Blue-rayed limpet (*Patella pellucida*)

MarLIN – Marine Life Information Network
Biology and Sensitivity Key Information Review

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The Marine Life Information Network, Marine Biological Association of the United Kingdom.

Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/species/detail/1298]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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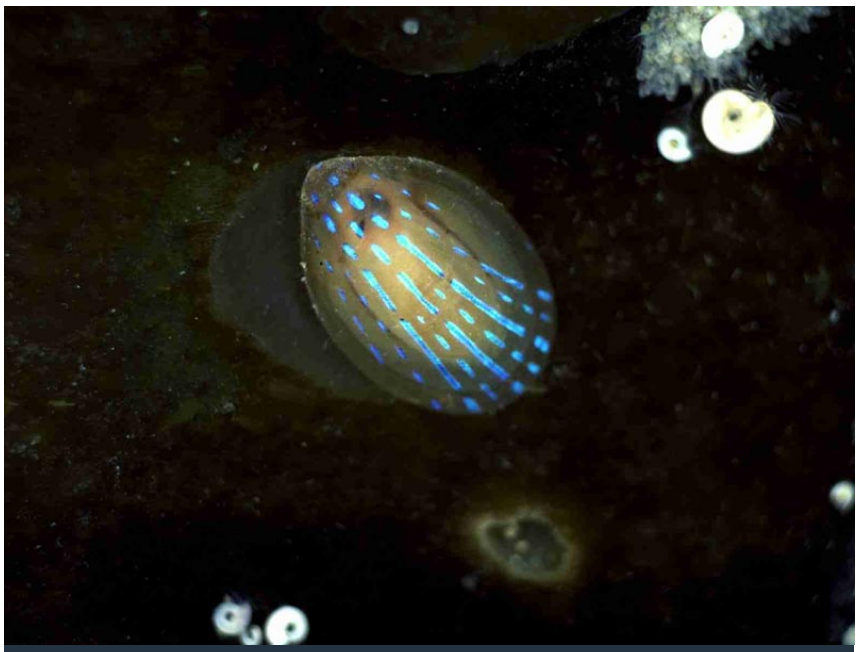

***Patella pellucida* on kelp blade.**
Photographer: John Bishop

See online review for distribution map

Distribution data supplied by the Ocean Biogeographic Information System (OBIS). To interrogate UK data visit the NBN Atlas.

Researched by	Dr Harvey Tyler-Walters	**Refereed by**	Dr David McGrath
Authority	Linnaeus, 1758		
Other common names	-	**Synonyms**	*Patina laevis* , *Patina pellucida* Linnaeus, 1758, *Helcion pellucidum* , *Helcion laevis*

Summary

Description

Smooth, translucent brownish yellow - horn coloured shell, up to 2 cm in length and much smaller than the common limpet (*Patella* spp.). Oval in outline in the shape of a depressed cone with the apex at the anterior end. The shell is overlayed by 2-8, characteristic, broken (dashed) blue-green rays, although these are absent from the juvenile shell until they reach 1.1mm in length.

Recorded distribution in Britain and Ireland

Recorded on all coasts of Britain and Ireland, except the coast surrounding the Wash.

Global distribution

Occurs in Iceland and from north Norway to south Portugal. It is found on the west coasts of Denmark, and Sweden south to Oresund. However it is absent from the Baltic sea and the east coasts of Denmark, Belgium and Holland.

Habitat

Found on the blade of laminarians or fronds of *Fucus serratus*, *Mastocarpus stellatus* or *Himanthalia elongata* from the lower eulittoral to a depth of ca 27 m. Newly settled juveniles found on encrusting coralline algae in wave exposed conditions in the lower eulittoral. It prefers areas of

considerable water flow and is not normally found in areas of low flow, siltation or freshwater influence.

Depth range

ca +1 m - ca 25 m

Identifying features

- Small, translucent, brownish yellow - horn coloured depressed shell.
- Characteristic dashed blue rays radiating from apex of shell.
- Foot and body cream but browner on head and edge of foot
- No pallial gills on edge of mantle at front of body

Additional information

Weber *et al.* (1997) suggested that *Patella pellucida* (as *Helcion pellucidum*) was genetically distinct from its South African con-geners and may have arisen independently. Studies of morphological features (Ridgeway *et al.*, 1998) and molecular characteristics (Koufopanou *et al.*, 1999) suggested that *Helcion pelludicum* belonged to the genus *Patella* and the species name was restored to *Patella pellucida* (Linnaeus, 1758).

Specimens found in cavities in holdfasts develop into the *laevis* form (*Patella pellucida* var. *laevis*). The *laevis* form has a taller, more robust opaque shell, ledged in profile, with blue rays that alternate with reddish brown rays. The most noticeable ledge of the shell indicates the size at which the individual enters the holdfast.

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Mollusca	Snails, slugs, mussels, cockles, clams & squid
Class	Gastropoda	Snails, slugs & sea butterflies
Family	Patellidae	
Genus	Patella	
Authority	Linnaeus, 1758	
Recent Synonyms	Patina laevis Patina pellucida Linnaeus, 1758Helcion pellucidum Helcion laevis	

Biology

Typical abundance	Moderate density
Male size range	3 - 12mm
Male size at maturity	5mm
Female size range	5mm
Female size at maturity	
Growth form	
Growth rate	1-2mm/month
Body flexibility	Low (10-45 degrees)
Mobility	Crawler / Walker, Creeper
Characteristic feeding method	Grazer
Diet/food source	Herbivore
Typically feeds on	*%Laminaria hyperborea%*, *%Laminaria digitata%*, *%Alaria esculenta%*, *%Saccorhiza polyschides%*, *%Fucus serratus%*, and when young *%Himanthalia elongata%* and *%Mastocarpus stellatus%*.
Sociability	No information
Environmental position	Epifaunal
Dependency	Not relevant.
Supports	Not relevant
Is the species harmful?	No No text entered

Biology information

Growth is rapid in summer, autumn and winter but slow in winter. Population studies suggest that few individuals survive to their second year (Fretter & Graham 1976; Graham & Fretter 1947). Vahl (1971) noted growth irregularities or 'checks' in the shell of specimens from Norway, which he suggested were caused by the interrupted growth of the mantle edge when the adult was retracted in response to severe wave action during heavy storms.

Adults can recolonize vacant fronds (McGrath, 1997), perhaps via the surface of the substratum or by mucus rafting, and if dislodged adults can right themselves and be carried to neighbouring plants by currents by secreting a mucus 'sail' (Vahl 1983).

Kain & Svendsen (1969) provide pictures of *Patella pellucida* on blades of *Laminaria hyperborea* together with the cavities grazed in the fronds and in holdfasts. Kain & Svendsen (1969) noted that in Norwegian populations severe grazing by *Patella pellucida* may result in perforation of blades by autumn (before new blades develop) and in some cases grazing where the blade and stipe meet may 'cut off' the blade.

Habitat preferences

Physiographic preferences	Open coast, Strait / sound, Sea loch / Sea lough, Open coast, Sea loch / Sea lough, Strait / sound
Biological zone preferences	Lower eulittoral, Sublittoral fringe, Upper infralittoral, Lower eulittoral, Sublittoral fringe, Upper infralittoral
Substratum / habitat preferences	Macroalgae, Macroalgae
Tidal strength preferences	Moderately Strong 1 to 3 knots (0.5-1.5 m/sec.), Moderately Strong 1 to 3 knots (0.5-1.5 m/sec.)
Wave exposure preferences	Exposed, Moderately exposed, Exposed, Moderately exposed
Salinity preferences	Full (30-40 psu), Full (30-40 psu)
Depth range	ca +1 m - ca 25 m
Other preferences	Occurs at 15 psu in Norway.
Migration Pattern	

Habitat Information

Studies in south-east Ireland demonstrated that the distribution of *Patella pellucida* on the shore depended on its size and age. McGrath (1992) noted that spat settled with a larval shell attached of ca 0.66 mm. Newly settled spat have a preference for lower shore *Lithothamnia* (encrusting coralline algae) reaching densities as high as 400 per sq. dm in February. As they grow juveniles (up to 1.8 mm) migrate to *Mastocarpus stellatus*. The juveniles recruit to Laminarians at about 1.8 mm but are found mainly at the tips of the fronds. Juveniles up to 3 mm may also be found on the receptacles of *Himanthalia elongata*. Dense populations may be found on *Fucus serratus*, *Alaria esculenta*, *Palmaria palmata* and *Halidrys siliquosa* (McGrath, 1992).

Adults show a seasonal migration on *Laminaria hyperborea*, migrating down to the stipe before the old blade tissue is discarded in spring to early summer. Larger individuals prefer the lower wave exposure of deeper water (Warburton 1976).

Approximately one third of the population examined by Graham & Fretter (1947) were the *laevis* form. However, Kain & Svendsen (1969) did not find any specimens in Laminarian holdfasts in Norwegian populations and the *laevis* form may be absent in Norway.

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	No information
Generation time	<1 year

Age at maturity	circa 6 months (5mm in size)
Season	Insufficient information
Life span	1-2 years

Larval characteristics

Larval/propagule type	Veliger
Larval/juvenile development	Planktotrophic
Duration of larval stage	11-30 days
Larval dispersal potential	10 -100 m
Larval settlement period	Insufficient information

Life history information

Few individuals survive into their second years. Most specimens > 1 year old are found in holdfasts as the *laevis* form. Breeding occurs throughout the year with a peak in spring. Fertilization is external and eggs are shed singly. The eggs are greenish, ca 0.16 mm across and covered with a gelatinous coat giving an overall diameter of ca 0.32 mm (Fretter & Graham, 1976; Lebour, 1937). Eggs hatch into a 200 micrometer tall trochophore that develops into a 160-180 micrometer veliger larva (Lebour, 1937). Fretter & Graham (1947) state that planktonic life is 'a few weeks'. There is little information on dispersal range, however, 10-100m is assumed given the depth of adult distribution and its settlement on lower shore at least. McGrath (1992) examined recruitment in south east Ireland and reported that newly settled spat have a preference for lower shore Lithothamnia (encrusting corallines). As they grow juveniles (up to 1.8 mm) migrate to *Mastocarpus stellatus*. The juveniles recruit to Laminarians at about 1.8 mm but are found mainly at the tips of the fronds. Juveniles up to 3mm may also be found on the receptacles of *Himanthalia elongata*. McGrath (1992) suggested that larvae settle on Lithothamina and migrate to *Mastocarpus stellatus* as they grow and finally to *Laminaria* sp. via *Himanthalia elongata*.

Sensitivity review

This MarLIN sensitivity assessment has been superseded by the MarESA approach to sensitivity assessment. MarLIN assessments used an approach that has now been modified to reflect the most recent conservation imperatives and terminology and are due to be updated by 2016/17.

Physical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Substratum Loss	High	Very high	Low	Moderate

Loss of the substratum, this species food plants, will involve removal of the adults themselves. Adults may be lost with plants during storms or swept off the fronds. However, McGrath (1997) demonstrated that *Patella pellucida* can rapidly recolonize available plants with as little as three days from adjacent plants. It is likely that recolonization from adjacent populations would be fairly rapid.

Smothering	Intermediate	Very high	Low	Low

Smothering by 5 cm of material is unlikely to affect adults on the fronds of kelps. The *laevis* form in holdfasts may be more intolerant. Similarly, the typical food species have a low intolerance to smothering. Smothering is likely to interfere with the settlement of larvae which, if lost, may significantly reduce the population of this near annual species.

Increase in suspended sediment	Intermediate	Very high	Low	Low

Patella pellucida is not found in areas of low water flow and siltation. Increased levels of suspended sediment are likely to interfere with feeding. However, its typical food species has a low intolerance to siltation. Larvae may be more intolerant at settlement which, if lost, may significantly reduce the population of this near annual species.

Decrease in suspended sediment

Dessication	Intermediate	Very high	Low	Low

Subtidal adults are unlikely to be affected except at extreme low tides. Increased desiccation is likely to affect the juvenile stages found in the lower eulittoral and adults on *Fucus serratus*. These are likely to be intolerant of an increased desiccation equivalent to moving from the lower to mid eulittoral for a year. Although the limpet can close tightly to macroalgae and creates pits and scars like its littoral co-familial *Patella* spp. the typical food plants (its substratum) are likely to be intolerant of increased desiccation and increased competition from other algal species more tolerant of desiccation. However, it is likely that recolonization from neighbouring populations would be rapid once the original conditions returned.

Increase in emergence regime	Low	Immediate	Not sensitive	Low

Decreased emergence is likely to increase the distribution of kelps up the shore and therefore *Patella pellucida*. Increasing emergence may reduce the upper extent of the kelp species, however, *Patella pellucida* could move to alternative food species such as *Fucus serratus*.

Decrease in emergence regime

Increase in water flow rate	Intermediate	Very high	Low	Moderate

The distribution of *Patella pellucida* is dependent on water flow rate. Studies in Lough Ine

rapids (Ebling *et al*. 1948) found that *Patella pellucida* was very scarce on *Saccorhiza polyschides* in weak currents, plentiful in moderately strong currents (0.6-1.5 m/s) and scarce in strong currents (>1.5 m/s). Warburton (1976) demonstrated that large individuals could resist currents up to 0.9-1.3 m/s and smaller individuals resisted stronger currents before being swept off the fronds of kelp. Adults aligned themselves with the current flow above 0.5m/s and currents above 1.0- 1.4 m/s interfered with feeding and normal behaviour. Larger individuals are found in higher abundance in deeper water although Fretter & Graham (1994) suggested that larger individuals migrate to holdfasts. Therefore, it is likely that this species would be intolerant of either a decrease or increase in the water flow rate, equivalent to the benchmark, outside its habitat preferences.

Decrease in water flow rate

Increase in temperature	Intermediate	Very high	Low

The wide distribution of this species suggests that it is tolerant of a wide range of temperatures. However, no information on the temperature tolerance of this species was found. It is likely that its food species are intolerant of increases in temperature consistent with the benchmark, so an intermediate intolerance has been recorded.

Decrease in temperature

Increase in turbidity	Intermediate	Very high	Low

Turbidity resulting from suspended sediment may interfere with feeding as above. Reduced light penetration will reduce the extent of the food species (kelps).

Decrease in turbidity

Increase in wave exposure	Low	Immediate	Not sensitive

This species prefers exposed to moderately exposed shores and it is likely to be intolerant of a change in wave exposure. The available food kelp species will change with exposure and increasing exposure may result in loss of older plants , especially those whose holdfasts had been weakened by *Patella pellucida* feeding, and adults of this species.

Decrease in wave exposure

Noise	Tolerant	Not relevant	Not sensitive	Moderate

There is no known effect of noise on this species or its prey species.

Visual Presence	Tolerant	Not relevant	Not sensitive	Moderate

Although this species probably displays phototaxis there is no evidence of disturbance due to visual stimuli.

Abrasion & physical disturbance	Intermediate	Very high	Low	Low

The shell in this species is relatively thin when compared with other limpets. Abrasion at the benchmark level is likely to knock some individuals off its food plant and crush or fracture the shell of others. A passing scallop dredge is likely to remove its substratum, i.e. kelps resulting in substratum loss as above. Therefore, a single scallop dredge will remove or damage a proportion of the kelp canopy and hence a proportion of *Patella pellucida*. Therefore, intolerance has been assessed as intermediate.

Displacement	Tolerant	Not relevant	Not sensitive	Moderate

It is presumed that individuals of this species are periodically swept off their food plant.

Although some individuals may be lost to deep water, *Patella pellucida* can re-orientate itself (as it will land upside down, foot upper most) and move to other plants using a mucus 'sail', secreted by the glands of the foot (Vahl 1983). McGrath (1997) demonstrated that plants cleared of *Patella pellucida* are rapidly recolonized by adults.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination	Intermediate	Very high	Low	Low

Gastropod molluscs are known to be sensitive to endocrine disruption from synthetic chemicals such as tri-butyl tin. However no information on the specific effects of tri-butyl tin on *Patella pellucida* was found. Hoare & Hiscock (1974) reported that *Patella pellucida* was excluded form Amlwch Bay, Anglesey by the presence of acidified, halogenated effluent; only eight specimens being found in Amlwch harbour where the silt levels probably reduced the toxicity of chlorine. *Patella pellucida* probably has an intermediate intolerance to, at least, this form of pollution.

Heavy metal contamination Not relevant

Bryan (1984) suggested that gastropods are rather tolerant of heavy metals. Crompton (1997) states that the following concentrations of heavy metals have caused mortalities in gastropods after 4-14days (short term); Cu (0.01-0.1 mg/l), Pb (0.1-1mg/l) , Zn (1-10mg/l), Cr and Ni (10-100mg/l). However, no data for this species was found.

Hydrocarbon contamination Not relevant

Insufficient information

Radionuclide contamination Not relevant

Insufficient information

Changes in nutrient levels	Intermediate	Very high	Low	

Increased nutrients are likely to increase epiphyte and food plant growth, potentially increasing the availability of food for *Patella pellucida*. However, significant increases in nutrient levels (eutrophication), resulting in excessive growth of epiphytes and phytoplankton may have a detrimental effect on this species food plants and, therefore the population of *Patella pellucida*.

Increase in salinity	Intermediate	Very high	Low	Low

Patella pellucida is found in full salinity but not in areas of freshwater influence. Juveniles settle on the lower eulittoral and are likely to be subject to freshwater runoff and rainfall at low tide. However, adults are primarily subtidal and likely to be intolerant of long term reduction in salinity outlined in the benchmark.

Decrease in salinity

Changes in oxygenation	Intermediate	Very high	Low

Oxygen concentrations at the level of the benchmark thought to likely to cause effects on marine organisms. In areas of exposure and moderately strong current flow it is unlikely to experience low oxygen levels. Therefore, it is likely to be intolerant of any spillage or activity that reduced the dissolved oxygen concentration to the level of the benchmark

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites				Not relevant

No microbial pathogens were reported in the literature.

Introduction of non-native species	Not relevant	Not relevant	Not relevant	Not relevant

No known alien or non-native species compete with *Patella pellucida*.

Extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant

This species is not subject to extraction.

Extraction of other species	High	Very high	Low	Moderate

Kelp species are harvested in Scotland, Isle of Man and Ireland. Extraction of kelp is equivalent to removal of substratum (see above) in *Patella pellucida*.

Additional information

Importance review

Policy/legislation

- no data -

Status

National (GB) importance	-	**Global red list (IUCN) category**	-

Non-native

Native	-		
Origin	-	**Date Arrived**	Not relevant

Importance information

Patella pellucida is an important and characteristic herbivore on Laminarians (kelps). It forms distinct pits in the surface of the blade or stipe. The *laevis* form feeds within the holdfast creating distinct cavities. Photographic images of *Patella pellucida* on *Laminaria hyperborea* are shown in Kain & Svendsen (1969). Its feeding, especially in the holdfast weakens the plant and is associated with the loss of adult plants from the kelp forest due to wave or storm action.

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