Common limpet (*Patella vulgata*)

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.

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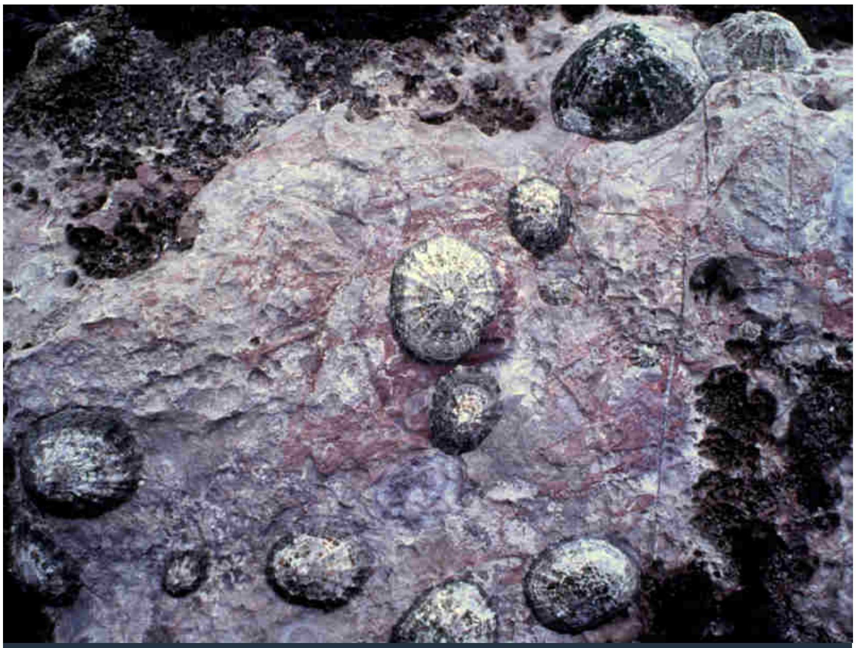

Patella vulgata on rock.
Photographer: Keith Hiscock
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See online review for distribution map

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

Researched by	Jacqueline Hill	**Refereed by**	Prof. Steve J. Hawkins
Authority	Linnaeus, 1758		
Other common names	-	**Synonyms**	-

Summary

Description

The conical shell of *Patella vulgata* is up to 6 cm long with radiating ridges and the apex central or slightly anterior. Individuals from the high shore generally have a taller shell and smaller shell length when compared to juveniles and low shore animals. The outer surface of the shell is greyish white or ashen, sometimes with a yellow tint, and has coarse radiating ridges and well-marked growth lines. The inner surface is smooth and greenish-grey in colour. The sole of the foot is yellowish, dull orange or brown with a grey or greenish tinge. The mantle skirt is fringed with translucent pallial tentacles arranged in three series of different lengths, internal to which lies a complete circlet of pallial gills.

Recorded distribution in Britain and Ireland

Found on all British and Irish coasts wherever there is a suitable hard substratum.

Global distribution

Distributed from north Norway to the Mediterranean.

Habitat

Patella vulgata is found wherever there is substratum firm enough for its attachment on rocks, stones and in rock pools, from the high shore to the sublittoral fringe. It is abundant on all rocky shores of all degrees of wave exposure although the highest densities of *Patella vulgata* coincide with wave exposed conditions. The species is usually not abundant on shores with a dense growth of seaweed. *Patella vulgata* extends into estuaries, surviving salinities down to about 20 psu.

Depth range
Intertidal

Identifying features

- Shell with irregular radiating ribs; apex central or slightly anterior; inner surfaces grey-green.
- Size up to 6 cm long x 5 cm wide x 3 cm high.
- Mantle skirt fringed with translucent pallial tentacles arranged in three series of different lengths.
- Operculum absent.
- The sole of the foot is yellowish, dull orange or brown with a grey or greenish tinge.

Additional information

No text entered

Listed by

Further information sources

Search on:

NBN WoRMS

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	-	

Biology

Typical abundance	High density
Male size range	<60mm
Male size at maturity	16-25mm
Female size range	Small-medium(3-10cm)
Female size at maturity	
Growth form	
Growth rate	2mm/month
Body flexibility	
Mobility	
Characteristic feeding method	Active suspension feeder
Diet/food source	
Typically feeds on	Wide range of micro-organisms and algae, including *Fucus* spp., germlings, other algal sporelings and encrusting red algae.
Sociability	
Environmental position	Epifaunal
Dependency	Independent.
Supports	Substratum several species: the peritrich protozoon, *Urceolaria patellae*; the shell boring polychaete *Polydora ciliata* and the sponge *Cliona celata*.
Is the species harmful?	No Edible, formerly eaten extensively as shown by stone, bronze and ironage middens. Still eaten until relatively recently, especially during famine and hard times.

Biology information

Female size at maturity

The species is protandric. Females are generally larger although small females are occasionally found. (Orton *et al*., 1956).

Growth rate

Value given is the maximum rate of increase in shell length observed in the first year of growth by

Blackmore (1969). From the findings of many workers however, it is clear that growth fluctuates from year to year and from place to place to such an extent it is difficult to make general statements. Growth depends on temperature and is greatest in summer, least in winter. Growth also varies between microhabitats being greater under fucoids (17.1 mm per year) than on barnacles (14.7 mm per year) where locomotion and grazing are difficult. Growth rates and longevity are inversely related. Animals under fucoids grow rapidly and may live only 2-3 years whereas those on bare rock, with little food, grow slowly but may live 15-16 years. Limpets move about when the tide is in and the sea is not too rough. Animals are more active when submerged due to the lower energetic cost of moving on mucus when under water. Under thick fucoid covering or when conditions are damp, individuals may be found on the move after the tide has fallen.

Habitat preferences

Physiographic preferences	Open coast, Strait / sound, Estuary, Enclosed coast / Embayment
Biological zone preferences	Lower eulittoral, Mid eulittoral, Upper eulittoral
Substratum / habitat preferences	Artificial (man-made), Bedrock, Cobbles, Crevices / fissures, Large to very large boulders, Overhangs, Pebbles, Rockpools, Small boulders
Tidal strength preferences	Moderately Strong 1 to 3 knots (0.5-1.5 m/sec.), Strong 3 to 6 knots (1.5-3 m/sec.), Very Strong > 6 knots (>3 m/sec.), Very Weak (negligible), Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Exposed, Extremely exposed, Extremely sheltered, Moderately exposed, Sheltered, Ultra sheltered, Very exposed, Very sheltered
Salinity preferences	Full (30-40 psu), Reduced (18-30 psu), Variable (18-40 psu)
Depth range	Intertidal
Other preferences	No text entered
Migration Pattern	Diel, Seasonal (environment)

Habitat Information

This species extends from the Arctic Circle in Norway to Portugal. Distribution is limited in the north by the ability of newly-settled young to survive cold, and in the south by their ability to withstand heat and desiccation (Bowman & Lewis, 1977).

The upper limit of distribution on a shore is increased by shade and exposure. In some situations seasonal variations in sunshine causes a downward migration in spring/summer and an upward migration in autumn/winter, though the upward movement is not confined to individuals which originally occupied the high levels (Lewis, 1954). Spat settle in pools and damp places, becoming vagrant after emergence for the first 1-3 years and then settle down to a homing lifestyle, although swapping of home does occur. Adult *Patella vulgata* generally return after feeding to their so-called 'home scar', a depression in the rock formed by abrasion of the rock surface by the shell, resulting in a tighter fit to the rock and reduced risk of desiccation. *Patella vulgata* is tolerant of low salinities extending into the mouth of estuaries, surviving in salinities down to about 20 psu (Fish & Fish, 1996).

Life history

Adult characteristics

Reproductive type	Protandrous hermaphrodite
Reproductive frequency	See additional information
Fecundity (number of eggs)	No information
Generation time	2-5 years
Age at maturity	Matures as a male at about 9 months of age and then can change to female at 2-3 years of age.
Season	See additional text
Life span	11-20 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Planktotrophic
Duration of larval stage	2-10 days
Larval dispersal potential	Greater than 10 km
Larval settlement period	Insufficient information

Life history information

Reproduction
Patella vulgata become sexually mature as males aged about nine months. Sex change may occur at one year, commonly at two to three, occasionally later and some limpets never become female. Spawning is believed to be induced by rough seas and onshore winds. Eggs (160 µm in diameter) are broadcast singly and fertilized externally. They are dark green in colour due to the presence of a pigment called chromoprotein Y (Fretter & Graham, 1974). The trochophore larvae has a pelagic life of about 2 weeks and then settles on rocks at a shell length of about 0.2 mm. Newly settled spat are usually found in rock pools or permanently damp situations. Recruitment fluctuates from year to year and from place to place and Bowman (1981) has pointed out that traditional statements about patellid breeding seasons are not universally valid for the British Isles.
Reproductive frequency:
Annual, with peaks within a defined spawning season (October - January) depending on location. *Patella vulgata* is a winter breeder only in southern England, in the north of Scotland it breeds in August and in north-east England in September.

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	High	Moderate	Moderate

The species is epifaunal so loss of the substratum would also result in loss of the population. Individuals unattached to the substratum are very vulnerable to desiccation and to predation by birds and crabs. Recolonization of *Patella vulgata* on rocky shores is rapid as seen by the appearance of limpet spat 6 months after the *Torrey Canyon* oil spill reaching peak numbers 4-5 years after the spill. However, although recolonization was rapid population structure was clearly abnormal for about 15 years because of the complex cycles of dominance involving limpets, barnacles and algae (Hawkins & Southward, 1992).

Smothering	High	High	Moderate	Moderate

Smothering of limpets by 5cm of sediment for one month is likely to interfere with locomotion, grazing and respiration. If the sediment is fluid and mobile limpets are unlikely to be able to move through the layer of sediment and will probably die. The species is absent from some sheltered shores where silt and algal turfs are likely to restrict space (Professor Steve Hawkins, pers. comm.). If movement through the sediment is possible migration to unsmothered areas may be possible. Settled larvae and spat are likely to be highly intolerant of smothering.

Increase in suspended sediment	Low	High	Low	Moderate

Patella vulgata is found in the lower reaches of turbid estuaries where there is sufficient rock or stone on which it may live, and in such muddy habitats, with abundant silt and detritus, the growth rate is rapid (Fretter & Graham, 1994), and is, therefore, unlikely to be adversely affected by an increase in suspended sediment concentration. Therefore, an intolerance of low has been recorded.

Decrease in suspended sediment	Low	High	Low	Moderate

Patella vulgata is found on a variety of shores from wave exposed to sheltered and is, therefore, unlikely to be significantly affected by a decrease in suspended sediment concentration and so intolerance is assessed as low.

Dessication	Low	High	Low	High

The species is typically intertidal and in ideal conditions may be found up to the high tide level and is therefore, relatively tolerant of desiccation. During exposure to the air feeding and locomotion are halted unless conditions are very damp. *Patella vulgata* creates a home-scar allowing it to clamp tightly to the rock to reduce water loss during periods of emersion. The species is tolerant of long periods (several hours) of exposure to the air and can survive up to 65&#37 water loss (Davies, 1969) although tolerance to desiccation is lower in low shore individuals. Smaller limpets are more vulnerable to desiccation than larger ones because of a high surface area: volume ratio. Shell morphology is also important. Higher shore individuals have taller shells which reduces the circumference to body size ratio and hence water loss from the shell margin. As a mobile species *Patella vulgata* has the ability to determine its position on the shore relative to the preferred zone, can orient itself in this direction and move into more suitable conditions. Migration of limpets up and down the shore in response to seasonal variation in sunshine has been observed (Fretter & Graham, 1994).

Increase in emergence regime	Low	High	Low	Low

Patella vulgata typically moves about when submerged or when conditions are very damp so a change in emergence may alter grazing time. The species is unlikely to be affected by the change in desiccation resulting from increasing or decreasing emergence (see above). Also, as a mobile species adult individuals of *Patella vulgata* can determine their position on the shore relative to environmental conditions. Therefore, the species is able to change its position on the shore if the emergence regime changes by the benchmark level of one extra hour in air per day for a year. Migration of limpets up and down the shore in response to seasonal variation in sunshine has been observed (Fretter & Graham, 1994).

Decrease in emergence regime

Increase in water flow rate	Low	High	Low	High

Patella vulgata inhabits a range of tidal conditions and is therefore, likely to tolerate a change in water flow rate. The streamlined profile of limpet shells is of importance in increasing their tolerance of water movement, and this is undoubtedly one factor in determining the different shape of limpets at different exposures. With increasing exposure to wave action the shell develops into a low profile reducing the risk of being swept away. The strong muscular foot and a thin film of mucus between the foot and the rock enables *Patella vulgata* to grip very strongly to the substratum (Fretter & Graham, 1994). The ability of limpets to resist accelerating, as distinct from constant currents, may set a limit to the kind of habitat which they can occupy and limit the size to which they can grow.

Decrease in water flow rate

Increase in temperature	Low	High	Low	High

Patella vulgata is a hardy intertidal species and can tolerate long periods of exposure to the air and consequently wide variations in temperature. Therefore adults would not be affected by temperature changes at the benchmark level. Fretter & Graham (1994) showed that adults could survive temperatures of up to 42 °C and 60% water loss. Temperatures in the British Isles do not generally reach this level. Adults are also largely unaffected by short periods of extreme cold. Ekaratne & Crisp (1984) found adult limpets continuing to grow over winter when temperatures fell to -6&#176C, and stopped only by still more severe weather. However, loss of adhesion after exposure to -13°C has been observed with limpets falling off rocks and therefore becoming easy prey to crabs or birds (Fretter & Graham, 1994). However, in the very cold winter of 1962-3 when temperatures repeatedly fell below 0°C over a period of 2 months large numbers of *Patella vulgata* were found dead (Crisp, 1964). The ability of newly-settled young *Patella vulgata* to survive cold and heat is important in setting limits of distribution of the species (Bowman & Lewis, 1977).

Decrease in temperature

Increase in turbidity	Low	Very high	Very Low	Low

Changes in turbidity will probably have little direct effect on the limpets. Some populations live in estuaries where turbidity tends to be high. However, *Patella vulgata* feeds mainly on algae and increased turbidity may reduce the photosynthetic capability of algae and so decrease food availability. Reduced food availability may reduce limpet growth rates and reproductive capacity. Decreases in turbidity are unlikely to have any effect.

Decrease in turbidity

Increase in wave exposure	Low	High	Low	High

Patella vulgata is found on rocky shores from the most exposed to the most sheltered although the highest densities coincide with moderate exposure (Fretter & Graham, 1994). Under conditions of very high exposure *Patella vulgata* may be limited to the upper region of the shore, its place being taken below mean tide level by *Patella aspera* (Blackmore, 1969). Wave action causes shell muscles to contract vigorously, clamping the animal to the rock. The full strength of pull of the pedal muscles has been estimated as 3.5kg/cm^2 (Fischer, 1948). This force, together with the fact that the conical shell offers little resistance to waves, secures the animal against the action of the waves in the most exposed situations. A decrease in wave exposure may reduce *Patella vulgata* abundance because the species does not favour thick algal cover that is often present on very sheltered shores.

Decrease in wave exposure

Noise	Low	High	Low	Low

Although limpets are not likely to be affected by atmospheric noise levels vibrations near to the animal will cause the shell muscles to contract vigorously, clamping the limpet to the rock (Fretter & Graham, 1994).

Visual Presence	Tolerant	Not relevant	Not sensitive	Low

Although the species has eyes, visual perception is probably quite limited and as such the species is unlikely to be sensitive to the visual presence of humans on the shore, for example. *Patella vulgata* has a low risk of predation because of its hard shell and so does not need the visual acuity required by some species to avoid predators.

Abrasion & physical disturbance	Low	Very high	Very Low	Very low

The adult has a tough shell that offers protection from any abrading factors and any near vibration causes the shell muscles to contract vigorously, clamping the animal to the rock. A short, sharp knock may dislodge an individual leaving it vulnerable to predation and small limpets may be crushed by people trampling on the shore. However, small individuals tend to occupy depressions, crevices, or pools that would provide protection from trampling. Therefore, an intolerance of low has been recorded.

Displacement	Intermediate	High	Low	Very low

Limpets are intolerant of being knocked off the rock by trampling on the shore and if the foot is damaged do not re-attach easily (Professor Steve Hawkins, pers. comm.). Displaced individuals with the foot exposed to the air, are likely to become prone to predation and desiccation and may die. If individuals remain foot down on rock after displacement and are not damaged they may be able to become reattached. However, individuals removed several feet from their scars do not appear to make their way home again (Fretter & Graham, 1996) and so may be more vulnerable to desiccation without the tight fit to their 'home scar'.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination	High	High	Moderate	High

Limpets are extremely intolerant of aromatic solvent based dispersants used in oil spill clean-up. During the clean-up response to the *Torrey Canyon* oil spill nearly all the limpets were killed in areas close to dispersant spraying. Viscous oil will not be readily drawn in under the edge of the shell by ciliary currents in the mantle cavity, whereas detergent, alone or diluted in sea water, would creep in much more readily and be liable to kill the limpet (Smith, 1968). A concentration of 5ppm killed half the limpets tested in 24 hours (Southward & Southward, 1978; Hawkins & Southward, 1992). Acidified sea-water affects the motility of *Patella vulgata*. At a pH of 5.5 motility was reduced whilst submerged but individuals recovered when returned to normal sea-water. At a pH of 2.5 total inhibition of movement occurred and when returned to normal sea-water half had died (Bonner *et al*., 1993). Reduced motility reduces time for foraging and may result in decreased survival of individuals. Acidified seawater can also change the shell composition which will lead to a decrease in its protective nature and hence survival (Bonner *et al*., 1993). Short periods (48 hours) are unlikely to have much effect on a population but long periods (1 year) may cause reduced grazing and an increase in algal growth. However, sea-water is unlikely to reach pH 2.5 therefore intolerance to slight changes in pH will be low. Gastropod molluscs are known to be intolerant of endocrine disruption from synthetic chemicals such as tri-butyl tin (Cole *et al*., 1999). However no information on the specific effects of tri-butyl tin on *Patella vulgata* was found. Hoare & Hiscock (1974) reported that in Amlwch Bay *Patella vulgata* was excluded from sites within 100-150m of the discharge of acidified, halogenated effluent.

Heavy metal contamination	Intermediate	High	Low	Moderate

Bryan (1984) suggested that gastropods are rather tolerant of heavy metals. In the Fal estuary *Patella vulgata* occurs at, or just outside, Restronguet Point at the end of the creek where metal concentrations are in the order: Zinc (Zn) 100-2000&#181g/l, copper (Cu) 10-100µg/l and cadmium (Cd) 0.25-5µg/l (Bryan & Gibbs, 1983). However, in the laboratory *Patella vulgata* was found to be intolerant of small changes in environmental concentrations of Cd and Zn by Davies (1992). At concentrations of 10µg/l pedal mucus production and levels of activity were both reduced, indicating a physiological response to metal concentrations. Exposure to Cu at a concentration of 100µg/l for one week resulted in progressive brachycardia (slowing of the heart beat) and the death of limpets. Zn at a concentration of 5500µg/l produced the same effect (Marchan *et al*.,1999).

Hydrocarbon contamination	High	High	Moderate	High

In areas of moderate oil deposit, up to about 1/2cm thick, on rocks after the *Torrey Canyon* oil spill, limpets had survived unscathed over a month after the event and feeding continued even though a coating of oil smothered their food source of algae and diatoms (Smith, 1968). Limpets can ingest thick oil and pass it through their gut. However, thick layers of oil smothering individuals will interfere with respiration and spoil normal food supplies for *Patella vulgata*. Limpets are unable to remain closed off from the environment for very long, the adductor muscles relax occasionally, lifting the shell very slightly. After the *Braer* oil spill, in common with many other oil spills, the major impact in the intertidal zone was on the population of limpets and other grazers. In West Angle Bay, where fresh oil from the *Sea Empress* tanker reached rocky shores within one day of the spill, limpet mortality was 90% (Glegg *et al*., 1999). Thus *Patella vulgata* has higher intolerance to fresh oil which has a high component of volatile hydrocarbons remaining. A significant reduction in the density of juvenile limpets was also observed at all sites known to have been oiled by the *Sea Empress* spill (Moore, 1997). In longer term studies into the environmental effects of oil refinery effluent discharged into Littlewick Bay, Milford Haven, the number of limpets, usually found in substantial numbers on this type of shore, were considerably reduced in abundance on areas close to the discharge (Petpiroon & Dicks, 1982). In particular only large individuals were found close to the outfall point and juveniles were completely absent, suggesting that observed changes in abundance resulted from effluent effects on larval stages rather than upon adults directly.

Radionuclide contamination				Not relevant

Insufficient information.

Changes in nutrient levels	Low	High	Low	Very low

The species occurs on all British and Irish coasts, including lower salinity areas such as estuaries where nutrient loading is likely to be higher than elsewhere and so intolerance is likely to be low. Higher nutrient levels will increase the growth of algae which will increase the food available to *Patella vulgata*. Although no direct correlation between increased nutrient levels and growth rate was found in the literature in estuaries with high levels of silt and detritus the growth rate of the species was rapid (Fretter & Graham, 1994). However, if nutrient loading is excessive this can have a detrimental effect on algal productivity and hence limpet growth.

Increase in salinity	Low	High	Low	High

Patella vulgata can tolerate varying salinities and its distribution extends into the mouths of estuaries surviving in salinities down to about 20psu. However, growth and reproduction may be impaired in reduced salinity. Little *et al.* (1991), for example, observed reduced levels of activity in limpets after heavy rainfall and in the laboratory activity completely stopped at 12psu. The species can endure periods of low salinity and was found to die only when the salinity was reduced to 3-1psu (Fretter & Graham, 1994). In experiments where freshwater was trickled over the shell Arnold (1957) observed limpets withdrawing and clamping the shell onto the substratum. There appears to be an increasing tolerance of low salinities from the lower to the upper limit of distribution of the species on the shore (Fretter & Graham, 1994).

Decrease in salinity

Changes in oxygenation	Intermediate	High	Low	Moderate

An oxygen concentration at the level of the benchmark, 2mg/l, is thought likely to cause adverse effects in marine organisms. In laboratory experiments a reduction in the oxygen tension of seawater from 148mm Hg (air saturated seawater) to 50mm Hg rapidly resulted in reduced heart rate in limpets of the genus *Patella* (Marshall & McQuaid, 1993). Heartbeat rate returned to normal in oxygenated water within two hours. In oxygen free water limpet metabolic rate gradually fell eventually resulting in death only after 36 hours (Grenon & Walker,1981). Therefore, some individuals may survive for one week at an oxygen concentration of 2mg/l and so intolerance is set at intermediate. However, *Patella vulgata* is an intertidal species, being able to respire in air, so will only be intolerant of low oxygen in the water column intermittently during periods of tidal immersion. In addition, in areas of wave exposure and moderately strong current flow low oxygen levels in the water are unlikely to persist for very long.

Biological Pressures

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

Patella vulgata has been reported to be infected by the protozoan *Urceolaria patellae*

(Brouardel, 1948) at sites sheltered from extreme wave action in Orkney. Baxter (1984) found shells to be infested with two boring organisms, the polychaete *Polydora ciliata* and a siliceous sponge *Cliona celata*.

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

No known non-native species compete with *Patella vulgata*.

Extraction of this species	Intermediate	High	Low	Moderate

This species is occasionally harvested by hand, without regulation, for human consumption. However, the delicate balance between limpets and algae is easily disturbed by even a small, localised temporary absence of limpets (Southward, 1956; Southward, 1964; Hawkins, 1981; Hawkins *et al.*, 1983). Removal of limpets at the benchmark level of 50% is likely to result in significant changes in community composition. Significant limpet kills resulting from the widespread use of dispersants after the *Torrey Canyon* oil spill dramatically altered rocky shore communities. *Laminaria digitata*, for example, was able to extend 2m upshore in the absence of limpets and there were dense growths of ephemeral green seaweeds followed by equally dense growth of fucoids (Southward & Southward, 1978; Hawkins & Southward, 1992).

Extraction of other species	Low	High	Low	Low

Adult *Patella vulgata* have no known obligate relationships. However, field studies support the suggestion that larvae of *Patella* spp. are induced to settle by chemicals in the red algae *Lithothamnia* (Bowman, 1981). Neither newly settled or older juveniles of any species are found on dead *Lithothamnia* even if the patch had been well-colonized when alive and although niches and epiphytes remain. Settlement on *Lithothamnia* benefits the young limpet by ensuring it settles in a permanently wet habitat and the pits in the surface probably also afford protection from the grazing of larger limpets. Therefore removal of *Lithothamnia* may be detrimental to recruitment of limpets.

Additional information

Importance review

Policy/legislation

- no data -

Status

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

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

Biotope structure and community importance
Grazing by *Patella vulgata* can be an important structuring feature on rocky shores and is often considered to be a keystone species on north-east Atlantic rocky shores. Reductions in limpet density have been observed to have a significant impact on rocky shore community composition, particularly of fucoid algae and barnacles (Raffaelli & Hawkins, 1996; Hawkins & Hartnol, 1985).

Culinary use Collection of limpets for culinary use is on a local scale.

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