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Mosman Intertidal Monitoring

Project Monitoring Plan

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Sydney
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Cairns

Cover photograph: Quakers Hat Bay

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1. Introduction

1.1 Context

Mosman Council are planning on monitoring the intertidal zone looking at existing marine species and identifying invasive species for future management. The monitoring program would provide baseline data that can be used to monitor future changes of these ecosystems in regard to species abundance and distribution associated with the impacts of climate change and invasive species. The intertidal monitoring program focusses on intertidal communities at two locations along the Middle Harbour foreshore of Pearl Bay and Quakers Hat Bay.

1.2 Project objectives

The project objectives are to identify and quantify marine organisms found within the intertidal zone along the foreshore areas of Pearl Bay and Quakers Hat Bay Mosman.

1.3 Background

Changes in rocky shore assemblages in response to climate fluctuations are recognised as significant ecological drivers of these communities (Hawkins *et al*. 2008). Sydney harbour is located in a region expected to warm faster than the global average and is heavily influenced by an extension of the East Australian Current that will likely result in elevated ocean temperatures (Hedge *et al*. 2013). Other potential changes to the physical foreshore environment from climate change include sea level rise and decreasing pH of ocean water. These changes may result in some long-term changes to intertidal communities. Such changes predicted include: impacts to the growth and development of some species of molluscs and echinoderms while other species may be favoured (Hedge *et al*. 2013); a decrease in prevalence of calcareous macroalgae and increase in fleshy macroalgae (Koch *et al*. 2012); and erosion of ecological resilience resulting in loss of diversity (Bernhardt and Leslie 2013). All these effects are likely to result in assemblage changes amongst intertidal communities that can be monitored through long-term assemblage based monitoring.

Sydney Harbour has a strong history of both commercial and recreational boat use. This has resulted in a significant risk to the establishment and proliferation of non-indigenous species and invasive species (Hedge *et al*. 2013). The introduction and establishment of these species can result in significant impacts on biodiversity and potentially economic losses for industries reliant on the use of the harbour. In Sydney Harbour, the most commonly occurring non-indigenous species found within intertidal areas is the Pacific Oyster (*Crassostrea gigas*). Other intertidal species that are of concern but not known to occur in Sydney Harbour include the European Green Shore Crab (*Carcinus maenas*)and the New Zealand Screw Shell (*Maoricolpus roseus*), which are known to have established in areas on the NSW south coast and Asian (NSW DPI 2016).

The two locations to be investigated under this monitoring plan are inherently different. The Pearl Bay location is within an area of high recreational use both of the foreshore and adjacent water ways. As a result the intertidal community is primarily restricted to surface on the cement seawall and rock area in the low intertidal zone at the base of the seawall. The second location of Quakers Hat Bay is located adjacent to a primarily residential area. A natural intertidal rocky shore is typically located below the foreshore cliffs which includes a small area of intertidal rock shelve with drying rocks.

2. Program design

The key questions to be addressed as part of this program include the following:

- Identify changes among the intertidal assemblage (barnacles and molluscs – individuals; algae – percent cover).
- Identify changes in diversity of intertidal species.
- Monitor the abundance of common intertidal introduced/ non-indigenous species (*C. gigas*).
- Identify the presence of other or new introduced or non-indigenous species.

2.4 Study locations

The two locations to be investigated under this monitoring plan are inherently different. The Pearl Bay location is within an area of high recreational use both of the foreshore and adjacent water ways. As a result the intertidal community is primarily restricted to surface on the cement seawall and rock area in the low intertidal zone at the base of the seawall. The second location of Quakers Hat Bay is located adjacent to a primarily residential area. A natural intertidal rocky shore is typically located below the foreshore cliffs and includes a small area of intertidal rock shelve with drying rocks

2.5 Intertidal zones

Two intertidal zones are to be sampled as part of this program (Low and High), while the high zone and associated assemblage at Pearl Bay is typically absent due to the cement seawall. Thus, the high zone will only be sampled at Quakers Hat Bay. Given the narrow width and restricted areas of the rocky shore present at the study locations, the establishment of a mid-zone for monitoring was not deemed feasible or of significant ecological value at these locations.

For these works the high zone is characterised by areas above the mean water mark, while those below it are characterised as the low zone. These can typically be distinguished by the top of the oyster line/ zone at each of the sites (See photos in Appendix A).

2.6 Survey Timing

Scales of temporal variation on rocky intertidal shores can occur at an inter-annual, seasonal, daily and tidal scales (Creese and Kingsford 1998). For monitoring of intertidal shores for effects of climate change and introduced species the longer time scales of inter-annual and seasonal are of most relevance. Thus, for this program a survey interval of every two to three years is deemed suitable to monitor for long-term changes with important seasonal variation measured through surveys in both autumn and spring.

2.7 Response variables

A number of response variables have been selected to address the key questions, while also providing additional information about changes related to climate change and introduced/ non-indigenous species (Table 1).

Table 1 Response variables

Response variable	Key Question	Notes
Assemblage (Sessile fauna)	1	All molluscs and barnacles combined
Assemblage (Intertidal algae)	1	Use of both species and groups
Diversity (Sessile fauna)	2	All molluscs and barnacles combined
Density (Sessile fauna)	1	All molluscs and barnacles combined
Total macroalgae cover	1	Percent cover
C. gigas abundance	3	Note identification difficulties
Recorded introduced and non-indigenous species	4	Present at location scale
Seawall height (Oysters & mussels)	Additional information	Pearl Bay Only

Drawn by: RJ Project Manager: DC Project Number: 2920 Date: 17/03/2016

Pearl Bay monitoring sites

Mosman Intertidal Zone Monitoring: Draft Report

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FIGURE 1

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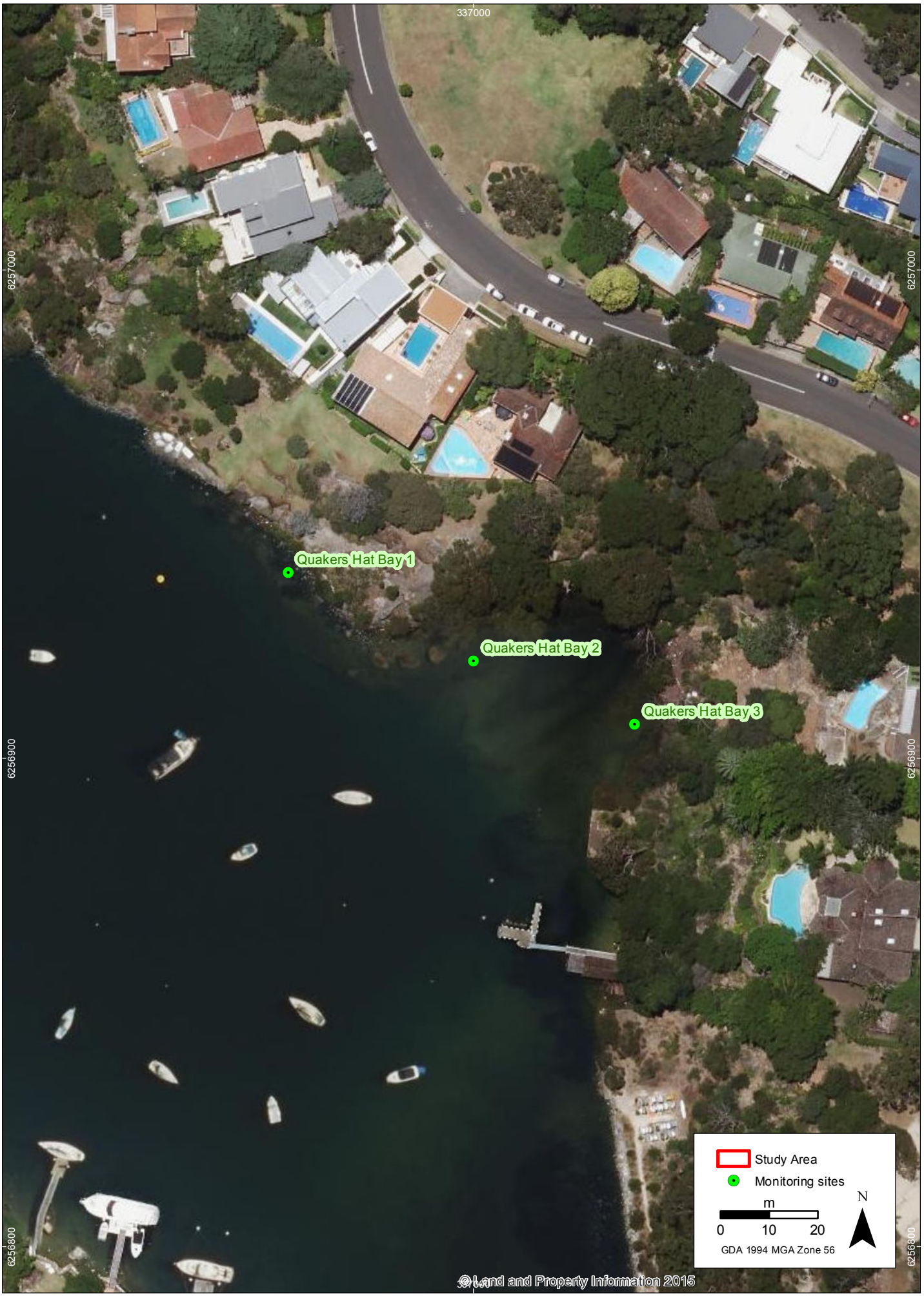
Imagery: (c) LPI 2014-01-06



Drawn by: RJ Project Manager: DC Project Number: 2920 Date: 17/03/2016

Quakers Hat Bay monitoring sites

Mosman Intertidal Zone Monitoring: Draft Report

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FIGURE 2

Path: T:\spatial\projects\a2900\a2920_MossmanIntertidal\Maps\report\2920_Figure_2_StudyArea_QHBay.mxd

Imagery: (c) LPI 2014-01-06

2.8 Experimental Design

A design tree is provided in Figure 3. This design tree outlines the collection of both univariate and multivariate data across a survey.

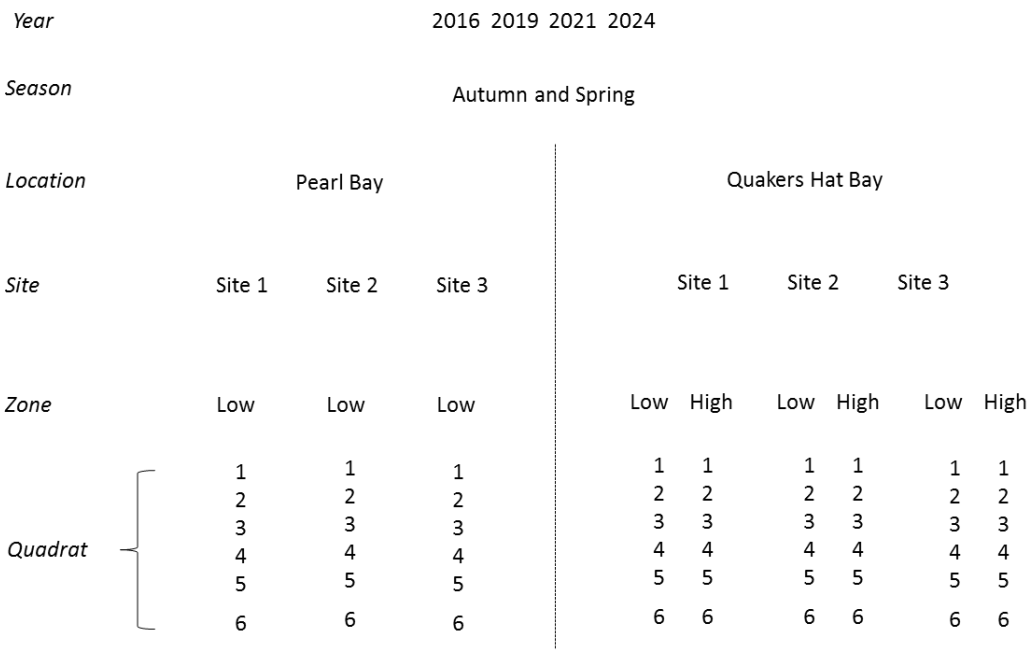

Figure 3: Design Tree

The experimental design for analysis of both univariate and multivariate data is as follows:

- Year – Random factor every three years
- Season – Random factor nested within Year with two levels (autumn and spring).
- Site – Random factor with three levels (1, 2 and 3)
- Zone – Fixed factor with two levels (Low and High -Quakers Hat Bay only).

3. Methodology

3.9 Site access

The Pearl Bay sites are accessed from the Spit Reserve on the western side of Military Road.

The Quakers Hat Bay sites are accessed from the public walkway to the foreshore along Bay Street Mosman.

All intertidal sites should be planned for surveys during daylight low tides of 0.3m or less. With the low intertidal areas surveyed within 1 hour of the low tide.

The GPS positions of the sites and provided in Table 2 and maps of site lay out are provided in Figure 1 and Figure 2. A site is defined as suitable habitat within 10m radius of the GPS position.

Table 2: Site details

Site	GPS Position	Photo
Pearl Bay 1	E 337544 N 6257632	
Pearl Bay 2	E 337575 N 6257688	
Pearl Bay 3	E 337592 N 6257761	

Site	GPS Position	Photo
Quakers Hat Bay 1	E 336962 N 6256938	
Quakers Hat Bay 2	E 337000 N 6256920	
Quakers Hat Bay 3	E 337033 N 6256907	

3.10 Sampling methods

Sampling Equipment

The following sampling equipment will be required:

- 0.5 x 0.5m (0.25m2) quadrat with a 10 by 10 grid (each square 5cm x 5cm)
- Pencils
- Waterproof data sheets
- Camera
- ID Guide (Appendix B)
- GPS
- Measuring tape
- Gloves
- Wetsuit boots

Sampling Instructions

Six replicate quadrats should be haphazardly placed and surveyed in each zone at each site. Care should be taken at each site to ensure quadrat is haphazardly placed in the correct zone (See Appendix A) and of a relatively flat surface.

Within each quadrat each mollusc and barnacle species should be identified and species and abundance recorded. Only individuals where 50% or more of the animal is within the quadrat should be recorded. For very abundant species (approximately >100) random sub-sampling can be done where their distribution is relatively even. Sub sampling is performed by randomly sampling 8 squares within the quadrat. This will result in sampling of $0.1m^2$ of the possible $0.5m^2$, therefore resulting data will require correction by multiplying by 5 to be consistent with the rest of the quadrat data. For fauna where number of individuals cannot be easily identified e.g. oysters, a percent cover measurement should be applied as described below for algae. Where this approach is chosen, it should be repeated for the species at all locations and during subsequent surveys.

Intertidal algae is measured as percent cover with the algae species or category under each cross hair within the quadrat grid identified/categorised and recorded. For algae species, *in situ* identification of some groups are not possible and require specialised expertise and analysis under laboratory conditions. Therefore the following categories should be used:

- turfing algae
- encrusting coralline algae,
- microalgae
- coralline red algae
- foliose (fleshy) green
- foliose brown
- foliose red algae.

Where possible data should also be recorded to species level. This will only be possible *in situ* for foliose algae and some coralline algae. Examples of these categories and common species that can be identified *in situ* are in Appendix B.

At the Pearl Bay sites the distance between the top of the seawall and the top of both the oyster and mussel bed layers should be recorded at 10 random positions within each site using a measuring tape. This will provide information on changes in zonation height of these communities with any subsequent sea level rise.

At each location additional survey effort should be undertaken to search for new or previously unrecorded introduced or non-indigenous species. This should be done on a location basis and include a visual inspection of areas between sites at each location as many of these species can be cryptic and likely to occur initially at low and patchy densities. The NSW DPI guidance for Marine Pests in Appendix C should be consulted for guidance on the identification of these species (NSW DPI 2016).

Identification of Pacific Oysters

The identification of Pacific Oysters (*C. gigas*) can be difficult without specialised training. Morphologically their shells can be highly variable making identification from visual observations of live specimens at low tide only difficult. Additional guidance in identification of these species has been provided in Appendix B, however this may require opening of the oysters. Additional training from NSW Fisheries may be beneficial for non-experienced survey staff and should be considered to increase reliability of identifications for this part of the survey.

Quality Assurance

The site specific identification guide should be used as the main quality assurance tool for field surveys.

To ensure appropriate sampling of the lower intertidal area, surveys of the low intertidal community should not occur outside of 1hr of a low tide or during a low tide higher than 0.3m.

To ensure consistency between surveys and survey staff it is recommended that an example photo of each species identification for each site is taken each survey and kept on record.

Where a species cannot be identified a preliminary identification should be given with a unique identifier until confirmation and/or expert identification can be made.

New species may be encountered during the survey, these should be photographed and added to the identification guide after each survey.

Collection and/or opening of oysters may require a NSW Fisheries Research permit. The requirements for this should be discussed with NSW Fisheries before undertaking these tasks.

4. Analysis of data

The minimum data analysis for each survey is outlined below.

- Density (mean and SE) of each molluscs, barnacles and macroalgae species/ category for each site.
- List and photos of any introduced species observed for each location.
- Diversity (mean and SE) of fauna for each location.
- Percent cover of total macroalgae (mean and SE) for each location and any fauna species that percent cover is deemed a more suitable measure.
- Seawall height (mean and SE) of oyster and mussel height at Pearl Bay site.

Statistical analysis of the data can be performed to identify and visualise assemblage relationships and determine if differences between means are statistically different. It is encouraged that statistical analysis is performed to visualise relationships and test the significance of differences between the means for key response variables following the second survey. The use of nMDS (non-metric multidimensional scaling) or PCO (principle coordinate analysis) can be used to visualise assemblage changes and differences. While univariate ANOVA (analysis of variance) tests can be performed to test the significance of differences of mean for individual response variables. For tests of multiple variables at once e.g. assemblages PERMANOVA (permutational analysis of variance) can be applied. To apply these procurement of the statistical software package PERAMNOVA+ for PRIMER (Anderson *et al.*2008) is recommended.

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Annex A: Site photos

Pearl Bay

Plate 1: Looking north towards site 1 and 2 from the public pontoon in Pearl Bay.

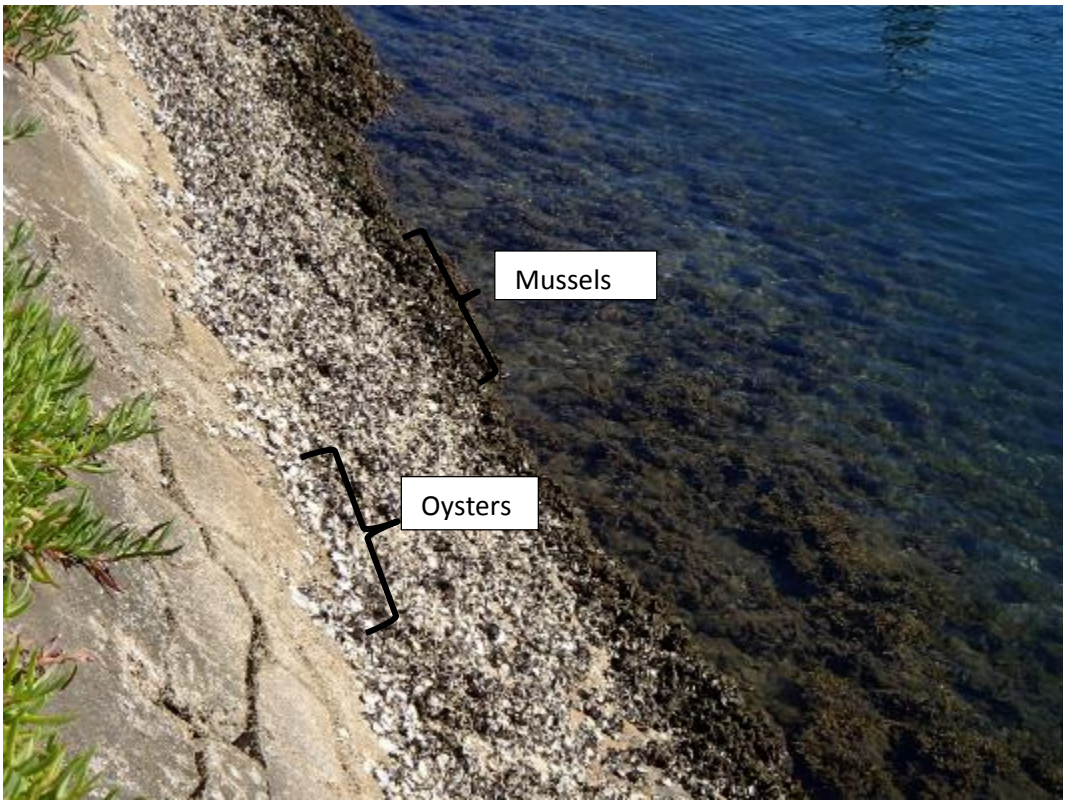


Plate 2: Clear zonation of the oyster and mussel zone along the seawall at Pearl Bay

Plate 3: Northern side of Site 1 at Quakers Hat Bay showing zonation by oysters between high and low zone

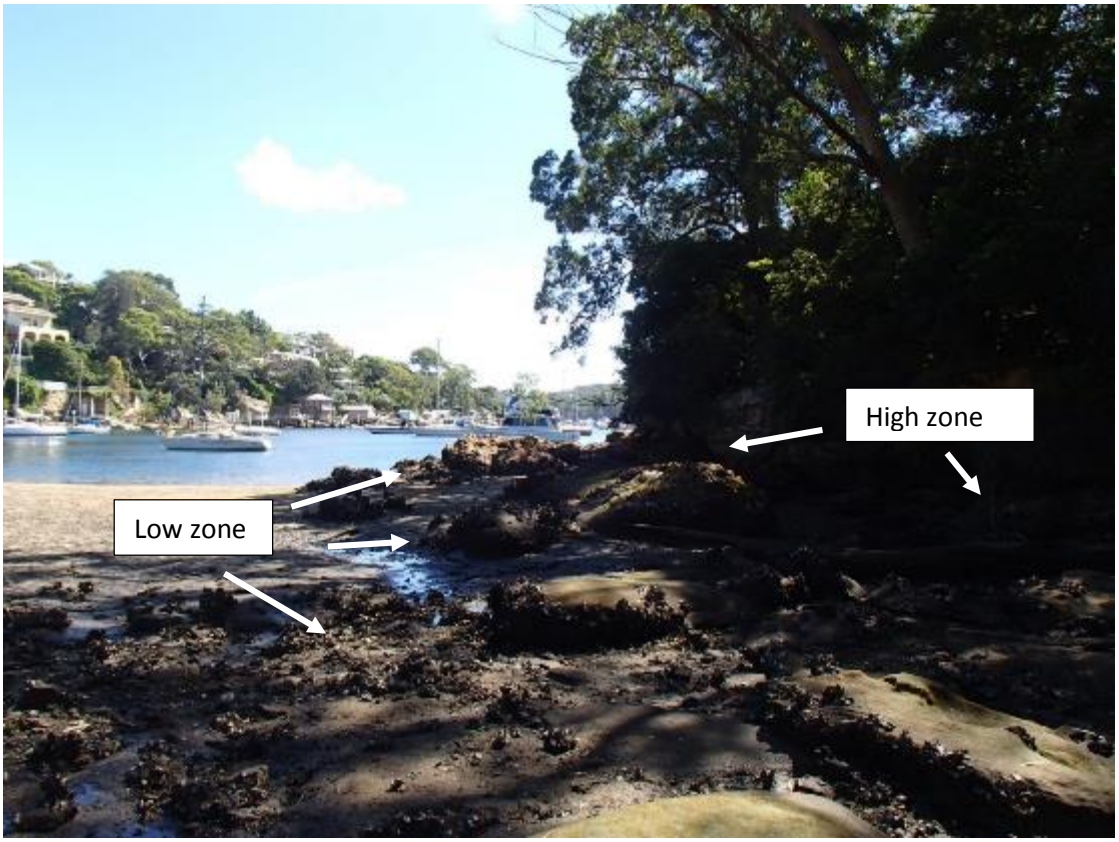


Plate 4: Site 2 at Quakers Hat Bay showing zonation by oysters between high and low zone

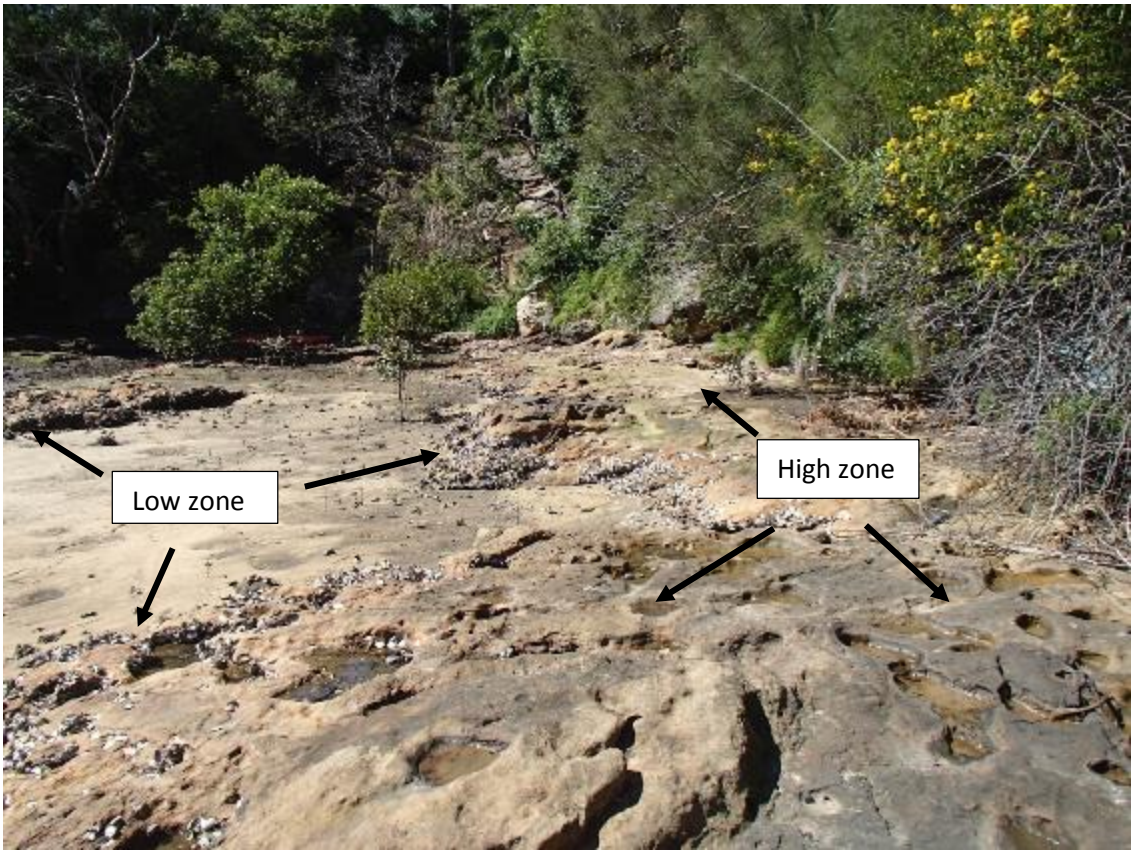
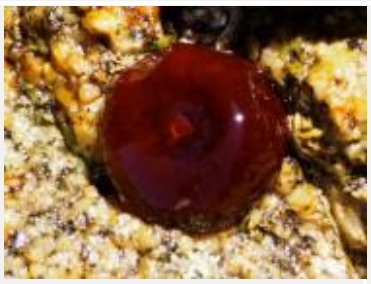
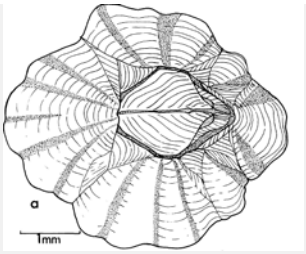


Plate 5: Site 3 at Quakers Hat Bay showing zonation by oysters between high and low zone

Plater 6: Quakers Hill Bay, above monitoring site 1.

Annex 2: Identification guide

Species	Notes / Distinguishing Features	Photo	Present
Cnidaria			
Actinia tenebrosa Waratah Anemone	• Diameter to 40mm • Appears as dark red blob at low tide • Red tentacles *Photo Source: Atlas of living Australia 2016Photo by: Wendy Feltham*		Not Recorded
Oulactis muscosa	• Diameter to 80mm • Blotched grey to green in colour • Buries in sand and sediment *Photo Source: Atlas of living Australia 2016Photo by: Adam Edmonds*		Not Recorded
Annelida			
Galeolaria caespitosa Tube Worm	• Most conspicuous polychaete • Calcareous tubes *Photo Source: Atlas of living Australia 2016Photo by: Ken Walker*		PB QHB
Arthropoda			
Heloecius cordiformis Semaphore crab	• Bent claws • Long extended eyes • Carapace to 25mm		QHB

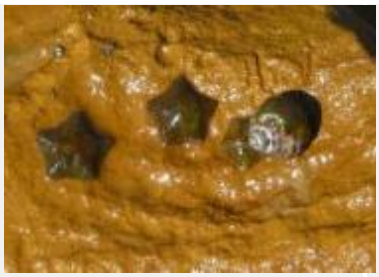
Parasesarma erythodactyla Red-handed shore crab	• Green in colour with bright orange tips on the claws. • Carapace to 25mm		QHB
Hexaminius spp.	• Six side plates including one small pair • To 15mm • Easily mistaken with *Eliminius spp.* *Drawing Source: Anderson et al. 1988*		Not Recorded
Chthamalus antennatus Six-plated Barnacle	• Six similar sized plates with easily seen divisions • Numerous grooves towards the bottom of the outer surface • Diameter to 12mm Photo Source: MESA 2016		Not Recorded
Chamaesipho tasmanica	• Honey comb like appearance • Four shell plates that are very difficult to distinguish • Appear fused together • Small to 8mm in diameter		Not Recorded
Eliminus spp.	• Estuarine • Four side plates • To 12mm in diameter • Easily mistaken for *Hexaminius* spp		PB QHB
Molluscs			
Cellana tramoserica Common Limpet	• Typically orange/brown – this one has algae on the shell – See Edgar 2000 • Dark radiating stripes • Length to 50mm		QHB PB

Siphonaria denticulata False limpet	• Prominent white radiating ribs and a strong, scalloped margin. • Pair of siphons evident on shell. • Pointed shell tip		QHB
Patelloida mimula Oyster limpet	• Mostly attached to oysters • Small to 20mm • Greenish-brown shell		PB QHB
Patelloida alticostata	• Black crescent shaped markings • Strongly crenulate margin • Apex slightly of centre • Length to 55mm *Photo Source: Beechey 2014*		Not Recorded
Patelloida *latistrigata*	• Smaller in size – length to 25mm • Variable shape • Typically has about 12-30 radial ribs • Can have spotted pattern *Photo Source: Beechey 2014*		Not Recorded

Patelloida mufria	• Smaller – up to 20mm in length • Apex of centre • Scalloped margin • Eroded appearance *Photo Source: Beechey 2014*		Not recorded
Trichomya hirsuta Hairy Mussel	• Bearded appearance • Length to 60mm • Fine barbed hairs		PB QHB
Nerita atramentosa Black Nerita	• Black shell • White apex and margin around the aperture • To 28mm height		QB
Austrocochlea porcata The Striped Austrocochlea	• Up to 45mm in height • Top shell-conical in shape • Highly variable in pattern • Pearly internal lining *Photo Source: Beechey 2014*		Not Recorded

Austrocochlea *Constricta* Common Periwinkle	• Height to 25mm • Prominent spiral ridges • Grooved appearance • Shell height is greater than or equal to width • Offwhite in colour *Photo Source: Beechey 2014*	 Fig. 2	
Bembicium nanum Striped-mouth Conniwink	• Abundant in the high shore • Squat spiral shell –lack siphonal canal • Conical shape • Brown wavy oblique lines across the lower whirls • To 10mm in height		PB QHB
Bembicium auratum Common Conniwink	• Larger to 20mm height • Squat spiral shell –lack siphonal canal • Higher shell • Nodular ridges giving wavy appearance		PB QHB
Nodolittorina unifasciata Banded Periwinkle	• Abundant of the high shore • Occur in clusters in slight depressions • Pale blue in colour • Often small with height to 16mm *Photo Source: Beechey 2014*	 Fig. 1	Not Recorded
Charma sp. Cemented bivalve	• Clam like and eroded in appearance • Can grow to 50mm+ length • Found in the low intertidal zone		QHB

Saccostrea glomerata Sydney Rock Oyster	• Length to 100mm • Upper valve is bluish-white and slightly covex • See additional information on distinguishing from *S. gigas*		PB QHB
Saccostrea gigas Pacific Rock Oyster	• Introduced Species • Larger to 250mm • Flaky rather than smooth exterior • See additional information on distinguishing from *S. glomerata*		PB QHB
Batillaria australis Brown Mud Whelk	• Nodular ridges • Raised folds • Height to 45mm		QHB
Pyrazus ebeninus Hercules Club Whelk	• Larger with height to 110mm. • Nodular ridges • More flared aperture *Photo Source: Beechey 2014*		Not Recorded
Sypharochiton pelliserpentis Snake Skinned Chiton	• Snake skin like appearance of the girdle • Greenish-brown in colour • Length to 65mm *Photo Source: MESA 2016*		Not Recorded
Echinodermata			

Patiriella calcar Eight-armed Cushion Star	• Arm radius to 50mm • Eight arms • Variable colours *Photo Source: Atlas of living Australia 2016Photo by: Sea kangaroo*		Not Recorded
Patiriella exigua Five-armed Cushion Star	• Small – arm radius to 13mm • Five arms • Brown to green in colour *Photo source: Atlas of living Australia 2016* *Photo by: James Bailey*		Not Recorded
Heliocidaris tuberculata Red Urchin	• Orange and red in colour • Spines oval in cross section • Test diameter to 106mm *Photo source: Atlas of living Australia 2016* *Photo by: Wendy Feltham*		Not Recorded
Chordata			
Pyura stolonifera Cunjevoi	• Brown in colour • Cylinder shaped body with two openings • Height to 150mm *Photo source: MESA 2016*		PB QHB
Algae			
Turfing Algae	Category for multispecific assemblage of diminutive, often filamentous, microalgae that attain a canopy height of only 1 to 10 mm		PB QBH

			
Encrusting Coralline	Stony, calcified, pink crusts of many coralline algae species form flat expanses over rocks, or on other plants and mollusc shells. *Photo source: MESA 2016*		Not Recorded
Microalgae	These include film creating or filamentous clumps of non-calcareous brown and green and red algae that form flat expanses on rocks or on other plants and mollusc shells.	 	PB QHB
Sargassum spp	Foliose brown algae		PB QHB
Hormosira banksii Neptunes Necklace	Foliose brown algae		Not Recorded
Ecklonia radiata Common Kelp	Foliose brown algae		Not Recorded

Padina elegans	Foliose brown algae *Photo source: WA Museum*		Not Recorded
Colpomenia spp. Globe Algae	Foliose brown algae *Photo source: MESA 2016*		Not Recorded
Ulva lactuca Sea Lettuce	Foliose green algae *Photo source: MESA 2016*		Not Recorded
Codium fragile Green Sea Fingers	Foliose green algae *Photo source: MESA 2016*		Not Recorded
Caulerpa filiformis	Foliose green algae *Photo source: NSW DPI* *Photo by: David Harasti*		Not Recorded
Amphiroa anceps	Branching coralline (red) algae		QHB

Corallina officinallis	Branching coralline (red) algae		Not Recorded

For additional species Edgar (2000) or a later versions.

Distinguishing differences between Pacific Oysters (POs) and Sydney Rock Oysters (SROs).

Some key morphological differences are:

- Size: POs grow to a larger size than SROs
- Shape: POs can be often more domed in shape in comparison to the SROs which are flat or convex.
- Shells: POs are typically more flaky than the more smooth SROs. Mature POs gape margin can also develop a pronounced 'zig zag' appearance, this is most common in the low intertidal zone.

However POs also exhibit a high amount of morphological variability of identification features are required. Especially in the high intertidal zone where they do not grow as big and develop a similar shape to SROs. In such conditions a thickened top shell is one of the only key identification feature to distinguishing POs from the SROs without opening the oysters.

- Hinge Teeth: POs do not have hinge teeth on the upper shell. To inspect for this characteristic it will require opening of the oyster.
- Mantle Colour: The mantle edges of the POs are black / much darker than the SROs. To inspect for this characteristic it will require opening of the oyster.
- Abductor Muscle: The abductor muscle colour of POs is a purple/brown in colour. To inspect for this characteristic it will require opening of the oyster.

Plate 7: A Pacific Oyster displaying larger size, more domed appearance and ‘zig zag’ gape margin.

Plate 8: Internal characteristics of an opened Sydney Rock Oyster (top) and Pacific Oyster (bottom).

Further information on the identification of Pacific Oysters can be obtained from the NSW DPI Pacific Oyster Report (2010) and Oyster Biology fact sheet (MDCA 2016)

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Annex 3: NSW DPI marine pests advisory booklet

Attachment from http://www.dpi.nsw.gov.au/fisheries/pests-diseases/marine-pests

Keeping your boat & gear clean will

SAVE MONEY ON FUEL
INCREASE BOAT PERFORMANCE
STOP THE SPREAD OF MARINE PESTS

Australian Government

Natural Resources Advisory Council
New South Wales

CMA
Sydney Metropolitan
CATCHMENT MANAGEMENT AUTHORITY

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Northern Pacific seastar

Keep your boat and fishing gear clean to help stop the spread of marine pests

NSW's marine life is under threat from introduced marine plants and animals. Marine pests can also have severe impacts on recreational boating and fishing and marine industries.

The pest seaweed *Caulerpa taxifolia* has already become established in Sydney and on the Central and South Coasts, and action needs to be taken to avoid other pest species arriving and becoming established in our estuaries. A recent study identified key pests which have a high risk of being transferred to Sydney's waterways by boating traffic from southern NSW and other states, such as the Asian bag mussel, Northern Pacific seastar, European/green shore crab and Japanese kelp.

Marine pests can affect your boat

- They damage the paint and hull where they attach
- They increase drag and therefore fuel costs
- They increase maintenance costs
- They clog pipes, motors or propellers causing engine overheating

Marine pests can affect your fishing

- They increase pressure on fish populations by competing for food, damaging their habitats, or preying on them
- A pest outbreak can result in fishing closures to stop the pests spreading further
- The Northern Pacific seastar can even steal your bait!

Meadow of *Caulerpa taxifolia*

How can I help?

Check and clean your boat regularly using the simple steps on pages 4 to 7, to make sure you are not spreading pests. Also, clean your fishing gear.

You may be carrying marine pests on your boat. You could unknowingly be spreading them to your favourite destinations. Cleaning your boat and gear will help stop the spread of marine pests. It will also reduce your fuel costs and increase the life of your boat.

Caulerpa taxifolia

Japanese kelp

Mussels on propeller

Learn to identify important existing or potential marine pests – see pages 8 to 39. If you see existing pests in new locations or new pests in NSW, please report them immediately.

NSW DPI's 24hr recorded hotline
(02) 4916 3877
email: **aquatic.pests@dpi.nsw.gov.au**

Note the location and take photos or collect a sample and freeze in a plastic bag to enable NSW DPI to confirm your sighting.

For more information, please visit:
www.dpi.nsw.gov.au/fisheries/pests-diseases
or phone 1300 550 474

Follow these simple steps to make sure pests aren't hitchhiking on your boat!

TRAILER BOATS, CANOES, KAYAKS, JETSKIS

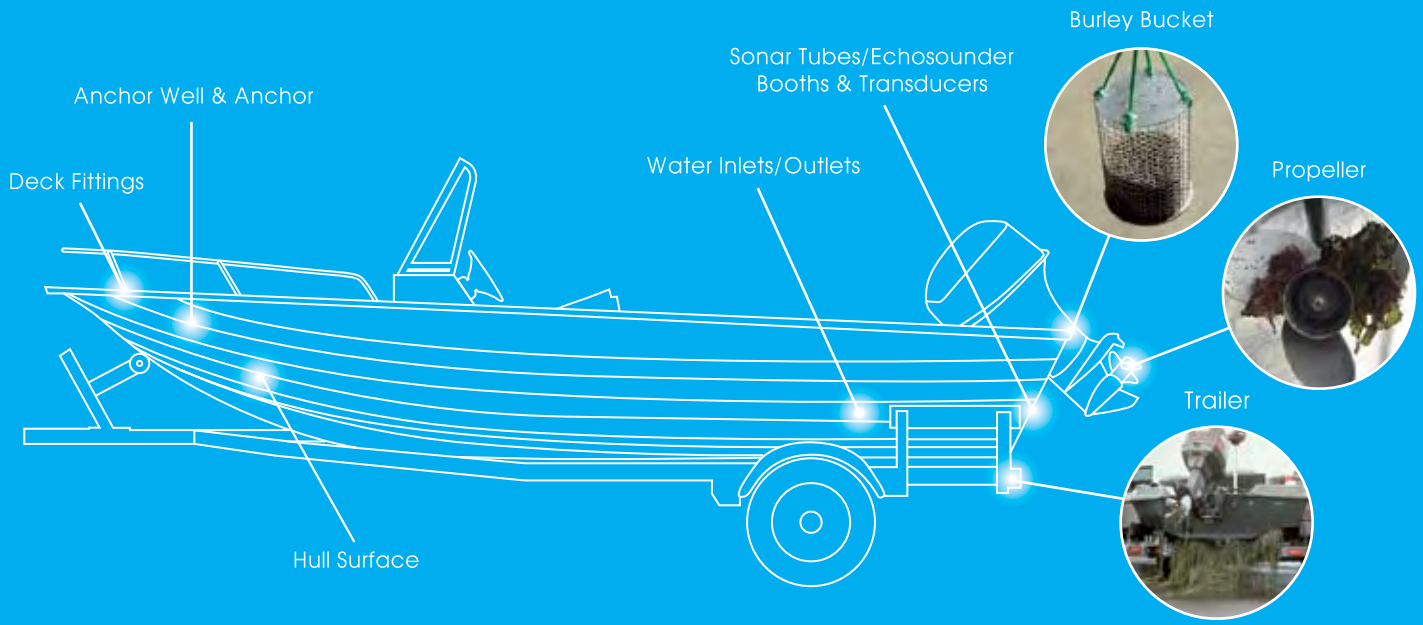
4 key steps to keep your boat and gear clean and dry. Target the areas shown in the diagram.

1. **Remove any weeds, animals or sediment from your boat, trailer and gear and put it in the bin** – NOT back in the water.

2. **After each trip rinse your boat, trailer and gear with fresh water,** in your yard or at a carwash. If you can't do this because of water restrictions go to the next step.

3. **Drain all the water from your boat and gear,** but don't let it drain back into the sea.

4. **Dry your boat and gear completely, including ropes and anchor.** Tiny eggs & plant spores can survive in a damp area for months.

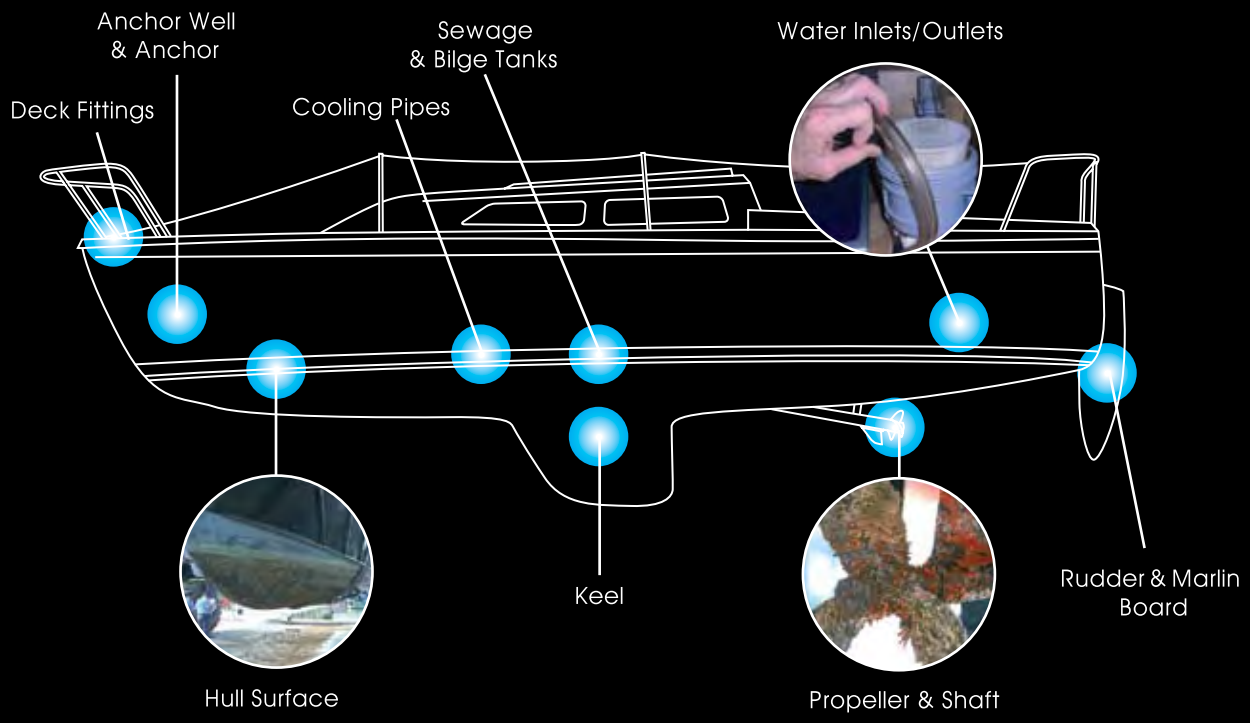


Follow these simple steps to make sure pests aren't hitchhiking on your boat!

MOORED BOATS

It's crucial to make sure your boat is clean before you move it. Follow these 5 key steps and target the areas shown in the diagram.

1. **Slip and clean your boat regularly,** at least every year and anytime there is a build up of fouling.
2. **Select an antifouling paint suited to your boat's activity, and apply it correctly following the manufacturer's advice.** Renew it when persistent fouling occurs.
3. **Check your boat for fouling every month** (any plants or animals attached to your hull, propellers, anchor, cables, fenders, cordage, tenders etc).
4. **Treat internal seawater systems regularly** – flush with fresh water or an approved treatment.
5. **Dispose of sewage and bilge water at an approved pump out facility.** Waste could contain marine pests, their eggs or plant spores.



MARINE PEST FOUND IN NSW

CAULERPA
Caulerpa taxifolia

Frond height 3-25cm

Flattened fronds, bright green colour. Known to turn pale & white during winter in colder waters

Leaflets on fronds attach directly opposite each other, curve upwards

Leaflets constricted at base

Photo: NSW DPI

KNOWN LOCATIONS:

Found in several NSW estuaries and coastal lakes including:

Lake Macquarie
Brisbane Water
Hawkesbury River
Pittwater
Port Jackson
Botany Bay
Port Hacking
St Georges Basin
Lake Conjola
Narrawallee Inlet
Burrill Lake
Durras Lake
Batemans Bay
Wallagoot Lake

Also found in SA

See NSW DPI website for up-to-date information www.dpi.nsw.gov.au

HABITAT:

- Sand or rock in sheltered and moderately exposed areas
- Has not been found in depths greater than 12m in NSW

IMPACTS:

- May compete with native seagrasses
- May adversely affect shellfish living in sediments
- Entangles in boat anchors, fishing nets and trawling gear

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: David Harasti

Caulerpa filiformis

KEY FEATURES:
Flattened strap-like fronds (not fern-like)

HABITAT:
Exposed and sheltered rocky reef and sandy areas, to 6m depth
Common between Port Stephens and Jervis Bay

Photo: John Huisman, Marine Plants of Australia

Caulerpa scalpelliformis

KEY FEATURES:
Fern-like fronds with leaflets either side of fronds not directly opposite each other

HABITAT:
Exposed rocky reef to 36m depth

Photo: John Huisman, Marine Plants of Australia

Caulerpa flexilis

KEY FEATURES:
Fern-like branchlets with secondary leaflets

HABITAT:
Exposed rocky reef to 40m depth
More common in deeper water

Photo: John Huisman, Marine Plants of Australia

Caulerpa cactoides

KEY FEATURES:
Short rounded club-like leaflets

HABITAT:
Sheltered and less exposed sand, mud and rock surfaces up to 38m depth

MARINE PEST FOUND IN NSW

EUROPEAN/GREEN SHORE CRAB
Carcinus maenas

Photo: © CSIRO

KNOWN LOCATIONS:

Found in several estuaries and coastal lakes along NSW southern coastline including:

Clyde River
Wagonga Inlet
Nangudga Lake
Bermagui River
Wapengo Lake
Nelson Lagoon
Merimbula Lake
Pambula Lake
Twofold Bay
Wonboyn Lake

Also found in SA, Vic, Tas

See NSW DPI website for up-to-date information www.dpi.nsw.gov.au

HABITAT:

- Shallow intertidal areas of bays and estuaries
- Typically amongst rocks with oysters or in mangroves

IMPACTS:

- Competes with native species
- Feeds on native shellfish and other crabs
- Potential impacts on aquaculture and fisheries

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: Graham Edgar, Australian Marine Life

Thalamita sima

KEY FEATURES:
Has swimming paddles
5 spines either side of eyes
Green/yellow colour

HABITAT:
Sheltered reef and sand up to 34m depth

Photo: Graham Edgar, Australian Marine Life

Surf crab/Sand crab
Ovalipes australiensis

KEY FEATURES:
Two red oval patches towards the rear
Light grey/sand colour

HABITAT:
Sandy beaches up to 34m depth

Photo: © Leon Altoff

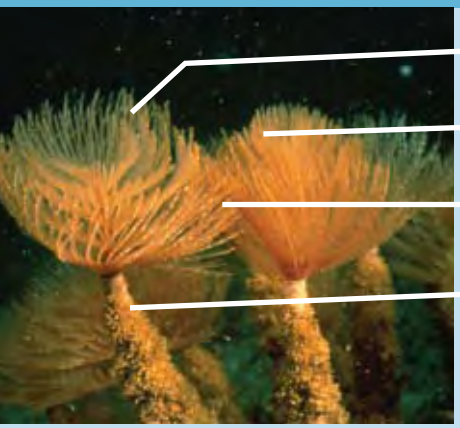
Red swimmer crab
Nectocarcinus integrifrons

KEY FEATURES:
Purple-red/brown colour
4 spines either side of eyes
Slightly hairy, claws black at tips, no swimming paddles

HABITAT:
Sheltered seagrass and seaweed up to 20m depth

MARINE PEST FOUND IN NSW

EUROPEAN FAN WORM
Sabella spallanzanii



Fan colour varies: white/orange/brown

Fan often has brightly banded colours

Feeding tentacles (radiole) form spiralled fan up to 20cm long

Flexible tube up to 40cm

Photo: © CSIRO

KNOWN LOCATIONS:

- Twofold Bay, NSW
- WA, SA, Vic, Tas

HABITAT:

- Sheltered waters up to 30m depth
- Soft sediments and hard surfaces such as wharf/marina piles, channel markers, submerged wrecks and pontoons

IMPACTS:

- Fouls man-made structures and soft sediments
- Competes for food and space with native species and can inhibit their settlement
- Clogs dredges and nets increasing sorting times for commercial fishers

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: Roger Steene

Feather-duster worm/ Banded fan worm/ Southern fan worm
Sabellastarte australiensis

KEY FEATURES:
Feeding tentacles not spiralled, up to 15cm diameter
Banded white and purple/brown

HABITAT:
Exposed rocky reefs up to 30m depth

Photo: David Harasti

Anemone horseshoe worm
Phoronis australis

KEY FEATURES:
Velvet black colour, tube length up to 20cm

HABITAT:
Silty/sandy sheltered areas, up to 30m depth

Photo: Mark Norman, Museum Victoria

Sabellastarte sp

KEY FEAURES:
Feeding tentacles not spiralled
Banded white/purple/ orange/brown
Shorter tube up to 5cm
Usually solitary not in clumps

HABITAT:
Exposed rocky reef and artificial structures in areas of good current flow, up to 200m depth

NEW ZEALAND SCREW SHELL
Maoricolpus roseus

Smooth spiralled cone (no beads) up to 9cm long

Yellow/red-brown in colour, often marbled or streaked

Photo: © CSIRO

Photo: © CSIRO

KNOWN LOCATIONS:

- Twofold Bay and continental shelf off Merimbula and Bermagui
- Vic and Tas

HABITAT:

- Lying on, or partially buried in sand, mud or gravel
- Intertidal to subtidal
- From 1-130m depth

IMPACTS:

- Densely blankets sea floor with live and dead shells
- Can affect growth of scallops and displace native shellfish

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

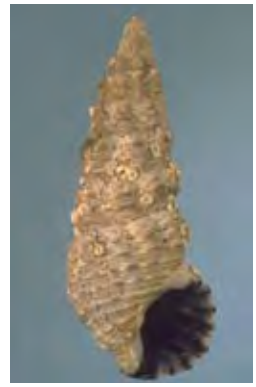


Photo: Patty Jansen, Australian Shells

Mud whelk
Velacumantus australis

KEY FEATURES:
Broader, rough spiralled shell up to 2-5cm long
Dull grey colour

HABITAT:
Soft sediments in sheltered waters, estuaries, mangroves, tidal flats, seagrasses

Photo: Holly Barlow, Australian Museum

Native screw shell
Gazameda gunnii

KEY FEATURES:
Shorter shell up to 5-6cm long
More mottled appearance, lighter colouration – white/light brown
Has fine beads forming ridges around the shell

HABITAT:
Inner continental shelf at depths to 140m

Photo: Patty Jansen, Australian Shells

Hercules club whelk/Mud whelk
Pyrazus ebeninus

KEY FEATURES:
Dark brown shell with flaring lip
Up to 11cm long

HABITAT:
Mudflats and mangrove swamps in estuaries

MARINE PEST FOUND IN AUSTRALIA

NORTHERN PACIFIC SEASTAR
Asterias amurensis

Five pointed arms with radius up to 23cm

Upturned tips, pointed spines (two rows on underside)

Juveniles are yellow with purple markings (adults more yellow)

Photo: © CSIRO

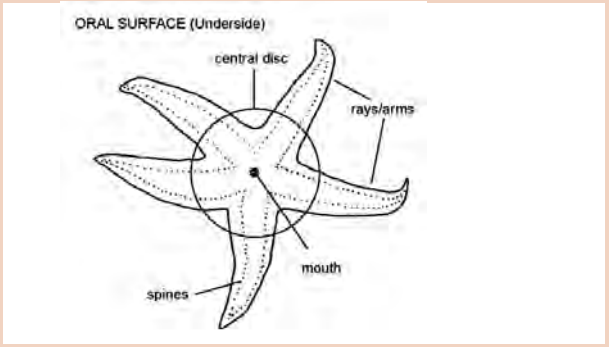


Diagram: © CSIRO

KNOWN LOCATIONS:

- Found in Vic and Tas
- Not known to occur in NSW

HABITAT:

- All surfaces such as mud, sand and rock in sheltered areas
- Intertidal zone up to 25m depth, occasionally to 200m depth

IMPACTS:

- Voracious predator, consumes many bivalves and other small invertebrates
- Impacts aquaculture and fisheries

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: Graham Edgar, Australian Marine Life

Irregular seastar
Smilasterias irregularis

KEY FEATURES:
Five arms with radius up to 6.5cm
Colour ranges pink/red/brown/grey
Pointed but no upturned tips

HABITAT:
Sheltered reef up to 30m depth
Southern NSW coastline

Photo: David Harasti

Granular/Zig zag seastar
Uniophora granifera

KEY FEATURES:
Five blunt tipped arms
Radius up to 12cm
Orange with purple spines

HABITAT:
Sheltered reef, silt, seagrass up to 30m depth
Entire NSW coastline

Photo: www.rling.com

Many-pored seastar
Fromia polypora

KEY FEATURES:
Five arms with radius up to 11cm
Bright orange/yellow with black pores

HABITAT:
Exposed reef up to 160m

MARINE PEST FOUND IN AUSTRALIA

JAPANESE SEAWEED
Undaria pinnatifida

Photo: © CSIRO

Photo: © CSIRO

KNOWN LOCATIONS:

- Tas and Vic
- Not known to occur in NSW

HABITAT:

- Sheltered temperate waters
- Intertidal to subtidal zone, usually found between 10-20m depth

IMPACTS:

- Can be highly invasive and grow rapidly into dense beds
- Overgrows and excludes native algal species

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: John Huisman, Marine Plants of Australia

Cray weed/Strap weed
Phyllospora comosa

KEY FEATURES:
No midrib or base
Long strand-like fronds with sawtooth edge, air sacks for floats
Up to 3m tall

HABITAT:
Exposed rocky reef up to 20m depth

Photo: John Huisman, Marine Plants of Australia

Common kelp
Ecklonia radiata

KEY FEATURES:
No midrib or base
Often has spines, brown fronds, up to 2m tall
Appearance varies with depth (longer, smoother fronds in deep water)

HABITAT:
Moderately exposed rocky reefs up to 44m depth

Photo: John Huisman, Marine Plants of Australia

Bull kelp
Durvillaea potatorum

KEY FEATURES:
No midrib or base
Large bulky fronds
Up to 8m tall

HABITAT:
Exposed rocky reef up to 30m depth

ASIAN DATE MUSSEL/BAG MUSSEL
Musculista senhousia

Smooth fragile shell up to 3cm long, olive green/brown colour

Shell has zigzag markings and iridescent radiating bands

Often in clumps of many individuals

Photo: courtesy Northern Territory Government

Photo: Graham Edgar, Australian Marine Life

KNOWN LOCATIONS:

- Found in Vic, SA, Tas and WA
- Not known to occur in NSW

HABITAT:

- Soft sediment or hard surfaces
- Occurs just below the low tide level in aggregated clumps

IMPACTS:

- Fouls man-made structures
- Forms dense mats competing with natives for food and space

REPORT NEW LOCATIONS

Photo: Graham Edgar, Australian Marine Life

Blue mussel
Mytilus galloprovincialis planulatus

KEY FEATURES:
Large fan shaped shell up to 12cm
Blue/black colour
Usually found in clumps

HABITAT:
Sheltered and moderately exposed reefs, pylons and pontoons
Up to 15m depth

Photo: Graham Edgar, Australian Marine Life

Brachidontes rostratus

KEY FEATURES:
Long flat shell up to 4cm
Purple colour, regular rounded ribs
Usually found in dense clumps

HABITAT:
Exposed rock platforms

Photo: Graham Edgar, Australian Marine Life

Hairy mussel
Trichomya hirsuta

KEY FEATURES:
Numerous hairs on lower half of shell
Up to 6cm

HABITAT:
Exposed reef up to 15m depth
Common intertidally and subtidally

Photo: Graham Edgar, Australian Marine Life

Little black horse mussel
Xenostrobus pulex

KEY FEATURES:
Small shiny inflated shell up to 2.5cm in length
Black colour
Forms dense clumps

HABITAT:
Exposed rocky shores
Mid intertidal

MARINE PEST FOUND IN AUSTRALIA

ASIAN GREEN MUSSEL
Perna viridis

Bright green juvenile shell and dark green to brown adult shell

Commonly 8-10cm in length, can reach up to 16cm in length

Smooth pearly shell

Photo: courtesy Northern Territory Government

Photo: Wayne Sheldon

KNOWN LOCATIONS:

- Cairns, QLD
- Not known to occur in NSW

HABITAT:

- Variety of hard surfaces, particularly floating, including vessels, wharves, buoys, intake pipes, aquaculture equipment
- Low tide to 42m depth, lower estuarine habitats to marine
- Tropical to warm waters but tolerates wide ranges of salinities and temperatures

IMPACTS:

- Fast growing, out competes native species
- Forms dense clumps, fouls man-made structures
- Accumulates toxins and is linked to shellfish poisoning in humans

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: Graham Edgar, Australian Marine Life

Blue mussel
Mytilus galloprovincialis planulatus

KEY FEATURES:
Blue/black colour
Large fan shaped shell up to 12cm

HABITAT:
Sheltered and moderately exposed reefs, pylons and pontoons, typically on floating surfaces
Can occur up to 15m depth

MARINE PEST FOUND IN AUSTRALIA

BLACK-STRIPED MUSSEL
Mytilopsis sallei

Small, fragile shell up to 2.5cm long with one side overlapping the other

Varied shell colour from black/brown-light grey/white

Some show light and dark zig zag pattern

Forms dense clusters, rarely seen as individuals

Photo: courtesy of Northern Territory Government

Photo: courtesy of Northern Territory Government

Photo: © CSIRO

KNOWN LOCATIONS:

- Not known to currently exist in Australia
- Eradicated from Darwin Harbour in 1999

HABITAT:

- Prefers shallow sheltered inshore estuarine habitats
- Tolerates wide range of salinities and temperatures
- Can attach to any hard surfaces, e.g. hulls, pylons

IMPACTS:

- Rapid growth forming dense clusters that exclude most other species
- Fouls man-made structures such as wharves, marinas, seawater systems, aquaculture equipment

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Photo: Graham Edgar, Australian Marine Life

Brachidontes rostratus

KEY FEATURES:
Long flat shell up to 4cm
Purple colour

HABITAT:
Forms dense mats on exposed rock platforms

Photo: Graham Edgar, Australian Marine Life

Little black horse mussel
Xenostrobus pulex

KEY FEATURES:
Small shiny inflated shell up to 2.5cm in length
Black colour
Forms dense clumps

HABITAT:
Exposed rocky shores, mid intertidal

ASIAN PADDLE CRAB
Charybdis japonica

Photo: Museum of New Zealand Te Papa Tongarewa (CR. 009843)

KNOWN LOCATIONS:

- Single live male found in SA
- Not known to occur in NSW

HABITAT:

- Estuarine and marine habitats
- Subtidal to 10-15m depth

IMPACTS:

- Is host/carrier of the White Spot Syndrome Virus which can infect native and farmed prawns, crabs and lobsters

REPORT NEW LOCATIONS

SIMILAR NATIVE SPECIES

Blue swimmer crab
Portunus pelagicus

KEY FEATURES:
No spines either side of eyes
Dark brown/bluish/ purple colour
Shell width up to 21cm

HABITAT:
Sheltered sand and seagrass habitat
Intertidal and subtidal up to 60-70m depth

Mud crab
Scylla serrata

KEY FEATURES:
9 spines either side of head
Dark brown to mottled green
Large robust claws
Shell up to 25cm wide

HABITAT:
Soft muddy bottoms in sheltered areas such as mangroves

Above illustrations: Pat Tully, NSW DPI

MARINE PEST FOUND OVERSEAS

ASIAN SHORE CRAB
Hemigrapsus sanguineus

Photo: Amy J Benson, U.S. Geological Survey

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

- Estuarine and marine habitats
- Intertidal shallow hard-bottom areas including under rocks, shells, debris and artificial structures

IMPACTS:

- Broad diet, competes with and preys upon native species

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES

Photo: Tim Glasby, NSW DPI

Swift-footed crab/Purple rock crab
Leptograpsus variegatus

KEY FEATURES:
Dark-olive green to dark purple
Shell up to 8cm wide
Purple claws with white tips
Three spines on either side of eyes

HABITAT:
Exposed rocky shores, intertidal

Photo: Michael Marmach, Museum Victoria

Smooth shore crab
Cyclograpsus audouinii

KEY FEATURES:
No spines either side of the eyes
Smooth rounded shell up to 4cm wide
Varied colours from red-brown/purple and yellow to purple, dark grey or brownish grey

HABITAT:
Under rocks on sheltered and moderately exposed shores

Photo: Tim Glasby, NSW DPI

Sowrie
Plagusia glabra

KEY FEATURES:
Smooth shell green-brown colour
4 distinct spines on either side of eyes, spines on legs

HABITAT:
Intertidal, exposed rock platforms or rock pools

Photo: © Leon Altoff

Spotted smooth shore crab
Paragrapsus laevis

KEY FEATURES:
Shell width up to 4cm
2 spines either side of eyes
First set of legs felted with hairs

HABITAT:
Intertidal, sheltered coastal bays and estuaries, prefers hiding under rocks, debris and in mangroves

MARINE PEST FOUND OVERSEAS

CHINESE MITTEN CRAB
Eriocheir sinensis

Photo: Lee Mecum, California Dept of Fish and Game

Photo: Stephan Gollasch GoConsult

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

- Tolerates a wide range of temperatures and modified habitats
- Prefers estuarine and coastal areas including lakes, wetlands and river banks

IMPACTS:

- Forms dense colonies that cause erosion by intense burrowing
- Opportunistic diet, out competes native species
- Can carry lung fluke that can infect humans

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES

Photo: Michael Marmach, Museum Victoria

Red bait crab
Plagusia chabrus

KEY FEATURES:
Hairy body and legs with spines on legs
Red/brown/orange colour
Shell up to 7cm wide
Deeply notched between the eyes

HABITAT:
Prefers subtidal reefs up to 8m depth

Photo: Tim Glasby, NSW DPI

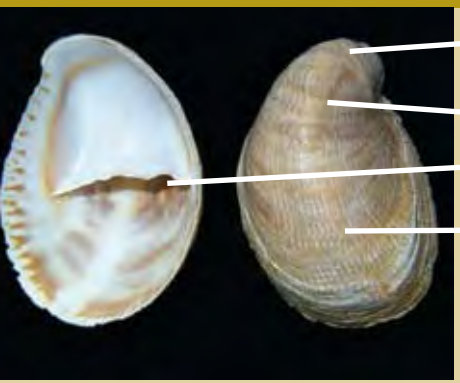
Swift-footed crab/Purple rock crab
Leptograpsus variegatus

KEY FEATURES:
Dark olive-green to dark purple
Shell up to 8cm wide
Purple claws with white tips
Three spines on either side of eyes

HABITAT:
Exposed rocky shores, intertidal

MARINE PEST FOUND OVERSEAS

SLIPPER LIMPET
Crepidula fornicata



Smooth oval shaped shell up to 5cm long

Irregular growth lines

Internal shelf extending half shell's length

White, yellow or pink with red/brown streaks

Commonly found in stacks

Photo: Bill Frank www.jaxshells.org

Photo: Sarah Longrigg

Slipper limpets showing stacking behaviour

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

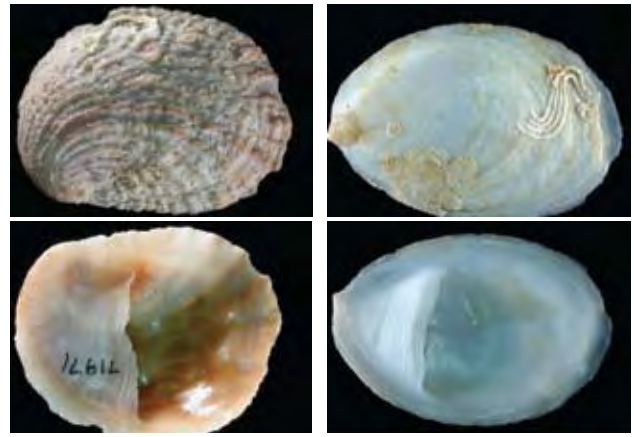
- Intertidal areas of estuaries and coastal bays
- Attached to other shells or hard surfaces in muddy/sandy/gravel/ rocky areas

IMPACTS:

- Can compete with natives for food and space
- Can impact commercial oyster cultivation

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES



Photos: Des Beechey www.seashellsofnsw.org.au

Northern slipper limpet/ Spiny slipper limpet
Crepidula aculeata

KEY FEATURES:
Shell commonly 1-3cm (up to 4cm), has spines and bumps, white and brown colour

HABITAT:
Intertidal to subtidal, exposed rocky shores

Southern slipper limpet
Crepidula immersa

KEY FEATURES:
Flat/thin shell up to 5cm long with internal shelf
White to fawn/brown colour

HABITAT:
Subtidal up to 350m depth

Photo: © Leon Altoff

Limpet
Notoacmea mayi

KEY FEATURES:
Smooth shell, no internal shelf

HABITAT:
Exposed reef, high intertidal zone

MARINE PEST FOUND OVERSEAS

RAPA WHELK/VEINED WHELK
Rapana venosa

- Large heavy shell up to 18cm long with large opening
- Outside shell colour varies grey to red/ brown
- Black vein-like pattern over whole shell
- Distinctive deep orange interior

Photo: US Geological Survey Archives, United States

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

- Tolerates wide range of temperatures and salinities, polluted and oxygen-deficient waters
- Prefers sandy estuarine and marine habitats, can also colonise hard substrates

IMPACTS:

- Can prey heavily on native shellfish and aquaculture species
- Can affect bottom dwelling organisms

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES

Photo: © Leon Altoff

Cartrut shell
Dicathais orbita

KEY FEATURES:
Shell sculptured with grooves
White/grey/brown/ green colour
Shell height up to 7-8cm

HABITAT:
Reef up to 10m depth

Photo: Des Beechey www.seashellsofnsw.org.au

Helmet shell
Semicassis pyrum

KEY FEATURES:
Smooth shell
Cream with brown blotches
Shell height up to 7cm

HABITAT:
Exposed sand up to 480m depth

MARINE PEST FOUND OVERSEAS

BRUSH-CLAWED SHORE CRAB
Hemigrapsus takanoi

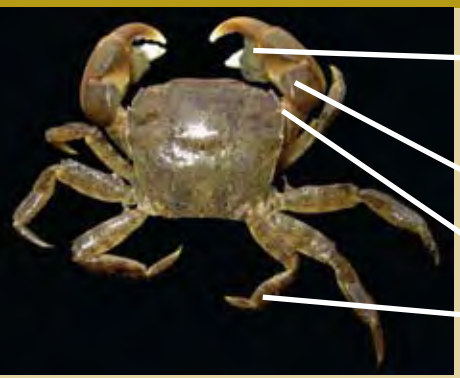


Photo: Hans Hillewaert

Light brown to yellow fur patches at base of pincers on male's claws

Small dark spots on claws

3 spines on either side of eyes

Light and dark banded legs

Most commonly orangey-brown in colour, can be green or maroon

Photo: Arjan Gittenberger

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

- Rocky intertidal habitats, but is also found in soft sediments

IMPACTS:

- Broad diet, competes with and preys upon native species

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES

Photo: Tim Glasby, NSW DPI

Swift-footed crab/Purple rock crab
Leptograpsus variegatus

KEY FEATURES:
Dark-olive green to dark purple
Shell up to 8cm wide
Purple claws with white tips
Three spines on either side of eyes

HABITAT:
Exposed rocky shores, intertidal

Photo: Michael Marmach, Museum Victoria

Smooth shore crab
Cyclograpsus audouinii

KEY FEATURES:
No spines either side of the eyes
Smooth rounded shell up to 4cm wide
Varied colours from red-brown/purple and yellow to purple, dark grey or brownish grey

HABITAT:
Under rocks on sheltered and moderately exposed shores

Photo: Tim Glasby, NSW DPI

Sowrie
Plagusia glabra

KEY FEATURES:
Smooth shell green-brown colour
4 distinct spines on either side of eyes, spines on legs

HABITAT:
Intertidal, exposed rock platforms or rock pools

Photo: © Leon Altoff

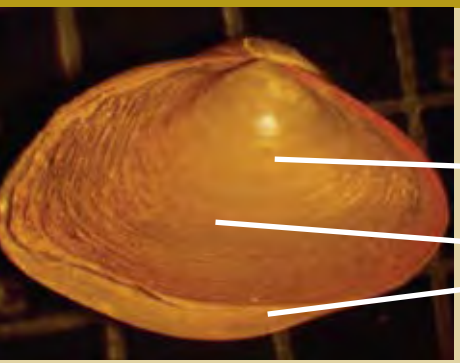
Spotted smooth shore crab
Paragrapsus laevis

KEY FEATURES:
Shell width up to 4cm
2 spines either side of eyes
First set of legs felted with hairs

HABITAT:
Intertidal, sheltered coastal bays and estuaries, prefers hiding under rocks, debris and in mangroves

MARINE PEST FOUND OVERSEAS

ASIAN CLAM
Potamocorbula amurensis



Thin smooth shell; older shells appear wrinkled on shell surface

White, tan or yellow in colour

2-3cm in length

Shell of unequal size – one side is larger than the other

Photo: Janet Thompson, US Geological Survey

KNOWN LOCATIONS:

- Not recorded in Australia

HABITAT:

- Mostly subtidal but also intertidal
- Can be found in marine, estuarine and freshwater habitats
- Occurs in all sediment types including mud, peat, clay, sand but most commonly found on mixed mud/sand bottoms

IMPACTS:

- Competes with native species for food and space
- Reduces planktonic food sources
- Can form dense layers

REPORT ANY SIGHTINGS

SIMILAR NATIVE SPECIES

Photo: John & Maria Grist

Narrow wedge shell/Shining wedge shell
***Paphies* species**

KEY FEATURES:
White/cream shell with brown covering
Interior of shell is white
Up to 2.5cm long

HABITAT:
Sandy intertidal

Photo: John & Maria Grist

Tellina semitorta

KEY FEATURES:
Shell usually white, but sometimes pink
Up to 1.6cm long

HABITAT:
Sandy intertidal

Northern Pacific seastar

Marine pests can:

- Damage your boat
- Increase your fuel and maintenance costs
- Impact on your fishing
- Destroy native habitats
- Threaten human health

Help prevent the spread of marine pests!

Check and clean your boat and fishing gear before you move

and

Report marine pests

24hr recorded hotline (02) 4916 3877
Email: aquatic.pests@dpi.nsw.gov.au

For more information:
www.dpi.nsw.gov.au/fisheries/pests-diseases
or phone 1300 550 474

THE NATIONAL SYSTEM FOR THE PREVENTION AND MANAGEMENT OF MARINE PEST INCURSIONS

BIA
Boating Industry Association

NSW MARITIME

COASTCARE

THE BOAT OWNERS ASSOCIATION OF NSW
BOA

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Photos on pages 1 -7 courtesy of BIA VIC, CSIRO, DAFF, Franz Grasser (VRFish), Michigan Sea Grant Archives, NSW DPI, Sandringham Yacht Club, VIC DSE, Yachting Victoria.

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