An acorn barnacle (*Balanus crenatus*)

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

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A report from:
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/1381]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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***Balanus crenatus*.**
Photographer: Keith Hiscock

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	Nicola White	**Refereed by**	Prof. Alan J. Southward
Authority	Bruguière, 1789		
Other common names	-	**Synonyms**	-

Summary

Description

Balanus crenatus is one of the most common sublittoral barnacles in Britain. It has six shell plates and grows up to 25 mm in diameter. The upper edge of the shell plates are usually toothed and the shell is inclined to one end when viewed in profile. It usually lives for around 18 months.

Recorded distribution in Britain and Ireland

All coasts of Britain & Ireland, and offshore in the North Sea and Celtic Sea.

Global distribution

Northeast Atlantic from the Arctic to the west coast of France as far south as Bordeaux; east and west coasts of North America and Japan.

Habitat

Balanus crenatus is primarily a sublittoral species that can sometimes be found under stones or overhangs on the lower shore. *Balanus crenatus* colonizes cobbles, shells, bedrock, molluscs and artificial substrata. It is found at a wide range of wave exposures and it can tolerate salinities as low as 14 psu.

Depth range
Data deficient

Identifying features

- Shell wall of 6 grey white plates.
- Up to 25 mm diameter.
- Opercular aperture a broad diamond shape.
- Upper edge of shell plates toothed.
- Shell inclined to one end when viewed in profile.
- Shell base calcareous.
- Tissue inside opercular aperture with yellow and purple stripes.

Additional information

No text entered

Listed by

Further information sources

Search on:

NBN WoRMS

Biology review

Taxonomy

Order	Sessilia	Sessilia
Family	Balanidae	
Genus	Balanus	
Authority	Bruguière, 1789	
Recent Synonyms	-	

Biology

Typical abundance	Moderate density
Male size range	
Male size at maturity	
Female size range	Small(1-2cm)
Female size at maturity	
Growth form	
Growth rate	4.4mm/month
Body flexibility	None (less than 10 degrees)
Mobility	
Characteristic feeding method	Active suspension feeder, Passive suspension feeder
Diet/food source	
Typically feeds on	Zooplankton and other organic particles of a suitable size, such as detritus and phytoplankton.
Sociability	
Environmental position	Epifaunal
Dependency	Independent.
Supports	None
Is the species harmful?	Data deficient

Biology information

Balanus crenatus has a calcareous base, while *Semibalanus balanoides* has a membranous base.

Feeding

Balanus crenatus feeds by extending thoracic appendages called cirri out from the shell to filter zooplankton from the water. In the absence of any current, the barnacle rhythmically beats the cirri. When a current is present *Balanus crenatus* holds the cirri fully extended in the current flow. Barnacles feed most during spring and autumn when plankton levels are highest. Little if any feeding takes place during winter, when barnacles rely on stored food reserves. Feeding rate is important in determining the rate of growth.

Moulting

Barnacles need to moult in order to grow. Frequency of moulting is determined by feeding rate and temperature. Moulting does not take place during winter when phytoplankton levels and temperatures are low.

Size:
Balanus crenatus is hermaphroditic and grows up to 25mm in diameter.

Habitat preferences

Physiographic preferences	Open coast, Offshore seabed, Strait / sound, Sea loch / Sea lough, Ria / Voe, Estuary, Enclosed coast / Embayment
Biological zone preferences	Lower eulittoral, Lower infralittoral, Sublittoral fringe, Upper infralittoral
Substratum / habitat preferences	Artificial (man-made), Bedrock, Cobbles, Gravel / shingle, Large to very large boulders, Pebbles, 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, Very exposed, Very sheltered
Salinity preferences	Full (30-40 psu), Low (<18 psu), Reduced (18-30 psu), Variable (18-40 psu)
Depth range	Data deficient
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

Balanus crenatus is a widespread species that occurs at quite high latitudes in the Arctic. It colonizes a wide range of substrata, attaching to any hard substrata, molluscs and their dead shells (Southward, pers. comm.), often as an initial colonizing species. Densely packed colonies occur particularly in areas exposed to strong tidal streams where few other epifauna survive. It can also be found attached to carapaces of the Norway lobster or Dublin Bay prawn (*Nephrops norvegicus*) and other crustaceans.
Balanus crenatus may have been misidentified as *Solidobalanus fallax* in shallow waters lying to the south of the UK. The deep water record of Gruvel (noted in Southward, 1998) is an error (Southward, pers. comm.). *Balanus crenatus* and *Solidobalanus fallax*colonize different substrates and also occur in different temperatures. *Solidobalanus fallax* occurs in warmer water on shells, false corals, seaweeds and other soft substrata, including plastic bags and synthetic netting (Southward, pers. comm.).

Life history

Adult characteristics

Reproductive type	Permanent (synchronous) hermaphrodite
Reproductive frequency	Annual episodic
Fecundity (number of eggs)	No information
Generation time	<1 year
Age at maturity	4 months
Season	February - September

Life span	1-2 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Lecithotrophic
Duration of larval stage	11-30 days
Larval dispersal potential	Greater than 10 km
Larval settlement period	Insufficient information

Life history information

- *Balanus crenatus* is an obligate cross-fertilizing hermaphrodite. Nauplii larvae are released from the barnacle between February and September, with peaks in April and late summer when phytoplankton levels are highest. However, release is not synchronised with the spring algal bloom, unlike *Semibalanus balanoides*.
- Nauplii larvae are planktotrophic and develop in the surface waters. They pass through six nauplii stages before eventually developing into a cyprid larva. Cyprid larvae are specialised for settlement. They drift and swim in the plankton before selecting a suitable substratum for settlement and metamorphosis. Peak settlement occurs in April and declines until October. Metamorphosis usually takes place within 24 hours of settlement.
- Barnacles grow rapidly except in winter. April-settled individuals may release larvae the same July and reach full size before their first winter. Individuals that settled later reach maximum size by the end of spring the following year (Rainbow, 1984).
- *Balanus crenatus* has a lifespan of 18 months (Barnes & Powell, 1953). Growth rate varies greatly with the degree of current flow and the presence of silt. *Balanus crenatus* populations attached to *Nephrops norvegicus grew only 2mm in 4 months, whereas populations on rafts grew at 0.2mm per day. This reduction in growth in epizoic populations is attributed to the higher presence of silt and reduction in water currents (Barnes & Bagenal, 1951).*

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

Balanus crenatus is permanently attached to the substratum so would be removed upon substratum loss. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Smothering	High	High	Moderate	Low

Balanus crenatus can withstand covering by silt provided that the cirri can extend above the silt layer but smothering by 5cm of sediment would prevent feeding and could cause death. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Increase in suspended sediment	Low	High	Low	Low

Balanus species are generally tolerant of moderate siltation but are intolerant of excessive siltation (Holt *et al.*, 1995). Silt could clog the filter feeding apparatus imposing an energetic cost on clearing the cirri. The reduced growth rate of barnacles living on carapaces of *Nephrops norvegicus* compared to barnacles growing on rafts has been partly attributed to the increased levels of silt in the immediate vicinity of *Nephrops norvegicus* (Barnes & Bagenal, 1951). Therefore, *Balanus crenatus* is reported to have a low intolerance to siltation as growth only would be affected. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Decrease in suspended sediment

Dessication	High	High	Moderate	High

Balanus crenatus has more permeable shell plates than other littoral barnacles and therefore loses water quicker and dies sooner when exposed to air. Foster (1971) recorded that *Balanus crenatus* adults of 6 mm and 11 mm diameter can withstand 17 hours and 40 hours of aerial exposure respectively. Similarly, Barnes *et al.* (1963) recorded that *Balanus crenatus* had a mean survival time of 14.4 hours in dry air. An increase in the period of desiccation would therefore lead to a depression in the upper limit of the species distribution. A decrease in the period of desiccation could lead to an extension of *Balanus crenatus* up the shore. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Increase in emergence regime	High	High	Moderate	High

Balanus crenatus is vulnerable to desiccation upon aerial exposure. The shell plates are more permeable than other littoral barnacles, therefore it loses water and dies quicker. Foster (1971) recorded that adults of 6 mm and 11 mm diameter can withstand 17 hours and 40 hours of aerial exposure respectively. An increase in the period of emergence would lead to a depression in the upper limit of the species distribution. A decrease in the period of emersion could lead to an extension of *Balanus crenatus* up the shore. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore, recovery is predicted to be high.

Decrease in emergence regime

Increase in water flow rate	Low	Very high	Very Low	Low

Balanus crenatus is found in a very wide range of water flow rates. However, Barnes & Bagenal (1951) found that the growth rate of *Balanus crenatus* epizoic on *Nephrops norvegicus* was considerably slower than animals on raft exposed panels. This was attributed to reduced currents and increased silt loading of water in the immediate vicinity of *Nephrops norvegicus*, so growth rate may be reduced if water flow rate decreases. On return to normal water flow rate the growth rate is predicted to rapidly recover.

Decrease in water flow rate

Increase in temperature	High	High	Moderate	Moderate

Balanus crenatus is a boreal species, and is intolerant of increases in water temperature. In Queens Dock, Swansea where the water was on average 10 °C higher than average due to the effects of a condenser effluent, *Balanus crenatus* was replaced by the subtropical barnacle *Balanus amphitrite*. After the water temperature cooled *Balanus crenatus* returned (Naylor, 1965). It has a peak rate of cirral beating at 20 °C and all spontaneous activity ceases at about 25 °C (Southward, 1955). The species is more tolerant of lower temperatures. *Balanus crenatus* was unaffected during the severe winter of 1962-63, when average temperatures were 5 to 6 °C below normal (Crisp, 1964). The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Decrease in temperature

Increase in turbidity	Low	Very high	Very Low	Low

An increase in turbidity could be beneficial for *Balanus crenatus*, if the suspended particles are composed of organic matter. However, if the suspended particles are inedible, an energetic cost may be imposed on clearing the cirri. A reduction in light penetration could also reduce growth rate of phytoplankton and so limit zooplankton levels, which form the bulk of barnacles food. Barnes & Bagenal (1951) found that growth rate of *Balanus crenatus* epizoic on the mud-burrowing prawn *Nephrops norvegicus* was considerably slower than animals on raft exposed panels. This was attributed to reduced currents and increased silt loading of water in the immediate vicinity of *Nephrops norvegicus*. On return to normal turbidity levels the growth rate of *Balanus crenatus* would resume quickly.

Decrease in turbidity

Increase in wave exposure	Low	Very high	Very Low	Low

Balanus crenatus can tolerate all degrees of wave exposure. However, barnacle growth is greatest at exposed locations (Crisp, 1960), so a decrease in wave exposure may reduce growth rate of barnacles if no tidal stream is present, by reducing the renewal rate of the water and therefore the food supply. On return to normal wave exposure levels the growth rate would quickly resume.

Decrease in wave exposure

Noise	Tolerant	Not relevant	Not sensitive	Low

Barnacles are unlikely to be sensitive to noise.

Visual Presence	Tolerant	Not relevant	Not sensitive	Low

Barnacles are unlikely to be sensitive to visual presence.

Abrasion & physical disturbance	Intermediate	High	Low	Low

Balanus crenatus would probably be crushed by a heavy force, such as an anchor landing on it. However, it is small and individuals in fissures and crevices would probably survive. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994) so recovery is predicted to be high.

Displacement	High	High	Moderate	Low

Balanus crenatus is permanently attached to the substratum and could not survive if it was removed. However, the species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily colonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994) so recovery is predicted to be high.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination	High	High	Moderate	Very low

Barnacles have a low resilience to chemicals such as dispersants, dependant on the concentration and type of chemical involved (Holt *et al.*, 1995). They are less intolerant than some species (e.g. *Patella vulgata*) to dispersants (Southward & Southward, 1978) and *Balanus crenatus* was the dominant species on pier pilings at a site subject to urban sewage pollution (Jakola & Gulliksen, 1987). Hoare & Hiscock (1974) found that *Balanus crenatus* survived near to an acidified halogenated effluent discharge where many other species were killed, suggesting a high tolerance to chemical contamination. Little information is available on the impact of endocrine disrupters on adult barnacles. Holt *et al.* (1995) concluded that barnacles are fairly sensitive to chemical pollution, therefore intolerance is reported as high. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily recolonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore, recovery is predicted to be high.

Heavy metal contamination	Intermediate	High	Low	Low

Barnacles accumulate heavy metals and store them as insoluble granules (Rainbow, 1987). Pyefinch & Mott (1948) recorded a median lethal concentration of 0.19 mg/l copper and 1.35 mg/l mercury, for *Balanus crenatus* over 24 hours. Barnacles may tolerate fairly high level of heavy metals in nature, for example they are found in Dulas Bay, Anglesey, where copper reaches concentrations of 24.5 µg/l, due to acid mine waste (Foster *et al.*, 1978). The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily recolonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Hydrocarbon contamination	Low	High	Low	Very low

No information is available on the intolerance of *Balanus crenatus* to hydrocarbons. However, other littoral barnacles generally have a high tolerance to oil (Holt *et al*., 1995) and were little impacted by the *Torrey Canyon* oil spill (Smith, 1968) so *Balanus crenatus* is probably fairly resistant to oil. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily recolonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Radionuclide contamination		Not relevant		Not relevant

Insufficient information

Changes in nutrient levels	Intermediate	High	Low	Very low

A slight increase in nutrient levels could be beneficial for barnacles by promoting growth of phytoplankton and therefore increasing food supplies. Indeed, *Balanus crenatus* was the dominant species on pier pilings, which were subject to urban pollution (Jakola & Gulliksen, 1987). However, a large increase in nutrients could cause barnacles to be killed by the dense overgrowth of ephemeral green algae (Holt *et al*., 1995). The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily recolonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Increase in salinity	Low	Very high	Very Low	High

When subjected to sudden changes in salinity *Balanus crenatus* closes its opercular valves so that the blood is maintained temporarily at a constant osmotic concentration. *Balanus crenatus* can tolerate salinities down to 14 psu if given time to acclimate (Foster, 1970). At salinities below 6 psu motor activity ceases, respiration falls and the animal falls in to a "salt sleep". In this state the animals may survive in fresh water for 3 weeks, enabling them to withstand changes in salinity over moderately long periods (Barnes, 1953).

Decrease in salinity

Changes in oxygenation	High	High	Moderate	Very low

Balanus crenatus respires anaerobically so it can withstand some decrease in oxygen levels. When placed in wet nitrogen, where oxygen stress is maximal and desiccation stress is minimal, *Balanus crenatus* has a mean survival time of 3.2 days (Barnes *et al*., 1963). It is therefore predicted that the species would not survive low oxygen levels for a week, so intolerance is reported as high. The species is an important early colonizer of sublittoral rock surfaces (Kitching, 1937) and it heavily recolonized a site that was dredged for gravel within 7 months (Kenny & Rees, 1994). Therefore recovery is predicted to be high.

Biological Pressures

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

Insufficient information

Introduction of non-native species		Not relevant		Not relevant

Insufficient information

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

NR

Extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant

NR

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

Balanus crenatus is an important initial colonizing species, perhaps obscuring material such as anti-fouling paint that would be toxic to other species. It is a source of food for *Nucella lapillus* in tidal sounds. *Balanus crenatus* is also grazed by *Echinus esculentus* and fish species probably nip its cirri. The plates of dead *Balanus crenatus* are probably an important part of the unique shell gravel banks in the Menai Strait, North Wales.

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