MarLIN
Marine Information Network
Information on the species and habitats around the coasts and sea of the British Isles

White furrow shell (*Abra alba*)

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

Georgina Budd

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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/1722]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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Abra alba.
Photographer: Peter Barfield

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	Georgina Budd	**Refereed by**	Prof. Jean-Claude Dauvin
Authority	(W. Wood, 1802)		
Other common names	A bivalve mollusc	**Synonyms**	-

Summary

Description

A bivalve with a brittle shell that may grow up to 25 mm in length. The shell is roughly oval in outline, with a slight elongation to the right. *Abra alba* is white in colour with a glossy shell. The exterior surface of the valves are sculpted with fine concentric lines and growth stages are conspicuous within the overall pattern. The interior of the shell is also white. The periostracum (a flaky epidermis) if present, is light brown in colour.

Recorded distribution in Britain and Ireland

Widespread around the British Isles.

Global distribution

Abra alba is distributed from the Norwegian Sea and the Baltic, south to the Iberian Peninsula, into the Mediterranean and Black Seas, and south along the coast of Africa to Senegal.

Habitat

Abra alba is a characteristic inhabitant of inshore muddy fine sand or mud substrates and may be found from the extreme low water-mark offshore to a depth of about 70 m. It is often particularly abundant at around 20 m depth (Tebble, 1976).

Depth range

Lower shore to 70 m depth

Identifying features

- Broadly oval in outline.
- Both valves of the shell are similar in shape and colour
- Beak (tip of each valve) curves inwards and slightly backwards
- Right valve has two small projecting cardinal teeth (projections) around the hinge of the valve.
- Shell white in colour and glossy
- Shell surface sculpted in fine concentric lines; growth stages (marking cessation in growth at varying times) are clear.
- The periostracum, if present, is brown.
- The posterior part of the shell twists slightly to the right.

Additional information

None entered

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Mollusca Snails, slugs, mussels, cockles, clams & squid
Order	Cardiida
Family	Semelidae
Genus	Abra
Authority	(W. Wood, 1802)
Recent Synonyms	-

Biology

Typical abundance	High density
Male size range	< 25mm
Male size at maturity	7-9mm
Female size range	7-9mm
Female size at maturity	
Growth form	Bivalved
Growth rate	0.1mm/day
Body flexibility	None (less than 10 degrees)
Mobility	Burrower
Characteristic feeding method	Active suspension feeder, Surface deposit feeder
Diet/food source	Detritivore
Typically feeds on	Phytoplankton, detritus.
Sociability	Not relevant
Environmental position	Infaunal
Dependency	None.
Supports	Not relevant
Is the species harmful?	No

Biology information

Abundance

Although described as solitary animals, adult densities may exceed 1,000 m^2 in favourable conditions. For instance, in the rich organic muddy harbour sediments in the Ria de la Coruna (NW Spain) *Abra alba* densities varied from 97 to 2,939 individuals/ m^2 (Francesch & Lopez-Jamar, 1991). In front of Dunkirk, France, densities can reach 9,000 individuals / m^2 (Ghertsos *et al.*, 2000). However, abundances typically fluctuate between years owing to variation in recruitment success (juvenile bivalves experience high mortality within the first month after settlement) or adult mortality. High densities of newly settled spat have been reported. For instance, estimated densities of between 16,000 - 22,000 individuals/ m^2 (collected on 1 mm sieves) were recorded by Jensen (1988) at the time of settlement in the western part of the Limfjord, Denmark.

Growth

The smallest recorded benthic specimen had a shell length of 0.34 mm (Dauvin & Gentil, 1989). In autumn settled spat growth is insignificant until spring when a maximum growth rate of 0.1 mm/day was reported (Dauvin, 1986). This growth rate applies from spring to autumn (Dauvin, pers. comm.).

Nutrition
Some bivalves, such as *Abra alba*, which inhabit muddy low energy environments can switch back and forth from suspension feeding and deposit feeding, depending upon the conditions of the environment (Dame, 1996). While suspension feeding, the inhalant siphon is held a few millimetres above the sediment surface and sucks in suspended particles. For instance, *Abra alba* significantly reduced the concentration of the flagellate *Isochrysis galbana* in suspension. Consumption of *Isochrysis galbana* over four hours was estimated to be 2.7% of the body weight (Rosenberg, 1993). While deposit feeding, the inhalant siphon is bent over toward the sediment surface, sucking up detritus. However, as the food quality of sediments is often low, deposit feeders either have to process large volumes of sediment through the digestive tract in order to gain a small amount of nutrition, or they sort particles before ingestion and reject the majority of particles as pseudofaeces. As a result the feeding rate is lower with a longer residence time for food in the gut, enabling digestion of the more complex organic compounds common to the benthic environment (Dame, 1996).

Biomass and productivity
In Kiel Bay, mean annual biomass varied greatly between sites and between years: Biomass (B) =0.1-3 g AFDW m^{-2}, with a long-term average (ratio) P:B = c 2.2 (Rainer, 1985); B = 0.1-2 g AFDW m^{-2} and P:B = 1.7-2.9 from five years of sampling at a location off the French coast (Dauvin, 1986); B = 0.3 g AFDW m^{-2} and P:B = 1.4 in the Bristol Channel, England (Warwick & George, 1980).

Habitat preferences

Physiographic preferences	Open coast, Offshore seabed, Strait / sound, Sea loch / Sea lough, Enclosed coast / Embayment
Biological zone preferences	Lower circalittoral, Lower infralittoral, Sublittoral fringe, Upper circalittoral, Upper infralittoral
Substratum / habitat preferences	Mud, Muddy gravel, Muddy sand, Sandy mud
Tidal strength preferences	Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Sheltered
Salinity preferences	Full (30-40 psu)
Depth range	Lower shore to 70 m depth
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

Dispersal of post-larval bivalve molluscs
The mechanism termed 'byssus drifting' has been observed in 20 species of bivalve molluscs, including *Abra alba*, and is the mechanism by which post-larval bivalves enter a second pelagic migratory stage. Young bivalves secrete a single, long thread which increases the drag acting upon them and enables them to be carried along on the current. The drag increase was found to be a factor of 3 to 30 times greater on byssus secreting bivalves than on inactive ones (Sigurdsson *et al.*, 1976). *Abra alba* were observed to re-enter the water column after larval settlement in the Bay of

Seine (Olivier *et al.*, 1996). The post-larvae and juveniles of *Abra alba* were most abundant at flood tide velocities . Furthermore, *Abra alba* were found to vary significantly in their vertical distribution in the water column, the species decreasing in abundance with distance from the sea bed. It was noted that *Abra alba* juveniles can regulate their vertical position in the flow, to some extent, by opening their valves to different extents (Olivier *et al.*, 1996).

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	10,000-100,000
Generation time	See additional information
Age at maturity	See additional information
Season	February - Autumn
Life span	See additional information

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Brooding
Duration of larval stage	1-2 months
Larval dispersal potential	Greater than 10 km
Larval settlement period	Insufficient information

Life history information

Gametogenesis
Dewarumez (1979) and Nott (1980) described the anatomy of the gonads of *Abra alba* and changes in the gonad condition during the reproductive cycle.

Fertilization and metamorphosis
The sexes are separate and may be distinguished microscopically by dissection. Nott (1980) estimated the number of eggs produced from an average sized animal 11 mm in length to be between 15,000 - 17,000 of 60 µm diameter. Gametes are shed within the shell cavity and swept out through the exhalent siphon by pumping, so that fertilization occurs externally. The eggs develop into free-swimming trochophore and then veliger larvae. The larval stage is planktonic, and in *Abra alba*, lasts about a month (Dauvin & Gentil, 1989). Larvae are subject to very high mortality. At metamorphosis, the larvae settle out of the plankton and the bivalve spends its remaining life as a member of the benthos (Dame, 1996).

Recruitment
Recruitment varies between localities. In a population of *Abra alba* from the Irish Sea, proliferation of the gonads commenced in March and the animals reached maturity between June and September. The exact time at which maturity was attained depended upon the size of the individual, but it seemed that only individuals with a minimum shell length of between 7-9 mm

reproduced (Nott, 1980). Normally, there two distinct spawning periods in summer and autumn, and according to the season of settlement, individuals differ in terms of growth and potential lifespan. Although peak recruitment usually occurs in summer (Dauvin & Gentil, 1989).

- In Kiel Bay a recruitment peak occurred in August, sometimes with a second peak between December and February (Rainer, 1985).
- Autumn settled individuals from the Bay of Morlaix, France, initially showed no significant growth; they were not collected on a 1 mm mesh sieve until April, 5 to 7 months after settlement. Such individuals were expected to have a maximum lifespan of 21 months and could produce two spawnings. In contrast, veliger larvae that settled during the summer grew very rapidly and were collected on a 1 mm mesh sieve just one month after settlement. They lived about one year and spawned only once (Dauvin & Gentil, 1989).
- Dauvin & Gentil (1989) observed three recruitment periods (February-March, April-June and August-October) in response to trophic conditions following the *Amoco Cadiz* oil spill in the Bay of Morlaix, France (see sensitivity, nutrients). The additional recruitment period was considered to be an adaptive response over the normal pattern of twice yearly recruitment.
- Two peaks (in July and September-October) were noted in the Limfjord (Jensen, 1988), with spat densities in excess of 20,000 m□ recorded (see general biology).
- Warwick & George (1980) inferred that settlement in Swansea Bay, Wales, occurred over a period of months between July and November.

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	High

Abra alba lives infaunally in muddy sediments. Removal of the substratum would also remove the entire population of the species and so intolerance has been assessed to be high. Recoverability has been assessed to be high (see additional information below).

	Intolerance	Recoverability	Sensitivity	Confidence
Smothering	Low	Immediate	Not sensitive	Moderate

Abra alba is a shallow burrower in muddy sediments. It requires its inhalant siphon to be above the sediment surface for feeding and respiration. Sudden smothering with 5 cm of sediment would temporarily halt feeding and respiration and require the species to relocate to its preferred depth. As an active burrower *Abra alba* would be expected to relocate with no mortality. However, growth and reproduction may be compromised owing to energetic expenditure and so intolerance has been assessed to be low. Growth and reproduction would return to normal following relocation so recoverability is recorded as immediate.

	Intolerance	Recoverability	Sensitivity	Confidence
Increase in suspended sediment	Tolerant*	Not relevant	Not sensitive*	Moderate

Levels of suspended sediment are likely to be most relevant to feeding. *Abra alba* practices two alternative modes of feeding. It either holds its feeding organ, the inhalant siphon, at a fixed position just above the sediment surface to filter out food particles suspended in the overlying water or else extends and moves its siphon around on the sediment above it to vacuum up deposited food particles. The alternative feeding methods are likely to make the species insensitive to relatively small changes in suspended sediment. If the level of suspended sediment becomes so high as to risk clogging the feeding structures, *Abra alba* could presumably switch to deposit feeding. Furthermore, an increase in suspended sediment is likely to increase the rate of siltation and therefore the food available to deposit feeders. *Abra alba* has been assessed to be tolerant at the benchmark level increase of 100 mg/ l for one month, with the potential for growth and reproduction to be enhanced by the increased food supply. However, a more substantial increase in suspended sediment levels would be expected to have a detrimental effect. For instance, the abundance of *Abra alba* declined over two years in the 1 km vicinity of an outfall pipe discharging fine-grained mineral waste from the china clay industry at a rate of 450, 000 tons per year to Mevagissey Bay, Cornwall. However, it was argued that persistent sediment instability was the more significant source of stress to the predominantly deposit-feeding community than the suspended sediment concentration (Probert, 1981).

	Intolerance	Recoverability	Sensitivity	Confidence
Decrease in suspended sediment	Low	Immediate	Not sensitive	Moderate

Abra alba practices two alternative modes of feeding. It either holds its feeding organ, the inhalant siphon, at a fixed position just above the sediment surface to filter out food particles suspended in the overlying water or else extends and moves its siphon around on the sediment above it to vacuum up deposited food particles. A decrease in suspended sediment is likely to decrease the availability of food for both suspension and deposit feeding. The reduction in food availability may result in less energy available for growth and reproduction by *Abra alba*. However, the benchmark change period is one month, during which time it is not expected that mortality would occur and so intolerance is assessed as low. When suspended sediment returns to original levels, growth and reproduction should quickly return to normal so recoverability has been assessed to be immediate.

Dessication	Low	Immediate	Not sensitive	Moderate

Abra alba lives infaunally in muddy sediments (Tebble, 1976) and is therefore likely to be largely protected from desiccation stress by its environmental position. Additionally, bivalves are able to respond to desiccation stress by valve adduction during periods of emersion. It is likely that *Abra alba* would be able to retain enough water within its shell to avoid mortality during the benchmark emersion period of one hour. However, during the period of emersion, the species would not be able to feed and respiration would be compromised, so there is likely to be some energetic cost. Intolerance has been assessed to be low. On immersion, metabolic activity should quickly return to normal and recoverability has been assessed to be immediate.

Increase in emergence regime	Intermediate	Very high	Low	Low

Although a largely subtidal species, a proportion of the population of *Abra alba* occurs in the proximity of the sublittoral fringe and so may be vulnerable to an increase in the emergence regime. The species does not colonize further up the shore and therefore must be limited by one or more factors including desiccation, temperature and wave exposure. An increase in the emergence regime may suppress the upper distribution of the population, some individuals may die and intolerance has been assessed to be intermediate. On return to prior conditions recolonization is likely and recoverability has been assessed to be very high (see additional information below).

Decrease in emergence regime	Tolerant	Not relevant	Not sensitive	High

Abra alba occurs in the subtidal zone and could therefore benefit from a decrease in the emergence regime.

Increase in water flow rate	Low	Very high	Very Low	Low

Abra alba lives in low energy environments (Tebble, 1976) where the substratum has a high proportion of fine sediment. Increased water flow rate will change the sediment characteristics in which the species lives, primarily by winnowing away the surface layers and preventing deposition of finer particles (Hiscock, 1983). Furthermore, increased water flow rate may prevent settlement of larvae and therefore reduce recruitment. Mature adults buried at depth are likely to be unaffected as muddy substrata is particularly cohesive. An intolerance assessment of low has been made owing to reduced viability that may result from poor larval recruitment. Recoverability has been assessed to be very high as the adult population is likely to have survived (see additional information below).

Decrease in water flow rate	Low	Very high	Very Low	Low

Abra alba occurs in areas of weak water flow rate, so the benchmark decrease in water flow rate will expose the species to conditions of almost negligible flow. Decreased water flow may reduce the availability of food that may be obtained from suspension feeding and the species would have to switch to deposit feeding. A decreased water flow rate may favour the deposition of material upon which *Abra alba* could feed. However, a decreased water flow rate may mean that dispersion of planktonic larvae is minimal, and that recruitment to the benthos occurs in the vicinity of the parent population which may result in parent induced mortality (via feeding). Intolerance has therefore been assessed to be low and recoverability assessed to be very high (see additional information below).

Increase in temperature Low Very high Very Low Moderate

Abra alba has a wide geographic range, occurring in waters to the south of the British Isles. It is likely therefore to be tolerant of higher temperatures than it experiences in Britain and Ireland. No specific information concerning temperature tolerances of *Abra alba* was found, but inferences of the effects may be made from other species of bivalve. For instance, Wilson (1978) reported the 24 hour LT50 for *Fabulina fabula* (studied as *Tellina fabula*) from Millport in Scotland to be 26.5 °C and noted that acclimation to higher temperatures enhanced the species' ability to withstand higher experimental temperatures. Similarly, Ansell *et al*. (1980) reported the 24 hour LT50 for *Fabulina fabula* (studied as *Tellina fabula* and acclimated at 10 °C) from Millport to be 27 °C. The 96 hour LT50 was 24-27 °C depending on acclimation temperature. Growth experiments by Salzwedel (1979) revealed that growth of *Fabulina fabula* (studied as *Tellina fabula*) correlated positively with temperature up to about 16 °C after which temperature increase inhibited growth. Considering that maximum sea surface temperatures around the British Isles rarely exceed 20 °C (Hiscock, 1998), it is unlikely that *Abra alba* would suffer mortality due to the benchmark increase in temperature. However, elevated temperatures would probably result in inhibition of growth and hence intolerance has been assessed to be low. A normal growth rate would resume on return to prior conditions so recoverability has been assessed to be very high.

Decrease in temperature Intermediate Very high Low Moderate

Abra alba has a wide geographic range, occurring in waters to the north of the British Isles. It is likely therefore to be tolerant of lower temperatures than it experiences in Britain and Ireland and would probably tolerate a long term chronic decrease of 2 °C. However, a short term acute periods of extreme cold and icing conditions are likely to cause stress and some mortality in bivalve populations (Dame, 1996). For instance, during the 1978/79 winter which was very cold with severe ice conditions, water temperature in the outer Weser estuary, Germany, remained below 0 °C on 45 successive days. Characteristic species of the benthos, including *Abra alba* were considerably damaged (Buhr, 1981). The intolerance of *Abra alba* to a short-term acute decrease in temperature has been assessed to be intermediate as a substantial proportion of the population maybe killed. The species is likely to re-populate and recovery has been assessed to be very high (see additional information below).

Increase in turbidity Low Very high Very Low Low

Abra alba does not require light and therefore the effects of increased turbidity on light attenuation are not directly relevant. An increase in turbidity may affect primary production in the water column and therefore reduce the availability of phytoplankton food. However, phytoplankton will also be transported from distant areas and so the effect of increased turbidity may be mitigated to some extent. The increased turbidity only persists for a year, so decreased food availability would probably only affect growth and fecundity and an intolerance of low has been recorded. As soon as light levels return to normal, primary production will increase, the species would resume optimal feeding, so recoverability has been assessed to be very high (see additional information below).

Decrease in turbidity Tolerant Not relevant Not sensitive Low

Abra alba does not require light and therefore the effects of decreased turbidity on light attenuation are not directly relevant. It is possible that decreased turbidity would increase primary production in the water column by phytoplankton and by microphytobenthos. The resultant increase in food availability may enhance growth and reproduction in *Abra alba*, but only if food was previously limiting.

Increase in wave exposure Intermediate Very high Low Moderate

An increase in wave exposure of two categories for one year would place the majority of the population in areas frequently subject to strong wave action and the species may be affected in several ways. Strong wave action may cause damage or withdrawal of the siphons, resulting in loss of feeding opportunities and compromised growth. Furthermore, individuals may be dislodged by scouring from sand and gravel mobilised by increased wave action. During winter gales along the North Wales coast, large numbers of *Abra alba* were cast ashore and over winter survival rate was as low as 7% in the more exposed locations (Rees *et al.*, 1977). Olivier *et al.* (1996) reported that the post-larvae and juveniles of *Abra alba* were most abundant in the near-bottom water stratum at flood tides. Therefore, increased wave action could result in enhanced resuspension and dispersal of early life stages. Overall, some mortality would be likely to occur and intolerance is recorded as intermediate. Recoverability has been assessed to be very high (see additional information below).

Decrease in wave exposure Tolerant Not relevant Not sensitive Low

Olivier *et al.* (1996) reported that the post-larvae and juveniles of *Abra alba* were most abundant in the near-bottom water stratum at flood tide velocities. Therefore, a reduction in wave exposure may lead to a decrease in dispersal of *Abra alba*. Changes in wave exposure are likely to have marked effects on the sediment dynamics of the shore. Decreased exposure will probably lead to increased siltation and reduced grain size (muddy sediment). However, as *Abra alba* favours muddy substrata such a change in the substratum in unlikely to affect the species and, overall, it has been assessed tolerant.

Noise Tolerant Not relevant Not sensitive Moderate

No information was found concerning the intolerance of *Abra alba* to noise. The siphons are likely to detect vibrations and are probably withdrawn as a predator avoidance mechanism, but the species is not expected to be sensitive at the level of the benchmark.

Visual Presence Not relevant Not relevant Not relevant Not relevant

Abra alba does not have visual acuity and an intolerance assessment for this factor was not considered to be relevant.

Abrasion & physical disturbance Intermediate Very high Low Moderate

Despite their robust body form, bivalves are vulnerable to physical abrasion. For example, as a result of dredging activity, mortality and shell damage has been reported in *Mya arenaria* and *Cerastoderma edule* (Cotter *et al.*, 1997). *Abra alba* is a shallow burrower and has a fragile shell (Tebble, 1976) and may be damaged by impact Bergmann & Santbrink (2000) reported between <0.5%and 18% mortality of *Abra alba* due to trawling in the southern North Sea, depending on the type of trawl (12 m or 6 m beam trawl or otter trawl). They included *Abra alba* amongst their list of bivalve species most vulnerable to trawling. However, they noted that many bivalve species were able to maintain a population in the face of fishing effort, depending on their life history characteristics. Therefore, intolerance has been assessed to be intermediate. Recoverability has been assessed to be very high (see additional information below).

Displacement Intermediate Immediate Very Low Moderate

Abra alba probably burrows into the sediment within a few minutes when displaced to the surface of muddy substrata. The species is therefore probably relatively tolerant of displacement. However, exposure at the sediment surface would increase the risk of predation, for example by the starfish *Asterias rubens* and flatfish predators (Allen, 1983;

Rainer, 1985; Basimi & Grove, 1985), so intolerance has been assessed to be intermediate. Recoverability for the majority of individuals has been assessed to be immediate.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination	High	High	Moderate	Moderate

Abra alba demonstrated alterations of its behaviour in response to exposure to marine sediments contaminated with pesticides (6000 ppm parathion, 200 ppm methyl parathion, 200 ppm malathion). No burrowing occurred in the most contaminated sediment, whilst burrowing was impaired in the moderately contaminated sediment with a median effective burrowing time ($ET_{(50)}$) of 9.0 (±3.0 - 28) minutes in comparison to a control time of 4.5 (±2.8 - 7.2) minutes (Møhlenberg & Kiørboe, 1983). Impaired burrowing would result in the species being exposed to predatory starfish and fish. However, no other information was found concerning the effects of synthetic chemicals specifically on *Abra alba*. However, inference can be drawn from related species. Beaumont *et al*. (1989) concluded that bivalves are particularly sensitive to tri-butyl tin (TBT), the toxic component of many antifouling paints. For example, when exposed to 1-3 µg TBT/l, *Cerastoderma edule* and *Scobicularia plana* suffered 100% mortality after 2 weeks and 10 weeks respectively. There is also evidence that TBT causes recruitment failure in bivalves, either due to reproductive failure or larval mortality (Bryan & Gibbs, 1991). Stirling (1975) investigated the effects of phenol, a non-persistent, semi-synthetic organic pollutant, on *Tellina tenuis*. Exposure to phenol produced a measurable effect on burrowing at all concentrations tested, i.e. 50 mg/l and stronger. Sub-lethal effects of exposure to phenol included delayed burrowing and valve adduction to exclude the pollutant from the mantle cavity. After exposure to 100 mg/l for 24 hours, the majority of animals were extended from their shells and unresponsive to tactile stimulation. Following replacement of the phenol solution with clean seawater, good recovery was exhibited after 2 days for animals exposed to 50 mg/l and some recovery occurred after 4 days for animals exposed to 100 mg/l. In light of the intolerance of other bivalve species, intolerance of *Abra alba* to synthetic chemicals has been assessed to be high. Recoverability has been assessed to be high (see additional information below) but would be partially dependent on the persistence time of synthetic contaminants in the sediments.

Heavy metal contamination	Intermediate	High	Low	Very low

Abra alba can live in polluted sediments (Dauvin, pers. comm.), for example, near Calais where high densities of *Abra alba* were found in sediment containing 8mg/g iron and 4 mg/g titanium (Dewarumez *et al*, 1976). The capacity of bivalves to accumulate heavy metals in their tissues, far in excess of environmental levels, is well known. Reactions to sub-lethal levels of heavy metals include siphon retraction, valve closure, inhibition of byssal thread production, disruption of burrowing behaviour, inhibition of respiration, inhibition of filtration rate, inhibition of protein synthesis and suppressed growth (see review by Aberkali & Trueman, 1985). Bryan (1984) states that Hg is the most toxic metal to bivalve molluscs while Cu, Cd and Zn seem to be most problematic in the field. In bivalve molluscs Hg was reported to have the highest toxicity, mortalities occurring above 0.1-1 g/l after 4-14 days exposure (Crompton, 1997), toxicity decreasing from Hg > Cu and Cd > Zn > Pb and As > Cr (in bivalve larvae, Hg and Cu > Zn > Cd, Pb, As, and Ni > to Cr). Owing to evidence in the literature of sub-lethal effects and mortality of bivalves, intolerance of *Abra alba* to heavy metal contamination has been assessed to be intermediate. Recoverability is recorded as high (see additional information below) but would be partially dependent on the persistence time of heavy metals in the sediments.

Hydrocarbon contamination	Low	Very high	Very Low	High

Suchanek (1993) reviewed the effects of oil on bivalves. Sublethal concentrations may produce substantially reduced feeding rates and/or food detection ability, probably due to ciliary inhibition. Respiration rates may increase at low concentrations and decrease at high concentrations. Generally, contact with oil causes an increase in energy expenditure and a decrease in feeding rate, resulting in less energy available for growth and reproduction. However, the *Abra alba* population affected by the 1978 *Amoco Cadiz* benefited from the nutrient enrichment caused by the oil pollution (see nutrient enrichment, below). The biomass of the fine-sand community remained low in 1979, a year after the spill, owing to the decimation of the *Ampelisca* amphipod population, but the biomass then doubled as a result of an increase in *Abra alba* abundance in 1980 and *Abra alba* remained a dominant species over the 20 year duration over which recovery of the community was monitored (Dauvin, 1998). Intolerance has been assessed to be low as the *Abra alba* population was apparently resilient to the presence of hydrocarbons in the subtidal sediments just two weeks after the wreck. The fact that *Abra alba* occurs subtidally may mitigate the effects of oil pollution on the species, as it avoids a direct oiling. Recoverability has been assessed to be very high as the species is able to adapt its demographic strategy in order to benefit from the resulting nutrient enrichment (Dauvin & Gentil, 1989).

Radionuclide contamination		Not relevant		Not relevant

No information was found concerning the effects of radionuclide contamination on *Abra alba*.

Changes in nutrient levels	Tolerant*	Not relevant	Not sensitive*	High

In a sewage dumping region of the North Sea, a great increase in the abundance of *Abra alba* occurred in much of the dumping area because of the ecological adaptations of the species enabled it to exploit the greatly increased supply of nutrients (Caspers, 1981). For example, the *Amoco Cadiz* oil spill in March 1978 caused vast disturbance to the fine-sand communities of the Bay of Morlaix, France (Dauvin, 1982). Drastic qualitative and quantitative changes in species abundance, diversity and biomass were recorded after the spill. However, the *Abra alba* population persisted in the disturbed environment under eutrophic conditions and as an 'opportunistic species' (Hily & Le Bris, 1984), it rapidly adapted its reproductive strategy by increasing its reproductive output to three spawnings per year. Increased growth and abundance was attributable to increased food availability and vacant ecological niches (Dauvin & Gentil, 1989). As *Abra alba* was able to adapt its demographic strategy in order to benefit from the nutrient enrichment, it has been assessed to be tolerant*.

Increase in salinity	Not relevant	Not relevant	Not relevant	Low

Abra alba is typically found in full salinity conditions. No information was found concerning the effects of hypersaline conditions on *Abra alba*.

Decrease in salinity	Intermediate	Very high	Low	Low

Abra alba is typically found in full salinity conditions and is therefore likely to be intolerant of reductions in salinity in some way. The benchmark decrease in salinity would place the population in areas of variable salinity for one year or reduced salinity for one week. The change would be likely to cause inhibition of growth and reproduction and exposure to low salinity may result in some mortality. Intolerance has been assessed to be intermediate. Recoverability has been assessed to be very high as a proportion of the adult population are likely to remain.

Changes in oxygenation	Tolerant	Not relevant	Not sensitive	High

Abra alba is typically found in organically enriched sediments where it may be present in high densities (Dauvin & Gentil, 1989). Such areas can be prone to periodic oxygen deficiency and individual growth and survival is dependent upon the maintenance of a continuous balance between high energy input (food availability) and high metabolic costs which result from periodic anaerobic metabolism and regulation of oxygen uptake (Hylland *et al.*, 1996). Experimental examination of the interactions between eutrophication and oxygen deficiency (2.4 - 3.5 mg O_2/ l over a 93 day experimental period) revealed that *Abra alba* became inefficient in its use of the available organic matter under prolonged conditions of hypoxia, as evidenced by a decreased growth rate (Hylland *et al.*, 1996). However, the benchmark assesses species' intolerance to hypoxia for one week and as *Abra alba* is able to shift from aerobic to anaerobic respiration, a short period of hypoxia is unlikely to have a significant effect upon the species and *Abra alba* has been assessed to be not sensitive at the benchmark level. However, prolonged exposure to oxygen concentrations below 3 mg O_2/ l may severely decrease growth and survival (Hylland *et al.*, 1996) and intolerance would be expected to be higher.

Biological Pressures

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

More than 20 viruses have been described for marine bivalves (Sinderman, 1990). Bacterial diseases are more significant in the larval stages and protozoans are the most common cause of epizootic outbreaks that may result in mass mortalities of bivalve populations. Parasitic worms, trematodes, cestodes and nematodes can reduce growth and fecundity within bivalves and may in some instances cause death (Dame, 1996). However, no information specifically concerning the effects of microbial pathogens and parasites on the viability of *Abra alba* was found.

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of non-native species	Not relevant	Not relevant	Not relevant	Not relevant

No evidence was found concerning the effect of non-native species on the viability of *Abra alba*.

	Intolerance	Recoverability	Sensitivity	Confidence
Extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant

Abra alba is not a species targeted for extraction.

	Intolerance	Recoverability	Sensitivity	Confidence
Extraction of other species	Intermediate	Very high	Low	Moderate

Dredging for scallops and use of other mobile fishing gear may cause abrasion and displacement of *Abra alba*. The delicate shell are vulnerable to physical damage (e.g. by otter boards; Rumohr & Krost, 1991), but the small size of *Abra alba* relative to meshes of commercial trawls may ensure survival of at least a moderate proportion of disturbed individuals which pass through (Rees & Dare, 1993). Intolerance has been assessed to be intermediate and recoverability very high (see additional information below).

Additional information

Recoverability

The life history characteristics of *Abra alba* and its widespread distribution contribute to its powers of recoverability. *Abra alba* spawns at least twice a year over a protracted breeding period, during which time an average sized animal of 11 mm can produce between 15, 000 to 17, 000 eggs. Such

egg production ensures successful replacement of the population, despite high larval mortality which is characteristic of planktonic development. Timing of spawning and settlement suggests that the larval planktonic phase lasts at least a month (Dauvin & Gentil, 1989), in which time the larvae may be transported over a considerable distance. Whilst some larvae may settle back into the parent population, the planktonic presettlement period is important for dispersal of the species and spatial separation from the adults also reduces the chances of adult induced mortality on the larvae through adult filter feeding (Dame, 1996). In addition to dispersal via the plankton, dispersal of post-settlement juveniles may occur via byssus drifting (Sigurdsson *et al.*, 1976, see adult distribution) and probably bedload transport (Emerson & Grant, 1991).
Diaz-Castaneda *et al*., (1989) investigated experimentally recolonization sequences of benthic associations over a period of one year, following defaunation of the sediment. Recovery of the *Abra alba* community was rapid, recruitment occurring from surrounding populations via the plankton. The abundance, total biomass and diversity of the community all increased until a maximum was reached after 20 to 24 weeks, according to the season. The community within the experimental containers matched that of the surrounding areas qualitatively but quantitatively within 4 to 8 months depending on the seasonal availability of recruits, food supply and faunal interactions. The experimental data suggest that *Abra alba* would colonize available sediments within the year following environmental perturbation. Summer settled recruits may grow very rapidly and spawn in the autumn, whilst autumn recruits experience delayed growth and may not reach maturity until the following spring/summer. In the worst instance, a breeding population may take up to two years to fully establish and so recoverability has been assessed to be high. However, recoverability may be very high in instances where a proportion of the adult population survives.

Importance review

Policy/legislation

- no data -

Status

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

Non-native

Native	Native		
Origin	-	**Date Arrived**	-

Importance information

A sequence of trawl surveys showed that the diet of plaice, *Pleuronectes platessa*, off eastern Anglesey was dominated by *Abra alba* in spring and summer (Basimi & Grove, 1985). Rainer (1985) considered *Abra alba* to be of ecological significance as food for juvenile fish and for intermediate-level predators that are also themselves prey for larger fish.

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