23
13	Latvia	28,880	4,631	16.04
14	Sweden	154,980	23,577	15.21
15	Chile	3,657,313	472,724	12.93
16	Finland	79,468	8,352	10.51
17	Italy	538,881	47,345	8.79
18	Spain	1,005,717	84,220	8.37
19	Japan	4,040,612	332,694	8.23
20	Global	362,317,963	25,253,562	6.97
21	Portugal	1,724,156	66,176	3.84
22	Argentina	1,083,151	41,127	3.8
23	Ireland	426,442	9,946	2.33
24	Korea	324,994	5,305	1.63
25	Greece	494,172	7,201	1.46
26	Canada	5,698,083	49,681	0.87
27	Norway	926,318	7,696	0.83
28	Iceland	752,784	2,863	0.38

4.1. Example of a coherent network of MPAs in California

As a response to overfishing in the 1990s, the state of California successfully implemented a science-guided, ecologically connected, coherent network of marine protected areas. The process behind this designation is now well documented by the scientists involved and can be used as a template for MPA designations elsewhere[34]. The process is briefly described here in order to illustrate the development and challenges of MPA designation.

The planning stage of the state-wide network of MPAs required almost $ 40 million in funding and nearly 7 years to complete[35]. Initial funding difficulty and negative stakeholder reaction were but two challenges that needed to be overcome. A private foundation finally agreed to fund the decision-making process which was then initiated and managed by an organization called MLPAI Initiative. The California coast was divided into five Study Regions with five separate science advisory teams (SAT) and regional stakeholder groups (RSG). A further advisory body, the Blue Ribbon Task Force (BRTF) was appointed by the state Secretary of Resources to oversee the integrity of the process and ensure that stakeholders reached a consensus. At the beginning of the planning stage for each Study Region, a regional profile was prepared which included ecology, human uses and economics in the area. Following this, scientific design guidelines were developed which included the minimum size and maximum spacing of MPAs. Spatial population models were created in order to measure how larval dispersal and fish movement might impact MPAs and fisheries yield.

A recommended network of MPAs was finally submitted to the California Fish and Game Commission. A Master Plan dictating the detailed procedures of the MPA design and process was developed during the planning process of the first Study Region which could be used for subsequent Study Regions[36]. Each Study Region took about three years from planning initiation to MPA implementation with the last one taking effect in 2013. The final network was comprised of 124 MPAs covering 16% of state waters, of which 61 MPAs were no-take reserves covering 9.4% of state waters[34].

The example in California shows that with high stakeholder participation, strong scientific input and smart spatial planning, the successful designation of a coherent network of MPAs including no-take marine reserves is possible[37].

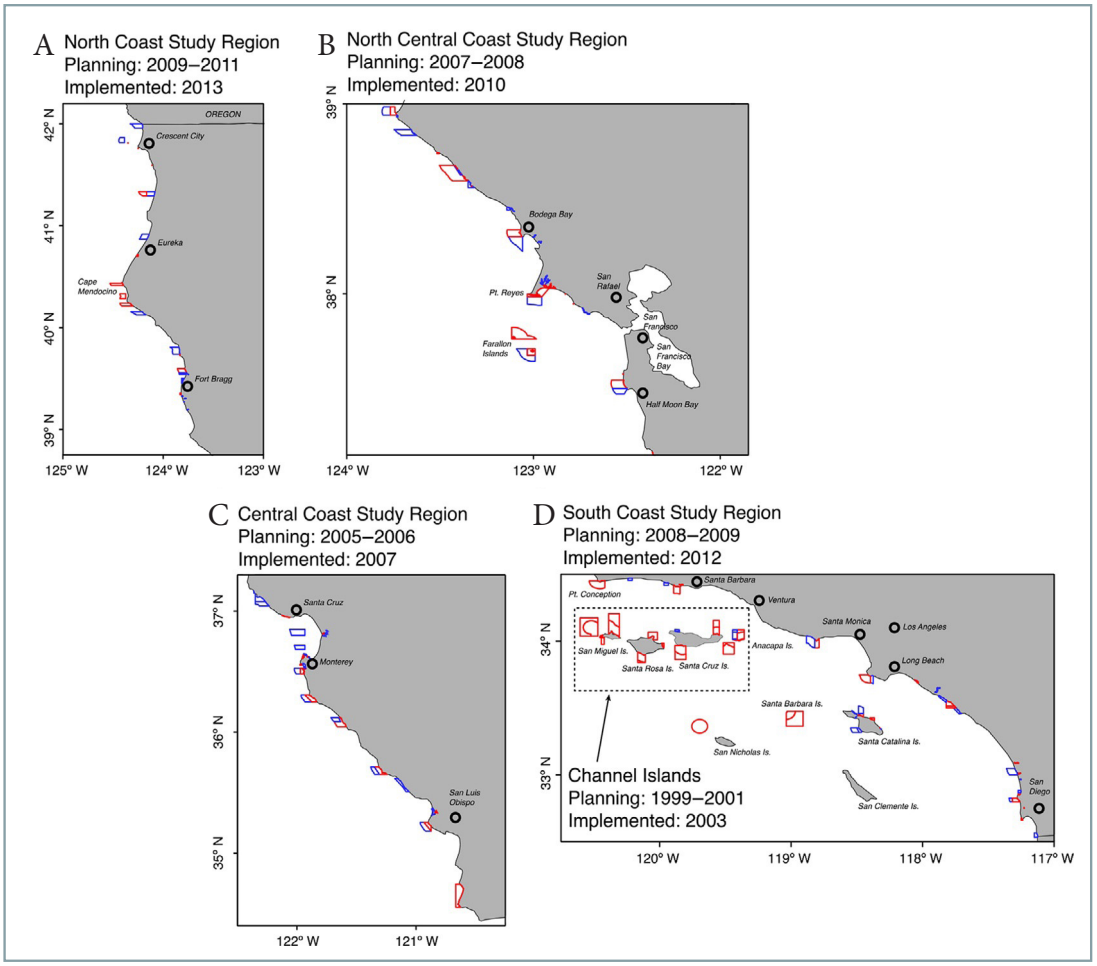

Figure 7: Maps of MPAs created in each of the Study Regions in California. No-take-zones are outlined in red, multi-use MPAs are outlined in blue and small circles are special closures for marine mammal haulout locations[34].

5. FUTURE VISION FOR MARINE PROTECTION IN IRELAND

This report has summarized the international commitments Ireland has made to establish a coherent network of marine protected areas within its waters by 2020. Furthermore, it has shown that such a network can have significantly positive effects on biodiversity and ecosystem function and can be used as a tool in sustainable fisheries management.

In a race to reach Aichi target 11 some concern has been voiced however that the designation of large isolated offshore MPAs with little enforcement will be favoured by some countries over the designation of highly protected, smaller, and spatially well designed networks of MPAs[14]. Historically, governments often preferred the protection of areas of low productivity, low economic interest or areas that are valuable for tourism and recreation, rather than places that are important for biodiversity[3].

Ireland is well behind other countries with regards to the percentage of marine area protected. This could be seen as an opportunity to rethink our marine protection and come out in front. Instead of falling into the trap of protecting large, biodiversity-poor areas, Ireland has the chance to invest in the future of our ocean wealth by following the example of California and putting time and money into good MPA design. Scientific advice is paramount and Ireland should support studies focusing on seabed mapping

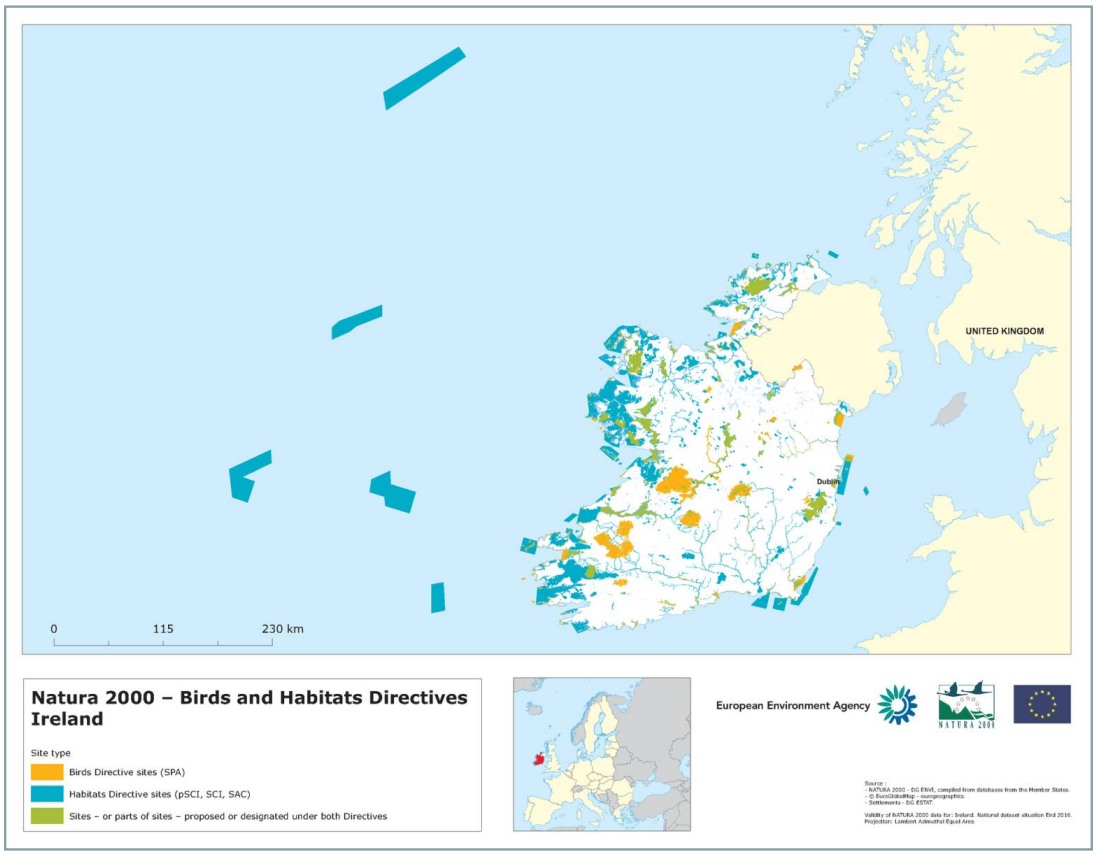

Figure 8: Current cover of protected areas in Ireland[47].

Why is a coherent network of MPAs so important?
A coherent network of MPAs ensures that habitats are ecologically connected and able to share genetic information. Genetic diversity contributes to adaptation of species to disturbances such as climate change and increases ecosystem resilience[38].

and site suitability modelling to ensure that future MPAs will be positioned in the best possible places for biodiversity. One study focusing on temporal dynamics of fisheries and bycatch found that a well-positioned network of MPAs in Australia had an impact on bycatch reduction[40]. Such studies highlight the potential of good MPA design to ensure the best possible impacts of protected areas for all marine species.

Several studies on MPA effectiveness have mentioned the importance of stakeholder participation throughout the decision-making process. While both bottom-up and top-down approaches are needed to achieve adequate protection, it has been shown that overall outcomes are improved when marine users are involved in the planning and design of MPAs[41]. As new technologies are made available, marine spatial planning will become more successful in satisfying all marine stakeholders while still maintaining rich biodiversity hotspots along our coasts[42].

A recent document published by IUCN '*Applying IUCN's Global Conservation Standards to Marine Protected Areas*' highlights many points made in this report. As mentioned in section 2.2, the ultimate goal of IUCN is to create a fully sustainable ocean of which at least 30% are designated no-take-zones as well as increased protection of the high seas. Furthermore, IUCN supplies elements and criteria that can be used to evaluate and improve MPA performance. It is clearly stated that area-based conservation measures only qualify as MPAs if the primary focus is the protection of biodiversity. Protected areas where the focus is on sustainable fishing, for example, do not qualify as MPAs. In addition it is noted that industrial activities such as mining, industrial fishing or oil and gas exploration are not compatible with MPAs[48].

The 2015 Paris Agreement is an additional international treaty of which Ireland is a signatory. This agreement demands significant cuts in greenhouse gas emissions in an effort to reduce average global temperature rise. What has been largely ignored so far is the fact that MPAs can play a crucial, low cost role in the mitigation and adaptation of climate change. The Oceans have absorbed approximately 30% of all anthropogenic CO2 emissions and therefore play an incredibly important role in climate regulation. MPAs should aim to protect habitats such as seagrass beds and kelp forests which absorb high amounts of CO2 in order to reduce atmospheric amounts of this greenhouse gas. In terms of adaptation, restoration of coastal habitats through MPAs can help reduce the impact of storms and coastal flooding, while networks of protected areas may act as stepping stones for species as they move towards polar regions in response to rising temperatures[43]. Furthermore, due to improved ecosystem health within MPAs, habitats become more resilient in the face of climate change and pollution[44].

Marine protected areas show incredible potential for habitat restoration and fisheries management. Unfortunately, spatial protection measures alone are not enough to combat all the anthropogenic impacts that our seas are facing today. Other tools must be used in conjunction with MPAs in order to improve ecosystem health in the marine environment and retain and improve the numerous ecosystem services. One option to reduce fishing impact would involve moving away from the TACs limitations described

in the CFP and instead introduce a real-time incentives (RTI) fisheries management approach. The Marine Institute is currently exploring whether fishing-impact credits (RTIs) could steer fishermen to avoid biologically sensitive areas as fishing in these areas would cost more credits. Fishermen may spend their spatiotemporally varying tariffs as they please and they can be updated based on real-time CPUE data. While this approach is far from being implemented, it could be a very useful tool to accompany MPAs in future fisheries management[45;46].

Ireland has a long journey ahead if it wants to become a country where '*biodiversity is valued, conserved, restored and wisely used*' while '*maintaining ecosystem services and delivering benefits essential for all people*'. With the right approach to marine environmental management however this vision set out in the CBD can soon become a reality.

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