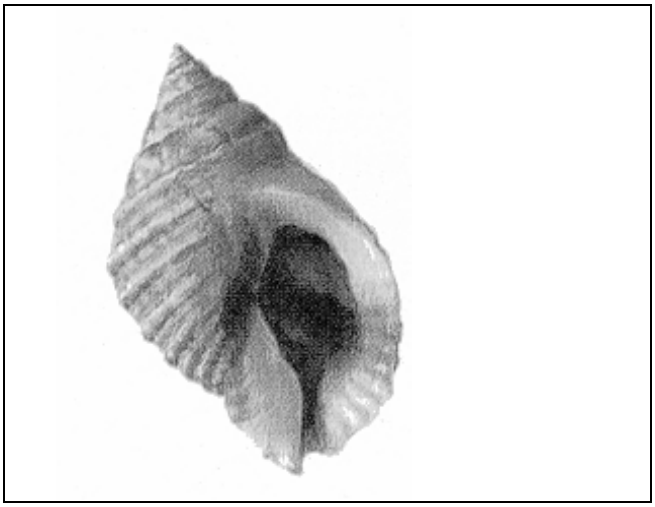
Nomination

Nucella lapillus,
Dog Whelk



Geographical extent

OSPAR Region; All
OSPAR Biogeographic zones: 4,6,7,9,11,14
Region & Biogeographic zones specified for decline and/or threat: II,III,IV

N.lapillus is a gastropod mollusc that is found on wave exposed to sheltered rocky shores. It is widely distributed on both sides of the North Atlantic where there is suitable habitat. In the OSPAR Maritime Area, its distribution extends from Iceland in the north, to Portugal in the south and includes Irish Sea and North Sea coasts.

Application of the Texel-Faial criteria

N.lapillus had two nominations for inclusion on the OSPAR list. The criteria in common were decline and sensitivity, with information also provided on threat.

Decline

Dog whelk populations are known to have declined in certain locations throughout their range in the OSPAR Maritime Areas. They used to be very common on the Belgium coast but disappeared during the end of the 1970s and early 1980s (Kerckhof, 1988). In the UK, local declines have been reported by Bryan *et al*., (1986) in south-west England.

The decline has been linked to contamination effects of tributyltin (TBT) compounds used in antifouling paints (see section on threats). Evans *et al.*, (1996) have suggested, for example, that the extinction of populations in Tarbert Harbour, western Scotland, the Clyde Sea, Lerwick in Shetland, the Solent, Channel Islands, Isle of Wight and east coast of the North Sea were probably due to TBT contamination. Since the introduction of a ban on use of TBT on small craft, some populations have recovered (e.g. Evans *et al.,* 1994;1995; Moore *et al.*, 2000). Nevertheless ten years after the introduction of restrictions on the use of TBT, biological effects are still evident many areas in OSPAR Region III, although often at a lower levels than some years previously (Harding *et al.,* 1998 in OSPAR 2000). Areas frequented by large vessels (which are not covered by the ban) such as such as Cork Harbour in Ireland, Sullom Voe in Scotland, and Milford Haven in south Wales, are still 'hot spots' of TBT contamination (e.g. Minchin *et al*., 1996; Moore *et al.*, 1995; Morgan *et al*., 2000).

Sensitivity

An assessment of the sensitivity of *N.lapillus,* based on a literature review by the Marine Life Information Network for Britain & Ireland (MarLIN), lists this species as being highly sensitive to synthetic compound contamination, changes in nutrient levels, and substratum loss (Tyler-Walters, 2002).

The most extensively studied sensitivity is in relation to TBT, which is known to cause an irreversible condition known as 'imposex' where female whelks develop male characteristics. The effects can be seen from very low concentrations. Imposex in *N. lapillus* is fully developed at ambient TBT concentrations of 1-2 ng/l and at 3ng/l or more females are fully sterilised (Gibbs & Bryan, 1996). The percentage of females in a locality falls with increasing degree of imposex which puts additional pressure on the population (Bryan *et al* 1986).

Sensitivity to changes in nutrient levels have been described by Gibbs *et al.* (1999) who reported a massive kill of *N. lapillus* in Bude Bay, north Cornwall, and suggested that the mass mortalities may have been caused by eutrophication and summer algal blooms linked to a new sewage outfall in the area.

N.lapillus has also been shown to be severely affected by toxic algal blooms. These have been reported from South West Ireland following a bloom of *Gyrodinium aureolum* in 1979 (Cross & Southgate, 1980), a bloom of *Chrysochromulina polylepis* in the Kattegat, Skagerrak and Norwegian coast of the North Sea in 1988 (Underdal *et al.,* 1989), and up to 98-99% mortality of dog whelks

exposed to a toxic bloom of *Chrysochromulina polylepis* in Gullmar Fjord, west Sweden in June 1988 (Robertson, 1991).

Dogwhelks do not have planktonic larvae. Instead the juvenile emerge from egg capsules laid on the shore. This limits possibilities for recruitment once populations have become locally extinct. In these situations recovery is dependant on recolonisation, and may take many years due to their poor dispersal capability.

Threat

In the OSPAR Maritime Area, the main threat to *N.lapillus* is from pollution. Imposex in dog whelks, which has been linked to exposure to TBT from antifouling paints, is one of the most widely reported threats. It was first recognised in *N.lapillus* by Blaber (1970) in dog whelks collected from the south coast of England. Significant changes were also noted between its incidence in the late 1960's and 1985, with the incidence of imposex rising from 5% and less than 0.1% at two sites studied, to 67% and 48% respectively. The effects of TBT have since been observed in dog whelks from the coastal areas of all countries bordering the North Sea, the Atlantic coast of Spain and Portugal, as well as in the more remote northern shores around Iceland (OSPAR 2000; Svavarsson & Skarphéoinsdóttir, 1995; Skarphédinsdóttir *et al.,* 1996). In Portugal the contamination is still increasing.

It has been suggested that the high levels of imposex in dogwhelks around marine European shipping and fishing ports are unlikely to decline until TBT is banned on all vessels (Minchin *et al.,* 1995). Even then, there is the possibility of a continued contamination as TBT is persistent in sediments (Bryan & Gibbs, 1991; Hawkins *et al.* 1994).

Relevant additional considerations

Sufficiency of data

There is a considerable body of information on dog whelk populations as well as changes in population numbers following the discovery of a link between TBT contamination and imposex. These studies continue, and have shown recovery of the populations in some areas as well as no improvement in other areas.

Changes in relation to natural variability

The significant decline in dog whelk populations reported in the last two decades have been linked to TBT contamination rather than the result of natural fluctuations in population numbers. A reduction in recruitment caused by a lowered reproductive capacity, therefore appears to be responsible for the decline in *N.lapillus* numbers.

Expert judgement

A link between decline in dog whelk populations, imposex, and TBT has been demonstrated clearly, both in the field and in the laboratory. There have also been documented declines in populations following oil spills and toxic blooms. Consideration of the case on the basis of expert judgement, has therefore not been necessary.

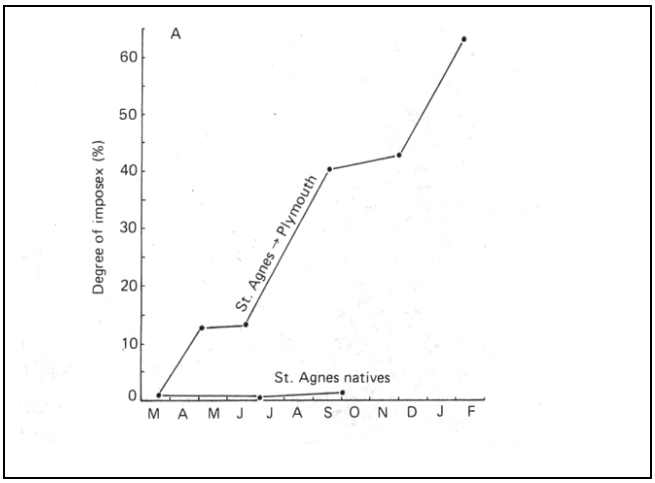
Threat and link to human activities

Cross-reference to checklist of human activities in OSPAR MPA Guidelines
Relevant human activities: Shipping and navigation; tourism & recreational activities; *Category of effect of human activity:* Chemical – synthetic compound contamination.

A direct link has been made between the decline in dog whelk populations and the concentration of TBT in surrounding waters. There is evidence from field observations and laboratory studies that organotins originating from the TBT compounds used in antifouling points cause imposex in dogwhelks, even at very low concentrations (e.g. Bryan *et al.,* 1986; Harding *et al.,* 1988; Gibbs *et al.,* 1991; Ruis *et al.,* 1998).

Further evidence for the relationship between imposex and TBT comes from transplantation experiments where dogwhelks were moved to areas where there was a high seawater concentration of tin. This resulted in a gradual increase in the degree of imposex (Figure A).
Oil pollution on rocky shores, and subsequent clean up operations are another potential threat to dog whelk populations (e.g. IPIECA, 1995). Declines have been observed following contamination of rocky shore with varying times for recovery depending on factors such as the severity of the spill, type of contamination, exposure of the shore, weather conditions and status before the incident (e.g. Bryan, 1968; Baker, 1976).

FIGURE A. Effect of transplantation on degree of imposex for dogwhelks moved from a relatively uncontaminated area (St. Agnes) to a contaminated area (Plymouth)
(from Bryan *et al.,* 1986)



Management considerations

TBT contamination has been determined as a major factor in the decline of dog whelk populations. The use of TBT based paints on vessels under 25m was first banned by France in 1982 and there is now a similar ban throughout the North Sea. In Portugal it was banned in 1993.

A more extensive ban is being promoted by the International Maritime Organisation (IMO) who adopted 'The International Convention on the Control of Harmful Anti-fouling Systems on Ships' on 5 October 2001. The Convention has still to come into force however, the IMO Assembly, also agreed to an effective implementation date of 1 January 2003 for a ban on the application of organotin-based systems.

Further information

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