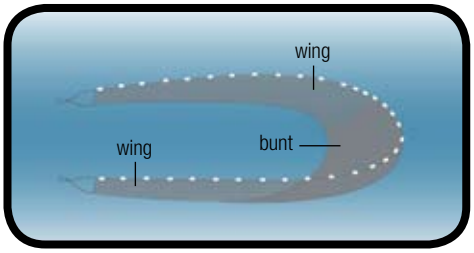
Beach Seines

Suitable Habitats

- Soft substrates: including seagrass/algal beds
- Hard substrates: not including hard rock substrates
- Water column

Hazards

- Underwater hazards – do not use over hard rock as net may snag and tear etc.
- Depth
- Inclement weather and/or high seas; unsuitable beach conditions
- The most appropriate sampling time may be restrictive, e.g. at night



Target species

Species: Fish and mobile epifauna, including:
Liza ramada – Thinlip mullet
Neogobius melanostomus – Round goby
Pagrus major – Red sea bream
Siganus rivulatus – Marbled spine foot
Tridentiger bifasciatus – Shimofuri goby

Life stages

Adults and juveniles

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Equipment specifications

Beach seine - Medium seine: 9.2 m long, with 4mm stretch mesh, a 3.1 m drop in the centre tapering to 1.1 m at the wings with two 10 m long ropes; haul lines of nylon or soft polypropylene and floatline with small styrofoam floats. Other seine sizes (larger or smaller) available.

Storage equipment - Insulated box or fish bin, ice, labels etc.

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of net; waterproof marker and labels.

Water supply - Access to seawater supply (that matches salinity at sample site) and freshwater supply for rinsing net

Description

A beach seine is a net operated from the shore which is used to capture demersal and pelagic fish and other motile species from shallow, nearshore waters. It is appropriate for sandy beaches with unencumbered access. Seine netting is more effective (i.e. has a greater likelihood of detecting specimens) if sampling is carried out to coincide with target species habits e.g. diel changes in population density at the sample site. The gear is composed of a bunt (bag or lose netting, constructed from cotton or nylon in a variety of mesh sizes) and long wings often lengthened with long ropes for towing the seine to the beach. The headrope with floats supports the top of the net at the water surface, the footrope or leadline has lead weights attached (or made of lead-core rope) and is in permanent contact with the bottom. The seine collects mobile organisms within the area enclosed by the net. Seine nets often require several people to tow the seine back to shore.

Application

Secure the first towing line ashore. The line, first wing, bag, second wing and second line are then set out offshore in a wide arc until the second line reaches the shore again. The beach seine may be set offshore using a sufficiently sized boat (a small boat without an engine is generally adequate) if wading out from shore is not possible (e.g. when the shoreline is too deep to wade out safely). Tow the lines in from ashore (the net may have poles attached to the tow lines for winding in). Do not tow hard enough to pull the leadline off the bottom or the top floats underwater. The fish will be herded in front of the bunt. The groundrope should reach the beach first to bring the gear underneath the fish. Once ashore remove the fish from the nets and place in buckets of fresh seawater. The fish may be identified while alive and returned to the sea, or preserved for further examination in the laboratory. Clean and rinse the seine with freshwater and let the net air dry when sampling is complete.

Quality assurance

The area sampled depends on the size of the net and density of the target species population. A larger net may be required for species distributed over a wide spatial scale. Example: three passes of a 9.2 m seine covered 90 m^2 and collected representatives of most fish species inhabiting a seagrass (*Zostera marina*) bed.

Recommendations

- Ensure seine remains in contact with seafloor as target species feed on benthos.
- Wear adequate footwear while seining to avoid foot injuries from underwater obstacles.
- Larger seines may not be suitable for deployment by hand.
- In New Zealand a collection permit may be required from the Ministry of Fisheries.

Beach walks & shore searches

Australian Government Department of Agriculture, Fisheries and Forestry

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Suitable Habitats

- Coastal areas
- Soft and hard substrates e.g. rocky and sandy shores

Field processing

- Labelling
- Narcotisation and fixing

Hazards

- Ineffective when species density is low, e.g. *A. amurensis* densities below 0.03 m^2.
- Not suitable for monitoring variations in target species abundance.
- Some factors may reduce the incidence of species washing up on shore, including the degree to which environments are sheltered,

Target species

Asterias amurensis – North Pacific seastar
Carcinus maenas – European green crab
Caulerpa taxifolia – marine algae
Codium fragile spp *tomentosoides* – green macroalgae
Corbula gibba - Clam
Crassostrea gigas – Feral Pacific oyster
Mytilopsis sallei – Black striped mussel
Undaria pinnatifida – Japanese kelp
Unknown/novel species

Life stages

Adults (Molting organisms/exuviae/shells)

Hazards cont.

seasonality of species abundance, wind speed and direction.

- Unfavourable environmental conditions could prevent effective searching, e.g. currents, crashing waves and tides.

Equipment specifications

Appropriate clothing for coastal environment - Wet weather gear, waders, gumboots or walking shoes etc.

Information sheets and voucher specimens - For target species

Collection containers - Ziplock bags, sample jars (plastic or metal); sufficient size to contain specimens; waterproof marker/ labels

Equipment for handling samples and preserved specimens - Gloves, safety glasses, forceps, sorting tray, petri dishes etc.

Description

Beach walks and shore searches are used to visually locate coastal or nearshore species, such as *Asterias amurensis* and *Carcinus maenas*. Searchers, e.g. local community members, explore a selected area of beach or shoreline for target species or unfamiliar organisms, including crab moults, seaweeds, and mollusc shells. If access permits, searchers should visually inspect rocky shores, sandy beaches, and vegetated areas near the high tide limit. Visual identification guides or voucher specimens should be provided to help identify specific organisms.

Quality assurance

Sampling effort, i.e., number of searchers and search time, should be considered in relation to the area of the study site, species population densities and the number of specimens required.

Recommendations

Beach walks/shore searches may be incorporated into public awareness programs.

Investigation of the biological and ecological aspects of a target species should be considered if the likelihood of detection is higher. For instance, shore searches along the high tide wrack line where storm driven vegetation accumulates may reveal exuvia of molting crabs, such as *C. maenas*. This is most profitable in areas with some vegetation intertidally or subtidally, as molting crabs prefer to have cover available during this vulnerable process. Additionally, spring or summer beach walks may be most effective for detecting *U. pinnatifida* and *C. gigas*, while winter beach walks may be most effective for detecting *A. amurensis*.

Application

Conduct searches in areas where the animals are most likely to be washed up or trapped with the receding tide. Beach walks should be standardised, i.e. undertaken at regular intervals, for a documented length of time, or with a set number of searchers. Alternatively, members of the public may carry out searches on an ad-hoc basis. Record details about the location (geographic markers, latitude, longitude, if possible) and the general weather conditions on a pre-prepared data sheet. At low tide (or as close to low tide as possible) walk the length of the beach one way along the low tide mark and back along the high tide mark. If the beach is too long to walk the full length, walk at least 50 m each way and note the stretch of beach that was examined. Turn over rocks (and replace afterwards) to examine the organisms underneath if the beach is a rocky shore. Required evidence for detection is the specimen (appropriately preserved as soon as possible) or a sufficiently detailed photograph. Record any target species that have washed up on the beach on the data sheet. Also carefully remove and retain additional organisms of particular interest. Note that storing live, cheliped bearing specimens with other animals should be avoided as they may damage more fragile species.

Beam trawls

Description

A beam trawl is used to collect sessile and motile epibenthic fish and invertebrates from soft substrates and should be applied in situations with minimal underwater hazards. This method is preferable when there is significant benthic biomass (i.e. preferable to using a benthic sled). A beam trawl is a towed fishing net, which is supported by a spreader beam and a system of buoys/floats and foot gear. The spreader beam is attached to the forward part of the trawl and provides the horizontal opening of the net. The length and diameter of the beam varies, depending upon the vessel size and sampling requirements. It is kept off the bottom by two end posts. Floats maintain the vertical height of the net opening. The foot gear is usually made of rubber tire discs and roller balls spaced along a wire cable. The net portion of the trawl consists of a cone-shaped body ending in a bag or codend, which retains the catch. There are various designs of beam trawl nets available. Weights made from chain (amounts vary, dependent on net size and tow speed) are placed on the wings of the trawl and at the centre hook-up to ensure the trawl stays in contact with the ocean floor (if bottom trawling is necessary). When sampling for flatfish the beam trawl should be equipped with tickler chains to disturb the fish from the seabed.

Application

Secure the trawl to the winch cable and remove the centre section of stern guardrail. Lower the trawl from the stern of the ship using a hydraulic winch capable of raising the beam trawl when full. On commencement of the tow, the vessel should maintain a steady course of approximately 0.4-0.5 m/s; however disengage the boat's propellers while the trawl is lowered over the stern and into the water. Continue to pay out cable to a length of 2-3 times the depth of the water column. The tow is most often timed from contact of the trawl with the bottom and should continue for a pre-determined duration (see quality assurance). At completion of the tow, raise the trawl at a steady rate as for lowering. When the trawl is visible at the surface, slow the retrieval rate. Once on board, empty the contents of the codend and net into an appropriately sized container or directly into a sieving device for processing. Thoroughly wash the trawl net with water from the sample site to decontaminate the device for further sample collection.

Target species

Benthic invertebrate and fishes, particularly motile species including:

Asterias amurensis - North Pacific seastar
Carcinus maenas - European green crab
Charybdis japonica - Japanese rock crab
Neogobius melanostomus - Round goby
Rapana thomasiana - gastropod
Rapana venosa - gastropod
Siganus rivulatus - Marbled spinefoot
Pelagic species, including:
Aurelia aurita – Moon jelly
Blackfordia virginica – Black sea jellyfish
Mnemiopsis leidyi – Comb jelly

Life stages

Adults Juveniles (dependent on net size)

Quality assurance

A constant net speed of_< 0.4-0.5 m/s should be maintained during deployment, while sampling and on retrieval of the trawl. A trawl should be towed for up to 2 hours or a sufficient time to collect target species. The depth to which the trawl is lowered will depend on target species habitats, e.g. benthic or pelagic, but can be at any depth.

Recommendations

- Use a trawl in areas where diver hazards are prevalent or visibility is limited.
- Beam trawl sampling requires a boat with enough power to maintain forward motion at a constant speed while setting, towing and retrieving the net.
- The direction of a tow will depend on tidal currents. Sampling should be done at or near slack water to reduce the effect of tidal currents.
- Night tows are preferred because of reduced avoidance by fish, but may be impractical because of safety concerns.

Hazards

- Underwater obstacles or snags
- Inclement weather or high seas or both

Equipment specifications

Beam trawl - Beam up to 12 m long; mesh sizes vary with trawl type and study objectives, but commonly the cod end has a minimum mesh size of < 5 mm.

Cable - Sufficient length for 3x the depth of water column and capable of raising approx. 3x weight of trawl and sample, e.g. > 24 mm wire

Lowering/raising mechanism - Including hydraulic A-frame (on stern) and winch

Sieves - 1.0 mm mesh opening; preferably stainless steel or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of trawl; waterproof marker and labels

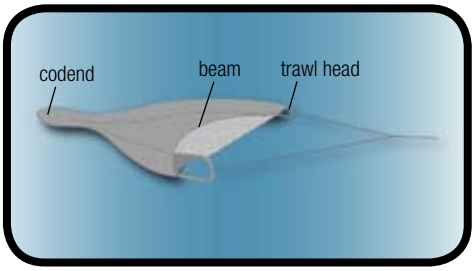
Water supply - Running seawater supply on vessel

Suitable Habitats

- Soft substrates – sand, gravel, mud, clay & similar substrates
- Seagrass/algal beds
- Water column

Field processing

- Sieving
- Elutriation
- Removal of incompatible specimens
- Labelling
- Narcotisation and fixing



Benthic sled/dredge

Description

Benthic sleds are used to collect sessile and motile epibenthic invertebrates and fish from submerged/subtidal soft substrates. This method is suitable for use in areas where benthic biomass is moderate to low (so as not to clog the net). Sleds are constructed from stainless steel and consist of a rectangular frame, to which a net is attached, welded to two runners which slide along the bottom as the device is towed (note that runners may be removed from the sled to scrape surface sediments). A small float is attached to the top of the frame to maintain upright orientation as the sled is deployed. The overall size of the sled is variable, as is the mesh size of the net (see equipment specifications across).

Application

Secure the sled to a winch cable and remove the centre section of the stern guardrail prior to deployment. Lower the sled from the stern of the boat using a hydraulic winch capable of raising the weight of a full benthic sled. On commencement of the tow, the vessel should maintain a steady course and net speed of 0.4-0.5 m/s; however it is preferable to disengage the boat's propellers while the sled is lowered over the stern. Continue to pay out cable to a length of 2-3 times the depth of the water column. A tension meter can be used to determine if the sled has reached the bottom, displayed on the meter's readout as an increase in load. The tow is most often timed from the contact of the sled with the bottom and can continue for a known length or duration of time (see quality assurance). At completion of the tow, raise the sled at a steady rate as for lowering. When the sled is visible at the surface, slow the retrieval rate. Once on board, wash the contents in the sled mesh and then empty into a suitable container or directly into a sieving device for processing. Thoroughly wash the sled with water from the same site to ensure all material is included in the sample, and to decontaminate the device for further sample collection.

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Sieving
- Narcotisation and fixing

Target species

Benthic invertebrate and fishes including:
Asterias amurensis - North Pacific seastar
Ampelisca abdita - amphipod
Carcinus maenas - European green crab
Caulerpa taxifolia aquarium strain - algae
Charybdis japonica - Japanese rock crab
Codium fragile tomentosoides – green macroalgae
Hydroides ezoensis - serpulid tubeworm
Musculista senhousia - Asian date mussel
Neogobius melanostomus - Round goby
Potamocorbula amurensis - Brackish-water Corbula
Rapana thomasiana - gastropod
Rapana venosa - gastropod
Sabella spallanzanii - Mediterranean fanworm
Siganus rivulatus - Marbled spinefoot
Undaria pinnatifida - Japanese kelp

Life stages

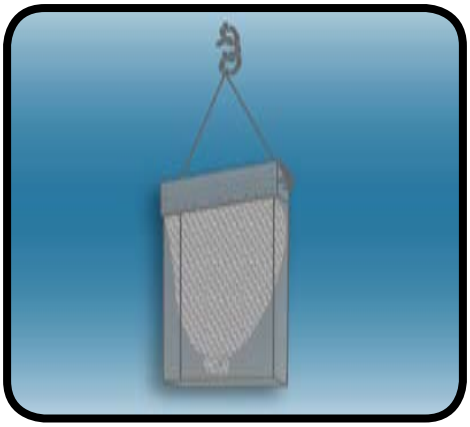
Adults / Some juvenile (for gregarious species)

Quality assurance

Tows should be of a known length (e.g. 100 m) or duration (e.g. 3-5 min; providing constant boat speed). Towing speed should not exceed 0.4-0.5 m/s. Subsamples may be taken if the content of the sled is large.

Recommendations

- Use a sled in situations where diver hazards are prevalent or visibility is limited.
- Night tows are preferred because of reduced avoidance by fish, but may be impractical because of safety concerns.
- Focus on known shellfish beds for *A. amurensis*, and areas next to public access, e.g. wharves and boat ramps, for *C. taxifolia* and *S. spallanzanii*



Equipment specifications

Sled/dredge e.g. Woods Hole epibenthic sled, Ockelmann sledge - Woods Hole epibenthic sled: 1 m wide and 30 cm high, 0.125 cm mesh; Ockelmann sled: mouth 1.5 m wide and 0.6 m high, 1.5 cm mesh size primary net, mounted inside a 2.5 cm mesh size heavy protective net; Wildco™-type stainless steel sled: weight <5 kg, runner size 508 mm, net 305 x 508 mm of 1000 um mesh, overall size: 350 x 620 x 350 mm; (Full sled weight varies: 10-100 kg)

Cable - Sufficient length for 3x the depth of water column, and capable of raising approximately 3x weight of sled and sample, e.g. >24 mm wire

Lowering/raising mechanism - Including hydraulic A-frame (on stern) and winch

Sieves - 1.0 mm mesh opening; preferably stainless steel or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of sled; waterproof marker and labels

Water supply - Running seawater supply on vessel

Hazards

- Underwater hazards
- Impenetrable substrates
- Inclement weather and/or high seas
- Sleds may not be appropriate for sampling in areas where algae, seagrass or other benthic biomass is substantial (e.g. use a beam trawl as an alternative sample device)

Suitable Habitats

- Soft substrates – sand, gravel, mud, clay and similar substrates
- Seagrass/algal beds

Grab Sampler for Benthic Macroinvertebrates

Australian Government Department of Agriculture, Fisheries and Forestry
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Suitable Habitats

- Soft substrates – sand, gravel, mud, clay and similar substrates

Target species

Benthic macroinvertebrates including:
Corbula gibba – Asian bivalve, Basket shell
Crassostrea gigas – Pacific oyster
Dreissena bugensis – Quagga mussel
Limnoperna fortunei – Golden mussel
Musculista senhousia – Asian date mussel
Mytilopsis sallei – Black striped mussel
Petricolaria pholadiformis – Golden mussel, False angel-wing
Potamocorbula amurensis – Asian clam

Life stages

Adults
Some juveniles (for gregarious species)

Equipment specifications

Grab sampler - e.g. Ponar Grab
Ponar grab: empty weight 23 kg, full weight 34kg, sample area 229 x 229 mm, volume 8.2L.

Cable - Sufficient length for 3x the depth of water column, and capable of raising approximately 3x weight of grab and sample, e.g. > 24 mm wire

Lowering/raising mechanism - Including hydraulic A-frame and winch

Sieves - 1.0 mm mesh opening; preferably stainless or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of grab; waterproof marker and labels

Water supply - Running seawater supply on vessel

Hazards

- Underwater hazards
- Impenetrable substrates
- Inclement weather and/or high seas
- Inappropriate for deep burrowing species
- May not provide adequate samples of highly mobile species, e.g. crabs, seastars

Field processing

- Seiving
- Elutriation
- Removal of incompatible specimens
- Labelling
- Narcotisation and fixing

Description

A remote grab sampler, e.g. Ponar, Smith McIntyre, Van Veen grab, is used to sample benthic or substrate dwelling species in submerged/subtidal sand, gravel, mud, clay and similar substrates (will not work for rocky or steeply graded substrates). Bottom sediment samples are collected using a power vessel of an appropriate size (generally >15 m, with sufficient clearance for the grab at the stern/side of the boat) and equipped with a power winch and cable capable of raising a full grab (approximately 70kg + 25kg of wet sediment). There may be some operational differences between the different types of grab samplers which the user should be aware of prior to use; refer to specific operating instructions associated with each.

Application

Attach the grab sampler to the cable of the power winch. Lower the grab vertically, from the stationary boat, through the water column until it contacts the seafloor. This requires a controlled lowering speed to ensure the device lands correctly, i.e. avoid free-fall which may cause the device to airplane, or cause a pressure wave and blowout of surface sediment. The recommended lowering speed is 0.3 m/s. When the legs of the device contact the bottom, the slackening of the springs and connecting cable will trigger the jaws, which then close and scoop up a sediment sample. The grab should then be raised slowly and steadily to the surface, as for lowering. Once on board, empty the contents of the grab into a suitable container or directly into a sieving device for processing. Thoroughly wash the grab with water from the same site to decontaminate the grab for further sample collection.

Quality assurance

Samples are limited to an area of 0.1 m^2, approximately 4 cm deep in hard sand and possibly deeper for softer substrates.

Recommendations

- Add extra weights to the grab when water currents are strong or when penetration of the sediment is difficult.

Large cores

Description

Large cores are used to sample the sessile benthic infauna of submerged/subtidal soft substrates. They are not suitable for hard substrates or areas inaccessible for boats. Box corers are designed to sample a large area of sediment (see equipment specifications below) to an approximate depth of 30-50 cm, with little disturbance to the sediment. There are a range of corer designs (e.g. box, tubular) and sizes available. Box corers are generally constructed from stainless steel, and require deployment from a power vessel of an appropriate size (generally >15 m, with sufficient clearance for the corer at the stern/side of the boat) and equipped with a power winch and cable capable of raising a full corer.

Application

Attach the corer to the cable of the power winch. Lower the corer vertically, from a stationary vessel, through the water column until it contacts the seafloor. This requires a controlled lowering speed to ensure the device lands correctly, i.e. avoid free-fall which may cause the device to airplane, or cause a pressure wave and blowout of surface sediment. The recommended lowering speed is < 0.3 m/s. When the frame touches the seafloor the weight is taken off the hoist cable, triggering the mechanism that releases the core box. This will then penetrate the seafloor under its' own weight. If necessary the driving force can be adjusted by adding or removing lead weights. Both the top and bottom of the core box will then automatically close. The corer should then be raised slowly and steadily to the surface, as for lowering. Once on board, empty the contents of the corer into a suitable container or directly into a sieving device for processing. Subsampling may be required if the core sample is large. Thoroughly wash the corer with water from the same site to decontaminate the corer for further sample collection.

Target species

Benthic fauna including:

Corbula gibba – Asian bivalve, Basket shell
Crassostrea gigas – Pacific oyster
Musculista senhousia – Asian date mussel
Potamocorbula amurensis – Asian clam
Perna perna – Brown mussel
Perna viridis – Asian green mussel
Petricolaria pholadiformis – Golden mussel, False angel-wing
Dreissena bugensis – Quagga mussel
Limnoperna fortunei – Golden mussel
Mytilopsis sallei – Black striped mussel

Life stages

Adults
Some juveniles (for gregarious species)

Field processing

- Seiving
- Elutriation
- Labelling
- Narcotisation and fixing
- Removal of incompatible specimens

Quality assurance

Sample volume is dependant on the size of the corer. Samples should be large enough to ensure inclusion of target organisms. Factors such as population density and physical size of the target species should be considered. Large cores may be subsampled using smaller core tubes if sampling high density species.

Recommendations

- May be useful for harder substrates unable to be sampled with a grab sampler
- Wooden blocks can be placed on the sides of the box to avoid over-penetration
- Useful when target species distribution is relatively patchy as large sample volume

Equipment specifications

Box corer, e.g. SBC-50, USNEL box corer, Craib or Millport corer - SBC-50: 150 x 150 x 230 mm, weight approx. 50 kg; Larger corers: 500 x 500 mm, weight approx. 75 kg; Some available options for sampling areas include 200 x 200mm, 300 x 300mm, 400 x 400mm, and 500mm x 500mm core boxes; Craib Corer: tube length 425 mm or 247 mm x 59 mm diameter, weight approx. 44 kg, operating depth up to 3,000 m.

Hydraulic winch and cable - Sufficient length for depth of water column, and capable of raising approx. 3x weight of corer and sample, e.g. stainless 300 g messenger cable, or stainless steel aircraft cable of 1/16" or 3/32" diameter

Sieves - 1.0 mm mesh opening; preferably stainless steel or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of core; waterproof marker and labels

Water supply - Running seawater supply on vessel

Hazards

- Underwater obstacles
- Inclement weather or high seas
- Unable to penetrate or retain coarse sand and gravely sediments
- May not provide adequate samples of motile species, e.g. crabs, seastars

Suitable Habitats

- Soft substrates - finely divided mud, clays, submerged marl, or fine peaty materials
- Seagrass/algal beds

Phyto- and zooplankton sampling

Australian Government Department of Agriculture, Fisheries and Forestry

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Suitable Habitats

- Water column

Field processing

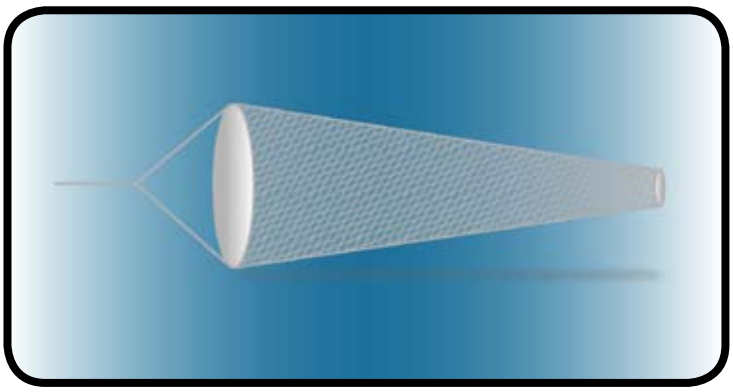
- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Hazards

- Ineffective when target species density is low
- Underwater hazards
- Inclement weather and/or high seas e.g. extremely high velocity currents

Description

Plankton nets, buckets or water bottles are used to sample phytoplankton, zooplankton or planktonic larvae. Samples are collected by filling the bottle or bucket with surface water or by vertical drops or horizontal tows of a net from jetties/wharves/floating docks or small boats.



Quality assurance

For horizontal tows, deploy the net into the water column to a suitable depth for detecting the target species (e.g. 2 m) and tow for a minimum of 10 m. For vertical tows, drop the net to approximately 1 m from the seafloor. Bucket and bottle samples should be taken just below the surface of the water. Number and location of sites will depend on the density of the target species. Conduct at least one net drop per site. Timing should coincide with the period when vegetative cells or planktonic stages of the target species are present in the water column.

Recommendations

- Conduct more than one tow per site if target species density is low.
- Tow length should be shortened at high cell densities.
- Note that the distribution and abundance of phyto- and zooplankton is strongly influenced by abiotic factors, such as light, depth, temperature, salinity, tides and time of year (i.e. seasonal effects).
- Investigation of the biological and ecological aspects of a target species should be considered if the likelihood of detection is higher.

Application

Generally, net haul or tow rates must not exceed 0.25 - 0.30 m/s for phytoplankton nets and 1.0 m/s for zooplankton nets (taking into account water current velocity at the sampling site). For example, if a net tow is carried out against a current moving at 0.25 m/s, then the resultant rate is your tow rate plus 0.25 m/s. Horizontal tows using hand nets (typically for phytoplankton) are taken at sites <5 m deep. Deploy the net into the water column to a suitable depth for detecting the target species and tow for a minimum of 10 m. Note that at high cell densities, the tow length should be shortened. Horizontal tows (typically for invertebrate larvae) can be done in water >5 m deep using nets deployed from boats. Vertical tows (typically for zooplankton) are taken at sites >5 m deep. Before deployment, the net should be weighted to achieve the required fall rate (see above). Deploy the net 'head-first' and allow the net to drop to approximately 0.5-1.0 m from the seafloor. Depth may be monitored using a maximum indicating depth gauge attached to the frame of the net. Avoid resuspension of bottom sediments. To retrieve the net, haul it back up through the water column to sample during both descent and ascent (phytoplankton) or close the net with the chocking bridle before retrieval (zooplankton). Wash the net down from the outside with seawater from the collection site to collect the plankton in the cod end.

Alternatively, plankton present in the surface water may be sampled using a bucket or bottle. Dip a well-rinsed, appropriately sized bucket or water bottle over the side of the vessel or wharf. Submerge under the surface and move it slowly towards the current until the container is full. Retrieve the bucket or bottle.

Phyto and zooplankton sampling

Equipment specifications

Phytoplankton tow net -
25 cm diameter, 45 cm long, 5 cm diameter codend opening; 20 µm mesh; net and bridle attached to 25 cm diameter ring made from 0.5 cm diameter stainless steel rod; plastic sample jar secured to codend with clamp and screw thread

Zooplankton drop net -
100 µm mesh free-fall drop net, 3-4 m long, 700 mm diameter mouth, 100 mm cod-end opening; net and bridle attached to 700 mm ring of 20-25 mm galvanised steel pipe; plastic or stainless steel sample jar secured to codend with clamp and screw thread

Extra weights -
Attach to net to achieve desired net fall rate

Storage equipment -
Insulated box or fish bin, ice, labels etc.

Collection containers -
Plastic or metal (durable, not prone to breakage); sufficient to contain contents of net; waterproof marker and labels

Carbonated water -
For anesthetising collected fauna

Sieves -
0.2 mm mesh opening; preferably stainless or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Equipment for handling samples and preserved specimens -
Gloves, safety glasses, forceps, sorting tray, petri dishes etc.

Water supply -
Running seawater supply on vessel

Target species

Meroplanktonic and holoplanktonic species including:
Alexandrium catenella – dinoflagellate
(only if mesh size is ~25 microns)
Alexandrium minutum – dinoflagellate
(only if mesh size is ~25 microns)
Alexandrium tamarense – dinoflagellate
(only if mesh size is ~25 microns)
Asterias amurensis - North Pacific seastar
Ampelisca abdita – amphipod
Aurelia aurita – Moon jelly
Balanus eburneus – Ivory barnacle
Blackfordia virginica – Black sea jellyfish
Bugula nertina – bryozoan
Carcinus maenas - European green crab
Charybdis japonica - Japanese rock crab
Ciona intestinalis – Sea vase
Corbula gibba – Asian bivalve, Basket shell
Crassostrea gigas – Pacific oyster
Cyanea spp. – Lion's mane jelly
Dinophysis norvegica - dinoflagellate
(only if mesh size is ~25 microns)
Dreissena bugensis – Quagga mussel
Eriocheir sinensis – Chinese mitten crab
Gymnodinium caenatum – dinoflagellate
(only if mesh size is ~25 microns)
Hemigrapsus sanguineus – Japanese shore crab
Hydroides dianthus – serpulid polychaete
Hydroides ezoensis – serpulid polychaete
Limnoperna fortunei – Golden mussel
Mnemiopsis leidyi – Comb jelly
Musculista senhousia – Asian date mussel
Mytilopsis sallei – Black striped mussel
Neogobius melanostomus – Round goby
Pagrus major – Red seabream
Perna perna – South African brown mussel
Perna viridis – Asian green mussel
Petricolaria pholadiformis – Golden mussel, False angel-wing
Pfiesteria pisicida - dinoflagellate (only if mesh size is ~25 microns)
Pseudodiaptomus marinus - calanoid copepod
Pseudo-nitzschia seriata – pennate diatom
(only if mesh size is ~25 microns)
Rapana thomasiana - gastropod
Rapana venosa - gastropod
Sabella spallanzanii – Mediterranean fanworm
Styela clava – sea squirt
Other planktonic larvae and organisms (possibly unknown)

Life stages

Vegetative cells
Cysts (recently formed in the water column or resuspended from the bottom)
Planktonic larvae
Adults (for holoplanktonic species)

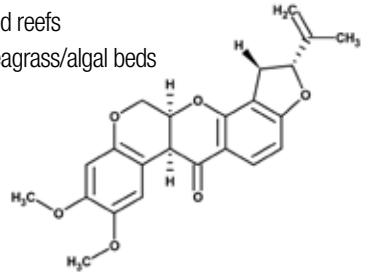
Poison stations

Australian Government Department of Agriculture, Fisheries and Forestry

MAF BIOSECURITY NEW ZEALAND

Suitable Habitats

- Water column
- Soft substrate
- Hard substrate – including wharf piles and reefs
- Seagrass/algal beds



Target species

Fish including:
Liza ramada – Thinlip mullet
Neogobius melanostomus – Round goby
Pagrus major – Red seabream
Siganus rivulatus – Red Sea rabbitfish
Tridentiger bifasciatus – Shimofuri goby

Life stages

Adults
Juveniles

Equipment specifications

Poison - Rotenone is generally available in two forms, 5 percent water wettable powder and a 5 percent liquid and is classified as either EPA toxicity class I or III (highly toxic or slightly toxic) depending on product formulation; Quinaldine; Clove oil

Detergent - Dishwashing liquid; for mixing with seawater and poison

Water supply - Seawater for mixing with poison at sample site

Poison containers - Plastic squeeze bottles or plastic bags; other containers required for preparing poison solution

Diving equipment - Includes exposure suit, air tanks, weight belt etc. as required to occupational diver standard or for snorkelling

Hand-net - To retrieve poisoned fish

Storage equipment - Insulated box or fish bin, ice, labels etc.

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Hazards

- Strong tidal currents
- Sensitive native species present in the environment
- Diving - depth, time & limited visibilty

Description

Poison stations are used to detect fish in a range of habitats, including wharf piles, breakwaters, and reefs. They are normally used in situations where large nets or trawls are unsuitable (i.e. close to wharf pilings and in areas with underwater hazards that may snare a net). Rotenone (a natural plant toxin) or other suitable material is released into the water to kill nearby fish.

Quality assurance

The concentration most commonly used for formulations containing rotenone is 0.5 or 1.0 mg/l (0.025–0.050 mg/l rotenone). This should be capable of killing most fish within an hour or two at temperatures of 15°C or more, but at much higher temperatures death may result in a few minutes. At temperatures below 10°C, death may take several hours. Poison may be dispersed along a transect, at one point, or throughout a previously designated area. Dispersal method will depend on the size and environmental parameters of the sample site, and species population density.

Recommendations

- A proper respirator mask should be used during mixing of rotenone powder, as rotenone in powder form may cause respiratory irritation if inhaled
- Read and follow the label directions completely, as for all chemicals
- Wash all clothing thoroughly after handling rotenone.
- Wash all equipment, including nets & diver apparel, thoroughly after sampling.
- If skin has come into contact with rotenone, remove contaminated clothing and wash affected areas with soap and water.
- If eyes have come into contact with rotenone, flush eye with clean water for at least 5-10 minutes.
- If ingested seek medical advice immediately.

Application

Make up a 3:1 mixture of seawater and detergent (dishwashing liquid), then add an amount of rotenone equal to the amount of seawater. The amounts used should be adequate to cover the sample area with poison at a concentration of 0.5-1.0 mg/l. Ensure safety precautions are strictly followed. This mixture should be prepared immediately before use. Avoid contact with eyes and skin, and wear protective clothing, including rubber gloves, safety glasses and dust masks (if using powder). Divers should take care to avoid contact with the poison and should wear appropriate exposure suits, gloves and hoods. Shower or bathe and thoroughly wash clothing after handling chemical substances. SCUBA divers are required to dispense the poison from squeezable plastic bottles or plastic bags along a transect, in one point or throughout a previously designated area. Poison release should take place at slack water to minimize dispersion and to ensure the retention of poisoned fish in the area. Poisoned fish are collected by divers and snorklers at the surface using hand-nets. Fish in the treated area should begin to surface within five minutes to one hour. Place specimens in suitable collection containers (e.g. insulated box or fish bin), in an ice-seawater slurry, for transport to the laboratory. Any residual rotenone in the environment will be broken down by light, heat and oxygen. Organisms that are exposed to rotenone, but not killed, generally recover as rotenone does not accumulate in the body of the animal. *Note:* A permit is required to use rotenone in Australian state waters. In New Zealand, use of rotenone for experimental purposes requires specific experimental use discharge consents under the Resource Management Act

Scrapings by divers

Australian Government Department of Agriculture, Fisheries and Forestry
MAF BIOSECURITY NEW ZEALAND

Suitable Habitats

- Hard substrates – including wharf pilings, ships hulls, harbour structures and other man-made structures, reefs.

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Hazards

- Diving – depth, time, limited visibility
- Underwater hazards
- Inclement weather and/or high seas

Description

Scrapings by divers are used to investigate sedentary, encrusting/fouling species on hard substrates, including wharf pilings, harbour structures and vessel hulls. SCUBA or snorkel divers remove the biota within a pre-defined quadrat from the hard surface using a scraper. The scrapings are then examined in the laboratory for target species.

Application

Fix a quadrat 0.10 m^2 (preferably constructed from plastic or metal as they do not easily warp or rot) to the outer surface of the pile/ structure using a bungee cord or some other suitable material. If quadrats cannot be easily fixed to facings they will need to be held by divers and the outline scraped into the biota. Carefully scrape the fauna and flora inside the quadrat, using a knife or other suitable tool, into a large plastic collection bag (with small drainage holes) or mesh bag. Once out of the water, drain all water from the sample bag and chill on ice in an insulated box for temporary storage, or transport immediately back to the laboratory for processing.

Target species

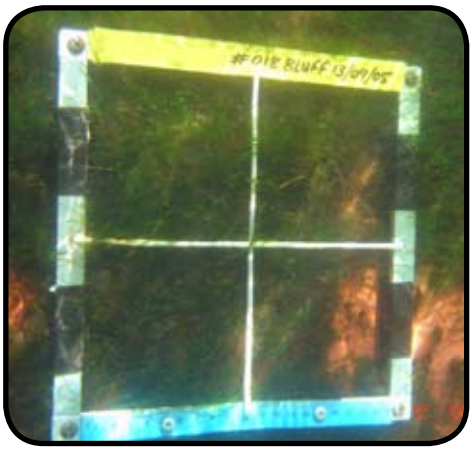
Fouling (sedentary, encrusting) species including:
Balanus eburneus – Ivory barnacle
Bugula nertina – Bryozoan
Caulerpa taxifolia aquarium strain - algae
Ciona intestinalis – Sea vase
Corbula gibba – Clam
Crassostrea gigas – Pacific oyster
Hydroides dianthus – Serpulid polychaete
Hydroides ezoensis – Serpulid polychaete
Limnoperna fortunei – Golden mussel
Musculista senhousia – Asian date mussel
Perna perna – South African brown mussel
Perna viridis – Asian green mussel
Polysiphonia brodiaei – Red macroalgae
Potamocorbula amurensis – Brackish-water corbula
Sabella spallanzanii – Mediterranean fanworm
Sargassum muticum – Asian seaweed
Schizoporella errata – bryozoan
Styela clava – sea squirt
Watersipora arcuata - bryozoan

Life stages:

Settled larvae
Juveniles
Adults

Quality assurance

Quadrat size: 0.10 m^2. Number and placement of quadrats will depend on target species population density.



Equipment specifications

SCUBA diving/snorkelling equipment - Includes exposure suit, air tanks, weight belt etc. as required to occupational diver standard or for snorkelling

Quadrat template - Plastic or metal preferably

Scraper - Suitable for removing encrusting epibiota

Water supply - Seawater supply on site

Collection bags - Plastic or mesh, with appropriate pore size to release water but retain organisms

Recommendations

- A random SCUBA swim or snorkel of the habitat will usually help decide the number and placement of quadrats.
- Snorkel diving may be sufficient when conducting scrapings near the water surface.
- Ensure collection bags are designed to let out water without losing the biological sample.

Settlement plates

Australian Government Department of Agriculture, Fisheries and Forestry

MAF BIOSECURITY NEW ZEALAND

Suitable Habitats

- Hard substrates – including areas near wharf pilings, ships hulls, harbour structures and other man-made structures, reefs.

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Hazards

- Low detection sensitivity for rare species
- Not possible to hang in strong currents

Target species

Encrusting (fouling) organisms including:
Balanus eburneus – Ivory barnacle
Blackfordia virginica – Black sea jellyfish
Bugula nertina – bryozoan
Ciona intestinalis – Sea vase
Crassostrea gigas – Feral Pacific oyster
Limnoperna fortunei – Golden mussel
Musculista senhousia – Asian date mussel
Perna perna – South African brown mussel
Polysiphonia brodiaei – Red macroalgae
Potamocorbula amurensis – Brackish-water corbula
Sabella spallanzanii – Mediterranean fanworm
Sargassum muticum – Asian seaweed
Schizoporella errata – bryozoan
Styela clava – sea squirt
Watersipora arcuata - bryozoan

Life stages

Adults and juveniles

Equipment specifications

PVC settlement plates - 14.5 cm x 14.5 cm; sandblasted on one side

Equipment for securing plates in environment - Cable ties, drill, rope, brick

Additional equipment for deployment of plates - Weights, buoy, float, extra rope etc.

Storage equipment - Insulated box or fish bin, ice, labels etc.

Sorting equipment - Mesh bags or nylon stockings; plastic bags

Water supply - Running seawater supply on site

Description

Settlement plates are used to collect and grow specimens of encrusting, or biofouling species in areas where hard settlement substrates occur, including ports and harbours, and near wharf piles. Plate design may vary according to target species' preferences, including construction material, size, surface texture, orientation, and depth, time and duration of deployment.

Quality assurance

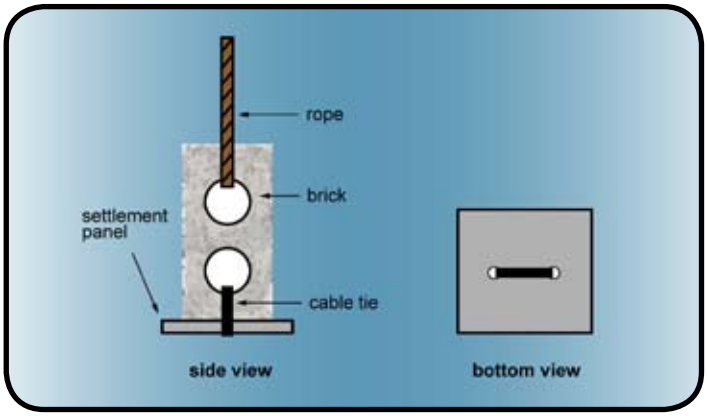
14.5 cm x 14.5 cm plates (sampling area of plates is 0.02 m^2). Recommended immersion duration is approximately 3 months, or a duration that allows encrusting organisms to grow to a sufficient size for identification. Note that immersion duration may be less for tropical locations and during periods of high settlement in temperate waters (e.g. late spring/summer).

Recommendations

- Allow sufficient deployment time to increase taxonomic resolution for identification.
- Increase the coverage (i.e. number of plates deployed) for detection of rare species.
- Settlement plates may be incorporated into a collection system that also utilises settlement trays and ropes.

Application

For detection of most target species use 14.5 cm x 14.5 cm PVC or black acrylic plates. These plates should be sandblasted on one side to promote settlement. Drill two holes in the middle of each plate and secure to a brick with cable ties. Attach one end of the rope to the brick and the other end to a structure in the environment (e.g. wharf, or piling) or to a float and marker buoy system. Lower the plates into the water column to a suitable depth for detecting the target species. Plates should be orientated to attract the target organisms, e.g. horizontally or vertically. Leave plates in the environment until encrusting organisms are large enough for taxonomic identification. When ready for collection, remove the fouled plates from the environment, carefully untie from the brick and place in a fine mesh bag (e.g. nylon stocking) or plastic bag to keep samples separated. Store in a bucket or container (e.g. insulted box or fish bin), in seawater until ready for preservation.



Settlement trays

Australian Government Department of Agriculture, Fisheries and Forestry
MAF BIOSECURITY NEW ZEALAND

Suitable Habitats

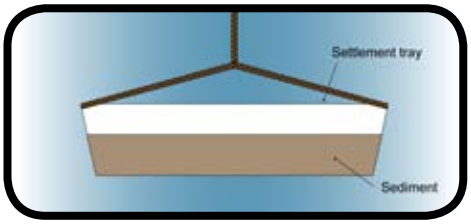
- Intertidal to subtidal, adjacent to wharf piles
- Soft substrates – mud, sand, silt etc.

Field processing

- Sieving
- Elutriation
- Removal of incompatible specimens
- Labelling
- Narcotisation and fixing

Hazards

- Diving – depth, time, limited visibility
- Low detection sensitivity for rare species
- Not suitable for highly dynamic environments



Description

Settlement trays are used to sample invertebrate species that reside in soft substrates, including the sediments in harbours and ports. Trays are generally constructed from plastic or metal in a variety of sizes and depths, and filled with filtered sediment from the sample site. Trays are deposited on the seafloor and left for a sufficient time to allow local invertebrate species to colonise the sediment in the tray. Trays are then retrieved and the species identified. They are not a suitable method for highly dynamic environments, as the sediment will be eroded from the tray.

Target species

Soft sediment species including:
Asterias amurensis – North Pacific seastar
Carcinus maenas – European shore crab
Corbula gibba – Clam
Hydroides dianthus – serpulid polychaete
Hydroides ezoensis – serpulid polychaete
Musculista senhousia – Asian date mussel
Perna viridis – Asian green mussel
Sabella spallanzanii – Mediterranean fanworm

Life stages

Settled larvae and juveniles
Adults

Application

Prior to tray deployment, collect a sufficient amount of sediment (i.e. enough sand, mud etc. to half fill the trays) from the vicinity of the sample site. Freeze the sediment to kill any organisms (at least 2 days in -20 ºC freezer). Rinse thawed sediment with freshwater and filter through an appropriately sized sieve (normally 1.0 or 0.5 mm mesh) to remove large shell fragments and dead organisms. Retain the filtered sediment and either refreeze until needed or placed directly in settlement trays. Half fill the settlement trays with filtered sediment, and seal with lids during transport to and from the seafloor. SCUBA or snorkel divers are generally required to deploy the trays, which are deposited flush with the sediment surface of the seabed. Remove the lids and leave the trays *in situ* for a duration of at least 1 month. Trays may be secured to nearby structures with rope (e.g. wharf pilings), if necessary. On retrieval, replace the lids on the trays before transporting to the surface. Empty the contents of the tray into a suitable container or directly into a sieving device for processing. Thoroughly wash the tray with water from the same site to ensure all sediment material is included in the sample.

Equipment specifications

Settlement tray - (e.g.) 44 cm x 32 cm x 12 cm PVC tray

Sieves - 1.0 mm mesh opening, 0.5 mm mesh opening, 0.2 mm mesh opening, 100 um mesh opening; preferably stainless steel or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Diving equipment - Includes exposure suit, air tanks, weight belt etc. as required to occupational diver standard or for snorkelling

Shovel - For collecting bulk sediment before tray deployment

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of tray; waterproof marker and labels

Water supply - Running seawater supply on site

Quality assurance

44 cm x 32 cm x 12 cm trays (sediment surface area of 1.4 m^2); duration: 1-3 months. Number and distribution of trays will depend in target species density and habitat preferences.

Recommendations

- Allow sufficient deployment time for colonisation of target species.
- Increase the coverage (i.e. number of trays deployed) for detection of rare species.
- Use divers to deploy and retrieve covered sediment trays to reduce sediment loss.
- Settlement plates may be incorporated into a collection system that also utilises settlement trays and ropes.

Small Cores

Suitable Habitats

- Intertidal to subtidal, adjacent to wharf piles
- Soft substrates – primarily uncompacted fine sediment

Target species

Cyst-forming dinoflagellate species including:
Alexandrium catenella
Alexandrium minutum
Alexandrium tamarense
Gymnodinium catenatum

Life stages

Cysts or resting stages

Equipment specifications

Hand-held core tube - Plastic, preferably clear but plumbing pipe is also suitable; 200 mm long, 25 mm internal diameter; firmly-fitting rubber bungs for both ends of tube

Gravity corer, e.g. TFO gravity corer or Phleger corer - Inner tube: 30 cm long, 1.5 cm diameter; firmly fitting rubber bung for bottom and plastic sheet/rubber band for top; lead weight 1-10 kg

SCUBA diving equipment - Includes exposure suit, air tanks, weight belt etc. as required to occupational diver standard

Storage equipment - Insulated box, ice, waterproof marker, waterproof labels

Hazards

- Diving -depth, time, limited visibility
- Compacted or hard sediments - coarse-grained habitats may not yield a sufficient number of cysts and the gravity corer may not sufficiently penetrate coarse sediment.

Field processing

- Labelling
- Storage over ice

Description

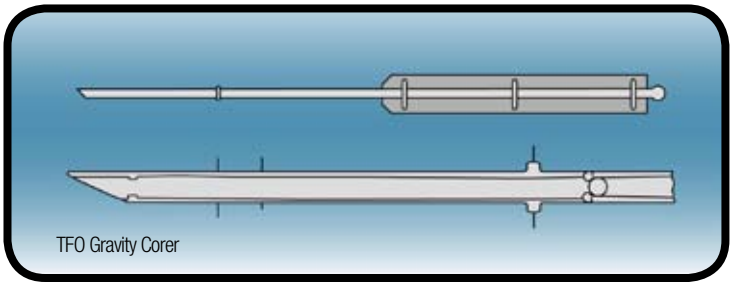
Small corers are used to detect cyst-forming species, e.g. dinoflagellates, from soft sediments. Hand-held corers are constructed from plastic tubes. Hand-held core sample collection is carried out by hand and may require SCUBA diving. Alternatively, a gravity corer may be deployed from a small vessel or wharf.

Quality assurance

Insert hand-held corers into the sediment to a depth that leaves the top 20-50 mm of the tube unfilled. Gravity corers should penetrate at least the top 2 cm of the sediment.

Recommendations

- Sample sites are preferably in areas where the deposition and undisturbed accumulation of sediment and cysts is likely to occur.
- Intertidal core sample may not require SCUBA diving.
- Some specialised training is required to deploy gravity corers.



TFO Gravity Corer

Application

For hand-held corer application, prior to use the lower rim of the tube is sharpened by bevelling around the inner and outer surface of the tube (generally for thick plastic tubes but may not be necessary for thin metal tubes). The top of the tube should be clearly marked. Corers are pushed into the sediment by hand to a depth that leaves the top 20-50 mm of the tube unfilled, i.e. the sediment should not overflow the top of the tube. Care should be taken not to disturb the surface of the sediment while inserting the corer. The top of the tube is capped with a rubber bung prior to withdrawal from the sediment and the lower end is capped after withdrawal, to ensure sample integrity.

For gravity corer application, prior to deployment a transparent polycarbonate tube is inserted into the corer body and a lead weight is attached to the device. The weight is selected according to the nature of the sediment and the water depth, e.g. 1-2 kg weight for mud and 5-10 kg weight for sand and deeper stations. Tie one end of the rope to the top of the corer and the other end to the boat (or wharf), and deploy the corer over the side of the vessel (with the tip of the core tube entering the water first). Let the device sink to the bottom where the corer will penetrate the sediment under its' own weight. After contact with the bottom, pull the corer smoothly to the surface ensuring it is retrieved in an upright position, so as not to lose the collected sediment. On retrieval, take out the tip of the corer and insert a rubber bung into the end of the inner tube. Take the inner tube out entirely while holding it in the vertical position (with the plugged end down) and cover the upper end securely with a plastic sheet and rubber band (or another bung) to prevent leaking and evaporation of surface water.

Cores are placed upright in an insulated box and stored over ice (<15°C, but not frozen) in the dark. Particular care should be taken to keep cores out of sunlight if they are constructed from clear plastic. Cores should remain sealed until the examination for cysts is conducted.

Spat bags

Australian Government Department of Agriculture, Fisheries and Forestry
MAF BIOSECURITY NEW ZEALAND

Suitable Habitats

- Intertidal and deeper
- Water column
- Wharf pilings and port structures

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Hazards

- Duration, density and seasonality of target species planktonic stages

Target species

Species with planktonic larval stage including:
Asterias amurensis – North Pacific seastar
Balanus eburneus – Ivory barnacle
Carcinus maenas – European shore crab
Charybdis japonica – Japanese rock crab
Corbula gibba – Clam
Crassostrea gigas – Pacific oyster
Hydroides dianthus – serpulid polychaete
Hydroides ezoensis – serpulid polychaete
Musculista senhousia – Asian date mussel
Perna perna – South African brown mussel
Perna viridis – Asian green mussel
Other encrusting/fouling organisms

Life stages

Settled larvae
Juveniles

Equipment specifications

Spat bags and cable ties - Draw-string bag of 1.5 mm mesh filled with pieces of 4 cm mesh; cable ties for attaching bags to rope

Rope and weight - Sufficient length to reach the seafloor and tie to structure at surface; weight tied to end of rope

Sieves - 1.0 mm mesh opening; preferably stainless steel or brass sieves as plastic sieves may stretch with use; rinse in freshwater after use to avoid corrosion

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of the bags; waterproof marker and labels

Water supply - Fresh seawater supply in field

Storage equipment - Insulated box, ice, waterproof marker, waterproof label

Description

Spat bags are used to collect species that have a planktonic larval phase. Bags are available in a range of designs and mesh sizes, and should be chosen to suit target species. Before deployment, additional scrunched pieces of mesh may be inserted into the mesh bag to increase the area available for larval settlement. The use of spat bags has greater success in locations with relatively long water residence times (i.e. larvae may be rapidly exported, before settlement, from areas with high velocity currents).

Quality assurance

Leave spat bags at sample site for at least 4 months, or for a sufficient time to allow organisms to grow large enough for easy identification. Timing should coincide with the period when planktonic stages of the target species are present in the water column. Number and placement of spat-bags will depend on the environment and the population density of the target species.

Application

Tie the bag closed with the draw strings. Attach a brick or weight to the end of a rope and attach the bag at an appropriate distance up from the weight (i.e. the most suitable height for detecting the target species). Note that more than one bag can be attached to the rope if required. Choose a site where the spat bags can be attached to a fixed structure such as a wharf. Drop the rope (weight first) into the water until the weight reaches the bottom and attach the remaining rope to the wharf or other structure. Leave the bags in the sample area for at least 4 months, allowing enough time for the settled larvae to develop into identifiable juveniles. On retrieval, lift the bags out of the water and shake gently to remove silt and other debris (taking care not to lose any attached organisms, such as mussels).

Recommendations

- Additional information on the larval duration, distribution and seasonal availability of target species should be considered when deploying spat bags, e.g. spat bags should be deployed by the end of October for *A. amurensis*.
- Do not leave spat-bags at sample site for too long as the chance of mortality from predation increases.

Traps

Suitable Habitats

- Soft substrates – sand, gravel, mud, clay & similar substrates
- Hard substrates –rocky shores, mussel beds, breakwalls, wharf pilings
- Estuarine, intertidal and shallow subtidal environments

Field processing

- Removal of incompatible specimens
- Elutriation
- Labelling
- Narcotisation and fixing

Target species

Mobile species including:
Asterias amurensis – North Pacific seastar
Carcinus maenas - European green crab
Charybdis japonica – Japanese rock crab
Eriochier sinensis – Chinese mitten crab
Hemigrapsus sanguineus – Japanese shore crab

Life stages

Adults

Hazards

- Low abundance of target species
- Strong wave action

Equipment specifications

Bait or small mesh traps - Box or cylinder of 2 mm plastic mesh; 150-200 mm high and 400-500 mm long;

Collapsible Japanese crab trap - plastic-coated frame; 600 mm long, 450 mm wide and 20 mm high; 12.7 mm square mesh netting

Standard minnow trap - cylindrical with inverted cone entrances of ~ 57 mm

Pitfall traps - Plastic plumbing pipe is suitable; 100 mm long, 25 mm internal diameter; ensure inside is smooth

Extra equipment for trap - Extra weights for trap; rope tethers and buoy for traps; bait-saver bag

Collection containers - Plastic or metal (durable, not prone to breakage); sufficient to contain contents of trap; waterproof marker and labels

Equipment for handling samples and preserved specimens - Gloves, safety glasses, forceps, sorting tray, petri dishes etc.

Description

A variety of traps are available for capturing mobile organisms such as crabs and seastars from estuarine to shallow subtidal habitats. Commercially available bait traps or any small mesh trap is suitable for sampling small crustaceans and other mobile fauna. The trap consists of a box or cylinder made from plastic mesh supported by wire hoops. Each end of the trap has an inwardly tapered entry cone. Access to the trap for baiting and removal of animals occurs via zippered closures or the separation of the trap into halves at its midline. Collapsible Japanese crab traps can be used for sampling *Carcinus maenas* and other crabs. These traps have a light-weight plastic-coated wire frame covered with 12.7 mm square mesh netting. Crabs enter the trap through the slits at the apex of inwardly directed V-shaped panels at each end of the trap. An internal mesh bag is secured to the upper frame. Set the trap in an erect position with the two clips along the upper mid-line of the trap. Releasing these clips collapses the trap and allows access to the inside of the trap for baiting and removal of crabs. Alternatively, standard baited minnow traps can be set near the edge of vegetation or along mud/peat banks. Set this trap with the opening perpendicular to the incoming tide. Other traps for catching crabs could include unbaited pitfall traps, fish traps and box traps deployed in intertidal and shallow subtidal environments. In high intertidal areas, pitfall traps are successful for sampling crabs with <45 mm carapace width, while folding traps and box traps successfully catch crabs with >40 mm carapace width.

Application

Set the traps in areas where the animals are most likely to occur to ensure that samples of the target species are caught. Traps are generally weighted with chain or lead weights and deployed with surface buoys or tethered to wharves. Submerge traps for at least 12 hours to allow sufficient time for the animals to detect the bait (if present) and enter the trap. Deployment of traps should preferably coincide with periods of high target species density. Traps may be baited to entice target species to enter. Locally available fish or shellfish are appropriate bait and can be contained in a bait-saver bag inside the trap. Carefully remove the fauna caught in the traps and treat accordingly. Note that holding live, cheliped bearing specimens with other animals should be avoided as they may damage more fragile species.

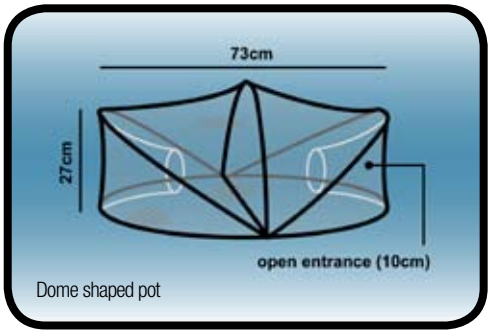
Note: A trapping licence from the appropriate authority is essential before sampling commences. This will require a written letter of permission detailing information on the species, location and duration of the trapping program.

Recommendations

- Do not deploy in shipping lanes
- Apply sufficient weights or tethers to traps to avoid loss
- Attach a buoy or other marker to the trap to ensure traps can be located for catch removal, particularly for deeper habitats.
- Note the potential for human interference of traps (e.g. theft, damage) when left in the sampling environment.

Quality assurance

Submerge traps for at least 12 hours, i.e. overnight. Number and size of traps may vary according to the physical size and population density of the target species.



Dome shaped pot

Underwater visual searches

Australian Government Department of Agriculture, Fisheries and Forestry
MAF BIOSECURITY NEW ZEALAND

Field processing

- Removal of incompatible specimens
- Labelling
- Elutriation
- Narcotisation and fixing

Hazards

- Diving – depth, time, limited visibility, water temperature
- Safety risks for divers e.g. dangerous animals in tropical ports such as crocodiles, stingers & sharks
- Visual searches are unlikely to be practical in regions where visibility is <1m.
- The visual resolution may limit the identification of smaller animals.
- Visual searches are generally ineffective when species density is low, e.g. <0.03 m^2 for *A. amurensis*
- Not suitable for monitoring variations in target species abundance.

Description

Underwater visual surveys are visual examinations for conspicuous target species (i.e. large epibenthic and encrusting taxa) along a set path or transect over soft and hard substrates including rocky reefs, wharf pilings and sandy bottoms. These surveys usually involve diver searches, and may include video and photo sampling where free-swimming divers are required to take underwater video recordings or still photographs. Alternatively, imaging technology can be mounted on remotely operated underwater vehicles (ROVs). Visual surveys are applicable in situations with minimal underwater hazards and relatively good underwater visibility. Skilled operators are required for high quality video and photo records of target species, which are then verified by comparison with collected specimens.

Quality assurance

Wharves and breakwaters etc. in port areas: swim the length of the structure at several depths (e.g. -0.5, -3, -7 m and the bottom, ~10-12 m), starting at the base of one of the piles (generally that closest to the end of the berth) or follow a vertical transect for each pile/facing from approximately high water mark downwards. Using the manta board: divers should be towed along 100 m transects at several depths (e.g. -2, -5 and -10 m; dependent on water depth) at speeds of less than 2 knots. Soft substrates and reefs etc.: an adequate spread of 50 m long transects to cover sample area.

Recommendations

- Test cameras before sampling to establish the appropriate exposure, stop and focal settings for the environmental conditions.
- Ensure that the flash gives an adequate and even illumination of the field.
- Carefully position underwater lights and flashes to minimise back-scatter from suspended particles in the water.
- A manta board tow may not be appropriate for smaller, cryptic target species.
- Consider hiring photographic and video equipment and experienced operators to minimise costs.
- Conduct visual surveys before proceeding with destructive sample methods.
- Biological and ecological aspects of a target species should be considered to increase likelihood of detection.
- Use a ROV for video and photo transects in high risk areas where diver safety is a concern.

Suitable Habitats

- Intertidal and shallow subtidal areas
- Seagrass/algal beds
- Soft substrate – sand, mud
- Hard substrate – including breakwaters, rockwall facings, rocky reefs, structureswithin port areas
- Mariculture facilities – mussel grow-out lines, oyster racks, cages, jetties, pipelines

Application

Lay out a series of appropriate transect lines that ensure complete visual coverage of the structure and/or seafloor (see quality assurance below). Secure a length of rope to the environment to mark out the transect path. Transects are generally horizontal but can be vertical, e.g. on wharf pilings. Divers are either free-swimming or towed using a manta board. When searching, divers should take care to minimise avoidance or camouflage behaviour by target species (e.g. retracting into burrows, moving away from search area). This may be accomplished by laying out the transects several hours before the search is conducted, or divers may conduct the search while swimming ahead of transect ropes as they are laid out. For video transects, use an analogue or digital video recorder contained in an underwater housing with attached twin 20 W underwater lights. Ensure that the camera is maintained at a constant distance (approx. 0.5 m) from the area being filmed using a distance measuring rod. Attach a scale and depth meter to the rod in a position so that they fall within the field of view of the camera at the wide-angle setting, to provide real-time depth information on the video recording. Care should be taken to ensure that reflected light does not obscure the readout on the depth meter. Use the zoom functions to take close-up, high resolution moving images if necessary. A video recording will cover the entire transect path. For still photographs, use a standard 35 mm SLR (Single Lens Reflex) underwater camera or digital camera contained in an underwater housing. Cameras should be fitted with twin flash units. Attach a distance-measuring rod to the camera to ensure the correct focal distance is consistently maintained. Use a 1:6 close-up frame to provide high resolution records of fouling communities if necessary. Still photographs may be taken of selected quadrats or organisms of interest (to potentially supplement the video images) along the transect. When photographing quadrats, place a 0.10 m^2 quadrat at allocated points along the transect path or fix to the outer surface of wharf piles using a bungee cord or some other suitable material. If quadrats cannot be easily fixed to facings they will need to be held by divers and the outline scraped into the biota. Alternatively, imaging technology can be mounted on remotely operated underwater vehicles (ROVs). Additionally, record the occurrence of any target species on waterproof paper or a dive slate. Carefully extract organisms of interest from their environment and retain in plastic or mesh sample bags for taxonomic identification. Note that care should be taken over muddy bottoms to minimise sediment resuspension.

Underwater visual searches

Target species

Epibiota and sedentary/encrusting species including:

Asterias amurensis - North Pacific seastar
Balanus eburneus – Ivory barnacle
Carcinus maenas - European green/shore crab
Caulerpa taxifolia aquarium strain - algae
Charybdis japonica - Japanese rock crab
Ciona intestinalis – Sea vase
Codium fragile spp *tomentosoides* – green macroalgae
Corbula gibba – Asian bivalve, Basket shell
Crassostrea gigas – Feral Pacific oyster
Dreissena bugensis – Quagga mussel
Eriochier sinensis – Chinese mitten crab
Hemigrapsus sanguineus – Japanese shore crab
Hydroides dianthus – serpulid polychaete
Hydroides ezoensis – serpulid polychaete
Limnoperna fortunei – Golden mussel
Liza ramada – Thinlip mullet
Musculista senhousia – Asian date mussel
Mytilopsis sallei – Black striped mussel
Neogobius melanostomus – Round goby
Pagrus major – Red seabream
Perna perna – South African brown mussel
Perna viridis – Asian green mussel
Petricolaria pholadiformis – False angelwing
Polysiphonia brodiaei – red macroalgae
Potamocorbula amurensis – Brackish-water corbula
Rapana thomasiana - gastropod
Rapana venosa - gastropod
Sabella spallanzanii – Mediterranean/European fanworm
Sargassum muticum – Asian seaweed
Schizoporella errata – bryozoan
Siganus rivulatus – Marbled spine foot
Styela clava – sea squirt
Tridentiger bifasciatus – Shimofuri goby
Undaria pinnatifida – Japanese kelp
Watersipora arcuata - bryozoan
Other epifaunal organisms (depending on the visual resolution of the images)

Life stages

Adults

Equipment specifications

Diving equipment - Includes exposure suit, air tanks, weight belt etc. as required to occupational diver standard or for snorkelling; waterproof paper or dive slate and graphite pencil for recording observations

Small boat and Manta board etc - A small (4 m) boat with 15-20 HP outboard motor and necessary safety gear; rope harness attached to transom; manta board with fitted harness; 17 m of 10 mm towing rope with quick release clips on either end; clamp fitted on board to hold recording paper, pencils etc.

Transect ropes - Sufficient length for transect e.g. ≥100 m

Stakes, nails etc. - As required for attaching transect rope

Quadrat template - Plastic or metal preferably

Collection bags - Plastic or mesh, with appropriate pore size to release water but retain organisms

Analogue or digital video recorder - Sony CCD-TR3000E2 or similar, including video cassette or recordable DVD

Underwater housing for video camera - Sony MPK-TRB Handycam Marine Pack2 or similar

Additional video camera equipment - 2x underwater lights, 20 W; distance-measuring rod (at least 500 mm long); scale and digital depth meter fitted to rod

Standard 35 mm underwater still camera - Nikonos V2 or similar, including batteries and appropriate film

Additional still camera equipment - 2x flash units and 1:6 over-lens close-up frame fitted to still camera; distance-measuring rod (at least 500 mm long); scale and digital depth meter fitted to rod

ROV - Eg. Little Benthic Vehicle (LBV)