Natural England Commissioned Report NECR065

# A recovery/conservation programme for marine species of conservation importance

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# Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

## Background

Natural England commissioned this project to provide an auditable, transparent methodology for prioritising marine species recovery programmes in the UK waters around England.

The aim of the work is to identify the conservation needs of all marine Biodiversity Action Plan (BAP), OSPAR and WCA species in English waters, that are not considered to be afforded sufficient protection by the forthcoming Marine Protected Areas network.

The results will be used by Natural England to improve our understanding the marine species that are most in need of targeted conservation action.

The report focuses on designing a prioritisation methodology that will be used to inform evidence based and transparent decision making regarding species recovery in the marine environment and where possible, suggests Specific, Measurable, Achievable, Realistic and Time bound recovery plans that should result in the relevant species becoming self-sustaining members of their ecosystems.

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**Further information**
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# Part 1 - Main Report

# Summary

This report summarises the work undertaken to identify which marine species, from Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006, are most in need of targeted conservation action and to prioritise species for such action. We have developed an evidence-base and methodology to inform decisions on the most appropriate conservation programme that should result in the relevant species becoming self-sustaining members of their ecosystems.

Species have been separated in to the following groups:

1) Species with no evidence of significant decline and/or that are likely to be protected by the UK Marine Protected Area (MPA) network and hence no further action is required.

2) Species that are likely to be protected by the UK MPA network but will require additional targeted action.

3) Species that are unlikely to be protected by the UK MPA network but where protection can be secured through wider measures in UK waters.

4) Species that are unlikely to be protected by the UK MPA network and are too far ranging for protection to be secured through wider measures in UK waters, and hence that require no further action for UK waters alone.

Those species that fall into groups 2 and 3 have been researched.

A 'Degree of threat' score was calculated for each species derived from the following measures:

- 'Decline' is based on knowledge of decline in the past or current 25 years. Decline is defined or determined within the 12 nm limit of British territorial seas.
- 'Rarity and scarcity'. Criteria for marine species are necessarily pragmatic and are via measurement of the number of 10km squares within the three mile limit of territorial seas occupied by the species (Sanderson, 1996). However, for highly mobile species such as cetaceans and large fish, existing measures have not been found but have been developed for this project.
- 'Extraction' (usually for consumption) is an important criterion as amount of extraction will affect potential for recovery.
- 'Conservation' refers to the percentage of a species occurrence that is or is likely to be within MPAs.
- 'Remoteness' is scored on the basis of accessibility of the locations where the species occurs.
- 'Visibility/catchability'. This criterion is used to indicate how easily a species can be found and caught if it is targeted for extraction or caught as bycatch.
- 'Protection'. This score relates to the degree of protection that a species has; whether under statute(s), listed in conventions and directives or is a UK Biodiversity Action Plan species.

Recovery/conservation potential was assessed as 'High' to 'Low' according to our understanding of:

- Biological and ecological limiting factors;
- Threats to the species existences (and therefore whether or not we can assess what action is needed) and;
- The management that is possible in terms of the management needed.

For each species researched, ‘Recovery/conservation goals’ were identified with ‘Management requirements and likely budget’.

Species were ranked according to their ‘Degree of threat’ and ‘Recovery/conservation potential’. The recovery/conservation plans for inshore seabed species were costed at £6,000 to £160,000, usually over a three year period. Large highly mobile species could often be combined into one costed programme with estimated budgets of £2,300,000 to £6,025,000.

We have not budgeted for commercial fish species which are the responsibility of fisheries regulators and fishermen, as Natural England does not have the relevant competencies.

We have not budgeted for enforcement which is part of the day-to-day duties of regulatory authorities.

Apart from specific measures for each species, we draw attention to wider beneficial general activities that should have a favourable effect on species in decline such as improvements in water quality.

We note that our knowledge of species occurrences and distributions is very poor in places and more survey work and maintenance of records is needed.

Many of the results of this exercise are pessimistic – both with regard to the degree of threat and the recovery/conservation potential. For commercially exploited species or species impacted by commercial fishing activities, we may know that recovery is possible but obtaining necessary measures is problematic. For non-commercial species and species that are not obviously being impacted by human activities, the poor outlook is generally because, although there has clearly been decline, we do not know (for certain) why.

There are many other species of conservation importance than the ones we have researched, and the project database can be added to and the ‘scoring’ system applied to those species.

Part 1 is the report and includes summarized conclusions. Part 2 includes dossiers for all of the researched species. The project database is supplied separately.

## Acknowledgments

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# 1 Introduction

## Background

1.1 Conservation effort for much of the 20th Century has been primarily concerned with protecting and managing wildlife under legislation which allowed the designation of special sites and the protection of certain species (for example, Wildlife and Countryside Act 1981).

1.2 During the past twenty years in particular, progress has been made to secure the future for marine wildlife in the waters around the UK with designated areas being established to protect our marine habitats and species. This protection has been through the establishment of European Marine Sites (EMS) which include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), the marine components of SSSIs and Ramsar sites, as well as forthcoming MCZs designated under the Marine and Coastal Access Act 2009. These designations along with national MPAs in the Devolved Administrations will all contribute to the UK Marine Protected Areas (MPAs) network. However, it is acknowledged that MPAs alone will not halt the decline in some of our marine wildlife or be able to provide protection for species threatened with decline. MPAs (in their current form) will only potentially provide very limited protection for highly mobile species except where breeding and feeding areas are protected.

1.3 In the early 1990s, it became clear that despite decades of nature conservation, populations of some plants and animals were continuing to decline and an increasing number were becoming endangered (Whitten 1990). In response to the Convention of Biological Diversity (CBD, 1992), the UK Biodiversity Action Plan (UK BAP, 1994) brought additional focus on restoration through the development of action plans that aimed to secure the recovery of the UK's most threatened habitats and species. From that time, programmes of action for species have been pursued in a more structured and systematic way for terrestrial species and, to a limited extent, for some marine species.

1.4 In 2008, the England Biodiversity Group published a new framework "Securing biodiversity" (Natural England 2008) to drive the work on priority BAP species and habitats in England. The framework aims to build on the strengths of the UK BAP, promote habitat-species integration, embed an ecosystem approach and climate adaptation principles in conservation action.

## Marine species conservation programme

1.5 In Natural England's capacity as lead delivery body for England's Biodiversity Strategy (EBS), 'species conservation programme' is currently developing to objectively assess conservation priorities and identify appropriate delivery mechanisms and accountabilities for the achievement of the biodiversity targets. To date, much of this work has focussed on recovery in terrestrial plant and animals. Natural England has identified that a similar approach is desirable for marine species and such an approach has been developed through the work described here.

1.6 Work has already been undertaken to identify actions for Biodiversity Action Plan species (see http://www.ukbap.org.uk/UKPrioritySpecies.aspx). However, that work has not characterized degree of threat or recovery potential as an aid to prioritizing action.

1.7 Our starting point was the approach developed and trialled by Whitten (1990) that was predominantly for terrestrial species although it did include some marine species. Such an 'adopt and adapt' approach takes advantage of the thinking already applied to terrestrial

conservation but also takes account of the differences that exist in the marine environment (see Appendix 1).

## Aims of the project

1.8 This project was designed to deliver an objective assessment of how to deliver the conservation needs of all marine BAP, OSPAR and WCA species (herein referred to as species of conservation importance or SOCI). The overall aims of the project were to:

- To enable Natural England to better understand those marine species which are most in need of targeted conservation action in light of their acknowledged conservation threat status.
- To develop an evidence base and methodology to inform decisions on the most appropriate conservation programme that will result in the relevant marine species becoming secure, self-sustaining members of its ecosystem
- To develop a tool that will be flexible to incorporate new information as and when it arises, and to be able to adapt priorities as a result of these changes.

1.9 This project also aimed to identify marine species for potential recovery/conservation programmes and allocate them into the following four categories:

1) Likely to be protected by the Marine Protected Area (MPA) network.
2) Those species that are likely to be protected by the MPA network but will require additional targeted action.
3) Unlikely to be protected by the MPA network but can be secured through wider measures.
4) Unlikely to be protected by the MPA network and too far ranging to be secured through wider measures.

## Objectives for recovery and conservation

1.10 The contractors considered how best to identify objectives for recovery and conservation. Species that have been identified as having declined or are threatened with decline should ideally be restored to, where known, their previous 'natural' abundance and extent or maintained (in the case of species that are threatened with decline) at their current status. However, for many species, such an objective is unrealistic because their habitats have disappeared, the decline has been due to natural environmental variability or they are an exploited species. Identifying "previous natural abundance and extent" is also problematic as our knowledge of past abundance and occurrences, except for some commercial or charismatic species, is poor. Recovery or maintenance of a population of some species is no doubt feasible but in many cases, the best approach might be that promoted in Whitten (1990):

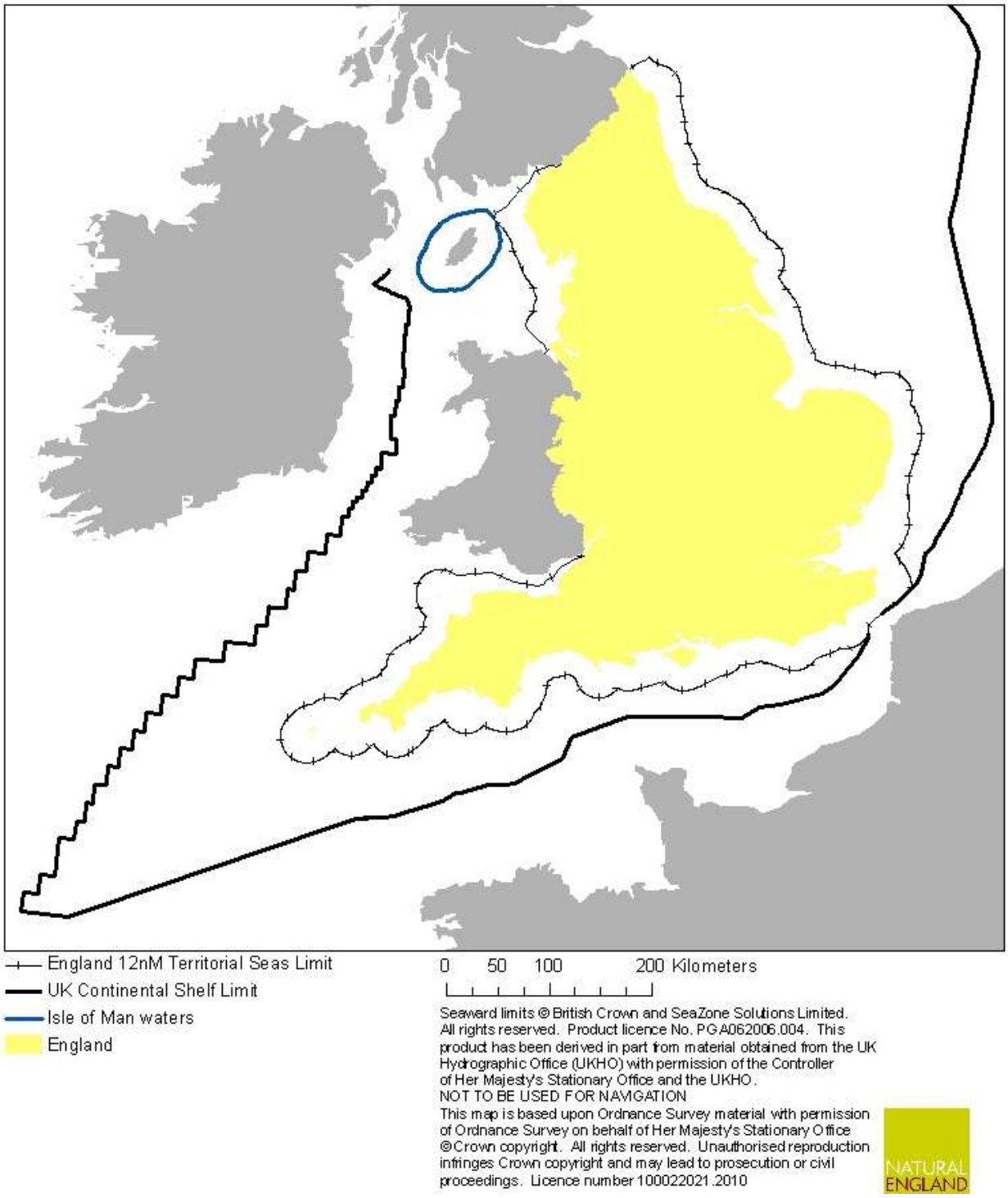
1.11 *"The Proposed Recovery Programme suggests means by which each of the scheduled species would become a secure, self-sustaining member of its ecosystem, and thus be considered for removal from the schedules".* In the context of marine species, few of which are part of the "schedules" in the W&C Act, we should refer to "Designated species".

## Mechanisms for recovery and conservation

1.12 There are three broad legislative approaches to consider:

1) Applying appropriate protection measures (ranging from voluntary to statutory) to locations where a declining or threatened species occurs. Sire-based measures are applied, for non-bird species, within intertidal Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) and Marine Conservation Zones (MCZ) in English waters. The statutory measures include for example fisheries bye-laws or the withholding of licenses for waste disposal, construction etc.
2) Scheduling a species for protection, wherever it occurs in UK waters, through schedules 5 and 8 of the Wildlife and Countryside Act 1981 (W&C Act) in Great Britain. The W&C Act seeks to protect species that are "in danger of extinction in Great Britain or likely to become so endangered unless conservation measures are taken" and also species for which the UK has international obligations. The protection extends throughout Great Britain and out to the 12 nautical mile (nm) limit of territorial seas.
3) Regulation of fisheries where a species has been made locally extinct in an area or where the species is being extracted at an unsustainable level or where the habitat of any species is being damaged by fishing practices. The UK has full control of fisheries management within the 6nm limit within some constraints (see point 1, 'fisheries bye-laws'). Between 6 and 12 nm, historic fishing rights, where foreign vessels legitimately operated within other Member States' waters, apply and competence is jointly (national and EC) held. Beyond 12 nautical miles and in relation to commercial species or to commercial fisheries, the European Common Fisheries Policy (CFP) currently provides the overarching framework for the regulation of Europe's commercial marine fisheries and, in the case of developing a species recovery programme for a fish species, the UK would work through European or international bodies.

1.13 Furthermore, the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list (the "S41" list) of species and habitats that are of principal importance for the protection of biodiversity. The list includes BAP marine species and habitats and is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the Act, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.




The provisions of the Wildlife and Countryside Act 1981 extend throughout the 12 nautical mile limit of UK territorial seas but not into the British Fisheries Limits or the UK Continental Shelf Area. The provisions of the Marine and Coastal Act 2009 can be applied throughout the UK Continental Shelf limit.

**Figure 1** Map of England (yellow) showing the 12nm territorial seas limit and the UK continental shelf limit

# 2 Methodology for the recovery / conservation plans

## Selecting species for trial

2.1 For the study, we referred to lists of species already identified to aid the design of the MPA network currently being developed in English and offshore waters as described in the Ecological Network Guidance (ENG) for the Marine Conservation Zone (MCZ) Project (Natural England and the Joint Nature Conservation Committee, 2010). These include: UK Biodiversity Action Plan Priority Species (2007), most OSPAR threatened and/or declining species and species listed on Schedule 5 of the Wildlife and Countryside Act (W&C Act) 1981. These species are, by definition, of 'principal importance' for the conservation of biodiversity in England.

2.2 In total, 67 species were initially selected for this exercise and are referred to throughout this report as marine Species of Conservation Importance (SOCI). All species selected are found within the 12 nautical mile limit of territorial seas around England[1] (see Figure 1). Species are of low or limited mobility and occur in England (Table 3 of the ENG) together with three highly mobile species (where spawning nursery or foraging areas may be represented in the MPA network) (Table 4 of the ENG). We have excluded anadromous fishes, birds and vagrants.

## Identification of species for recovery/conservation plans

2.3 Four categories were identified to establish which species should be researched for a potential recovery/conservation programme. They were:

1) **'No evidence of significant decline and/or likely to be protected by the UK Marine Protected Area network, no further action required'** If Marine Protected Areas provide adequate conservation management for Features Of Conservation Importance (FOCI) including any action to aid recovery of declining species, then a recovery/conservation plan may not be needed. This assumption encompasses species that are rare or listed for protection on Schedule 5 of the W&C Act, are OSPAR threatened and/or declining species, or are BAP species but there is no evidence of decline in their numbers. Our assumption is that, for the limited mobility taxa, the quantitative targets in the ENG for number of MCZs with populations of those taxa will be achieved and, providing a species occurs in the relevant region, there will be populations of FOCI represented in three to five of the MPAs (SSSIs, European Marine Sites, RAMSAR and MCZs together) in each regional project area that contribute to the network of MPAs. Furthermore, the ENG provides an indication of minimum viable patch diameter for species of conservation importance and our assumption is that will be achieved within MCZs. All MPAs will have conservation objectives and public authorities will identify measures to ensure species and their habitats are protected. If those assumptions are met, some species can be considered adequately protected by the MPA network and no further action is required for their recovery/conservation.

2.4 However, some low mobility species that have achieved the quantitative criteria for inclusion in the MPA network may still require additional targeted action and they are defined next.

[1] The authors acknowledge that action(s) may need to extend beyond this limit

2) **'Likely to be protected by the UK MPA network but will require additional targeted action'** There will be situations where the life history traits or the distributional characteristics of species mean that, to ensure recovery or conservation, additional measures (such as protection wherever they occur) will need to be taken in addition to protection within MPAs. The tests to establish which of the species to be protected within MPAs will also require additional targeted action are:

a) the species occurs within existing MPAs with adequate protection but continues to decline or is threatened with a decline in abundance or extent;
b) the species has resident populations within MPAs but a significant part of the population is wide-ranging or migratory;
c) occurrence within a MPA is dependant (or is likely to be dependant) on recruitment from populations outside of the MPA;
d) the distribution of the species, and especially location of resident populations, is poorly known and new locations may be found deserving protection of the species;
e) the species is highly sensitive and populations are unlikely to return if lost; and
f) there is uncertainty about breeding, recruitment, longevity and other life history traits so that research is needed (an 'additional measure') into those traits.

3) **'Unlikely to be protected by the UK MPA network but protection can be secured through wider measures in UK waters'.** Species that fall into this category are generally highly mobile species or species with a variable or poorly understood distribution and significant populations occur in the UK. They can be protected through scheduling against being taken, landed or sold or by restrictions on catches in the case of commercial species.

4) **'Unlikely to be protected by the UK MPA network and too far ranging for protection to be secured through wider measures in UK waters, no further action required for UK waters alone'**. These are species where the great majority of their population occurs outside of UK waters and measures taken in English waters will have little impact on their conservation.

2.5 This project is targeted at species that will need additional or different measures to those developed as a part of MPA management and we have not questioned whether management measures in an MPA or MPAs in general will protect a particular species when considering if MPAs are a suitable protection measure.

2.6 The full list of selected species and their categorization according to the above considerations is given in Appendix 2. Those species that corresponded to categories 2 and 3 above were researched to establish measures, likelihood of success and costs.

2.7 There are three species that were originally listed for research but that have not been included in the exercise:

- The sea anemone *Edwardsia ivelli*, has not been recorded in England since 1985, may be extinct and therefore did not qualify as occurring in English waters. This species has not therefore been researched although it would be wise to keep on looking for it.
- The amphipod crustacean *Gitanopsis bispinosa* has not been recorded from English waters and therefore did not qualify.
- The dog whelk *Nucella lapillus* was originally included as a BAP species because it had conspicuously declined as a result of the use of tributyl-tin antifouling paint, which is now banned. The species is widespread and abundant on rocky shores almost everywhere, although it is still absent from a few enclosed locations where it once occurred. *N. lapillus* lays eggs on the shore that produce 'crawl-away' young so dispersal via planktonic larvae does not occur. Nevertheless, the species is no longer in decline and its characteristics do

not correspond to any of the four categories used to assess which species should be included in recovery/conservation plans. The species has not therefore been researched.

## Overall methods

2.8 Once species were identified as those to be considered for action, we then established what the action would be, the likelihood of success, and the likely cost.

2.9 The starting point for this work is the methodology described in Whitten (1990). We have used the Ecological Network Guidance for the MCZ project in England (Natural England and Joint Nature Conservation Committee, 2010) to identify species for research and used up-to-date methods and information resources for entering, accessing and displaying data and information, and for identifying conclusions. We have:

1) reviewed the methodology outlined in Whitten (1990) and interpreted it for our knowledge of marine species and for the activities and processes that affect them;

2) developed a database for entering relevant data and information using the terminology of Whitten (1990) with additions;

3) undertaken an initial sift to exclude species from research that fell into selection categories 1 and 4;

4) researched and described distribution of the species for English waters, the UK Continental Shelf and globally;

5) described aspects of ecology that are relevant to assessing vulnerability, life history etc.

6) included a subsection on 'Relevant biological traits' (from www.marlin.ac.uk/biotic) under 'Ecology' as such traits (where known) will inform any action that may be possible but also whether decline might be natural and part of some inherent characteristic of a species;

7) included a subsection on 'long-term natural fluctuations' under 'Ecology' as some species may show decadal scale variation in abundance driven by natural processes;

8) catalogued existing conservation status as the 'designations' from a marine subset (with additions for Nationally Important Marine species and Rare Algae) of the JNCC 'Designated Taxa' spreadsheet (see www.jncc.gov.uk/page-3408);

9) used the 'activities-factors' matrix developed by MarLIN as a thesaurus to identify sources of threats;

10) re-calculated rarity of researched seabed species using the measures outlined by Sanderson (1996);

11) researched how rarity is assessed for large mobile species to, if possible identify a meaningful indication of their rarity in English and adjacent waters;

12) researched and identified existing knowledge of decline and threat of decline and established a scoring system (described under 'Criteria') to rank 'Degree of threat';

13) applied criteria (described under 'Criteria') to rank 'Recovery potential';

14) re-considered whether a species qualified for consideration for a recovery/conservation plan and re-assigned some to selection categories 1 and 4;

15) set a ‘Recovery/Conservation Goal’ that is realistic given the results of research undertaken but which aims, wherever possible, to ensure that a species recovers to or remains in a ‘Least Threatened’ category; and

16) identified likely management requirements for the species and how much they might cost to implement.

2.10 A dossier-style information sheet was prepared for each researched species. Information on degree of threat and recovery/conservation potential was used to rank species in terms of importance/feasibility of action and estimated costs for different actions to inform any action that might be taken.

2.11 The identification and costing of management requirements caused some difficulty as many *types o*f management are the responsibility of fisheries regulators and many fisheries measures (especially changes of gear) are very expensive to implement. Those types of action were considered to be part of ongoing fisheries conservation and regulation and no attempt was made to cost them.

## Commercial fish species

2.12 Many commercially fished species are under similar threats to each other and therefore the action needed for each is similar. The action is in the form of fisheries measures rather than nature conservation regulation. Those species are not generally in danger of overall extinction but are or may be being fished beyond sustainable or ‘Safe Biological Limits’. The original Biodiversity Action Plans states:

*“The stocks of immediate relevance are those for which the International Council for the Exploration of the Seas (ICES) scientists` assessment is that they are below Safe Biological Limits (SBL). SBL is an assessment based on a range of biological reference points varying according to the quantity and quality of the scientific data available. Furthermore, this grouped action plan reflects the fact that the majority of species are caught in mixed, i.e. multi-species, fisheries rather than directed single species fisheries. It also recognises that individual stocks can fluctuate around SBL in response to inter-annual variations in fishing activity and natural processes.”*

2.13 Where commercially caught fish species are listed under section 41 of the NERC Act 2006 and are suffering as a result of targeted fisheries, we have considered them together. The species (which are those listed in the original Biodiversity Action Plan (BAP) and in the current BAP except for *Hippoglossus hippoglossus* and *Ammodytes marinus* as a ‘Grouped plan for commercial marine fish’) are:

| | |
|---|---|
| Sand eel | *Ammodytes marinus* |
| Herring | *Clupea harengus* |
| Cod | *Gadus morhua* |
| Atlantic halibut | *Hippoglossus hippoglossus* |
| Whiting | *Merlangius merlangius* |
| European hake | *Merluccius merluccius* |
| Plaice | *Pleuronectes platessa* |
| Mackerel | *Scomber scombrus* |
| Sole | *Solea solea* |
| Horse mackerel | *Trachurus trachurus* |

2.14 Two species, the angler-fish *Lophius piscatorius* and ling *Molva molva*, are described as ‘Deep-water fish’ in BAP but are in fact wide-ranging species that occur in shallow inshore as well as deep offshore waters where the main fisheries for them occur. They are added to the list above. The sand eel *Ammodytes marinus* is a semi-pelagic fish and has therefore been added to the list above.

2.15 The total list is separated into demersal and pelagic fish (*Ammodytes marinus* is included in pelagic fish) to reflect the main fishing techniques used to catch them.

Demersal fish or fish caught by bottom-fishing gear

| | |
|---|---|
| Cod | *Gadus morhua* |
| Atlantic halibut | *Hippoglossus hippoglossus* |
| Whiting | *Merlangius merlangius* |
| European hake | *Merluccius merluccius* |
| Plaice | *Pleuronectes platessa* |
| Sole | *Solea solea* |
| Angler-fish | *Lophius piscatorius* |
| Ling | *Molva molva* |

Pelagic fish

| | |
|---|---|
| Herring | *Clupea harengus* |
| Mackerel | *Scomber scombrus* |
| Horse mackerel | *Trachurus trachurus* |
| Sand eel | *Ammodytes marinus* |

2.16 All of these commercially exploited fish are wide ranging and occur extensively outside of UK territorial waters, although some may have spawning areas in UK waters.

2.17 Research into commercial fish species has been limited to basic information and assessment of 'Degree of threat' and 'Recovery/conservation potential' done for all.

2.18 The European smelt *Osmerus eperlanus* is and inshore and estuarine species and has been considered separately.

# Assessing 'degree of threat'

## Introduction

2.19 Assessing 'Degree of threat' is an important first stage in identifying species that should be considered for protection. Appendix 4 of Whitten (1990) identifies factors for assessing 'Degree of threat' and a scoring system for those factors for terrestrial species. The following text describes how that approach has been 'marinised'.

2.20 Ideally, species should be assessed for 'Risk of extinction' against IUCN criteria (Appendix 3) including on a regional (Great Britain) level (IUCN, 2003). However, for many marine species especially for which there are no quantitative measurers of decline, other more practical ways of assessing 'Degree of threat' that are not so dependent on measures of decline need to be identified. Furthermore, in identifying how IUCN criteria can be used for regional assessments, IUCN (2003) observe:

*"The purpose of the Red List categorization is to produce a relative estimate of the likelihood of extinction of the taxon. Setting conservation priorities, on the other hand, which normally includes the assessment of extinction risk, also takes into account other factors such as ecological, phylogenetic, historical, or cultural preferences for some taxa over others, as well as the probability of success of conservation actions, availability of funds or personnel to carry out such actions, and legal frameworks for conservation of threatened taxa."*

2.21 The work described here is about setting conservation priorities and, although wherever available, IUCN Red List categories for species provide one of the starting points for identifying threat, identifying degree of threat in Great Britain and prioritizing for action

employs national criteria which are both those of Whitten (1990) and more recent development of criteria in relation to the identification of UK BAP Priority Species including of criteria for marine species (used in 'Decline' below and see Appendix 4). Therefore assessment of conservation priorities in the work described here uses Whitten (1990) as a starting point and 'marinises' the criteria according to those agreed for marine species and described in Hiscock *et al.* (2006) and additional interpretations developed for the work described here. We have added a category for 'Protection' as the criteria in Whitten (1990) do take account of whether a species is protected in statutes, directives and conventions but such protection should reduce degree of threat.

2.22 In the database, 'Decline' and 'Rarity' have their own pages, Extraction, Conservation, Remoteness and Visibility/Catchability are on the 'Degree of Threat' page and Protection is on the 'Status page.

2.23 The 'Degree of threat' score for each species is therefore derived from the measures of:

- Decline;
- Rarity and Scarcity ('Number of locations' in Whitten, 1990);
- Extraction ('Attractiveness' in Whitten, 1990);
- Conservation;
- Remoteness;
- Visibility/catchability ('Accessibility' in Whitten, 1990); and
- Protection.

2.24 Criteria for assessing rarity of marine mammals have not previously been developed. The lack of a rarity measure is perhaps due, in part, to lack of knowledge of population size and location and in part due to populations being wide ranging and, therefore, the numbers present at any one time in any one location being very difficult to assess. Another issue, which can also be applied to the criteria for benthic species (Sanderson, 1996), is that abundance is not incorporated if occupancy of 10 km squares is used: there may be one individual or millions (for example, some benthic invertebrates) in a 10 km square but the contribution to rarity assessment is the same.

2.25 The criteria outlined by Sanderson (1996) were designed for inshore areas, not least because that is where the majority of survey data for benthic species exists. Cetaceans are wide-ranging and, although they do occur in inshore waters, it is far more relevant to identify rarity for the UK Continental Shelf.

2.26 A further problem with wide-ranging species is that a 'false' idea of occurrence is given by simply mapping locations where they have been reported. Inevitably, at any one time, they will be present in only a small proportion of the squares they have been reported in over time.

2.27 Another consideration is that a wide-ranging species may regularly enter the 12 nm limit of territorial seas (and therefore fall within the 'jurisdiction' of Natural England and of other national regulatory authorities) but may also spend large amounts of time outside that area. Those species need to be protected and appropriate action for conservation taken wherever they occur so that they continue to occur within English waters. Their abundance within UK (or English) territorial seas is not as relevant as their wider abundance in the NE Atlantic region and therefore abundance relevant to English waters should be assessed more widely and on this larger scale and not according to a political boundary, although measures that are available refer to 'UK waters'. This consideration is catered for in the measure of 'Approximate proportion of world stock in UK waters'.

2.28 A separate methodology was therefore developed to assess rarity for wide ranging mammal species but maintaining continuity of terminology with the work of Sanderson (1996) which, in turn, was based on the quantitative measures used for terrestrial species.

2.29 The methodology for assessing rarity in highly mobile species is outlined in Appendix 5 and aims to take many more factors into account, all of which could have some bearing on whether a species is to be considered 'rare'.

2.30 The assessment (scoring) system is summarized below and compared with that developed by Whitten (1990) in Appendix 6.

## Decline

2.31 The measure of decline requires a long history of systematic geo-referenced recording which is very unlikely to be available for most seabed marine species. For commercial fish species, landings can be used as a proxy for decline but caution should be applied in doing this as quotas may affect targeting and quota-induced discarding may be occurring at sea. Also, 'fashions' change in terms of desirable fish and landings data will be affected. Decline in abundance is also important especially for some seabed species where new survey work is turning-up new locations leading to apparent increases in 10km squares occupied.

2.32 The criteria used for marine species (the BAP selection criteria described in Hiscock *et al.* 2006 and in Appendix 4) follow:

1) International threat – global or European threat according to international criteria.
2) International responsibility & moderate decline in the UK – the species has declined by more than 25% in the past 25 years in the UK if the UK supports 25% or more of the global or European population.
3) Marked decline in the UK – a species which has declined by 50% or more over the past 25 years (measured or deduced).
4) Other important factor(s):
    a. It is predicted that the species will decline by 50% in a current or next 25 year period.
    b. The species is believed to be long-lived (>25 years) with low recovery potential and, if action not taken to reverse current trends, is likely to become extinct in the next 100 years.
    c. The species is declining and is a good 'indicator' that represents an issue causing problems for other species. The species may represent a unique or favoured habitat or food for a BAP species.
    d. The species is known to have been more abundant and widespread in the recent past and population now not likely to be viable in the long term.
    e. The species is threatened globally or in the European seas so that the UK could become a 'stronghold'.

2.33 The above measures are converted into practical criteria relevant to application within the 12 nm limit of British territorial seas and scored as follows:

- 0 = Decline not believed to have occurred in extent or abundance or less than 25% in the past 25 years (includes expert judgment).
- 1 = Species that have declined in abundance or extent by more than 25% in the past 25 years (includes expert judgment).
- 2 = It is predicted that the species will decline by 50% in abundance or extent in a current or next 25 year period (includes expert judgment) OR 'Other important factors' listed above.

## Rarity and scarcity

2.34 Rarity is often used as a surrogate for degree of threat. Whitten (1990) recognizes that there are different forms of rarity and that needs to be considered when species are identified for protection. The categories transfer across well to the marine environment and are 'marinised' below:

- Species that are restricted to certain climatic or habitat conditions and which are therefore rare. Such species will include edge-of-range in Britain or require a very specialised habitat that is itself very restricted in occurrence. Such species would be classed as 'rare' even in the absence of human interference.
- Species that are rare because their natural habitat has been destroyed or altered so much that it is no longer available or suitable for them.
- Species that have been directly and relentlessly exploited by man.

2.35 Species that are rare because of climatic or other environmental conditions qualify for protection because, although they might be more common elsewhere geographically, they are an important part of the British fauna and flora and their rarity makes them susceptible to damage.

2.36 Although habitat damage or destruction occurs in the marine environment (via, for instance, port construction, causeway construction, dredging, infilling of lagoons etc.) and local extinctions have no doubt occurred, such activities are not believed to have increased rarity *per se*.

2.37 There are many marine species that have been reduced in abundance because of exploitation by man and some species of cetaceans, fin fish, and some shellfish are particularly notable examples. Some of those would now be classed as rare or scarce but many are declining in abundance, which is addressed under 'Decline' criteria.

2.38 Some species may be naturally 'rare' and have always been thus.

2.39 Criteria to assess 'rarity' for marine species are necessarily pragmatic and are via measurement of the number of 10km squares within the three mile limit of territorial seas occupied by the species (Sanderson, 1996). However, for highly mobile species such as cetaceans and large fish, existing rarity measures have not been found and it seems that is because the sizes of populations are, for the most part, unknown (Dr J. Reid, pers. comm.).

2.40 Assessment based on personal knowledge can be used and the following criteria (the BAP/NIMF criteria but adding scarcity) are scored as follows:

- 0 = Species uncommon or widespread (recorded from more than 55 10 km squares within the three mile limit of territorial seas around Britain or expert judgment further offshore).
- 1 = Species nationally scarce (recorded from 9-55 10 km squares within the 3 mile limit of territorial seas around Britain or expert judgment further offshore).
- 2 = Species nationally rare (recorded from 1-8 10 km squares within the 3 mile limit of territorial seas around Britain or expert judgment further offshore).

2.41 Where assessment was carried out using the SMRU Ltd criteria for assessing rarity in highly mobile marine species, scores were assigned as follows:

- 0 = Species uncommon or widespread (total score of 0 – 30)
- 1 = Species nationally scarce (total score of 31 – 40)
- 2 = Species nationally rare (total score of 41 – 60)

## Extraction

2.42 Marine species are very rarely collected for decorative purposes and home aquaria for temperate marine species are not a popular pastime. This criterion therefore refers to collection for consumption of edible species, both commercially and by the public and within the 12nm limit of British territorial seas. If there was any increase in, for instance, interest in temperate marine aquaria, this criterion could be applied to non-edible species. Scores are allocated as follows:

- 0 = not taken.
- 1 = taken occasionally, commercial and/or recreational take OR take highly regulated to preserve stocks – take retained or, if returned, unlikely to survive.
- 2 = taken frequently, commercial and/or recreational - take retained or, if returned, unlikely to survive.

## Conservation

2.43 Measures for marine species refer to sessile or low mobility species including species that are highly mobile but stay in a limited area (for instance, some fish species). The ENG for MCZs requires 3-5 locations to be identified for each species of conservation importance where they are present within each Regional Project area. Whilst protection and opportunities for recovery will be accommodated in those MPAs, they may only be a small percentage of the known occurrences of a particular species. The approach used by Whitten (1990) is retained (percentage of occurrences within sites designated for nature conservation purposes) and can be applied to marine species within the three mile limit of territorial seas as there is reasonable survey coverage there.

2.44 At the time this work was being carried out, many sites were candidate or possible SACs and the provisions for MCZs in the Marine & Coastal Access Act 2009 had not generated final site locations except for Lundy. Therefore, for the purpose of the trial and using the location of established SSSIs and SACs, candidate SACs and possible SACs as well as indications in the second iteration of MCZ Regional Projects of which areas were being considered for MCZ status, we have estimated likely inclusion of species within the possible network of MPAs. The number or percentage of localities designated for protection that a species occurs in is a crude measure of degree of protection and designation of an area does not equal protection without appropriate management:

- 0 = more than 66% of localities in SSSIs, SACs and MCZs
- 1 = from 33-66% of localities in SSSIs, SACs and MCZs
- 2 = Less than 33% of localities in SSSIs, SACs and MCZs or pelagic species where individuals rarely stay in localized areas for any significant amount of time

(SACs and SSSIs are only relevant where they are scheduled for marine biological features.)

2.45 Fisheries closed areas should also be considered where they are relevant to protection of a species (whether a fish species or species that might be adversely affected by a particular fishing method). However, in practice, the characteristics of the areas are very variable and difficult to match to species protection especially where they are seasonal closures. All-in-all, it was decided that fisheries closed areas were not relevant to many SOCI and, where the SOCI were fish, the extent of the areas is unlikely to account for more than 33% of the range of occurrence of the species. Fisheries closed areas were therefore considered irrelevant to application of the criteria.

### Remoteness

2.46 Measures relate to distance from nearest port and may be applied to fishing vessels or to angling and diving boats. They include species that may be seasonally or occasionally present. The measures are empirical and based on likely day trip distances and live-a-board distances. Day trips would be unlikely to be more than 50km out and 50km back:

- 0 = location of the species occurrences not easily reached; generally requiring a more than 100 km return trip.
- 1 = location of the species occurrences reached only by trips away from port of more than one day.
- 2 = location of the species occurrences reached easily but boat access required.
- 3 = location of the species occurrences can be reached from the shore with nearby vehicle access.

### Visibility/catchability

2.47 'Accessibility' is covered by 'Remoteness' and this criterion is used to indicate how easily a species can be found and caught if it is targeted for extraction or caught as bycatch:

- 0 = not easily visible to the naked eye or easily caught – targeted searches are likely to miss many.
- 1 = moderately easily found/caught – searches by experienced observers/fishers will find individuals.
- 2 = easily found/caught.

### Protection

2.48 This score relates to species that are protected by statutes (the Wildlife and Countryside Act 1981) or are listed for protection in conventions and directives including OSPAR, the Habitats Directive, the Berne Convention, CITES, and Biodiversity Action Plan species (a UK response to the Convention on Biodiversity):

- 0 = the species is listed for protection on Schedule 5 the Wildlife and Countryside Act 1981.
- 1 = the species is a Biodiversity Action Plan species, OSPAR species or Habitats Directive species. Or, the species is subject to fisheries regulation.
- 2 = the species is not protected or listed on statutes, directives and conventions or their derivatives.

## Interpretation of 'Degree of threat' scores

2.49 There are significant dangers in applying criteria of Conservation, Remoteness and of Accessibility. For Conservation, presence in a SAC or MCZ must be accompanied by designation, objectives and subsequent management measures that protect the species. Remoteness and Accessibility are irrelevant for species that are not being targeted for collection or recreational fishing and is not necessarily a benefit to a species where there is determination to target collection. 'Decline' and 'Rarity and scarcity' are key criteria. 'Decline' has therefore been 'weighted' and an additional point has been added compared with the three degrees of decline in Whitten (1990).

2.50 The scores possible range from 0 to 16 where 0 is not threatened and 16 is a high degree of threat. To make the assessment more understandable, 'degree of threat' is described as: 'Low' (scores 0 to 5); Moderate (scores 6 to 10), and High (scores 11-16). Scores are

however, a rough indication/ranking. When decisions are being made about what action is needed, the reason for the scores should be taken into account.

## Recovery/conservation potential

2.51 Recovery/conservation potential is assessed as 'High' to 'Low' according to our understanding of:

- biological and ecological limiting factors;
- threats to the species existences (and therefore whether or not we can assess what action is needed); and
- the management that is possible (in terms of the management needed).

2.52 Whitten (1990) descriptors have been interpreted for the marine environment in Appendix 6 so that continuity can be retained with terrestrial approaches.

2.53 The system of scoring follows that developed by Whitten (1990) and is shown in **Table** .

**Table 1** Recovery Potential

| | **High recovery potential** | **Low recovery potential** |
|---|---|---|
| **Biological and ecological limiting factors** | Well understood (scores 3) | Poorly understood (scores 2) |
| **Threats to species' existence** | Well understood, easily alleviated (scores 3) | Poorly understood (scores 2), or<br>Not known / Pervasive and difficult to alleviate (scores 1) |
| **Management needed** | Intensive management not needed [the decline is likely to be natural / part of a cycle and recovery will most likely occur without assistance] (scores 4), or | Intensive management with uncertain probability of success [Techniques such as removal of damaging pressure (for example, mobile fishing gear, extraction, contamination) but permanent damage to long-lived species is unlikely to be reversed, the habitat has been changed too much for species to colonize or contaminants remain] (scores 1), or |
| | Techniques well documented with high probability of success [Techniques such as removal of damaging pressure (for example, mobile fishing gear, extraction, contamination) where habitats remain intact are likely to result in success] (scores 3). | Techniques unknown (scores 2), or |
| | | Techniques still experimental (scores 2). |

The categories are from Whitten (1990) with interpretation of 'Management needed' for marine species in square brackets. Scores for each of the three categories are multiplied to give a final score.

2.54 The possible scores range from 2 to 36, where 2 is very low probability of success whilst 36 is very high probability of success. To make the assessment more understandable, 'Recovery

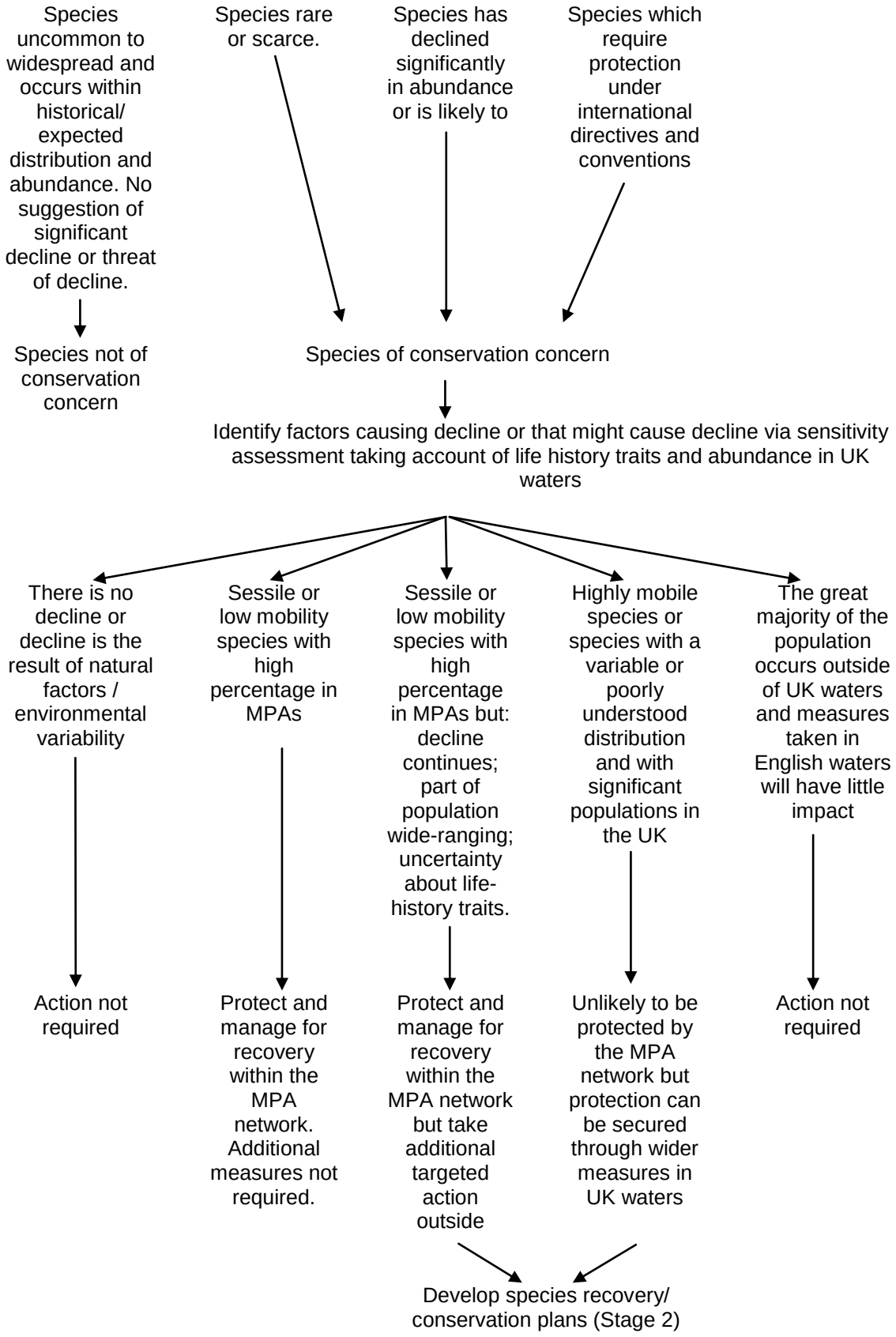
potential' is described as: 'Low' (scores 2 to 8); Moderate (scores 9 to 16), and High (scores 17-36).

## Bringing it all together

2.55 The methodology for identifying what is likely to be the most appropriate and effective programme of action to enable recovery/conservation of a species is summarized in **Figure** .

2.56 Although the four categories of action were specified at the start of the project, much of the segregation of species into each category required research to be undertaken and information to be entered to the database and to the dossiers before a decision was made. There is therefore information entered (in the database) for species that were not, in the end, identified as likely to need or to benefit from a species recovery/conservation plan.

**Stage 1:** Identification of species of conservation concern and actions required



**Stage 2:** Development of species recovery/conservation plans

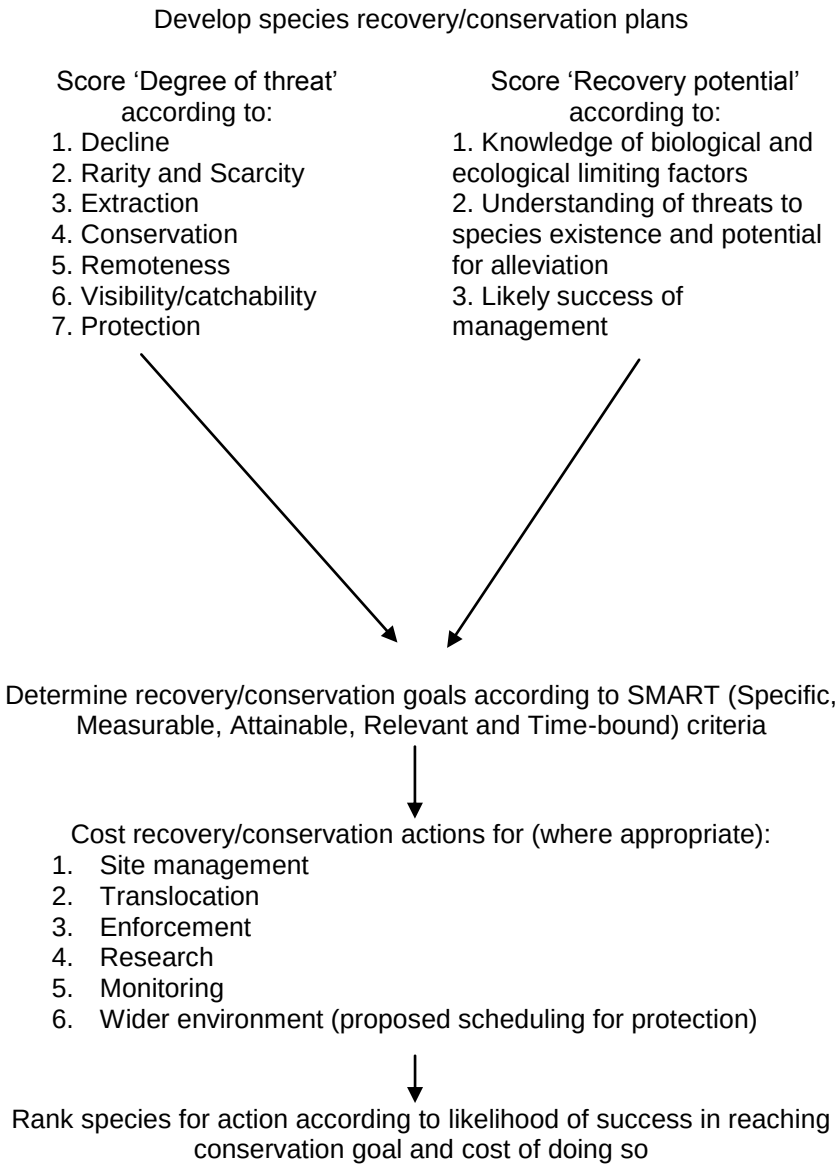



**Figure 2** Species conservation requirements and the development of species recovery / conservation plans

## Identifying the recovery/conservation goals

2.57 The recovery/conservation goals were identified according to SMART (Specific, Measurable, Attainable, Relevant and Time-bound) criteria. The process of identifying goals was determined by a number of considerations but especially:

- Does the habitat for the species still exist and in a high quality state?
- Is the remaining species pool adequate to re-populate in that area?
- Do we know what caused decline or threatens decline (determines if action to take can be identified)?
- Will management of human activities result in full or partial recovery/protection?
- If not full recovery/conservation of populations, how much and how extensive?

- Bearing in mind life history traits, how long is recovery likely to take after action to remove pressures?

2.58 Cost was not considered in setting goals.

## Identifying management requirements and likely budget

2.59 Reference was made to the actions already identified for BAP Priority species (see: http://www.ukbap.org.uk/UKPrioritySpecies.aspx) but additional requirements were identified from the research undertaken for this project and split between the categories identified in Whitten (1990):

- site management;
- translocation;
- enforcement;
- research;
- monitoring; and
- the wider environment.

2.60 BAP actions were included where they were relevant to the marine environment and were adjusted to fit into the categories listed above.

## Specialists

2.61 Specialists with a detailed knowledge of the biology of a particular species identified during the literature searches and as a result of personal knowledge were listed. However, they have not been consulted as a part of developing this report.

# 3 Results

3.1 The species that have been used in this work are listed according to the results of the 'tests' listed in 'Methods' in Appendix 2. For those species that were identified as likely to benefit from recovery/conservation measures (Categories 2 and 3 in Appendix 2), the scores for each criterion used to assess 'Degree of threat' and 'Recovery/conservation potential' are given in Appendix 7 and 8 respectively. Costs for each of the categories of action and the total likely cost over the period defined in the dossiers are given in Appendix 8. Table 2 summarizes the results and, as far as possible, ranks species according to degree of threat, recovery/conservation potential and likely total cost of action.

3.2 The ranking in **Table** has used expert judgement and is not definitive and cannot rely entirely on scores because, for separate measures, they will rank differently. We have taken account of which would be the 'most beneficial' measures for marine species conservation. For instance, projects that would give information about a wider range of species that are in decline or threatened with decline and measures that will improve prospects for a species (not just add to our understanding of its biology).

3.3 Part 2 of this report includes dossiers for each of the species identified as candidates for recovery/conservation programmes as well as dossiers that had been completed before species were considered **not** to have qualified for inclusion in the recovery/conservation programme. The dossiers for commercial fish species are for basic information only.

3.4 The project database is supplied as a separate output.

**Table 2** Approximate ranking of species according to degree of threat (descending) and recovery/conservation potential (descending)

| **Species** | **Degree of threat score** (1=Low to 16 High) | **Recovery/conservation potential score** (2 = Low to 36 = high) | **Cost of recovery/conservation programme** (Costs are mainly for a three year period) | **Comments** |
|---|---|---|---|---|
| **Low mobility species** | | | | |
| *Palinurus elephas* | 12 | 6 | £150,000 (R= £105,000; M = £30,000) | Populations have been extirpated in many areas and, since at least a proportion of the population seems resident in an area, re-introduction of males and females in unfished areas may help to increase reproductive stock. Captive rearing and release is also a possibility – decline has been so great that restoration is needed. |
| *Ostrea edulis* | 11 | 4 | £160,000 (T = £60,000; M= £100,000) | Translocation of healthy individuals could help to re-stock areas. Otherwise, the populations need monitoring in a way that informs management. Work with other relevant authorities. |
| *Arctica islandica* | 10 | 9 | £25,000 (M) | Populations adversely affected by mobile fishing gear and likely to be affected by seawater warming. Costs of including in ongoing monitoring studies for five years. |

**Table continued...**

| Species | **Degree of threat score** (1=Low to 16 High) | **Recovery/conservation potential score** (2 = Low to 36 = high) | **Cost of recovery/conservation programme** (Costs are mainly for a three year period) | Comments |
|---|---|---|---|---|
| *Phymatolithon calcareum* | 9 | 27 | £100,000 (M) | Physical disturbance by mobile fishing gear and harbour development projects may prove the greatest threats. Better understanding of variability and change needed. Probable economies if combined with *L. corallioides.* |
| *Lithothamnion corallioides* | 8 | 27 | £105,000 (R = £5,000; M = £100,000) | As above and better knowledge of where the species is present in English waters. Budget is for survey and monitoring. Probable economies if combined with *P. calcareum.* |
| *Leptopsammia pruvoti* | 9 | 8 | £85,000 (R = £25,000; M = £60,000) | Populations have continued to decline despite being in MPAs and better understanding of reproduction and growth rates needed before any action (if possible) is taken. Reproductive studies including dispersal ability relevant to assist conservation of other species. |
| *Lucernariopsis cruxmelitensis* | 9 | 4 | £120,000 (R) | The reason(s) for significant decline are not known and recovery potential without assistance is very low. Recovery may be successful via re-introduction of breeding populations but understanding of reproduction and development of captive breeding is first necessary. Understanding of conditions for successful breeding and rearing are of wider interest/significance. |
| *Lucernariopsis campanulata* | 9 | 4 | | |
| *Haliclystus auricula* | 8 | 4 | | |
| *Atrina fragilis* | 9 | 4 | £10,000 (R) | Never a common species but populations are vulnerable to physical disturbance. Better understanding of population genetics is needed to understand where recruitment is from. Budget is for opportunistic sampling for DNA studies. |
| *Eunicella verrucosa* | 6 | 18 | £70,000 (R = £20,000; M = £50,000) | Much relevant work already done. Populations are mainly healthy and main threat is mobile fishing gear. Recovery potential, although high, will be achieved through fisheries measures and does not need other action. More understanding of reproduction is needed and monitoring of populations to identify natural variability and any decline/increase. |
| *Armandia cirrosa* | 7 | 12 | £6,400 (T = £2,000; M = £4,400) | Translocation to restore lost populations is proposed together with monitoring. The proposal is partly experimental to see if such an approach works (and if not why not) for a marine worm. |
| *Pollicipes pollicipes* | 7 | 8 | £6,000 (R) | Existing individuals are most likely from long-distance dispersal. If reproductively viable populations are established, it should be by natural means. Survey required to better establish the occurrence of the species in SW England and to understand if populations are viable. |
| *Hippocampus guttulatus* *Hippocampus hippocampus* | 5 | 18 (only relevant resident pops) | £109,000 (SM = £26,000; M = £83,000) | Protecting and maintaining known breeding populations and existing studies of behaviour and occurrence (Studland Bay). |

**Table continued...**

| Species | **Degree of threat score** (1=Low to 16 High) | **Recovery/conservation potential score** (2 = Low to 36 = high) | **Cost of recovery/conservation programme** (Costs are mainly for a three year period) | Comments |
|---|---|---|---|---|
| **Elasmobranchs** | | | | |
| *Cetorhinus maximus* | 9 | 2 | | |
| *Dipturus batis* | 12 | 2 | | |
| *Galeorhinus galeus* | 10 | 2 | | |
| *Lamna nasus* | 9 | 2 | | |
| *Leucoraja circularis* | 6 | 8 | £3,500,000 (R) | Fisheries regulation is the main tool to aid recovery of elasmobranchs and costs fall to relevant competent authorities and to fishermen. The measures costed here are research to better understand degree of population dispersal, migrations, breeding and pupping areas etc. and are similar for different species. |
| *Raja clavata* | 9 | 3 | | |
| *Raja undulata* | 10 | 8 | | |
| *Rostroraja alba* | 10 | 4 | | |
| *Squalus acanthias* | 10 | 3 | | |
| *Squatina squatina* | 9 | 2 | | |
| **Mammals** | | | | |
| *Balaenoptera acutorostrata* | 6 | 8 | £4,425,000 (R = £4.425m; M = £1.5m) | There are currently insufficient data to meaningfully assess population trends in cetacean species. The measures costed here are to raise levels of knowledge to a level suitable to allow the creation of meaningful management goals. |
| *Delphinus delphis* | 7 | 6 | | |
| *Lagenorhynchus albirostris* | 5 | 8 | | |
| *Phocoena phocoena* | 7 | 2 | | |
| *Tursiops truncatus* | 7 | 9 | | |
| *Globicephala melas* | 5 | 8 | | |
| Phoca vitulina | 13 | 3 | £2,600,000 (R) | The measures costed here are to undertake research in to habitat requirements and to maintain the current monitoring programme. Some of these research costs can be undertaken in conjunction with the cetacean measures outlined above, this saving costs. Additionally, further research is required into the “corkscrew” seal deaths which have been reported from sites on the UK east coast and in Northern Ireland. Whilst the injuries themselves have been found to be consistent with the seals being drawn through a ducted propeller, further research is required to fully understand the mechanism for this type of injury and also to investigate potential mitigation techniques to prevent further injuries. It is also important to fully assess the scale and extent of the problem. |
| All mammals | | | £2,050,000 (M = £1.5m; WE = £550,000) | |

Elasmobranchs where tagging programmes are suggested are listed together as one programme would provide economies and are not ranked. (Costs for different types of action for each species are given in Appendix 7. Actions are: SM = Site

Management; T = Translocation; E= Enforcement; R = Research; M= Monitoring; WE=Wider environment). Commercial fish species are not included as conservation measures and associated costs are the responsibility of fisheries authorities. *Anguilla anguilla* is not included as the Environment Agency and others are already taking action and there is no cost for SNCBs.

# 4 Discussion

## UK context

4.1 This exercise for Natural England needs to be seen in the context of relevant exercises undertaken for other Statutory Nature Conservation Bodies in the UK in recent years. In particular, the guidance documents recently produced by the Marine Biological Association (MBA) for Scottish Natural Heritage (SNH) could also be of use to Natural England staff (Tyler-Walters *et al.* 2011, in prep.).

## Marine differences

4.2 The differences between marine and terrestrial environments (Appendix 1) leads to a very different approach to conservation and recovery to that pursued for terrestrial species. The key measure identified is removal of pressures, by regulation, of the activities that create those pressures. The key pressures affecting marine species are physical disturbance, usually by bottom fishing gears, and extraction for food. In the case of water quality (whether natural characteristics such as salinity, nutrients and turbidity or characteristics derived from human activities especially presence of contaminants including chemicals and nutrient levels) it is very difficult to know what effect they are having on species presence and abundance and whether therefore action (in the case of contaminant levels or nutrients) is likely to aid recovery or conservation.

Image: Tricia Hoskins

**Plate 1** The harbour porpoise *Phocoena phocoena* is amongst the most protected of species but is still subject to bycatch

## Degree of threat

4.3 Producing a score for 'Degree of threat' helps to prioritise species for action but understanding how that score was generated is of great importance as some factors (such as 'Remoteness' and 'Visibility/catchability' in' Degree of threat') may be far less important than, for instance, continued decline and rarity. Also, 'protection' is irrelevant if a species is not being extracted. The harbour porpoise has the largest number of listings on directives, conventions and statutes but is still caught as bycatch and is highly sensitive because of low fecundity. Also, the categories used do not include sensitivity to human activities which may be very important in judging how vulnerable a species is to those activities.

## Translocations

4.4 Re-introduction and translocation, 'popular' for terrestrial and freshwater species, may be appropriate for a very few marine species that have become locally extinct and are unlikely to re-colonize an area through their own dispersal mechanisms (larval dispersal, migration). However, we have not recommended translocation except in the case of the lagoon sandworm *Armandia cirrhosa*, native oysters *Ostrea edulis* and crawfish *Palinurus elephas*. For some species, captive breeding and introduction is a possibility to be considered.

## Enforcement

4.5 We have not costed for enforcement of regulations as this is a statutory responsibility of relevant agencies.

## Wider environment

4.6 There are many 'wider environment' actions that could benefit marine species that are in decline or threatened with decline. They include better fisheries regulation, improvements in water quality and recording and education projects. Fisheries regulation and improvement of water quality are part of EU Directives and Policies implemented by the competent authorities in the UK and so are not costed separately as part of species recovery/conservation plans. Recording and education projects are wide-ranging and so not costed here as part of separate species recovery/conservation plans (but see 'Beneficial general activities' later).

## Commercial fish species

4.7 Jurisdiction is a particularly difficult issue to address where measures to protect species from damaging fisheries are proposed. The European CFP currently provides the overarching framework for the regulation of Europe's commercial marine fisheries. All fisheries within territorial waters (0-12nm) must at least comply with the minimum European standard. The UK has full control of management within 6nm within certain constraints. Because of historic fishing rights, where foreign vessels legitimately operated within other Member States' waters, the 6-12nm zone falls under joint (national and EC) competence and a number of foreign fleets operate there. Bearing in mind that the EU has exclusive competence over the management of marine fisheries in community waters, very limited action can be taken by the UK alone to improve the status of wide-ranging species and, although the Statutory Nature Conservation Bodies have relevant interests, it is the fisheries agencies that have competence in pursuing conservation measures.

4.8 Although wildlife conservation applies to all species where they are in decline or threatened with decline, inclusion of commercial fish species in this exercise has caused particular difficulties in interpretation of recovery action and costing that action.

## Plans that have 'no' associated costs

4.9 Several species identified as qualifying for species recovery/conservation plans do not have specific costs associated with them as it would be expected that monitoring studies will be a part of MPA management and costed into that management. Also, there are research projects that are undertaken as part of the academic remit of institutions that are relevant to monitoring and understanding the reasons for change. Species that are commercially important are managed by competent authorities charged with stock maintenance.

## Application to other marine species

4.10 If the approach developed here is to be applied more widely, the scale of the task is relevant. There are proportionately many less marine species that are protected or identified as in need of protection compared with terrestrial and freshwater habitats. In terms of the number of marine species (excluding birds) that are listed for protection under provision in the W&C Act, there are no marine algae listed in Schedule 8 and there are 47 marine species of 155 species in total listed in Schedule 5 (Section 9) of which 27 are cetaceans and six are turtles, many of which are vagrants, and the walrus). Eighty-seven of the 1150 BAP Priority species are marine only (www.ukbap.org.uk) although lagoonal species are wrongly listed as terrestrial and some fish are found in marine and freshwater habitats so are not listed as 'marine only'.

4.11 Bearing in mind that very few species have qualified for protection or listing as BAP Priority species because too little is known about their historical abundance and range to apply required quantitative criteria, the number of species that may need to be considered as of conservation importance can be calculated from various sources. Taking the 'Designated taxa' list maintained by the Joint Nature Conservation Committee (see http://www.jncc.gov.uk/default.aspx?page=3408), identifying those that are marine and adding unlisted algae identified as 'rare' in the Important Plant Areas review (Brodie *et al.* 2008) and unlisted species identified as Nationally Important Marine Features (Connor *et al.* 2002) (identified in Hiscock & Harris 2007 but which are practical to assess), the resulting list includes 440 marine species or about 5% of the total of the JNCC Designated taxa list. Of those marine species, 320 are low-mobility taxa which might be a 'realistic' number of suitable species to be considered for recovery/conservation plans

## Efficient use of funds

4.12 The management requirements for some species are very similar and, as already undertaken in Biodiversity Action Plans, grouped plans can aid efficient use of funds. The species that have been researched as a part of this project and that should be included in grouped plans are:

- stalked jellyfish (*Lucernariopsis campanulata*, *Lucernariopsis cruxmelitensis* and *Haliclystus auricula*);
- seahorses (*Hippocampus guttulatus* and *Hippocampus hippocampus*);
- some elasmobranchs;
- most commercial bony fish; and
- cetaceans.

4.13 In many cases, although costs have been identified, the expense of action may be disproportionate to conservation gain. This is particularly the case where:

- it is known what is adversely affecting a population (for example, overfishing or impact of fishing activities, construction or aggregate dredging) and research or monitoring will only inform advocacy for protection; or
- we do not know what is adversely affecting a population and research proposed is unlikely to gain that knowledge (although may assist management).

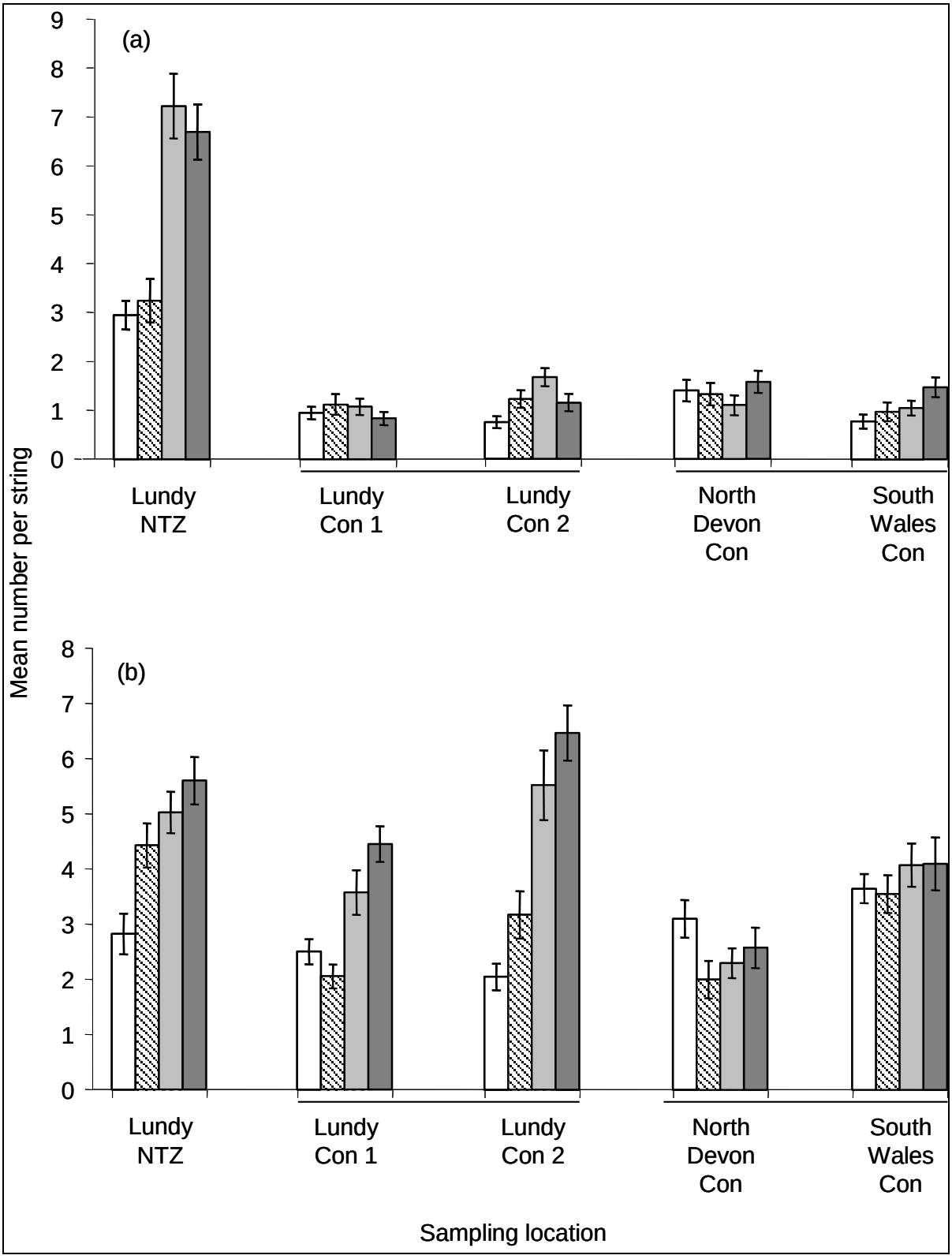
## Beneficial general activities

4.14 There are a number of generic activities that will support conservation and inform recovery programmes for all species. Such activities include reporting schemes (both for occurrence records and for observations of behaviour) and public engagement/education schemes that encourage sea-users and everyone who has an interest in the sea to show a duty-of-care to the marine environment and the species in it. Reporting schemes also include survey – both by volunteers (for instance, Seasearch) and by professional marine biologists undertaking *in situ* survey and monitoring. Those activities are not costed into the separate programmes but need support overall.

## Wider context – what we know that informs recovery/conservation plans

**4.15** The results of this exercise show that many species have a high degree of threat and low recovery/conservation potential. For commercially exploited species or species impacted by commercial fishing activities, we may know that recovery is possible but obtaining necessary measures is problematic. In the case of a commercial species, the lobster *Homarus gammarus*, although not considered threatened, a favourable response to fisheries restrictions has been seen, demonstrating the effectiveness of particular measures (see (a) legal-sized lobsters and (b) sublegal lobsters among NTZ, Near Control and Far Control locations in years 2004 to 2007. Each bar represents the mean abundance (±SE) per string of 10 pots over 5 days of sampling. Clear bars are for 2004, hatched bars 2005, light grey 2006 and dark grey bars are for 2007. From Hoskin and others (2011).

4.16 **Figure** , from Hoskin *et al.,* 2011). For non-commercial species and species that are not obviously being impacted by human activities, the poor outlook is generally because, although there has clearly been decline, we do not know (for certain) why.




(a) legal-sized lobsters and (b) sublegal lobsters among NTZ, Near Control and Far Control locations in years 2004 to 2007. Each bar represents the mean abundance (±SE) per string of 10 pots over 5 days of sampling. Clear bars are for 2004, hatched bars 2005, light grey 2006 and dark grey bars are for 2007. From Hoskin and others (2011).

**Figure 3** Successful results of fisheries regulatory measures on size and abundance of lobster, *Homarus gammarus* stocks in the no-take zone at Lundy

4.17 Species such as stalked jellyfish were once much more abundant whilst continued recorded decline of sunset corals are difficult to account for. Perhaps such decline is part of decadal scale changes and recovery will 'just happen'. For example, such recovery happened in a non-listed species but one that was much less abundant, until 2009, than old records suggested: the football sea squirt *Diazona violacea*. In spring 2009, there was a large settlement on reefs off Plymouth and the species is (once again?) a frequent species in some locations. Another species that is not listed but has not been seen in British waters since about 1986 is the blue spot sea slug *Greilada elegans* – perhaps another species waiting for a regime change in environmental conditions that will result in re-occurrence.

**Plate 2** The football sea squirt *Diazona violacea*

The football sea squirt *Diazona violacea* has not been present off Plymouth for many years in abundances suggested from observations in the 1950's. In 2009, it 'recovered' naturally at one location off Plymouth. Established colony and recruits, 4 July 2009.

**Plate 3** The blue-spot sea slug *Greilada elegans*

The blue-spot sea slug *Greilada elegans* has not been seen in British waters since about 1986. Nudibranchs are 'known' to be highly variable in abundance from year to year and some to disappear for many years before reappearing. Although not on any 'threatened' lists, we should anyway expect reappearance at some time in the future.

4.18 In the case of species adversely affected by human activities such as commercial fishing, a lower abundance than that historically present may need to be accepted although sustainable fisheries are always a desirable objective. Suspicion for causes of decline in some species may fall to introduction of contaminants and nutrient enrichment but decrease in water quality and possible high sensitivity of some species to low-level pollution is very difficult to establish and therefore to act upon. Directives that aim to improve water quality are very welcome even if it is uncertain that wildlife will benefit greatly.

4.19 The reasons for decline in the abundance of some seabed species are very unclear. However, some populations may not have recovered from events (whether natural such as a very cold winter or brought about by human activities such as the TBT episode) and, because numbers are now so low, may not be capable of producing enough young or larvae to re-colonise. Such species may benefit from re-introduction.

## Wider context – other species of conservation importance

4.20 Species to be considered for protection is not a static exercise. There are regular reviews of the Wildlife and Countryside Act and of Biodiversity Action Plans. However, those reviews happen infrequently and species worthy of protection can be identified at any time. Such a situation is especially the case for the marine environment where few species have the sort of quantitative information that identifies them as 'threatened' and there are many gaps in survey data with species previously unrecorded for Britain are frequently found.

4.21 The rarity criteria (Sanderson 1996) are a pragmatic way to identify important species but the list produced then is now very out-of-date (some species would no longer qualify as rare or scarce and there are species that have only been recorded from Britain in recent years including species new to science). The 'long list' of Nationally Important Marine Features needs to be a 'living list' and be the main touchstone for marine conservation. Whilst we have trialled the methodology described here using BAP species, the criteria can be applied to any species to establish whether they would benefit from action, how much action might cost and to prioritise each species. It also remains the case that many species will be protected as long as their habitat is protected from damaging activities and separate plans are often not needed.

# 5 Conclusions

5.1 This report should be used as a starting point for further discussion and workshops to re-rank species if appropriate and re-cost if appropriate.

5.2 There are measures that can be taken to assist recovery of marine species that have declined in abundance or to protect species that are at risk of decline. Those measures are rarely the sort of measures that are used in terrestrial environments except that stock management is relevant to exploited commercial fish species. In the marine environment, measures are concerned with removing or reducing pressures causing or likely to cause decline and, to assist management measures, by obtaining a better understanding of life history traits of a species. These traits include, for fish especially, the location of breeding, spawning/egg laying and feeding areas.

5.3 Marine Protected Areas with effective management measures will help many species that have been or could be adversely affected by human activities to recover or maintain existing populations. Some species researched as a part of this project and present in MPAs, if they require conservation objectives, will be helped by implementation of actions proposed here. Other species need to be conserved wherever they occur and are included in 'wider measures'.

5.4 One of the greatest threats to sensitive species is not knowing where they occur and therefore where to protect them. Our survey knowledge is very limited and needs to be increased.

5.5 A 'threat' to taking action is lack of knowledge about life history traits of species. In many cases, we do not know how likely a species is to recover from decline or what action could/should be taken to assist that recovery. Advice from biologists with relevant knowledge and experience may be all that is available but see next point.

5.6 Utilising natural history knowledge and observation greatly helps understanding what activities and factors adversely affect species and includes information on breeding, feeding and other traits that inform recovery/conservation plans. Such natural history observations need to be solicited and maintained.

5.7 Reporting schemes (both for occurrence records and for observations of behaviour) can inform species recovery and conservation across the whole range of Designated Taxa.

5.8 Public engagement/education schemes can encourage sea-users and everyone who has an interest in the sea to show a duty-of-care to the marine environment and the species in it.

5.9 Although there is little cause-and-effect knowledge linked to water quality and particularly pollution effects for many species, overall improvements in water quality will most likely assist recovery and conservation.

5.10 Costs of taking action range widely, from a few thousand pounds to millions of pounds. Whatever funding is required, the questions have to be asked "will spending this money improve the prospects for this species?" and "what is the most cost-effective action for improving the prospects for this species?".

5.11 The 64 species for which we have applied criteria are a proportion of the taxa that are of conservation concern. Some of the measures proposed for researched species will benefit other species but separate plans may be needed for others. More species can be added to the database and that provides a starting point for identifying action.

# 6 References


Brodie J., Holmes M.J. & Tittley I. (2008). Important plants areas for marine algae. In Brodie J & John D.M (eds). Important Plant Areas for algae. Plantlife, Salisbury. Electronic Publication [pp. 8-46].

Connor D.W., Breen J., Champion A., Gilliland P.M., Huggett D., Johnston C., Laffoley D.d'A., Lieberknecht L., Lumb C., Ramsay K., Shardlow M. (2002). *Rationale and criteria for the identification of nationally important marine nature conservation features and areas in the UK: Version 02.11.* Peterborough, Joint Nature Conservation Committee (on behalf of the statutory nature conservation agencies and Wildlife and Countryside Link) for the Defra Working Group on the Review of Marine Nature Conservation Working paper.

Hiscock, K. & Harris, R. (2007). Nationally Important Marine Features and Biodiversity Action Plan Marine Priority Habitats and Species: Supplementary Report. *Report to the Joint Nature Conservation Committee from the Marine Biological Association.* Plymouth: Marine Biological Association. JNCC Contract F90-01-892.

Hiscock, K., Harris, R. & Lukey, J. (2006). Nationally Important Marine Features and Biodiversity Action Plan Marine Priority Habitats and Species. *Report to the Joint Nature Conservation Committee from the Marine Biological Association.* Plymouth: Marine Biological Association. JNCC Contract F90-01-892.

Hiscock, K., Smirthwaite, J. (2004). Marine Life Topic Note. Marine Biodiversity. *Marine Life Information Network* [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/learningzone/ [Accessed on 11/01/2011].

Hoskin, M.G., Coleman, R.A., von Carlshausen, E. & Davis, C.M. (2011). Variable population responses by large decapods crustaceans to the establishment of a temperate marine no-take zone. *Canadian Journal of Fisheries & Aquatic Sciences*, 68, 185–200.

IUCN (2003). *Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0.* IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. ii + 26 pp. (available from: http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Red_List/regionalguidelinesEn.pdf).

Natural England and the Joint Nature Conservation Committee (2010). The Marine Conservation Zone Project: Ecological Network Guidance. Sheffield and Peterborough, UK.

Sanderson, W. (1996). Rarity of marine benthic species in Great Britain: development and application of assessment criteria. *Aquatic Conservation*, 6, 245-256.

Tyler-Walters, H.(ed.), Wilding, C., Durkin, O, Neilly, M., Seeley, R., and Adams, L. (2011) (in prep). Guidance and information on priority marine species and habitats in Scotland. *Scottish Natural Heritage Commissioned Report.*

Whitten, A.J. (1990). *Recovery: a proposed programme for Britain's protected species*. Peterborough, Nature Conservancy Council, CSD Report No. 1089.

# Appendix 1 ‘Marinisation’ of terrestrial approaches for recovery/conservation plans

In identifying action for recovery or for conservation of a species in the marine environment, practitioners need to take account of differences between marine and terrestrial environments. The following brief has been prepared by Keith Hiscock.

**Marine is different because…**

1. ‘Restoration’ and ‘Recovery’ almost always relies on natural processes (not on habitat alteration and re-introduction).
2. Although extensive parts of the sea have been impacted by human activities, some (mostly open coast rocky) marine habitats are close to natural.
3. Species and habitats that are ‘rare’ in the sea are more likely to be naturally so than on the land and, except for exploited species, decline is much more likely to be due to natural causes than to human activities compared to terrestrial species and habitats.
4. There are no marine species known to be endemic to British waters.
5. Regional extinction is less of an issue. There is only one marine species (*Edwardsia ivelli*) believed to have become extinct in British waters.
6. There is high potential for connectivity and therefore for (re-)colonisation (for larvae, propagules and migratory species) via the water column between locations – and the water column is always there.
7. Marine species are not ‘contained’ by a terrestrial land-mass that also provides convenient political boundaries for legislation and marine species often occur across such boundaries (the same is true for migratory birds)
8. The ecological processes that shape and maintain marine biodiversity are very different to terrestrial.
9. Fluctuations in the abundance of a species may occur on decadal scales so that long-term decline or sudden ‘outbursts’ may be natural (there will be terrestrial similarities).
10. Our knowledge of what is where (habitats and species) is, compared to terrestrial, very poor and, in the UK, there are major areas of even inshore marine areas that we have not surveyed for habitats or biology.
11. Information on changes in abundance of a species is rarely as quantitative as for terrestrial species. Criteria such as for Red List categories can rarely (cetaceans and some fish species are an exception) be applied to marine species which are therefore recorded as ‘Data deficient’.
12. Research that requires ship time, professional diving or remote survey is very expensive to undertake.

# Appendix 2 Separation of trial species according to protection regime

Separation of trial species according to protection regime determined as most appropriate.

**Table A** Species with no evidence of significant decline and/or likely to be protected by the Marine Protected Area (MPA) network

| Scientific name | Common Name | Taxon group | Explanation |
|---|---|---|---|
| *Alkmaria romijni* | Tentacled lagoon-worm | Annelid (worm) | Current known locations are likely to be encompassed within the MPA network. |
| *Amphianthus dohrnii* | Sea-fan anemone | Cnidarian | Decline is likely to be natural or part of a cycle and recovery will most likely occur without assistance. Management techniques are not known. |
| *Caecum armoricum* | Defolin`s lagoon snail | Mollusc | The species is rare and therefore needs to be protected wherever it occurs. |
| *Cruoria cruoriaeformis* | Burgundy maerl paint weed | Red alga | Current known locations are likely to be encompassed within the MPA network. |
| *Gammarus insensibilis* | Lagoon sand shrimp | Crustacean | Current known locations are likely to be encompassed within the MPA network. |
| *Gobius cobitis* | Giant goby | Bony fish | The species is listed on the Wildlife & Countryside Act 1981 (W&C Act) but there is no evidence of recent decline. |
| *Gobius couchi* | Couch's goby | Bony fish | Current known locations are likely to be encompassed within the MPA network. |
| *Grateloupia montagnei* | A red seaweed | Red alga | Current known locations are likely to be encompassed within the MPA network. |
| *Nematostella vectensis* | Starlet sea anemone | Cnidarian | The species already occurs within existing MPAs with adequate protection. Listed for protection on the W&C Act 1981. Population stable. |
| *Padina pavonica* | Peacock's tail | Brown alga | Current known locations are likely to be encompassed within the MPA network. |
| *Paludinella littorina* | Sea snail | Mollusc | Known from one location in England, which is an SSSI and SAC. |
| *Raja montagui* | Spotted ray | Sharks and rays | The species is listed as 'Least concern' by IUCN and, although listed by OSPAR as 'Threatened and/or declining' there are increases in abundance in some areas as well as continued low numbers/decline in others. |
| *Tenellia adspersa* | Lagoon sea slug | Mollusc | The species is listed on the W&C Act but there is no evidence of recent decline. Current known locations are likely to be encompassed within the MPA network. |
| *Victorella pavida* | Trembling sea mat | Bryozoan (sea mat) | Known from one location in England, which is an SSSI. |

**Table B** Species likely to be protected by the UK MPA network but will require additional targeted action

| Scientific name | Common Name | Taxon group | Explanation |
|---|---|---|---|
| *Lithothamnion corallioides* | Coral maerl | Red alga | The species is highly sensitive and populations are unlikely to return if lost. |
| *Phymatolithon calcareum* | Common maerl | Red alga | The species is highly sensitive and populations are unlikely to return if lost. |
| *Armandia cirrhosa* | Lagoon sandworm | Annelid (worm) | The species no longer occurs at the location where it was once abundant. The species is rare and needs protection/management wherever it occurs. |
| *Hippocampus guttulatus* | Long snouted seahorse | Bony fish | Listed for protection on the W&C Act. |
| *Hippocampus hippocampus* | Short snouted seahorse | Bony fish | Listed for protection on the W&C Act. |
| *Eunicella verrucosa* | Pink sea-fan | Cnidarian | There is uncertainty about breeding, recruitment, longevity and other life history traits so that research is needed (an 'additional measure') into those traits. Listed for protection on the W&C Act. |
| *Haliclystus auricula* | Stalked jellyfish | Cnidarian | There is uncertainty about breeding, recruitment, longevity and other life history traits so that research is needed (an 'additional measure') into those traits. |
| *Leptopsammia pruvoti* | Sunset cup coral | Cnidarian | The species is rare and therefore needs to be protected wherever it occurs. Decline in numbers within existing SACs and so plan needed. |
| *Lucernariopsis campanulata* | Stalked jellyfish | Cnidarian | There is uncertainty about breeding, recruitment, longevity and other life history traits so that research is needed (an 'additional measure') into those traits. |
| *Lucernariopsis cruxmelitensis* | Stalked jellyfish | Cnidarian | There is uncertainty about breeding, recruitment, longevity and other life history traits so that research is needed (an 'additional measure') into those traits. |
| *Pollicipes pollicipes* | Gooseneck barnacle | Crustacean | The species is rare and needs protection/management wherever it occurs |
| *Palinurus elephas* | Spiny lobster | Crustacean | The species has resident populations within MPAs but a part of the population is wide-ranging or migratory. |

**Table continued...**

| Scientific name | Common Name | Taxon group | Explanation |
|---|---|---|---|
| *Arctica islandica* | Ocean quahog | Mollusc | The species has resident populations within MPAs but a significant part of the population is wide-ranging or migratory. |
| *Atrina fragilis* | Fan mussel | Mollusc | The species is rare and therefore needs to be protected wherever it occurs. Listed for protection on the W&C Act. |
| *Anguilla anguilla* | European eel | Bony fish | The species already occurs within existing MPAs with adequate protection but continues to decline/is threatened with decline in abundance or extent. |
| *Osmerus eperlanus* | Smelt | Bony fish | Widely distributed |
| *Raja undulata* | Undulate ray | Sharks and rays | The species has resident populations within MPAs but a part of the population is wide-ranging or migratory. |
| *Raja clavata* | Thornback skate / ray | Sharks and rays | The species has resident populations within MPAs but a part of the population is wide-ranging or migratory. |
| *Squatina squatina* | Angel shark | Sharks and rays | The species has resident populations within MPAs but a part of the population is wide-ranging or migratory. |
| *Phoca vitulina* | Harbour seal | Marine mammal (semi-aquatic) | Listed for protection on the W&C Act. |
| *Tursiops truncatus* | Bottlenose dolphin | Whales and dolphins | The species has resident populations within MPAs (not in England) but a large part of the population is wide-ranging or migratory. Listed for protection on the W&C Act. |

**Table C** Species unlikely to be protected by the UK MPA network but protection can be secured through wider measures in UK waters

| Scientific name | Common Name | Taxon group | Explanation |
|---|---|---|---|
| *Ammodytes marinus* | Lesser sandeel | Bony fish | Widely distributed |
| *Clupea harengus* | Herring | Bony fish | Widely distributed |
| *Gadus morhua* | Cod | Bony fish | Widely distributed |
| *Hippoglossus hippoglossus* | Atlantic halibut | Bony fish | Widely distributed |
| *Lophius piscatorius* | Angler-fish | Bony fish | Widely distributed |
| *Merlangius merlangus* | Whiting | Bony fish | Widely distributed |
| *Merluccius merluccius* | European hake | Bony fish | Widely distributed |
| *Molva molva* | Ling | Bony fish | Widely distributed |
| *Pleuronectes platessa* | Plaice | Bony fish | Widely distributed |
| *Scomber scombrus* | Mackerel | Bony fish | Widely distributed |
| *Solea solea* | Sole | Bony fish | Widely distributed |
| *Trachurus trachurus* | Horse mackerel | Bony fish | Widely distributed |
| *Cetorhinus maximus* | Basking shark | Sharks and rays | Widely distributed although there are locations where large numbers often occur. |
| *Galeorhinus galeus* | Tope shark | Sharks and rays | Widely distributed |
| *Lamna nasus* | Porbeagle shark | Sharks and rays | Widely distributed |
| *Leucoraja circularis* | Sandy ray | Sharks and rays | Widely distributed |
| *Dipturus batis* | Common skate | Sharks and rays | Widely distributed although there are locations where there might be resident populations. |
| *Raja montagui* | Spotted ray | Sharks and rays | Widely distributed |
| *Rostroraja alba* | White or bottlenosed skate | Sharks and rays | Widely distributed |
| *Squalus acanthias* | Spiny dogfish | Sharks and rays | Widely distributed |
| *Balaenoptera acutorostrata* | Minke whale | Whales and dolphins | Widely distributed |
| *Delphinus delphis* | Common dolphin | Whales and dolphins | Widely distributed |
| *Lagenorhynchus albirostris* | White-beaked dolphin | Whales and dolphins | Widely distributed |
| *Phocoena phocoena* | Harbour porpoise | Whales and dolphins | Widely distributed |

**Table D** Species unlikely to be protected by the UK MPA network and too far ranging for protection to be secured through wider measures in UK waters, no further action required for UK waters alone

| Scientific name | Common Name | Taxon group |
|---|---|---|
| *Isurus oxyrinchus* | Shortfin mako | Sharks and rays |
| *Prionace glauca* | Blue shark | Sharks and rays |
| *Grampus griseus* | Risso's dolphin | Whales and dolphins |
| *Lagenorhynchus acutus* | Atlantic white-sided dolphin | Whales and dolphins |
| *Globicephala melas* | Long-finned pilot whale | Whales and dolphins |

Three species were excluded from the initial list of 67 trial species before the above filtering:

- *Nucella lapillus*- declines are largely historical although there are some locations where populations have not returned following loss due to TBT anti-fouling paint usage.
- *Gitanopsis spinosa* - not present in England.
- *Edwardsia ivelli* - possibly extinct.

# Appendix 3 IUCN criteria for critically endangered, endangered and vulnerable

**CRITICALLY ENDANGERED (CR)**
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:
**A**. Reduction in population size based on any of the following:
1. An observed, estimated, inferred or suspected population size reduction of ≥90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
    (a) direct observation
    (b) an index of abundance appropriate to the taxon
    (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
    (d) actual or potential levels of exploitation
    (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
2. An observed, estimated, inferred or suspected population size reduction of ≥80% over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible**,** based on (and specifying) any of (a) to (e) under A1.
3. A population size reduction of ≥80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
4. An observed, estimated, inferred, projected or suspected population size reduction of ≥80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

**B**. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:
1. Extent of occurrence estimated to be less than 100 km2, and estimates indicating at least two of a–c:
    a. Severely fragmented or known to exist at only a single location.
    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.
    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) number of locations or subpopulations
        (iv) number of mature individuals.
2. Area of occupancy estimated to be less than 10 km2, and estimates indicating at least two of a–c:
    a. Severely fragmented or known to exist at only a single location.
    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.
    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence

(ii) area of occupancy
(iii) number of locations or subpopulations
(iv) number of mature individuals.

**C**. Population size estimated to number fewer than 250 mature individuals and either:
1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
a. Population structure in the form of one of the following:
(i) no sub-population estimated to contain more than 50 mature individuals, OR
(ii) at least 90% of mature individuals in one subpopulation.
b. Extreme fluctuations in number of mature individuals.
**D**. Population size estimated to number fewer than 50 mature individuals.
**E**. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

**ENDANGERED (EN)**
A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

**A**. Reduction in population size based on any of the following:
1. An observed, estimated, inferred or suspected population size reduction of ≥70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
(a) direct observation
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
(d) actual or potential levels of exploitation
(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
2. An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
3. A population size reduction of ≥50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
4. An observed, estimated, inferred, projected or suspected population size reduction of ≥50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

**B**. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:
1. Extent of occurrence estimated to be less than 5000 km2, and estimates indicating at least two of a–c:
a. Severely fragmented or known to exist at no more than five locations.
b. Continuing decline, observed, inferred or projected, in any of the following:
(i) extent of occurrence
(ii) area of occupancy
(iii) area, extent and/or quality of habitat
(iv) number of locations or subpopulations
(v) number of mature individuals.
c. Extreme fluctuations in any of the following:
(i) extent of occurrence
(ii) area of occupancy

(iii) number of locations or subpopulations
(iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at no more than five locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

**C**. Population size estimated to number fewer than 2500 mature individuals and either:
1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 250 mature individuals, OR
      (ii) at least 95% of mature individuals in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

**D**. Population size estimated to number fewer than 250 mature individuals.

**E**. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

**VULNERABLE (VU)**
A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

**A**. Reduction in population size based on any of the following:
1. An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   (a) direct observation
   (b) an index of abundance appropriate to the taxon
   (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   (d) actual or potential levels of exploitation
   (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
2. An observed, estimated, inferred or suspected population size reduction of ≥30% over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible**,** based on (and specifying) any of (a) to (e) under A1.
3. A population size reduction of ≥30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
4. An observed, estimated, inferred, projected or suspected population size reduction of ≥30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

**B**. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:
1. Extent of occurrence estimated to be less than 20,000 km2, and estimates indicating at least two of a–c:
    a. Severely fragmented or known to exist at no more than 10 locations.
    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.
    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) number of locations or subpopulations
        (iv) number of mature individuals.
2. Area of occupancy estimated to be less than 2000 km2, and estimates indicating at least two of a–c:
    a. Severely fragmented or known to exist at no more than 10 locations.
    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.
    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) number of locations or subpopulations
        (iv) number of mature individuals.

**C**. Population size estimated to number fewer than 10,000 mature individuals and either:
1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
    a. Population structure in the form of one of the following:
        (i) no subpopulation estimated to contain more than 1000 mature individuals, OR
        (ii) all mature individuals are in one subpopulation.
    b. Extreme fluctuations in number of mature individuals.

**D**. Population very small or restricted in the form of either of the following:
1. Population size estimated to number fewer than 1000 mature individuals.
2. Population with a very restricted area of occupancy (typically less than 20 $km^2$) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

**E**. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

# Appendix 4 Criteria for identifying BAP Priority Marine Species

Criteria for identifying BAP Priority marine species taken from the instructions to consultees issued during the exercise reported in Hiscock *et al.* (2006).

**CRITERION 1: International threat**

Assess the species' status in either a global or a European context.

i) Use the best available knowledge, for example;
   - IUCN global Red Lists
   - Red Lists from individual European countries
   - Other (specified) authoritative sources that assess threat or decline.

ii) Where possible, use the new IUCN categories (CR, EN, VU): if Red Lists use the old IUCN criteria, treat the Rare category with caution.

iii) Red listing in >50% of countries with adequate data within the biogeographic or European range of the species, would qualify a species as internationally threatened. If this evidence is cited, please indicate the range of the species and list the countries that include it in a Red List.

iv) The revised IUCN Red List Categories and Criteria (version 3.1, published in 2001) and guidelines on their application at global and national levels are available electronically at: www.iucn.org/themes/ssc/red-lists.htm. See www.redlist.org for lists of globally threatened species.

**CRITERION 2: International responsibility + moderate decline in the UK**

Under this criterion, a species that has declined by more than 25% in the last 25 years in the UK may qualify if the UK supports 25% or more of the global or European population. Please quantify your answer as far as possible and provide all supporting information.

i) The European or global proportion can be measured in terms of grid square records, sites, numbers of individuals etc. Please provide as much data as possible.

ii) Make a special note if the species is endemic or near-endemic.

iii) The species needs to have declined by 25% or more over the past 25 years.

**CRITERION 3: Marked decline in the UK**

A species which has declined by 50% or more over the past 25 years qualifies under this criterion.

i) Decline may have been measured or may be deduced from other evidence.

ii) If no direct evidence exists, deterioration or loss of habitat; threat to a food plant; or other relevant factors may be used as surrogates (i.e. inferred decline).

iii) Decline can be expressed in a number of possible ways, for instance as population size, range or number of occupied sites.

iv) In the absence of a 25-year run of data, decline rate will be automatically extrapolated from a shorter (or longer) period in the spreadsheet (Appendix 6).

v) Evidence and sound reasoning must be given in support of the claim.

vi) Please give the types of record (for example, 10 km square, 1 km square, site data) and time-span of the supporting data.

In relation to the run of data available, please provide a judgement on how appropriate the extrapolation to 25 years is, and how able the data are to be used in this context. Equally, if you have used an alternative means of measuring rate of decline, please provide the working and outline its usage in this context. If some data were ignored, or discontinuous or more than one data set was used (covering different time periods) this should be highlighted.

**CRITERION 4: Other important factor(s)**

**Even if a species does not qualify under Criteria 1, 2 or 3 there may still be a case for listing it as Priority. However, evidence of extreme threat is required. Justifications may include reasons such as those listed below.**

1. It is predicted that the species will decline by 50% in a current 25 year period, or in the next 25 years.
2. The species is believed to be long-lived (>25 years) with a low recovery potential and if action is not taken to reverse current trends then the species is likely to become extinct in the next 100 years.
3. The species is declining and is a good 'indicator' that represents an issue causing the decline of a range of less easily incorporated species. The species may represent a unique or favoured habitat or food source for an established or proposed BAP species.
4. The species is known to have been more abundant and widespread (i.e. population or extent twice as large+) in the recent past and, whilst the species is recovering, the factors that caused the original decline are still operating or the species' population has not recovered to a point where it is likely to be viable in the long term.
5. The species is threatened globally or in the European seas so that the UK could become a future 'stronghold'.

**See also:** 'BAP Criteria and evidence' accessed via http://www.ukbap.org.uk/newprioritylist.aspx

# Appendix 5 Designing rarity criteria for highly mobile marine species

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## Introduction

Criteria for assessing rarity of highly mobile marine species have not previously been developed. This lack of a rarity measure may be due, in part, to:

- lack of knowledge of population size and location; and
- populations being wide ranging.

Therefore, the numbers present at any one time in any one location are very difficult to assess.

Another issue, which can also be applied to the criteria for benthic species (Sanderson, 1996), is that abundance is not incorporated if only occupancy of 10 km squares is used. There may be one individual or millions (for example, some benthic invertebrates) in a 10 km square but the contribution to existing rarity measures is the same.

A further problem with wide-ranging species is that a 'false' idea of occurrence is given by simply mapping locations where they have been reported. Inevitably, at any one time, they will be present in only a small proportion of the squares they have been reported in over time.

The criteria outlined by Sanderson (1996), and applied to benthic species in this report, were designed for inshore areas, not least because that is where the majority of survey data for benthic species are. Many cetaceans are wide-ranging species that occur both inside the 12 nm limit of territorial seas (and therefore fall within the 'jurisdiction' of Natural England and of regulatory authorities) and more widely in the UK continental shelf waters. Those species need to be protected and appropriate action for conservation taken wherever they occur so that they continue to occur within English waters. Their abundance within UK (or English) territorial seas is therefore not as relevant as their wider abundance in the region and therefore abundance relevant to English waters should be assessed more widely and on a North East Atlantic scale and not according to an artificial political boundary although measures that are available refer to 'UK waters'. This consideration is catered for in the measure of 'population size' included in the methodology below.

A separate methodology was therefore developed to assess rarity for wide ranging mammal species while maintaining continuity of terminology with the work of Sanderson (1996) which, in turn, was based on the quantitative measures used for terrestrial species.

The methodology proposed aims to take many more factors into account, all of which could have some bearing on whether a species is to be considered 'rare'.

## Methodology

It is acknowledged that the required data will not always be available to complete this methodology. Consequently there is an 'unknown' option for all choices. This aims to provide a precautionary score.

The methodology relies on obtaining a score out of a possible maximum of 60. Scores are attributed according to criteria set out below.

Names of assigned criteria were (as far as possible) intended to be consistent with those provided in the Sanderson (1996) methodology.

## Population size

Using the best available population estimates; calculate the percentage of the worldwide stock of animals that resides in the area of interest.

**Table E** Population size

| Percentage | Score (max 25 available) |
|---|---|
| Endemic species – 100% | 25 |
| 80-99% | 22 |
| 60-80% | 20 |
| 40-60% | 17 |
| 25-40% | 12 |
| Unknown or 5-25% | 10 |
| 1-4% | 8 |
| 0.05 – 1% | 5 |
| <0.05% | 3 |

*Worked example – harbour seal*
*There is a European subspecies* – Phoca vitulina vitulina*, which will be considered as the total population for this exercise. Approximately 30% of European harbour seals are found in the UK (SCOS 2009).* ***So this scores 12***

## Occurence

This section refers only to occurrence within the area of interest. Occurrence is classified as falling into one of five categories, and then a score assigned accordingly.

**Table F** Occurence

| Distribution category | Score (max 25 available) |
|---|---|
| Continuous (found all around the coast) | 6 |
| Almost continuous (a few isolated areas where they aren't found) | 8 |
| Multiple Patches (found in multiple patches around the coast) | 10 |
| Occasional patches (found in (5-10) patches around the coast | 17 |
| Isolated (found only in very few a few isolated areas (less than 5) | 25 |
| Unknown | 12 |

*Worked example – harbour seal*
*Harbour seal haul out sites are concentrated in approximately 15 main locations. This is occurrence in multiple patches.* ***So this scores 10***

## Trophic level

As apex predators are naturally rarer than primary producers, it was thought that some measure of this should be accounted for within these criteria.

**Table G** Trophic Level

| Trophic level | Score (max 10 available) |
|---|---|
| Apex predator | 10 |
| Mid level predator | 7 |
| Planktivore | 5 |
| Primary producer | 3 |

*Worked example – harbour seal*
*Harbour seals are mid level predators, feeding on fish and crustaceans, but also falling prey to killer whales, and so* ***score 7***

## Final scores

Add up all of the scores for each section to get a final score out of 60. Compare to the table below.

**Table H** Final scores

| Score (out of 60) | Assigned criteria |
|---|---|
| 41-60 + | Nationally rare |
| 31 – 40 | Nationally scarce |
| 15 – 30 | Nationally uncommon |
| <15 | Widespread |

*Worked example – harbour seal*
*Harbour seal total score: = 12+10+7= (29) = Nationally Uncommon.*

## References

Sanderson, W. G. (1996) Rarity of marine benthic species in Great Britain: development and application of assessment criteria. Aquatic conservation: marine and freshwater ecosystems; **6**, 245 – 256.

# Appendix 6

**Table I** The "Degree of threat" scores compared with those used in Whitten (1991) and interpreted for marine species

| Factors and scores from Whitten (1990) | Measures for marine species |
|---|---|
| Decline – the number of 10km squares [in Great Britain] occupied now and in the past:<br>0 = decline of less than 33%<br>1 = decline from 33% to 66%<br>2 = decline over 66% | Decline.<br>0= Decline not believed to have occurred in extent and/or abundance.<br>1 = Decline has occurred but is believed less than 25% in the past 25 years (includes expert judgment)<br>2 = Species that have declined in abundance or extent by more than 25% in the past 25 years (includes expert judgment)<br>3 = It is predicted that the species will decline by 50% in abundance or extent in a current or next 25 year period (includes expert judgment) OR 'Other important factors listed above. |
| Number of localities (present in 1 km squares in Britain)<br>0 = 16 or more localities<br>1 = 10-15 localities<br>2 = 6-9 localities<br>3 = 3-5 localities<br>4 = 1-2 localities | Rarity and scarcity. Assessment based on personal knowledge can be used and the following criteria (the BAP/NIMF criteria but adding scarcity) can be applied:<br>0 = Species nationally uncommon to widespread (recorded from more than 55 10 km squares within the 3 mile limit of territorial seas around Britain or 'expert judgment' further offshore).<br>1 = Species nationally scarce (recorded from 9-55 10 km squares within the 3 mile limit of territorial seas around Britain or expert judgment further offshore).<br>2 = Species nationally rare (recorded from 1-8 10 km squares within the 3 mile limit of territorial seas around Britain or expert judgment further offshore).<br>(For highly mobile species such as cetaceans, an estimate of 10km squares in which likely to be present at any one time based on personal knowledge and experience is used but is extended to the 12 km limit of territorial seas). |
| Attractiveness - a measure of how great pressure may be to collect a species from the wild.<br>0 = not attractive<br>1 = moderately attractive<br>2 = highly attractive | Extraction Marine species are very rarely collected for decorative purposes and home aquaria for temperate marine species are not a popular pastime. This criterion therefore refers to collection for consumption of edible species, both commercially and by the public. If there was any increase in, for instance, interest in temperate marine aquaria, could be applied to non-edible species.<br>0 = not taken<br>1 = taken occasionally, commercial and/or recreational take OR take highly regulated to preserve stocks – take retained or, if returned, unlikely to survive<br>2 = taken frequently, commercial and/or recreational - take retained or, if returned, unlikely to survive |

**Table continued...**

| Factors and scores from Whitten (1990) | Measures for marine species |
|---|---|
| Conservation - the percentage of locations which are within reserves and SSSIs.<br>0 = more than 66% of localities in nature reserves and SSSIs<br>1 = from 33-66% of localities in nature reserves and SSSIs<br>2 = Less than 33% of localities in unthreatened nature reserves and SSSIs<br>3 = Less than 33% of localities in threatened nature reserves and SSSIs | Conservation<br>0 = more than 66% of localities in SSSIs, SACs and MCZs.<br>1 = from 33-66% of localities in SSSIs, SACs and MCZs<br>2 = Less than 33% of localities in SSSIs, SACs and MCZs or pelagic species where individuals rarely stay in localized areas for any significant amount of time. Or, highly mobile species, MPAs not relevant.<br>(SACs and SSSIs are only relevant where they are scheduled for marine biological features.) |
| Remoteness – the ease with which localities can be reached by the public.<br>0 = not easily reached<br>1 = moderately easily reached<br>2 = easily reached | Remoteness<br>0 = location of the species occurrences not easily reached; generally more than 100 km return trip<br>1 = location of the species occurrences reached only by trips away from port of more than one day<br>2 = location of the species occurrences reached easily but boat access required<br>3 = location of the species occurrences can be reached from the shore with nearby vehicle access |
| Accessibility – the ease with which a species can be found or reached at a site.<br>0 = not easily found or reached<br>1 = moderately easily found or reached<br>2 = easily reached | Visibility/catchability<br>0 = not easily visible to the naked eye or easily caught – targeted searches are likely to miss many<br>1 = moderately easily found/caught – searches by experienced collectors/fishers will find individuals<br>2 = easily found/caught |
| [Not in Whitten, 1990] | Protection<br>0 = the species is listed for protection on the Wildlife and Countryside Act 1981.<br>1 = the species is a Biodiversity Action Plan species, which includes OSPAR species and Habitats Directive species. Or, the species is subject to fisheries regulation.<br>2 = the species is not protected or listed on statutes, directives and conventions or their derivatives. |

# Appendix 7 Scoring threat

Degree of threat scores for each category and totals used in the dossiers and for ranking. The scores are added together to provide a total.

**Table J** Degree of threat scores

| | Decline | Rarity & Scarcity | Extraction | Conservation | Remoteness | Visibility / Catchability | Protection | Total |
|---|---|---|---|---|---|---|---|---|
| **Low mobility species** | | | | | | | | |
| *Amphianthus dohrnii* | 2 | 1 | 0 | 0 | 2 | 2 | 1 | 9 |
| *Anguilla anguilla* | 2 | 0 | 2 | 2 | 3 | 1 | 2 | 12 |
| *Arctica islandica* | 2 | 0 | 1 | 2 | 2 | 2 | 1 | 10 |
| *Armandia cirrosa* | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 7 |
| *Atrina fragilis* | 1 | 1 | 0 | 3 | 3 | 1 | 0 | 9 |
| *Eunicella verrucosa* | 1 | 0 | 0 | 1 | 2 | 2 | 0 | 6 |
| *Haliclystus auricula* | 2 | 0 | 0 | 2 | 3 | 0 | 1 | 8 |
| *Hippocampus guttulatus* | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 5 |
| *Hippocampus hippocampus* | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 5 |
| *Leptopsammia pruvoti* | 2 | 2 | 0 | 0 | 2 | 2 | 1 | 9 |
| *Lithothamnion corallioides* | 1 | 0 | 1 | 1 | 3 | 1 | 1 | 8 |
| *Lucernariopsis campanulata* | 2 | 1 | 0 | 2 | 3 | 0 | 1 | 9 |
| *Lucernariopsis cruxmelitensis* | 2 | 1 | 0 | 2 | 3 | 0 | 1 | 9 |
| *Nematostella vectensis* | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 4 |
| *Ostrea edulis* | 2 | 0 | 2 | 1 | 3 | 2 | 1 | 11 |
| *Palinurus elephas* | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 12 |
| *Phymatolithon calcareum* | 1 | 0 | 2 | 1 | 2 | 2 | 1 | 9 |
| *Pollicipes pollicipes* | 0 | 2 | 0 | 1 | 3 | 0 | 1 | 7 |
| **Elasmobranchs** | | | | | | | | |
| *Cetorhinus maximus* | 2 | 0 | 1 | 2 | 3 | 1 | 0 | 9 |
| *Dipturus batis* | 3 | 2 | 1 | 2 | 2 | 0 | 2 | 12 |
| *Galeorhinus galeus* | 2 | 0 | 2 | 2 | 2 | 1 | 1 | 10 |
| *Lamna nasus* | 2 | 0 | 1 | 2 | 2 | 1 | 1 | 9 |
| *Leucoraja circularis* | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 6 |
| *Raja clavata* | 1 | 0 | 2 | 2 | 1 | 1 | 2 | 9 |
| *Raja undulata* | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 10 |
| *Rostroraja alba* | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 10 |
| *Squalus acanthias* | 2 | 0 | 2 | 3 | 2 | 0 | 1 | 10 |
| *Squatina squatina* | 3 | 1 | 1 | 2 | 2 | 0 | 0 | 9 |

**Table continued...**

| | Decline | Rarity & Scarcity | Extraction | Conservation | Remoteness | Visibility / Catchability | Protection | Total |
|---|---|---|---|---|---|---|---|---|
| **Inshore bony fish, high mobility** | | | | | | | | |
| *Osmerus eperlanus* | 3 | 0 | 1 | 2 | 2 | 2 | 1 | 11 |
| **Commercial bony fish – 'demersal'** | 2 | 0 | 2 | 2 | 2 | 2 | 1 | 11 |
| **Commercial bony fish – 'pelagic'** | 1 | 0 | 2 | 2 | 2 | 2 | 1 | 10 |
| **Marine mammals** | | | | | | | | |
| *Balaenoptera acutorostrata* | 0 | 1 | 0 | 2 | 2 | 1 | 1 | 7 |
| *Delphinus delphis* | 0 | 1 | 0 | 2 | 2 | 1 | 1 | 7 |
| *Grampus griseus** | 0 | 2 | 0 | 2 | 0 | 1 | 1 | 6 |
| *Lagenorhynchus albirostris* | 0 | 1 | 0 | 2 | 2 | 1 | 1 | 7 |
| *Lagenorhynchus acutus** | 0 | 2 | 0 | 2 | 0 | 1 | 1 | 6 |
| *Phoca vitulina* | 2 | 0 | 1 | 2 | 3 | 2 | 1 | 11 |
| *Phocoena phocoena* | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 6 |
| *Tursiops truncatus* | 0 | 2 | 0 | 2 | 2 | 1 | 1 | 8 |
| *Globicephala melas** | 0 | 2 | 0 | 2 | 0 | 1 | 1 | 6 |

* These species are classified as category 4 "Unlikely to be protected by the UK MPA network and too far ranging for protection to be secured through wider measures in UK waters; no further action required for UK waters alone" but scores have been retained here.

# Appendix 8 Scoring recovery conservation potential

Recovery/conservation potential scores for each category and totals (arrived at by multiplication of each score) used in the dossiers and for ranking.

**Table K** Recovery/conservation potential scores

| Species name | Biological and ecological limiting factors | | Understanding of threats to species' existence & potential for alleviation | | | Likely success of management | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Well understood (3) | Poorly understood (2) | Well understood, easily alleviated (3) | Poorly understood (2) | Pervasive and difficult to alleviate (1) | Intensive management not needed (4) | Techniques well documented with high probability of success (3) | Intensive management with uncertain probabilities of success (1) | Techniques unknown (2) | Techniques still experimental (2) | |
| **Low mobility species** | | | | | | | | | | | |
| *Amphianthus dohrnii* | | 2 | | | 1 | | | | 2 | | 4 |
| *Anguilla anguilla* | 3 | | | | 1 | | | 1 | | | 3 |
| *Arctica islandica* | 3 | | | | 1 | | 3 | | | | 9 |
| *Armandia cirrosa* | | 2 | | 2 | | | 3 | | | | 12 |
| *Atrina fragilis* | | 2 | | 2 | | | | 1 | | | 4 |
| *Eunicella verrucosa* | | 2 | 3 | | | | 3 | | | | 18 |
| *Hippocampus guttulatus* | 3 | | | 2 | | | 3 | | | | 18 |
| *Hippocampus hippocampus* | 3 | | | 2 | | | 3 | | | | 18 |
| *Haliclystus auricula* | | 2 | | | 2 | | | | 2 | | 4 |
| *Leptopsammia pruvoti* | | 2 | | 2 | | | | | 2 | | 8 |
| *Lithothamnion corallioides* | 3 | | | 3 | | | 3 | | | | 27 |

**Table continued...**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lucernariopsis campanulata* | | 2 | | | 1 | | | | 2 | | | 4 |
| *Lucernariopsis cruxmelitensis* | | 2 | | | 1 | | | | 2 | | | 4 |
| *Nematostella vectensis* | 3 | | | 2 | | | 3 | | | | | 18 |
| *Ostrea edulis* | | 2 | | 2 | | | | 1 | | | | 4 |
| *Phymatolithon calcareum* | 3 | | 3 | | | | 3 | | | | | 27 |
| *Palinurus elephas* | 3 | | | | 1 | | | | | 2 | | 6 |
| *Pollicipes pollicipes* | | 2 | | 2 | | 4 | | | | | | 8 |
| Elasmobranchs | | | | | | | | | | | | |
| *Cetorhinus maximus* | | 2 | | | 1 | | | 1 | | | | 2 |
| *Dipturus batis* | | 2 | | | 1 | | | 1 | | | | 2 |
| *Galeorhinus galeus* | | 2 | | | 1 | | | 1 | | | | 2 |
| *Lamna nasus* | | 2 | | | 1 | | | 1 | | | | 2 |
| *Leucoraja circularis* | | 2 | | 2 | | | | | 2 | | | 8 |
| *Raja clavata* | 3 | | | | 1 | | | 1 | | | | 3 |
| *Raja undulata* | | 2 | | 2 | | | | | 2 | | | 8 |
| *Rostroraja alba* | | 2 | | 2 | | | | 1 | | | | 4 |
| *Squalus acanthias* | 3 | | | | 1 | | | 1 | | | | 3 |
| *Squatina squatina* | | 2 | | | 1 | | | 1 | | | | 2 |
| Inshore bony fish, high mobility | | | | | | | | | | | | |
| *Osmerus eperlanus* | 3 | | | 2 | | | | 1 | | | | 6 |
| Commercial bony fish – ‘demersal’ | 3 | | | | 1 | | 3 | | | | | 9 |
| Commercial bony fish – ‘pelagic’ | 3 | | | 2 | | | 3 | | | | | 9 |
| Marine mammals, high mobility | | | | | | | | | | | | |
| *Balaenoptera acutorostrata* | | 2 | | | 1 | 4 | | | | | | 8 |
| *Delphinus delphis* | | 2 | | | 1 | | 3 | | | | | 6 |
| *Grampus griseus** | | 2 | | | 1 | 4 | | | | | | 8 |
| *Lagenorhynchus acutus** | | 2 | | | 1 | 4 | | | | | | 8 |
| *Lagenorhynchus albirostris* | | 2 | | | 1 | 4 | | | | | | 8 |
| *Phoca vitulina* | 3 | | | | 1 | | | 1 | | | | 3 |
| *Phocoena phocoena* | | 2 | | | 1 | | | | 2 | | | 2 |
| *Tursiops truncatus* | 3 | | | | 1 | | 3 | | | | | 9 |
| *Globicephala melas** | | 2 | | | 1 | 4 | | | | | | 8 |

* These species are classified as category 4 “Unlikely to be protected by the UK MPA network and too far ranging for protection to be secured through wider measures in UK waters, no further action required for UK waters alone” but scores have been retained here.

# Appendix 9 Costing recovery

Likely costs of recovery/conservation programmes over the periods specified in dossiers for each species (Part 2). The cost of overarching projects that will support species recovery/conservation programmes such as reporting schemes, the cost of required monitoring within MPAs and actions that are the responsibility of fisheries regulators, including enforcement of regulations, are not included in the calculation of costs. Where actions are very similar for several species in the same broad grouping and there can be 'economy of scale', the separate costs outlined in dossiers are replaced by the cost of a single large programme.

* Collaborate with / contribute to existing programmes
** Costs are part of MPA condition monitoring

**Table L** Likely costs of recovery/conservation programmes

| | Site management | Translocation | Enforcement | Research | Monitoring | Wider environment | Total over period(s) specified in dossiers |
|---|---|---|---|---|---|---|---|
| **Low mobility species** | | | | | | | |
| *Amphianthus dohrnii* | | | | 20,000 | | | 20,000 |
| *Anguilla anguilla* | | | | | | | * |
| *Arctica islandica* | | | | | 25,000 | | 25,000 |
| *Armandia cirrosa* | | 2,000 | | | 4,400 | | 6,400 |
| *Atrina fragilis* | | | | 10,000 | | | 10,000 |
| *Eunicella verrucosa* | | | | 20,000 | 50,000 | | 70,000 |
| *Hippocampus guttulatus*<br>*Hippocampus hippocampus* | 26,000 | | | | 83,000 | | 109.000 |
| *Leptopsammia pruvoti* | | | | 25,000 | 60,000 | | 85,000 |
| *Lithothamnion corallioides* | | | | 5,000 | 100,000 | | 105,000 |
| *Haliclystus auricula*<br>*Lucernariopsis campanulata*<br>*Lucernariopsis cruxmelitensis* | | | | 120,000 | | | 120,000 |
| *Ostrea edulis* | | 60,000 | | | 100,000 | | 160,000 |
| *Palinurus elephas* | | 15,000 | | 105,000 | 30,000 | | 150,000 |
| *Phymatolithon calcareum* | | | | | 100,000 | | 100,000 |
| *Pollicipes pollicipes* | | | | 6,000 | | | 6,000 |

| | Site management | Translocation | Enforcement | Research – cost for each species | Research – all species in one programme | Monitoring | Wider environment | Total over period(s) specified in dossiers |
|---|---|---|---|---|---|---|---|---|
| **Elasmobranchs** | | | | | | | | |
| *Cetorhinus maximus* | | | | 516,000 | 3.5m | | | 3.5m |
| *Dipturus batis* | | | | 1,040,000 | | | | |
| *Galeorhinus galeus* | | | | 100,000 | | | | |
| *Lamna nasus* | | | | 516,000 | | | | |
| *Leucoraja circularis* | | | | 694,000 | | | | |
| *Raja clavata* | | | | 704,000 | | | | |
| *Raja undulata* | | | | 599,000 | | | | |
| *Rostroraja alba* | | | | 614,000 | | | | |
| *Squalus acanthias* | | | | 606,000 | | | | |
| *Squatina squatina* | | | | 704,000 | | | | |
| **Mammals** | | | | | | | | |
| *Balaenoptera acutorostrata* | | | | | 4.425m | 1.5m* | 550,000* | 5,925m |
| *Delphinus delphis* | | | | | | | | |
| *Lagenorhynchus albirostris* | | | | | | | | |
| *Phocoena phocoena* | | | | | | | | |
| *Tursiops truncatus* | | | | | | | | |
| *Phoca vitulina* | | | | | 2.6m | | | |

* All cetaceans and the harbour seal

Commercial species of bony fish are not included here as costs of management are borne by fisheries authorities and fishermen. The costs included for elasmobranchs are mainly for research to better understand life history traits which are previously little researched.

# Part 2 - Dossiers

Dossiers have been prepared and are given next for each species qualifying as:

**‘Likely to be protected by the UK MPA network but will require additional targeted action’** and

**‘Unlikely to be protected by the UK MPA network but protection can be secured through wider measures in UK waters’**

Dossiers were not generally prepared for species that do not qualify for action which were categorised as

**‘No evidence of significant decline and/or likely to be protected by the UK Marine Protected Area network, no further action required’** and

**Unlikely to be protected by the UK MPA network and too far ranging for protection to be secured through wider measures in UK waters, no further action required for UK waters alone’**.

However, as part of the research to establish which category a species should be allocated to, dossiers were prepared for some species that do not qualify for action and those dossiers are included last.

# Dossiers for species that are ‘Likely to be protected by the UK MPA network but will require additional targeted action'

# CORAL MAERL *LITHOTHAMNION CORALLIOIDES* P.L. CROUAN & H.M. CROUAN, 1867

**Synonyms:** *Mesophyllum corallioides, Spongites corallioides*

**Taxonomy:**

**Phylum:** *Rhodophycota*

**Order:** *Corallinales*

**Family:** *Hapalidiaceae*


(Image:Christine Maggs)

## DISTRIBUTION

**English waters**: Some occurrences in south west England.

**UK Continental shelf**: Patchily distributed along the exposed western coasts of the southern British Isles. Locations include the west and south-west of Ireland, the south-west corner of Wales and a few sites off the south coast of England.

**Global:** West and south-west British Isles south to the Canary Isles (unconfirmed records from Mauritania and Cape Verde). Also found in the Mediterranean.

## ECOLOGY

**Description:** An unattached, fragile, alga with a calcareous skeleton. It is very similar to and often confused with *Phymatolithon calcareum*. Its form is very variable but it commonly occurs as highly branched nodules forming a 3-D lattice. Individual plants may reach 4 - 5 cm across and are bright pink in colour when alive but white when dead. This is a fragile, slow growing and long-lived species, reaching ages of 10 to 50 years[1]. Little is known about the reproductive mechanisms of this species. However, sexual reproduction can occur between gonochoristic plants. Asexual reproduction occurs through the formation of spores. In some populations sexual individuals are rare and reproduction is mediated mainly if not entirely by the production of asexual conceptacles. Reproduction is probably mainly controlled by temperature and in Britain only occurs during winter[1,2]. Maerl biotopes are included within the Annex 1 Habitat 'Sandbanks slightly covered by seawater all of the time' of the European Habitats Directive. Maerl beds are an important habitat for a wide variety of marine animals and plants which live amongst or are attached to its branches, or burrow in the coarse gravel of dead maerl beneath the top living layer.

***Feeding method***: Photoautotrophic

***Mobility***: Not relevant, typically an unattached plant.

***Development mechanism***: Insufficient information

***Reproductive type***: Vegetative propagules

***Biological zone***: Sublittoral Fringe, Upper & Lower Infralittoral

***Salinity***: Full (30-40 psu)

***Substratum***: sand, mud, gravel.

***Water flow rate***: Strong (3-6 kn), Moderately Strong (1-3

***Wave exposure***: Moderately Exposed,

kn) Sheltered, Very Sheltered.

**Long-term natural fluctuations:** There are extensive areas of dead maerl off Falmouth and in western Scotland but they are believed to have been dead for several thousand years.

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan**: UK BAP Priority Species and habitat (Maerl beds)

**EU Habitats Directive:** Annex II / IV / V

**Sources of threats:** the primary threats to Maerl health are loss of substratum, smothering, increased sedimentation, reduced salinity, dessication, abrasion and disturbance.

Loss of the substratum (which may include maerl itself) will also cause loss of the living *Lithothamnion corallioides*, as the species is photosynthetic and is only found on the surface of the maerl bed or other substratum. Propagation in the British Isles is almost entirely vegetative so recruitment of new individuals to the population will not aid recovery. The very slow growth rate of *Lithothamnion corallioides* means that vegetative regeneration will take a long time[3] . Boat moorings, dragging anchor chains and demersal fishing gear have been noted to severely damage the surface of maerl beds. A single pass of a scallop dredge could bury and kill 70% of the living maerl, redistribute coarse sediment, and affect the associated community [4,5]. Dredge tracks remained visible for 2.5 years. Repeated anchorage could also create impacts similar to towed fishing gear[4,5]. Maerl is also restricted to less wave exposed areas. Strong wave action can break up the coralline red algae nodules into smaller pieces and scatter them from the maerl bed. *Lithothamnion corallioides* is less tolerant of high wave exposure than *Phymatolithon calcareum*. Dead Maerl is commercially exploited and has been extracted from the Fal estuary, Cornwall, and in Scotland.

**RARITY**

Scarce: recorded in 34 of the 10 km squares within the 3 nautical mile limit of British seas.

**DECLINE**

Insufficient data measuring actual decline, but severe threat of decline due to the fragile, sessile and long- lived nature of this species. Assessed by BAP as 'If Action not taken species likely to become extinct in the next 10 years.'

**DEGREE OF THREAT**

**Score (range 0-16):** 8 (Moderate)

**Comments:** Severe threat of decline due to the fragile, slow-growing and long- lived nature of this species. The primary threats to this species are identified to be from demersal fishing gear and harbour activities (construction, dredging). Assessed by BAP as 'If Action not taken species likely to become extinct in the next 10 years' but that is considered unlikely.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 27 (High)

**Comments:** There is very limited knowledge currently available on the life-history traits of *L.corallioides*, particularly in regard to reproductive strategies. However the primary threat to this species is identified to be from demersal fishing gear and can be prevented. This may require intensive management outside of MPAs with regard to controlling fishing locations and gear types used, and this may not cover all areas of occurrence for this species.

**RECOVERY/CONSERVATION GOAL**

Maintain the current distribution of maerl beds and the associated plant and animal communities in the UK.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: From BAP assessment:

- Ensure that planning for aquaculture and other operations, which may cause eutrophication and smothering does not adversely affect the conservation requirements of important maerl beds.

- Ensure that road, bridge, energy and other construction schemes which might affect maerl beds do not risk damage to their conservation interest.
- Take account of the conservation requirements for maerl bed communities in the development and implementation of coastal zone management plans and ensure they are not managed in isolation from other habitats and communities in these areas.
- Include the maintenance of the extent and health of maerl bed communities in management plans for SACs/ MCZs where these include maerl beds.
- Ensure that fishing operations do not adversely affect the conservation interests of maerl beds within designated sites.

**Translocation**: Not advised.

**Enforcement**: Action taken to prevent mobile fishing gear, extraction and other mechanical disturbance and other damaging activities including fish farms at locations where significant beds are known to occur. (may include legislation) for example, where above a certain density, where there is evidence of decline or where evidence of historical beds), through implementation of management measure(s). Part of licensing and enforcement duties and no specific cost.

**Research**: Research needed into the biology and ecology of the species, along with measurement/ re-assessment of the actual extent of this species (as often confused with other maerl types). In particular, health and character of the maerl bed in the Helford as possibly the only bed of *L. corallioides* in England. Survey: £5,000. Otherwise, cost is part of reporting.

**Monitoring:** Monitor populations at examples of existing locations. Take appropriate measurements to identify possible reasons for change. Re-examine identification of records of *Lithothamnion corallioides* and *L. glaciale* around the UK and Irish coasts to confirm actual distribution. Cost in first 10 years: £100,000.

**Wider environment**: Water quality needs to be maintained in regions around Maerl beds to ensure eutrophication and / or pollution does not occur and deteriorate the habitat. Part of statutory duties of EA and no specific costs identified.

**SPECIALISTS**

Dr Jason Hall-Spencer, University of Plymouth
Prof. Christine Maggs, Queens University Belfast

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 8 (Moderate) | 27 (High) | Research: £5,000<br>Monitoring: £100,000<br>Total £105,000 in first ten years |

**REFERENCES**

[1] Adey, W.H. & McKibbin, D.L., (1970). Studies on the maerl species Phymatolithon calcareum (Pallas) nov. comb. and Lithothamnion corallioides (Crouan) in the Ria de Vigo. *Botanica Marina*, **13**, 100-106.

[2] Hall-Spencer, J.M. & Moore, P.G. (2000a). Impact of scallop dredging on maerl grounds. In *Effects of fishing on non-target species and habitats.* (ed. M.J. Kaiser & S.J., de Groot) 105-117. Oxford: Blackwell Science.

[3] Jackson, A. (2007). Lithothamnion corallioides. Maerl. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 24/12/2010]. Available from: http://www.marlin.ac.uk/speciesbenchmarks.php?speciesID=3710

[4] Hall-Spencer, J.M. & Moore, P.G. (2000b). Scallop dredging has profound, long-term impacts on maerl habitats. *ICES Journal of Marine Science*, **57**, 1407-1415.

# COMMON MAERL — *PHYMATOLITHON CALCAREUM* — (PALLAS) W.H. ADEY & D.L. MCKIBBIN, 1970

**Synonyms:**

**Taxonomy:**
**Phylum:** *Rhodophycota*
**Order:** *Corallinales*
**Family:** *Hapalidiaceae*

(Image:Keith Hiscock)

## DISTRIBUTION

**English waters**: Patchy distribution around the south and west coast of England with a dense bed only in the Fal.

**UK Continental shelf**: Recorded around the Shetland Orkney Islands and along the east coast of Scotland, south coast of England with isolated records at Bideford Bay, Pembrokeshire and Caernarfon Bay. Abundant at locations in western Scotland.

**Global:** From Norway down to northern Spain. Includes the western Baltic and the Mediterranean

## ECOLOGY

**Description:** A fragile, coralline alga often confused with *Lithothamnion corallioides*. Its form is very variable but commonly resembles stag's horns of irregular diameter. Older specimens become somewhat erect with nodular branches and are reminiscent of red 'coral'. Unattached plants may reach about 7 cm in diameter with branches up to 6 mm in diameter and mauvish brown in colour. The surface can be smooth or flaky. Typically found in less than 20 m depth on sand, mud or gravel substrata in areas that are protected from strong wave action but have moderate to high water flow. The crustose form is very rare in the British Isles. Usually found as unattached plants forming beds of coralline algal gravel (maerl) in the sub-littoral and occasionally lower littoral. Typically found together with *Lithothamnion corallioides* in the southern British Isles or *Lithothamnion glaciale* in the northern British Isles[1]. Growth rate is between 1-2 mm per year and the species can live up to between 51 and 100 years [1,2]. *Phymatolithon calcareum* may have phasic reproduction with peaks every six years[3]. This species is more widespread than the similar *Lithothamnion corallioides,* but is still rare and vulnerable to impacts.

***Feeding method***: Photoautotrophic

***Mobility***: Not relevant, typically an unattached plant.

***Development mechanism***: Insufficient information

***Reproductive type***: Vegetative propagules

***Biological zone***: Sublittoral Fringe, Upper & Lower Infralittoral.

***Salinity***: Full (30-40 psu)

***Substratum***: Sand, mud, gravel.

***Water flow rate***: Strong (3-6 kn), Moderately Strong (1-3 kn)

***Wave exposure***: Moderately Exposed, Sheltered

**Long-term natural fluctuations:** There are extensive areas of dead maerl off Falmouth and in western Scotland but they are believed to have been dead for several thousand years.

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species

**EU Habitats Directive:** Annex II / IV / V

**Sources of threats:** The two primary threats are hydraulic dredging of bivalves, and scallop dredging[4]. Loss of substratum, smothering, sedimentation, dessication, abrasion and disturbance also severely affect this species.

Loss of the substratum (which may include maerl itself) will also cause loss of the living *Phymatolithon calcareum*, as the species is photosynthetic and is only found on the surface of the maerl bed or other substratum. Propagation in the British Isles is almost entirely vegetative so recruitment of new individuals to the population will not aid recovery. The very slow growth rate of *Phymatolithon calcareum* means that vegetative regeneration will take a long time[2]. Boat moorings, dragging anchor chains and demersal fishing gear have been noted to severely damage the surface of maerl beds including that a single pass of a scallop dredge could bury and kill 70% of the living maerl, redistribute coarse sediment, and affect the associated community[5,6]. Dredge tracks remained visible for 2.5 years. Repeated anchorage could also create impacts similar to towed fishing gear[5,6]. Maerl is also restricted to less wave exposed areas. Strong wave action can break up the coralline red algae nodules into smaller pieces and scatter them from the maerl bed although *Phymatolithon calcareum* is more tolerant of high wave exposure than *Lithothamnion corallioides*. Dead maerl is commercially exploited and has been extracted from the Fal estuary, Cornwall, and in Scotland.

**RARITY**

Recorded from 103 of the 10km squares within the 3 nautical mile limit of British seas (=Widespread), although only present in abundance in the Fal in England.

**DECLINE**

Insufficient data measuring actual decline. BAP criteria: ‘Slow growing, grow about 0.5.-1.5 mm per year). Two main threats: hydraulic dredging of bivalves and scallop dredging( Blake and Maggs, 2003, in JNCC FCS assessment). Maerl biotopes are included within the Annex 1 Habitat "Sandbanks slightly covered by seawater all of the time" of the European Habitats and Species Directive. *Phymatolithon calcareum* is listed on Annex Vb. Maerl biotopes are covered by a UK Biodiversity Action Plan and *Phymatolithon calcareum* is listed on the UK BAP 'long list'.[7]

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)
**Comments:** Severe threat of decline due to the fragile, slow-growing and long- lived nature of this species. The primary threats to this species are identified to be from demersal fishing gear and harbour activities (construction, dredging). Assessed by BAP as ‘If Action not taken species likely to become extinct in the next 10 years’ but that is considered unlikely. There are significant threats to the continued existence of *P. calcareum* beds in England.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 27 (High)
**Comments:** There is very limited knowledge currently available on the life-history traits of *P.calcareum*, particularly in regard to reproductive strategies.. Prevention of damage by mobile fishing gear may require intensive management outside of MPAs with regard to controlling fishing locations and gear types used, and this may not cover all areas of occurrence for this species.

**RECOVERY/CONSERVATION GOAL**

Maintain the current distribution and extent of maerl beds and the associated plant and animal communities in the UK by protecting existing beds from damage and monitor status.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management:** From BAP assessment:

- Ensure that planning for aquaculture and other operations, which may cause eutrophication and smothering does not adversely affect the conservation requirements of important maerl beds.
- Ensure that road, bridge, harbour, energy and other construction schemes which might affect maerl beds do not risk damage to their conservation interest.
- Take account of the conservation requirements for maerl bed communities in the development and implementation of coastal zone management plans and ensure they are not managed in isolation from other habitats and communities in these areas.
- Include the maintenance of the extent and health of maerl bed communities in management plans for SACs/ MCZs where these include maerl beds.
- Ensure that fishing operations do not adversely affect the conservation interests of maerl beds within designated sites.

No direct cost involved.

**Translocation:** Not advised.

**Enforcement:** Action taken to prevent mobile fishing gear, extraction and other mechanical disturbance and other damaging activities including fish farms at locations where significant beds are known to occur (may include legislation) (for example, where above a certain density, where there is evidence of decline or where evidence of historical beds) through implementation of management measure(s). Part of licensing and enforcement duties and no specific cost.

**Research**: As more surveys of benthos are undertaken, results for *P. calcareum* should be contributed to recording schemes and used to develop a detailed map of distribution and abundance in British waters. Cost is part of reporting schemes.

**Monitoring:** Monitor populations at examples of existing locations. Take appropriate measurements to identify possible reasons for change. Can be part of monitoring in MPAs but as a separate project. Baseline surveys costing £40,000 and then surveys at three year intervals costing £30,000 per survey. Cost in first 10 years: £100,000.

**Wider environment**: Water quality needs to be maintained in regions around maerl beds to ensure eutrophication and / or pollution does not occur and deteriorate the habitat. Part of statutory duties of EA and no specific costs identified.

**SPECIALISTS**

Dr Jason Hall-Spencer, University of Plymouth
Prof. Christine Maggs, Queens University Belfast

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 9 (moderate) | 27 (High) | Monitoring: £40,000 for establishment of sites then £30,000 after three years. Total £100,000 in first ten years. |

REFERENCES

[1]Jackson, A. (2007). Phymatolithon calcareum. Maerl. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 24/12/2010]. Available from: http://www.marlin.ac.uk/reproduction.php?speciesID=4121

[2] Cabioch, J. (1969). Les fonds de maërl de la baie de Morlaix et leur peuplement végétal. *Cahiers de Biologie Marine*, **10**, 139–161.

[3]Adey, W.H. & McKibbin, D.L. (1970). Studies on the maerl species Phymatolithon calcareum (Pallas) nov. comb. and Lithothamnion corallioides (Crouan) in the Ria de Vigo. *Botanica Marina*, **13**, 100-106.

[4] Blake, C., Maggs, C. A. (2003). Comparative growth rates and internal banding periodicity of maërl species (Corallinales, Rhodophyta) from northern Europe. *Phycologia*, **42,** 606-612.
[5] Hall-Spencer, J.M. & Moore, P.G. (2000a). Impact of scallop dredging on maerl grounds. In *Effects of fishing on non-target species and habitats.* (ed. M.J. Kaiser & S.J., de Groot) 105-117. Oxford: Blackwell Science.
[6] Hall-Spencer, J.M. & Moore, P.G., (2000b). Scallop dredging has profound, long-term impacts on maerl habitats. *ICES Journal of Marine Science*, **57**, 1407-1415.
[7] JNCC (2010) UK Priority Species data collation *Phymatolithon calcareum* (version 2). UK BAP Assessments [On-line]. Avalailable from: http://www.jncc.gov.uk/_speciespages/2508.pdf [Accessed on 31/01/2010].

# LAGOON SANDWORM *ARMANDIA CIRRHOSA* FILIPPI, 1861

**Synonyms:** None

**Taxonomy:**
**Phylum:** *Annelida*
**Order:** *Opheliida*
**Family:** *Opheliidae*


## DISTRIBUTION

**English waters**: Formerly very abundant in Eight-Acre pond in the Keyhaven-Lymington lagoons in Hampshire but has not been recorded there since 1990 (BAP notes since early 2000's). It is now known from two locations: Small Mouth Spit (Portland Harbour) and East Fleet Sandbank (Fleet Lagoon) in Dorset discovered in 1994.

**UK Continental shelf**: As above.

**Global:** South from the English Channel along the eastern Atlantic coasts, on Madeira and in the Mediterranean and Adriatic.

## ECOLOGY

**Description:** A very small and fragile, ribbon-like species, less than 8 mm long with three eyes on its head. It has 26 or 27 segments that bear chitinous bristles. It is found in gravely, sandy and muddy substrata in water only slightly less saline than seawater. Almost nothing is known of the biology of this species. Abundance varies markedly, from 463 individuals per metre square in Eight-Acre Pond to just 12 specimens recorded after extensive searching in the whole of the Fleet and Portland Harbour. [1,2,3]

***Feeding method***: Sub-surface deposit feeder

***Mobility***: Burrower, swimmer

***Development mechanism***: Planktotrophic

***Reproductive type***: Insufficient information

***Biological zone***: Lower eulittoral

***Salinity***: Reduced (18-30 psu), Variable (18-40 psu)

***Substratum***: muddy gravel, muddy sands

***Water flow rate***: Insufficient information

***Wave exposure***: very sheltered

**Long-term natural fluctuations:**

No information

## STATUS AND THREATS

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species (incorrectly assigned as a terrestrial species)

**Wildlife and Countryside Act**: Schedule 5, section 9.

**Sources of threats:** *Armandia cirrhosa* is probably found within the top 1-2 cm of sediment so would be highly damaged by substratum loss. Recovery would be very low due to only two extant populations of the species existing within the UK. Similarly, with increased wave exposure, the thin layer of fine sediment with which the worm is usually associated would be washed away. The species has only been recorded at sites with reduced salinity so can therefore also probably not tolerate increased salinity

levels. Alteration to any of the three small sites where it has been reported in terms of hydrodynamic flow, salinity or abrasion of the sediment would be expected to cause a severe decline in terms of total UK population numbers.[4]

**RARITY**

Rare, only known from 3 sites in the UK, may be extinct from one.

**DECLINE**

Insufficient data. A decline observed at the Eight Acre Pond site may be associated with changes in salinity and/or inappropriate drainage.

**DEGREE OF THREAT**

**Score (range 0-16):** 7 (Moderate)

**Comments:** Since 1984 this species has only ever been recorded in England, where it is currently known from only one locality. Before this, there were only eight records ever in the whole world. It is now absent from the only previously known UK site.[5]

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 12 (Moderate)
**Comments:** Extremely little is known of this species biology and ecology, and therefore the threats to its existence (other than changes to normal saline lagoon habitat, for example, through pollution, regime change or substratum loss). It is felt that translocation (if required) should be successful.

**RECOVERY/CONSERVATION GOAL**

Halt/reverse any decline/loss observed at the Eight Acre Pond and maintain/enhance populations at existing sites through site protection and management. Stable populations at known sites by 2015.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Seek advice to ensure that water quality (especially salinity) regime is maintained to the benefit of the species at known sites.

**Translocation:** After surveys, if the species is no longer present at a location, arrange translocation of individuals from other sites. £2,000

**Enforcement**: Environment Agency.

**Research:** Survey to establish status of populations at known sites. Cost included with 'Translocation'.

**Monitoring:** Annual check of occurrence at known sites with review in 2015. Take appropriate measurements to identify possible reasons for change. £800 p.a. for each of four years.

**Wider environment:**

**SPECIALISTS**

Dr Andy Mackie, National Museum of Wales.
Dr Martin Sheader,
Dr Richard Barnes

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery/Conservation potential (range 2-36) | Cost |
|---|---|---|
| 7 (Moderate) | 12 (Moderate) | £2,000 in year 1<br>£800 p.a. in years 2, 3, 4.<br>Total: £4,400 |

**REFERENCES**

[1] Downie, A. J. (1996). The lagoon sandworm Armandia cirrhosa. *English Nature Research Reports*, **202**, 26pp.
[2] Barnes, R.S.K. (1994). The brackish-water fauna of northwestern Europe. Cambridge: Cambridge University Press.
[3] Rouse, G.W. & Pleijel, F. (2001). Polychaetes. New York: Oxford University Press.

[4] White, N. (2007). *Armandia cirrhosa. Lagoon sandwor*m. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11/01/2011]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=2600

[5] Bamber, R.N., Evans, N.J. (2003) 140 years of the Lagoon sand worm *Armandia cirrhosa* Filippi, 1862 – the whole story so far. *Porcupine Marine Natural History Society Newsletter*, **13**.

# LONG SNOUTED SEAHORSE *HIPPOCAMPUS GUTTULATUS* CUVIER, 1829

**Synonyms:** *Hippocampus ramulosus*

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Syngnathiformes*
**Family:** *Syngnathidae*

(Image:Steve Trewhella)

## DISTRIBUTION

**English waters**: Southern Norfolk, Essex, South Eastern England, and along the south coast and in north Cornwall.
**UK Continental shelf**: Recorded from the south and south west coasts of Britain and western Ireland, and on the western coasts of Scotland to Orkney and Shetland.[1]

**Global:** North-east Atlantic from the Netherlands, south to Portugal, and the Mediterranean, including the Black Sea and British Isles.

## ECOLOGY

**Description:** *Hippocampus guttulatus* can be up to 15 cm in length and has a long snout. It can be coloured from greenish-yellow through to reddish-brown and often mimics the colour of associated vegetation. Individuals become sexually mature in their first year, and live for between 3 to 5 years. They have an annual protracted breeding frequency, brooding a mean number of 214 eggs per year (April – October), with incubation lasting for 3-5 weeks. This species has a low mobility and small home range. The long-snouted seahorse is typically found associated to seagrass habitat, but can also be found on other substrata. Populations are sparsely distributed and primarily found in the inshore shallows. [2,3]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: Gonochoristic

***Biological zone***: Upper- lower eulittoral zone and sub-littoral fringe.

***Salinity***: Variable (18-40 psu)

***Substratum***: Algae, seagrass, mud.

***Wave exposure***: Moderately Exposed, Sheltered, Very Sheltered.

***Water flow rate***: Weak (<1 kn), Moderately Strong (1-3 kn).

**Long-term natural fluctuations:**

Sightings seem always to have been sporadic and unpredictable with knowledge of resident populations only in recent years.

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Bern Convention:** Appendix II

**Biodiversity Action Plan:** UK BAP Priority Species

**CITES:** Seahorses are considered internationally endangered and every species is classified as endangered under CITES.

**IUCN Red list:** Unclassified (Data deficient), previously classed as Vulnerable (1994 criteria).

**OSPAR Convention:** Annex V, threatened/declining species within OSPAR regions II to V.

**Wildlife and Countryside Act:** Schedule 5, section 9

**Sources of threats:**

Threats to *Hippocampus guttulatus* are primarily associated with habitat loss through trawling and anchor damage especially in seagrass as abundance is highly influenced by habitat structure. Widely reported to occur in inshore seagrass habitats, which are themselves under threat. Worldwide, seahorses are threatened by the traditional medicine, curio and aquarium trades. In many areas of the world seahorses have disappeared entirely and fishermen are looking for new regions to find seahorses in. The British Isles were previously targeted for the aquarium trade but, although this was stopped, the relatively low densities in population in the areas seahorses are found in would make local extinction a possibility without protection. [2,4,5]

**RARITY**

Rarity is difficult to identify as sightings are sporadic and at different locations. Since the species is mobile, the number of locations in total (unless of resident populations) is irrelevant. The species is, at any one time, most likely scarce.

**DECLINE**

There are no published data about population trends or total numbers of mature animals for this species. There is an increase in sightings but this is most likely due to increased public awareness and almost all occurrences must be considered serendipitous. Included within BAP assessment as they were Red listed in: Croatia, Cyprus, France, Greece, Italy, Malta, Morocco, Netherlands, Portugal, Spain and United Kingdom, and subject to the medicine, curio, and aquarium trade.[5]

**DEGREE OF THREAT**

**Score (range 0-16):** 5 (low)

**RECOVERY/CONSERVATION POTENTIAL**

**Score:** 18 (High)

**Comments:** Recovery/conservation potential refers to resident populations as the ephemeral occurrences that constitute most records cannot warrant site management. While the main factors affecting seahorse survival are known, the current population status and methods for captive breeding are still in need of further research. Recovery will be fairly rapid given that the necessary habitat is in good condition and recruitment level from neighbouring populations is high.

**RECOVERY/CONSERVATION GOAL**

Recovery or conservation will have been achieved when a constant level of abundance has been reached though removal of habitat degrading activities and negative pressures. If suggested measures are implemented, within 5 years the population at a site with a persistent population should be within a healthy state.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management:** Maintenance of strict regulations on placement of anchors, and fishing gear types used to ensure that degradation of habitat will not occur at known resident population sites. Consider

provision of fixed moorings at resident sites if anchoring perceived to be a problem. Similarly, impact assessments of any developments will reduce effects of smothering/ nutrient loading that may affect the seagrass regions. Moorings at one location could cost in the region of £20,000. Costs of enforcement covered by MMO normal activities and normal development budgets.

**Translocation:** Not recommended as a primary management technique, due to high cost and difficulty of captive breeding, although it can be an effective method of allowing re-population of previously highly-impacted sites where re-colonisation is not viable.

**Enforcement:** Maintenance of current legislation which excludes killing or extraction of this species in UK waters. Enforcement of local regulations to prevent anchor damage to seagrass habitat is also needed. Cost should be covered by MMO normal activities (Under W&C Act).

**Research:** Occurrences need to be reported especially where populations appear to be resident at a location. Reporting schemes need to be supported generally and separate costs are not given. Targeted surveys are unlikely to be successful unless as a result of a tip-off when the nature of the population (ephemeral, serendipitous or resident) needs to be established and no specific cost is suggested. Long-term detailed population and behaviour data is needed at sites where there are known resident populations. Annual cost for survey, study and analysis of seahorses at Studland Bay (primarily), and the rest of the UK by Seahorse Trust equivalent to £41,000 (although would be much higher if volunteers not used). If other sites (for example Poole harbour/ Dart populations) were also intensively surveyed, a similar amount would be needed again. [6]

**Monitoring:** Monitoring of populations size and the health of the habitat is needed to improve knowledge of the species' abundance and life-history, and also to assess current status of threat. Research and monitoring collaborations already instigated between the Seahorse Trust, Project Seahorse, the National Marine Aquarium, and the Anglesey SeaZoo.

**Wider environment:** No measures.

**SPECIALISTS**

Neil Garrick-Maidment, The Seahorse Trust

Dr Heather Koldeway, Project Seahorse, ZSL

*Breeding/ behaviour research:*

Karen Tuscon, Anglesey Sea Zoo

Robin James, Weymouth Sealife centre

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost (shared with *H.hippocampus*) |
|---|---|---|
| 5 (Low) | 18 (High) (But only relevant to resident populations) | Establish moorings at resident site: £20,000 and annual maintenance cost.<br>Maintain existing studies of behaviour and occurrence in Studland Bay: £41,000 p.a. for each of five years. |

**REFERENCES**

[1] Garrick-Maidment, (2007) British seahorse survey report 2007. Report by the Seahorse Trust, Devon, England. 26 pp.

[2] Neish, A (2007). *Hippocampus guttulatus*. Long snouted seahorse. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3505 [Accessed on 17/01/2011].

[3] Garrick-Maidment, N., (1998) A note on the status of indigenous species of seahorse. *Journal of the Marine Biological Association of the United Kingdom*, **78**, 691-692.

[4] OSPAR (2009) Background Document for the Long-snouted seahorse *Hippocampus guttulatus* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00429_long_snouted_seahorse.pdf. [Accessed 11/01/2011].

[5]JNCC (2010) UK Priority Species data collation *Hippocampus guttulatus* (version 2). UK BAP Assessments [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/2335.pdf [Accessed on 11/01/2011].

[5] Garrick-Maidment, N. (2011) Personal communications.

# SHORT SNOUTED SEAHORSE *HIPPOCAMPUS HIPPOCAMPUS* LINNAEUS, 1758

**Synonyms:** *Hippocampus europaeus*

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Syngnathiformes*
**Family:** *Syngnathidae*

(Image: Steve Trewhella)

## DISTRIBUTION

**English waters**: Found along the southern English coastline with fewer sightings in Lincolnshire and north Norfolk (possibly due to lack of reporting rather than distribution).

**UK Continental shelf**: Distributed along the south coast of England, and around Wales, with substantial populations around the Channel Islands[1]. More recently seen around northern Scotland and north of the Dogger Bank[2].

**Global:** Reported from the Netherlands, Belgium, the East Atlantic coast of Europe, Algeria, Italy, Malta and Greece.

## ECOLOGY

**Description:** *Hippocampus hippocampus* has a very distinctive shape with the head set at an angle to the body. The trunk of the body is short and rather fat whilst the tail is tapering, curled and prehensile. The body can be up to 15 cm in length, with the snout short and upturned. Individuals have a lifespan of up to 10 years and become sexually mature at 6 to 12 months. Seahorses are viviparous and tend to produce between 2 to 300 young[3]. Seahorses are predominantly sedentary but will move due to territorial, feeding and mating requirement or to overcome winter storms (by moving deeper). Animals live on a range of substrata from a depth of roughly 5 to 70 m.[4]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Eulittoral, Mid Eulittoral, Lower Eulittoral, Sublittoral Fringe

***Salinity***: Variable (18-40 psu)

***Substratum***: Gravel, silt, sand, rock and man-made structures, seagrass.

***Water flow rate***:
Weak (<1 kn), Moderately Strong (1-3 kn), Strong (3-6 kn).

***Wave exposure***: Moderately Exposed, Sheltered, Very Sheltered, Extremely Sheltered, Ultra Sheltered

**Long-term natural fluctuations:**

Sightings seem always to have been sporadic and unpredictable with knowledge of resident populations only in recent years.

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Bern Convention:** Appendix II

**Biodiversity Action Plan:** UK BAP Priority Species

**CITES:** Seahorses are considered internationally endangered and every species is classified as endangered under CITES.

**IUCN Red list:** Unclassified (Data deficient), previously classed as Vulnerable (1994 criteria).

**OSPAR Convention:** Annex V, threatened/declining species within OSPAR regions II to V.

**Wildlife and Countryside Act:** Schedule 5, section 9.

**Sources of threats:**

Threats to *Hippocampus hippocampus* are primarily associated with habitat loss through trawling and anchor damage especially in seagrass habitats, which are too under threat. Worldwide, seahorses are threatened by the traditional medicine, curio and aquarium trades. In many areas of the world seahorses have disappeared entirely and fishermen are looking for new regions to find seahorses in. The British Isles were previously targeted for the aquarium trade but, while this was stopped, with the relatively low densities in population in the areas seahorses are found in it would not take much for them to be made locally extinct without such protection.[4,5]

**RARITY**

Rarity is difficult to identify as sightings are sporadic and at different locations. Since the species is mobile, the number of locations in total (unless of resident populations) is irrelevant. The species is, at any one time, most likely scarce.

**DECLINE**

There are no published data about population trends or total numbers of mature animals for this species. There is an increase in sightings but this is most likely due to increased public awareness and almost all occurrences must be considered serendipitous. Included within BAP assessment as they were Red listed in: Croatia, Cyprus, France, Greece, Italy, Malta, Morocco, Netherlands, Portugal, Spain and United Kingdom, and subject to the medicine, curio, and aquarium trade.[6]

**DEGREE OF THREAT**

**Score (range 0-16):** 5 (low)

**RECOVERY/CONSERVATION POTENTIAL**

**Score:** 18 (High)

**Comments:** Recovery/conservation potential refers to resident populations as the ephemeral occurrences that constitute most records cannot warrant site management. While the main factors affecting seahorse survival are known, the current population status and methods for captive breeding are still in need of further research. Recovery will be fairly rapid given that the necessary habitat is in good condition and recruitment level from neighbouring populations is high.

**RECOVERY/CONSERVATION GOAL**

Recovery or conservation will have been achieved when a constant level of abundance has been reached though removal of habitat degrading activities and negative pressures. If suggested measures are implemented, within 5 years the population at a site with a persistent population should be within a healthy state.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management:** Maintenance of strict regulations on placement of anchors, and fishing gear types used to ensure that degradation of habitat will not occur at known resident population sites. Consider provision of fixed moorings at resident sites if anchoring perceived to be a problem. Similarly, impact

assessments of any developments will reduce effects of smothering/ nutrient loading that may affect the seagrass regions. Moorings at one location could cost in the region of £20,000. Costs of enforcement covered by MMO normal activities and normal development budgets.

**Translocation:** Not recommended as a primary management technique, due to high cost and difficulty of captive breeding, although it can be an effective method of allowing re-population of previously highly-impacted sites where re-colonisation is not viable.

**Enforcement:** Maintenance of current legislation which excludes killing or extraction of this species in UK waters. Enforcement of local regulations to prevent anchor damage to seagrass habitat is also needed. – Cost should be covered by MMO normal activities (Under W&C Act).

**Research:** Occurrences need to be reported especially where populations appear to be resident at a location. Reporting schemes need to be supported generally and separate costs are not given. Targeted surveys are unlikely to be successful unless as a result of a tip-off when the nature of the population (ephemeral, serendipitous or resident) needs to be established and no specific cost is suggested. Long-term detailed population and behaviour data is needed at sites where there are known resident populations. Annual cost for survey, study and analysis of seahorses at Studland Bay (primarily), and the rest of the UK by Seahorse Trust equivalent to £41,000 (although would be much higher if volunteers not used). If other sites (for example Poole harbour/ Dart populations) were also intensively surveyed, a similar amount would be needed again. [7]

**Monitoring**: Monitoring of established populations size and the health of the habitat is needed to improve knowledge of the species' abundance and life-history, and also to assess current status of threat. Research and monitoring collaborations already instigated between the Seahorse Trust, Project Seahorse, the National Marine Aquarium, and the Anglesey SeaZoo.

**Wider environment**: No measures.

**SPECIALISTS**

Neil Garrick-Maidment, The Seahorse Trust

Dr Heather Koldeway, Project Seahorse, ZSL

*Breeding/ behaviour research:*

Karen Tuscon, Anglesey Sea Zoo

Robin James, Weymouth Sealife centre

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost (shared with *H.guttulatus*) |
|---|---|---|
| 5 (Low) | 18 (High) (But only relevant to resident populations) | Establish moorings at resident site: £20,000 and annual maintenance cost.<br>Maintain existing studies of behaviour and occurrence in Studland Bay: £41,000 p.a. for each of five years. |

**REFERENCES**

[1] Garrick-Maidment, N.,Jones, L., (2004) British seahorse survey report 2004. Report by the Seahorse Trust, Devon, England.

[2] Garrick-Maidment, (2007) British seahorse survey report 2007. Report by the Seahorse Trust, Devon, England. 26 pp.

[3] Garrick-Maidment, N., (1998) A note on the status of indigenous species of seahorse. *Journal of the Marine Biological Association of the United Kingdom*, **78**, 691-692.

[4] Sabatini, M., Ballerstedt, S. (2007) *Hippocampus hippocampus. Short snouted seahorse*. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3506 [Accessed on 11/01/2011].

[5] OSPAR (2009) Background Document for the Short-snouted seahorse *Hippocampus hippocampus* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00430_short_snouted_seahorse.pdf. [Accessed 11/01/2011].

[6] JNCC (2010) UK Priority Species data collation *Hippocampus hippocampus* (version 2). UK BAP Assessments [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/2336.pdf [Accessed on 11/01/2011].

[7] Garrick-Maidment, N. (2011) Personal communications.

# PINK SEA FAN *EUNICELLA VERRUCOSA* PALLAS, 1766


(Image: Keith Hiscock)

**Synonyms:** None

**Taxonomy:**

**Phylum:** *Cnidaria*

**Order:** Alcyonacea

**Family:** Gorgoniidae

The 'pink' seafan also occurs as white individuals.

## DISTRIBUTION

**English waters**: Restricted to the south-west (Cornwall, Devon and Dorset)

**UK Continental shelf**: Northwards to north Pembrokeshire and eastwards to Portland Bill in Britain. Common in parts of south Devon and Cornwall, frequent in the Isles of Scilly and at Lundy. Present on the south and west coasts of Ireland but common only in Galway and Donegal Bays.[1]

**Global:** UK southwards to north-west Africa and the western Mediterranean. [1]

## ECOLOGY

**Description:** Present on hard substrate within the circalittoral zone, in weak to moderately strong currents. Colonies are sessile and long-lived (several decades), reaching a maximum size of up to 50 cm high but more often up to 30 cm and in densities sometimes of 10+/sq m. Fans are usually oriented in one plane (at right angles to the prevailing water currents).

***Feeding method***: Passive suspension feeder.

***Mobility***: Permanent attachment.

***Development mechanism***: Lecithotrophic.

***Reproductive type***: Gonochoristic.

***Biological zone***: Upper & lower circalittoral.

***Salinity***: Full (30-40 psu).

***Substratum***: Artificial (for example metal / concrete), bedrock, large to very large boulders.

***Wave exposure***: Sheltered to very exposed.

***Water flow rate***: Weak (<1kn); Moderately strong (1-3 kn).

**Long-term natural fluctuations:** Distribution probably stable. Recruitment may be episodic, especially at limits of distribution.

**Past declines and current threats**: "Older records suggest that this species occurred in the English Channel almost to the Thames Estuary (Margate)"[1]. Recent declines (to the 1980's) were caused in part by souvenir taking. Disease[2], affecting fans from 2001-2003 caused declines in some populations in south west England, especially at Lundy[3].

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species.

**IUCN Red list:** Vulnerable (classification: A1d, version 2.3)

**Wildlife and Countryside Act**: Schedule 5, section 9

**Sources of threats:** Mobile fishing gear, souvenir collecting, displacement by clumsy finning (divers), disease, warming, sedimentation. Continued pressure from mobile fishing gear is the main concern but disease encouraged by warming events[4] and possibly exacerbated by high nutrient levels is a concern.

**RARITY**

Uncommon (occurring in 56 to 150 10 km squares within the 3 nautical mile limit of British seas).

**DECLINE**

Localised because of disease[2], and damage caused by dredging[5]. Otherwise, no apparent change in geographical distribution in the past 50 years at least. Classified on BAP as 'vulnerable' within IUCN.

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)
Whilst the species seems to be thriving in its core distribution, outlying populations are threatened by being edge-of-range and may also be less able to recover from events such as disease. Although outbreaks of disease may cause mortality, such outbreaks may be natural and occur on decadal timescales[6].

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 18 (High)
**Comments:** Measures are concerned with removing pressures that are damaging populations, i.e. mobile fishing gear. The disease that affected sea-fans is likely to be a natural occurrence with no action possible. Recovery can be fairly rapid but settlement does not happen every year and growth is slow so that re-colonisation might be within five years but moderately sized colonies will be present within 10 years[7].

**RECOVERY/CONSERVATION GOAL**

Recovery/conservation will have been achieved when the recent historical distribution and abundance has been restored/maintained by protection of existing populations and removal of (manageable) pressures causing decline. Research aimed at understanding reproductive characteristics and population genetics should be complete by end of 2014.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**:Remove damaging activities such as mobile fishing gear. [Cost of regulatory activities]

**Translocation**: Not relevant.

**Enforcement**: Maintain scheduled status. Enforce through statutory authorities including fisheries regulation. [Cost of regulatory activities]

**Research**: Improve understanding of dispersal and isolation, through observation and genetic studies. Laboratory observation and experiment - £20,000 [Genetic studies are already funded and underway].

**Monitoring**: Maintain survey and photographic monitoring sites that identify change (abundance, size and condition) at specific locations. Part of existing monitoring - £10,000 per annum.

**Wider environment**: Unknown. Possibly ensure nutrient loadings are reduced

**SPECIALISTS**

Jamie Stevens – University of Exeter
Dr Keith Hiscock – Marine Biological Association
Dr Jason Hall-Spencer – University of Plymouth

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 6 (Moderate) | 18 (High) | Reproduction: £20,000<br>Monitoring: £10,000 pa |

**REFERENCES**

[1] Manuel, R.L. (1988) *British Anthozoa*. London: Academic Press. [Synopses of the British Fauna, no. 18.]

[2] Hall-Spencer, J.M., Pike, J. & Munn, C.B. (2007) Diseases affect cold-water corals too: *Eunicella verrucosa* (Cnidaria: Gorgonacea) necrosis in SW England. *Diseases of Aquatic Organisms*, **76**, 87-97.

[3] Hiscock, K. 2003. Changes in the marine life of Lundy. *Report of the Lundy Field Society.* **53**: 86-95.

[4] Cerrano, C., Bavestrello, G., Bianchi, C.N., Cattaneo-vietti, R., Bava, S., Morganti, C. (2000) A catastrophic mass-mortality episode of gorgonians and other organisms in the Ligurian Sea (North-western Mediterranean), summer 1999. *Ecology Letters*, ***3***, 284-293.

[5] Lart, W.J., Dalby, T.M., MacMullen, P.H. & Willerton, P.F. (1993) Benthic and ecosystem impacts of dredging for pectinids. Final report to the Commission of European Communities Special Study Project on the Protection of Marine Species 1992/1993. Consultancy report No. 71, Sea Fish Industry Authority November 1993. 55 pages.

[6] Marine Biological Association (1957) *Plymouth Marine Fauna*. Plymouth, Marine Biological Association. [See pg 62 for account of poor condition and mortality in 1924.]

[7] Hiscock, K., Sharrock, S., Highfield, J. & Snelling, D. (2010) Colonization of an artificial reef in south-west England – ex HMS Scylla. *Journal of the Marine Biological Association of the United Kingdom*, **90(1),** 69–94.

# KALEIDOSCOPE JELLYFISH *HALICLYSTUS AURICULA* RATHKE, 1806

**Synonyms:** *Lucernaria auricula*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Stauromedusae*
**Family:** *Lucernariidae*

(Image:Marco Faasse)

## DISTRIBUTION

**English waters**: All English coasts

**UK Continental shelf**: Recorded from the Shetland Isles, Orkney, the west coasts of England, Wales and Scotland, with isolated records from Northumberland.

**Global:** North-west and north-east Atlantic coasts including Arctic waters.

## ECOLOGY

**Description:** *Haliclystus auricula* is a funnel-shaped stalked jellyfish up to 2-2.5 cm high with eight arms radiating from the mouth, connected near the tips by a thin membrane. It is fixed to the substratum by a stalk that is the same length as the bell. Colour varies from grey/green to red/brown. The arms are tipped by clusters of up to 100 short tentacles. The main distinguishing feature of *Haliclystus auricula* is the presence of kidney-shaped primary tentacles on the membrane margin, between the arms. This species is found attached to algae such as *Ulva* spp., *Ceramium fornicata* and *Gymnogongrus furcellatus,* and seagrasses in the low intertidal and shallow sub-littoral zone. [1]

***Feeding method***: Suspension feeder

***Mobility***: Attached, sessile

***Development mechanism***:

***Reproductive type***: Gonochoristic

***Biological zone***: Sublittoral fringe, lower infralittoral

***Salinity***: Full (30-40 psu)

***Substratum***: Macroalgae, seagrass

***Water flow rate***: Weak (< 1 kn).

***Wave exposure***: Exposed, moderately exposed, sheltered.

**Long-term natural fluctuations:** Stalked jellyfish were studied extensively in south-west England and elsewhere in the 1950's to 70's by P.G. Corbin. Numbers found on shores were often high (>750 in one search at Wembury in 1973) but the species is now very rarely seen. [2]

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority species

**Sources of threats:** Degradation of rocky coastal habitat and associated macro-algal species thought to be associated with the apparent decline in populations.

**RARITY**

Recorded in 63 10x10 km grid squares in Great Britain (nationally uncommon). However, historical records are included and the species in now very little seen.

**DECLINE**

**Decline:** This species was found in often high numbers (>750 in one shore search in 1973: Corbin, 1979) on shores in south west-England but is now rarely seen. Estimated reduction of population size of 90% from 1970s to 2005. [2]

**DEGREE OF THREAT**

**Score (range 0-16):** 8 Moderate

**Comments:** Decline has been very high in at least parts of south-west England and, without an understanding of the reasons, threat of continued low numbers or continued decline is high.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (low)
**Comments:** There is very limited knowledge of the biology and ecology of this species (particularly reproductive strategy and minimum viable population level), its full distribution, and what is most effecting its survival/ apparent decline.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when there are no avoidable human activities occurring that are likely to adversely affect existing populations and when reasons for decline and/or variability in abundance are known.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: The primary management strategy at present would be to maintain the health of the macro-algal rocky shore habitats in which they most commonly occur. Ensure that the management of MPAs takes account of this stalked jellyfish and any large rocky shore habitats present within the site. This will include measures (such as EIAs) to prevent anthropogenic impacts such as any nearby developments having a detrimental effect on species or habitat.

**Translocation**: More research would be needed on the species' biology and ecology before this management option was to become effective.

**Enforcement**: Usual enforcement of MPA regulations to prevent collection and limit disturbance. No specific budget.

**Research**: Encourage/facilitate recording of abundance and distribution. [Cost of reporting schemes.] Further research is needed into life-history traits of this species, particularly concerning reproductive strategies. Three year programme of research including other stalked jellyfish species to identify life history strategies and possibility of a captive breeding programme. £100,000 (all three species).

**Monitoring**: Monitoring should be focussed on known existing populations, particularly within MPAs, as a part of site management. No specific budget.

**Wider environment**: Continue improvements to water quality (Water Framework Directive). If new sites for significant populations are identified, consider scheduling those sites.

**SPECIALISTS**

None known.

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 8 (Moderate) | 4 (Low) | £120,000 (for all three species of stalked jellyfish) |

**REFERENCES**

[1] Neal, K. (2007) *Haliclystus auricula*. Kaleidoscope jellyfish. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on 17/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3445

[2] Corbin, P.G. (1979) The seasonal abundance of four species of Stauromedusae (Coelenterata: Schyphomedusae) in Plymouth. *Journal of the Marine Biological Association of the United Kingdom*, **59**, 385-391.

# SUNSET CUP CORAL *LEPTOPSAMMIA PRUVOTI* LACAZE-DUTHIERS, 1897

**Synonyms:** *Leptopsammia microcardia*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Scleractinia*
**Family:** *Dendrophylliidae*

(Image: Sue Scott)

## DISTRIBUTION

**English waters**: Portland Bill, Lyme Bay, off Plymouth Sound, Phillips Rocks, the Isles of Scilly and Lundy only. Believed to no longer occur in North Devon near Ilfracombe where it was present in 1969[1]

**UK Continental shelf**: As above.

**Global:** Found throughout the Mediterranean west of Cyprus and in the Adriatic. Also on the Atlantic coasts of SW England, the Channel Isles, Brittany and Portugal. It has not been recorded despite targeted survey in Madeira, the Azores, or the Canary Isles.

## ECOLOGY

**Description:** A bright yellow or orange solitary cup coral that grows up to about 20 mm high and 17 mm across the corallum[2]. The tentacles are quite long and number around 96. The coral is usually found in discrete colonies 1-2 m across composed of a few hundred individuals and most abundantly on shaded overhanging or vertical rock in wave sheltered situations evidenced by a muddy bottom below. But can also occur in wave-exposed conditions. Individuals may be very long-lived (several decades) but are subject to attack by boring worms and molluscs that weaken the skeleton so that detachment occurs if struck. The barnacle *Bostrychia anglicum* attaches to the corallum becoming incorporated in it, although whether this causes harm to the coral is uncertain.[3] Larvae are about 2 mm long and are lecithotrophic, probably settling near to their parents[1]. Growth rate from settlement depends greatly on how plentiful food supply is but can be rapid[4].

***Feeding method***: Opportunistic carnivore

***Mobility***: Permanent attachment

***Development mechanism***: Lecithotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Circa-littoral

***Salinity***: Full (30-40 psu)

***Substratum***: Bedrock, large to very large boulders

***Water flow rate***: Moderately Strong (1-3 kn), Weak (<1 kn), Very Weak (negligible)

***Wave exposure***: Exposed, Moderately Exposed, Sheltered

**Long-term natural fluctuations:** No information.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Threats are mainly due to lack of replacement of individuals lost by natural

processes although detachment by clumsy divers is a possibility. The species is not taken as a souvenir.

**RARITY**

Rare (occurring in eight or less of the ten km$^2$ squares within the 3 nautical mile limit of British seas). Rarity is because of edge-of-range bio-geographic character.

**DECLINE**

Numbers at monitoring sites at Lundy and in the Isles of Scilly have fallen by in excess of 50% in the 25 years since 1984[2,3].

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)

It is likely that decline will continue but it is not believed to be influenced by human activities.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 8 (Low)
**Comments:** Reasons for fluctuations in abundance and threats to existence are poorly understood especially in British waters. Therefore, although existing populations need to be protected where they are, benefits of that protection for recovery are uncertain. The 'baseline' against which to assess recovery/conservation success is a recent one (the species was first observed in British waters in 1969 and the first quantitative records are from 1983).

**RECOVERY/CONSERVATION GOAL**

Maintain potential for survival and expansion by protection of existing and any newly discovered colonies and better understand reproduction and growth by laboratory studies in 2011-2015.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management:** No take by any means in MCZ Reference Zones.

**Translocation:** Not considered relevant and could introduce non-local genetic strains.

**Enforcement:** Inshore Fisheries & Conservation Authorities. MPA local staff. [Cost of regulatory activities]

**Research:** Better understand reproduction and importance of food supply for reproduction and growth by experimental observation of captive individuals linked to field census. During period 2011-2015. Six months. £25,000.
Understand better the likely degree of isolation by completing genetic studies on samples collected from Plymouth, Lundy, Isles of Scilly and Brittany. Work in progress. During period 2011-2015. No cost.

**Monitoring:** Continue monitoring studies at Lundy and the Isles of Scilly. Re-survey every five years including between 2011 and 2015 and 2016-2020. £20,000 each event. Establish a monitoring site off Plymouth in the period 2011-2015 (£10,000) and re-survey in 2016-2020 (£10,000). Total: £60,000

**Wider environment/Additional measures**: Publicize the fragile nature of the species and of populations. Incorporate cost into wider publicity activities.

**SPECIALISTS**

Dr Keith Hiscock, Marine Biological Association
Robert Irving, SeaScope

**FINAL CONCLUSION**

Numbers of *Leptopsammia pruvoti* appear to have fallen significantly over the past 25 years in England although the reasons are most likely natural and relate to long-term variability in ecosystems and the edge-of-range nature of populations. Nevertheless, a better knowledge of the extent to which populations are isolated (and therefore rely on self-recruitment) and of reproduction and growth as well as monitoring existing populations would inform conservation.

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 9 (Moderate) | 8 (Low) | £25,000 reproduction and growth<br>£30,000 total 2011-2015<br>£30,000 total 2016-2020<br>Grand Total: £85,000 |

**REFERENCES**

[1] K. Hiscock, own observations

[2] Manuel, R.L. (1988) British Anthozoa. London: Academic Press. [Synopses of the British Fauna, No. 18.]

[3]Irving, R., Hiscock, K. **(**2010) The status of the sunset cup coral *Leptopsammia pruvoti* at Lundy. *Journal of the Lundy Field Society*, 2, 67-84.

[4] Paul Tranter, personal communication

[5] Hiscock, K. (in submission). Census of sunset corals, *Leptopsammia pruvoti*, at Gap Point, Isles of Scilly, September 2010. Porcupine Marine Natural History Society Newsletter.

# STALKED JELLYFISH *LUCERNARIOPSIS CAMPANULATA* LAMOUROUX, 1815

**Synonyms:** *Lucernaria discoidea*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Stauromedusae*
**Family:** *Kishinouyeidae*

(Image: Keith Hiscock)

## DISTRIBUTION

**English waters**: Primarily found along the southern coast from the Isles of Scilly to the Isle of Wight, but also found along the North-East and west coast and around the Irish Sea.

**UK Continental shelf**: *Lucernariopsis campanulata* may be found all around the coasts of the British Isles but less frequently on the east coast.

**Global:** All of Great Britain, from northern Scotland southward to Brittany, France.

## ECOLOGY

**Description:** *Lucernariopsis campanulata* has a funnel-shaped bell, which may grow to 5 cm in height. The colour is always uniform but varies between red, green or brown. Each of the eight arms has approximately 45 tentacles, the outer ones displaying significant basal swelling. The species inhabits the lower shore and shallow sub-littoral of rocky coasts and is found on algae and seagrasses. The species is gonochoristic and reproduces through external fertilization whereby gametes are shed into the water from the gonads situated on the sepal walls. Once fertilized, the zygotes develop into vermiform planula larvae. The planula larvae attach to the substratum and undergo a period of encystment followed by development into the adult form via a small larval polyp.The species is considered to have a short larval stage and very limited dispersal potential. The life cycle is completed in one year. [1]

***Feeding method***: Suspension feeder

***Mobility***: Attached, sessile.

***Development mechanism***:

***Reproductive type***: gonochoristic

***Biological zone***: Sub-littoral fringe, lower infra-littoral.

***Salinity***: Full (30-40 psu)

***Substratum***: Cobbles, macro-algae, seagrass.

***Water flow rate***: Weak (< 1 kn).

***Wave exposure***: Moderately exposed, sheltered.

**Long-term natural fluctuations:** Annual counts between 1953 and 1974[1] varied between 8 and 90 individuals along a c. 150m length of shore with highest abundance in the autumn.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Although habitat loss (seagrass) is often mentioned, there is no evidence to suggest that is the reason for decline. Sources of threat are therefore unknown.

**RARITY**

Recorded in 18 10 x 10 km grid squares in Great Britain (nationally scarce). However, records in any one year are few and, whilst the species was once common on some shores[1], it is now rarely seen.

**DECLINE**

**Decline:** Stalked jellyfish were studied extensively in south-west England and elsewhere in the 1950's to 70's by P.G. Corbin[1]. Numbers found on shores were often high (90 in one search at Wembury in 1973) but the species is now very rarely seen. Estimated reduction of population size of 90% from 1970s to 2010 in south Devon and southeast Cornwall. The species is described as 'Rare' in west Pembrokeshire in the 1950's and 60's[2]. The species is readily found in the Isles of Scilly[3] but there is no data for comparison with previous numbers.

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)
**Comments:** Decline has been very high in at least parts of south-west England and, without an understanding of the reasons, threat of continued low numbers or continued decline is high.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (low)
**Comments:** There is very limited knowledge concerning the biology and ecology of this species and the reasons for decline are not known.

**RECOVERY/CONSERVATION GOAL**:

Conservation will have been achieved when there are no avoidable human activities occurring that are likely to adversely affect existing populations and when reasons for decline and/or variability in abundance are known.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Ensure that the management of MPAs takes account of the stalked jellyfish and their habitats present within the site. This will include measures (such as EIAs) to prevent anthropogenic impacts such as any nearby developments having a detrimental effect on species or habitat, and to closely monitor their status within the MPA zones. No specific budget.

**Translocation**: More research would be needed on the species' biology and ecology before this management option was to be considered.

**Enforcement**: Usual enforcement of MPA regulations to prevent collection and limit disturbance. No specific budget.

**Research**: Encourage/facilitate recording of abundance and distribution. [Cost of reporting schemes.] Further research is needed into life-history traits of this species, particularly concerning reproductive strategies. Three year programme of research including other stalked jellyfish species to identify life history strategies and possibility of a captive breeding programme. £100,000 (all three species).

**Monitoring**: Monitoring should be focussed on known existing populations, particularly within MPAs, as a part of site management. No specific budget.

**Wider environment**: Continue improvements to water quality (Water Framework Directive). If new sites for significant populations are identified, consider scheduling those sites.

**SPECIALISTS**

None known

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 4 (low) | £120,000 (for all three species of stalked jellyfish) |

**REFERENCES**

[1] Corbin, P.G. (1979) The seasonal abundance of four species of Stauromedusae (Coelenterata: Schyphomedusae) in Plymouth. *Journal of the Marine Biological Association of the United Kingdom*, **59**, 385-391.

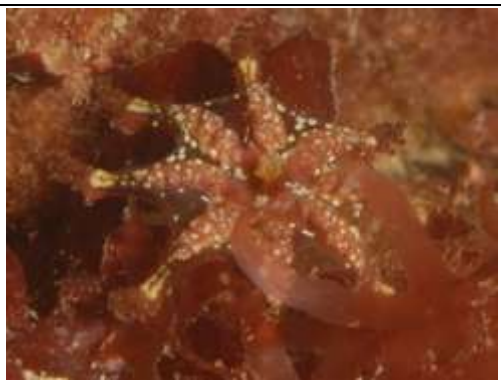
[2] Crothers, J.H. (1966) Dale Fort Marine Fauna. *Field Studies (supplement to volume 2).*

[3] K. Hiscock, own observations

# ST JOHN'S JELLYFISH *LUCERNARIOPSIS CRUXMELITENSIS* CORBIN, 1978

**Synonyms:** *None*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Stauromedusae*
**Family:** *Kishinouyeidae*



(Image:Steve Trewhella)

## DISTRIBUTION

**English waters**: Found in the south west between north Devon and Swanage.

**UK Continental shelf**: The distribution of *Lucernariopsis cruxmelitensis* appears to be limited to the south-west of England, from Swanage around to north Devon.

**Global:** As above and the Atlantic coasts of Ireland (possibly elsewhere, but not currently recorded).

## ECOLOGY

**Description:** This stalked jellyfish is the smallest member of its family. *Lucernariopsis cruxmelitensis* has a translucent, maroon, broad funnel-shaped bell that can reach 1.2 cm in diameter and 0.8 cm in height. The bell is divided by hollow septa. The reproductive gonads are thick and linear, and arranged inside the bell in halves which join at the base and extend in a linear fashion to the arms. The eight arms are arranged in a circle and well-developed with up to 35 tentacles each. It has a stalkless appearance due to the base of the bell involuting around the stalk that is 0.8cm in height and attached to the substratum by a broad basal disc. The stalked jellyfish inhabits moderately-exposed rocky shores in the low intertidal and shallow sub-littoral zones. In contrast to most species of Stauromedusae it is rarely attached to *Zostera spp.* but, is often found on the algae *Chondrus crispus, Mastocarpus stellatus, Ulva* spp and *Corallina officianalis*. Individuals are gonochoristic and reproduce through external fertilization whereby gametes are shed into the water from the gonads situated on the sepal walls. Once fertilized, the zygotes develop into vermiform planula larvae. The planula larvae attach to the substratum and undergo a period of encystment followed by development into the adult form via a small larval polyp. [1, 2] The species is considered to be annual due to distinctly higher densities being seen during the winter and often none seen during summer[3]. The species is considered to have a short larval stage and very limited dispersal potential[3].

***Feeding method***: Suspension feeder.

***Mobility***: Attached, sessile

***Development mechanism***:

***Reproductive type***: Gonochoristic, broadcast spawner

***Biological zone***: Sublittoral fringe, lower infralittoral

***Salinity***: Full (30-40 psu)

***Substratum***: Stone, cobbles, macro-algae.

***Water flow rate***: Weak (< 1 kn). ***Wave exposure***: Moderately exposed, sheltered.

**Long-term natural fluctuations:** Stalked jellyfish were studied extensively in south-west England and elsewhere in the 1950's to 70's by P.G. Corbin[3]. Numbers found on shores were often high (90 in one search at Wembury in 1973) but the species is now very rarely seen.

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority species

**Sources of threats:** Degradation of rocky coastal habitat and associated macro-algal species thought to be associated with the apparent decline in populations.

**RARITY**

Recorded in one 10 x 10 km grid square (in the Isles of Scilly) in Britain (nationally rare) in searchnbn.net but known to occur in other locations.

**DECLINE**

This species was found in often high numbers (90 in one shore search at Wembury, Devon in 1973[3] on shores in south west-England but is now rarely seen. Estimated reduction of population size of 90% from 1970s to 2005. (BAP assessment)

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)

**Comments:** Decline has been very high in at least parts of south-west England and, without an understanding of the reasons, threat of continued low numbers or continued decline is high.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (Low)

**Comments:** There is very limited knowledge of the biology and ecology of this species (particularly reproductive strategy and minimum viable population level), its full distribution, and what is most effecting its survival/ apparent decline.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when there are no avoidable human activities occurring that are likely to adversely affect existing populations and when reasons for decline and/or variability in abundance are known.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: The primary management strategy at present would be to maintain the health of the macro-algal rocky shore habitats in which they most commonly occur. Ensure that the management of MPAs takes account of this stalked jellyfish and any large rocky shore habitats present within the site. This will include measures (such as EIAs) to prevent anthropogenic impacts such as any nearby developments having a detrimental effect on species or habitat.

**Translocation**: More research would be needed on the species' biology and ecology before this management option was to become effective.

**Enforcement**: Usual enforcement of MPA regulations to prevent collection and limit disturbance. No specific budget.

**Research**: Encourage/facilitate recording of abundance and distribution. [Cost of reporting schemes.] Further research is needed into life-history traits of this species, particularly concerning reproductive strategies. Three year programme of research including other stalked jellyfish species to identify life history strategies and possibility of a captive breeding programme. £100,000 (all three species).

**Monitoring**: Monitoring should be focussed on known existing populations, particularly within MPAs, as a part of site management. No specific budget.

**Wider environment**: Continue improvements to water quality (Water Framework Directive). If new sites

for significant populations are identified, consider scheduling those sites.

**SPECIALISTS**

None known

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 4 (Low) | £120,000 (for all three species of stalked jellyfish) |

**REFERENCES**

[1] Hayward, P.J., Ryland, J.S. (ed.), (1995b) Handbook of the marine fauna of North-West Europe. Oxford: Oxford University Press.

[2] Howson, C.M. & Picton, B.E. (ed.), (1997) The species directory of the marine fauna and flora of the British Isles and surrounding seas. Belfast: Ulster Museum. [Ulster Museum publication, no. 276.]

[3] Corbin, P.G. (1979) The seasonal abundance of four species of Stauromedusae (Coelenterata: Schyphomedusae) in Plymouth. *Journal of the Marine Biological Association of the United Kingdom*, **59**, 385-391.

# GOOSENECK BARNACLE *POLLICIPES POLLICIPES* GMELIN, 1790

**Synonyms:** *Mitella pollicipes, Pollicipes cornucopia.*

(Image: Keith Hiscock)

**Taxonomy:**

**Phylum:** *Arthropoda*

**Order:** *Scalpelliformes*

**Family:** *Pollicipedidae*

## DISTRIBUTION

**English waters**: Recent confirmed records restricted to the far south-west of Cornwall[1]. Others should be considered misidentifications/errors.

**UK Continental shelf**: As above.

**Global:** South-west England, Atlantic coasts of France, northern Spain, Portugal and North Africa as far south as Senegal.

## ECOLOGY

**Description:** Pedunculate, goose or goose-neck barnacles have a flexible, muscular stalk, known as the peduncle, which supports the main body known as the capitulum. In *Pollicipes pollicipes* the capitulum is triangular in nature and white-grey in colour. A number of plates of different sizes protect the capitulum, increasing to over 100 in number with age. The plates may reach up to 0.5 cm in length. Six pairs of thin, feather-like cirri can be seen to arise from within the mantle cavity and are used for feeding. The peduncle may reach over 10 cm in length and is strongly attached to the substratum to withstand repeated battering in wave exposed conditions[2]. Found on the lower rocky shore and sub-tidal regions of hard substrate. Abundances higher in high energy environments[3]. Dispersal would appear to be high, with animals taking 11-24 days to complete their planktonic development, and the similar species *Pollicipes polumerus* dispersing distances of 116 – 580 miles in currents up to 0.5 kn[4].

***Feeding method***: Active suspension feeder

***Mobility***: Attached, sessile

***Development mechanism***: Planktotrophic

***Reproductive type***: hermaphroditic

***Biological zone***:

***Salinity***: Full (30- 40 psu)

***Substratum***: Any hard substrate

***Water flow rate***: Moderately strong (1-3 kn), Weak (< 1 kn).

***Wave exposure***: Extremely to Very exposed

**Long-term natural fluctuations:**

Very small numbers have been occasionally recorded in the far west of Cornwall since the 19th century with no indication of larger number at any time.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Overharvesting (for food) of probable source populations in continental Europe.

**RARITY**

Rare (occurring in less than nine 10 km squares within the 3 nautical mile limit of British seas)

**DECLINE**

There is currently insufficient data to state a decline in the UK**.** However, a number of individuals in UK arrive by drift from Europe where they are strongly threatened by harvesting. Spanish stocks have become so depleted that there are now strict conservation measures in place. Since the 1970s animals have been imported from Morocco & France where populations are now also being exhausted due to overfishing.[5]

**DEGREE OF THREAT**

**Score (range 0-16):** 7 (moderate)

**Comments:** No evidence of decline but nationally rare, locations accessible but the species is cryptic, a BAP Priority Species with half of recent known individuals (there are six) outside of MPAs.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 8 (low)

**Comments:** Individuals that occur in Britain are most likely recruited from continental European populations and are very unlikely to be from local individuals. The species may be taken for curiosity but is cryptic in occurrence and probably therefore protected. There is currently no management besides being included within BAP.

**RECOVERY/CONSERVATION GOAL**

To prevent any collection of individuals within the UK population of this species, to ensure that observations of occurrence are recorded and to monitor population numbers. Targeted surveys of known/expected locations to establish a baseline at sometime before 2015.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: A no-take policy for any individuals present within the MPA network would be advisable given their low abundance in the UK and vulnerability to decline.

**Translocation**: Not considered desirable: the low numbers are natural.

**Enforcement**: Recommended for addition to the Wildlife and Countryside Act to ensure prevention of extraction within the UK. Support measures to and prevent over-harvesting and severe decline in continental Europe.

**Research**: Survey and monitoring to establish locations and density – especially to establish if any populations may be reproductively viable (individuals close enough together to mate). Targeted surveys of known/expected locations to establish a baseline at sometime before 2015. Cost: £6,000.

**Monitoring**: See above.

**Wider environment**: Support enforcement of sustainable harvests within European countries.

**SPECIALISTS**

Morvan Barnes, Plymouth Marine Laboratory.

Nova Mieskowska, Marine Biological Association

**FINAL CONCLUSION**

| Degree of threat (Range 0-16) | Recovery/Conservation potential | Cost |
|---|---|---|
| 7 (moderate) | 8 (low) | £6,000 |

**REFERENCES**

[1] Southward, A.J. (2008) *Barnacles*. Shrewsbury: Field Stidies Council (for the Linnean Society and the Estuarine and Coastal Sciences Association). [Synopses of the British Fauna, no. 57.]

[2] Barnes, M. (1996) Pedunculate cirripedes of the genus *Pollicipes. Oceanography and Marine Biology, Annual Review*. **34**, 303-394.

[3] Borja, A., Muxika, I., Bald, J., (2006) Protection of the goose barnacle *Pollicipes pollicipes*, Gmelin, 1790 population: the Gaztelugatxe Marine Reserve (Basque Country, northern Spain). *Scientia Marina*, **70**, 235-242.

[4] Barnes, M. (2009) Pollicipes pollicipes. A goose barnacle. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 23/12/2010]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4159

[5] JNCC (2010). *UK Priority Species data collation Mitella pollicipes* (version 2). UKBAP 2008 reporting assessment. Available from: http://www.jncc.gov.uk/_speciespages/2434.pdf

# SPINY LOBSTER *PALINURUS ELEPHAS* FABRICIUS, 1787 / CRAWFISH

**Synonyms:** *Astacus elephas*; *Palinurus vulgaris*
**Taxonomy:**
**Phylum:** *Arthropoda*
**Order:** *Decapoda*
**Family:** *Palinuridae*


(Image: Keith Hiscock)

## DISTRIBUTION

**English waters**: South-West coastal regions (Cornwall, Devon including Lundy, and to the Isle of Purbeck, Dorset). However many records are historical (1950-70s), with sightings apparently no longer occurring in many previous locations. Rare in the eastern English Channel & the North Sea.

**UK Continental shelf**: The main populations are confined to the west coast of Scotland, the extreme south-west coasts of England & Wales and the west coast of Ireland.

**Global:** South and west coasts of the British Isles, South to the Azores, the western Mediterranean, Adriatic Sea and Aegean Sea.


Many records historical and may no longer occur where shown.

## ECOLOGY

**Description:** *Palinurus elephas* is found on rock ledges and in hollows, usually in the circalittoral on open coasts. Individuals may be up to 60 cm in total length with a stout, heavily armoured orange body. Populations in south-west England are related closely to those from Brittany but are genetically distinct from the western Ireland/western Scotland populations[1]. Much of the information about ecology is based on unpublished observation but it seems that some individuals stay in the same location for several years whilst some may actively migrate. A small proportion of crawfish tagged in the 1960's were recovered and most of those were recaptured within a short distance of where they were released[2]. There is one clutch of eggs annually with larvae released in about mid-summer[3]. Laboratory rearing of *P. elephas* has demonstrated that the planktonic stage is about 4 months and that jellyfish are favoured food[4]. The species reaches sexual maturity in 4-5 years and lives for up to 25 years (in the Mediteranean)[5]. However, longevity may be much longer as measured growth rate is very low (carapace length increase average 0.9mm per moult, probably one moult a year[2]) suggesting that large crawfish may be over a hundred years old.

***Feeding method***: Omnivore especially echinoderms and molluscs[3].

***Mobility***: Swimmer, Crawler

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Upper & lower circa-littoral, lower infra-littoral.

***Salinity***: Full (30-40 psu)

***Substratum***: Bedrock, large to very large boulders, small boulders

***Wave exposure***: Extremely exposed, very exposed, exposed

***Water flow rate***: Insufficient information

**Long-term natural fluctuations:** Recruitment from the plankton may be episodic and very infrequent. Small (<10 cm total length) individuals were observed at Lundy and Skomer in 2007 and such small individuals had not been seen in 30+ years previously. (K. Hiscock, personal observations). The Plymouth Marine Fauna[6] notes young (3" long from rostron to tip of tail) at the Mewstone on 17 July 1914 but that is the only record of small individuals in the publication. Settlement stages in the plankton off Plymouth appear to be June to September[6].

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**IUCN Red list:** Unclassified but, using landings data from ICES as a proxy for Catch Per Unit Effort and an estimated generation time in wild decapods of five years[5] would, under IUCN definitions, render this species **Critically Endangered** (see 'Decline' below).

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** This species is taken both in targeted fisheries and as a by-catch from other fisheries. Potting (creeling), diving and tangle or trammel netting for *Palinurus elephas* is believed to have contributed to the very substantial decline in population size since the 1970's[2].

Other threats to recovery are related especially to the edge-of range nature of populations. Recruitment of the species in south-west Britain is from a wide range of populations[3], bearing mind the long period that the larva most likely spends in the plankton, is most likely from distant populations. Decreases in temperature may result in a reduction of populations in the British Isles and *Palinurus elephas* held in the aquarium of the Marine Biological Station on the Isle of Man died during the severe winter of 1962-63 when seawater temperature in Port Erin Bay dropped to 3.5 °C[7], but that would be a very rare event.

**RARITY**

Uncommon (recorded within between 56-150 km$^2$ squares within the 3 nautical mile limit of British seas).

**DECLINE**

Only declines in the past 50 years have been observed and recorded and those are considered to be due to exploitation. In the 7 years between 1962 and 1968 just four English ports landed approximately 10 000 cwt [=508 tonnes] of *P. elephas* with yearly landings averaging 1 400 cwt [=71 tonnes] per year[2]. Landings of *P. elephas* in England and Wales between 1998 and 2008 have averaged just 9 tonnes per year[8] (87% decrease or 13% of 1960's landings). Size has also declined - male carapace size from landings in Cornwall from 140 - 180mm (1963 to 1971) to 100 - 130mm (1993 to 1994).

**DEGREE OF THREAT**

**Score (range 0-16):** 12 (High)

Current threats are continued commercial exploitation by potting and netting as well as extraction by divers.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 6 (Low)

**Comments:** Despite the fact that *Palinurus elephas* reproduces annually, the lack of recovery after substantial exploitation in the 1960's and 1970's suggests that recovery potential is very low and, at the northern and western limits of distribution, may be because larvae ready to settle are not reaching many locations where the crawfish was once present. Sources of migrating adults may be so depleted that they are not acting as a source. Since larvae most likely come from distant sources (for instance, Brittany) and adults may also migrate into British waters from elsewhere, only partial recovery can be expected as exploitation outside of British territorial waters will maintain source populations at residual levels.

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when the general historical distribution and a constant level of abundance has been reached. If suggested measures are implemented, the goal should be reached within 50 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: If not scheduled, no take in Reference MCZs. Otherwise, normal fisheries regulations.

**Translocation**: Restock depleted areas where relevant fishing activity is prohibited: £5,000 every three years.

**Enforcement**: Inshore Fisheries & Conservation Authorities

**Research**: Monitor movement of individuals and growth by tagging and by direct observation at their home locations: £10,000 in each of three years. Repeat every 10 years. Undertake experimental captive rearing to suitable release stage: £25,000 in each of three years.

**Monitoring**: Include in reporting schemes (distribution and abundance). Monitor landings (if not scheduled).

**Wider environment**: Propose addition to Wildlife & Countryside Act 1981:

9(1) - killing, injuring and taking

9(2) - possession

9(4)(a) and 9(4)(b) - damage, disturbance, destruction of a place of shelter/protection and:

9(5) - sale.

**SPECIALISTS**

Dominic Boothroyd, National Lobster Hatchery, Padstow
Dr Ewan Hunter, Cefas

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/Conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 12 (high) | 6 (Low) | Translocation: £5,000 every three years.<br>Monitor incl. Tagging: £30,000 in 2011-2015, 2021-2026 etc.<br>Captive rearing and release: £75,000 2011-2016 then review. |

**REFERENCES**

[1] Palero, F., Abelló, P., Macpherson, E., Gristina, M., Pascual, M. (2008) Phylogeography of the European spiny lobster (Palinurus elephas): influence of current oceanographical features and historical processes. *Molecular Phylogenetics and Evolution*, 48, 708–717.

[2] Hepper, B.T. (1977) The fishery for crawfish, *Palinurus elephas*, off the coast of Cornwall. *Journal of the Marine Biological Association of the U.K.*, 57, 925-941.

[3] Hunter, E. (1999) Biology of the European spiny lobster, *Palinurus elephas* (Fabricius, 1787) (Decapoda, Palinuridae). *Crustaceana,* 72, 545-565.

[4] Kittaka, J. (1997) Application of ecosystem culture method for complete development of phyllosomas of spiny lobster. *Aquaculture*, 155, 319-331.

[5] Marin, J. (1997) La langouste rouge: biologie et exploitation. *Pêche Maritime*, 64, 105-113.

[6] Marine Biological Association (1957). *Plymouth Marine Fauna*. Plymouth, Marine Biological Association.

[7] Crisp, D.J. (ed.), (1964) The effects of the severe winter of 1962-63 on marine life in Britain. *Journal of Animal Ecology*, 33, 165-210.

[8] Eurostat/ICES database on catch statistics - ICES 2010 Copenhagen

# OCEAN QUAHOG *ARCTICA ISLANDICA* LINNAEUS, 1767

**Synonyms:** *Cyprina islandica, Venus islandica*

**Taxonomy:**
**Phylum:** *Mollusca*
**Order:** *Veneroida*
**Family:** *Arcticidae*

(Image:Steve Trewhella)

## DISTRIBUTION

**English waters**: Found along the south coast of England from Dorset to the Isles of Scilly, Cornwall.

**UK Continental shelf**: *Arctica islandica* is found around all British and Irish coasts and offshore. It is primarily found around the waters of northern and western Scotland.

**Global:** Recorded from Iceland, the Faeroe Islands, Onega Bay in the White Sea to the Bay of Biscay and from Labrador to North Carolina.

## ECOLOGY

**Description:** *Arctica islandica* has a heavy, thick, oval to rounded shell up to 13 cm in length. The shell is sculptured with numerous fine concentric lines and the beaks are anterior. It has a thick glossy periostracum that is brown in smaller individuals, becoming greenish-brown to black in larger specimens. *A.islandica* is a slow growing boreal species that can reach extremely old ages of 400+ years[1]. Spawning is protracted and recruitment is very sporadic, potentially being over 10 years between episodes[2] Maturity is reported to vary between 5 and 11 years and may be dependent upon growth rate and locality[2]).

***Feeding method***: passive suspension feeder, active suspension feeder, surface deposit feeder, sub-surface deposit feeder.

***Mobility***: burrower.

***Development mechanism***: Planktotrophic.

***Reproductive type***: Gonochoristic.

***Biological zone***: Sub-littoral fringe, upper and lower Infra-littoral, upper and lower circa-littoral.

***Salinity***: variable (18-40 psu), full (30-40 psu).

***Substratum***: fine clean sand, coarse clean sand, sandy mud, muddy sand.

***Water flow rate***: insufficient information.

***Wave exposure***: extremely exposed, very exposed, exposed, moderately exposed.

**Long-term natural fluctuations:** The extent of occurrence of *A. islandica* has reduced in the past 9,000 years[3] but reductions in extent and abundance over the past 100+ years is most likely due to human activities.

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** Welsh LBAP

**OSPAR Convention:** Annex V, threatened/declining species within the Greater North Sea region.

**Sources of threats:** Habitat at risk from deepwater trawling. Commercial fishing may wipe out stocks. This species needs up to 50 years to reach market size, and it is possible a whole breeding stock could be wiped out in one trawl as mortality of *A. islandica* caught in a beam trawl has been estimated to be in the range of 74 - 90%[4]. An increase in temperature may also affect spawning and recruitment levels[5], potentially restricting their southern most extent. However, there is insufficient data on distribution and abundance of *A. islandica* in OSPAR Region II (Greater North Sea).[6]

**RARITY**

Common (occurring in between 151-500 km squares within the 3 nautical mile limit of British seas) (NBN gateway)

**DECLINE**

**Decline:** The ICES review [7] agreed that the species is impacted by bottom trawling fisheries and OSPAR documents that declines had occurrred[8]. For instance, *A. islandica* was present at 45 % of the stations sampled in the early part of the 20th century compared to between 20-30 % of all stations in 1986[9]. OSPAR considered that there is, however, no indication that the entire population is threatened.

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (moderate)

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** The recovery potential of this species would be expected to be high, but over a prolonged period. Once the damaging impacts of fishing activity (as a non-target species) have been removed, the species would be expected to recover. However, preventing damage by fisheries is unlikely to be a successful option as fisheries will continue. *A. islandica* is a cold-water species and seawater warming may prevent re-colonisation of southern areas and may adversely affect existing populations.

**RECOVERY/CONSERVATION GOAL**

Recover populations close to historic levels within 50 years but bearing in mind likely impacts of seawater warming and continued impacts of fisheries which will mean full recovery will not happen.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Regulation/ prohibition of beam trawling/dredging in regions holding high densities of *A.islandica* and/or gear changes to fishing gear. Cost absorbed within normal fisheries management activities.

**Translocation**: Not relevant. Natural larval distribution should re-colonise areas.

**Enforcement**: Fisheries patrols. Inshore Fisheries & Conservation Authorities. Cost absorbed within normal fisheries management activities.

**Research**: As more surveys of benthos are undertaken, results for *A. islandica* should be contributed to recording schemes and used to develop a detailed map of distribution and abundance in British waters. Cost is part of reporting schemes.

**Monitoring**: Based on OSPAR advice:

- Historical data should be compiled;

- Gaps in current knowledge of distribution should be filled using targeted initial surveys;
- Known *A. islandica* habitats should be sampled regularly (annually or bi-annually), including areas facing known or suspected threats (for example, trawling) and un-impacted control sites;
- 'Triple-D' dredges and, in addition, box cores should be used as sampling methods;
- Animals should be examined on board and returned into their habitat, except for specific, necessary additional research goals;
- Distribution maps should be prepared and be kept updated.

Much of the work can be included within standard monitoring by Cefas but any specific costs related to *A. islandica* likely to be in the order of £5,000 p.a. initially for each of five years.

**Wider environment**: None proposed.

**SPECIALISTS**

Professor C.A. Richardson, University of Bangor

Dr P. Butler, University of Bangor

**FINAL CONCLUSION**

| Threat of decline (range 0-16) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 10 (moderate) | 9 (moderate) | £5,000 p.a. initially for each of five years (total £25,000) |

**REFERENCES**

[1] Ridgway, I., Richardson, C.A., Scourse, J.D., Wanamaker, A.D., Jr., Butler, P.G. (2008) The long-lived clam *Arctica islandica*, a new model species for ageing research. *British Society for Research on Ageing.*

[2] Thorarinsdottir, G.G. (1999) Lifespan of two long lived bivalves Arctica islandica and Panopea generosa. *Phuket Marine Biological Center Special Publication*, no. 9, pp. 41 -46.

[3] Dahlgren T.G., Weinberg J.R., Halanych K.M. (2000) Phylogeography of the ocean quahog (*Arctica islandica*): influences of paleoclimate on genetic diversity and species range. Marine Biology (2000) 137: 487-495.

[4] Fonds, M. (1991) Measurements of the catch composition and survival of benthic animals in beam-trawl fishery for sole in the southern North Sea. BEON Report 13. 85pp.

[5] Kennish, M. J. Lutz, R. A. (1995) Assessment of the ocean quahog, *Arctica islandica* (Linnaeus, 1767), in the New Jersey fishery. *Journal of Shellfish Research*, **14** (1) 45 pp.

[6] OSPAR (2009) Background Document for the Ocean quahog *Arctica islandica* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00407_Ocean_quahog.pdf. [Accessed 11/01/2011].

[7] ICES (2002) Report of the Working Group on Ecosystem Effects of Fisheries. Advisory Committee on Ecosystems. ICES CM 2002/ACE:03.

[8] Witbaard R., Klein R. (1994) Long-term trends on the effects of the southern North Sea beamtrawl fishery on the bivalve mollusc *Arctica islandica* L. (Mollusca, bivalvia). ICES J. mar. Sci. 51: 99-105.

[9] Rumohr, H., Ehrich, S., Knust, R., Kujawsik, T., Philippart, C.J.M., & Schroeder, A. (1998) Long term trends in demersal fish and benthic invertebrates. In: Linderboom, H.J. & de Groot, S.J. (1998). The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems. IMPACT-II. NIOZ-RAPPORT 1998-1.

# FAN MUSSEL *ATRINA FRAGILIS* PENNANT, 1777

**Synonyms:** *Pinna fragilis,*

(*Atrina fragilis* has been synonomised with *Atrina pectinata* but the most recent entry to www.marinespecies.org maintains it as a separate species.)

**Taxonomy:**

**Phylum:** *Mollusca*

**Order:** *Pterioida*

**Family:** *Pinnidae*

(Image:Sue Scott)

## DISTRIBUTION

**English waters**: Cornwall and Devon coasts.

**UK Continental shelf**: Predominantly southern and western areas of the UK.

**Global:** Northern UK to Iberian Peninsula and the Adriatic Sea.

Historic records are included and the species may no longer occur in some locations.

## ECOLOGY

**Description:** A large mussel (30-48 cm long), with a triangular, thin shell tapering to a point. Fan-mussels live with their pointed end embedded in sediment, attached by abundant fine byssal threads to pebbles and shell fragments. The posterior (broad) end protrudes from the surface. If removed from the sediment, the fan mussel is unlikely to be able to re-burrow. The species is often solitary but populations occur as small low-density groups or patches of individuals forming small beds from just below Low Water of Spring Tides (LWST) to a depth of 400 m. Animals grow at around 2-3 cm/year and are thought to live for between 10 to 15 years[1]. Little is known of dispersal but is likely to be long-distance as bivalve larvae from mid-Channel hauls were of this species[2]. Fertilization is external and dependant on proximity of other individuals, and factors including water movement. When populations of *A. fragilis* become very sparse, as is the case in the UK, fertilization failure is likely to be significant[3]. Recruitment is likely to be sporadic due to variable larval survival and irregular, limited dispersal.

***Feeding method***: Suspension feeder

***Mobility***: Burrower

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Sublittoral Fringe, Upper & lower Infralittoral, Upper & lower Circalittoral.

***Salinity***: Full (30-40 psu)

***Substratum***: Gravel / shingle, Muddy gravel, Coarse clean sand, Fine clean sand, Sandy mud, Muddy sand, Mud, Mixed.

***Water flow rate***: Weak (<1 kn), Moderately

***Wave exposure***: Sheltered, Very Sheltered

Strong (1-3 kn) currents.

**Long-term natural fluctuations:** The species seems always to have been rarely recorded.

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** BAP Priority Species

**Wildlife and Countryside Act**: Schedule 5, section 9.

**Sources of threats:** Removal of substratum though activities such as trawling and dredging, will cause removal of this species. *A. fragilis* has a fragile shell, damaged easily by fishing gear, anchor impact and trampling by bathers.[4] Rapido trawling for scallops (a form of beam trawl) in the Gulf of Venice resulted in the removal of organisms from the top 2 cm of sediment and an 87% reduction in the species' abundance in the trawl tracks. Some specimens of fan mussel were speared on the trawl teeth and pulled from the sediment[5]. Although *A. fragilis* can burrow once vertical[6], adults cannot dig themselves back into the sediment and will not survive being uprooted[4]. Although this species is extracted for various consumer purposes in Europe, within the UK it is currently protected due to W&C Act legislation preventing extraction.

**RARITY**

Scarce – Reported from 25 of the 10 km grid squares within the 3 nm limit of British seas (nationally scarce).

**DECLINE**

There is very little information on population status of *A. fragilis* within the UK (particularly within England). It has been suggested that the populations of *A. fragilis* around the UK and Ireland have declined since the turn of the century due to the impacts of demersal fishing activities and, in some areas, sand and gravel extraction[4]. It is possible that direct removal by collectors may have contributed to the apparent decline although this is now prohibited.

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (moderate)

**Comments:** Although the species is not collected in the UK, it might be that the source of larvae is continental Europe where collecting is believed still to occur.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (Low)

**Comments:** Larval longevity and recruitment possibilities are poorly understood. Mobile fishing gear is a clear threat to species existence especially offshore. Although still to be found in UK inshore waters, individuals appear to be too far apart to reproduce so that recovery from local populations seems unlikely.

**RECOVERY/CONSERVATION GOAL**:

Ensure that *Atrina fragilis* individuals are protected wherever they are found to occur and that their habitat is protected wherever historically they have occurred.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Prohibit use of mobile fishing gear at locations where this species occurs. Ensure that the management of SACs, MCZs, MNRs takes account of fan mussel populations, along with informing divers of species' fragility and legal status.

**Translocation**: Not appropriate except where individuals have been accidentally removed from locations (for example by mobile fishing gear).

**Enforcement**: Maintenance of current legislation protecting the species from extraction. Enforcement of appropriate dredging / demersal fishing restrictions in marine protected areas housing known populations. Inshore Fisheries and Conservation Authorities.

**Research**: The genetic characteristics of NE Atlantic populations need to be established so that

recruitment sources and gene flow between populations are clearer. The work requires access to tissue which will prove problematic but not impossible. However, several years will be needed to gather samples (which will be small snips from undisturbed individuals) as finding new individuals is very rare. Opportunistically collect tissue samples over a ten year period and then consider genetic analysis. Funds for sampling and holding samples: £10,000 over ten years.

**Monitoring**: Monitor populations at examples of existing locations. Take appropriate measurements to identify change and possible reasons for change.

**Wider environment**:

## SPECIALISTS

F. Woodward, Kelvingrove museum, Glasgow

Prof. C.A. Richardson, University of Bangor, Wales

## FINAL CONCLUSION

| Degree of threat Score (range 0-16) | Recovery/conservation potential Score (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 4 (Low) | £10,000 |

## REFERENCES

[1] Dr C. Richardson, pers. comm.

[2] Prof. A Southward, pers. comm.

[3] Butler, A.J., Vicente, N. & de Gaulejac, B. (1993) Ecology of the pteroid bivalves Pinna bicolor Gmelin and Pinna nobilis Linnaeus. *Marine Life*, **3**, 37-45.

[4] Tyler-Walters, H., Wilding, C. (2009) *Atrina pectinata. Fan mussel*. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11/01/2011]. Available from: http://www.marlin.ac.uk/speciesimportance.php?speciesID=2680.

[5] Hall-Spencer, J.M., Froglia, C., Atkinson, R.J.A & Moore, P.G. (1999) The impact of Rapido trawling for scallops, Pecten jacobaeus (L.), on the benthos of the Gulf of Venice. *ICES Journal of Marine Science*, **56**, 111-124

[6] Yonge, C.M. (1953) Form and Habit in Pinna carnea Gmelin. *Philosophical Transactions of the Royal Society of London, Series B,* **237**, 335-374.

# NATIVE / FLAT OYSTER *OSTREA EDULIS* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**
**Phylum:** *Mollusca*
**Order:** *Ostreoida*
**Family:** *Ostreidae*

(Image: Keith Hiscock)

## DISTRIBUTION

**English waters**: Occurs primarily along the south coast from the Isles of Scilly to Lowestoft, with large oyster beds found around the Fal estuary, Torbay, Southbourne, and the Solent. A number of sightings have also occurred around the Wash and Liverpool Bay.

**UK Continental shelf**: Widely distributed around the British Isles but less so on the east and north-east coasts of Britain and Ireland. The main stocks are now in the west coast of Scotland, the south-east and Thames estuary, the Solent, the River Fal, and Lough Foyle.

**Global:** Found naturally from the Norwegian Sea south through the North Sea down to the Iberian Peninsula and the Atlantic coast of Morocco. Found in the Mediterranean Sea and extends into the Black Sea.

The map includes historical records and the species may no longer be present in some locations.

## ECOLOGY

**Description:** *Ostrea edulis* is a bivalve mollusc that has an oval or pear-shaped shell with a rough, scaly surface. The oyster grows up to 110 mm long, rarely larger. The inner surfaces are pearly, white or bluish-grey, often with darker blue areas. The species typically lives for between 5 to 10 years, maturing at 3 years. Their fecundity may be as high as 2,000,000.[1]

***Feeding method***: Active suspension feeder

***Mobility***: Permanent attachment

***Development mechanism***: Planktotrophic

***Reproductive type***: Protandrous hermaphrodite

***Biological zone***: Lower Eulittoral, Sublittoral Fringe, Upper and lower Infralittoral, Upper and lower Circalittoral.

***Salinity***: Full (30-40 psu), Variable (18-40 psu)

***Substratum***: Large to very large boulders, Small boulders, Cobbles, Pebbles, Gravel / shingle, Artificial (for example metal/wood/concrete), Muddy gravel, Muddy sand, Mud, Bedrock

***Water flow rate***: insufficient information

***Wave exposure***: Exposed, Moderately Exposed, Sheltered, Very Sheltered, Extremely Sheltered

**Long-term natural fluctuations**: Large offshore *O. edulis* beds existed in north western European waters until the 19th century, with beds occurring all along the European coasts, but these have declined or have been largely lost since that period[2]. Natural effects such as severe weather (particularly the winters of 1947 and 1963) and disease affect the population of oysters in the North Sea. Other variables such as environmental temperature and food supply, have marked effects on annual recruitment[1].

Habitat alteration over time and density of the stock can also affect successful spawning and settlement rates.[1]

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**IUCN Red list:** Unclassified

**Biodiversity Action Plan:** UKBAP Priority Species

**Wildlife and Countryside Act:** Unclassified

**OSPAR Convention:** Annex V, threatened/declining species within the Greater North Sea region.

**Sources of threats:** Primary threats to *O.edulis* include over-exploitation through fishing and habitat damage. Other factors include disease (through the protozoan *Bonamia ostreae*[3], pollution (specifically contamination by tributyl tin antifouling paints[4], competition with invasive species (including the slipper limpet *Crepidula fornicata* and the Pacific oyster *Crassostrea gigas*), smothering [5,6], and (to some extent) severe cold weather conditions[2].

**RARITY**

Common (occurring in between 151-500 10 km squares within the 3 nautical mile limit of British seas), although natural beds of *O. edulis* have become increasingly rare in the North Sea.

**DECLINE**

Within the past forty years production of *O. edulis* showed a drastic decline from a peak output of nearly 30 000 tonnes in 1961, due to the impact of diseases and a consequential shift to the rearing of the Pacific oyster (*Crassostrea gigas*). European flat oyster production has remained low throughout the decade 1993-2002; output peaked in 1996 (7,996 tonnes) but became more stable (6,000-7,000 tonnes) in 2000, 2001 and 2002[7].

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (high)

**Comments:** The species has declined by a very large amount in the past and, although stocks appear stable at present, the species is still harvested commercially.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (Low)
**Comments:** The highest risk to the population and subsequent recovery lies in the introduction of microbial pathogens such as the protist *Mareilia refringens* which can cause 75-100% mortality. Introduction must be prevented and/or an inoculation produced. Similarly without adequate control of annual fishery yield and extraction techniques, recovery will not be possible. The species settles from the plankton and, to produce larvae, spawning stock are needed. Whatever caused decline and/or loss from a large part of the species' 19th century range, recovery has not occurred despite removal of pressures, which does not auger well for restoration of historical range and abundances and the recovery goal needs to be realistic.

**RECOVERY/CONSERVATION GOAL**:
Maintain and facilitate expansion of existing populations through fisheries management measures so that a significant improvement in extent of occurrence and abundance is seen by 2020.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Control of fishing methods utilised in oyster bed regions is essential to the recovery of this species. Exclusion of bottom-trawling and seasonal fishing to quotas is therefore highly advised. EIAs to assess the potential damage of pollution and smothering which are highly detrimental to the oyster's health should be enforced. Active exclusion of invasive species (especially slipper limpets, *Crepidula fornicata*) is advised. Site management is already undertaken where oyster beds are commercial and no further cost is suggested.

**Translocation**: Translocation has been shown to be a useful technique for seeding new areas and

previously known beds (demonstrated in Lough Swilly and Lough Foyle). However the effectiveness of this method is not fully researched, and needs further investigation. Translocate disease-free stocks to re-populate locations where beds had previously been present, most likely within MPAs. £20,000 in first year and then £10,000 p.a. for monitoring in each of subsequent four years. Total: £60,000.

**Enforcement**: Native oyster fisheries are managed by national legislation and the shellfish health and hygiene regimes under EU regulations (*for example* 95/70/EC and 91/492/EEC). Adequate enforcement of sustainable harvesting levels and fishing techniques used in the vicinity is essential. Inclusion of oyster beds into the MCZ network is appropriate considering the importance of this species as habitat/substrate for other marine organisms. Inshore Fisheries and Conservation Authorities and Environment Agency as part of their normal duties.

**Research**: Continue research into prevalence of disease and (other) reasons for mortality/decline. £20,000 p.a. for each of five years. Total £100,000.

**Monitoring**: Monitoring of stock density, levels of recruitment and incidence of disease is highly advised to ensure that populations do not fall into decline. Environment Agency as part of normal duties.

**Wider environment**: Prevention of competition with invasive/ introduced species is necessary to maintain the local stock. Similarly, prevention of changes to the genetic integrity of the local stock through mixing with non-regional strains will help to keep the stock resilient. Shellfish regulations through competent authorities.

**SPECIALISTS**

Professor C. A. Richardson – University of Bangor

**FINAL CONCLUSION**

| Threat of decline (range 0-16) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 11 (high) | 4 (Low) | Translocation (five year project) £60,000<br>Disease and other reasons for decline monitoring (five year project £100,000). |

**References**

[1] Jackson, A., Wilding, C., (2009). *Ostrea edulis. Native oyster*. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Cited 11/01/2011]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3997).

[2] Haelters, J., Kerckhof, F., (2009) *Background document for Ostrea edulis and Ostrea edulis beds.* OSPAR Commission report, Belgium. 22 pp.

[3] Edwards, E., (1997). Molluscan fisheries in Britain. In *The History, Present Condition, and Future of the Molluscan Fisheries of North and Central American and Europe*, vol. 3, *Europe*, (ed. C.L. MacKenzie, Jr., V.G. Burrell, Jr., Rosenfield, A. & W.L. Hobart). *National Oceanic and Atmospheric Administration*, NOAA Technical Report NMFS 129.),

[4] Rees, H.L., Waldock, R., Matthiessen, P. & M.A. Pendle, 2001. Improvements in the epifauna of the Crouch estuary (United Kingdom) following a decline in TBT concentrations. *Mar. Poll. Bull.* 42, 137-144.

[5] Yonge, C.M. (1960). *Oysters.* London: Collins.

[6] Grant, J., Enright, C.T. & Griswold, A., (1990). Resuspension and growth of *Ostrea edulis*: a field experiment. *Maine Biology*, **104**, 51-59.

[7] Goulletquer, P., (2005-2011). Cultured Aquatic Species Information Programme. *Ostrea edulis*. *Cultured Aquatic Species Information Programme***.** *FAO Fisheries and Aquaculture Department* [on-line]. Rome. [Cited 11/01/2011]. Available from: http://www.fao.org/fishery/culturedspecies/Ostrea_edulis/en

# EUROPEAN EEL *ANGUILLA ANGUILLA* LINNAEUS, 1758

**Synonyms:** *Anguilla vulgaris*
**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Anguilliformes*
**Family:** *Anguillidae*


(Image: Steve Trewhella)

## DISTRIBUTION

**English waters**: Present all around England, except within the Wash and nearby coastline.

**UK Continental shelf**: Present around all of the UK coastline, except the east coast of Scotland, and East Anglia. Also present upstream in freshwater systems and offshore.

**Global:** Found in rivers, estuaries and coasts around north-east Europe. From Russia to Iceland, and south to North Africa and the Mediterranean. Spawning areas in the west Atlantic, within the Sargasso Sea.

## ECOLOGY

**Description:** The common eel is long and snake-like in shape with a tough, slimy skin. The dorsal fin starts on the back some way behind the gill slits and the small pectoral fins and runs the length of the body. The eel can be black, brown, or dark olive green in colour on top, with paler and yellowish markings on the underside. Sexually maturing eels become silver rather than yellow, with age at maturity being anything from 4 to 20 years, dependent on a number of environmental factors. *Anguilla anguilla* can live for up to 85 years and have a complex life history that is poorly understood, involving migration of mature adults from European rivers and estuaries to the Sargasso Sea in the west Atlantic for spawning. This is subsequently followed by the return (over a period of up to 3 years) of juveniles. They metamorphose twice, and are catadromous, having part of the life cycle spent in fresh water and part in estuarine or full sea water[1]. Eels can also survive out of water and often travel large distances over land. Both the adult eels and the returning juveniles (elvers) are commercially fished.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Lecithotrophic, planktotrophic (long-term).

***Reproductive type***: gonochoristic.

***Biological zone***: Riverine, estuarine, lagoonal, benthopelagic.

***Salinity***: Full (30-40 psu), Variable (18-40 psu), Low (<18 psu).

***Substratum***: Mud, Cobbles

***Wave exposure***: Variable

***Water flow rate***: Variable

**Long-term natural fluctuations:** The North Atlantic Oscillation (NAO) may have reduced larval survival and/or growth rate[2].

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species (2007)

**CITES:** listed in Appendix II in June 2007. The listing came into effect on 13 March 2009, after which time all Parties to the Convention are required to issue permits for all exports of the species.

**IUCN Red list:** Critically endangered (categories A2bd+4bd, version 3.1)

**OSPAR Convention:** Annex V, threatened/declining species within all OSPAR regions.

**Sources of threats:** Over-fishing, increased larval/ juvenile mortality, pollution (disrupting spawning potential), climatic change (affecting larval mortality and habitat/breeding grounds), disease (and parasitism), habitat loss/alteration (particularly from river dams).

**RARITY**

Widespread (recorded in more than 150 of the 10 km squares within the 3 nautical mile limit of British seas).

**DECLINE**

"The European eel stock is facing an unprecedented level of decline" with the estimated total yield reduced to about half that of the mid-1960s[3]. Juvenile (glass) eel recruitment decline was first noticed in 1985 and is currently at a historically low level of 1 to 5% of the pre-1980 level. [4] Similarly, while a prolonged decline in commercial landings was first mentioned in 1975[5] it has continued to fall steadily. Recruitment has fallen gradually in the UK, and more sharply elsewhere in Europe since the 1980's and shows no sign currently of returning to previous levels[6]. While landings from wild populations have all been falling, aquaculture has risen sharply since the mid 1980's, and production currently exceeds landings by around 3000 tonnes annually. Landings in Britain reached peaks of roughly 1100 tonnes in 1980 and 1989, dropping to around 800 tonnes in 2001. This decline in recruitment will see a future decline in adult stocks for at least the coming two decades, due to the species' prolonged age at maturity. Full and immediate protection is therefore required and ICES have recommended that a recovery plan be developed for the whole stock on an urgent basis.

**DEGREE OF THREAT**

**Score (range 0-16):** 12 (High)

**Comments.** Current threats are continued exploitation and most likely unknown, possibly natural, factors.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (RANGE 1-15):** 3 (Low)

**Comments:** While the management techniques are known, the ability to initiate and enforce them may be harder and more costly. There is also still some uncertainty concerning the causes of the declining recruitment rates[7] and how best to manage a stock with this kind of unusual life-history (Long-lived, spawning only once over possibly 50 years)[4].

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when the general historical distribution and a constant level of abundance has been reached. If suggested measures are implemented, the goal should be reached within 60 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: No-take in Reference MCZs. Improvement of habitat and provision of passing places in rivers for migration. [Consult with EA to establish costs.]

**Translocation**: Not recommended (except on a small scale to avoid dams during migration) due to subsequent decreased genetic variability, disruption of migration patterns, and increased risk of spread of disease/parasites.

**Enforcement**: Inshore Fisheries & Conservation Authorities, catch size (maturity stage) restrictions to ensure adequate recruitment. Defra (UK CITES Management Authority)/UK Border Agency.

**Research**: Investigate the reasons behind recent declines in European eel populations including factors affecting survivorship of juvenile eels and recruitment, along with factors reducing the quality of adult spawners (i.e. pollution/diseases). [Collaborate with / contribute to existing programmes.]

**Monitoring**: Establish widespread UK monitoring programme for both elvers and adults (both yellow and silver); including detailed monitoring of landings – The European Commission Workshop on Data Collection for European eel held in 2005 should have helped this goal. [Collaborate with / contribute to existing programmes.]

**Wider environment**: Propose addition to Wildlife & Countryside Act 1981:

6 – Animals which may not be killed or taken by certain methods.

9(4)(a) and 9(4)(b) - damage, disturbance, destruction of a place of shelter/protection

Enforce CITES

**SPECIALISTS**

Willem Dekker - Netherlands Institute for Fisheries Research.

J.E. Thorpe - University of Glasgow.

**FINAL CONCLUSION**

| Degree of threat (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 12 (High) | 3 (Low) | [Collaborate with / contribute to existing programmes.] |

**REFERENCES**

[1] Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.-C., Nielson, J. & Tortonese, E. (1986) Fishes of the North-eastern Atlantic and the Mediterranean. Vol. I, II & III. Paris: United Nations Educational, Scientific and Cultural Organisation (UNESCO).

[2] Castonguay, M., Hodson, P., Moriarty, C., Drinkwater, K., Jessop, J. (1994) Is there a role of ocean environment in American and European eel decline? *Fisheries Oceanography* **3** (3): 197-203.

[3] EIFAC (1985) Report of the 1985 meeting of the working party on eel and of the workshop on eel aquaculture, Perpignan, September 1985. European Inland Fisheries Advisory Commission of the Food and Agriculture Organization of the United Nations, Rome. EIFAC/XIV/86/3. 23 pp.

[4] Curd, A. (2010) *Background Document for European eel Anguilla anguilla*. OSPAR Commission report, France. 29 pp. Available online from: http://www.ospar.org/documents/dbase/publications/P00479_european_eel.pdf [Accessed 11/01/2011].

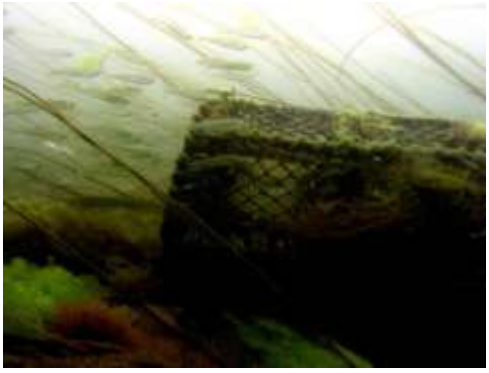
[6] Freyhof, J. & Kottelat, M. (2008) *Anguilla anguilla*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4 [on-line]. Available from: www.iucnredlist.org

[7] Dekker, W. (2007) Coming to grips with the eel stock slip-sliding away. In: M. G. Schechter, W. W. Taylor, & N. J. Leonard, (ed.), International governance of fisheries ecosystems: learning from the past, finding solutions for the future. Bethesda, MD.

# EUROPEAN SMELT *OSMERUS EPERLANUS* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Osmeriformes*
**Family:** *Osmeridae*



(Image:Paul Newland)

## DISTRIBUTION

**English waters**: Primarily the Eastern English coast, also North-west from Liverpool Bay to Scotland.

**UK Continental shelf**: Found on the east coasts of Britain as well as western Scotland as far north as the Hebrides.

**Global:** Coastal waters of White, Barents, Baltic and North Seas, Great Britain, western Ireland, Atlantic Ocean southward to Garonne estuary. Landlocked populations in lakes of coastal areas of North, Baltic, White and Barents Seas. North to about 68°N in Scandinavia.

## ECOLOGY

**Description:** *Osmerus eperlanus* is an elongate fish reaching up to 45 cm. Large cycloid scales cover its body. It has a large caudal fin and tall but short dorsal and anal fins with fairly large jaws reaching back to under the eye. The lower jaw projects a little and the teeth are larger in the lower jaw. It has olive green back and a creamy white belly, with a silvery stripe on the flanks[1] European smelt is an anadromous midwater species rarely found far from the shore. The species congregate near river mouths in winter and usually ascend the river between February and April, returning to the sea soon after spawning takes place. While typically migratory, some sedentary resident stocks exist in lakes[2]. It is sometimes divided into two subspecies, *Osmerus eperlanus eperlanus* and *Osmerus eperlanus schonfoldi*, with only the latter occurring around the British Isles and Ireland[3]. Becomes sexually mature in 3-4 years (15-18 cm) in brackish populations, 1-2 years (8-10 cm) in freshwater. Produces 8,000-50,000 eggs with a diameter of 0.6-0.9 mm which adhere to the bottom. Used commercially in some countries for food, bait and fish oil[4].

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Laid eggs, planktotrophic.

***Reproductive type***: Gonochoristic

***Biological zone***: bentho-pelagic, estuarine.

***Salinity***: Full (30-40 psu), Variable (18-40 psu), Low (<18 psu).

***Substratum***: sand, gravel

***Water flow rate***: Weak (<1 kn), moderately strong (1-3 kn).

***Wave exposure***: Moderately exposed, sheltered

**Long-term natural fluctuations:** Not known

**Past declines and current threats:** See 'Decline' below

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species

**IUCN Red list:** Least Concern (version 3.1)

**Sources of threats:** Threatened locally due to barriers to migration such as dams and weirs within rivers preventing successful annual spawning patterns and water pollution [5].

**RARITY**

Uncommon (recorded in less than 56-150 10 km squares within the 3 nautical mile limit of British seas). Noted to be 'rare' between Flamborough Head and Winterton, and between North Foreland and Portland Bill. Population noted to be 'common' on the east coast between Winterton and North Foreland[6].

**DECLINE**

Historical decline: Historical decline. An estimated loss of 33% of known smelt populations in England and Wales and a loss of 80% of sites in Scotland. Species known to be in serious decline (Fall from 15 (10 km squares) to 3 (10 km squares) over 100 years) within Scottish rivers but over a timescale not suitable for it to be included in other criteria (such as IUCN).[7]

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**RECOVERY/CONSERVATION POTENTIAL AND COSTS**

**Score 6 (range 2-36):** 6 (Low)

**Comments:** While the threats to the species are understood to some level, limited knowledge exists on the precise cause of the long-term decline of this species, and whether genetic variability is subsequently being lost. Management may need to be intensive due to the wide-ranging influence of pollution, development and damming of rivers.

**RECOVERY/CONSERVATION GOAL**

Maintain and improve existing populations so that a steady increase in numbers can be seen.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site/population management**: Ensure that barriers to migration are removed and that fisheries are sustainable. Responsibility of the Environment Agency and costs included in management activities.

**Translocation**: Restoration of previous stocks that have declined or disappeared such as within the river Tyne, Nith and Annan, will need research into whether this will affect the genetic stock or introduce disease, but may be a useful method for restoring populations rapidly. Responsibility of EA.

**Enforcement**: Enforcement of fishing regulations through appropriate bodies, along with prevention of polluting activities through EIA and local authorities. Maintenance of clear paths within river systems is also needed to ensure adequate spawning potential. Responsibility of EA.

**Research**: Genetic research needed into the UK population of this species, to determine where groups originate from and the extent of genetic exchange between groups. This will facilitate any reintroduction programmes necessary. Responsibility of fisheries competent authorities.

**Monitoring**: Monitoring through fishing bodies and careful observation of annual spawning success is recommended. Responsibility of EA.

**Wider environment**: Ultimate removal of barriers to migration in all rivers in which the species are known to reside.

**SPECIALISTS**

S.I. Rogers - Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowerstoft.

R.S. Milner - Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowerstoft.

**FINAL CONCLUSION**

| Degree of Threat (range 0-16) | Recovery/conservation (range 2-36): | Cost |
|---|---|---|
| 11 (High) | 6 (Low) | Responsibility of EA and Fisheries authorities |

**REFERENCES**

[1] Barnes, M. (2008). Osmerus eperlanus. European smelt. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 23/12/2010]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3993

[2] Muus, B.J. and P. Dahlström (1967) Guide des poissons d'eau douce et pêche.

[3] Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.-C., Nielson, J. & Tortonese, E., (1986). Fishes of the North-eastern Atlantic and the Mediterranean. Vol. I, II & III. Paris: United Nations Educational, Scientific and Cultural Organisation (UNESCO).

[4] Muus, B.J. and J.G. Nielsen (1999) Sea fish. Scandinavian Fishing Year Book, Hedehusene, Denmark. 340 p.

[5] Kottelat, M. and J. Freyhof (2007) Handbook of European freshwater fishes. Publications Kottelat, Cornol, Switzerland. 646 p.

[6] Rogers, S.I. and R.S. Millner (1996) Factors affecting the annual abundance and regional distribution of English inshore demersal fish populations: 1973 to 1995. *ICES J. Mar. Sci*. **53**:1094-1112.

[7] JNCC (2010) UK Priority Species data collation *Osmerus eperlanus* (version 2). UK BAP Assessments.[On-line]. Available from: http://www.jncc.gov.uk/_speciespages/2477.pdf [Accessed on 17/01/2011].

# UNDULATE RAY (UNDULATE SKATE, PAINTED RAY) *RAJA UNDULATA* LACEPÉDE, 1802

**Synonyms:** *Raia undulata*

**Taxonomy:**
**Phylum:** Chordata
**Order:** Rajiformes
**Family:** Rajidae

(Image:Crown Copyright)

## DISTRIBUTION

**English waters**: Found in English waters on the west and south coast

**UK Continental shelf**: Found off the southern and western coasts of England as well as the coasts of Wales. Most common in the English Channel

**Global:** The undulate ray is found in the east Atlantic from Senegal to the southern British Isles. It is encountered in the western Mediterranean, mainly along the African coast, and as far west as the Canary Islands.

## ECOLOGY

**Description:** A moderately sized dorso-ventrally flattened skate, growing to 85 cm in length. It has a flat rostrum but pointy rostral ridge. The leading edge of the disc undulates from the snout to the wingtips, giving the species its name. The dorsal fins are widely spaced, normally with two dorsal spines between them. Median spines are scattered in adults, regular on young. Males have one row of 20-55 median thorns while females have three. The undulate ray is a bottom dwelling species found on continental shelves, most commonly on sandy substrata.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Lower Infralittoral, Upper Circalittoral, Lower Circalittoral, from 50m - 200m. Off-shore shelf waters and upper slope.

***Salinity***: Unknown. May prefer inshore areas with lower salinity when juvenile.

***Substratum***: Coarse clean sand, fine clean sand, sandy mud, muddy sand

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats**: The species appears to have patchy distribution making it difficult to determine population trends. However, it appears that the species is now absent from some areas where it was previously abundant. Furthermore, it has traditionally been observed in English beam trawl surveys in the eastern English Channel, but has been absent for the most recent two years. This species is a bycatch of trawl, trammel net and other demersal fisheries operating within its range.[1]

**A STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species

**IUCN Red list**: Endangered (Category A2bd+3d+4bd, version 3.1)

**Sources of threats:** By-catch in demersal, and long-line fisheries, are the biggest threats to the species. ICES recommends that due to the lack of knowledge regarding this species there should be no targeted fishery. However, the species is taken as by-catch and is allowed to be retained and landed.

**RARITY**

Scarce (Recorded in 9 to 55 10 km squares within the 3nm limit of territorial seas around Britain), but may be more abundant in some parts of its range.

**DECLINE**

Contested: have disappeared from some parts of range, but limited information on which to base this and lack of observed trend

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** Intensive trawling across its range may have lead to declines in local populations.

**RECOVERY/CONSERVATION POTENTIAL**

**Score: (range 2-36):** 8 (Low)

**Comments:** Score is low due to the fact that the techniques required to manage this species are unknown as little is known about the species. Experimental cod ends have been shown to significantly reduce the bycatch of batoids and increase the survival of those caught[2]. As with most large skate, late maturity and low fecundity means they are vulnerable to intensive fishing. As the status of the species is uncertain, recovery/conservation goals should aim at recovering species to previous densities in areas where they have been exploited and are now absent. However, long generation times and low fecundity are likely to make population increases and restoration a lengthy process.

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when the general historical distribution and a constant level of abundance has been reached. If suggested measures are implemented, the goal should be reached within 50 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management**: UK and EU to implement effective fisheries management, fully incorporating scientific advice from ICES. Reporting of separate species, rather than being reported grouped, will allow for monitoring and assessment of population size and stability. Introduction of batoid excluding gear for trawl fisheries not targeting these species, and for all trawl fisheries inside MCZ and MPA network. Cost absorbed within normal fisheries management activities.

**Translocation**: Unknown. Never tested but impractical due to difficulty, cost and time scale of captive breeding species. Furthermore, species is mobile and has potential to decolonise given enough numbers

**Enforcement**: Currently ICES recommends there be no targeted fishery for the species unless adequate information is available to show that such a fishery is sustainable. Furthermore, the EC states that this species “may not be retained on board and shall be promptly released”. Enforcement should be through statutory authorities and the species should be include in reporting schemes (distribution and

abundance) and landings monitored. Cost absorbed within normal fisheries management activities.

**Research**: Initiate study of movements and population structure. Reporting of landings would provide useful insight into the dynamics of the species as well as adding to the understanding of skate/ray fisheries and trends. Examine available survey data so as to better delineate important grounds for various life-history stages and continue long-term tag-and-release programme. However, baseline information regarding range and movement patterns (due to their scarcity satellite tagging will be required: £167,000 p.a. for a minimum of three years), as well as studies of populations structure (£98,000) should be a priority.

**Monitoring**: Species specific landings would allow for monitoring declines or recoveries that may occur. Cost absorbed within normal fisheries management activities.

**Wider environment**: Species occurs in areas fished by many different nations making adoption of batoid excuding management a high priority internationally. The UK should take an active role in advocating management for this species as well as EU wide monitoring and research. Cost absorbed within normal fisheries management activities.

**SPECIALISTS**

Dr Viki Wearmouth – The Marine Biological Association of the UK, Plymouth, UK

Dr Jim Ellis – CEFAS, Lowestoft, UK

Dr Andrew Griffiths – The Marine Biological Association of the UK, Plymouth, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 10 (Moderate) | 8 (Low) | Satellite tagging: £167,000 p.a. for each of at least three years = £501,000<br>Population genetics: £98,000<br>Total: £599,000 |

**REFERENCES**

[1] Barnes, M. (2008) *Raja undulata*. Undulate ray. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4231 [Accessed on 11/01/2011].

[2] Enever, R., Revill, A.S., Caslake, R., Grant, R. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, **102**, 9-15

# THORNBACK RAY (THORNBACK SKATE, ROKER, MAIDEN TAY) *RAJA CLAVATA* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**
**Phylum:** Chordata
**Order:** Rajiformes
**Family:** Rajidae

(Image:Mark Thomas)

## DISTRIBUTION

**English waters**: Throughout English waters

**UK Continental shelf**: Common all around the coasts of Britain, the most abundant ray in in-shore waters. Distribution includes the Wash, Outer Thames Estuary, Solent, Carmarthen Bay, Cardigan Bay, Liverpool Bay and Solway Firth.

**Global:** Eastern Atlantic: Iceland, Norway, North Sea and the western Baltic southward to Morocco and Namibia, including the Mediterranean and the Black Sea. Although reported from southern Africa, its status in the area is uncertain.

## ECOLOGY

**Description:** Dorso-ventrally flattened batoid, reaching 120 cm in length, with upper surface scattered with buckler thorns, wholly spinulose with rows of 25-50 'thorns' on midline. The rostrum is short and rounded at the extremity. Pectoral fins have clear angles on lateral side and triangular pelvic fins. Upper surface very variable, all shades of brown, variegated with dark and light spots and blotches, underside white. Females form large spawning aggregations which locations are suitable for protection. The species shows little movement and interbreeding between populations.[1]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral, down to 300 m.

***Salinity***: Full (30-40 psu), but also occurs in brackish waters (5-30 psu).

***Substratum***: Muddy gravel, coarse clean sand, fine clean sand, sandy mud, muddy sand, mud, mixed and can be found over coarser ground.

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats**: Serious decline in large parts North Sea over the past 20 years, species now absent from many areas[2]. Species remains highly vulnerable to targeted fisheries and as by-catch multi-species fisheries in southern North Sea and eastern Channel due to female forming large spawning aggregations, as well as in the rest of its range.

**STATUS AND THREATS**

**Directives / convention / statutes (from the UK Designated Taxa list):**

**IUCN Red list:** Near Threatened (Version 3.1)

**OSPAR Convention:** Annex V, threatened/declining species within all OSPAR regions.

**Sources of threats:** Targeted and utilised by-catch fishery. Secondary threat from habitat damage by mobile fishing gears and pollution. Particularly young animals at risk as they tend to occupy shallow inshore waters.

**RARITY**

Widespread (Celtic Sea) to scarce (Bay of Biscay) to rare (Northern and mid-North Sea) depending on areas. North Sea areas severely depleted.

**DECLINE**

**Decline:** IUCN lists this species as decreasing and has been extirpated from parts of its North Sea range.

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** One of the most targeted elasmobranchs in the North-East Atlantic makes this species in serious threat of decline. The large size, late maturation and low fecundity, coupled with its tendency to aggregate in large groups, makes this species highly vulnerable to over-exploitation.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 3 (Low)

**Comments:** Females are particularly vulnerable to fisheries during spawning events where large aggregations form in the southern North Sea. Closing fishing grounds during these times would greatly reduce the impact on the species. Experimental cod ends have been shown to significantly reduce the bycatch of batoids and increase the survival of those caught[3]. However, the species shows little movement and interbreeding between populations and are thus unlikely to recolonise areas of historical range before reaching high densities.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when there is a sustained and continuing increase in numbers in North-East Atlantic population by 2020 as well as restoring the species to its full North Sea range by 2030.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management**: Introduction of proper fisheries management with species specific TAC (not 'Skate and Ray' TAC). Closure of mating grounds during mating season. Cost absorbed within normal fisheries management activities.

**Translocation**: Unknown. Never tested but unpractical due to difficulty, cost and time scale of captive breeding species. Furthermore, species is mobile and has potential to decolonise given enough numbers

**Enforcement**: Through statutory authorities including fisheries regulation and with quay-side inspection and fisheries observers. Cost absorbed within normal fisheries management activities.

**Research**: Species appearance is very plastic and highly habitat dependent and thus requires better species identification guides, particularly for regional fisheries. Population genetic study £98,000. Improving understanding of rates of natural and fisheries mortality (catch-release study, £30,000 per

annum, project should run indefinitely but costed here for three years). Satellite tagging to determine survivability £172,000 per annum, project should run minimum 3 years.

**Monitoring**: Reporting of catches, targeted and by-catch. Cost absorbed within normal fisheries management activities.

**Wider environment**: Reporting of individuals caught from areas where species was previously absent but has (re)colonised. Cost absorbed within normal fisheries management activities.

**SPECIALISTS**

Dr. Ewan Hunter – CEFAS, Lowestoft, UK

Dr. Nick K. Dulvy – Simon Fraser University, Canada

Dr. Viki Wearmouth – The Marine Biological Association of the UK, Plymouth, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery potential (range 2-36) | Cost |
|---|---|---|
| 10 (Moderate) | 3 (Low) | Population genetic study: £98,000; £30,000 p.a. for each of 3 years - £90,000; Satellite tagging for survivability study: 172,000 p.a. for each of 3 years = £516,000. Total = £704,000. |

**REFERENCES**

[1] Wilding & Snowden (2008) *Raja clavata*. Thornback ray. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=4229 [Accessed on 02/02/2011].

[2] OSPAR (2009) Background Document for the Thornback ray *Raja clavata* [On-line] OSPAR Commission Biodiversity Series. Available from http://www.ospar.org/documents/dbase/publications/P00475_thornback_ray.pdf. [Accessed 11/01/2011].

[3] Enever, R., Revill, A.S., Caslake, R., Grant, R. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, **102**, 9-15.

# ANGEL SHARK (MONK *SQUATINA SQUATINA* LINNAEUS, 1758 FISH, ANGEL FISH)

**Synonyms:**

**Taxonomy:**
**Phylum:** Chordata
**Order:** Squatiniformes
**Family:** Squatinidae

(Image: Paul Newland)

## DISTRIBUTION

**English waters**: Entire English coast, although absent from the North Sea, north of the Thames estuary

**UK Continental shelf**: Historically distribution all around the coast.

**Global:** Northeast Atlantic: historically from Norway to Mauritania, Canary Islands, Mediterranean and Black Sea. Absent from many of these areas now

Map is of recent records

## ECOLOGY

**Description:** Large and stocky dorso-ventrally flattened shark, reach at least 183 cm (possibly 244 cm) in length, with a flat rostrum, broad trunk and caudal peduncle, and very high broad pectoral fins. Dorsal fins set towards the end of the precaudal tail. Seasonally migratory in colder waters.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Ovoviviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral, down to 150 m on continental shelf

***Salinity***: Full (30-40 psu), may penetrate estuaries and brackish waters

***Substratum***: Muddy and sandy substrates

***Water flow rate***: All

***Wave exposure***: Very Exposed, Exposed, Moderately Exposed, Sheltered, Very Sheltered

**Long-term natural fluctuations:** Unknown

**Past declines and current threats**: Reported to be common during the 19th century and early 20th centuries throughout its range. During the early 1900s, an average of one specimen was taken during every ten hours of trawl survey, but in recent years the species has virtually vanished[1]. CEFAS surveys recorded angel sharks in low numbers in Cardigan Bay during the 1980s[2] but report just one individual in the last 15 years. It has now virtually disappeared from much of its former range in the Northeast Atlantic and Mediterranean. Highly vulnerable to all trawl gear, trammel nets and bottom-set longlines where the species occurs as by-catch. Continuous removal of individuals as by-catch is hampering species recovery. Anthropogenic developments and habitat degradation may also be contributing to the species absence and decline. Very little exchange between populations makes them highly vulnerable to local extinction and loss of genetic diversity and makes re-colonisation extremely slow

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan**: Biodiversity Action Plan (UKBAP: 2007 )

**IUCN Red list:** Critically Endangered (categories A2bcd+3d+4bcd, version 3.1)

**Wildlife and Countryside Act**: Listed under the Wildlife and Countryside Act's schedule 5, section 9

**Sources of threats:** Main threats are predominantly from trawl and bottom longline fisheries where the species occur as by-catch. Secondary source of threat is through habitat loss and degradation from mobile fishing gear, pollution and eutrophication[3,4]

**RARITY**

Recent records in no more than 1 to 8 of the 10 km squares within the 3nm limit of British seas. Rare.

**DECLINE**

Declining in most of its range and extirpated from large parts of its historical range.

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)

**Comments:** Very high due to continuing exploitation of areas where the species occurs, further aggravated by the biology and ecology of the species. The large size, late maturation and low fecundity makes this species highly vulnerable to over-exploitation

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36)** 2 (low)

**Comments:** Conservation and management must focus on protecting known species refuge population, particularly pupping grounds and adjacent areas, by means of protected areas and no take zones. Large females are of particular importance as they produce higher numbers of high quality offspring. As the species migrates south from northern latitudes in the winter, closure area closure for *S. squatina* may only need to be seasonal. As well as other elasmobranchs, the angel shark is a sturdy species that should have high discard survival. Experimental cod ends have been shown to significantly reduce the bycatch of batoids and increase the survival of those caught[5]. The species shows little movement and interbreeding between populations and are thus unlikely to re-colonise areas of historical range before reaching high densities.

**RECOVERY/CONSERVATION GOAL**

Conservation goals should aim at continuing to ensure that the species is returned whenever taken as by-catch and establishing safe-havens for the spcies. Recovery will have been achieved when the species abundance has been restored by maintenance of existing populations and re-colonisation of at least some of its historical range and removal of pressures causing decline.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management**: Maintenance of "Zero Quotas" and reduction in by-catch, as well as a strict policy of returning caught animals in as good a state as possible. Species is considered very sturdy and is likely to survive if returned. Fishers should be encouraged to develop techniques and equipment to facilitate the rapid and safe release of by-caught individuals. As the main threat to elasmobranchs lies with

commercial fisheries all efforts must be made to reduce by catch. Preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK (cost to be carried by fishermen, with possibility to apply for funding to cover part of cost).

**Translocation**: Untested in elasmobranchs, but may represent an option. However, there are no known areas of high abundance that would work as a source population and captive breeding programmes would be long due to slow growth and low fecundity.

**Enforcement**: Through statutory authorities including fisheries regulation and maintenance of current measures in place

**Research**: Angel sharks are relatively well studied and much is known about the *Squatina* species. However, the current range of *S. squatina* is not well known and efforts should be made to determine where current population refuges exist to ensure protection (tag-release study £30,000, satellite tagging study £172,000, both p.a. for each of three years initially). A study of the population structure of the species in the North-East Atlantic should also be carried out when sufficient tissue samples are available to determine number of populations present and their connectivity (£98,000)

**Monitoring**: Obligatory reporting of catch of this species. Introduction of a tagging programme is probably of limited use due to the species' scarcity and does not warrant the risk of harming the few remaining animals.

**Wider environment**: Reporting of individuals caught from areas where species was previously absent but has (re)colonised.

**SPECIALISTS**

Dr. Jim Ellis – CEFAS, Lowestoft, UK

**FINAL CONCLUSION**

| Degree of threat Score (range 0-16) | Recovery potential Score (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 2 (low) | Satellite tagging (£516,000)<br>Catch-release tagging (£90,000)<br>Population genetics (£98,000)<br>Total: £704,000 |

**REFERENCES**

[1] Rogers, S.I. and Ellis, J.R. (2000) Changes in the demersal fish assemblages of British coastal waters during the 20th century. *ICES Journal of Marine Science* 57: 866-881

[2] Ellis, J.R., Pawson, M.G. and Shackley, S.E. (1996) The comparative feeding ecology of six species of shark and four species of ray (Elasmobranchii) in the North-East Atlantic. *Journal of the Marine Biological Association of the United Kingdom* 76: 89-106

[3] Marine and Coastal Nature Conservation Unit" of the German Federal Agency for Nature Conservation (2010) Background Document for Angel Shark *Squatina squatina*. OSPAR Commission.

[4] OSPAR (2009) Background Document for the Angel shark *Squatina squatina* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00471_angel_shark.pdf. [Accessed 11/01/2011].

[5] Enever, R., Revill, A.S., Caslake, R., Grant, R. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, 102, 9-15

# HARBOUR SEAL *PHOCA VITULINA VITULINA* LINNAEUS, 1758

(Image: Louise Cunningham)

**Synonyms:** Common seal

**Taxonomy:**

**Phylum:** Chordata

**Order:** Carnivora

**Family:** Phocidae

## DISTRIBUTION

**English waters**: Major concentrations exist in the estuaries of the Thames and the Wash. with other large groups along the Lincolnshire, Norfolk, Suffolk and Kent coasts. There are also some small haul-out sites in the Solent[4, 1].

**UK Continental shelf**: Widespread around the west coast of Scotland, throughout the Hebrides and Northern Isles. More restricted distribution on the East coast, centred around the Firth of Tay, the Moray Firth and the English sites listed above[4].

**Global:** Five subspecies of harbour seal are recognised. Of these, the European subspecies *P. v. vitulina*, ranges from Northern France in the south, to Iceland in the west, to Svalbard in the north and to the Baltic Sea in the east. The largest population in Europe is in the Wadden Sea[4.2].

## ECOLOGY

**Description:** Harbour seals are small seals with a torpedo-like body shape and thick, solid appearance. Adult male harbour seals are up to 1.9m long and weigh 70-150kg, whilst females grow up to 1.7m long and weigh 60-110kg. The pelage is variably coloured, ranging from dark to light grey. Their fur is uniformly spotted with a combination of medium sized spots and ring-like markings and blotches. Harbour seals may be confused with grey seals. When their heads are viewed in profile, grey seals have much flatter noses than harbour seals, which have relatively distinct foreheads. Grey seals' eyes are located midway between the nose and the back of the head, whereas harbour seals' eyes are very much on the front of the face, closer to the nose. Both species tend to haul out in groups, but grey seals tend to lie much closer together than harbour seals. Harbour seals can be found hauled out on rocky shores, grassy islands and sandy beaches and banks. At sea they generally have a coastal distribution but can travel long distances between haul out sites. Harbour seals are found in largest numbers on shore during the moult season in August, breeding occurs during June and July[4,2].

***Feeding method***: predator

***Development mechanism***: viviparous (parental care)

***Biological zone***: Oceanic

***Substratum***: Not applicable

***Water flow rate***: Not applicable

**Long-term natural fluctuations:** unknown

***Mobility***: swimmer (water); crawler (land).

***Reproductive type***: gonochoristic

***Salinity***: Normally Full-Variable

***Wave exposure***: Not applicable

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Bern convention:** Appendix III

**Biodiversity Action Plan:** UK BAP Priority Species

**Bonn convention:** Annex I / II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annexes II and V

**IUCN Red list:** Least Concern

**Wildlife and Countryside Act:** Not listed, but some protection offered under the Conservation of Seals Act, 1970.

**Sources of threats:**

*Climate change*: It is likely that seals could be affected indirectly by climate change if the distribution or abundance of important prey species is affected.

*Coastal defence:* seals are sensitive to noise disturbance from construction and increased levels of shipping in areas of development. Effects range from displacement to physiological damage.

*Shipping*: "Corkscrew injury" refers to the occurrence of dead seals with characteristic spiral injuries. At this time the most likely cause of death for the seals is associated with the seals being drawn through a ducted propeller[5].

*Development:* Construction activities, pile driving etc, for harbour facilities, or offshore wind and renewable energy developments may cause noise disturbance.

*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect seals. Increased contaminants can lead to increased bioaccumulation in top predators such as seals. Dredging is also a major source of underwater noise, which is likely to have an effect on seals.

*Energy generation:* marine renewable devices may pose a collision threat to seals and may also be a source of noise and electromagnetic field effects.

*Fisheries/shell fisheries:* drowning through entanglement or incidental by-catch in gillnets, driftnets, trawls, and creels. Levels of by-catch for seals are unknown.

Noise: Seismic exploration, military sonar, depth sounders, fish finders, acoustic deterrent devices, engine noise, propeller noise, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This may lead to a wide variety of consequences including habitat exclusion, masking of vocalisations and physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational Vessels:* create noise and visual disturbance, especially small fast vessels. Some seal haul outs and breeding beaches are at risk from disturbance if walkers or dogs approach too close.

*Waste:* Persistent contaminants such as DDT and PCB's accumulate in the fatty tissues and are passed from the female to the pup by lactation. During periods of fasting (when breeding and moulting) seals draw on their fat reserves and toxins are released into the blood. These toxins can affect the immune system and reduce resistance to diseases that they would otherwise be able to fight (such as phocine distemper virus).

**RARITY**

Widespread (recorded in more than 150 10km squares within the 3nm limit of territorial seas)

**DECLINE**

The population along the east coast of England was reduced by 52% following an outbreak of phocine distemper virus (PDV) in 1988. The population recovered to pre-epidemic levels by 2001. A second epidemic in 2002 resulted in a decline of 22% in the same area. Counts are no longer decreasing, but

have failed to demonstrate a recovery to pre-epidemic population levels.

The much larger adjacent population in the Wadden Sea has grown at 12%pa since the 2002 epidemic.

Major declines have been documented in harbour seal populations around Scotland with declines of up to 50% since 2000 in Orkney, Shetland, the Moray Firth and the Firth of Tay[4].

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 3 (Low)

**Comments:** Attempts to conserve this species should include maintaining areas of important habitat, both for haul-out and foraging and protecting breeding and haul-out sites.

**RECOVERY/CONSERVATION GOAL**

Achieve and maintain sustained population increases towards the levels exhibited prior to the PDV outbreak in 1988 and by 2016-2021.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population/site management**: Locate suitable sites, then establish offshore MPAs to protect important foraging areas, in addition to maintaining existing MPAs. Cost is part of ongoing work by competent authorities.

**Translocation**: Not relevant in highly mobile species.

**Enforcement**: Maintain existing enforcement for current conservation orders. In addition, the Conservation of Seals Act (1970) is now outdated; and any revisions to this legislation could increase the requirement for enforcement. It may be appropriate for potential revision to follow a template similar to the Marine (Scotland) Act (2010), although it is acknowledged that there are differences between Scotland and England. Any new legislation should cover issues relating to disturbance of seals. Review of legislation – £50,000

**Research**: Further research into the spatial usage by harbour seals of offshore areas; identify important areas of habitat, which may then be suitable candidates for designation as MPA's.

Further research into the 'corkscrew' seal deaths should be undertaken. £500,000 over 3 years.

Undertake research into how harbour seal populations will respond to anthropogenic changes (for example construction of multiple offshore wind farms).

Undertake research into how harbour seal populations will respond to changes (for example in foraging behaviour and pup production) in grey seal populations.

Habitat and disturbance research: £500,000 over 3 years.

**Monitoring**: Continuation of current monitoring program for harbour seal abundance.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping (£250,000). Monitor levels of potentially toxic pollutants – here, marine mammal species may act as ecosystem indicator species (Applicable to all marine mammal species concurrently, £250,000 combined). Ensuring marine spatial planners are aware of the need for adjacent availability of appropriate coastal (haul-out) and offshore (feeding) habitat (£50,000).

**SPECIALISTS**

Dr Dave Thompson (Sea Mammal Research Unit)

Callan Duck (Sea Mammal Research Unit)

**FINAL CONCLUSION**

| **Threat of decline (range 0-16)** | **Recovery/conservation potential (range 2-36)** | **Cost (2010 prices)** |
|---|---|---|
| 11 (High) | 3 (Low) | Review of legislation – £50,000; Habitat and disturbance research – £500,000; 'Corkscrew' research –£500,000; Noise monitoring – |

£250,000 p.a.; Pollution monitoring – £250,000 p.a. Spatial planning awareness- £50,000

**REFERENCES**

[1] Chesworth, J. C., Leggett, V. L. & Rowsell, E. S. (2010) Solent Seal Tagging Project Summary Report. Wildlife Trusts' South East Marine Programme, Hampshire and Isle of Wight Wildlife Trust, Hampshire. Available from http://www.conservancy.co.uk/assets/assets/seal_report_2010.pdf

[2] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. Academic Press. 573pp.

[3] Joint Nature Conservation Committee. (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17

[4] SCOS. (2009) Scientific Advice on Matters Related to the Management of Seal Populations: 2009. Sea Mammal Research Unit. Available to download from http://www.smru.st-and.ac.uk/documents/341.pdf

[5] Thompson, D., Bexton, S., Brownlow, A., Wood, D., Patterson, T., Pye, K., Lonergan, M.& Milne, R. (2010) Report on recent seal mortalities in UK waters caused by extensive lacerations. Available from http://www.smru.st-and.ac.uk/documents/366.pdf

[6] Thompson, D. & Härkönen, T. (2008) *Phoca vitulina*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on **6 January 2011**.

# BOTTLENOSE DOLPHIN *TURSIOPS TRUNCATUS* MONTAGU, 1821

**Synonyms:** None
**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

(Image: Anneli Englund)

## DISTRIBUTION

**English waters**: Off the south and southwest coasts of England, the English channel and North Sea[4]

**UK Continental shelf**: In the UK there are resident populations of bottlenose dolphins in the Moray Firth - East coast of Scotland, Cardigan Bay (Wales). This species is also recorded around the inner and outer Hebrides[4].

**Global:** The bottlenose dolphin has a worldwide distribution, and can be found in both temperate and tropical waters. It occupies a wide range of habitats, ranging from coastal bays to deep ocean waters[1, 2].

## ECOLOGY

**Description:** The bottlenose dolphin is a large robust dolphin measuring up to 4m long, with a dark to light grey back that fades to white on its underside. It has a pronounced short beak with a crease separating it from the melon. This species has a gently curving mouthline which can resemble a smile. The tall falcate dorsal fin is found in the middle of the back. There are between 18 - 27 pairs of large teeth in each jaw. Bottlenose dolphins are social animals. They are known to approach boats and bow ride and are often seen engaging in acrobatic leaps[2].

***Feeding method***: predator

***Mobility***: swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: gonochoristic

***Biological zone***: Oceanic

***Salinity***: Full

***Substratum***: Not applicable

***Wave exposure***: Not applicable

***Water flow rate***: Not applicable

**Long-term natural fluctuations:** Not known

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Bern convention**: Appendix II

**Biodiversity Action Plan:** UK BAP Priority Species

**Bonn convention:** Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex's II & IV

**IUCN Red list**: Least Concern

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats[1,2,3,4 5]:**

*Aquaculture:* the extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* bottlenose dolphins are a very widely distributed species and are not constrained to any particular water temperatures. It is likely that they could be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* like all cetaceans, bottlenose dolphins are sensitive to noise disturbance[4] and vessel collisions, which may result from construction. Effects may include habitat displacement, masking of vocalisations, and physiological damage *Development:* like all cetaceans, bottlenose dolphins are sensitive to noise disturbance and vessel collisions Effects may include habitat displacement, masking of vocalisations, and physiological damage.*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect bottlenose dolphins. Increased contaminants can lead to increased bioaccumulation in top predators such as bottlenose dolphins. Dredging is also a major source of underwater noise, which is likely to have a direct effect on bottlenose dolphins.

*Energy generation:* like all cetaceans, bottlenose dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: entanglements in fishing nets may be a threat as is overfishing of prey species.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational Vessels*: Harassment from dedicated whale watch vessels and private boats may also occur.

*Waste:* pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like bottlenose dolphins.

**RARITY**

Widespread (recorded in more than 150 10km squares within the 3nm limit of territorial seas)

**DECLINE**

Insufficient data

**DEGREE OF THREAT**

**Score (range 0-16):** 8 (Moderate)

**Comments:** There is a paucity of data concerning many aspects of marine mammal biology, even for those species which are relatively well studied. As such, a moderate degree of threat is assigned to take into account many of the uncertainties which still exist.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Low)

**Comments:** There are insufficient data available to meaningfully assess this species for decline in UK or English waters, so this score is indicative of the problems of assessing a species for a decline which may / may not have occurred, if it has occurred, what may have caused it, and how to combat these causes once they have been established.

**RECOVERY/CONSERVATION GOAL**

Raise levels of knowledge of this species to a suitable level to allow the creation of meaningful management goals within 10-15 years, this includes sufficient time to assess trends in both population

numbers and distribution.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population/site management**: With further knowledge, there is the potential to designate sites based on new knowledge on distribution and abundance. (Applicable to all cetacean species concurrently) – see Research.

**Translocation**: Not relevant in highly mobile pelagic species.

**Enforcement**: Maintain current enforcement of by-catch regulations (applicable to all cetacean species concurrently). Through statutory authorities including fisheries regulation and maintenance of current measures in place.

**Research**: Improve cost-effective survey techniques for estimating abundance and distribution of cetaceans (includes visual, aerial, passive acoustic techniques) (applicable to all cetacean species concurrently). £500,000 p.a. initially for three years and then reappraise for all cetacean species. Concurrent UK wide survey of cetaceans: £4,000,000.

Improve knowledge of life history characteristics of the species in order to better understand potential causes of possible future declines and how best this species may recover should such declines occur. £500,000 over three years initially then reappraise. It may be possible to implement this for several cetacean species together, but may require to be done for this species in isolation.

One of the main threats to cetaceans is the effects of anthropogenic noise, both behaviourally and physiologically. A research program to investigate the effects of this would be invaluable. . £500,000 over three years initially then reappraise (potentially applicable to all cetacean species concurrently).

**Monitoring**: Increase frequency of cetacean surveys for assessing abundance and spatial and temporal distribution of cetaceans within UK waters (applicable to all cetacean species concurrently). This would also improve knowledge required for 'Population/site management'. Cost dependant on frequency of survey.

Establish a centralised repository for data collected during baseline surveys for offshore development to allow a more complete overview of animal distribution (applicable to all cetacean species concurrently).Development/maintenance of centralized database (applicable to all cetacean species concurrently) £25,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a. All initially for three years.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping. Monitor levels of potentially toxic pollutants – here, marine mammal species may act as ecosystem indicator species - £250,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a. (Applicable to all marine mammal species concurrently).

**SPECIALISTS**

Prof. Phil Hammond (Sea Mammal Research Unit)

Prof. Paul Thompson (University of Aberdeen)

**FINAL CONCLUSION**

| Threat of decline (range 0-16) | Recovery/conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 8 (Moderate) | 9 (Low) | Improving survey techniques: £500,000 p.a.<br>Concurrent UK wide survey of cetaceans: £4,000,000<br>Research into life history: £500,000 over 3 years<br>Research into effects of anthropogenic noise: £500,000 over 3 years.<br>Centralised database and admin: £25,000 p.a.<br>Noise monitoring: £250,000 p.a.<br>Pollution Monitoring: £250,000 p.a.<br>**Total** for three years research into improving survey techniques, life history characteristics and reponses to anthropogenic noise; monitoring pollution and |

noise and one off survey of UK waters: £6,025,000.

**REFERENCES**

[1] Hammond, P.S., Bearzi, G., Bjørge, A., Forney, K., Karczmarski, L., Kasuya, T., Perrin, W.F., Scott, M.D., Wang, J.Y., Wells, R.S. & Wilson, B. (2008) *Tursiops truncatus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. [Available from: www.iucnredlist.org]. Accessed on 6 January 2011.

[2] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press.

[3] Joint Nature Conservation Committee. (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

[4] Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee.

[5] Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press

*Distribution/abundance reference:*

Burt, ML., Borchers, DL. & Samarra, F. (2008) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L., Samarra, F. (2008a) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245

# Dossiers for species that are ‘Unlikely to be protected by the UK MPA network but protection can be secured through wider measures in UK waters’

# LESSER SANDEEL *AMMODYTES MARINUS* RAITT, 1934

**Synonyms:**

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Perciformes*
**Family:** *Ammodytidae*

Image: Keith Hiscock

## DISTRIBUTION

**English waters**: Found throughout English waters.

**UK Continental shelf**: Widely distributed throughout the UK and Ireland.

**Global:** Mainly the UK, Norway and Greenland. Also throughout the Northeast Atlantic from 74°N (Novaya Zemlya and Bear Islands) to 49°N (Channel Islands, western English Channel), including eastern Greenland, Iceland, Barents Sea, and the Baltic.

## ECOLOGY

**Description:** *Ammodytes marinus* is a thin and elongated sand eel with a pointed jaw. It can reach a maximum length of 25 cm, and has been reported to live to up to 10 years of age. Its dorsal colouring is usually dark green, while the ventral and lateral sides are silvery in colour. There is a single long dorsal fin, and the anal fin is half the length of the dorsal fin. It is a territorial, schooling bentho-pelagic species, which may congregate in large schools near the surface or bury itself in sand. They may be found both inshore (primarily when young) and offshore. Individuals mature at an age of 2 to 3 years and spawn between November to February.[1]

***Feeding method***: Predator, planktivore

***Mobility***: Swimmer, burrower

***Development mechanism***: Planktotrophic.

***Reproductive type***: Gonochoristic

***Biological zone***: Bentho-pelagic

***Salinity***: Full (30-40 psu), variable (18-40 psu).

***Substratum***: Sand

***Water flow rate***: Moderately strong (1-3 kn), strong (3-6 kn),

***Wave exposure***: All

**Long-term natural fluctuations:** No information.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Traditionally *Ammodytes marinus*, like other sand eels, has been little exploited for human consumption but is a major target of industrial fishing for animal feed and fertilizer, particularly in

the North Sea. Increasing fishing pressure may be causing problems for some of their natural predators, especially seabirds which prey on them in deeper water.[2] Subject of the largest fishery in the North Sea - possibility for over-exploitation. Particularly threatened off Shetland where major seabird colonies occur. Sustainable harvest limits in the North Sea may decline with time if recruitment becomes compromised by rising temperatures - especially in more southerly areas. The size of the sandeel stock each year is strongly influenced by the number of young sandeels born in that and previous years. [3,4,5]

**RARITY**

Occurs very widely.

**DECLINE**

**Decline:** Declines off Shetland and North Sea linked to overfishing and climate change. Due to such dramatic declines between 1982 & 1990 the fishery was closed from 1991 - 1994.[3,6]

**DEGREE OF THREAT**

**Score (range 0-16):**10 (Moderate)

**Comments:**

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within Safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Wilding, C., Barnes, M. (2008) Ammodytes marinus. Raitt's sand eel. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 18/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=2479

[2] Muus, B.J., Nielsen, J.G. (1999) Sea Fish. Scandinavian Fishing Year Book. Hedehusene: Denmark.

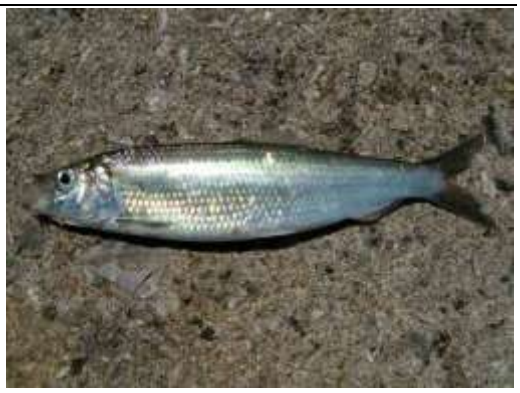
[3] Goodlad, J., Napier, I. (1997) Assessment of the Shetland sandeel fishery - 1996. *Fisheries Development Note No 6.* Scalloway: North Atlantic Fisheries College.

[4] Daunt F., Wanless S., Greenstreet S. P. R., Jensen H., Hamer K. C., Harris M. P. (2008) The impact of the sandeel fishery closure on seabird food consumption, distribution, and productivity in the northwestern North Sea. *Canadian Journal of Fisheries and Aquatic Sciences*, **65**, 362-381.

[5] Arnott, S. A. and Ruxton, G. D. (2002) Sandeel recruitment in the North Sea: demographic, climatic and trophic effects. *Marine Ecological Progress Series,* **238**, 199-210.

[6] JNCC (2010) UK Priority Species data collation *Ammodytes marinus* (version 2). UK BAP Assessments [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/2029.pdf [Accessed on [17/01/2011].

# ATLANTIC HERRING *CLUPEA HARENGUS* LINNAEUS, 1758



(Image: David Fenwick)

**Synonyms:**

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Clupeiformes*

**Family:** *Clupeidae*

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

## DISTRIBUTION

**English waters**: Throughout southern and western English waters.

**UK Continental shelf**: The Atlantic herring is widespread in UK and Irish waters, occurring in the North Sea, the English Channel, the Irish Sea as well as the Northern Atlantic.

**Global:** North Atlantic: Northern Bay of Biscay northward to Iceland and Southern Greenland, eastward to Spitsbergen and Novaya Zemlya, including the Baltic; South-Western Greenland and Labrador southward to South Carolina.

## ECOLOGY

**Description:** *Clupea harengus* is a streamlined shoaling fish. It may reach up to 40 cm in length and 0.68 kg in weight. The overall colouring of the body is silver but a darker blue iridescence is present over the upper half of the body. The underside is considerably paler. It is pelagic in its distribution and occurs in the surface waters down to a depth of around 200 m. Outside of the spawning season, *Clupea harengus* stays away from the immediate coastal areas. It is often found in vast near-surface shoals covering an area of several square kilometers.[1] Individuals mature at between 3 to 9 years, and can live for over 20 years.[2]

***Feeding method***: Selective planktivore / filter-feeder (dependent on conditions)

***Mobility***: Swimmer

***Development mechanism***: Lecithotrophic, Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Nerito-pelagic

***Salinity***: Full (30-40 psu), Variable (18-40 psu), Low (<18 psu).

***Substratum***: Not relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**IUCN Red list:** Least Concern (version 3.1)

**Sources of threats: '**The biggest threat to this species is over-harvesting by the fishing fleets of many nations. Domestic pressure on governments to support their fishing industries has led to overfishing, and agreed quotas being exceeded, depleting populations of herring across much of its range.' [3] It is feared that there are more herring being caught by trawlers than can reproduce annually, particularly in European waters.

**RARITY**

Widespread to common

**DECLINE**

Atlantic populations are considered to be above SBF, populations in the North Sea are giving cause for concern with CEFAS describing the stock as at risk of having reduced reproductive capacity and at risk of being harvested unsustainably. Reproduction fell to an all time low in the 1990s [4].

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:**

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Barnes, M. (2008) Clupea harengus. Atlantic herring. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 13/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3017

[2] Fishbase (2011) Clupea harengus. In Fishbase [on-line]. Available from: http://www.fishbase.org/Summary/speciesSummary.php?ID=24&genusname=Clupea&speciesname=harengus&AT=clupea+harengus&lang=English [Accessed on 11/01/2011]

[3] JNCC (2010) *UK Priority Species data collation Clupea harengus* (version 2). UK BAP Assessment. [On-line]. Avalailable from: http://www.jncc.gov.uk/_speciespages/228.pdf [Accessed on 11/01/2011]

[4] CEFAS (2009) Herring in the North Sea (ICES Division IV, VIId and IIIa). Report by the Centre for Environment, Fisheries & Aquaculture Science. Lowestoft, Suffolk.

# ATLANTIC COD *GADUS MORHUA* LINNAEUS, 1758

(Image: Fiona Crouch)

**Synonyms:**

**Taxonomy:**

**Phylum:** Chordata

**Order:** Gadiformes

**Family:** Gadidae

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

## DISTRIBUTION

**English waters**: All English coasts.

**UK Continental shelf**: Atlantic cod are found all around the coasts of Britain and Ireland, as far south as the Bay of Biscay and to the north Barents Sea.

**Global:** Cape Hatteras to Ungava Bay along the North American coast; east and west coasts of Greenland extending for variable distances to the north, depending upon climate trends; around Iceland; coasts of Europe from the Bay of Biscay to the Barents Sea, including the region around Bear Island. [1]

## ECOLOGY

**Description:** Cod are a heavy and powerful fish with three dorsal and two anal fins, all slightly rounded, and either a square or rounded tail fin. The upper jaw overhangs the lower and the long chin barbel is equal to the eye in diameter. They are primarily demersal, living on sandy substrate, although can be pelagic under certain conditions. *Gadus morhua* grow to approximately 120 cm in length, weighing around 12 kg, however larger fish have been recorded. Age of maturity varies regionally but is usually between one and fifteen years. Colour is variable depending on habitat but most are spotted with white bellies.[2]

***Feeding method***: Predator, omnivore

***Mobility***: Swimmer

***Development mechanism***: Lecithotrophic, Planktotrophic

***Reproductive type***: Gonochoristic.

***Biological zone***: Neritic, Epi-pelagic, Meso-pelagic.

***Salinity***: Full (30-40 psu), Variable (18-40 psu), Low (<18 psu).

***Substratum***: Sand, mid-water.

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** Priority species

**IUCN Red list:** Vulnerable (Category A1bd, version 2.3)

**OSPAR Convention, Annex V:** threatened/declining species within the Greater North Sea and the Celtic seas regions.

**Sources of threats:** Atlantic cod is caught mainly with bottom otter trawls and pelagic trawls. Devices such as handlines and cod traps are being recently replaced by gillnets (especially in Newfoundland). Other types of gear used are longlines, Danish seines, purse seines, twin beam trawls, light trawls, shrimp trawls and pound nets. [1]

**RARITY**

Widespread to common

**DECLINE**

Large fluctuations in recruitment of young cod to the fishery, the recruitment has been at or below the long term average since the mid 1980s, these large fluctuations have influenced the adult stock.[3,4] Fish stocks in the Irish Sea have fallen drastically in the past few years. Total stocks have declined by more than 33% in 30yrs. Global captures have decreased from ~1,270,500 tonnes in 1995 to ~764,500 tonnes in 2008).[1,5]

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**Comments:** Exploitation of the species through over-fishing, also caught as by-catch in trawl fisheries targeting Plaice & Sole as well as Otter trawl fisheries targeting Nephrops (prawns). Risk of collapse in the North Sea is considered high, particularly as populations are outside safe biological limits, as a result of over-exploitation. [6]

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** It has been seen in the Newfoundland banks, that once stocks have been over-fished it may be difficult or impossible to restore populations to certain high levels. However regulation of stock to remain within maximum sustainable yield, adherence to TAC and minimum EC mesh restrictions, and maintenance of spawning grounds should allow stocks to return and remain at healthy levels. Enforcement of existing regulations is the primary management objective.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] FAO (2010) *Gadus Morhua*. In Species Fact sheets, Fisheries and Aquaculture Department [On-line]. Available from: http://www.fao.org/fishery/species/2218/en [Accessed on 17/01/2011].

[2] Wilding, C., Heard, J. (2004) *Gadus morhua*. Atlantic cod. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on 17/01/2011]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3359

[3] Brander, K.M., (2007) The role of growth changes in the decline and recovery of North Atlantic cod stocks since 1970. *ICES Journal of Marine Science*, **64**(2), 211-217.

[4] Brander, K.M., (2005) Cod recruitment is strongly affected by climate when stock biomass is low. *ICES Journal of Marine Science: Journal du Conseil*, **62**(3), 339-343.

[5] JNCC (2010) UK Priority Species data collation *Gadus morhua* (version 2). UK BAP Assessments [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/318.pdf [Accessed on 17/01/2011].

[6] OSPAR (2009) Background Document for Atlantic cod *Gadus morhua* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/p00482_cod.pdf [Accessed 11/01/2011].

# ATLANTIC HALIBUT *HIPPOGLOSSUS HIPPOGLOSSUS* LINNAEUS, 1758

**Synonyms: None**

**Taxonomy:**

**Phylum:** Chordata

**Order:** Pleuronectiformes

**Family:** Pleuronectidae

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

(Image: Douglas Herdson)

## DISTRIBUTION

**English waters**: Unknown (potentially all English waters).

**UK Continental shelf**: Historically found throughout British and Irish waters although the current distribution is relatively unknown.

**Global:** Eastern Atlantic: Bay of Biscay to Spitsbergen, Barents Sea, Iceland and eastern Greenland. Western Atlantic: southwestern Greenland and Labrador in Canada to Virginia in USA [1]

## ECOLOGY

**Description:** Highly sought after commercially, the Atlantic halibut is the largest flatfish in the world reaching up to 2.5 m in length. It is a right-handed flatfish. The visible upper side of its laterally compressed body is usually dark brown to dark olive green in colour. The underside is a dirty white. Younger specimens may appear paler in colour and show a mottled pattern. They are a predominantly benthic and demersal species and also more infrequently pelagic. They spend the majority of their life at depths of 100 to 2000 metres, but live inshore at shallow (<50 m) depths for up to 4 years whilst juvenile. [2] *Hippoglossus hippoglossus* have slow growth rates and late onset of sexual maturity at around 10 years of age (dependent on region). Individuals have been known to reach ages of 40+ years [3]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***:

***Reproductive type***: Gonochoristic

***Biological zone***:

***Salinity***: Full (30-40 psu)

***Substratum***: Sand, sandy gravel, gravel

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority species

**IUCN Red list:** Endangered (A1d, version 2.3)

**Sources of threats:** *Hippoglossus hippoglossus* populations can be seriously affected by overfishing, due to high longevity and slow rate of maturity. [4]

**RARITY**

Occurs very widely

**DECLINE**

Included within the BAP priority species list as classed as 'Endangered' by the IUCN classification ('Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating').

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.[5]

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within Safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Robins, C.R., Ray, G.C. (1986) A field guide to Atlantic coast fishes of North America. Houghton Mifflin Company, Boston, U.S.A. 354 p.

[2] Barnes, M. (2008) Hippoglossus hippoglossus. Atlantic halibut. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 17/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3509

[3] Flower, M.S.S. (1935) Further notes on the duration of life in animals. - I. Fishes: as determined by otolith and scale - readings and direct observations on living animals. Proceedings of the Zoological Society of London 1935: 265.

[4] Muus, B.J. & Nielsen, J.G. (1999) Sea Fish. Scandinavian Fishing Year Book. Hedehusene: Denmark

[5] Sobel, J. (1996). *Hippoglossus hippoglossus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4.[On-line] Available from: www.iucnredlist.org. [Accessed on 17 January 2011].

# ANGLER-FISH *LOPHIUS PISCATORIUS* LINNAEUS, 1758

(Image:Keith Hiscock)

**Synonyms:** *Batrachus piscatorius*, *Lophius eurypterus*

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Actinopterii*

**Family:** *Lophiidae*

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

## DISTRIBUTION

**English waters**: All English waters.

**UK Continental shelf**: *Lophius piscatorius* occurs in coastal waters all around Britain and Ireland. It is predominantly recorded on the west coast of England, Wales and Scotland and the north, south and east coasts of Ireland.

**Global:** Eastern Atlantic: south-western Barents Sea to Strait of Gibraltar including the Mediterranean and Black Sea. Reported from Iceland and Mauritania.

## ECOLOGY

**Description:** The angler fish grows up to 200 cm in length and is a very distinctive fish, recognizable by having its head and body depressed, a wide mouth, broad head and a fleshy 'lure' at the end of its first dorsal spine, which is used to attract prey. Its colour can be variable but is principally brown or greeny brown with reddish or dark brown mottlings. It always has a white underside. It is a slow moving, bottom dwelling fish and is present in waters from the low intertidal down to depths of 550 m. It is uncommon to see an angler fish in water shallower than 18 m though it may migrate down to as deep as 2000 m in offshore waters in order to spawn. It is found mostly on sandy or muddy bottoms but is also present on shell, gravel and occasionally rocky areas.[1] The angler matures at around 5 years, and can live for than 20 - 30 years.[2]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Epi-benthic, meso-benthic, bathy-benthic.

***Salinity***: Full (30-40 psu)

***Substratum***: Sand, sandy gravel

***Water flow rate***: Variable

***Wave exposure***: Very sheltered

**Long-term natural fluctuations:**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan**: UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution.

The biology of anglerfish is still relatively unknown as deep-water fishing is largely unregulated, it is difficult to assess whether populations of these fish are being adversely affected. Also due to their late maturity (females 14 years & males 6 years) there is a greater risk of them being caught before reaching reproductive age. This species is also caught as by-catch in indiscriminate trawling and are already dead before they are returned to the sea. These large predatory fish are thought to be top of the food chain within the ecosystem they inhabit, and there are fears that commercial overfishing of their food, and subsequent damage to their habitat by weighted trawl nets, could have an adverse effect on populations.[3]

**RARITY**

Occurs very widely

**DECLINE**

Not noted as in decline, but highly vulnerable to overfishing due to their slow growth rate and longevity. 'Stock status has been assessed by ICES as below Safe Biological limits (SBL) in 2003-2004 for the North Sea, West of Scotland, Celtic Sea and Eastern Channel. Resilience: Low, minimum population doubling time 4.5 - 14 years'[4] Within the Bay of Biscay and Celtic Sea stock landings have increased since the 1990s to their highest level of 36 000t in 2007. The state of this stock is currently unknown.' It has not been possible to quantify SSB, fishing mortality, and recruitment for either stock. However, survey data indicate that biomass of *L. piscatorius* has been increasing over the 1997–2006 time-series and recruitment in 2001, 2002, and 2004 appear to be above average.' [5]

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Reeve, A. (2008) Lophius piscatorius. Angler fish. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 13/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3728

[2] Fishbase,(2011) *Lophius piscatorius*.[On-line] Available from: http://www.fishbase.org/Summary/speciesSummary.php?ID=716&genusname=Lophius&speciesname=piscatorius&AT=lophius+piscatorius&lang=English [Accessed on 11/01/2011]

[3] Thangstad T., Dyb J. E., Jónsson E., Laurenson C., Ofstad L. H., Reeves S. A. (2002) Report for Nordic grant, Journal no. 660102111401. *Anglerfish (Lophius spp.) in Nordic and European Waters— Status of current knowledge and ongoing research.* Institute of Marine Research. Norway: Bergen; p. 56

[4] JNCC, (2010) UK Priority Species data collation *Lophius piscatorius* (version 2) UK BAP Assessment [on-line]. Available from: http://www.jncc.gov.uk/_speciespages/420.pdf [Accessed on 01/11/2011]

[5] CEFAS (2009) Anglerfish in the South West of the British Isles (ICES Division VIIb-k and VIIIa,b). Report by the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft, Suffolk.

# WHITING *MERLANGIUS MERLANGUS* (LINNAEUS, 1758)

**Synonyms:**

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Gadiformes*
**Family:** *Gadidae*

(Image: Holly Latham)

## DISTRIBUTION

**English waters**: South-east England and the English Channel, Irish Sea off the coasts of west England and Wales.

**UK Continental shelf**: Found off western Scotland, south-east England and the English Channel, and in the Irish Sea off the coasts of west England and Wales.[1]

**Global:** Northeast Atlantic: south-eastern Barents Sea and Iceland to Portugal, also in the Black Sea, Aegean Sea, Adriatic Sea and adjacent areas. Rare in the north-western Mediterranean.[2]

## ECOLOGY

**Description:** The whiting *Merlangius merlangus* is a cod-like fish. It has an elongated body with a small head and a pointed snout. It can grow up to 70 cm in length. It has a blue-green upper colouring and is silvery-white underneath. It has three dorsal fins and two anal fins. The pectoral fins are on the side and the pelvic fins are near the gills. The tail is truncate. It is a bentho-pelagic species usually found as depths of 30-100 m. It can be found near mud and gravel bottoms, but also above sand and rock.[1] Maturity is reached at roughly 2 years, and can live for more than 10 years. Fertilisation is external and eggs are pelagic. Larvae and juveniles tend to remain inshore, moving into the open sea after one year.[2]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Lecithotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Bentho-pelagic

***Salinity***: Full (30- 40 psu)

***Substratum***: Rock, sand, gravel

***Water flow rate***:

***Wave exposure***:

**Long-term natural fluctuations:** No information.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution.

The BAP assessment states, 'The biggest threat to this species is over-harvesting by the fishing fleets of many nations, despite still being a fairly numerous species. Domestic pressure on governments to support their fishing industries has led to the situation where overfishing takes place, and agreed quotas are exceeded.'[3] Similar to a number of other commercially important fish it is now feared that there are more being caught by trawlers than reproduce annually.

**RARITY**

Widespread to common

**DECLINE**

'The last accepted assessments in 2003 showed that the west of Scotland stock decreased by a factor of 5 and the Irish Sea stock by a factor of 10 between the 1980s and 90s. For the Celtic sea stock, indications were that the stock was at a high level in the early 1990s but has declined in recent years. Stocks in the North sea are also unknown but are relatively lightly exploited and ICES have advised that current rate of exploitation is sustainable.' [3]

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Barnes, M. (2008) Merlangius merlangus. Whiting. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3794

[2] Fishbase. *Merlangius merlangus*. [On-line]. Available from: http://www.fishbase.org/Summary/speciesSummary.php?ID=29&genusname=Merlangius&speciesname=merlangus&AT=merlangus+merlangus&lang=English [Accessed on 11/01/2011]

[3] JNCC, (2010) UK Priority Species data collation *Merlangius merlangus* (version 2). In UK BAP reporting. [on-line] Available from: http://www.jncc.gov.uk/_speciespages/449.pdf [Accessed on 11/01/2011]

# EUROPEAN HAKE *MERLUCCIUS MERLUCCIUS* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Gadiformes*

**Family:** *Merlucciidae*

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

(Image: Holly Latham)

## DISTRIBUTION

**English waters**: Found in the western English Channel as far east as Dorset, around Cornwall and Devon an along the North-east coast of England as far as the Isle of Man.

**UK Continental shelf**: Found in the western English Channel as far east as Dorset, in the Irish Sea as far north as the Isle of Man and off southern Ireland. One sighting puts it as far north as western Scotland.

**Global:** Eastern Atlantic: Norway and Iceland, southward to Mauritania. Also in the Mediterranean Sea and along the southern coast of the Black Sea.

## ECOLOGY

**Description:** M*erluccius merluccius* has an elongate body that may reach up to 1.3 m in length. Although superficially similar to the cod-like family, it only has two dorsal fins and one anal fin. The first dorsal fin is short and triangular. The second dorsal fin, like the anal fin, is prolonged. It has a straight lateral line. It has a large and narrow head with a large mouth. It has a dark blue dorsal colouring but is silvery-grey underneath. *Merluccius merluccius* has been observed using its pectoral and pelvic fins to dig into soft sandy substrates, often throwing sand onto their backs. It is a demersal species that is usually found between 70-350 m. May be observed feeding alone on the bottom or in shoals in the water column.[1]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Plantotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Epi-benthic

***Salinity***: Full (30-40 psu)

***Substratum***: Sand

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** No information

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing

gear impacts/pollution. Stocks are outside safe biological limits (in the north between sub-areas IV, VI & VII and in the south in VIIc & IXa). No Hake have been caught at Hinkley Point, Somerset since 1999 - despite continued surveys up to 2004. This extreme decline could be site specific. Species was once common but is now considered as an infrequent visitor to Bridgwater Bay, Somerset.

**RARITY**

Occurs very widely

**DECLINE**

BAP Assessment states that the 'stock status below safe biological limits (ICES) in 2003 - 04 for N Sea, West Scotland, Eastern Channel, Irish Sea, Celtic Sea and West Channel.'[2]

**DEGREE OF THREAT**

**Score (range 0-16):** 11 (High)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Barnes, M. (2008) Merluccius merluccius. European Hake. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 18/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3797

[2] JNCC (2010) UK Priority Species data collation *Merluccius merluccius* (version 2). In UK BAP reporting. [on-line] Available from: http://www.jncc.gov.uk/_speciespages/451.pdf [Accessed on 11/01/2011].

# LING *MOLVA MOLVA* LINNAEUS, 1758

**Synonyms:** *Gadus molva, Gadus raptor, Lota mola, Molva linnei, Molva vulgaris*

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Actinopterygii*

**Family:** *Lotidae*

**INCLUDED IN THE GROUPED PLAN FOR COMMERCIAL BONY FISH**

(Image: Fiona Crouch)

## DISTRIBUTION

**English waters**: Off all English coasts, particularly the South and West.

**UK Continental shelf**: Widely recorded around the British Isles, mainly off the south and west coasts of England and the west coast of Scotland.

**Global:** Northwest Atlantic: off southern Greenland and Canada. Northeast Atlantic: Barents Sea and Iceland to Morocco. Mediterranean Sea, (north-western Mediterranean only).

## ECOLOGY

**Description:** *Molva molva* is the largest fish of the cod family, growing up to 200 cm in length and 30 kg in weight. Both its head and eyes are small and the upper jaw projects beyond the lower. The lower jaw bears a distinct sensory barbel. Unlike most other cod species, *Molva molva* has two instead of three dorsal fins. The first dorsal fin is short with 14-15 fin rays; the second is considerably longer and has 61-68 fin rays. The anal and dorsal fins have a distinct white edge and bear a dark spot at the rear. Spawning occurs offshore between March and August at a depth of 100-300 m. [1] The females produce between 20-60 million pelagic eggs ca.1 mm in diameter. Juveniles stay in coastal waters until the 2-3 years of age [2,3]. Growth is initially rapid: up to 20 cm long in the first year; 35 cm in the second; 55 cm in the third and up to 83 cm in the forth year. Subsequent annual growth is between 8-10 cm until the ninth year. Females invariably grow faster and live longer than males. Females reach maturity at 90-100 cm or 6-8 years of age and can live up to 14 years. Males reach maturity at ca. 80 cm and rarely live over 10 years of age. [3]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Epi-benthic, Meso-benthic

***Salinity***: Full (30-40 psu)

***Substratum***: Sand, gravel, rock.

***Water flow rate***: All

***Wave exposure***: Sheltered, very sheltered

Long-term natural fluctuations: **No information**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution.

Caught primarily as by-catch in ICES Subareas IV, V, VI. Several Irish long-liners target this species. Direct long-line & gillnet fishery in ICES Subareas I & II. Ling is a late-maturing deep-water species that occupies a habitat vulnerable to exploitation and the impacts of trawling.

## RARITY

Occurs very widely

## DECLINE

'The last accepted assessments in 2003 showed that the west of Scotland stock decreased by a factor of 5 and the Irish Sea stock by a factor of 10 between the 1980s and 90s. For the Celtic sea stock, indications were that the stock was at a high level in the early 1990s but has declined in recent years. Stocks in the North sea are also unknown but are relatively lightly exploited and ICES have advised that current rate of exploitation is sustainable.' [3] According to previous BAP assessments: 'Stocks around the UK have never been assessed by ICES but the limited information available suggests a decline between the 1970s and 1990s, since when stocks have been stable or slightly increasing. The scale of the decline cannot be quantified but may be in the order of 50%. Fisheries data suggest that the landings for the species in the NE Atlantic were a steady 55-65,000 tonnes through the 70's, 80's and early 90's, and have now dropped (and continue to decline) to about 30,000 tonnes.' [4]

## DEGREE OF THREAT

**Score (range 0-16):** 11 (High)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

## RECOVERY/CONSERVATION POTENTIAL

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

## RECOVERY/CONSERVATION GOAL

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

## MANAGEMENT REQUIREMENTS AND BUDGET

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

## REFERENCES

[1] Rowley,S. (2008) Molva molva. Ling. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on 23/12/2010]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3826

[2] Dipper, F. (2001) British sea fishes (2nd edn). Teddington: Underwater World Publications Ltd.

[3] Wheeler, A. (1969) The fishes of the British Isles and north-west Europe. London: Macmillan.

[4] JNCC (2010) UK Priority Species data collation *Molva molva* (version 2). UK BAP Assessments. [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/460.pdf [Accessed on 24/01/2011].

# PLAICE *PLEURONECTES PLATESSA* LINNAEUS, 1758

**Synonyms:** None recently

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Pleuronectiformes*
**Family:** *Pleuronectidae*

(Image: Keith Hiscock)

## DISTRIBUTION

**English waters**: Present along all English coastline. Spawning grounds in Liverpool Bay, the Fastnet and Malin regions, the Channel, and along the east coast (primarily the Dogger bank).

**UK Continental shelf**: Found off all British and Irish coasts although perhaps under recorded off western Irish coasts.

**Global:** Spain and France in the Western Mediterranean and along all European coasts to White and Barents Seas up to Greenland and Norway. Absent from northern Baltic, Black and Caspian Seas. Regularly reported from freshwaters in Kanin Peninsula (Barents Sea). [1, 2]

## ECOLOGY

**Description:** *Pleuronectes platessa* is an oval-shaped, right-eyed flatfish and has a brown coloured upper side with numerous, conspicuous orange or red spots. This fish also has the ability to change colour for camouflage. The usual size limit is about 50-60 cm but exceptional specimens can reach 100 cm. Plaice feed on bottom-living animals and mostly spawn between January to March, each female producing up to half a million eggs in her lifetime. Around Britain, the eggs are laid in fairly shallow water between 20-40 m in well-defined spawning grounds.

Plaice live mostly on sandy bottoms, although they also live on gravel and mud.[3] They can grow at 2-3 cm per year and live for up to 50 years (maturing at 3-5 years). They adults tend to move large distances offshore to deeper water (up to 200 m) when mature, while juveniles remain closer to shore in the shallows. Plaice are highly important commercially and are usually caught in trawls and seine nets.

***Feeding method***: Predator, scavenger

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Sublittoral Fringe, Upper and lower Infra-littoral, Upper and lower Circa-littoral, Circalittoral Offshore, Bathybenthic (Bathyal).

***Salinity***: Variable (18-40 psu)

***Substratum***: Mixed

***Water flow rate***: Weak(<1 kn), moderately strong (1-3 kn). ***Wave exposure***: Variable

**Long-term natural fluctuations:** No information

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**IUCN Red list**: Least Concern (version 3.1)

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution. Classified under BAP as 'Long-lived, vulnerable and low recovery: Provides habitat/food source for an established proposed BAP: More abundant and widespread in the past and not viable now.'[4]

**RARITY**

Common (occurring in between 151-500 $km^2$ squares within the 3 nautical mile limit of British seas).

**DECLINE**

Landings of plaice in the Celtic Sea, Irish Sea and North Sea increased sharply from the mid 1970s until the end of the 1980s where they peaked (at ~2,000 tonnes, ~6,000 tonnes and ~170,000 tonnes respectively) and have been steadily declining since, to a present level of around 500 tonnes in both the Celtic and Irish Sea regions, and ~50,000 tonnes in the North Sea. Recruitment has also dropped significantly from the peaks seen during the 1980s period. While landings have reduced dramatically in areas such as the Irish Sea, this is due in great part to reduced fishing effort in this area, with most plaice caught (primarily males) being taken only as by-catch, allowing the population to largely recover. Both the Celtic Sea and North Sea communities are still classed by ICES as overfished in relation to highest yield, and with the Celtic Sea community having reduced reproductive capacity.[5,6,7]

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (moderate)

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (moderate)

**Comments:**

Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Primarily the jurisdiction of fisheries agencies to enforce stock quotas and maintain areas of protection (Plaice box) for adequate recruitment.

**Translocation**: Mobile species. Not recommended.

**Enforcement**: MMO enforcement of stock quota, the Plaice box, and gear regulations.

**Research**: Undertake research into factors effecting recruitment levels. Tagging work to investigate movements at various stages of their life-history, and locate aggregations can be very useful to management.

**Monitoring**: Monitoring of fish stocks need to be maintained and conducted with accuracy, to include the effects of by-catch. This work is done by fisheries agencies.

**Wider environment**:

UK and EU to implement effective fisheries management, fully incorporating scientific advice from ICES.

**SPECIALISTS**

Dr Ewan Hunter (CEFAS)

A. D. Rijnsdorp (Netherlands Institute for Fisheries Research)

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 10 (moderate) | 9 (moderate) | [Cost of fisheries management and research already underway. Collaborate with / contribute to existing programmes.] |

**REFERENCES**

[1] Freyhof, J. & Kottelat, M. (2008) *Pleuronectes platessa*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. Available from: www.iucnredlist.org. [Accessed 11/01/2011].

[2] Froese, R. & Pauly, D. (Editors). (2010) FishBase, Pleuronectes platessa. In: www.fishbase.org/, version (11/2010). [Accessed on 11/01/2011].

[3] Ruiz, A. (2007) *Pleuronectes platessa. Plaice*. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4144

[4] JNCC (2010) UK Priority Species data collation *Pleuronectes platessa* (version 2). UKBAP Assessments [On-line]. Available from http://www.jncc.gov.uk/speciespages/523.pdf [Accessed on 24/01/2011].

[5] CEFAS (2009a) *Plaice in the Celtic Sea (ICES Division VIIf&g).* Report for the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft Suffolk.

[6] CEFAS (2009b) *Plaice in the Irish Sea (ICES Division VIIa).* Report for the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft Suffolk.

[7] CEFAS (2009c) *Plaice in the North Sea (ICES Sub-area IV).* Report for the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft Suffolk.

# ATLANTIC MACKEREL *SCOMBER SCOMBRUS* LINNAEUS, 1758

(Image: David Fenwick)

**Synonyms:** *Scomber glauciscus, Scomber punctatus, Scomber scomber,Scomber scriptus, Scomber vernalis, Scomber vulgaris, Scomber vulgaris*

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Perciformes*

**Family:** *Scombridae*

## DISTRIBUTION

**English waters**: All English waters

**UK Continental shelf**: Widely distributed in the continental shelf seas around the British Isles and Ireland, usually at depths of less than 200 m. Found in greater abundance on the shelf edges during winter.

**Global:** North Atlantic.

## ECOLOGY

**Description:** Atlantic mackerel are most readily identified by the strong dark markings on their back, which are oblique to near-vertical with relatively little undulation. The belly is unmarked and a mixture of silver and metallic blue in colour. *Scomber scombrus* is a streamlined fish with a total of 8-14 dorsal spines, 11-13 dorsal soft rays and 12-13 anal soft rays. They also show a conspicuous anal fin spine, joined to the fin by a thin membrane. They do not possess a swim bladder. It is a pelagic species that makes extensive migrations, and there are a variety of hydrographical features such as temperatures as well as the abundance and composition of zooplankton and other prey is likely to affect its distribution. *Scomber scombrus* can be extremely common and found in huge shoals feeding on small fish and prawns.[1] Matures at 2-3 years and can live up to 15 years in the wild.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Epi-pelagic

***Salinity***: Full (30-40 psu)

***Substratum***: None

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** No information

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution.

**RARITY**

Abundant in trawl surveys.

**DECLINE**

Two stocks in north-east Atlantic: North Sea (east) and British Isles (west). North Sea stock decreased dramatically in the 1960's because of direct overfishing. Recruitment has been poor and unstable. BAP assessment states that 'ICES data show the total Spawning Stock Biomass in the NE Atlantic has fallen from 4Mt in 1972 to about or less than 2Mt in the early 2000s.' and that 'Species face pressure from fishing throughout its wide range. An extensive pelagic trawl fishery targets mackerel in the northern North Sea. Massive catches in N Sea in 1960s (1 mill t) and nothing there now. Level of fishing mortality is above level needed for recovery.'[2]

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** Recovery conservation would be based on ensuring that fishing restrictions are beneficial to species recovery and are enforced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Barnes, M. (2008) Scomber scombrus. Atlantic mackerel. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on 18/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4310

[2] JNCC (2010) UK Priority Species data collation *Scomber scombrus* (version 2). UK BAP Assessment [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/567.pdf [Accessed on 17/01/2011].

# COMMON SOLE *SOLEA SOLEA* LINNAEUS, 1758

(Image: Andrew Marriott)

**Synonyms:** *Solea vulgaris*

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Pleuronectiformes*
**Family:** *Soleidae*

## DISTRIBUTION

**English waters**: Off all English coasts.

**UK Continental shelf**: *Solea solea* is found off the coast all around Britain and Ireland.

**Global:** Eastern Atlantic: southward from Trondheim Fjord (including North Sea and western Baltic) and Mediterranean Sea (including Sea of Marmara, Bosporus and southwestern Black Sea). Elsewhere, southward to Senegal, including Cape Verde.

## ECOLOGY

**Description:** *Solea solea* is a strongly compressed flatfish with eyes and snout on the right hand side. It is oval in shape with a rounded head and can grow up to 70 cm in length but is more commonly between 30-40 cm. Depending on the substratum the colour of the sole can vary between grey, reddish brown and grey-brown with dark blotches. The sole has two well developed pectoral fins, and the dorsal and anal fins connect to the base of the tail. It is usually found on sandy and muddy seabeds, and also in estuarine habitats. The sole is present from depths of 1 to around 70 m, except in winter when it moves offshore and can be found down to depths of around 150 m.[1] Spawning takes place in shallow coastal waters, mainly during the months of February-May, at temperatures of 6 - 12°C, but occasionally at the start of winter in warmer regions. Reproduction starts after 3-5 years of age, when 25-30cm size is reached, and can live for over 20 years.[2] Incubation lasts about 5 days (at 12°) and larval phase 35 days (at 18°C). [3]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Pelagic, bentho-pelagic

***Salinity***: Full (30-40 psu), Variable (40 – 18 psu).

***Substratum***: Sand, sandy mud.

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** No information

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution.

**RARITY**

Occurs very widely

**DECLINE**

Included within BAP due to a 'decline in spawning stock biomass from 90,000 tonnes in 1967 to 30,000 in 1982.' [4]. CEFAS note that the Irish Sea and North Sea stocks are overfished, at risk of being fished unsustainably, and with reduced reproductive capacity, [5,6] with landings reduced from a 1986/87 peak of ~3,000 tonnes, to a 2007 level of ~500 tonnes for Irish Sea stocks,[5] and reduced from a 1989/90 peak of 35,000 tonnes to a 2007 level of ~15,000 tonnes.[6] Celtic Sea stocks appear to be stable, harvested sustainably and with full reproductive capacity.[7]

**DEGREE OF THREAT**

**Score (range 0-16):**

**Comments:** Stocks of demersal fish continue to be over-exploited and to be discarded as by-catch in trawl fisheries. Populations of most species are outside of safe biological limits and at a reduced reproductive capacity.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):**

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Reeve, A. (2007) Solea solea. Sole. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 23/12/2010]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4347

[2] Beverton, R.J.H., Beddington, J.R., Lavigne, D.M (eds.) (1985) In *Marine Mammals and Fisheries. Boston*: G. Allen & Unwin.

[3] Quéro, J.C., Desoutter, M., Lagardère, F. (1986) *Soleidae*. p. 1308-1324. In Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen, J., Tortonese, E. (eds.) *Fishes of the North-eastern Atlantic and the Mediterranean*. UNESCO, Paris. Vol. 3.

[4] JNCC (2010) *UK Priority Species data collation Solea solea* (version 2). UK BAP Assessment. [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/578.pdf [Accessed on 11/01/2011].

[5] CEFAS (2009) *Sole in the Irish Sea (ICES Division VIIa)* Report by the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft, Suffolk. 2 pp.

[6] CEFAS (2009) *Sole in the North Sea (ICES Sub-area IV)* Report by the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft, Suffolk. 2 pp.

[7] CEFAS (2009) *Sole in the Celtic Sea (ICES Division VIIf&g)* Report by the Centre for Environment, Fisheries & Aquaculture Science, Lowestoft, Suffolk. 2 pp.

# HORSE MACKEREL OR SCAD *TRACHURUS TRACHURUS* LINNAEUS, 1758

**Synonyms:** *Caranx trachurus, Scomber trachurus, Trachurus europaeus, Trachurus saurus, Trachurus vulgaris*

(Image: Keith Hiscock)

**Taxonomy:**

**Phylum:** *Chordata*

**Order:** *Perciformes*

**Family:** *Carangidae*

## DISTRIBUTION

**English waters**: Primarily South coast of England, including Cornwall, Devon, Dorset, Hampshire, Sussex, Kent, and also Cheshire, Lancashire, Cumbria.

**UK Continental shelf**: The horse mackerel has a south-western distribution and can be found in throughout the English Channel, in the Irish Sea as far north as Lancashire and off the south coast of Ireland.

**Global:** Mediterranean and eastern Atlantic: Norway to South Africa, round the coast to Maputo.

## ECOLOGY

**Description:** The horse mackerel *Trachurus trachurus* is a slender schooling species that may reach up to 60 cm in length. The leading rays of its dorsal, anal and pelvic fins have conspicuous spines. It has two dorsal fins, the first of which is short and tall. The second dorsal fin, like the anal fin, is prolonged from the end of the first dorsal almost to the tail. It is a pelagic coastal species that may be found on continental shelves down to over 200 m in depth.[1] Horse mackerel form large schools in coastal areas, and can females can lay up to 140,000 eggs, which hatch into 5mm long larvae.[2]

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Lecithotrophic, Planktotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Neritic, Epi-pelagic, Meso-pelagic.

***Salinity***: Full (30-40 psu).

***Substratum***: Gravelly sand, muddy sand, sand.

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** No information

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Over-fishing, by-catch, damage to spawning grounds and habitats through fishing gear impacts/pollution. Stocks in ICES Subareas VIIIc and Ixa are being harvested outside their safe biological limit.

**RARITY**

Occurs very widely

**DECLINE**

Traditionally, most horse mackerel were landed in small-mesh industrial fisheries, though there has been an increase in targeted fisheries landing larger fish for human consumption.[3] The species was considered abundant around the Britain in the late 1960s but is now scarce around the British coasts. (Global captures have also decreased from ~560,000 tonnes in 1995 to ~186,000 tonnes in 2008).[4] 'The most recent BAP assessment states 'very high landings reported were reported for horse mackerel by Fishstat+ from the mid 90s. The 2006 ICES advice seems to suggest that recruitment events are relatively infrequent, and that this year's quota for the NE Atlantic (about 180,000 tonnes) would put the stock at risk of collapse if it was set at that level repeatedly. The Spawning Stock biomass figure also reflects that the fishery depended for a long time on the 1982 year class and that the stock has been declining ever since.' [5]

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** Recovery conservation would be based on ensuring that fishing restrictions are beneficial to species recovery and are enforced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 9 (Moderate)

**Comments:** Primary action would be to make sure recommended fishing restrictions are enforced, with by-catch levels from other commercial fisheries reduced. Important spawning areas/habitats also need to be properly maintained and protected from impacts.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when all UK stocks are within safe Biological Limits, at reproductive capacity and producing a sustainable yield.

**MANAGEMENT REQUIREMENTS AND BUDGET**

Management of the stock is the responsibility of fisheries regulators, research the responsibility of fisheries departments and costs are borne by those competent authorities and by fishermen. No further estimate of cost is undertaken here.

**REFERENCES**

[1] Barnes, M. (2008) Trachurus trachurus. Horse mackerel (or scad). Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on: 18/01/2011]. Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=4492

[2] Muus, B.J., Nielsen, J.G. (1999) *Sea fish. Scandinavian Fishing Year Book*, Hedehusene, Denmark. 340 p.

[3] Macer, C.T., (1977) Some aspects of the biology of the horse mackerel (Trachurus trachurus L.) in waters around Britain. *Journal of Fish Biology*, **10**, 51-62.

[4] FAO (2010) *Trachurus trachurus*. In Species Fact sheets. Fisheries and Aquaculture Department [On-line]. Available from: http://www.fao.org/fishery/species/2306/en [Accessed on 17/01/2011].

[5] JNCC (2010) UK Priority Species data collation *Trachurus trachurus* (version 2). UK BAP Assessments [On-line]. Available from: http://www.jncc.gov.uk/_speciespages/614.pdf [Accessed on 17/01/2011].

# BASKING SHARK *CETORHINUS MAXIMUS* GUNNERUS, 1765

(Image:Keith Hiscock)

**Synonyms:**

**Taxonomy:**
**Phylum:** Chordata
**Order:** Lamniformes
**Family:** Cetorhinidae

## DISTRIBUTION

**English waters**: Throughout English waters

**UK Continental shelf**: Usually sighted in summer in areas such as western Ireland, western Scotland, the Clyde area, the central Irish Sea, approaches to the Bristol Channel and the western English Channel.

**Global:** World-wide, cold to warm-temperate waters

## ECOLOGY

**Description:** Distinguished from all other sharks by the enormous gill slits practically encircling the head, with a pointed snout, large, sub terminal mouth with minute hooked teeth and caudal peduncle with strong lateral keels, and almost homocercal caudal fin. Can reach 980 cm in length. Often seen feeding on the surface in spring and summer months, most often in groups of several individuals. Often seen feeding on surface aggregations of plankton, moving slowly forward with open mouth, sometimes in large numbers. Highly migratory species with highly complex courtship behaviour. Very long-lived (around 50 years) and slow rate of maturity (18+ years).

***Feeding method***: Filter feeder

***Mobility***: Swimmer

***Development mechanism***: Ovoviviparous, oophagous

***Reproductive type***: Gonochoristic

***Biological zone***: Circalittoral offshore, epipelagic, mesopelagic

***Salinity***: Full (30-40 psu)

***Substratum***: Not relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** No clear pattern to changes in abundance. However, certain years have seen very large influxes of sharks to some United Kingdom areas, while in other years, the numbers recorded are low[1,2,3]. A shift in the timing and distribution of *Calanus* copepod (one of *C. maximus*' main prey species) communities in the North Atlantic may be affecting basking shark populations or distribution[4].

**Past declines and current threats:** There are no firm estimates of population size of basking sharks but it has been estimated that over the past 50 years some 80,000 to 106,000 animals have been removed from the North-East Atlantic[4]. Most basking shark fisheries appear to have collapsed after initial high yields. Landings throughout the northeast Atlantic have also fluctuated, but a continued downwards trend is evident over the past few decades. A few well-documented declines in catches by directed

fisheries for the basking shark suggest that reduction in numbers caught of at least 50% to over 90% have occurred in some areas over a very short period (usually ten years or less)[5]. These apparent declines have persisted into the long-term with no apparent recovery several decades after exploitation has ceased. Current threats include bycatch in commercial fisheries and from harassment and collision with boats.[6]

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Bern Convention:** Appendix II

**Biodiversity Action Plan:** Biodiversity Action Plan (UKBAP: 2007 )

**IUCN Red list:** Endangered (Categories A2ad+3d, version 3.1) In North Pacific and North-East Atlantic.

**OSPAR Convention:** Annex V, threatened/declining species within all areas it occurs.

**Wildlife and Countryside Act:** Listed under the Wildlife and Countryside Act's schedule 5, section 9

**Sources of threats:** Major threat is from commercial fisheries where it occurs as bycatch, harassment and accidental collision with boats and anthropogenic pollution from run-off resulting in a degradation of the species habitat.[7]

**RARITY**

Basking sharks are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but basking sharks would most likely be described as 'uncommon'.

**DECLINE**

Declining in the North-East Atlantic with no signs of recovery after termination of exploitation. Absent from parts of historical range.

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)

**Comments**: Vulnerable as by-catch in trawl and gill-net fisheries. The large size, late maturation and low fecundity of the species make it highly vulnerable to over-exploitation. Increased rate of reported collisions with ships

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** Poor knowledge of the status of the population and of the factors adversely affecting recovery/conservation especially lead to the low score. Also, it seems likely that by catch will continue.

**RECOVERY/CONSERVATION GOAL**

Recovery/conservation will have been achieved when by-catch has been reduced to a level to be determined by fisheries scientists as meaningful in that the population will, despite by catch, continue to increase.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management**: Maintenance of "Zero Quotas" and reduction in by-catch. As the main threat to elasmobranchs lies with commercial fisheries all efforts must be made to reduce by catch. Cost is part of fisheries regulatory activities.

**Translocation**: Not relevant in highly migratory pelagic species.

**Enforcement**: Through statutory authorities including fisheries regulation and maintenance of current fisheries regulations. International enforcement is vital due to high mobility and wide distribution of the species. Cost is part of fisheries regulatory activities.

**Research**: Understanding the relationship between variations in *C. maximus* appearances and abundances in relation to *Calanus* distributions is vital to determine if the species is shifting its distribution. Continuing monitoring of sightings to attempt to get population estimates. Re-start satellite tagging programme (£172,000 p.a.) and run for three years = Total £316,000.

**Monitoring**: Sightings reported from basking shark watching groups and marine mammal surveys. Reporting of accidental captures. Cost is part of reporting programmes.

**Wider environment**: International protection throughout its range is vital to ensure recovery of the species. Zero catch quotas should be maintained through international waters as well. As the species has a global distribution with geneflow between all ocean basins further reductions of population numbers will have global impact on the species. Cost is part of fisheries regulatory activities.

**SPECIALISTS**

Prof. David W. Sims – The Marine Biological Association of the UK, Plymouth, England

Dr Mauvis Gore - University Marine Biological Station, Millport, Scotland

Prof. Monty Priede – OceanLab, University of Aberdeen, Scotland

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery/Conservation potential (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 2 (Low) | £172,000 electronic tagging p.a. (Total £516,000 over three years) |

**REFERENCES**

[1] Kunzlik, P.A., (1988) The basking shark. Scottish Fisheries. Information Pamphlet no14. Department of Agriculture and Fisheries for Scotland. Aberdeen.

[2] Speedie, C.D., Witt M., Johnson L.A., in press. Basking shark hotspots in Scotland.

[3] Fairfax, D. (1998) The Basking Shark in Scotland : natural history, fishery and conservation. Tuckwell Press, East Linton, Scotland. 206 pp.

[4] Beaugrand, G., Reid, P.C., Ibanez, F., Lindley, J.A., Edwards, M. (2002) Reorganization of North Atlantic Marine Copepod Biodiversity and Climate. *Science,* **296**. 1692-1694.

[5] Sims, D.W., Reid, P.C. (2002) Congruent trends in long-term zooplankton decline in the Northeast Atlantic and basking shark (Cetorhinus maximus) fishery catches off west Ireland. *Fisheries Oceanography*, **11** (1), 59-63

[6] OSPAR (2009) Background Document for the Basking shark *Cetorhinus maximus* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00419_basking_shark.pdf. [Accessed 11/01/2011].

[7] Fowler, S.L. (2005) Status of the basking shark : Cetorhinus maximus (Gunnerus). In Fowler, S.L., Camhi, M., Burgess, G., Fordham, G., Musik, J., *Sharks, rays and chimaeras*. The status of the Chondrichtyan fishes. IUCN species survival commission shark specialist group. IUCN, Gland, Switzerland and Cambridge UK, 461 pp.

# TOPE SHARK (SOUPFIN SHARK, SCHOOL SHARK, SWEET WILLIAMS) *GALEORHINUS GALEUS* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**
**Phylum:** Chordata
**Order:** Carcharhiniformes
**Family:** Triakidae

(Image:Davy Holt)

## DISTRIBUTION

**English waters**: From surfline to offshore, but not oceanic. Found throughout English waters.
**UK Continental shelf**: Widely distributed off the coasts of Britain and Ireland
**Global:** Worldwide in temperate waters

## ECOLOGY

**Description:** Large, slender hound shark, reaching 195 cm in length at least, with a long pointed rostrum and large mouth. Eyes are large and oval, second dorsal fin is of similar size to the anal fin and caudal fin is heterocercal with a larger upper lobe. The species occurs in small schools, is partly segregated by size and sex, and is seasonally migratory in higher latitudes.

***Feeding method***: Predator
***Mobility***: Swimmer
***Development mechanism***: Ovoviviparous: Aplacental viviparous
***Reproductive type***: Gonochoristic
***Biological zone***: Benthopelagic, epipelagic
***Salinity***: Full (30-40 psu)
***Substratum***: Not relevant
***Water flow rate***: All
***Wave exposure***: All

**Long-term natural fluctuations:** None known

**Past declines and current threats**: Biological data for this species is limited in the north-east Atlantic. The species is not targeted heavily however late maturity (around 10 years) and low reproductive potential make *G. galeus* highly vulnerable to overfishing. Landings of this species are restricted in the UK.

## STATUS AND THREATS

**Directives / convention / statutes (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**IUCN Red list:** Vulnerable (A2bd+3d+4bd, version 3.1)

**Sources of threats:** Mainly by-catch in commercial demersal fisheries targeting high value species.

**RARITY**

No estimates available, but the species is considered to be common although reports are becoming increasingly rare where they used to be abundant.

**DECLINE**

The IUCN lists the species as declining. However, there is little data for the North-East due to historical landing of the species as "dogfishes and hounds".

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** Tope shark are very long lived and mature at a late stage. Coupled with a reproductive cycle lasting up to 3 years, the species is extremely vulnerable to over-fishing.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** This species has not had the dramatic population declines reported in other heavily targeted elasmobranchs, such as porbeagle, however there is little data available. This species represent a good candidate for implementing the proper management now to avoid dangerous declines. New Zealand actively manages *G. galeus* fisheries and has had 10 years of sustainable catches.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when there is a sustained and continuing increase in numbers in North-East Atlantic population by 2020.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management:** UK and EU to implement effective fisheries management, fully incorporating scientific advice from ICES. Introduction of strict management of stock through reduction in bycatch, by introducing new technologies and by use of more selective gear to reduce shark by-catch (for example Shark Defence 'Smart Hook'). Cost absorbed within normal fisheries management activities.

**Translocation:** Not relevant in highly migratory pelagic species.

**Enforcement:** International enforcement is vital due to high mobility and wide distribution of the species. Statutory authorities including fisheries regulation. Cost absorbed within normal fisheries management activities.

**Research:** The species is known to range along the entire coast of Europe, however the timing and cycle of migration is poorly understood. Location of nursery and pupping grounds would be beneficial to protect early life stages. Development of species specific management models. Examine available survey data so as to better delineate important grounds for various life-history stages and continue long-term tag-and-release programme: Cost (in combination with other species programmes) c. £20,000 p.a. for each of five years.

**Monitoring:** Species specific reporting of catches and landings (already in place in many European countries, including UK).

**Wider environment:** Genetic analysis shows distinct populations between Europe and the South Atlantic, so pan-European management is likely to be effective[1].

**SPECIALISTS**

Dr Jim Ellis – CEFAS, Lowestoft, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-16): | Recovery/conservation potential (range 0-16): | Cost |
|---|---|---|
| 10 (High) | 2 (Low) | £20,000 p.a. for each of five years = £100,000 total |

**REFERENCES**

[1] Chabot, C.L., Allen, L.G. (2009) Global population structure of the tope (*Galeorhinus galeus*) inferred by mitochondrial control region sequence data. *Molecular Ecology,* **18**, 545–552.

# PORBEAGLE SHARK *LAMNA NASUS* BONNATERRE, 1788

**Synonyms:**

**Taxonomy:**
**Phylum**: Chordata
**Order:** Lamniformes
**Family:** Lamnidae


(Image: Viki Wearmouth)

## DISTRIBUTION

**English waters**: Inshore and surface in the summer months to deep continental offshore waters in the winter.

**UK Continental shelf**: Recorded across the entire UK continental shelf throughout the year.

**Global:** Found mainly in boreal, temperate waters in the latitudinal bands 30-70°N in the North Atlantic and 30-50°S in the South Atlantic and South Pacific from 1 to >1000 m. Species absent from North Pacific. May penetrate into water up to 24°C.

## ECOLOGY

**Description:** Large spindle-shaped shark, reaching 300 cm, with large teeth, conical head, long gill openings and crescent-shaped caudal fins with strong caudal keel. Migratory, schooling in sexually immature animals and segregated by sex and size in adults[1]. Occurs inshore in summer months in south-west UK waters at least[2]. Life history is characterised by long life-span, late age of maturity and low fecundity. This species is also one of the few warm-blooded shark species.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Ovoviviparous: Aplacental viviparous and oophagous

***Reproductive type***: Gonochoristic

***Biological zone***: Pelagic Zone, meso-pelagic, epi-pelagic, neritic, oceanic

***Salinity***: Full (30-40 psu), one record from brackish waters (5-30 psu)

***Substratum***: Not relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** None known

**Past declines and current threats**: Commercially exploited since the 1800s. Heavy exploitation in the 1940s and 1950s led to fisheries collapse in the North-East Atlantic. Subsequent exploitation in the North-West had high initial landing followed by a similar collapse by 1967[3]. Currently, the major threat is from long-line fisheries for other pelagic sharks, tuna and marlin where porbeagles occur as by-catch. The estimated landings as by-catch is <500 tons in 2007[4,5]

## STATUS AND THREATS

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UKBAP Priority Species

**IUCN Red list:** Vulnerable (A2bd+3d+4bd, version 3.1) (North-East Atlantic sub-population)

**Wildlife and Countryside Act:** Species recommended for Schedule 5 by JNCC

**Sources of threats:** By-catch in fisheries targeting pelagic elasmobranchs, tunas, swordfish and marlin; valued game fish species

**RARITY**

Historically abundant. Populations would probably be described as 'uncommon' Rarely caught now (though occasional opportunistic large catches do occur) and a rare game fish compared to other large sharks.

**DECLINE**

Decline throughout the North Atlantic ocean. No apparent absence from historical range

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate**)

**Comments:** Vulnerable to harvesting and sports fishing, as well as a secondary target species in long-line fisheries in international waters. Accidental by-catch. The large size, late maturation and low fecundity makes this species highly vulnerable to over-exploitation

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** Measures to ensure recovery must focus on reducing by-catch of the species and ensuring international protection due to the pelagic nature of the species. Furthermore, it is imperative to continue supporting of minimal/zero fishery quotas to allow stocks to recover

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when the species abundance has been restored by maintenance of existing populations and removal of pressures causing decline.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management**: Conservation action should focus on reducing bycatch by introducing new technologies and more selective gear to reduce shark by-catch (for example Shark Defence 'Smart Hook') as well as pushing for an EU adoption of a no-fining policy in for all EU vessels and foreign vessels fishing within EU waters. Maintenance of 'Zero Quotas' and reduction in by-catch. Preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK. Cost is part of fisheries regulatory activities but change in gear to be carried by fishermen, with possibility to apply for funding to cover part of cost.

**Translocation**: not relevant in highly migratory pelagic species

**Enforcement**: Through statutory authorities including fisheries regulation. International enforcement is vital due to high mobility and wide distribution of the species

**Research**: Improved understand of species dispersal and movement patterns (satellite tagging study £172,000 per annum, project should run minimum 3 years). Location of nursery and pupping grounds would be beneficial to protect early life stages. Total: £526,000.

**Monitoring**: Continuation of tag-and-release of caught porbeagles and reporting catches by the sports fishing community. Cost of reporting schemes.

**Wider environment**: Reporting of by-catch through international bodies such as ICES and ICCAT. International introduction of species-level reporting of landings.

**SPECIALISTS**

Dr Nicolas G. Pade – Marine Biological Association, UK

Prof. David W. Sims – Marine Biological Association, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-15) | Recovery/Conservation potential (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 2 (Low) | Satellite tagging (£172,000 per annum for three years). Total £516,000 |

**REFERENCES**

[1] Gauld, J.A. (1989) Records of the porbeagles landed in Scotland, with observations on the biology distribution and exploitation of the species. DAFS Scottish Fisheries Research.

[2] Pade, N.G., Queiroz, N., Humphries, N.E., Witt, M.J., Jones, C.S., Noble, L.R., Sims, D.W. (2009) First results from satellite-linked archival tagging of porbeagle shark, *Lamna nasus*: Area fidelity, wider-scale movements and plasticity in diel depth changes. *Journal of Experimental Marine Biology and Ecology* **370**, 64-74.

[3] Campana, S.E., Joyce, W., Marks, L.*, Hurley, P.,* Natanson, L.J., Kohler, N.E.,Jensen, C.F., Mello, J.J., Pratt Jr., H.L., Myklevoll, S., Harley,S. (2008) *The rise and fall (again) of the porbeagle shark population in the Northwest Atlantic. In: Sharks of the Open Ocean: Biology, Fisheries & Conservation* (eds. Camhi MD, Pikitch EK, Babcock EA), pp. 445-461. Blackwell Publishing, Oxford, UK.

[4]ICCAT (2009) Report of the 2009 porbeagle stock assessment s meeting. In: *SCRS/2009/014 – Sharks Stock Assessment*.

[5] OSPAR (2009) Background Document for the Porbeagle shark *Lamna nasus* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00474_porbeagle_shark.pdf. [Accessed 11/01/2011].

# SANDY RAY SANDY SKATE, LEATHER RAY, FAROESE ROKER *LEUCORAJA CIRCULARIS* COUCH, 1838

**Synonyms:**

[No image available]

**Taxonomy:**
**Phylum:** Chordata
**Order:** Rajiformes
**Family:** Rajidae

## DISTRIBUTION

**English waters**: Occasionally found on west coast of England, in the Irish Sea, Bristol Channel and Western Approaches and along the North-East coast in the North Sea

**UK Continental shelf**: Mainly found of the north coast of Scotland and the Shetland Isles but also off western Scotland and Northern Ireland.

**Global:** Eastern Atlantic: Iceland, southern Norway, Skagerrak and Morocco, including western Mediterranean.

Reported distribution includes occasional records in some English waters.

## ECOLOGY

**Description:** Large dorso-ventrally flattened batoid, reaching 120 cm length, with a short rostrum (tip slightly pronounced) and the tail only slightly longer than body. Dorsal fins close together with no spines between. Upper surface reddish-brown to dark brown with 4-6 creamy spots on each wing, underside white. Generally has row of 8 thorns around inner margin of the eye and a triangle of neuchal thorns behind the head.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral, from 70m - 275m. Off-shore shelf waters and upper slope. Recorded down to 676m, but most common around 100m

***Salinity***: Full (30-40 psu)

***Substratum***: Muddy gravel, coarse clean sand, fine clean sand, sandy mud, muddy sand, mud, mixed

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats**: French landings of the species have declined from 500 tonnes per year to about 300 tonnes. CEFAS trawls have not recorded the species in the North Sea and Celtic Sea since 1996 and 1997 respectively. Still occurs occasionally in the Scottish FRS survey. The reduction in catch has led to the belief that the species has declined. However, it is possible that the species has shifted to deeper waters as majority of individuals taken in the FRS trawls are in 180-500 m depth. This has led to uncertainty of the magnitude of decline[1]

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** BAP Priority Species

**IUCN Red list:** Vulnerable (categories A2bcd+3bcd+4bcd, version 3.1)

**Sources of threats:** This species is a by-catch in mixed trawl fisheries operating in the outer parts and edge of the continental shelf. It may also be taken as a bycatch in gillnet fisheries targeting anglerfish and long-line fisheries targeting hake, though information on the catches in these fisheries are poor. The potential threat of deepwater fisheries within the deeper part of the species range is also a possible cause for concern. The relatively large body-size (120 cm) would also indicate that this species is vulnerable to over-fishing. Due to its offshore habitat, it is of no importance to recreational fisheries.

**RARITY**

Widespread but in deep water.

**DECLINE**

The species is thought to have declined and its distribution contracted, but this is not certain (see above).

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)

**Comments:** Intensive trawling across its range may have lead to declines in populations particularly on the continental shelf (at the edge of its range). As with most large skate, low fecundity means they are vulnerable to intensive fishing. Infrequently taken in inner continental shelf waters.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 8 (Low)

**Comments:** Score is low due to the fact that the techniques required to manage this species are unknown as it is unsure how much of observed decline is due to range shift and how much is due to fisheries. Major threat to this species is from by-catch. Experimental cod ends have been shown to significantly reduce the by-catch of batoids and increase the survival of those caught[2].

**RECOVERY/CONSERVATION GOAL**

Recovery/conservation will have been achieved when by-catch has been reduced to a level to be determined by fisheries scientists as meaningful in that the population will, despite by catch, continue to increase.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management:** Introduction of species specific landing to allow for adequate monitoring of landings and abundances.

**Translocation**: Unknown. Never tested but impractical due to difficulty, cost and time scale of captive breeding species. Furthermore, species is mobile and has potential to decolonise given enough numbers.

**Enforcement**: Through statutory authorities including fisheries regulation and with quay-side inspection and fisheries observers

**Research**: Reporting of landings would provide useful insight into the dynamics of the species as well as adding to the understanding of skate/ray fisheries and trends. Tag-and-release studies would be

required to determine the range of individuals (£30,000 per annum, project should run indefinitely but costed here for three years) and electronic tagging for determining habitat utilisation (£172,000 per annum per annum, project should run minimum 3 years). Molecular genetic study would be necessary to determine connectivity across range (£98,000).

**Monitoring**: Species specific landings would allow for monitoring declines or recoveries that may occur.

**Wider environment**: Species occupies deeper waters and there will require international management as much of the range will possibly be found in international water.

**SPECIALISTS**

Dr Jim Ellis – CEFAS, Lowestoft, UK

**FINAL CONCLUSION**

| **Degree of threat (range 0-15):** 6 (Moderate) | **Recovery/Conservation potential (range 2-36)** 8 (Low) | **Cost** |
|---|---|---|
| | | £30,000 mark-recapture p.a. (Total £90,000 over three years)<br>£172,000 electronic tagging p.a. (Total £516,000 over three years)<br>£98,000 population structure study (will require tissue samples from across range)<br>Total: £694,000 |

**REFERENCES**

[1] Ungaro, N., Serena, F., Ellis, J., Dulvy, N., Tinti, F., Bertozzi, M., Mancusi, C. & Notarbartolo di Sciara, G. (2008) *Leucoraja circularis*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 14 December 2010.

[2] Enever, R., Revill, A.S., Caslake, R., Grant, R. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, **102**, 9-15

# COMMON SKATE SPECIES COMPLEX (FLAPPER SKATE, BLUE SKATE, GREY SKATE) *DIPTURUS BATIS* LINNAEUS, 1758

**Synonyms:**

**Taxonomy:**
**Phylum:** Chordata
**Order:** Rajiformes
**Family:** Rajidae

(Image:Davy Holt)

## DISTRIBUTION

**English waters**: Throughout English waters from shallow coastal waters to at least 600 m.

**UK Continental shelf**: Historically found throughout UK continental shelf, all year round. Now only regularly observed off northern, western, and north-western Scotland, Shetland, Orkney, Celtic Sea and along the edge of the continental shelf (>150 m depth)

**Global:** Continental shelf of the North-east Atlantic, from Madeira and the coast of northern Morocco in the south, to Iceland and northern Norway in the north, including the Mediterranean Sea, Western Baltic and North Sea.

## ECOLOGY

**Description:** Largest European batoid, growing to 285 cm, with long and pointy rostrum and a broad rhombic disc shape with acute outer corners. Little is known about the social interaction in this species, but aggregations have been observed. Long-distance movements appear to be rare with some degree of site-fidelity[1]. Some long distance movements may be seasonal. Life history is characterised by long life-span, late age of maturity and low fecundity. Highly active pursuit predator, moving throughout the water column. Larger, older individuals are significantly more active than younger ones making them more susceptible to fisheries.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral and throughout the water column

***Salinity***: Full (30-40 psu)

***Substratum***: Muddy gravel, Coarse clean sand, Fine clean sand, Sandy mud, Muddy sand, Mud, Mixed

***Water flow rate***: All

***Wave exposure***: Very Exposed, Exposed, Moderately Exposed, Sheltered, Very Sheltered

**Long-term natural fluctuations:** Not known

**Past declines and current threats:** *D. batis* has undergone dramatic declines in abundance over the last 100 years. Landings at Concarneau, France, decreased by 92% during the 1970s, whilst only 6 common skate were captured in UK government surveys of the Irish Sea between 1988 and 1997[2]. Common skate is now thought to be locally extinct in the Irish Sea[3], central and southern North Sea, West Baltic and western Mediterranean[2]. However, local 'remnant' populations of common skate have been found off the coast of Norway, around the Shetland Islands, off the west coast of Scotland and to the south and southwest of Ireland[2]. Current threats are from commercial fisheries where it occurs as a by-catch, its large size rendering it highly susceptible to all trawl gear and gill-nets. Threats are currently aggravated by the cryptic speciation of the *Dipturus* genus and it appears that *D. batis* in fact represent two separate species[4,5,6].

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** Biodiversity Action Plan (BAP) Priority Species

**IUCN Red list:** Critically Endangered (category A2bcd+4bcd, version 3.1)

**OSPAR Convention:** Annex V, threatened/declining species within all OSPAR regions.

**Wildlife and Countryside Act:** Species recommended for Schedule 5 by JNCC

**Sources of threats:** By-catch in trawl and gill net fisheries for high-value teleost and crustacean species. Large size at hatching means that juveniles are recruited very early to the fishery

## RARITY

Recorded in 1 to 8 of the 10 km squares within the 3nm limit of British seas (Rare). Historically abundant. Rarely caught now in commercial fishery but refuge populations are known where they are caught by sports anglers

## DECLINE

Declining in all parts of the species range. 'Was once an abundant constituent of the demersal fish community of north-western Europe. It formerly occupied the shelf and slope areas of the Mediterranean excluding North Africa west of Morocco but now appears to be virtually absent from much of this range.'

## DEGREE OF THREAT

**Score (range 0-16):** 12 (High)

**Comments:** Vulnerable as by-catch in trawl and gill-net fisheries from birth and a sought-after rod-and-line game fish. Currently sports anglers practice catch and release. The large size, late maturation and low fecundity of the species makes it highly vulnerable to over-exploitation

## RECOVERY/CONSERVATION POTENTIAL

**Score (range 2-36):** 2 (Low)

**Comments:** Score is low because the species is now widely dispersed and numbers are very low so that recovery potential is poor. Currently few young survive to reproduction, thus conservation should make protection of neonates and juveniles a priority.

**Recovery/conservation goal**: Recovery will have been achieved when the species abundance has been restored by maintenance of existing populations and removal of pressures causing decline. Efforts should be made to restore the species to its historical range.

## MANAGEMENT REQUIREMENTS AND BUDGET

**Site management:** Management must focus on protecting known species refuge populations, particularly the egg-laying grounds and adjacent areas, by means of protected areas and no take zones. Maintenance of "Zero Quotas" and reduction in by-catch, as well as a strict policy of returning caught animals in as good a state as possible. The species is considered very sturdy and is likely to survive if returned. Fishers should be encouraged to develop techniques and equipment to facilitate the rapid and safe release of by-caught individuals. As the main threat to elasmobranchs lies with commercial fisheries

all efforts must be made to reduce by catch. Experimental cod ends have been shown to significantly reduce the by-catch of batoids and increase the survival of those caught[7]. Furthermore, preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK (cost to be carried by fishermen, with possibility to apply for funding to cover part of cost)

**Translocation**: Untested in elasmobranchs, but may represent an option as although the species shows high activity patterns, it is thought to occupy relatively small home ranges

**Enforcement**: Through statutory authorities including fisheries regulation and maintenance of current measures in place

**Research**: Research must focus on establishing movement and seasonality patterns of the species complex (satellite tagging £172,000 per annum, project should run minimum 3 years; Data Storage Tagging £112,000 per annum, project should run minimum 3 years). Furthermore, to ensure proper management for each species identified in the complex it is imperative to determine abundance and geographical differences in distribution and habitat of the two species (Population genetic study £98,000).

**Monitoring**: Reporting of catches and initiation of tag-and-release programmes from known refuge populations (£30,000 per annum, project should run indefinitely but costed here for three years).

**Wider environment**: Reporting of individuals caught from areas where species was previously absent but has (re)colonised. The two species comprising the *Dipturus* species complex are physiologically distinguishable, thus a campaign needs to be launched to educate fishermen, fisheries observer and managers about these differences to ensure adequate reporting of both species.

## SPECIALISTS

Dr Victoria J. Wearmouth - Marine Biological Association, UK

Dr Andrew M. Griffiths - Marine Biological Association, UK

Dr Samuel P. Iglesias - Station de Biologie Marine de Concarneau, France

## FINAL CONCLUSION

| Degree of threat (range 0-15): | Recovery/Conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 12 (High) | 2 (Low) | £172,000 p.a. satellite tagging (Total £516,000 over three years)<br>£112,000 p.a. data storage tagging p.a. (Total £336,000 over three years)<br>£30,000 p.a. catch-release tagging. Total £90,000 over three years)<br>£98,000 population genetics<br>Total: £1,040,000 |

## REFERENCES

[1] Wearmouth, V.J., Sims, D.W. (2009) Movement and behaviour patterns of the endangered common skate *Dipturus batis* revealed by electronic tagging. *Journal of Experimental Marine Biology and Ecology* **380**, 77-87

[2] Dulvy, N.K., Reynolds, J.D., (2002) Predicting extinction vulnerability in skates.*Conservation Biology* 16, 440–450

[3] Brander, K., (1981) Disappearance of common skate Raia batis from Irish Sea. *Nature* 290, 48–49

[4] Griffith, A.M., Sims, D.W., Cotterell, S.P. Nagar, A.E., Ellis, J., R., Lynghammar, A., McHugh, M., Neat, F.C.,Pade, N.C., Queiroz, N., Serra-Pereira, B., Rapp, T., Wearmouth, V., Genner, M.J. (2009) Molecular markers reveal spatially segregated cryptic species in a critically endangered fish, the

common skate (Dipturus batis). *Proceedings of the Royal Society - Biological Sciences (Series B)*, doi: 10.1098/rspb.2009.2111.

[5]Iglesias, S.P., Toulhoat, L. and Sellos, D.Y. (2010) Taxonomic confusion and market mislabelling of threatened skates: important consequences for their conservation status. *Aquatic Conservation: Marine and Freshwater Ecosystems* 20, 319-333

[6] OSPAR (2009) Background Document for the Common skate Dipturus batis [On-line] OSPAR Commission Biodiversity Series. Available from http://www.ospar.org/documents/dbase/publications/P00477_common_skate.pdf. [Accessed 11/01/2011].

7 Enever, R., Revill, A.S., Caslake, R., Grant, R. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, 102, 9-15

# WHITE SKATE (BOTTLENOSE SKATE, SPEARNOSE SKATE, WHITE SKATE) *ROSTRORAJA ALBA* LACEPÈDE, 1803

**Synonyms:**

[No image available]

**Taxonomy:**

**Phylum**: chordata

**Order:** Rajiformes

**Family:** Rajidae

## DISTRIBUTION

**English waters**: Formerly distributed in southern coastal and English continental shelf waters, including the English Channel and Celtic Sea.

**UK Continental shelf**: Occurs mainly in southern British waters, in the Western Approaches, Celtic Sea and Irish Sea.

**Global:** The overall geographical range of *Rostroraja alba* covers the Eastern Atlantic coasts from the southern British Isles south to South Africa, including the Mediterranean Sea, and extending into the southwestern parts of Indian Ocean.

## ECOLOGY

**Description:** Large dorso-ventrally flattened batoid, reaching 230 cm length, with a broad-based, abruptly narrow-tipped rostrum covered with small, sharp thorns. Thorns absent from nape and back, but three rows of large thorns on tail. Larger immature and adult individuals grey with numerous small white spots above, underside white with no black pores. Generally a poorly understood species with quite limited knowledge regarding its biology and ecology.

***Feeding method***: Predator, scavenger

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral and throughout the water column

***Salinity***: Full (30-40 psu)

***Substratum***: Muddy gravel, Coarse clean sand, Fine clean sand, Sandy mud, Muddy sand, Mud, Mixed

***Water flow rate***: All

***Wave exposure***: Very Exposed, Exposed, Moderately Exposed, Sheltered, Very Sheltered

**Long-term natural fluctuations:** Unknown

**Past declines and current threats**: Based on anecdotal and trawl survey data, this species has undergone dramatic declines in abundance and substantial reductions in geographic range within the Mediterranean and the Northeast Atlantic. This species is likely to be caught as by-catch to multispecies trawl fisheries which operate on much of the continental shelf and slope, coinciding with this species habitat.[1]

**STATUS AND THREATS**

**Directives / convention / statutes (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** Biodiversity Action Plan (BAP, 2007) Priority Species

**IUCN Red list:** Endangered (category A2cd+4cd, version 3.1) (Critically Endangered in north-east Atlantic).

**Wildlife and Countryside Act:** Species recommended for Schedule 5 by JNCC

**Sources of threats:** Commercial trawl fisheries for high-value species is the major threat as this species is taken as valuable by-catch. Due to its large size, already from hatching, all life history stages of the species are recruited to the fishery[1].

**RARITY**

Widely recorded but now difficult to assess. Possibly Nationally Scarce. Southern Britain represents the northern limit of the species' range.

**DECLINE**

Decline is throughout its European range and complete absence from historical fishing grounds.

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments:** Still occurs as by-catch in demersal fisheries with noted severe local declines. Maybe be under-reported as it is frequently confused with shagreen ray *Leucoraja fullonica* and sandy ray *L. circularis*[2]. The large size, late maturation and low fecundity makes this species highly vulnerable to over-exploitation.

**RECOVERY/CONSERVATION POTENTIAL AND BUDGET**

**Score (range 2-36): 4** (Low)

**Comments:** Conservation and management must focus on protecting known species refuge population, particularly the egg-laying grounds and adjacent areas, by means of protected areas and no take zones. Currently few young survive to reproduction, thus conservation should make protection of neonates and juveniles a priority. The species is protected in ICES areas VI, VIIa-c, VIIe-k, VIII and IX, meaning that it cannot be targeted or retained if taken as by-catch.

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when measures that protect the species are showing success through increased extent of distribution and larger populations. (Anything more ambitious is likely to be unsuccessful as long as the species is being caught).

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management**: Maintenance of current protection level and reduction in by-catch, as well as a strict policy of returning caught animals in as good a state as possible. Species is considered very sturdy and is likely to survive if returned. Fishers should be encouraged to develop techniques and equipment to facilitate the rapid and safe release of by-caught individuals. As the main threat to elasmobranchs lies with commercial fisheries all efforts must be made to reduce by catch. Experimental cod ends have been shown to significantly reduce the by-catch of batoids and increase the survival of those caught[3]. Also, preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK. Cost absorbed within normal fisheries management activities and carried by fishermen.

**Translocation**: Untested in elasmobranchs, but seems an unrealistic option due to the long generation times and sizes.

**Enforcement**: Through statutory authorities including fisheries regulation and maintenance of current

measures in place, as well as quay side inspection and fisheries observers.

**Research**: Research should focus on increasing our understanding of the life history characteristics of this species although this is difficult to do without destructive sampling. Furthermore, basic knowledge of their movement and migration patterns, home ranges and level of site fidelity, as well as ontogenetic differences, are needed to determine which conservation measures will be most effective and to ascertain the effectiveness of MPAs to protect this species (satellite tagging £172,000 per annum, project should run minimum 3 years). Furthermore, it needs to be established if several isolated populations are present in the North-East Atlantic or if there is one panmictic population. Population genetic analysis should be carried out when sufficient samples have been collected from across the North-East Atlantic (£98,000).

**Monitoring**: Reporting of catches and initiation of tag-and-release programmes from known refuge populations.

**Wider environment**: Reporting of individuals caught from areas where species was previously absent but has (re)colonised. It should also be ensured that fishers, fisheries observers and managers are competent in the identification of similar batoid species to avoid misidentification and illegal landing.

**SPECIALISTS**

Dr Nick K. Dulvy – Simon Fraser University, Canada

Dr Leonard J.V. Compagno - Iziko Museums Cape Town

Dr Samuel P. Iglesias - Station de Biologie Marine de Concarneau, France

**FINAL CONCLUSION**

| **Degree of threatScore (range 0-16):** | **Recovery/conservation potential (range 2-36)** | **Cost (per annum)** |
|---|---|---|
| 10 (Moderate) | 4 (Low) | Satellite tagging (£172,000 p.a. for each of three years = £516,000;<br>Population genetics £98,000<br>Total = £614,000 |

REFERENCES

[1] OSPAR (2009) Background Document for the White skate *Rostroraja alba* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00476_white_skate.pdf. [Accessed 11/01/2011].

[2] Dulvy, N.K., Pasolini, P., Notarbartolo di Sciara, G. Serena, F., Tinti, F., Ungaro, N., Mancusi, C. & Ellis, J.E. 2006. *Rostroraja alba*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 23 November 2010

[3] Enever, R Revill, A.S., Caslakec, R. Grant, A. (2010) Discard mitigation increases skate survival in the Bristol Channel. *Fisheries Research*, **102**, 9-15.

# SPINY DOGFISH (SPURDOG, ROCK SALMON, PIKED DOGFISH) *SQUALUS ACANTHIAS* LINNAEUS, 1758

**Synonyms:**

[No image available]

**Taxonomy:**
**Phylum:** Chordata
**Order:** Squaliformes
**Family:** Squalidae

## DISTRIBUTION

**English waters**: Throughout English waters.

**UK Continental shelf**: Across the UK continental shelf from 0-600 m depth.

**Global:** Almost world-wide, although absent from tropics and near poles.

## ECOLOGY

**Description:** Small dogfish species reaching up to 200 cm in length. Slender body and narrow head with large round eyes and a large conspicuous spiracle diagonally above the eye. It has a grey to brown dorsal colouring and conspicuous white spots covering the entire body. Dorsal fins have spines, no anal fin present. It has two dorsal fins each with large spines. Species segregated by sex and size into schools.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Ovoviviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Pelagic Zone, mesopelagic, epipelagic, neritic, oceanic

***Salinity***: Full (30-40 psu)

***Substratum***: Not Relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats:** Fisheries stock assessments report a decline in total biomass of >95% from baseline in the Northeast Atlantic[1]. By-catch mortality in inshore fisheries is the most significant threat to *S. acanthias*, which is taken by trawls, static (gill or tangle) nets, and hook and line (commercial and sports). This species is very vulnerable to capture in large numbers because of its aggregating nature.[2]

## STATUS AND THREATS

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UKBAP Priority Species

**IUCN Red list:** Critically Endangered within North East Atlantic. Overall population: Vulnerable (categories A2bd+3bd+4bd, version 3.1)

**OSPAR Convention**: Annex V, threatened/declining species within all OSPAR regions.

**Sources of threats:** Major threat is by-catch mortality. This is one of the more vulnerable species of shark to over-exploitation by fisheries because of its late maturity, low reproductive capacity, longevity, long generation time (25–40 years) and hence a very low intrinsic rate of population increase (2–7% per annum).

**RARITY**

Not rare (OSPAR)

**DECLINE**

IUCN lists this species as decreasing and has been observed to be in steep decline throughout the North-East Atlantic.

**DEGREE OF THREAT**

**Score (range 0-16):** 10 (Moderate)

**Comments** Although no fisheries exist the species still experiences high by-catch mortality. The large size, late maturation and low fecundity makes this species highly vulnerable to over-exploitation.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 3 (Low)

**Comments:** The species has a tendency to school by sex and size which makes by-catches significant when they do occur. Additionally, surveys suggest that large mature females are hugely under-represented in the population as they have been heavily targeted by fisheries. This makes recovery for the species very slow.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved when there is a sustained and continuing increase in numbers in North-East Atlantic population by 2020.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management:** Following of ICES advice of “no targeted fishery should be allowed”. Retention of by-catch is allowed, however with a Maximum Retention Size to spare sexually mature individuals. However, studies suggest post-release survival in the species is low and by-catch should therefore be reduced as far as possible. Fishers should be encouraged to develop techniques and equipment to facilitate the rapid and safe release of by-caught individuals. Recovery must focus on increasing numbers and turn around the decreasing population trend. Conservation should aim at reducing by-catch to a maximum and encourage the introduction of shark limiting gear, such as Smart Hooks (manufactured by Shark Defence) as well as pushing for an EU adoption of a no-fining policy in for all EU vessels and foreign vessels fishing within EU waters. As the main threat to elasmobranchs lies with commercial fisheries all efforts must be made to reduce by catch. Cost absorbed within normal fisheries management activities.

**Translocation:** Not relevant in highly migratory pelagic species.

**Enforcement:** Through statutory authorities including fisheries regulation. Cost absorbed within normal fisheries management activities.

**Research**: There is a need for increasing current knowledge regarding discard fisheries mortality (through discard and landing), natural mortality rates (tag and release study £30,000 per annum, project should run indefinitely but costed here for three years). In order to develop accurate fisheries management models information is required on growth parameters as well as pupping and nursery grounds. A population genetic study showed connectivity across the north Atlantic, however satellite tagging is required to determine the extent and frequency of such interactions as well as the range of individual animals (Satellite tagging £172,000 per annum, project should run minimum 3 years).

**Monitoring:** Initiation of tag-and-release studies in conjunction with local sports fishermen as well as monitoring of fisheries landings. Cost included in Research above.

**Wider environment:** Previous research has shown that *S. acanthias* is likely to cross international boundaries in their movements and thus require international management. Landings should be reported throughout the EU. Cost absorbed within normal fisheries management activities.

**SPECIALISTS**

Dr Francis Neat – Fisheries Research Services, Aberdeen, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/Conservation (range 2-36) | Cost |
|---|---|---|
| 10 (Moderate) | 3 (Low) | Tag and release study £30,000 p.a. for each of three years initially = £90,000.<br>Satellite tagging £172,000 per annum for each of three years = £516,000.<br>Total = £606,000. |

**REFERENCES**

[1] Fordham, S., Fowler, S.L., Coelho, R., Goldman, K.J. & Francis, M. (2006) *Squalus acanthias (Northeast Atlantic subpopulation)*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 08 December 2010.

[2] OSPAR (2009) Background Document for the Spurdog or Spiny dogfish *Squalus acanthias* [On-line] OSPAR Commission Biodiversity Series. Available from: http://www.ospar.org/documents/dbase/publications/P00470_spurdog.pdf. [Accessed 11/01/2011].

# COMMON MINKE WHALE *BALAENOPTERA ACUTOROSTRATA* LACÉPÈDE,1804

Image credit: Sanna Kuningas

**Synonyms:** Lesser rorqual

**Taxonomy:**

**Phylum:** Chordata

**Order:** Cetacea

**Family:** Delphinidae

## DISTRIBUTION

**English waters**: Primarily northern and central North Sea, from the Scottish border as far south as the Yorkshire coast. Much less common in the southern North Sea. Sightings in the English Channel are concentrated almost exclusively to the far west of the Cornish coast[4].

**UK Continental shelf**: Minke whales are distributed widely throughout the Atlantic seaboard of Britain. They occur throughout Scottish coastal waters, with highest concentrations on the west coast, around the Hebrides and in the Minches. Some sightings also occur along the coast of Northern Ireland[4].

**Global:** Wide distribution from the tropics to the ice edges. Although seen offshore, most often found in coastal and inshore areas[1].

## ECOLOGY

**Description:** Minke whales are the smallest of the rorqual or baleen whales in UK waters, with adult males reaching lengths of around 8m and females 8.8m. They have a sleek body and distinctive, V-shaped head. The dorsal fin is relatively tall and curved – located about two thirds of the way along the back. The flippers are narrow with pointed tips and a distinctive white patch, clearly visible through the water. The minke whale has a dark grey back, white underside, and streaks of lighter grey on each side. There are 50-70 throat pleats, and 231 – 285 pairs of baleen plates. When surfacing, the dorsal fin and blowhole usually appear simultaneously. Unlike most of the other rorqual species, the blow is easily dissipated and is not often seen. Minke whales don't tend to fluke when diving, but are known to breach and carry out other aerial behaviours[1].

***Feeding method***: predator

***Mobility***: swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: gonochoristic

***Biological zone***: Oceanic

***Salinity***: Full

***Substratum***: Not applicable

***Wave exposure***: Not applicable

***Water flow rate***: Not applicable

**Long-term natural fluctuations:** Not known

**Past declines and current threats:**

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority species

**Bonn convention:** Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex IV

**IUCN Red list**: Least Concern (Version 3.1)

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats[1,2,3,5]:**

*Climate change:* minke whales are a very widely distributed species and not constrained to any particular water temperatures. It is likely that they could be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* like all cetaceans, minke whales are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage.. Once the construction phase is completed, coastal defence is unlikely to pose a threat to minke whales.

*Development:* like all cetaceans, minke whales are sensitive to noise disturbance and vessel collisions. . Effects may include habitat displacement, masking of vocalisations, and physiological damage..

*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect minke whales. Increased contaminants can lead to increased bioaccumulation in predators such as minke whales. Dredging is also a major source of underwater noise, which is likely to have a direct effect on minke whales.

*Energy generation:* like all cetaceans, minke whales are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage. Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: entanglements in fishing nets and ropes (for example creel lines) may be a threat. Overfishing for important prey species may be a threat. Globally, dedicated hunts also occur.

*Noise*: seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational vessels*: harassment from dedicated whale watch vessels and private boats may occur.

*Waste:* pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like minke whales.

**RARITY**

Minke whales are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but minke whales would most likely be described as ‘scarce’ in UK waters.

**DECLINE**

Minke whales have been exploited in the North Atlantic, mainly since the 1940s, and recorded catches total about 140,000. Catches were phased out from 1984 to 1987. Commercial whaling resumed in 1993 at a lower level and continues to the present.

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)

**Comments:** There are a paucity of data concerning many aspects of marine mammal biology, even for those species which are relatively well studied. As such, a moderate degree of threat is assigned to take into account many of the uncertainties which still exist.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 8 (Low)

**Comments:** There are insufficient data available to meaningfully assess this species for decline in UK or English waters, so this score is indicative of the problems of assessing a species for a decline which may / may not have occurred, if it has occurred, what may have caused it, and how to combat these causes once they have been established.

**RECOVERY/CONSERVATION GOAL**

Raise levels of knowledge of this species to a suitable level to allow the creation of meaningful management goals within 10-15 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management**: With further knowledge, there is the potential to designate sites based on new knowledge on distribution and abundance. (Applicable to all cetacean species concurrently) – see Research.

**Translocation**: Not relevant in highly mobile pelagic species.

**Enforcement**: Maintain current enforcement of by-catch regulations (applicable to all cetacean species concurrently). Through statutory authorities including fisheries regulation and maintenance of current measures in place.

**Research**: Improve cost-effective survey techniques for estimating abundance and distribution of cetaceans (includes visual, aerial, passive acoustic techniques) (applicable to all cetacean species concurrently). £500,000 p.a. initially for three years and then reappraise for all cetacean species. Concurrent UK wide survey of cetaceans: £4,000,000.

Improve knowledge of life history characteristics of the species in order to better understand potential causes of possible future declines and how best this species may recover should such declines occur. £500,000 over three years initially then reappraise. It may be possible to implement this for several cetacean species together, but may require to be done for this species in isolation.

One of the main threats to cetaceans is the effects of anthropogenic noise, both behaviourally and physiologically. A research program to investigate the effects of this would be invaluable. . £500,000 over three years initially then reappraise (potentially applicable to all cetacean species concurrently).

**Monitoring**: Increase frequency of cetacean surveys for assessing abundance and spatial and temporal distribution of cetaceans within UK waters (applicable to all cetacean species concurrently). This would also improve knowledge required for 'Population management'. Cost dependant on frequency of survey.

Establish a centralised repository for data collected during baseline surveys for offshore development to allow a more complete overview of animal distribution (applicable to all cetacean species concurrently). Development/maintenance of centralized database (applicable to all cetacean species concurrently). All initially for three years.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping. Monitor levels of potentially toxic pollutants – here, marine mammal species may act as ecosystem indicator - £250,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a.. species (applicable to all marine mammal species concurrently).

**SPECIALISTS**

Prof. Phil Hammond – Sea Mammal Research Unit

Dr Simon Northridge – Sea Mammal Research Unit

**FINAL CONCLUSION**

| Threat of decline (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 7 (moderate) | 8 (Low) | Improving survey techniques: £500,000 p.a.<br>Concurrent UK wide survey of cetaceans: £4,000,000<br>Research into life history: |

£500,000 over 3 years

Research into effects of anthropogenic noise: £500,000 over 3 years.

Centralised database and admin: £25,000 p.a.

Noise monitoring: £250,000 p.a.

Pollution Monitoring: £250,000 p.a.

**Total** for three years research into improving survey techniques, life history characteristics and reponses to anthropogenic noise; monitoring pollution and noise and one off survey of UK waters: £6,025,000.

**REFERENCES**

[1] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press

[2] Joint Nature Conservation Committee. (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

[3] Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urbán, J. & Zerbini, A.N. (2008) *Balaenoptera acutorostrata*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 January 2011.

[4] Reid, J.B., Evans, P.G.H. & Northridge, S.P., (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee.

[5] Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press.

*Distribution/abundance reference:*

Burt, M.L., Borchers, D.L.. & Samarra, F. (2008) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L. & Samarra, F. (2008) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245

# SHORT-BEAKED COMMON DOLPHIN *DELPHINUS DELPHIS* LINNAEUS, 1758

**Synonyms:** None
**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

## DISTRIBUTION

**English waters**: Primarily seen in continental shelf waters of the Western Approaches[6]

**UK Continental shelf**: Primarily west coast of Britain. Sightings also occur on the west of Scotland, around the Hebrides[6].

**Global:** Warm-temperate and tropical waters. It occurs in both nearshore and oceanic waters. Appears to have a strong preference for upwelling-modified waters[3].

## ECOLOGY

**Description:** Short-beaked common dolphins can reach 2.7m in length and weigh up to 200kg. They have a well defined beak with a crease separating it from the melon. This species has a tall slightly falcate dorsal fin. Some older males develop a ventral keel on the tailstock. Common dolphins have a very distinctive colouration with a dark grey back, white belly and a figure of eight or hourglass pattern on the flanks with a pale yellow patch on the anterior end and a lighter grey area to the posterior. These dolphins have 41-57 pairs of sharp pointed teeth[3].

***Feeding method***: predator

***Development mechanism***: Viviparous (Parental Care)

***Biological zone***: Oceanic

***Substratum***: Not applicable

***Water flow rate***: Not applicable

***Mobility***: swimmer

***Reproductive type***: gonochoristic

***Salinity***: Full

***Wave exposure***: Not applicable

**Long-term natural fluctuations:** Not known

**Past declines and current threats:** Not known

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**IUCN Red list**: Least Concern (Version 3.1)

**Bern convention**: Listed

**Biodiversity Action Plan:** UK BAP Priority Species

**Bonn convention:** Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex IV

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats[2,3,4,7]:**

*Aquaculture:* the extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* increasing sea surface temperature (SST) may result in changes in distribution of this species; an increase in the abundance (sighting and stranding records) over time of common dolphins off the northwest Scottish coast (period examined 1948–2003) was attributed to an increase in the SST in the region. They could be affected indirectly by climate change if the distribution or abundance of important prey species is affected[5]. *Coastal defence:* like all cetaceans, common dolphins are sensitive to noise disturbance and vessel collisions, which may result from construction Effects may include habitat displacement, masking of vocalisations, and physiological damage.*Development:* like all cetaceans, common dolphins are sensitive to noise disturbance and vessel collisions Effects may include habitat displacement, masking of vocalisations, and physiological damage.*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect common dolphins. Increased contaminants can lead to increased bioaccumulation in top predators such as common dolphins. Dredging is also a major source of underwater noise, which is likely to have a direct effect on these dolphins.

*Energy generation:* like all cetaceans, common dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage. Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: entanglements in fishing nets may be a threat as is overfishing of prey species.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational vessels*: Harassment from dedicated whale watch vessels and private boats may also occur.

*Waste:* pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like common dolphins.

**RARITY**

Short-beaked common dolphins are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as ‘rare’ in inshore waters and ‘uncommon’ offshore.

**DECLINE**

There are insufficient data available to meaningfully assess this species for decline in UK or English waters. The sub-population in the Mediterranean has declined by an inferred 50% in the last 30 - 45 years[1].

**DEGREE OF THREAT**

**Score (range 0-16):** 7 (Moderate)

**Comments:** There are a paucity of data concerning many aspects of marine mammal biology, even for those species which are relatively well studied. As such, a moderate degree of threat is assigned to take into account many of the uncertainties which still exist.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 6 (Low)

**Comments:** There are insufficient data available to meaningfully assess this species for decline in UK or English waters, so this score is indicative of the problems of assessing a species for a decline which may / may not have occurred, if it has occurred, what may have caused it, and how to combat these causes once they have been established

**RECOVERY/CONSERVATION GOAL**

Raise levels of knowledge including assessing trends in both population numbers and distribution of this species to a suitable level to inform meaningful management goals within10 – 15 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management**: With further knowledge, there is the potential to designate sites based on new knowledge on distribution and abundance. (Applicable to all cetacean species concurrently) – see Research.

**Translocation**: Not relevant in highly migratory mobile pelagic species.

**Enforcement**: Maintain current enforcement of by-catch regulations (applicable to all cetacean species concurrently). Through statutory authorities including fisheries regulation and maintenance of current measures in place.

**Research**: Improve cost-effective survey techniques for estimating abundance and distribution of cetaceans (includes visual, aerial, passive acoustic techniques) (applicable to all cetacean species concurrently). £500,000 p.a. initially for three years and then reappraise for all cetacean species. Concurrent UK wide survey of cetaceans: £4,000,000. Improve knowledge of life history characteristics of the species in order to better understand potential causes of possible future declines and how best this species may recover should such declines occur. £500,000 over three years initially then reappraise. It may be possible to implement this for several cetacean species together, but may require to be done for this species in isolation.

One of the main threats to cetaceans is the effects of anthropogenic noise, both behaviourally and physiologically. A research program to investigate the effects of this would be invaluable. . £500,000 over three years initially then reappraise (potentially applicable to all cetacean species concurrently).

**Monitoring**: Increase frequency of cetacean surveys for assessing abundance and spatial and temporal distribution of cetaceans within UK waters (applicable to all cetacean species concurrently). This would also improve knowledge required for “Site management”. Cost dependant on frequency of survey

Establish a centralised repository for data collected during baseline surveys for offshore development to allow a more complete overview of animal distribution (applicable to all cetacean species concurrently). Development/maintenance of centralized database (applicable to all cetacean species concurrently) £25,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a. All initially for three years.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping. Monitor levels of potentially toxic pollutants – here, marine mammal species may act as ecosystem indicator species - £250,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a.. species (applicable to all marine mammal species concurrently).

**SPECIALISTS**

Prof. Phil Hammond – Sea Mammal Research Unit

Dr Simon Northridge – Sea Mammal Research Unit

**FINAL CONCLUSION**

| Threat of decline (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 7 (Moderate) | 6 (Low) | Improving survey techniques: £500,000 p.a. |

Concurrent UK wide survey of cetaceans: £4,000,000

Research into life history: £500,000 over 3 years

Research into effects of anthropogenic noise: £500,000 over 3 years.

Centralised database and admin: £25,000 p.a.

Noise monitoring: £250,000 p.a.

Pollution Monitoring: £250,000 p.a.

**Total** for three years research into improving survey techniques, life history characteristics and reponses to anthropogenic noise; monitoring pollution and noise and one off survey of UK waters: £6,025,000.

**REFERENCES**

[1] Bearzi, G. (2003) *Delphinus delphis (Mediterranean subpopulation)*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 January 2011

[2] Hammond, P.S., Bearzi, G., Bjørge, A., Forney, K., Karczmarski, L., Kasuya, T., Perrin, W.F., Scott, M.D., Wang, J.Y., Wells, R.S. & Wilson, B. (2008) *Lagenorhynchus albirostris*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 6 January 2011.

[3] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press

[4] Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

[5] MacLeod, C. D, Bannon, S.M, Pierce, G.J, Schweder, C, Learmonth, J.A, Herman, J.S, & Reid, R.J. (2005) Climate change and the cetacean community of north-west Scotland. *Biological Conservation*, **124**, 477- 483

[6] Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee

[7] Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press.

*Distribution/abundance reference:*

Burt, M.L., Borchers, D.L. & Samarra, F. (2008) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L. & Samarra, F. (2008) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245

# WHITE-BEAKED DOLPHIN *LAGENORHYNCHUS ALBIROSTRIS* GRAY, 1846

(Image: Volker Deecke)

**Synonyms:** None
**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

## DISTRIBUTION

**English waters**: Frequently recorded in the North Sea, south as far as the Yorkshire coast. Occasional sightings occur south of that[4].

**UK Continental shelf**: White beaked dolphins occur over a large part of the shelf, from the central North Sea, around the Scottish coasts and into the Hebrides[4].

**Global:** White beaked dolphins are found in temperate and sub-Arctic seas of the North Atlantic. They are usually found over the continental shelf in waters of 50-100m depth[2].

## ECOLOGY

**Description:** White-beaked dolphins are extremely robust, growing to 3.1m. Males are slightly larger than females. Their flippers are long and relatively broad and they have a tall and slightly falcate dorsal fin located in the middle of the back. The colour pattern is highly variable but they are primarily black to dark grey on the upper sides and back, and white to light grey on their belly and beak. Wisp-like pale grey colouration runs along the flanks, and a pale saddle patch is visible behind the dorsal fin. They have 22-28 large teeth on both the top and bottom jaw. This species is very aerobatic; it is often seen breaching and will commonly bowride[2].

***Feeding method***: predator

***Mobility***: swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: gonochoristic

***Biological zone***: Oceanic

***Salinity***: Full

***Substratum***: Not applicable

***Wave exposure***: Not applicable

***Water flow rate***: Not applicable

**Long-term natural fluctuations:** Not known

**Past declines and current threats:** Not known

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Bern convention**: Listed

**Biodiversity Action Plan:** UK BAP Priority Species.

**Bonn convention**: Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex IV

**IUCN Red list**: Least Concern (version 3.1)

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats[1,2,3,5]:**

*Aquaculture:* the extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* white-beaked dolphins are characteristic of cold temperate to sub-polar waters. It is likely that changes in water temperature will result in changes in distribution of these animals. Climate change may also have an indirect effect on animals by affecting prey distribution.

*Coastal defence:* like all cetaceans, white-beaked dolphins are sensitive to noise disturbance and vessel collisions, which may result from construction. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Development:* like all cetaceans, white-beaked dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect white-beaked dolphins. Increased contaminants can lead to increased bioaccumulation in top predators such as white-beaked dolphins. Dredging is also a major source of underwater noise, which is likely to have a direct effect on these dolphins.

*Energy generation:* like all cetaceans, white-beaked dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage. Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: entanglements in fishing nets may be a threat as is overfishing of prey species.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational vessels*: Harassment from dedicated whale watch vessels and private boats may occur.

*Waste:* pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like white-beaked dolphins.

**RARITY**

White-beaked dolphins are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as ‘rare’ in inshore waters and ‘scarce’ offshore..

**DECLINE**

There are insufficient data available to meaningfully assess this species for decline in UK or English waters.

**DEGREE OF THREAT**

**Score (range 0-16):** 7 (Moderate)
**Comments:** There are a paucity of data concerning many aspects of marine mammal biology, even for those species which are relatively well studied. As such, a moderate degree of threat is assigned to take into account many of the uncertainties which still exist.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 8 (Low)

**Comments:** There are insufficient data available to meaningfully assess this species for decline in UK or English waters, so this score is indicative of the problems of assessing a species for a decline which may / may not have occurred, if it has occurred, what may have caused it, and how to combat these causes once they have been established.

**RECOVERY/CONSERVATION GOAL**

Raise levels of knowledge including assessing trends in both population numbers and distribution of this species to a suitable level to inform meaningful management goals within10 – 15 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population/site management**: With further knowledge, there is the potential to designate sites based on new knowledge on distribution and abundance. (Applicable to all cetacean species concurrently) – see Research.

**Translocation**: Not relevant in highly mobile pelagic species.

**Enforcement**: Maintain current enforcement of by-catch regulations (applicable to all cetacean species concurrently). Through statutory authorities including fisheries regulation and maintenance of current measures in place.

**Research**: Improve cost-effective survey techniques for estimating abundance and distribution of cetaceans (includes visual, aerial, passive acoustic techniques) (applicable to all cetacean species concurrently). £500,000 p.a. initially for three years and then reappraise for all cetacean species. Concurrent UK wide survey of cetaceans: £4,000,000.

Improve knowledge of life history characteristics of the species in order to better understand potential causes of possible future declines and how best this species may recover should such declines occur. £500,000 over three years initially then reappraise. It may be possible to implement this for several cetacean species together, but may require to be done for this species in isolation.

One of the main threats to cetaceans is the effects of anthropogenic noise, both behaviourally and physiologically. A research program to investigate the effects of this would be invaluable. . £500,000 over three years initially then reappraise (potentially applicable to all cetacean species concurrently).

**Monitoring**: Increase frequency of cetacean surveys for assessing abundance and spatial and temporal distribution of cetaceans within UK waters (applicable to all cetacean species concurrently). This would also improve knowledge required for 'Population/site management'. Cost dependant on frequency of survey.

Establish a centralised repository for data collected during baseline surveys for offshore development to allow a more complete overview of animal distribution (applicable to all cetacean species concurrently).

Development/maintenance of centralized database (applicable to all cetacean species concurrently) £25,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a. All initially for three years.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping. . Monitor levels of potentially toxic pollutants – here, marine mammal species may act as ecosystem indicator species - £250,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a.. (Applicable to all marine mammal species concurrently.)

**SPECIALISTS**

Prof. Phil Hammond – Sea Mammal Research Unit

Dr Simon Northridge – Sea Mammal Research Unit

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 7 (Moderate) | 8 (Low) | Improving survey techniques: £500,000 p.a. |

Concurrent UK wide survey of cetaceans: £4,000,000

Research into life history: £500,000 over 3 years

Research into effects of anthropogenic noise: £500,000 over 3 years.

Centralised database and admin: £25,000 p.a.

Noise monitoring: £250,000 p.a.

Pollution Monitoring: £250,000 p.a.

**Total** for three years research into improving survey techniques, life history characteristics and reponses to anthropogenic noise; monitoring pollution and noise and one off survey of UK waters: £6,025,000..

**REFERENCES**

[1] Hammond, P.S., Bearzi, G., Bjørge, A., Forney, K., Karczmarski, L., Kasuya, T., Perrin, W.F., Scott, M.D., Wang, J.Y., Wells, R.S. & Wilson, B. (2008) *Lagenorhynchus albirostris*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 6 January 2011.

[2] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press.

[3] Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

[4] Reid, J.B., Evans, P.G.H. & Northridge, S.P., (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee.

[5] Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press.

*Distribution/abundance reference:*

Burt, M.L., Borchers, D.L.. & Samarra, F. (2008) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L. & Samarra, F. (2008) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245.

# HARBOUR PORPOISE *PHOCOENA PHOCOENA* LINNAEUS, 1758

**Synonyms: None**
**Taxonomy:** Cetacea
**Sub-Order:** Odontoceti
**Family:** Phocoenidae

(Image: Claire Lacey )

## DISTRIBUTION

**English waters**: Distributed throughout east and west coasts, with relatively few sightings on the south coast[5]

**UK Continental shelf**: Recorded across the North Sea and UK continental shelf throughout the year[5]

**Global:** Occurs primarily in temperate waters of the North Pacific and North Atlantic, largely limited to continental shelf waters, usually less than 200m depth[2]

## ECOLOGY

**Description:** The harbour porpoise is one of the smallest cetaceans and has a rotund body with a short, blunt head, no beak and a small, wide-based triangular dorsal fin in the centre of the back. Maximum length is 1.9m; females grow slightly larger than males. Pectoral fins are small, grey and rounded at the tips. Mouth-line is straight and dark, sloping upwards towards the eye. They exhibit counter-shading being generally dark grey on the back and white on its underside. The upper jaw is level with or only slightly farther extended than the lower jaw, and teeth are blunt with 22-28 pairs in the upper jaw and 21-25 in the lower. Porpoises occur in small groups or singly, but large aggregations may be seen occasionally; they are not generally found in association with other cetacean species. They frequently use narrow sounds or bays, are characteristically shy of boats and other human activities and consequently are likely to be easily disturbed[2].

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Viviparous (parental care)

***Reproductive type***: Gonochoristic

***Biological zone***: Oceanic

***Salinity***: Full

***Substratum***: Not applicable

***Water flow rate***: Not applicable

***Wave exposure***: Not applicable

**Long-term natural fluctuations:** Insufficient data

**Past declines and current threats:** Not known

**STATUS AND THREATS**

**Designations (from the UK Designated Taxa list):**

**Bern convention**: Listed

**Biodiversity Action Plan:** UK BAP Priority species

**Bonn convention:** Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex's II & IV

**IUCN Red list**: Least Concern (Version 3.1)

**OSPAR Threatened and Declining Species:** Listed

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats**[1,2,3,4,6]**:**

*Aquaculture:* the extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* harbour porpoises are a very widely distributed species and are not constrained to any particular water temperatures. It is likely that they could be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* like all cetaceans, harbour porpoises are highly sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Development:* like all cetaceans, harbour porpoises are highly sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Dredging:* the act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect harbour porpoises. Increased contaminants can lead to increased bioaccumulation in top predators such as harbour porpoises. Dredging is also a major source of underwater noise, which is likely to have a direct effect on harbour porpoises.

*Energy generation:* like all cetaceans, harbour porpoises are highly sensitive to noise disturbance and vessel collisions Effects may include habitat displacement, masking of vocalisations, and physiological damage Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: drowning through entanglement or incidental bycatch in gillnets (primarily bottom set ones), driftnets, purse seines, and trawls is the most frequent cause of harbour porpoise mortality. *A*round 7,000 harbour porpoises are killed annually by EU fisheries in the North Sea. This exceeds 2% of the North Sea the population which is above the sustainable mortality limit (cetacean populations can only withstand by-catch levels of up to 1.7%). Additionally, overfishing of prey species may affect harbour porpoise distribution[7].

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational vessels*: Harassment from dedicated whale watch vessels and private boats may also occur.

*Waste:* pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like harbour porpoises.

**RARITY**

Harbour porpoises are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as 'uncommon'.

**DECLINE**

Declines have occurred within both the Black Sea and Baltic Sea populations. Insufficient data are available to meaningfully assess this species for decline in UK waters.

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)

**Comments:** There are a paucity of data concerning many aspects of marine mammal biology, even for those species which are relatively well studied. As such, a moderate degree of threat is assigned to take into account many of the uncertainties which still exist.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** There are insufficient data available to meaningfully assess this species for decline in UK or English waters, so this score is indicative of the problems of assessing a species for a decline which may / may not have occurred, if it has occurred, what may have caused it, and how to combat these causes once they have been established.

**Recovery/conservation goal**: Raise levels of knowledge of this species to a suitable level to allow the creation of meaningful management goals.

**Time taken**:

10 – 15 years. Sufficient time must be allowed to assess trends in both population numbers and distribution.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population/site management**: With further knowledge, there is the potential to designate sites based on new knowledge on distribution and abundance. (Applicable to all cetacean species concurrently) – see Research.

**Translocation**: Not relevant in highly mobile pelagic species.

**Enforcement**: Maintain current enforcement of by-catch regulations (applicable to all cetacean species concurrently). Through statutory authorities including fisheries regulation and maintenance of current measures in place.

**Research**: Improve cost-effective survey techniques for estimating abundance and distribution of cetaceans (includes visual, aerial, passive acoustic techniques) (applicable to all cetacean species concurrently). £500,000 p.a. initially for three years and then reappraise for all cetacean species. Concurrent UK wide survey of cetaceans: £4,000,000.

Improve knowledge of life history characteristics of the species in order to better understand potential causes of possible future declines and how best this species may recover should such declines occur. £500,000 over three years initially then reappraise. It may be possible to implement this for several cetacean species together, but may require to be done for this species in isolation.

One of the main threats to cetaceans is the effects of anthropogenic noise, both behaviourally and physiologically. A research program to investigate the effects of this would be invaluable. . £500,000 over three years initially then reappraise (potentially applicable to all cetacean species concurrently).

**Monitoring**: Increase frequency of cetacean surveys for assessing abundance and spatial and temporal distribution of cetaceans within UK waters (applicable to all cetacean species concurrently). This would also improve knowledge required for “Site management”. Cost dependant on frequency of survey.

Establish a centralised repository for data collected during baseline surveys for offshore development to allow a more complete overview of animal distribution (applicable to all cetacean species concurrently). Development/maintenance of centralized database (applicable to all cetacean species concurrently) £25,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a. All initially for three years.

**Wider environment**: Monitor and work towards minimising levels of ocean noise from offshore construction and shipping. Monitor levels of potentially toxic pollutants – here, marine mammal species may act as

ecosystem indicator species - £250,000 p.a. Undertake noise monitoring - £250,000 p.a. £250,000 p.a. Undertake pollution monitoring - £250,000 p.a.. species. (Applicable to all marine mammal species concurrently.)

**SPECIALISTS**

Prof. Phil Hammond – Sea Mammal Research Unit

Dr Simon Northridge – Sea Mammal Research Unit

**FINAL CONCLUSION**

| Degree of threat | Recovery potential (range 2-36)l | Cost |
|---|---|---|
| 6 (Moderate) | 2 | Improving survey techniques: £500,000 p.a.<br>Concurrent UK wide survey of cetaceans: £4,000,000<br>Research into life history: £500,000 over 3 years<br>Research into effects of anthropogenic noise: £500,000 over 3 years.<br>Centralised database and admin: £25,000 p.a.<br>Noise monitoring: £250,000 p.a.<br>Pollution Monitoring: £250,000 p.a.<br>**Total** for three years research into improving survey techniques, life history characteristics and reponses to anthropogenic noise; monitoring pollution and noise and one off survey of UK waters: £6,025,000.. |

**REFERENCES**

[1] Hammond, P.S., Bearzi, G., Bjørge, A., Forney, K., Karczmarski, L., Kasuya, T., Perrin, W.F., Scott, M.D., Wang, J.Y., Wells, R.S. & Wilson, B. (2008) *Lagenorhynchus albirostris*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 6 January 2011.

[2] Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press.

[3] Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

[4] OSPAR (2008) OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6). OSPAR Convention For The Protection Of The Marine Environment Of The North-East Atlantic.

[5] Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee.

[6] Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) Marine Mammals and Noise. San Diego, California, Academic Press.

[7] SCANS-II. (2008) Small cetaceans in the European Atlantic and North Sea. Final Report submitted to the European Commission under project LIFE04NAT/GB/000245, SMRU, Gatty Marine Laboratory, University of St Andrews, St Andrews, Fife KY16 8LB, UK. http://biology.st-andrews.ac.uk/scans2/.

*Distribution/abundance reference:*
Burt, M.L., Borchers, D.L. & Samarra, F. (2008) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245.

# Other dossiers (before species were assigned to group 2 or 3)

# SEA-FAN ANEMONE *AMPHIANTHUS DOHRNII* KOCH, 1878

**Synonyms:** *None*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Actinaria*
**Family:** *Hormathiidae*

(Image: Keith Hiscock)

## DISTRIBUTION

**English waters**: Restricted to the South-west coast around Dorset, Devon and Cornwall.

**UK Continental shelf**: Most frequently recorded "off Plymouth"[1]. Also recorded from Lyme Bay, the Lizard, Isles of Scilly, Lundy, off the south-west and south coasts of Ireland and from the west coast of Scotland.

**Global:** Recorded from the Atlantic coast of France and into the western Mediterranean

## ECOLOGY

**Description:** A small species of anemone rarely exceeding 10 mm across the disk, exceptionally up to 25 mm along the axis of the base. The colour is pink, buff, orange or red with streaks or splashes of opaque white. The species lives on sea fans (*Eunicella verrucosa and Swiftia pallida*) and sometimes other organic rod-like structures. Asexual reproduction is via basal laceration where the anemone creeps along the substratum leaving fragments of its base behind which develop into miniature new anemones.[2] Occurs on less than 1% of sea fans at the Manacles (SW Cornwall)[3]. Sexual reproduction and dispersal by larvae has not been recorded but most likely occurs.

***Feeding method***: Passive suspension feeder, Predator

***Mobility***: Temporary attachment

***Development mechanism***: Not relevant

***Reproductive type***: Asexual fission

***Biological zone***: Lower Infralittoral, upper circalittoral, lower circalittoral

***Salinity***: Full (30-40 psu)

***Substratum***: Other species

***Water flow rate***: Moderately Strong (1-3 kn), Weak (<1 kn)

***Wave exposure***: Very Exposed, Exposed, Moderately Exposed, Sheltered

**Long-term natural fluctuations:** Evidence for fluctuations in abundance and changes in location of occurrence is being accumulated via observations by divers at known locations (see next).

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Biodiversity Action Plan:** UK BAP Priority Species

**Sources of threats:** Pollution, trawling damage

**RARITY**

Nationally scarce (recorded from 9 to 56 10 km$^2$ squares within the 3 nautical mile limit of British territorial seas)

**DECLINE**

"Formerly common in the English Channel and around southern Ireland. Recently, however, this anemone appears to have become rare" [2]. Noted as "numerous specimens taken off Plymouth, where it is not uncommon (Mewstone ledge, etc.)"[1] but very rarely seen at the Mewstone now[4]. Numbers in the Mediterranean also appear to be decreasing. Abundance has declined significantly on a wreck in Bigbury Bay since the 1980's but may have increased on another wreck in Whitsand Bay[4]. The species may have variable recruitment at different locations. If species was considered common in the 1930s & now rare in 2005 - at least a 50% decrease over the last 75 years (estimate).

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)
**Comments:** A number of causes of decline have been suggested, one primary cause being changes in water masses - since the 1970s water masses have become colder, which has caused problems for species at the northernmost limit of their distribution. Contamination of water as a result of human activities affecting larval and adult survival may also be a factor. Threats are due to removal of the host sea fans by mobile fishing gear. [**Check source and cite or delete.]

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 4 (Low)
**Comments:** In the absence of any clear cause of decline, recovery potential must be considered unknown and a recovery/conservation goal needs to be very conservative.

**RECOVERY/CONSERVATION GOAL**

Maintain potential for survival and expansion of existing populations by ensuring that the host species (*Eunicella verrucosa*) is protected from loss and better understand reproduction and population genetics (commission research within next 10 years).

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Remove damaging activities (mobile fishing gear) [cost of regulatory activities]

**Translocation**: Not relevant

**Enforcement**: Enforce through statutory authorities including fisheries regulation. [Cost of regulatory activities]

**Research**: Improve understanding of dispersal and isolation, through observation and genetic studies. Laboratory observation and experiment - £20,000

**Monitoring**: Encourage/facilitate recording of abundance and distribution. [Cost of reporting schemes.]

**Wider environment**: Unknown. Possibly ensure nutrient and chemical pollutant loadings are reduced

**SPECIALISTS**

Chris Wood & Sally Sharrock (Seasearch Programme)
Dr Keith Hiscock, Marine Biological Association

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation potential (range 2-36) | Cost |
|---|---|---|
| 6 (Moderate) | 4 (Low) | Research: £20,000 |

**REFERENCES**

[1] Stephenson, T.A., (1935) *The British sea anemones*, vol. 2. London: Ray Society.
[2] Manuel, R.L., (1988) *British Anthozoa*. London: Academic Press. [Synopses of the British Fauna, no. 18.]
[3] Wood, C. (2005) *Seasearch guide to sea anemones and corals*. Marine Conservation Society, Ross-on-Wye.
[4] K. Hiscock, own observations

# GIANT GOBY *GOBIUS COBITIS* PALLAS, 1814

**Synonyms:** *Gobius algarbiensis, Gobius exanthematosus gibbosus, Gobius guttatus, Gobius limbatus, Gobius spilogonurus, Macrogobius cobitis*

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Perciformes*
**Family:** *Gobiidae*

(Image: Robin Gibson)

## DISTRIBUTION

**English waters**: The distribution of *Gobius cobitis* in Britain is restricted to the south-west coast of England, from Wembury, Devon to the Isles of Scilly, Cornwall.

**UK Continental shelf**: As above.

**Global:** Found in the eastern Atlantic, from the western English Channel to Morocco, the Mediterranean, the Black Sea (except north-west) and the Gulf of Suez.

## ECOLOGY

**Description:** The giant goby has relatively small and well spaced eyes, a short tail stalk and a deep body throughout its length. Greyish to olive brown in colour with 'pepper and salt' speckling. Breeding males are darker in colour than females. The fish reaches up to 27 cm in length, and is sexually mature at 2-3 years. The typical habitat is uppershore rockpools. Females usually produce 2 clutches of eggs each season for a further 8 years[1]. Eggs are laid by the female and attached to the under-surface of large boulders. It is believed that males fertilise and guard batches of eggs from at least two females[2]. Thus the eggs are protected and kept inshore until the feeding larvae hatch. The breeding season usually occurs in spring and early summer in Britain. Fecundity was reported by to be dependent on size, and varies between 2,000 and 12,000 eggs per female[2]. The species is reported to have a large dispersal potential of 40-49 km[3] and individuals can live for approximately 10 years[1].

***Feeding method***: Omnivore

***Mobility***: Swimmer

***Development mechanism***: Oviparous, planktotrophic.

***Reproductive type***: Gonochoristic

***Biological zone***: Sub-littoral fringe

***Salinity***: variable (18-40 psu)

***Substratum***: rock pools, under boulders, mixed

***Water flow rate***: insufficient information

***Wave exposure***: Sheltered

**Long-term natural fluctuations:** No information.

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Wildlife and Countryside Act:** Schedule 5, section 9.

**Sources of threats:** Habitat alteration and/or degradation are the primary threats to this species due to

its low population number and limited distribution. *Gobius cobitis* lives and forages on a variety of substrata and requires rockpools in the intertidal to survive at low tide. Therefore, loss of rockpools (for instance, by infilling) or loss of rocky substrata (for instance, by spoil dumping or land claim) will most likely cause a proportion of the species population to die. However, at high tide adults are sufficiently mobile and will be able to re-colonise areas which contain suitable substrata. Although there is no evidence that the species is currently endangered in the UK, it is still considered vulnerable to human interference due to its preferred shore habitat[4,5] and likely intolerance to pollution such as heavy metal contamination[6]. A temperature decrease is not likely to have a significant impact on *Gobius cobitis*. However, during the severe winter period in 1962-63 the south-west coast of Britain experienced temperatures 5 and 6 °C below the long-term average for about 2 months. During this period there was heavy mortality of observed populations of *Gobius paganellus*, *Gobius minutus* and *Gobius flavescens* at least[7]. Therefore a decrease in temperature may adversely affect populations in the British Isles. *Gobius cobitis* is however thought to be tolerant to temperature increase[8,9].

**RARITY**

Rare (occurring in less than 9 of the 10 km squares within the 3 nautical mile limit of British seas)

**DECLINE**

Despite previous records for Wembury and West Looe, no *Gobius cobitis* within these areas were found during surveys in the 1990's and it was assumed that populations had declined or were absent at that time[1]. However, a record of *Gobius cobitis* was made at West Looe on 31 January 1998 by John Markham[5].

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (moderate)

**Comments:** There is no evidence of habitat loss/degradation or decline except that the species may have been adversely affected by very cold winters.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 36 (High)
**Comments:** The species is relatively well studied and the factors affecting its survival well understood. The species is normally found at a low population level, but within quite restricted habitat types making it vulnerable to decline if environmental conditions deteriorate. However, populations can be protected from degradation of habitat in well-managed MPAs.

**RECOVERY/CONSERVATION GOAL**:

Conservation will have been achieved when there are no avoidable human activities occurring that are likely to adversely affect existing populations.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Enforce the protection granted under the W&C Act and include in MPA management plans where the species occurs in the MPA or has occurred there.

**Translocation**: Not advisable due to the very specific habitat requirements of this species and cost of breeding.

**Enforcement**: Enforcement of protection afforded under the W&C Act is essential due to the rarity of this species within UK waters. Proper EIAs for any proposed nearby development are also essential to prevent any negative impacts occurring within the intertidal region in which these animals reside.

**Research**: The biology and ecology of this species is well understood. Research effort is minimal management requirement, excepting research invested within further investigation of the species' distribution. Occurrences need to be reported especially where populations appear to be resident at a location. Reporting schemes need to be supported generally and separate costs are not given.

**Monitoring**: Monitoring should be focussed on known existing populations, particularly within MPAs to ensure that effort is used effectively and to ensure MPAs are affording the correct protection to these organisms.

**Wider environment**: Where new sites are found outside of the MPA network through monitoring/ research, effective protection of sites by inclusion within the MPA network should sought.

**SPECIALISTS**

**FINAL CONCLUSION**

| Threat Score (range 0-15): | Recovery potential (range 2-36): | Cost |
|---|---|---|
| 6 (moderate) | 36 (High) | [Incorporate in MPA monitoring] |

**REFERENCES**

[1] Potts, G.W. & Swaby, S.E. (1992) The current status of the giant goby, Gobius cobitis Pallas in the British Isles. , Peterborough: Joint Nature Conservation Committee. Unpublished report no. 99 F2A 059.
[2] Gibson, R.N., (1970). Observations on the biology of the giant goby, Gobius cobitis Pallas. *Journal of Fish Biology*, **2**, 281-288.
[3] Hill, J., Pearce, B., Georgiou, L., Pinnion, J., Gallyot, J. (2010) *Meeting the MPA Network Principle of Viability*. *Feature specific recommendations for species and habitats of conservation importance.* Natural England Commissioned Reports, Number 043.
[4] Faria, C., Almada, V. & Nunes, M.D. (1998) Patterns of agonistic behaviour, shelter occupation and habitat preference in juvenile *Lipophrys pholis*, *Coryphoblennius galerita* and *Gobius cobitis. Journal of Fish Biology*. **53**,1263-1273.
[5] Riley, K. (2005) Gobius cobitis. Giant goby. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 23/12/2010]. Available from: http://www.marlin.ac.uk/specieshabitats.php?speciesID=3396
[6] Mueller, D. (1979) Sub-lethal and lethal effects of copper, cadmium and lead to organisms representative for the intertidal flats at the outer Elbe Estuary. *Archiv fur Hydrobiologie*, supplement 43, **2-3**, 289-346.
[7] Crisp, D.J. (ed.), (1964) The effects of the severe winter of 1962-63 on marine life in Britain. *Journal of Animal Ecology*, **33**, 165-210.
[8] Gil, M.F., Goncalves, E.J., Faria, C., Almada, V.C., Baptista, C., Carreiro, H. (1997) Embryonic and larval development of the giant goby, Gobius cobitis. *Journal of Natural History*, **31**, 799-804.
[9] Horn, M.H., Gibson, R.N., (1990) Effects of temperature on the food processing of three species of seaweed-eating fishes from the European coastal waters. *Journal of Fish Biology*, **37**, 237-247.

# COUCH'S GOBY *GOBIUS COUCHI* MILLER & EL-TAWIL, 1974

**Synonyms:** *None*

**Taxonomy:**
**Phylum:** *Chordata*
**Order:** *Perciformes*
**Family:** *Gobiidae*

(Image:Pamela Tompsett)

## DISTRIBUTION

**English waters**: Only recorded in two English locations; Helford in south Cornwall; Bill of Portland, Dorset

**UK Continental shelf**: This species has only been recorded from four locations in the British Isles: Helford in south Cornwall; Bill of Portland, Dorset; Lough Hyne, Co. Cork, Ireland; and Mulroy Bay, Co. Donegal, Ireland.

**Global:** Couch's goby has recently been recorded at Naples in the western Mediterranean and in the Adriatic Sea.

## ECOLOGY

**Description:** *Gobius couchi* is a typically shaped goby, reaching a maximum of 9 cm in length. It is fawn brown to grey in colour with dark markings on its back. There is a deeper-than-long dusky patch at the upper base of the pectoral fin and five dark lateral blotches. It is also found with one, or sometimes two dark spots on the cheeks. There are 35-45 rows of scales along the sides, from the pectoral fin to the tail fin. The species is found in the lower intertidal and inshore waters, under stones or algae on sheltered muddy sand down to 16 m[1]. *Gobius couchi* has a life span of up to 6 years[2]. Reproduction is likely to be similar to that of other Gobiidae. For instance, *Gobius cobitis*, *Pomatoschistus microps*, and *Pomatoschistus minutus* usually produce 2 clutches of eggs each breeding season. Eggs are laid by the female and attached to the under-surface of large boulders or shells. The eggs are then fertilized and guarded by the male. Thus the eggs are protected and kept inshore until the feeding larvae hatch. The breeding season usually occurs in spring and early summer in Britain. Fecundity will probably vary between 2,000 and 12,000, within the same range as that of other Gobiidae[3].

***Feeding method***: Omnivore

***Mobility***: Swimmer

***Development mechanism***: Oviparous, planktotrophic.

***Reproductive type***: Gonochoristic

***Biological zone***: Sublittoral fringe

***Salinity***: variable (18-40 psu)

***Substratum***: Pebbles, Mixed, Rockpools, Under boulders, Maerl, Fine clean sand, Muddy sand, Sandy mud, Mud

***Water flow rate***: insufficient information

***Wave exposure***: Sheltered

**Long-term natural fluctuations:** None known.

## STATUS AND THREATS

**Directives / convention / statutes:**

**Wildlife and Countryside Act:** Schedule 5, section 9.

**Sources of threats:** Habitat alteration and/or degradation are the primary threats to this species due to its low population number and limited distribution.

**RARITY**

Rare (occurring in less than 9 10 km$^2$ squares within the 3 nautical mile limit of British seas.

**DECLINE**

**Decline:** *Gobius couchi* was discovered relatively recently, in 1974, and is considered to be a resident of only three locations in England and two in Ireland[3]. It was placed on the W&C Act in 1998, and is thought to currently be in decline[4], primarily through the observations[5] that the population at the Helford site in Cornwall had diminished over the period 1980 - 1990.

**DEGREE OF THREAT**

**Score (range 0-16):** 6 (Moderate)

**Comments:** Should be 'Low' if management measures adequate but score biased by 'Remoteness' which is irrelevant if the species is not being targeted.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 36 (High)

**Comments:** The species is less studied than the related *Gobius cobitis*, but likely to be highly similar in terms of biology and ecology. Factors affecting its survival are well understood. The species is normally found at a low population level. MPAs where the species is found should be adequate protection.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved in numbers and occurrence is maintained or increased.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: Ensure that the management of MCZs, SACs and MNRs takes account of Couch's goby, and by guarding against any coastal developments that may have detrimental impacts on the species or intertidal habitats. Cost is part of MPA management.

**Translocation**: Not advisable due to the very specific habitat requirements of this species and cost of breeding.

**Enforcement**: Enforcement of protection afforded under the W&C Act is essential due to the rarity of this species within UK waters. Proper EIAs for any proposed nearby development are also essential to prevent any negative impacts occurring within the intertidal region in which these animals reside. Cost is part of MPA management.

**Research**: The biology and ecology of this species is well understood. Research effort is minimal management requirement, excepting research invested within further investigation of the species' distribution. Cost is part of maintaining reporting schemes.

**Monitoring**: Monitoring of known populations is advised. Monitoring should be focussed on known existing populations, particularly within MPAs to ensure that effort is used effectively and to ensure MPAs are affording the correct protection to these organisms. Cost is part of MPA management.

**Wider environment**: Where new sites are found outside of the MPA network through monitoring/ research strategies, effective protection by inclusion within the network should be undertaken.

**SPECIALISTS**

**FINAL CONCLUSION**

| **Degree of threat (range 0-15)** 6 (Moderate) (see comment above) | **Recovery/conservation potential (range 2-36)** 36 (High) | **Cost** Cost is part of MPA management. |
|---|---|---|

**REFERENCES**

[1] Minchin, D. (1987) Fishes of the Lough Hyne Marine Reserve. *Journal of Fish Biology*, **31**, 343-352.

[2] Miller, P.J. (1986) Gobiidae. P. 1019 - 1085. *Fishes of the North-eastern Atlantic and Mediterranean*. In Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.C., Nielson, J., Tortonese, E. (eds.), Paris: UNESCO, vol. 3.

[3] Riley, K. (2005) Gobius cobitis. Giant goby. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 23/12/2010]. Available from: http://www.marlin.ac.uk/specieshabitats.php?speciesID=3396

[4] Hill, J., Pearce, B., Georgiou, L., Pinnion, J., Gallyot, J. (2010) *Meeting the MPA Network Principle of Viability*, Feature specific recommendations for species and habitats of conservation importance. Natural England Commissioned Reports, Number 043.

[5] Potts, G.W. & Swaby, S.E. (1992) *The current status of the giant goby,* Gobius cobitis *Pallas in the British Isles.* Peterborough, Joint Nature Conservation Committee. Unpublished report no. 99 F2A 059.

# STARLET SEA ANEMONE *NEMATOSTELLA VECTENSIS* STEPHENSON, 1935

**Synonyms:** *Nematostella pellucida*

**Taxonomy:**
**Phylum:** *Cnidaria*
**Order:** *Actinaria*
**Family:** *Edwardsiidae*

(Image:Dennis R. Seaward)

## DISTRIBUTION

**English waters**: Found on coastal lagoons around the north coast of Norfolk, the east coast of Suffolk, the Blackwater Estuary and Hamford Water in Essex, the Hampshire coast, Isle of Wight and on the south coast of Dorset. . It may also occur in some brackish ponds and ditches

**UK Continental shelf**: As above.

**Global:** In North America from Nova Scotia to Georgia on the Atlantic coast, from Florida to Louisiana in the Gulf of Mexico and from California to Washington on the Pacific coast. Also found on the south and east coast of England.

## ECOLOGY

**Description:** A tiny anemone, with the column rarely more than 15 mm in length. It is translucent and colourless in appearance except for variable patterns of opaque white on the column and disk. The 9-18 tentacles are large in proportion to body and strongly adhesive. Individuals live in isolated or semi-isolated brackish lagoons around the high water mark. Typically found in mud, muddy sand and muddy shingle[1] but is also on vegetation. *Nematostella vectensis* is known to reproduce both sexually and asexually but, in England, there seems to be only female asexual reproduction.[1] Males are absent from populations on the south coast of England suggesting that these populations produce all their offspring asexually.[2] In the laboratory, *Nematostella vectensis* became sexually mature at 3-4 months old and at column lengths of between 1.5-3.5 cm. Gametes were found to be produced at all times of the year. The number of eggs is dependent on adult size. Large individuals reared in the laboratory can produce up to 2000 eggs. Eggs are 170-240 µm in diameter and are released embedded in a gelatinous mucoid mass. Larvae take 1 week to settle.[3]

***Feeding method***: Passive suspension feeder, predator

***Development mechanism***: Schizotomous

***Biological zone***: Lagoonal

***Substratum***: mud, algae

***Mobility***: Burrower, temporary attachment

***Reproductive type***: Fission, budding, gonochoristic

***Salinity***: variable (18-40 psu), low (<18 psu)

***Water flow rate***: very weak (negligible) ***Wave exposure***: Ultra sheltered

**Long-term natural fluctuations:**

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species

**IUCN Red list:** Vulnerable (category A1ce, version 2.3)

**Wildlife and Countryside Act:** Schedule 5, section 9.

**Sources of threats:**

Primary threats come from loss or damage to lagoon / sheltered brackish water habitats from pollution, drainage and other activities. Isolation of pools leading to fragmentation of populations and coastal development (potential associated infilling) are also issues.

*Nematostella vectensis* typically lives within the muddy substratum or on algae. Loss of the substratum is likely to result in loss of the entire population. Limited dispersal due to the isolated nature of suitable habitat, the lack of a dispersive phase in UK populations, and preponderance of asexual reproduction makes recovery potential very low. Change in water level are likely to affect populations as they are likely to be intolerant to desiccation and mortality is likely to be high at the upper limit of the population distribution if emergence increases. Williams (1991) suggested that desiccation is likely to be a limiting factor in the distribution of this species.[4] *Nematostella vectensis* only inhabits areas that are ultra sheltered and have very low water flow rates.[2] Extreme shelter is needed as it allows a layer of fine mud to build up, in which the animal burrows.[5] In the UK, *Nematostella vectensis* was found to be absent from areas where water flow exceeded 0.18 cm/s [(2)] and is likely to be highly intolerant to changes in water flow rate at the benchmark level.

**RARITY**

Scarce (occurring in 9-55 of the 10 km squares within the 3 nautical mile limit of British seas). Recorded in 40 sites/populations within England.[6]

**DECLINE**

**Decline:**

The population would appear to currently be stable[7] but highly vulnerable to any environmental alterations. Further detailed monitoring would be needed to verify this.

**DEGREE OF THREAT**

**Score (range 0-15):** 4

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 18

**RECOVERY/CONSERVATION GOAL**:

Maintain current populations at a stable level within all current known sites.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: (from the BAP):

- Maintain and, where possible, increase the amount of brackish lagoon habitat and ditches in occupied areas and in areas within the dispersal range of this species, to encourage expansion of existing colonies.
- Promote the implementation of practices to encourage the formation and development of brackish lagoons and sheltered brackish water habitats at suitable sites.
- Continue programme to conserve lagoon habitats under the EC Habitats Directive, to benefit this species.
- Consider the need to notify [further] sites for this species as SSSI.

Saline lagoons are also a priority habitat under the EC Habitats directive and therefore need to be safeguarded irrespective of this species.

The cost of maintaining and constructing lagoonal habitats is difficult to assess but allocation of funds to ensure that lagoons are maintained and some construction of new habitats or restoration of pre-existing ones would benefit from an allocation of £30,000 p.a.

**Translocation**: Re-introduction is a potentially useful tool, once all viable sites have been identified and if sites become degraded. The 1999 BAP proposed "If biologically feasible, re-introduce to 5 sites by the year 2005". However, for the moment, re-introduction is unnecessary.

**Enforcement**: Enforcement of current protection of both the species and saline lagoons found within the MPA network, along with enforcement of actions approved under the W&C Act for *N. vectensis*. Appropriate instigation of EIAs for any development is essential to prevent any negative anthropogenic impact such as water regime change, smothering or substrate removal. No dedicated funding required.

**Research**: Further work is needed to identify the full distribution of the species (including lesser surveyed brackish ponds and ditches) along with identification of any former sites that could be viable for re-introduction. Survey should also be 'shared' with other species that occur in the same habitats.

**Monitoring**: Regular monitoring is needed of existing populations to ensure no decline occurs and to identify (and prevent) potential further threats to the species status. Combine monitoring with research.

**Wider environment**: No other measures except education with other species and no specific cost.

**SPECIALISTS**

Dr A. Sheader, University of Southampton

Dr R. Bamber

**FINAL CONCLUSION**

| Threat of decline (range 0-15) | Recovery/conservation potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 4 | 18 | Not relevant |

**REFERENCES**

[1] M.Sheader pers comms.

[2] Sheader, M., Suwailem, A.M. & Rowe, G.A., (1997) The anemone, Nematostella vectensis, in Britain: considerations for conservation management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **7**, 13-25Williams 1991.

[3] Marshall, C., Jackson, A. (2007) *Nematostella vectensis*. Starlet sea anemone. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed on 11/01/2011]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3860

[4] Williams, R.B. (1991) Nematostella vectensis. In *British Red Data Books. III. Invertebrates other than insects* (ed. J.H. Bratton), pp. 32-33. Peterborough: Joint Nature Conservation Committee.

[5] Williams, R.B. (1983) Nematostella vectensis. In *The IUCN invertebrate red data book* (ed. S.M. Wells, R.M. Pyle and N.M. Collins), pp. 43-46. Gland: IUCN.

[6] *Bamber, R. (2008) National action plan - Nematostella vectensis (Starlet Sea Anemone). Biodiversity Action Reporting System, 2008 [on-line]. Available from:* http://ukbap-reporting.org.uk/plans/national_plan.asp?SAP={1E39CD96-8A39-4729-B507-70FF931954E1}, *[Accessed on 11/01/2011]*

[7] Bamber R N, Evans N J, Robbins R S & Barnes N. (2004) *Habitats Regulations review of consents: Solent and Isle of Wight lagoons survey, Spring 2004*. Natural History Museum Consultancy Report to Environment Agency No. ECM 706F/03, June 2004, 36pp

# SPOTTED RAY (SPOTTED SKATE, ROKER, HOMELYN SKATE) *RAJA MONTAGUI* FOWLER, 1910

**Synonyms:** *Dipturus montagui*

**Taxonomy:**
**Phylum:** Chordata
**Order:** Rajiformes
**Family:** Rajidae

(Image:John Brooks)

## DISTRIBUTION

**English waters**: Found along most of the English coast, with few or none observed on the North Sea coast

**UK Continental shelf**: It is widespread around most coasts of Britain but appears to be rare off the east coast

**Global:** Eastern Atlantic: Shetlands, southern North Sea and the western Baltic to Mauritania, including the western part of the Mediterranean (to Tunisia and western Greece)

## ECOLOGY

**Description:**

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Oviparous

***Reproductive type***: Gonochoristic

***Biological zone***: Upper Infralittoral, Lower Infralittoral, Upper Circalittoral, Lower Circalittoral, down to 530 m

***Salinity***: Full (30-40 psu)

***Substratum***: Soft substrates: Muddy gravel, coarse clean sand, fine clean sand, sandy mud, muddy sand, mud, mixed

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats:** Species considered to be a commonly occurring species in Belgian waters in the mid-1900s, but had declined severely since then and become very rare. This decline/scarcity has persisted only in the southern and eastern North Sea and eastern English Channel. Its range and abundance has, however, reportedly increased significantly elsewhere in the North Sea, and in other parts of its range

## STATUS AND THREATS

**Directives / convention / statutes (from the UK Designated Taxa list):**

**IUCN Red list:** Least Concern (Version 3.1)

**OSPAR Convention:** Annex V, threatened/declining species within OSPAR Regions II, III, IV, V

**Sources of threats:** The species is an important component of inshore demersal fisheries in the North East Atlantic. Although not targeted (due to its small size) it is landed and sold.

**RARITY**

Species is considered common in UK waters (>150 10 km squares within the 3nm limit of territorial seas).

**DECLINE**

*R. montagui* is under threat or in decline in parts of the North Sea. However, there are no indications of major declines except off the Belgian coast.

**DEGREE OF THREAT**

**Score (range 0-16):** 7 (Moderate)

**Comments:** Currently the species is managed as part of the Skates & Rays quota and not managed separately.

**RECOVERY/CONSERVATION POTENTIAL AND COST**

**Score (range 2-36):** 12 (Moderate)

**Comments:** Due to its small size the species is more resilient to fisheries impact and have a higher fecundity than other species such as *R. clavata*. However, life history is still much slower than teleosts and is therefore susceptible to overfishing. Although species is not considered threatened introduction of sustainable management at an early stage will ensure the stability of the species

**RECOVERY/CONSERVATION GOAL**

Continue sustainable management to restore animals from areas of extirpation.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Population management**: Introduction of species specific landing to enable species specific management. Maintenance of minimum landing size which allows return of young which appear to have good survival rates. Landing statistics should be reported to species level as taxonomic groupings provide insufficient information for adequate management and monitoring. Landing by taxonomic group, i.e. “Skate and Rays”, should be phased out due to its potentially damaging impact. Cost absorbed within normal fisheries management activities.

**Translocation**: Unknown. Never tested but unpractical due to difficulty, cost and time scale of captive breeding species.

**Enforcement**: Through statutory authorities including fisheries regulation. Cost absorbed within normal fisheries management activities.

**Research**: Reporting of landings would provide useful insight into the dynamics of the species as well as adding to the understanding of skate/ray fisheries and trends. There are also some reported identification issues making it necessary to evaluate the level of plasticity in the morphology of the species in different regions of its range (population genetic study £98,000). Tagging studies would be required to determine the range of individuals and habitat utilisation (satellite tagging £172,000 per annum, project should run minimum 3 years; data storage tagging £112,000 per annum, project should run minimum 3 years)

**Monitoring**: Species specific landings would allow for monitoring of species and declines that may occur.

**Wider environment**: Species might possibly be interbreeding across the North East Atlantic (excluding the Mediterranean) and thus genetic impact of fisheries will impact the whole of the region. Management should therefore be European wide as UK measures will only impact parts of the species range.

**SPECIALISTS**

Dr. Jim Ellis – CEFAS, Lowestoft, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/conservation (range 2-36) | Cost |
|---|---|---|
| 7 (Moderate) | 12 (Moderate) | Satellite tagging £172,000 p.a. for each of three years = £516,000;<br>Data storage tagging £112,000 p.a. for each of three years = £336,000)<br>Population genetics: £98,000<br>Total = £950,000 |

# LAGOON SEA SLUG *TENELLIA ADSPERSA* NORDMANN, 1845

**Synonyms:** *Eolis ventilabrum, Tenellia pallida,Tergipes adspersus*

**Taxonomy:**

**Phylum:** *Mollusca*

**Order:** *Nudibranchia*

**Family:** *Tergipedidae*

(Image:Dennis R. Seaward)

## DISTRIBUTION

**English waters**: The few British records are from the Bristol Channel, Essex, the Fleet in Dorset, off Pembrokeshire and at Liverpool Bay.

**UK Continental shelf**: See above.

**Global:** Recorded from the eastern and western North Atlantic, Baltic, Mediterranean Sea, Black Sea, Azov Sea, Caspian Sea, Japan, Pacific coast of USA, Brazil

## ECOLOGY

**Description:** A tiny nudibranch with finger-like protrusions, arranged in groups of two or three along each side of the body. The pale brown body is marked with tiny black spots as are the protrusions. It grows up to 8 mm in length and is found intertidally and in the shallow sub-littoral. A euryhaline species often in harbours, estuaries and canals.[1] *Tenellia adspersa* has a sub-annual lifecycle with a short generation time of as little as 20 days when reared at 20 $^{o}$C and 30 ppt on the hydroid *Cordylophora lacustris*. The animals may spawn 3 to 5 times a day with 25 to 50 eggs per spawn (Chester, 1996). The spawn consists of a short, curved, lozenge-shaped mass. The period from spawning to hatching lasts 4-5 days. The method of development varies with the environmental conditions. Dispersal can be between 100 – 1000 m, and the life span is typically less than a year.[1,2]

***Feeding method***: Predator

***Mobility***: Crawler

***Development mechanism***: Planktotrophic / lecithotrophic

***Reproductive type***: Gonochoristic

***Biological zone***: Lower Eulittoral, Sublittoral Fringe, Upper Infralittoral

***Salinity***: Variable (18-40 psu), Low (<18 psu)

***Substratum***: Seagrass, Artificial (for example metal/wood/concrete), Algae, Small boulders, Pebbles, Cobbles

***Water flow rate***: Moderately Strong (1-3 kn), Weak (<1 kn)

***Wave exposure***: sheltered, very sheltered

**Long-term natural fluctuations:** None recorded

## STATUS AND THREATS

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UK BAP Priority Species

**Wildlife and Countryside Act:** Schedule 5, section 9.

**Sources of threats:**

The loss of the substrate would cause removal of the species and recovery would be very low due to the limited distribution of the host species. Similarly removal of their hydroid food source through abrasion or smothering would cause a decline in local populations due to their limited distribution.[1]

**RARITY**

Rare (occurring in 4 of the 10 km squares within the 3 nautical mile limit of British seas), although data is scarce.

**DECLINE**

The population would appear to currently be stable but highly vulnerable to any environmental alterations. The one site loss occurred where conditions were altered by sluice management.[3] Further detailed monitoring would be needed to verify current status due to lack of detailed data.

**THREAT OF DECLINE**

**Score (range 0-16):** 6 (moderate)

**Comments:** The species is most likely sensitive to water quality and loss/decline of food species. There may also be long-term natural fluctuations that confuse the impact of human activities.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 12 (Moderate)

**Comments:** While the biological and ecological conditions necessary for this species are known, the precise factors threatening this species are not fully understood, and techniques for re-introduction are in need of further research. Exact distribution and any apparent decline of this species also needs to be assessed.

**RECOVERY/CONSERVATION GOAL**

Maintain current populations at a stable level, within limits of natural variability, within all current known sites.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**:

- Maintain and, where possible, increase the amount of brackish lagoon habitat and ditches in occupied areas and in areas within the dispersal range of this species, to encourage expansion of existing colonies.
- Promote the implementation of practices to encourage the formation and development of brackish lagoons and sheltered brackish water habitats at suitable sites.
- Continue programme to conserve lagoon habitats under the EC Habitats Directive, to benefit this species.

Saline lagoons are also a priority habitat under the EC Habitats directive and therefore need to be safeguarded irrespective of this species. Cost is part of MPA site management.

**Translocation**: Re-introduction is a potentially useful tool, once all viable sites have been identified and if sites' habitat becomes degraded. However previous re-introduction schemes at the Abbot Hall site have been unsuccessful.[3] Research is needed on methods for potential re-introduction including identification of prey species and ensuring they are included in any (re)introductions. Research: can be combined with other nudibranch species. Two year research project. £10,000 p.a.

**Enforcement**: Enforcement of current protection of both the species and saline lagoons found within the MPA network, along with enforcement of actions in the W&C Act for *T.adspersa*. Appropriate instigation of EIAs for any development is essential to prevent any negative anthropogenic impact such as water regime change, smothering or substrate removal.

**Research**: Further work is needed to identify the full distribution and abundance of the species, along with identification of any former sites that could be viable for re-introduction. Should be a part of translocation studies (above) and more general survey work. No specific costs.

**Monitoring**: Regular monitoring is needed of existing populations to record fluctuations in abundance and to identify potential further threats to the species status. £5,000 p.a. for each of three years initially.

**Wider environment**: *T. adspersa* is most likely sensitive to changes in salinity regime and to contaminents. Continued improvement in water quality is the responsibility of the EA and is not costed here.

**SPECIALISTS**

C.M. Chester - Department of Zoology, University of New Hampshire, USA

**FINAL CONCLUSION**

| **Degree of threat (range 0-16)** 6 (moderate) | **Recovery/conservation potential (range 2-36)** | **Cost** |
|---|---|---|
| | 12 (Moderate) | Translocation: £20,000<br>Research: £15,000<br>Total: £35,000 |

**REFERENCES**

[1] White, N. (2008) Tenellia adspersa. Lagoon sea slug. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12/01/2011]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=4433

[2] Chester, C.M. (1996) The effect of adult nutrition on the reproduction and development of *Tenellia adspersa* (Nordmann, 1845). *Journal of Experimental Marine Biology and Ecology*, **198**, 113-130.

[3] JNCC (2010) UK Priority Species data collation *Tenellia adspersa* (version 2). UK BAP reporting.[on-line]. Available from: http://www.jncc.gov.uk/_speciespages/595.pdf [Accessed on 11/01/2011]

# SHORTFIN MAKO SHARK (MAKO, BLUE POINTER, MACKEREL SHARK, BONITO SHARK) *ISURUS OXYRINCHUS* RAFINESQUE-SCHMALZ, 1810

**Synonyms:** *Isurus oxyrhynchus*

[No image available]

**Taxonomy:**
**Order:** Lamniformes
**Family:** Lamnidae

## DISTRIBUTION

**English waters**: Potentially all of the English territorial seas have suitable habitats, but rarely observed or caught.

**UK Continental shelf**: Found throughout UK and Irish coastal waters although rarely seen off south-east Britain.

**Global:** World-wide distribution in all temperate and tropical seas.

Inshore occurrence

## ECOLOGY

**Description:** A large, spindle-shaped shark with large black eyes, a sharp snout, and large, narrow, hooked teeth with smooth edges. Reported to reach 400 cm total length and considered one of the fastest fish in the ocean. Caudal fin lunate, almost homocercal, lower lobe strongly developed and strong caudal keel. Dark blue/black above, white below. Very small second dorsal and anal fins. The species is pelagic and coastal, caught down to at least 500m depth. *I. oxyrinchus is* highly migratory, makes extensive movements up to 4,542 km and 36% of recaptures are caught at more than 550km from their tagging site. It is a popular game fish, known to leap out of the water when hooked or pursuing prey. This species is also one of the few warm-blooded shark species.

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Ovoviviparous: Aplacental viviparous and oophagous

***Reproductive type***: Gonochoristic

***Biological zone***: Pelagic Zone, mesopelagic, epipelagic, neritic, oceanic

***Salinity***: Full (30-40 psu)

***Substratum***: Not relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** none known

**Past declines and current threats**: Historically mature males were occasionally caught in the western English Channel in the 1960s and 1970s but are now rarely encountered[1], suggesting possible range contraction in the north-east Atlantic. The species is noted to have declined by various amounts in the North Atlantic, with the CPUE data suggesting a decline of 50%[2]. Log book analysis for the North West Atlantic shows *I. oxyrinchus* to have declined by at least 43%[3]. Main threat to species in North East Atlantic waters is as by-catch, or secondary catch (they have high value), in longline fisheries for high value teleosts, including tunas and swordfish.

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UKBAP Priority Species

**IUCN Red list:** Vulnerable (A2abd+3bd+4abd, version 3.1)

**Sources of threats:** By-catch in fisheries targeting pelagic elasmobranchs, tunas, swordfish and marlin; valued game fish species

**RARITY**

Recorded in recent yeras in no more than 8 10km squares within the 3nm limit of British seas (Rare). Historically frequently caught. Rarely caught now and a rare game fish compared to other large sharks.

**DECLINE**

The species is noted to have declined in all areas of exploitation. Although estimates vary, the most commonly quoted figure is a 50% reduction in stock size.

**DEGREE OF THREAT**

**Score (range 1-16):** 10 (Moderate)

**Comments:** Vulnerable to harvesting and sports fishing, as well as a secondary target species in long-line fisheries in international waters. Accidental by-catch. The large size, late maturation and low fecundity makes this species highly vulnerable to over-exploitation.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** Measures to ensure recovery must focus on reducing by-catch of the species and ensuring international protection due to the pelagic nature of the species. Furthermore, it is imperative to continue supporting of minimal/zero fishery quotas to allow stocks to recover. Conservation action should focus on reducing bycatch by introducing new technologies and more selective gear to reduce shark by-catch (for example Shark Defence 'Smart Hook').

**RECOVERY/CONSERVATION GOAL**

Recovery will have been achieved when the species abundance has been restored to historic levels by removal of pressures causing decline. This should have been achieved within 50 years.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management:** (No named fishery but highly valued target and secondary catch.) Introduction of management and quotas for the species and reduction in by-catch. As the main threat to elasmobranchs lies with commercial fisheries all efforts must be made to reduce by catch. Preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK. Full reporting of *I. oxyrinchus* catches for management purposes. Cost absorbed within normal fisheries management activities.

**Translocation**: Not relevant in highly migratory pelagic species

**Enforcement**: Through statutory authorities including fisheries regulation. International enforcement is vital due to high mobility and wide distribution of the species. Particularly, the UK should focus on encouraging EU (or worldwide) introduction of shark reducing gears and the implementation of a total fining ban, i.e. sharks must be landed whole, with all fins attached. Cost absorbed within normal fisheries

management activities.

**Research**: Population demographic information is greatly needed and necessary for producing effective management. Location of nursery and pupping grounds would be beneficial to protect early life stages. Satellite tagging is required to determine the space use and ranges of individual *I. oxyrinchus* as well as to determine potential hot spots (£172,000 p.a. over minimum three years).

**Monitoring**: Species specific reporting of catches and landings from commercial fisheries and recreational/sports anglers. Cost absorbed within normal fisheries management activities.

**Wider environment**: Genetic analysis shows distinct populations between North and the South Atlantic[4]. As this species is highly migratory and pelagic pan-Atlantic management should be implemented to ensure protection across the whole of the population's range. Cost absorbed within normal fisheries management activities.

**SPECIALISTS**

Prof. David W. Sims – The Marine Biological Association of the UK, Plymouth, UK

**FINAL CONCLUSION**

| **Degree of threat (range 1-16)** 10 (Moderate) | **Recovery/conservation potential (range 2-36)** 2 (Low) | **Cost** Satellite tagging study: £172,000 p.a. for each of minimum of three years = £516,000. |
|---|---|---|

**REFERENCES**

[1] Cailliet, G.M., Cavanagh, R.D., Kulka, D.W., Stevens, J.D., Soldo, A., Clo, S., Macias, D., Baum, J., Kohin, S., Duarte, A., Holtzhausen, J.A., Acuña, E., Amorim, A. & Domingo, A. (2004) *Isurus oxyrinchus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 17 December 2010

[2] Stevens, J.D. (2008) The Biology and Ecology of the Shortfin Mako Shark, *Isurus oxyrinchus*. In: *Sharks of the Open Ocean: Biology, Fisheries & Conservation* (eds. Camhi, M.D., Pikitch, E.K., Babcock, E.A.), pp. 445-461. Blackwell Publishing, Oxford, UK.

[3]Cortes, E., Brown, C.A., Beerkircher, L.R. (2007) Relative abundance of pelagic sharks in the North West Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. *Gulf and Caribbean Research*, **19**, 37-52.

[4] Schrey, A.W., Heist, E.J. (2003) Microsatellite analysis of population structure in the shortfin mako (*Isurus oxyrinchus*). *Canadian Journal of Fisheries and Aquatic Sciences*, **60**, 670-675.

# BLUE SHARK (BLUE DOG, BLUE WHALER) *PRIONACE GLAUCA* LINNAEUS, 1758

(Image:Nuno Queiroz)

**Synonyms:**

**Taxonomy:**

**Phylum:** Chordata

**Order:** Carcharhiniformes

**Family:** Carcharhinidae

## DISTRIBUTION

**English waters**: South and western England during summer months

**UK Continental shelf**: Blue sharks undertake north-south migrations in the north-east Atlantic and seasonally visit western British and Irish waters in the summer

**Global:** Worldwide in temperate and tropical oceanic waters

## ECOLOGY

**Description:** A large, slim, graceful blue shark with a long, conical snout, large eyes, and curved triangular upper teeth with saw edges. Maximum reported length is 400 cm total length. The pectorals fins are long and narrow and the caudal fin is heterocercal with the upper lobe being more developed. Dorsally the species is indigo blue with metallic blue flanks and a white ventral surface. The species is highly migratory with complex movement patterns related to reproduction and the distribution of prey. Tagging studies have revealed extensive movements in the Atlantic with numerous trans-Atlantic migrations. This is thought to be the most wide-ranging shark species in the world

***Feeding method***: Predator

***Mobility***: Swimmer

***Development mechanism***: Viviparous, placental

***Reproductive type***: Gonochoristic

***Biological zone***: Pelagic Zone, mesopelagic, epipelagic, neritic, oceanic

***Salinity***: Full (30-40 psu)

***Substratum***: Not relevant

***Water flow rate***: All

***Wave exposure***: All

**Long-term natural fluctuations:** None known

**Past declines and current threats**: There is no stock assessment for this species. However, logbook data suggests that the species has declined by as much as 60% in the North-West Atlantic as well as large declines in males by as much as 80% between the mid-1980s and the early 1990s. However, there was no significant drop in the number of females caught[1]. There are conflicting reports of *P. glauca* stocks being stable and not threatened[2].

**STATUS AND THREATS**

**Directives / convention / statutes:**

**Biodiversity Action Plan:** UKBAP Priority Species

**IUCN Red list:** Near Threatened (Version 3.1)

**Sources of threats:** Targeted and secondary catch/by-catch species in fisheries targeting pelagic elasmobranchs, tunas, swordfish and marlin; valued game fish species.

**RARITY**

No estimates available, however, as a game fish it is reliably chummed and caught in the Irish and Celtic Seas and Western Approaches.

**DECLINE**

Conflicting information as to the severity of the species decline. The IUCN Red List lists the population trend for *P. glauca* as 'Unknown'

**DEGREE OF THREAT**

**Score (range 0-16):** 9 (Moderate)
**Comments:** Vulnerable to commercial and sports fishing, as well as a secondary target species in long-line fisheries in international waters. Accidental by-catch. Although this species is amongst the most fecund elasmobranchs its life history is significantly slower than that of teleosts and is highly susceptible to overfishing. The ecology of *P. glauca* is characterised by large size, late maturation and a low number of offspring.

**RECOVERY/CONSERVATION POTENTIAL**

**Score (range 2-36):** 2 (Low)

**Comments:** This species has not had the dramatic population declines reported in other heavily targeted elasmobranchs, such as porbeagle, however there is little data available. This species represent a good candidate for implementing the proper management now to avoid dangerous declines.

**RECOVERY/CONSERVATION GOAL**

Conservation will have been achieved if numbers remain the same or increase.

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Stock management:** No named fishery but a highly valued target and secondary catch. As the main threat to elasmobranchs lies with commercial fisheries all efforts must be made to reduce by catch. However in terms of conservation it is imperative to introduce species specific management to ensure sustainable exploitation. Conservation action should also focus on reducing by catch by introducing new technologies and more selective gear to reduce shark by-catch (for example Shark Defence 'Smart Hook')Preliminary results on specialised magnetised fishing hooks are showing the potential for reducing by catch and should be considered to be introduced to the UK. Full reporting of *P. glauca* catches for management purposes. Cost absorbed within normal fisheries management activities.

**Translocation:** Not relevant in highly migratory pelagic species.

**Enforcement:** Through statutory authorities including fisheries regulation. International enforcement is vital due to high mobility and wide distribution of the species. Particularly, the UK should focus on promoting EU (or worldwide) introduction of shark reducing gears and the implementation of a total fining ban, i.e. sharks must be landed whole, with all fins attached.

**Research:** Population demographic information is badly needed and necessary for producing effective management. Stock structure and population sizes of blue sharks are not known. Location of nursery and pupping grounds would be beneficial to protect early life stages. Molecular population studies are

required to determine the population structure and the connectivity between ocean basins (£98,000). Satellite tagging is required to determine the range and movement patterns of the species as well as to determine potential hot spots (£172,000 p.a. for each of three years initially)

**Monitoring:** Species specific reporting of catches and landings from commercial fisheries and recreational/sports anglers.

**Wider environment:** The poor management of this globally distributed species is partially down to the poor quality of the data accumulated so far. Tagging studies suggest that the there is a single pan-North Atlantic stock[3], making it essential that management of this species involves all nations catching this species in the North Atlantic.

**SPECIALISTS**

Dr. Nuno Querioz – The Marine Biological Association of the UK, Plymouth, UK & CIBIO, Oporto, Portugal

Prof David W. Sims - The Marine Biological Association of the UK, Plymouth, UK

**FINAL CONCLUSION**

| Degree of threat (range 0-16) | Recovery/Conservation (range 2-36) | Cost |
|---|---|---|
| 9 (Moderate) | 2 (Low) | Population Genetic Study (£98,000); Satellite Tagging (£516,000). |

**REFERENCES**

[1] Nakano, H., Stevens, J.D. (2008) The Biology and Ecology of the Blue Shark, *Prionace glauca*. In: *Sharks of the Open Ocean: Biology, Fisheries & Conservation* (eds. Camhi MD, Pikitch EK, Babcock EA), pp. 445-461. Blackwell Publishing, Oxford, UK.

[2] Stevens, J. (2005) *Prionace glauca*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on **21 December 2010**

[3]Kohler, N.E., Turner, P.A. (2008) Stock structure of the blue shark (*Prionace glauca*) in the North Atlantic Ocean based on tagging data. In: *Sharks of the Open Ocean: Biology, Fisheries & Conservation* (eds. Camhi MD, Pikitch EK, Babcock EA), pp. 445-461. Blackwell Publishing, Oxford, UK.

# RISSO'S DOLPHIN *GRAMPUS GRISEUS* CUVIER, 1812

**Synonyms:** None
**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

## DISTRIBUTION

**English waters**: Very few records exist for English waters, although there are occasional records from the western end of the Channel.

**UK Continental shelf**: Most sightings are from western Scotland, primarily the Outer Hebrides, although there are also sightings around Orkney and Shetland, and to the East of Scotland.

**Global:** Risso's dolphins are widely distributed, inhabiting deep waters of the continental slope and outer shelf from the tropics through to temperate regions in both hemispheres.

## ECOLOGY

**Description:** Risso's dolphins are large, robust dolphins with a very distinctive body shape. They have a blunt, square-ish head (with no discernable beak) and a vertical crease down the front of the melon. They have long flippers, and the dorsal fin is very tall. Males and females appear to be a similar size – ranging up to 3.8m long. Colour patterns change dramatically with age. Young calves are much darker than adults – a dark brownish grey, and get lighter as they mature. Adults range from grey to white and are very heavily scarred. Risso's dolphins have unique dentition – 2-7 pairs of stout, pointed teeth in the front of the lower jaw, and usually none (but sometimes 1-2 pairs) in the upper jaw. The teeth of adults are often very worn.

***Feeding method***: predator

***Development mechanism***: Viviparous (Parental Care)

***Biological zone***: Oceanic

***Substratum***: N/A

***Water flow rate***: N/A

***Mobility***: swimmer

***Reproductive type***: gonochoristic

***Salinity***: Full

***Wave exposure***: N/A

**Long-term natural fluctuations:** Not known

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**
**Bern convention**: Listed
**Bonn convention:** Appendix II
**CITES:** Appendices I & II
**EU Habitats Directive:** Annex II
**IUCN Red list**: Least Concern (Version 3.1)

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats:**

*Aquaculture:* The extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* Risso's dolphins are a widely distributed species and are not constrained to any particular water temperatures. It is likely that they could be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* Like all cetaceans, Risso's dolphins are sensitive to noise disturbance and vessel collisions, which may result from construction. Effects may include habitat displacement, masking of vocalisations, and physiological damage.

*Development:* Like all cetaceans, Risso's dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage.

*Dredging:* The act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect Risso's dolphins. Increased contaminants can lead to increased bioaccumulation in top predators such as Risso's dolphins. Dredging is also a major source of underwater noise, which is likely to have a direct effect on Risso's dolphins.

*Energy generation:* Like all cetaceans, Risso's dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage. Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: Entanglements in fishing nets may be a threat as is overfishing of prey species.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational Vessels*: Harassment from dedicated whale watch vessels and private boats may also occur.

*Waste:* Pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like Risso's dolphins.

**RARITY**

Risso's dolphin are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as 'scarce'.

**DECLINE**

Hunted in Sri Lanka, Japan, the Philippines and Taiwan. Also subject of considerable global bycatch.

**DEGREE OF THREAT**

**Score (range 0-13):** 5

**RECOVERY POTENTIAL**

**Score:** 8

**Comments:**

**RECOVERY/CONSERVATION GOAL**

N/A

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: N/A

**Translocation**: N/A

**Enforcement**: N/A

**Research**: N/A

**Monitoring**: N/A.

**Wider environment**: N/A

## SPECIALISTS

Prof. Phil Hammond (Sea Mammal Research Unit)

Dr Simon Northridge (Sea Mammal Research Unit)

## FINAL CONCLUSION

| Threat of decline (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 5 | 8 | N/A |

## REFERENCES

Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press

Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee

Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press

Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo di Sciara, G., Wade, P. & Pitman, R.L. (2008) *Grampus griseus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 January 2011.

*Distribution/abundance reference:*

Burt, ML., Borchers, DL. & Samarra, F. (2008a) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L., Samarra, F. (2008b) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245

# ATLANTIC WHITE-SIDED DOLPHIN *LAGENORHYNCHUS ACUTUS* GRAY, 1828

**Synonyms:** Lag.
**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

Image credit: Oliver O Cadhla

## DISTRIBUTION

**English waters**: In English waters, most Atlantic white-sided dolphin sightings come from the east coast - in the North Sea. This species is rarely seen in the Channel.

**UK Continental shelf**: Most UK wide sightings come from the north and north west of Britain, in the deeper offshore areas.

**Global:** Confined to temperate and sub-arctic areas of the North Atlantic. More abundant north of 56 North and in deeper waters.

## ECOLOGY

**Description:** The Atlantic white-sided dolphin may grow up to 2.5-3m in length. The head is gently sloping with a short stout beak and straight mouthline. Fins are moderately large and pointed; dorsal fin is tall, falcate and pointed, and located in the middle of the back. The tail stock has deep keels both dorsally and ventrally. Colouration is complex and clearly demarcated; dorsally dark grey-black, laterally light grey and ventrally white. There is a white band on the flanks below the dorsal fin, which runs into a yellow/ochre stripe towards the rear.

***Feeding method***: predator

***Mobility***: swimmer

***Development mechanism***: Viviparous (Parental Care)

***Reproductive type***: gonochoristic

***Biological zone***: Oceanic

***Salinity***: Full

***Substratum***: N/A

***Wave exposure***: N/A

***Water flow rate***: N/A

**Long-term natural fluctuations:** Not known

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**
**Bern convention**: Listed
**Biodiversity Action Plan:** UK BAP Priority Species
**Bonn convention:** Appendix II
**CITES:** Appendices I & II
**EU Habitats Directive:** Annex IV
**IUCN Red list**: Least Concern (Version 3.1)

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats:**

*Aquaculture:* The extended use of acoustic deterrent devices may result in exclusion of animals from certain areas.

*Climate change:* In waters to the west of Scotland, sea surface temperature (SST) was the most important variable relating to occurrence of white-sided dolphins, which occurred more frequently in areas with SST>12.2°C. It is likely that they could also be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* Like all cetaceans, white-sided dolphins are sensitive to noise disturbance and vessel collisions, which may result from construction. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Development:* Like all cetaceans, white-sided dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Dredging:* The act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect white-sided dolphins. Increased contaminants can lead to increased bioaccumulation in top predators such as white-sided dolphins. Dredging is also a major source of underwater noise, which is likely to have a direct effect on white-sided dolphins.

*Energy generation:* Like all cetaceans, white-sided dolphins are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: Entanglements in fishing nets may be a threat as is overfishing of prey species.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational vessels*: Harassment from dedicated whale watch vessels and private boats may also occur.

*Waste:* Pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like white-sided dolphins

**RARITY**

Atlantic white-sided dolphin are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as ‘uncommon’.

**DECLINE**

Some historical hunting for this species has occurred and some dolphins are still taken in Greenland, the Faroe Islands and eastern Canada

**DEGREE OF THREAT**

**Score (range 0-13):** 5

**RECOVERY POTENTIAL**

**Score:** 8

**Comments:**

**RECOVERY/CONSERVATION GOAL**

N/A

## MANAGEMENT REQUIREMENTS AND BUDGET

**Site management**: N/A

**Translocation**: N/A

**Enforcement**: N/A

**Research**: N/A

**Monitoring**: N/A

**Wider environment**: N/A

## SPECIALISTS

Dr Simon Northridge (Sea Mammal Research Unit)

Prof. Phil Hammond (Sea Mammal Research Unit)

## FINAL CONCLUSION

| Threat of decline (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 5 | 8 | N/A |

## REFERENCES

Hammond, P.S., Bearzi, G., Bjørge, A., Forney, K., Karczmarski, L., Kasuya, T., Perrin, W.F., Scott, M.D., Wang, J.Y., Wells, R.S. & Wilson, B. (2008) *Lagenorhynchus acutus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 January 2011.

Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press

Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

Macleod, C.D, Weir, C.R, Pierpoint. C & Harland. E.J. (2007) The habitat preferences of marine mammals west of Scotland (UK). *Journal of the Marine Biological Association of the UK* 87: 157-164

MacLeod, K. (2004) Abundance of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) during summer off northwest Scotland. *Journal of Cetacean Research and Management* 6: 33-40

Reid, J.B., Evans, P.G.H., Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee

Richardson, W. J., Greene Jr., C. R., Malme, C. I., Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press.

*Distribution/abundance reference:*

Burt, ML., Borchers, DL. & Samarra, F. (2008a) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L., Samarra, F. (2008b) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245

# LONG-FINNED PILOT WHALE *GLOBICEPHALA MELAS* TRAILL, 1809

**Synonyms:** Blackfish

**Taxonomy:**
**Phylum:** Chordata
**Order:** Cetacea
**Family:** Delphinidae

Image credit: Sanna Kuningas

## DISTRIBUTION

**English waters**: Isolated sightings in the south-west English Channel.

**UK Continental shelf**: Species occasionally seen in the Moray Firth, Shetland, The Hebrides, and Irish Sea as well as the Western Approaches

**Global:** Temperate and sub-Arctic regions of the North Atlantic, and in the southern oceans. Mainly found in deep waters (200 - 3000m), seaward of, and along the edges of the continental slopes. Occasionally found in coastal waters such as fjords and bays.

## ECOLOGY

**Description:** Long-finned pilot whales have a stocky body which is predominantly black or dark grey in colour. They have a light grey patch on the underside, which extends from the chest to the urogenital area, and a light grey saddle patch behind the dorsal fin. They also have light grey streaks above and behind the eye. Calves are paler than adults, and may appear brownish in colour. The head is bulbous, and the beak is only slightly discernable, if present at all. The flippers are very long (up to 27% of the body length) and have an "elbow" formed by strong angling of the leading edge. The distinctive dorsal fin is situated approximately 1/3 of the way along the back and is falcate with a very wide base. There are 8-13 pairs of teeth in each jaw. There is considerable sexual dimorphism; males (up to 6.7m) are much larger than females (5.7m) In comparison with females, males have much more bulbous heads, larger dorsal fins and thicker tail stocks.

***Feeding method***: Predator

***Development mechanism***: Viviparous (Parental Care)

***Biological zone***: Oceanic

***Substratum***: N/A

***Water flow rate***: N/A

**Long-term natural fluctuations:** Not known

***Mobility***: Swimmer

***Reproductive type***: gonochoristic

***Salinity***: Full

***Wave exposure***: N/A

## STATUS AND THREATS

**Designations (from the UK Designated Taxa list):**

**Bern convention**: Listed

**Biodiversity Action Plan:** UK BAP Priority Species

**Bonn convention:** Appendix II

**CITES:** Appendices I & II

**EU Habitats Directive:** Annex II

**IUCN Red list**: Data Deficient (Version 3.1)

**Wildlife and Countryside Act**: It is illegal to intentionally kill, injure or harass any cetacean in UK waters.

**Sources of threats:**

*Climate change:* Pilot whales are a widely distributed species and not constrained to any particular water temperatures. It is likely that they could be affected indirectly by climate change, however, if the distribution or abundance of important prey species is affected.

*Coastal defence:* Like all cetaceans, pilot whales are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage. Once the construction phase is completed, coastal defence is unlikely to pose a threat to pilot whales as they are typically found further offshore.

*Development:* Like all cetaceans, long-finned pilot whales are sensitive to noise disturbance and vessel collisions Effects may include habitat displacement, masking of vocalisations, and physiological damage

*Dredging:* The act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect pilot whales. Increased contaminants can lead to increased bioaccumulation in top predators such as pilot whales. Dredging is also a major source of underwater noise, which is likely to have a direct effect on pilot whales.

*Development:* Like all cetaceans, pilot whales are sensitive to noise disturbance and vessel collisions. Effects may include habitat displacement, masking of vocalisations, and physiological damage.

*Dredging:* The act of dredging disturbs the sea-floor and increases sedimentation. It may also stir up contaminants settled on the sea-bed. These actions may influence prey distribution and abundance and consequently affect pilot whales. Increased contaminants can lead to increased bioaccumulation in predators such as pilot whales. Dredging is also a major source of underwater noise, which could have a direct effect on pilot whales.

*Energy generation:* Like all cetaceans, pilot whales are sensitive to noise disturbance and vessel collisions Effects may include habitat displacement, masking of vocalisations, and physiological damage. Marine renewable devices may pose a collision threat to marine mammals and may also be a source of noise and electromagnetic field effects.

*Fisheries*: Entanglements in fishing nets may be a threat. Overfishing of important prey species may be a threat. Globally, including areas of the North Eastern Atlantic, dedicated hunts also occur.

*Noise*: Seismic exploration, military sonar, acoustic deterrent devices, engine noise, propeller noise, depth sounders, mineral extraction, construction noise, for example piling activity can all introduce high levels of noise into the marine environment. This can have a wide variety of consequences ranging from habitat exclusion, to masking of vocalisations, to physical damage. Recoverability depends on the type of sound, source level and duration.

*Recreational Vessels*: Harassment from dedicated whale watch vessels, private boats may also occur.

*Waste:* Pollutants, pesticides (organochlorides) and heavy metals accumulate in the tissues of top predators like pilot whales.

**RARITY**

Long-finned pilot whales are a highly mobile species for which the global population size and structure remains unknown. It is therefore very difficult to define its degree of rarity but would most likely be described as ‘scarce’.

**DECLINE**

A fishery for pilot whales is undertaken in the Faroe Islands and Greenland

**DEGREE OF THREAT**

**Score (range 0-13):** 5

**RECOVERY POTENTIAL**

**Score (range 2-36):** 8

**Comments:**

**RECOVERY/CONSERVATION GOAL**

N/A

**MANAGEMENT REQUIREMENTS AND BUDGET**

**Site management**: N/A

**Translocation**: N/A

**Enforcement**: N/A

**Research**: N/A

**Monitoring**: N/A

**Wider environment**:

**SPECIALISTS**

Prof. Phil Hammond (Sea Mammal Research Unit)

Dr Simon Northridge (Sea Mammal Research Unit)

**FINAL CONCLUSION**

| Threat of decline (range 0-13) | Recovery potential (range 2-36) | Cost (2010 prices) |
|---|---|---|
| 5 | 8 | N/A |

**REFERENCES**

Jefferson, T. A., Webber, M. A. & Pitman, R. L. (2008) Marine Mammals of the World. A comprehensive guide to their identification. San Diego, California, Academic Press

Joint Nature Conservation Committee (2007) Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.

Macleod, C.D, Weir, C.R, Pierpoint. C & Harland. E.J. (2007) The habitat preferences of marine mammals west of Scotland (UK). *Journal of the Marine Biological Association of the UK* 87: 157-164

MacLeod, K. (2004) Abundance of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) during summer off northwest Scotland. *Journal of Cetacean Research and Management* 6: 33-40

Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) *Atlas of Cetacean distribution in north-west European waters.* Joint Nature Conservation Committee

Richardson, W. J., Greene Jr., C. R., Malme, C. I. & Thomson, D. H. (1995) *Marine Mammals and Noise.* San Diego, California, Academic Press

Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo di Sciara, G., Wade, P. & Pitman, R.L. (2008) *Globicephala melas*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2009.2. <www.iucnredlist.org>. Downloaded on 06 January 2011

*Distribution/abundance reference:*

Burt, ML., Borchers, DL. & Samarra, F. (2008a) Aerial survey abundance estimates for minke whale and dolphins. Appendix D3.3 of the SCANS-II Final Report, 2008.

Burt, M.L., Borchers, D.L., Samarra, F. (2008b) Design-based abundance estimates from SCANS-II. Appendix D3.4 SCANS-II. Final report to the European Commission under contract LIFE04NAT/GB/000245