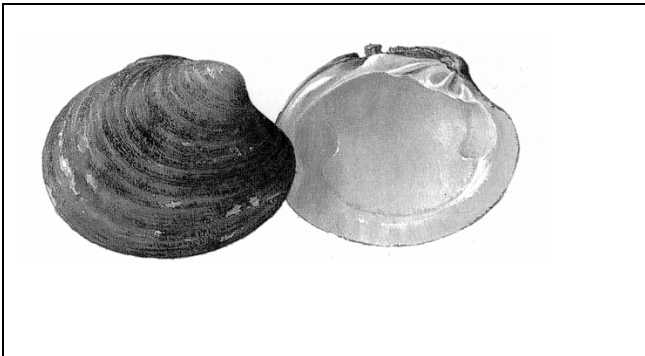


## Nomination

*Arctica islandica*, Ocean quahog



## Geographical extent

OSPAR Region; I,II,III,IV

Biogeographic zones: 6,7,8,9,11,13,14,15,  
Region & Biogeographic zones specified for decline  
and/or threat: II/11

*A.islandica* is found buried in sediment on sandy and muddy sand from the low intertidal down to 400m. The species occurs on both sides of the North Atlantic and the Baltic. Within the OSPAR Maritime Area it has a distribution that extends from Iceland and the Faroes to the Bay of Biscay and includes the Irish Sea and North Sea, but not the wider Atlantic area (OSPAR Region V) (Merill & Ropes, 1969). This is thought to cover about 60% of its distribution area (AquaSense, 2001).

## Application of the Texel-Faial criteria

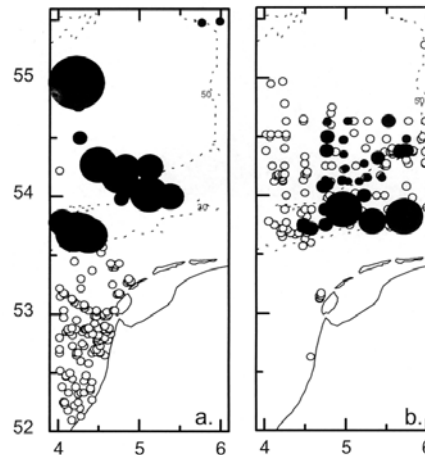
*A.islandica* was nominated for inclusion on the OSPAR list with particular reference to decline, sensitivity with information also provided on threat, and as priority for OSPAR Region II.

### Decline

Information on the distribution and density of *A.islandica* in the North Sea reveals significant changes during the last century. A comparison of historic epifauna data from 1902-1912 collected during ICES routine cruises in the North Sea, with epifauna data from the ICES-Benthos Survey of 1986, shows that *A.islandica* was present at 45% of the stations sampled in the early part of the century compared to between 20-30% of all stations in 1986 (Rumohr *et al.*, 1998). Most of the difference was due to its absence at the shallower sampling stations between 30-50m. There is also information on the density of *A.islandica* in different parts of the North Sea including a detailed study of the south-eastern North Sea suggesting a significant

decrease in relative abundance between 1972-80 and 1990-94 (Figure A).

FIGURE A. A comparison of relative densities of *A.islandica* in the south-eastern North Sea (fig.2.2. from Whitbaard, 1997).



The size of the circles corresponds to the relative abundance. Hollow circles indicate the absence despite sampling (a) abundance as estimated by Noort *et al* (1979-1986) between 1972 and 1980 (b) densities determined from cruises with RV *Aurelia* and RV *Pelagia* between 1990 and 1994.

A study that examined the ecological requirements of *A.islandica* and used these to plot its potential distribution in the Dutch sector of the North Sea, suggested that it could potentially be more widespread. In particular, it was mainly absent from areas of apparently suitable habitat but where fishing intensity was high (AquaSense, 2001).

### Sensitivity

The Ocean Quahog is a long-lived species with a very slow growth rate. Populations of 40-80 years old specimens with a substantial proportion over 100 years old have been observed. The population structure is often skewed with some locations dominated by juveniles and other by adults (AquaSense, 2001). These factors plus evidence of irregular recruitment or low juvenile survival mean that recovery may be very slow in areas where the population numbers become depleted.

Mechanical damage and incidental catch of *A.islandica* from bottom fishing gear is known to damage shells and lead to direct mortality (Piet *et*

*al.*, 1998; Fonds, 1991, Klein & Whitbaard, 1995). This may have a particularly significant effect on sub-adult individuals as shell strength is correlated with size. *Arctica* can live with some shell damage but repeated disturbance may lead to death. After its planktonic larval stage *Arctica* settles on the seabed and is relatively stationary. It is therefore unlikely to move away or burrow rapidly to avoid damage from rapidly approaching beam trawls.

Winter storms can wash *Arctica* ashore (Rees *et al.*, 1977) but as most populations in the North Sea live deep enough, this should not be an issue.

#### *Threat*

The main threat to *A.islandica* in OSPAR Region II is from disturbance to the seabed. This is particularly linked to beam trawling which is known to cause shell damage and direct mortality (e.g., Witbaard & Klein, 1994; Piet *et al.*, 1998). Mortality of *Arctica* caught in a beam trawl has been estimated to be in the range of 74-90% (Fonds, 1991). Klein & Whitbaard (1995) have reported corresponding trends in the scar frequencies of *Arctica* shells and temporal fluctuations in the total engine capacity of the Dutch beam trawl fleet.

Other threats include sand and gravel extraction, where these coincide with the occurrence of *Arctica*, and direct as well as indirect effects of oil and gas extraction including suggested decrease in growth rates around exploration facilities (Witbaard, 1997).

*A.islandica* is recorded at significantly different densities across its range with the highest report in the northern parts of its distribution (up to 100/m<sup>2</sup> compared to 16/m<sup>2</sup> in the northern North Sea and 0.18/m<sup>2</sup> in the south-eastern North Sea (Zatsepin & Filatova, 1961; Thórarinsdóttir & Einarsson, 1994; Witbaard, 1997). It is not clear whether there is any relationship between these figures and the intensity of human activities that pose a threat to this species.

It has been suggested that it is unlikely for *Arctica* to become extinct in the North Sea because of its relatively long pelagic larval stage (which is not affected by fishing activity), together with low catch-efficiency of the beam trawl for this species, and its wide-spread distribution in the North Sea (Witbaard, 1995).

## **Relevant additional considerations**

### *Sufficiency of data*

A comparison of present distribution with historical data is difficult as early records did not produce distributional maps or used a variety of sampling techniques that are not directly comparable. Some comparisons can be made using historic ICES data from the early 1900's (see section on decline). There are more easily comparable data from the last few decades and ongoing studies on this species that should contribute to future assessments of its status.

### *Changes in relation to natural variability*

*A.islandica* is subject to irregular recruitment and irregular survival of recruits, which will lead to natural fluctuations in population numbers and potentially, a long time scale for recovery of depleted populations. The likely contribution of natural variability to the observed declines in density and extent has not been determined.

### *Expert judgement*

Changes in the abundance and the distribution of *A.islandica* in Region II have been documented in recent years as well as by using survey data from the early part of the 20<sup>th</sup> century. This is supplemented by detailed information for particular sectors of the North Sea. The damage caused to this species by bottom fishing activity has also been demonstrated, both in the field and in the laboratory. Nevertheless, without a systematic, repeat sampling programme that covers the whole of the North Sea, an element of expert judgement needs to be applied to assess the severity of the decline of this species throughout Region II.

### *ICES evaluation*

The ICES review of this nomination (ICES, 2002) agreed that the species is impacted by bottom trawling fisheries and acknowledged the decline reported by Witbaard & Klein (1994). The group considered that there is no indication that the entire population is threatened (e.g. there is no decline in the Baltic and the species is common along the Norwegian coast). It should be noted however that some declines have been reported from outside the OSPAR Maritime Area (e.g. east coast of Denmark and the Keel Bight off the Baltic coast of Germany (Pearson *et al.*, 1985; Weigelt, 1991). This species is now only nominated for OSPAR Region II (the North Sea), which should address this concern.

ICES also noted that the failure of recruitment for many years in the North Sea is a possible point of concern and may be a signal, but there are no clues to the cause at the present time. The group suggests that further work is needed on the recruitment biology of this species to find possible explanations (ICES, 2002).

## Threat and link to human activities

*Cross-reference to checklist of human activities in OSPAR MPA Guidelines*

Relevant human activity: Fishing, hunting, harvesting. Category of effect of human activity: Biological – removal of non-target species

Incidental shell damage and direct mortality of *Arctica* has been linked to fishing (specifically beam trawling).

Field observations and laboratory experiments have shown that *A.islandica* is sensitive to damage from beam trawling e.g. a direct mortality of 20% in the tracks of a 12m trawl (Bergman & Van Santbrink, 2000). There is also some time series data on the incidence of shell damage that has been attributed to damage by fishing gear (Witbaard & Klein, 1994). Another potential link is that the decline in *Arctica* between the 1970's and 1990's in the Dutch sector the North Sea (Figure A) coincides with the intensification of beam trawl fisheries in this area (AquaSense, 2001).

## Management considerations

The main cause of damage and direct mortality linked to human activity is the use of bottom fishing gear. Possible management options to reduce the threat to this species therefore include limiting or prohibiting disturbance of the benthos by such activity.

Management of fisheries in the OSPAR Region II falls under the remit of the European Common Fisheries Policy and the fisheries management bodies in Norway. OSPAR will therefore need to advocate management measures through these bodies as well as considering any additional actions that it can take to support appropriate measures introduced by such bodies.

## Further information

*Nominated by:*  
UK, WWF.

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### Useful References:

AquaSense (2001.) Distribution and threats of *Arctica islandica*. *A.islandica* as an example for listing of species and habitats subject to threat or rapid decline. Sponsor: The Netherlands Directorate-General of Public Works and Water Management (RWS), North Sea Directorate. Report No. 1738.

Bergman, M.J.N & van Santbrink, J.W. (2000). Fishing mortality of populations of megafauna in sandy sediments. In: Kaiser, K.J. & de Groot, S.J. (Eds) Effects of fishing on non-target species and habitats. Biological, conservation and socio-economic issues. Blackwell Science, London.

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

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

Klein, R. & Whitbaard, R. (1995). Long-term trends in the effects of beam trawl fishery on the shells of *Arctica islandica* NIOZ Rapport 1995-3.

Merill, A.S. & Ropes, J.W. (1969). The general distribution of the surf clam and ocean quahog. *Proc.Nat.Shellfish.Assn.* 59:40-45.

Pearson, T.H., Josefson, A.B. & Rosenberg, R., (1985). Petersen's benthic stations revisited. I. Is the Kattegat becoming eutrophic? *J.Exp.Mar. Biol.Ecol.* 92:157-206.

Piet, G.J., Rijnsdorp, A.D., Bergman, M.J.N., van Santbrink, J.W., Craeymeersch, J.A. & Buys, (1998). A quantitative evaluation of the impact of beamtrawl fishery on benthic fauna in the southern North Sea. In Bergman *et al* (Eds) The distribution of benthic macrofauna in the Dutch sector of the North Sea in relation to the micro distribution of beam trawling. Final report. 1998. BEON Rapport No. 98-2:5-15.

Rees, E.I.S., Nicholaidou, A., & Laskaridou, P. (1977). The effects of storms on the dynamics of

shallow water benthic associations. Pp 465-474. In: Keegan *et al* (Eds) *The Biology of Benthic Organisms*. Pergamonn Press, Oxford.

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.

Thórarinsdóttir, G.G. & Einarsson, S.T. (1994). Distribution, abundance, population structure, meat yield, size of sexual maturity and sex ratio of the ocean quahog, *Arctica islandica* in Icelandic waters. ICES statutory meeting, St.Johns Canada. Shellfish Committee C. M.1994/k:39;7pp.

Weigelt, M. (1991). Short and long-term changes in the benthic community of the deeper parts of Kiel Bay (Western Baltic) due to oxygen depletion and eutrophication. *Meeresforsch.* 33:197-224.

Witbaard, R. (1997). *Tree of the Sea*. The use of the internal growth lines in the shell of *Arctica islandica* (Bivalvia, Mollusca) for the retrospective assessment of marine environmental change. Thesis. University of Groningen. 149pp.

Witbaard & Klein (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.

Zatsepin, V.I. & Filatova, Z.A. (1961). The bivalve mollusc *Cyprina islandica* (L). Its geographic distribution and role in the communities of benthic fauna. *Trans.Instit. Oceanology*. XLVI:2-24.