Plumose anemone (*Metridium dianthus*)

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

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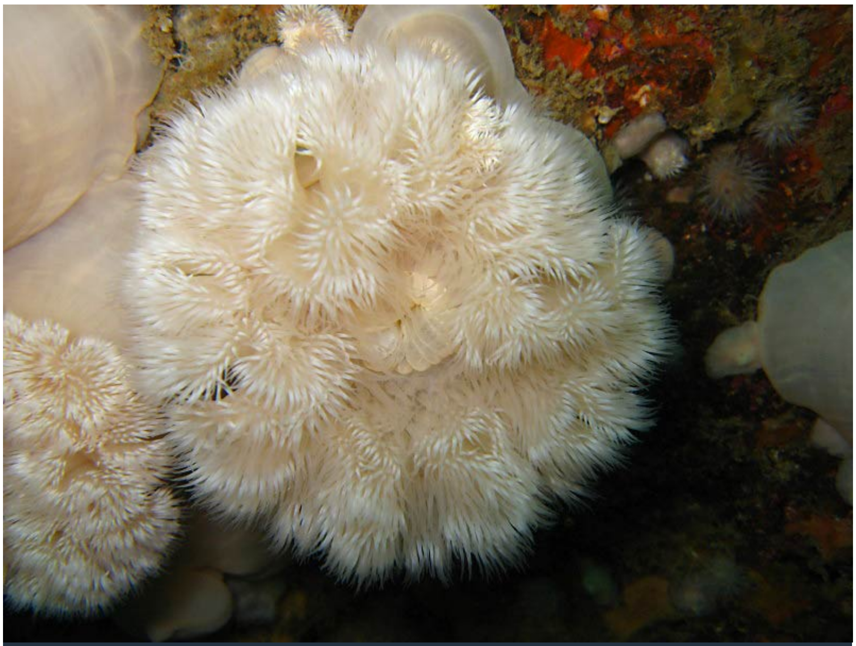

Close up of *Metridium dianthus* on Raglan Reef, Manacles, sout-west Cornwall.
Photographer: Robert Keen
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See online review for distribution map

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

Researched by	Dr Keith Hiscock & Emily Wilson	**Refereed by**	This information is not refereed.
Authority	(Ellis, 1768)		
Other common names	-	**Synonyms**	*Metridium senile* (Linnaeus, 1761)

Summary

Description

Metridium dianthus is an anemone of very variable form. The base is wider than the column and often irregular. When expanded, the numerous tentacles form a 'plume' above a conspicuous parapet at the top of the smooth column. Large individuals may be 30 cm high. The colour is plain, commonly white orange or dark green but brown, grey or occasionally red or yellow varieties occur.

Recorded distribution in Britain and Ireland

All British and Irish coasts.

Global distribution

See additional information below.

Habitat

Attached to any suitable hard substratum in overhangs, caves and beneath boulders on the lower shore, and on pier piles and rock faces to at least 100 m.

Depth range

Lower shore to considerable depths.

Identifying features

- The base is wider than column, moderately or firmly adherent, outline often ragged due to basal laceration.
- The column is divided into a smooth scapus and relatively long capitulum, with a parapet and fosse; in full expansion, the parapet often forms a salient, collar-like ring.
- The disc is fairly wide and there are prominent protruding lips around the mouth.
- The form 'dianthus' is tall (up to 30 cm), up to 15 cm across the base and has several thousand short slender tentacles which give the expanded anemone a fluffy appearance.
- The form 'pallidus' (pallidum in Bucklin, 1985) is small, not generally exceeding 2.5 cm across the base) and the tentacles are long and slender, not usually exceeding 200 in number.

Additional information

Manuel (1988) describes two distinctive varieties of *Metridium dianthus* (syn. *M. senile*). Var. *dianthus* is large with a tall column when expanded. The disc is deeply waved or folded. The many tentacles give a 'fluffy' appearance. Individuals may be 30 cm in height, with a basal diamer and tentacle span of 15 cm or more. Var. *pallidus* is a small form not exceeding 2.5 cm across the base with a flat disc without folds. Bucklin (1985) investigated biochemical genetic variation and concluded the presence of two morphs of *Metridium dianthus* but that they were variants resulting from different environmental conditions and were not taxonomically distinct and, therefore, not 'varieties' as described in many texts.

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Cnidaria	Sea anemones, corals, sea firs & jellyfish
Class	Anthozoa	Sea anemones, soft & cup corals, sea pens & sea pansies
Order	Actiniaria	
Family	Metridiidae	
Genus	Metridium	
Authority	(Ellis, 1768)	
Recent Synonyms	Metridium senile (Linnaeus, 1761)	

Biology

Typical abundance	High density
Male size range	30cm
Male size at maturity	
Female size range	Medium-large(21-50cm)
Female size at maturity	
Growth form	Radial
Growth rate	9cm/month
Body flexibility	High (greater than 45 degrees)
Mobility	
Characteristic feeding method	Non-feeding, Passive suspension feeder
Diet/food source	
Typically feeds on	Zooplankton but also larger prey. (See additional information.)
Sociability	
Environmental position	Epilithic
Dependency	Independent.
Supports	Substratum *Aeolidia papillosa*, *Pycnogonum littorale*.
Is the species harmful?	No Toxicity is equivocal. *Metridium dianthus* is eaten by some fish (for instance black bream *Spondyliosoma cantharus* (Mattacola, 1976)) and therefore appears low toxicity. However, nematocysts are present and some stinging is possible in sensitive humans.

Biology information

Growth rate

- Bucklin (1987a) observed that *Metridium dianthus* grew rapidly in laboratory culture when fed daily reaching a mean pedal diameter of 45 cm after 5 months.

Feeding

- Anthony (1997) noted that small anemones had the highest feeding efficiency at moderate to high flow regimes (which might help to account for the prevalence of small individuals at wave-exposed locations).
- Robbins & Schick (1980) found that current strength was the principal cause of expansion in *Metridium dianthus* rather than food availability. The greatest percentage of the anemones were expanded when the tide was running than at slack water.
- Examination of waste pellets of *Metridium dianthus* on wharf pilings in Monterey Bay, California (Purcell, 1976) revealed a diet of copepods, polychaete larvae, bivalve and gastropod veligers, copepod naupliii, and barnacle nauplii and cyprids.
- Sebens (1984) demonstrated that barnacle cyprids, ascidian larvae and gammarid amphipods were the preferred food of *Metridium dianthus* over invertebrate eggs, foramaniferans, calanoid and harpacticoid copepods and ostracods.

Predation on *Metridium dianthus*

- *Metridium dianthus* is subject to predation from both small and large consumers. The life stages of the sea spider *Pycnogonum littorale* found feeding on the anemone were reported by Wilhelm *et al*. (1997). The sea slug *Aeolidia papillosa* also feeds on *Metridium dianthus* (see, for instance, Reidy, 1996; Sebens, 1985). Sebens (1985) reported heavy mortality every winter in the Gulf of Maine, USA from *Aeolidia papillosa*. However, infestations may be sporadic. Gorzula & Cameron (1976) reported a population boom of *Aeolidia papillosa* at Millport, Firth of Clyde during February 1974 and that it was the third recorded that century. Effects on the *Metridium dianthus* population were considerable although the slugs vanished after four weeks. Epitonid snails (wentletraps) feed on anemones and Perron (1978) observed that *Metridium dianthus* was the preferred prey of *Epitonium greenlandicum* in the Bay of Fundy. Whether north-east Atlantic wentletraps feed on *Metridium dianthus* is uncertain although Graham (1988) notes that *Epitonium clathrus* feeds on *Anemonia sulcata*. Larger species that eat whole anemones include the black bream *Spondyliosoma cantharus* (Mattacola, 1976) and, in New Foundland, the winter flounder *Pseudopleuronectes americanus* (Keats, 1990).

Habitat preferences

Physiographic preferences	Offshore seabed, Ria / Voe, Strait / sound
Biological zone preferences	Lower circalittoral, Lower infralittoral, Sublittoral fringe, Upper circalittoral, Upper infralittoral
Substratum / habitat preferences	Artificial (man-made), Bedrock, Biogenic reef, Caves, Large to very large boulders, Overhangs
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.)
Wave exposure preferences	Exposed, Extremely exposed, Extremely sheltered, Moderately exposed, Sheltered, Very exposed, Very sheltered
Salinity preferences	Full (30-40 psu)
Depth range	Lower shore to considerable depths.
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

The species occurs from Biscay to Scandinavia in the northeast Atlantic. It is unknown from the western basin of the Mediterranean but recorded from the Adriatic (where it is believed to have been introduced) (Manual 1988). The same species occurs on the west and east coasts of North America. It has recently (Griffiths *et al*., 1996) been reported from Table Bay Harbour in South Africa where it was probably introduced from Europe. Both *dianthus* and *pallidum* forms may occur in estuaries and *pallidum* in brackish creeks. Braber & Borghouts (1977) recorded *Metridium dianthus* from salinities as low as 10 ppt Chlorinity (about 19 psu) in the Delta Region of the Netherlands.

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	No information
Fecundity (number of eggs)	No information
Generation time	Insufficient information
Age at maturity	Insufficient information
Season	August - September
Life span	See additional information

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Lecithotrophic
Duration of larval stage	1-6 months
Larval dispersal potential	Greater than 10 km
Larval settlement period	Insufficient information

Life history information

The Plymouth Marine Fauna (Marine Biological Association, 1957) reports that ova and sperm are produced in August and September at Plymouth. Bull (1939b) records that ova and sperm are given off at intervals throughout the year in north-east England. An account of reproductive cycles in Californian *Metridium dianthus (as Metridium senile*), where spawning occurred in September and October, is given in Bucklin (1982). Sebens (1985) suggests that the larva is lecithotrophic but has a 'pre-metamorphosis' period of months, a dispersal potential of >10,000m and a colonization rate of 5-10 years. *Metridium dianthus* colonizes areas aggressively. In studies of succession in rock wall communities in the Gulf of Maine, USA, Sebens (1985), the anemone was a late colonizer but grew over earlier colonizers and used specialized 'catch-tentacles' to damage other anemones and soft corals. The presence of such 'catch-tentacles' is also reported for *Metridium dianthus* in Britain (Williamson, 1975).

Growth is rapid. Bucklin (1985), working in Britain, found that for *Metridium dianthus* (as *Metridium senile*) f. *dianthus* fragments and for f. *pallidum* newly settled individuals, a growth rate of up to 0.6

mm and 0.8 mm in pedal diameter per day occurred respectively. Bucklin (1987a) found that, for *Metridium dianthus* from California, individuals showed rapid growth to large sizes when fed at frequent intervals. Mean size grew steadily during the first eight months then levelled off. An increase from 5 cm^2 pedal disk area to 45 cm^2 occurred within 12 months. No information on longevity has been found although it would be expected that individuals are long-lived (10 years+).

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

Adult *Metridium dianthus* live attached to the substratum and will be removed with it. Re-colonization is likely to be rapid and occur within two or three years, although full recovery of dominance may take in excess of five years (see additional information below). Larvae of *Metridium dianthus* settle readily from the plankton and are known to colonize new structures such as wrecks and jetty piles within two to three years (K. Hiscock, own observations). Growth rate is rapid and a large size is reached in well-fed individuals within about nine months (see Bucklin, 1985). It is also possible that migration might occur from nearby adult populations as is believed to occur in re-colonizing previously de-oxygenated areas (Wahl, 1985). Therefore an intolerance of high and a recoverability of high has been recorded.

Smothering	Low	Immediate	Not sensitive	High

Smothering by sediment is unlikely to occur as the anemone can expand above a layer of silt. Smothering by more impervious material is likely to result in anoxia and *Metridium dianthus* is very tolerant of deoxygenated conditions (Wahl, 1884). However, smothering may result in the anemone withdrawing its tentacles and shrinking or expending energy to rise above the sediment so that an intolerance of low is appropriate.

Increase in suspended sediment	Low	Immediate	Not sensitive	High

Metridium dianthus can produce mucus to clear itself of silt. The production of mucus may have an energetic consequence and an intolerance of low is recorded.

Decrease in suspended sediment	Tolerant*	Not relevant	Not sensitive*	Moderate

Metridium dianthus does not rely on silt for feeding and may benefit by not having to produce mucus to slough off silt. However, decrease in siltation may result in decreased turbidity but see 'turbidity' for effects.

Dessication	Intermediate	High	Low	Low

Metridium dianthus do not generally occur in the intertidal although may be present under piers and under overhangs, i.e. in shaded locations. They can produce mucus which would provide some protection from desiccation but, on the open shore, are most likely vulnerable and would be adversely affected. At least some may be killed following a one hour exposure to sunshine whilst, in the case of a longer-term alteration in tidal level (see increase in emergence) migration is likely. An intolerance of intermediate is suggested but with a low confidence. For recoverability, see additional information below.

Increase in emergence regime	High	High	Moderate	High

Metridium dianthus do not generally occur in the intertidal but may be present under piers and under overhangs, i.e. in shaded locations. In the case of an increase in emergence, migration is likely. *Metridium dianthus* is capable of detaching and floating away when conditions become undesirable. For instance, Wahl (1984, 1985) noted that in anoxic conditions, anemones detached from the substratum and drifted away. Although individual anemones are therefore unlikely to be killed by increase in emergence, they will be lost from a particular location and therefore intolerance is described as high. For recoverability, see additional information below.

Decrease in emergence regime	Tolerant*	Not relevant	Not sensitive*	High

Metridium dianthus is predominantly a subtidal species and therefore decrease in emergence would provide new habitats for it to settle in.

Increase in water flow rate	Intermediate	Very high	Low	Moderate

Metridium dianthus is a passive suspension feeder relying on water currents to bring food. Hiscock (1983) describes the reaction of *Metridium dianthus* to increasing flow rate (to 90 cm/s) in a flume. The anemones were stimulated to expand tentacles as flow increased and only withdrew them at flow rates in excess of 70 cm/s. They were not swept away. Whilst large *Metridium dianthus* thrive in tidal narrows where surface velocity may be in the region of 3-5 knots, they do not appear to occur in very strong tidal flows (exceeding 5 knots) such as in the Gulf of Corryvreckan or Strangford Lough Narrows. Increase in water flow rate to about 5 knots is therefore likely to favour settlement and growth of *Metridium dianthus* especially because of increased food supply whilst above 5 knots, adverse effects including inability to feed and possible displacement occur. As the benchmark is for an increase from moderately strong to very strong (>6 knots) water flow, adverse effects may occur and an intolerance assessment of intermediate is suggested to reflect the possible loss of some individuals.

Decrease in water flow rate	Low	Very high	Very Low	Moderate

Metridium dianthus is a passive suspension feeder relying on water currents to bring food. Decrease in water flow rate is likely to significantly reduce opportunities for feeding and growth rate and expansion of populations by basal laceration may be reduced. Established individuals are likely to survive for the period of decreased flow prescribed in the benchmark and therefore an intolerance of low is suggested. However, in the long-term, the population is likely to decline through predation and detachment and not be replaced so that an intolerance, in that situation, of intermediate or high would be appropriate. For recoverability, see additional information.

Increase in temperature	Tolerant	Not relevant	Not sensitive	Low

Metridium dianthus occurs to the Bay of Biscay south of Britain but also in the Adriatic (Manual, 1988) suggesting that it would be tolerant of long-term increases in temperature in Britain and Ireland. No evidence has been found of adverse effects of short-term temperature increase on anemones occurring, for instance, adjacent to thermal effluents. Therefore an assessment of tolerant is made but with low confidence.

Decrease in temperature	Tolerant	Not relevant	Not sensitive	High

Metridium dianthus occurs in much colder waters than those surrounding Britain and Ireland. Crisp (1964) records (but from only one location) that the anemone was unaffected by the cold winter of 1962-63.

Increase in turbidity	Tolerant*	Not relevant	Not sensitive*	Moderate

Metridium dianthus may benefit from increase in turbidity as algal growth on hard substrata will be reduced. For instance, Svane & Groendahl (1988) found that, in comparison with records from 1926-29, *Metridium dianthus* had colonized areas in the Gullmar Fjord where it had not been recorded and ascribed the reason to possible increase in turbidity (and tolerance of pollution).

Decrease in turbidity	Intermediate	High	Low	

Metridium dianthus may be adversely affected by decrease in turbidity as algal growth on hard substrata will be increased. Svane & Groendahl (1988) found that, in comparison with records from 1926-29, *Metridium dianthus* had colonized areas in the Gullmar Fjord where it had not been recorded and ascribed the reason to possible increase in turbidity (and tolerance of pollution). However, evidence for an adverse effect on *Metridium dianthus* due to decrease in turbidity is poor and, although an intolerance of intermediate is assigned, confidence is very low. For recoverability, see additional information below.

Increase in wave exposure	Low	Immediate	Not sensitive	Low

Metridium dianthus occurs in greatest abundance in the most wave sheltered situations (but usually with significant tidal flow) and in the most extremely wave exposed conditions where populations are of small individuals in shallow surge situations. The likely impact of increased wave exposure on the large individuals that typically occur in wave sheltered situations is especially considered here. Those wave sheltered situations may, from time-to-time, be subject to strong wave action when winds blow from a direction that is not prevailing. For instance, on the open east coast of Lundy, *Metridium dianthus* occurs on shallow jetty piles and on a wreck at 15 m depth where they persist despite occasional strong wave action during easterly winds. It seems most likely that individuals close and shrink-down during strong wave action but survive. *Metridium dianthus* is strongly adherent and when closed probably produces little resistance to water flow. Therefore, the impact will be of decreased feeding opportunity and perhaps loss of condition but recovery will be rapid. For situations where wave exposure increases in already wave exposed situations, it might be that abundance of *Metridium dianthus* will increase. Bucklin (1987b) found that the small size of intertidal populations was imposed, most likely, by limited food and feeding time and damage from wave action, which stimulates fragmentation. Their reaction to strong wave action seems to be to increase in numbers but remain small.

Decrease in wave exposure	Tolerant*	Not relevant	Not sensitive*	Moderate

Metridium dianthus occurs in greatest abundance in the most wave sheltered (but usually with significant tidal flow) situations. Therefore, a decrease in wave exposure may favour colonization by the anemone. However, decreased wave exposure at the sort of extremely exposed locations where populations of small individuals occur may adversely affect survival of those populations. For the purpose of this review, the most widespread occurrence of *Metridium dianthus* (in sheltered locations) is applied and where decrease in wave exposure might be favourable.

Noise	Tolerant	Not relevant	Not sensitive	High

Metridium dianthus is likely to have poor ability for detection of noise vibrations and as such is unlikely to be sensitive to noise.

Visual Presence	Tolerant	Not relevant	Not sensitive	High

Metridium dianthus has very limited, if any, ability for visual perception. The anemone is unlikely to be sensitive to visual presence.

Abrasion & physical disturbance	Intermediate	Very high	Low	High

The anemone is soft, flexible and can reform its attachment to the substratum. Physical impact is likely to cause damage and mortality to exposed individuals but, because the species habitually reproduces by basal laceration, it seems likely that torn individuals will re-grow.

Although some individuals will be displaced or killed, at the level of the benchmark, effects will be intermediate and recovery likely to be very high. In more extensive events of physical disturbance, intolerance is likely to be more similar to substratum removal.

Displacement	Low	Very high	Very Low	Moderate

Wahl (1984) observed that anemones detached from the substratum during the first week of deoxygenation in the Inner Flensburg Fjord and may drift away eventually to resettle. *Metridium dianthus* therefore seems able to survive displacement from the substratum but, presumably, may be damaged during the displacement in which case some repair may be needed.

Chemical Pressures

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

Mercier *et al*. (1998) exposed *Metridium dianthus* to tributyltin contamination in surrounding water and in contaminated food. The species produced mucus 48 hours after exposure to contaminated seawater. TBT was metabolized but accumulated lower levels of butyltins leading the authors to suggest that they seemed vulnerable to TBT contamination. However, Mercier *et al*. (1998) do not indicate any mortality and, since *Metridium dianthus* is a major component of jetty pile communities immediately adjacent to large vessels coated with TBT antifouling paints, intolerance is assessed as low specifically to TBT.

Heavy metal contamination		Not relevant		Not relevant

No information has been found of accumulation or effects of heavy metals on *Metridium dianthus*.

Hydrocarbon contamination	Low	Immediate	Not sensitive	Low

Metridium dianthus is a major component of jetty pile communities immediately adjacent to areas subject, in previous times, to the discharge of oily ballast and also, in Milford Haven, to a refinery effluent containing hydrocarbons (K. Hiscock, own observations). The anemone is able to produce mucus as a protective mechanism should oil settle onto individuals. No records have been found of any mortality of *Metridium dianthus* during oil spills or of any experimental studies of effects. Therefore, although an intolerance of low is indicated, it is with low confidence.

Radionuclide contamination		Not relevant		Not relevant

No information has been found.

Changes in nutrient levels	Tolerant*	Not relevant	Not sensitive*	Very low

Metridium dianthus may benefit from increase in nutrients. For instance, Svane & Groendahl (1988) found that, in comparison with records from 1926-29, *Metridium senile* had colonized areas in the Gullmar Fjord where it had not been recorded and ascribed the reason to possible tolerance of pollution from a pulp mill (and increase in turbidity). Therefore tolerant* is indicated.

Increase in salinity	Low	Immediate	Not sensitive	Low

The species occurs in full salinity but seems to thrive in variable salinity conditions (for instance in tidal narrows at the entrance to estuaries and on jetty piles in enclosed areas). It might be that higher salinity conditions would reduce its competitiveness and an intolerance of 'low' is suggested.

Decrease in salinity	Low	Very high	Very Low	High

Although *Metridium dianthus* is predominantly marine, the species does penetrate into estuaries. Braber & Borghouts (1977) found that *Metridium dianthus* occurred in about 10 ppt Chlorinity (about 19 psu) in the Delta Region of the Netherlands suggesting that it would be tolerant of reduced salinity conditions. Shumway (1978) found that, during exposure to 50% seawater, animals retracted their tentacles whilst animals exposed to fluctuating salinity, contracted their body wall and produced copious mucus. Therefore, the species seems to have a high tolerance to reduction in salinity but may have to retract tentacles, suffer reduced opportunity to feed and expend energy to produce mucus. Intolerance has therefore been assessed as low suggesting that individuals are unlikely to be killed by changes at the level of the benchmark. Recovery is in terms of condition and is therefore very high.

Changes in oxygenation	Tolerant	Not relevant	Not sensitive	High

Wahl (1984, 1985) noted that the LC_{50} value for *Metridium dianthus* in anoxic conditions is about three weeks and that none survive beyond six weeks. He observed that anemones detached from the substratum during the first week of deoxygenation in the Inner Flensburg Fjord and may drift away. When oxygen is lacking, *Metridium senile* diminishes body surface area. At the level of the benchmark, *Metridium dianthus* is not sensitive and even in extreme conditions seems able to survive for some time and then detach. Although, at the benchmark level, recoverability is 'Not Relevant', it seems that re-colonization can be very rapid from nearby individuals. However, following a severe effect, it might take several years for re-colonization to previous cover to occur (see additional information below).

Biological Pressures

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

No information has been found of effects of any microbial pathogens.

Introduction of non-native species	Tolerant	Not relevant	Not sensitive	High

No non-native species currently present in Britain and Ireland are known to have any impact on populations of *Metridium dianthus*.

Extraction of this species	High	High	Moderate	High

If the species were to be extracted, mortality would occur. For recoverability, see additional information below.

Extraction of other species	High	High	Moderate	High

Metridium dianthus sometimes occur, as small individuals, on kelp (*Laminaria hyperborea*) stipes. Kelp is extracted in some countries. Where attached individuals are collected, demise is certain. For recoverability, see additional information below.

Additional information

Recovery following loss is likely to be high. The species reproduces each year and the planulae, according to Sebens (1985), spend months in the plankton and are likely to disperse over in excess of 10 km from parent anemones. New jetty piles at Lundy were colonized by their third year (L. Cole, pers. comm.). Settled planulae or individuals produced by basal laceration are likely to grow rapidly. Bucklin (1987a) found that, for *Metridium dianthus* from California, individuals showed rapid growth to large sizes when fed at frequent intervals. Mean size grew steadily during the first eight months then levelled off. An increase from 5 cm pedal disk area to 45 cm occurred within 12 months. However, in the clearance experiments undertaken by Sebens (1985) he found that it took 5-10 years for *Metridium dianthus* to return to pre-clearance cover rates. In another study, Wahl (1985) found that *Metridium dianthus* as (*Metridium senile*) returned to rock walls only one week after oxic conditions returned following annual de-oxygenation events in the Inner Flensburg Fjord. Overall, a recoverability of high is probable even where no nearby populations exist.

Importance review

Policy/legislation

- no data -

Status

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

Non-native

Native	-		
Origin	-	Date Arrived	-

Importance information

Metridium dianthus may dominate large areas of rock and artificial substrata such as jetty piles and wrecks. It is capable of aggressively displacing other species through the use of 'catch-tentacles' that sting adjacent fauna causing necrotic patches to develop. Studies of community dynamics have been undertaken particularly by K. P. Sebens (see, for instance, Sebens 1985). It is possible that several fish species may feed on *Metridium dianthus*. The sea slug *Aeolidia papillosa* and the sea spider *Pycnogonum littorale* feed on this and other sea anemones. (See 'General Biology' for more information and references.)

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