Spatial and habitat-related patterns in the biodiversity of Brisbane Water estuary: a tool for sustainable estuary management

DRAFT FINAL REPORT

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Executive Summary

The objectives of this study were:

(i) To survey the macro-invertebrate biodiversity occurring in representative habitats throughout Brisbane Water estuary, including mangroves, seagrass, intertidal rock (natural and constructed rock walls), intertidal sediment and subtidal sediment
(ii) To survey the environmental variation occurring in subtidal sediment throughout Brisbane Water estuary and to test for its relationship to spatial variation in the macroinvertebrate assemblages of this habitat
(iii) To use the results of (i) to quantify variation in conservation value throughout Brisbane Water estuary
(iv) To prepare data from objectives (i) and (ii) as GIS layers

This report provides the results of objectives (i)-(iii). Results of objective (iv) are provided in a separate report as GIS layers.

A comprehensive sampling program was undertaken throughout Brisbane Water estuary, focussing on the biodiversity of macroinvertebrates. The total area of the estuary was divided into 36 grids of 1 × 1-km squares in order to provide a uniform degree of sampling resolution. Each habitat present in each grid was sampled for macroinvertebrates. Habitats present in the estuary included: mangroves; *Zostera capricorni* seagrass beds; unvegetated subtidal sediment; unvegetated intertidal sediment; intertidal rocky reef; and human-made hard substrate (e.g. rock walls). Grid cells extended from the entrances of three creeks entering the estuary (Narara, Erina, Kincumber), the central water body of the estuary; three adjoining water bodies (Fagan's Bay; Woy Woy Bay; and Kincumber Broadwater); and the seaward limit of the estuary at Ettalong-Umina.

Habitat diversity

Five habitats were sampled throughout the estuary: *Zostera capricorni* seagrass meadows; subtidal unvegetated sediment; intertidal mud flats; intertidal hard substrates (natural and anthropogenic); and mangroves. Habitats were represented throughout Brisbane Water in the following pattern: subtidal unvegetated substrates (present in 36 grid cells), intertidal mud flats (33 grid cells), *Z. capricorni* seagrass meadow (30 grid cells), intertidal hard substrates (28 grid cells), and mangroves (27 grid cells).

Biodiversity of macroinvertebrates

A total of 324 species (72,524 individuals) were recorded, representing 16 phyla: Foraminifera (1 species), Porifera (2 species), Ectoprocta (2 species), Chordata (3 species), Cnidaria (3 species), Platyhelminthes (1 species), Nematoda (2 species), Nemertea (1 species), Annelida (74 species), Sipuncula (2 species), Arthropoda (66 species), Echinodermata (7 species), Mollusca (141 species), Chlorophyta (5 species), Phaeophyta (5 species), and Rhodophyta (9 species).

The polychaete worm *Bispira* sp. (Polychaeta: Sabellidae) was a new record from NSW. This species had been previously reported only from Queensland (P Hutchings *personal communication*).

The greatest number of species was recorded in Pheagan's Bay (112 species). The least number of species was recorded in the area extending between Point Frederick and Green Point (23 species).

One hundred and eighty-eight species were recorded from *Zostera capricorni* seagrass meadows habitat with an average of 40 species (range 21-56 species) per grid cell. The greatest number of species (56 species) in the seagrass habitat was recorded at Yattalunga and Ettalong.

One hundred and eight species were recorded from intertidal mud flats with an average of 14 species (range 1-28 species) per grid cell. The greatest number of

species (28 species) in the intertidal mud flat was recorded in Woy Woy – St. Hubert's Island.

A total of 124 species were recorded from mangrove habitat with an average of 27 species (range 1-40 species) per grid cell. The greatest number of species in the mangrove habitat was recorded in Point Claire, Koolewong and Saratoga (40 species).

A total of 160 species were recorded from subtidal unvegetated sediment with an average of 22 species (range 2-51 species) per grid cell. The greatest number of species in the submerged unvegetated habitat was recorded in Woy Woy Bay – Pelican Island (51 species).

A total of 73 species were recorded from intertidal hard substrates with an average of 17 species (range 5-35 species) per grid cell. The greatest number of species in the intertidal hard substrates habitat was recorded in Ettalong (35 species).

Spatial patterns in assemblages of macroinvertebrates in unvegetated subtidal sediment and their relationship with environmental variables

Five assemblages of macroinvertebrates occurred in Brisbane Water estuary: (1) entrance to Narara Creek; (2) the marine boundary with the estuary between Wagstaff and near Pearl Beach; (3) the entrance to Kincumber Creek and the adjacent Kincumber Broadwater; (4) the central section of the estuary; and (5) all remaining grid cells.

This spatial pattern in assemblage structure was significantly related to: concentration of phaeopigments in the sediment; concentration of chlorophyll a in surface water; and pH of surface water.

Conservation value

The conservation value of different parts of the estuary was quantified as the contribution of each grid cell to the conservation target of representing each species in Brisbane Water estuary. A simulated conservation planning exercise found that the

top five grid cells, which together included 74% species, were Ettalong, Narara Creek, Koolewong, Woy Woy Bay-Pelican Island; and Umina. The grid cell with the highest conservation value in Brisbane Water estuary (Ettalong) included 34.5% of all species. A total of 25 grid cells (representing 69% of the area of Brisbane Water estuary) included all species recorded in the study.

Management implications

Conservation of the biodiversity of Brisbane Water estuary must be based on the objective of maintaining the existing spatial patterns of biodiversity. This can be done by conserving the ecological processes and environmental factors underlying the spatial patterns in biodiversity, by managing human uses to minimize changes to these factors and processes.

The identification of a suite of environmental variables underlying the spatial variation in biodiversity (silt/clay content of sediment; conductivity; depth; sediment phaeopigments; surface water chlorophyll a; pH) suggests that management should attempt to ensure minimal disturbance to their natural patterns of variation. Human activities likely to alter these variables therefore need careful assessment and management.

Five grid cells were identified as being highly important for the representation of the species biodiversity of Brisbane Water estuary macroinvertebrates: Ettalong, Narara Creek, Koolewong, Woy Woy Bay-Pelican Island; and Umina. These grid cells require a high priority for management action to minimize impacts of human activities.

The grid cell with the second-highest conservation value occurred in Narara Creek. This area will require special management attention, if the high conservation value is to be conserved, due to the range of human uses currently occurring along the banks and within the catchment of Narara Creek.

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Introduction

Existing at the ocean-land interface, estuaries contain unique assemblages of animals and plants that support a range of human uses. Estuarine assemblages vary at a range of spatial and temporal scales (Morrisey et al., 1992a,b; Legendre et al., 1997; Kendall and Widdicombe, 1999; Edgar and Barrett, 2002; Ysebaert and Herman, 2002; Noren and Lindegarth, 2005). Environmental variables that underlie this spatial variation within estuaries include primary productivity (Heip et al., 1995); degree of flushing (Ardisson and Bourget, 1997); seagrass biomass (Howard et al., 1989; Heck et al., 1995), sediment particle size (Mannino and Montagro, 1997; Ysebaert and Herman, 2002; Dauvin et al., 2004); salinity (Ardisson and Bourget, 1997; Ysebaert and Herman, 2002), and chlorophyll a (Ysebaert and Herman, 2002).

Gosford City Council is committed to the sustainable management of Brisbane Water estuary, and as part of that is currently undertaking the Brisbane Water Estuary Process Study. Understanding the spatial patterns in estuarine biodiversity and the environmental factors and processes that underlie this variation is a necessary prerequisite for sustainable management of estuaries.

The aim of this study is: to describe the spatial and habitat-related patterns in the biodiversity of macroinvertebrates of Brisbane Water estuary and to support planning and decision-making for sustainable estuary management. The specific objectives of this study are:

(i) To survey the macro-invertebrate biodiversity occurring in representative habitats throughout Brisbane Water estuary, including mangroves, seagrass, intertidal rock (natural and constructed rock walls), intertidal sediment and subtidal sediment

(ii) To survey the environmental variation occurring in subtidal sediment throughout Brisbane Water estuary and to test for its relationship to spatial variation in the macroinvertebrate assemblages of this habitat

(iii) To quantify variation in conservation value throughout Brisbane Water estuary

(iv) To prepare data from objectives (i) and (ii) as GIS layers

Methods and Materials

Study area

This study was undertaken in Brisbane Water estuary in south-east Australia. The total area of the estuary was divided into 36 grids of 1 × 1-km squares in order to provide a uniform degree of sampling resolution (Fig.1). In doing so, three distinctive systems are recognized in the estuary including a fully estuarine system in inner Brisbane Water consisting of 24 grids, 3 creek systems in inland extensions of the estuary, and 6 marine-estuarine grids.

Biological sampling

Biological sampling was carried out in different habitats including intertidal mud flats, sea grass meadows (*Zostera capricorni*), mangroves, submerged unvegetated substrates, and intertidal hard substrates inside each grid cell from May to December 2005. In each habitat present in each grid cell sampling occurred in two replicate sites located approximately 100 m apart. The optimal number of replicate samples in intertidal mud flats, sea grass meadows, submerged unvegetated substrates, and intertidal hard substrates were determined following previous studies (Courtenay et al., 2005; Gladstone 2006). In mangroves, a pilot study found that 7 replicates provided means with acceptable precision (i.e. standard error/mean) for species richness (precision = 0.09- 0.19).

Sea grass macroinvertebrates were sampled by inserting a 10 cm wide × 10 cm deep PVC corer (N=6) into the sediment in water from 20 to 50 cm deep and then sieving the sediment sample through a 1 mm mesh. In mangroves, 7 replicate 0.1-m^2 quadrates were haphazardly placed about 5 m apart in each site and sediments and leaf litter were collected to the nutritive root layer (from 1-2 cm depth) and placed in the plastic bag. Sediments collected in mangroves and sea grass meadows were rewashed in the laboratory over a 1 mm mesh sieve and retained sediments, leaf litter

and wrack were separated. Sediments were preserved in 5-7% formalin, followed by 70% ethanol with rose bengal for further sorting. Leaf wrack and litter were placed in a paper bag and oven dried at 70°C until dry and then their dry weight recorded to the nearest 0.1 g. Macroinvertebrates living on the trunk of mangrove trees occurred at the closest distance to the seaward edge of the mangrove trees were also sampled from the base of the tree to 1 m up the trunk. Five replicate mangrove trees with radius of 0.15 m were sampled at each site providing 0.94 m^2 surface area of the trunk for each tree.

Macroinvertebrates occurring in intertidal mud were sampled by inserting a 10 cm wide × 10 cm deep PVC corer (N=6) into the sediment and then sieving the sediment sample through a 1 mm mesh in the filed. Macroinvertebrates in submerged unvegetated substrates were collected using a 0.125 m² Van Veen grab to a depth of 3 cm (N=6), then sieving the sediment sample through a 1 mm mesh in the filed. Sediments collected in intertidal mud and unvegetated substrates were rewashed in the laboratory over a 1 mm mesh sieve and retained sediments were preserved in 5-7% formalin, followed by 70% ethanol with rose bengal for sorting.

Macroinvertebrates occurring on intertidal hard substrate were counted in 6 sub-habitats including platforms, boulders (1 m wide × 1 m length × 0.5 m height), retaining sea walls, cobbles (15 cm × 25 cm side-lengths), rock crevices and rock pools. These sub-habitats were identified by previous studies (Archambault and Bourget, 1996; Benedetti-Cecchi and Cinelli, 1996; Chapman, 2002; Chapman and Underwood, 1996) to contain different assemblages of macroinvertebrates. Sampling was conducted during low tide. In platforms and retaining sea walls sampling was done with 6 haphazardly placed 0.25 m^2 quadrats at each site inside each gird.

Macroinvertebrates of rock boulders (1 m × 1 m × 0.5 m) were sampled with a stratified sampling design that included all available micro-habitats. The sides and top surfaces of boulders were sampled with 0.01m^2 quadrats (N=3). The crevice between the boulder and the substrate was sampled with 0.5 m length of PVC pipe (N=3) and all macroinvertebrates occurring within 20 cm either side of the midline of the pipe were recorded. Macroinvertebrates on cobbles with approximately 15 cm × 25 cm side-lengths were counted on all sides of cobbles. Five replicate cobbles were

sampled in each site. Five replicate rock pools with approximate radius of 0.15 m were sampled at each site. Depth of pools was ignored during calculation of the surface area being sampled. Macroinvertebrates on 7 replicate v-shaped crevices with 0.5 m length × 0.1 m wide providing 0.119 m^2 surface area were sampled at each site. The abundance of macroalgae, small sized barnacles, and encrusting organisms such as bryozoans, sponges and ascidians were estimated in percentage cover of the area being sampled. Organisms in all habitats were identified to species-level where possible.

Environmental sampling

The results of previous studies in aquatic systems confirm the link between the spatial pattern of the biotic community with some environmental variables such as sediment type (Al Bakri et al., 1997a), dissolved oxygen, surface-sediment pigments, bottom-water oxygen concentration, water depth (Levin et al., 2000), and sedimentary organic carbon (Ramey and Snelgrove, 2003). In fact environmental variables were found to be the major influential factors in structuring biotic assemblages (Al Bakri et al., 1997a; Al Bakri et al., 1997b; Al Bakri and Kittaneh, 1998; Levin et al., 2000; Magni et al., 2006; Ramey and Snelgrove, 2003; Schlacher et al., 1998). Given the confirmed relationship between environmental variables and benthic macrofauna, the environmental parameters of each habitat most likely to be relevant to the distribution of macroinvertebrate biodiversity were measured including depth, water temperature, conductivity, salinity, dissolved oxygen, turbidly, pH, and total organic content in sediment and sediment particle size distribution. In addition, photosynthetic pigments consisting of chlorophyll a and non-photosynthetic pigments (i.e. pheopigments) were measured in both water column and substrate. Data were collected during two different periods to obtain an actual average of variation consisting of (1) a single sunny day in September 2005 as a baseflow data, and (2) a single day after a rain event (13.6 mm rain fall; Source: Bureau of Meteorology) on 3rd of December 2005 as an event data. Event sampling was undertaken in order to capture the variation in water quality experienced after the rainfall as a result of freshwater input into the estuary system. To allow for the actual influence of freshwater input on the water quality of the estuary, event sampling was undertaken within 2 days of the rainfall. A

total of 6 replicate measurements were undertaken inside the same sites used for the biological sampling. Water quality data were collected in triplicates in each site using a portable water quality analyzer Model 611 YEO-KAl. This unit allows the operator to measure simultaneously depth, water temperature, conductivity, salinity, dissolved oxygen, turbidly, and pH. In the same sites, photosynthetic pigments in water column were measured in triplicates using a portable device (Aquaflour, model no. 8000-001, Turner Designs, Sunnyvale, C.A., USA). In order to measure the benthic photosynthetic pigments in the substrate, triplicate sediment samples were collected in each site using a 0.125 m² Van Veen grab and the top 1cm of undisturbed sediment sample was taken using a cut-off 60 cc syringe and placed in a centrifuge tube in order to supply 5 g wet sediment. Centrifuge tubes were stored in the dark and freezer (-20°C) prior to pigment extraction and measurement in the lab. Benthic photosynthetic pigments were measured (Gambi and Dappiano, 2004). Triplicate sediment samples in each site were also separately analyzed for organic content by the ignition method as well as for particle size distribution (Gambi and Dappiano, 2004). The particle size distribution of sediments was classified into five fractions: >1mm, 0.5-1mm, 0.2-0.5mm, 63-200µm, and <63µm.

Multivariate analysis

The macroinvertebrate assemblages present in unvegetated subtidal sediment were analysed with multivariate statistics. This habitat was selected for analysis because it was represented in all grid cells and a limited analysis only was possible in the report of the Brisbane Water Estuary Biodiversity Study (Gladstone, 2006). The data used for analysis was the mean density of each species in each grid cell, calculated as the mean of the two site-average density. Spatial patterns in assemblage structure were visualized with ordination diagrams using the program Canoco 4.5 (ter Braak and Smilauer, 2002). The mean density data for species were square-root transformed prior to analysis and the importance of rare species was down-weighted (ter Braak and Smilauer, 2002). Canonical correspondence analysis (CCA) was used to test for associations between assemblage patterns and the measured environmental variables. The mean value of each environmental variable in each grid cell was used. The distribution of each environmental variable was checked prior to analysis by

examination of box and whisker plots and normality tests. Data were transformed, where necessary, to reduce skewness and outliers and approximate normality. The following transformations were used in the analysis: The environmental variables were recorded in different units and so the data were standardized prior to analysis, by subtracting the mean and dividing by the standard deviation.

A manual forward selection process in Canoco was used to select the subset of environmental variables that best explained the spatial patterns in assemblage structure. Environmental variables were ranked according to the proportion of total variance in the species data set they explained. The highest ranking environmental variable was selected and the remaining variables re-ordered according to the proportion of total variance they explained in conjunction with the variable already selected. The statistical significance of the variance explained by each of the environmental variables was tested by a Monte Carlo test (999 permutations) and variables that were significant at $P<0.05$ were added to the model.

Assessment of conservation value

One of the most widely used tools in conservation planning to conserve biodiversity is the protected area. A protected area is a means of zoning the landscape, coastline, or open water so human activities are managed (by legal and other means) to conserve biodiversity. Protected areas range in intensity of management from reserves or no-take sanctuary zones (in which no collecting or destructive activities are permitted), to habitat protection zones (where some extractive activities are excluded and others allowed and managed) to general use zones (where most activities are permitted but managed).

The first step in conservation planning is to identify a goal for conservation. This is typically stated as "conservation of a representative sample of all species (or assemblage-types, or habitats, or ecosystems) in the planning area". This may be achievable by selecting a number of sites within the planning area that collectively contain all species (or assemblage-types, or habitats, or ecosystems) in the planning area. The basis of this is a map of the planning area, sub-divided into grids or other

planning units, with data for each planning unit on the number of species (or assemblage-types, or habitats, or ecosystems) occurring within it. Quantitative methods have become available in recent years that quantify the relative value of each planning unit towards achieving the conservation goal.

For the purposes of this analysis the following conservation target was used: to conserve a sample of all species occurring in the Brisbane Water estuary. The network of grid cells selected to achieve this conservation target should not be seen as a final arrangement because factors relating to socio-economics and management feasibility have not been considered. It should therefore be seen as a map of the relative conservation value (for species representation) of different parts of Brisbane Water estuary or the first step in developing a network of conservation reserves for the estuary. We used the conservation planning software C-Plan (New South Wales National Parks and Wildlife Service) (Pressey, 1999) to identify the minimum set of grids that satisfied the conservation target. We used summed irreplaceability as a quantitative measure of each grid's contribution to the conservation target. Irreplaceability is a measure of the likelihood that a grid will be required to represent each species in the study area (Pressey et al., 1994). Summed irreplaceability is the sum of the irreplaceability values of the grid for each of the species occurring there (Ferrier et al., 2000). The algorithm in C-Plan first selected the grid with the highest summed irreplaceability. The summed irreplaceability values of the remaining grids were re-calculated and the grid with the highest summed irreplaceability value was selected for inclusion in the network of conservation reserves. Where a selection was tied between two grids because of equal summed irreplaceability value the grid with the highest initial summed irreplaceability value (i.e. its summed irreplaceability value before any grids had been selected) was preferentially selected. If there was still a tie between two grids the grid cell that appeared first in the list was selected. Selection continued in this way until 100% of species had been included in at least one conservation reserve.

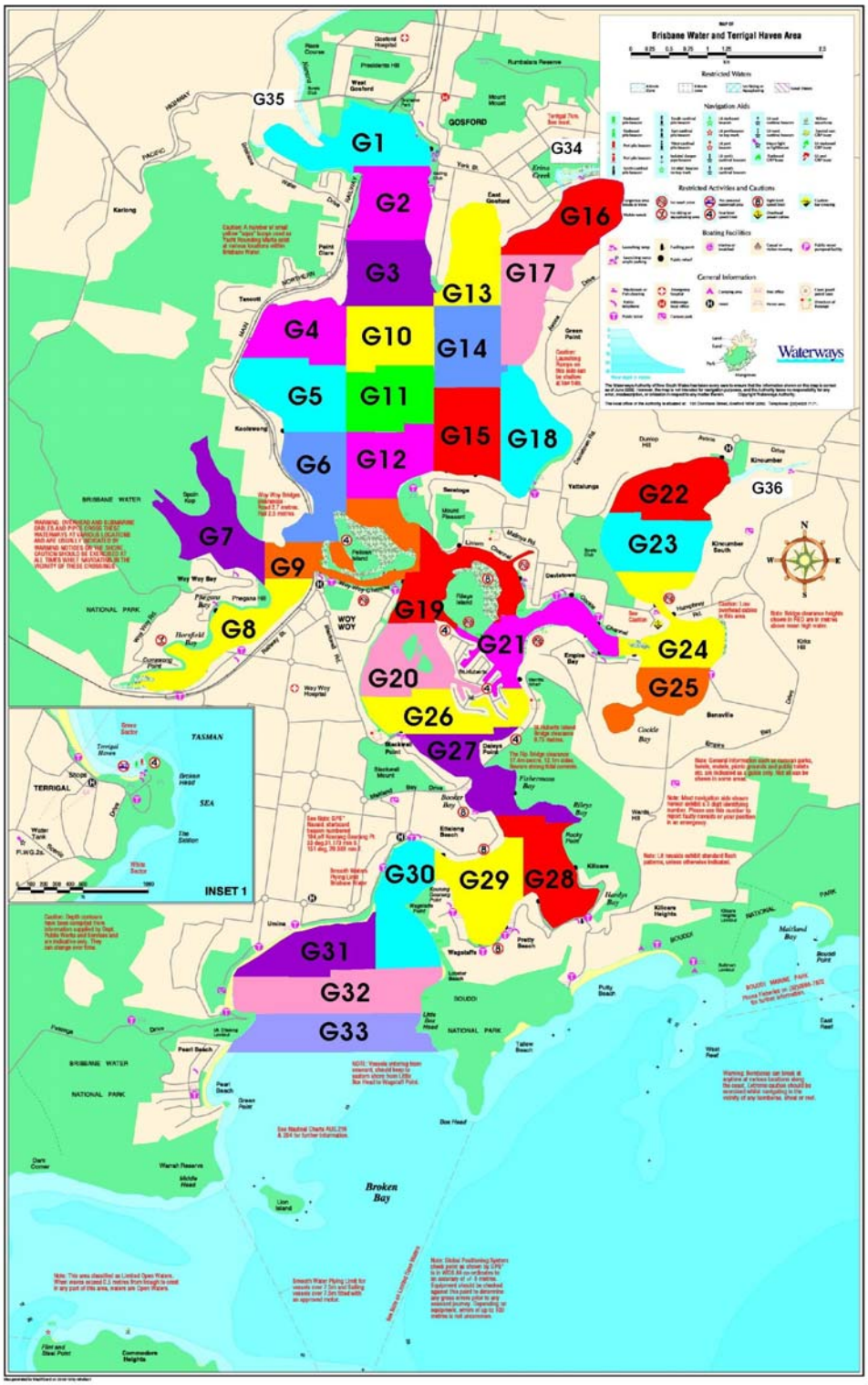

Fig. 1. Location of grid cells used for sampling in Brisbane Water estuary.

Results

Biodiversity - General

A total of 324 species (72,524 individuals) were recorded, representing 16 phyla (Appendix 1): Foraminifera (1 species), Porifera (2 species), Ectoprocta (2 species), Chordata (3 species), Cnidaria (3 species), Platyhelminthes (1 species), Nematoda (2 species), Nemertea (1 species), Annelida (74 species), Sipuncula (2 species), Arthropoda (66 species), Echinodermata (7 species), Mollusca (141 species), Chlorophyta (5 species), Phaeophyta (5 species), and Rhodophyta (9 species).

The polychaete worm *Bispira* sp. (Polychaeta: Sabellidae) was a new record from NSW. This species had been reported only from Queensland (P Hutchings *personal communication*).

The greatest number of species was recorded in grid cell 8, Pheagan's Bay (112 species). The least number of species was recorded in grid cell 14, the area extending between Point Frederick and Green Point (23 species).

The greatest number of habitats (five habitats) occurred in grid cells 1-3, 5-9, 12-13, 16-19, 21-22, 24-29, and 35 (intertidal mud flats, *Zostera capricorni* seagrass meadows, mangroves, submerged unvegetated substrates, intertidal hard substrates) (Appendix 2). The least number of habitats (one habitat) was recorded in grid cells 10, 11 and 14 (subtidal unvegetated substrate).

Habitats were represented throughout Brisbane Water in the following pattern: subtidal unvegetated substrates (present in 36 grid cells), intertidal mud flats (33 grid cells), *Z. capricorni* seagrass meadow (30 grid cells), intertidal hard substrates (28 grid cells), and mangroves (27 grid cells).

Seagrass

A total of 188 species were recorded from *Z. capricorni* seagrass meadows habitat with an average of 40 species (range 21-56 species) per grid cell. The greatest number of species in the seagrass habitat was recorded in grid cells 18 and 30 (56 species). Assemblages were dominated by molluscs (88 species), polychaetes (57 species), crustaceans (32 species), echinoderms (4 species), nematodes (2 species) and sponge, platyhelminthes, nemerteans, earthworms and sipunculans (1 species each). The five most abundant species were *Barantolla lepte* and *Capitella* sp. (Polychaeta: Capitellidae), *Simplisetia aequisetis* (Polychaeta: Nereididae), *Aricidea* sp. (Polychaeta: Paranoidae) and *Spirorbidae* sp. (Polychaeta: Spirorbidae).

Intertidal mud flats

A total of 108 species were recorded from intertidal mud flats with an average of 14 species (range 1-28 species) per grid cell. The greatest number of species in the intertidal mud flat was recorded in grid cell 26 (28 species). Assemblages were dominated by molluscs (52 species), crustaceans (30 species), polychaetes (22 species), echinoderms, nematods, sponge and earthworms (1 species). The five most abundant species were *Barantolla lepte* (Polychaeta: Capitellidae), *Salinator fragilis* (Gastropoda: Amphibolidae), *Batilaria australis* (Gastropoda: Batillariidae), *Owenia australis* (Polychaeta: Owenidae), and *Mysella vitrea* (Bivalvia: Galeommatidae).

Mangroves

A total of 124 species were recorded from mangrove habitat with an average of 27 species (range 1-40 species) per grid cell. The greatest number of species in the mangrove habitat was recorded in grid cells 2, 6 and 12 (40 species). Assemblages were dominated by molluscs (57 species), crustaceans (36 species), polychaetes (25 species), nematodes (2 species), echinoderms, sponge, earthworms and sipunculans (1 species). The five most abundant species were *Cryptassiminea* sp. (Gastropoda:

Assimineidae), *Batilaria australis* (Gastropoda: Batillariidae), *Tatea huonensis* (Gastropoda: Hydrobiidae), *Barantolla lepte* (Polychaeta: Capitellidae), and *Owenia australis* (Polychaeta: Owenidae).

Unvegetated subtidal sediments

A total of 160 species were recorded from submerged unvegetated habitat with an average of 22 species (range 2-51 species) per grid cell. The greatest number of species in the submerged unvegetated habitat was recorded in grid cell 9 (51 species). Assemblages were dominated by molluscs (63 species), polychaetes (53 species), crustaceans (33 species), echinoderms (6 species), nematods, sponge, earthworms, foramniferans and nemerteans (1 species). The five most abundant species were *Soletellina biradiata* (Bivalvia: Psammobiidae), *Owenia australis* (Polychaeta: Owenidae), *Elysia* sp. (Gastropoda: Elysioidea), *Tanaidae* sp. 1 (Crustacea: Tanaidacea), and *Maldane sarsi* (Polychaeta: Maldanidae).

Intertidal hard substrates

A total of 73 species were recorded from intertidal hard substrates with an average of 17 species (range 5-35 species) per grid cell. The greatest number of species in the intertidal hard substrates habitat was recorded in grid cell 30 (35 species). Assemblages were dominated by molluscs (34 species), rhodophytes (8 species), crustaceans (7 species), phaeophytes (6 species), chlorophytes (5 species), polychaetes, cnidarians, chordata (3 species), bryozoans (2 species), and echinoderms and sponge (1 species). The five most abundant species were *Bembicium auratum* (Gastropoda: Littorinidae), *Saccostrea glomereta* (Bivalvia: Ostreidae), *Patelloida mimula* (Gastropoda: Lottiidae), *Siphonaria denticulata* (Gastropoda: Siphonariidae), and *Austrocochlea porcata* (Gastropoda: Trochidae).

Spatial patterns in assemblages of unvegetated subtidal sediments and their relationship with environmental variables

The partial canonical correspondence analysis (pCCA) ordination plot of the spatial distribution of assemblage types within Brisbane Water estuary suggests an underlying geographical pattern (Fig. 2). A single assemblage type at the top of the ordination plot occurs in grid cell 35 (entrance to Narara Creek) (see Fig. 1). The assemblage type in the bottom right of the ordination plot is represented by a cluster of grid cells (29-32) at the seaward entrance to Brisbane Water estuary. The assemblage type represented at grid cells 36 and 22 (upper left of the ordination plot) occurs at the entrance to Kincumber Creek and the adjacent Kincumber Broadwater. The large cluster of grid cells in the centre-right of the ordination plot depicting another assemblage type is mostly localized to the central section of the estuary. All remaining grid cells occur in the cluster in the centre-left of the ordination plot.

Preliminary examination of the matrix of correlations between all environmental variables revealed a high correlation between total organic matter content and silt/clay content of sediment (R_s=0.96). Data for total organic matter were therefore removed from subsequent analyses. Manual forward testing of environmental variables, to explain the spatial patterns depicted in Fig. 2, found three variables explained significant proportions of the total spatial variation: concentration of phaeopigments in the sediment (λ=0.38, P=0.001); concentration of chlorophyll a in surface water (λ=0.23, P=0.01); and pH of surface water (λ=0.16, P=0.03) (Table 1). Values for the inter-set correlations (Table 1) show that axis 1 (the horizontal axis) of the ordination plot in Fig. 3 depicts (from right to left) a decreasing trend in concentration of phaeopigments in the sediment and an increasing trend in pH of surface water. Axis 2 (the vertical axis) depicts (moving upwards) a trend of increasing concentrations of chlorophyll a in surface water. The highest concentrations of chlorophyll a in surface water occur in grid cells at the entrance to Narara Creek (grid cell 35), Kincumber Creek (grid cell 36), and the water adjacent to the entrance to Kincumber Creek (grid cell 22). The position of the macroinvertebrate assemblage at the extreme right of the ordination plot (grid cells 29-32 at the seaward entrance to Brisbane Water estuary) is

correlated with higher surface water pH. However, these correlations must be used and interpreted cautiously because of the total spatial variation in assemblage structure depicted in Fig. 3 (and quantified by a total inertia of 4.08), only 18.9% is explained by the selected environmental variables.

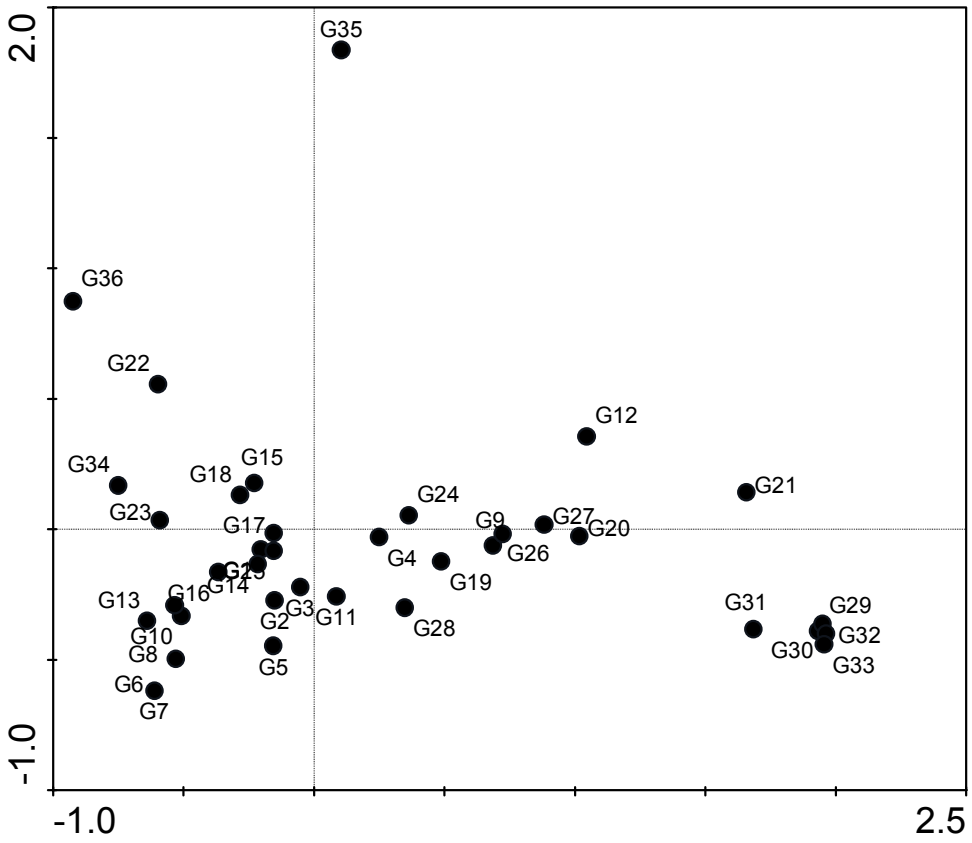

Fig. 2. Partial canonical correspondence analysis (CCA) ordination diagram of macroinvertebrates in unvegetated subtidal sediments showing grid cells grouped on the basis of similarity in assemblage structure. Locations of grid cells (identified as G1=grid cell 1 etc.) are shown in Fig. 1.

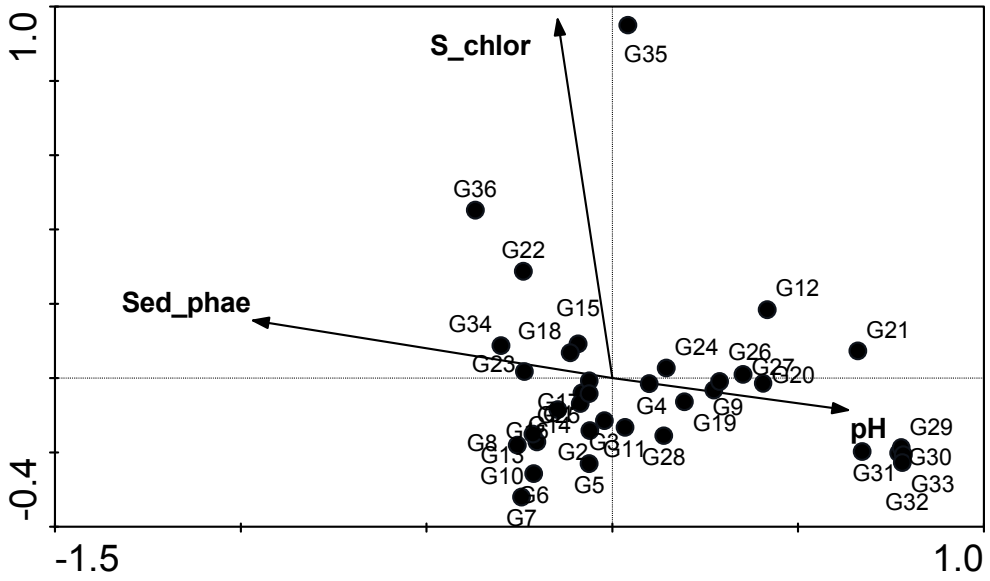

Fig. 3. Partial canonical correspondence analysis (CCA) ordination diagram showing associations between environmental variables and spatial patterns in assemblages. Locations of grid cells (identified as G1=grid cell 1 etc.) are shown in Fig. 1. The environmental variables (shown by arrows) that explained a significant proportion of the spatial variation in the assemblages were selected by manual forward selection (Sed_phaeo: concentration of phaeopigments in sediment; S_chlor: concentration of chlorophyll a in surface water).

Table 1. Summary results of partial canonical correspondence analysis (CCA) for macroinvertebrate species abundance in unvegetated subtidal sediments. Abundance data were square-root transformed prior to analysis. Variables included are those selected by manual forward selection to explain a significant amount (at P=0.05) of variation in the species data and only significant variables are shown. Conditional effect for each selected variable (in brackets) is the proportion of variation in the species data explained by each of the environmental variables selected in addition to the proportion explained by the first variable selected. The significance of conditional effects was determined by Monte Carlo test (999 unrestricted permutations) (* $P < 0.05$, ** $P < 0.01$)

Variables	Inter-set correlations		Eigenvalues		% variance explained		Total inertia	Canonical inertia	R^2
included	Axis 1	Axis 2	Axis 1	Axis 2	Axis 1	Axis 2			
Sed_phaeo (0.38**)	-0.88	0.13	0.39	0.23	50.9	30.3	4.08	0.77	18.9%
S_chlor (0.23*)	-0.13	0.83							
pH (0.16*)	0.58	-0.07							

Sed_phaeo: concentration of phaeopigments in sediment (log_{10}-transformed); S_chlor: concentration of chlorophyll a in surface water (log_{10}-transformed); pH (untransformed).

Conservation value

Twenty-five grid cells were required to achieve the conservation target of each species being represented in at least one conservation reserve (Fig. 4). These 25 grid cells represented 69% of the area of Brisbane Water estuary. The top five grid cells (30, 35, 5, 9 and 33) included 74% species and represented 14% of the area of the estuary (Fig. 5 and Table 2). All habitats were represented in the top five grid cells and these cells also spanned the environmental range of the estuary, including creeks entering the estuary (grid cell 35); upper reaches of the estuary (grid cell 5); middle reach of the estuary and part of an arm of the estuary (grid cell 9); the lower reach of the estuary (grid cell 30); and the seaward boundary of the estuary (grid cell 33).

The final 5% of species required selection of 12 grid cells (Fig. 4). The slow accumulation of species occurred because there were many species that occurred only in single, but different grid cells.

The first grid cell selected (grid cell 30, Ettalong) contained 34.5% of all species in the database. Grid cell 30 included the following habitats: intertidal mud flats, *Z. capricorni* seagrass meadows, subtidal unvegetated sediment, and intertidal hard substrates. Grid cell 35 occurred at the entrance to Narara Creek and it contributed an additional 17.7% of species. All habitats (intertidal mud flats, *Z. capricorni* seagrass meadows, mangroves, subtidal unvegetated sediment, intertidal hard substrates) were represented in grid cell 35.

Grid cells 5 (Koolewong) and 9 (Woy Woy Bay – Pelican Island) contributed an additional 12.4% and 6.2% of species, respectively, and all habitats were represented in both grid cells.

Grid cell 33 (Umina) occurred at the seaward extremity of Brisbane Water estuary. It contributed an additional 3.1% of species and included the following habitats: intertidal mud flats; subtidal unvegetated sediment; and intertidal mud flats.

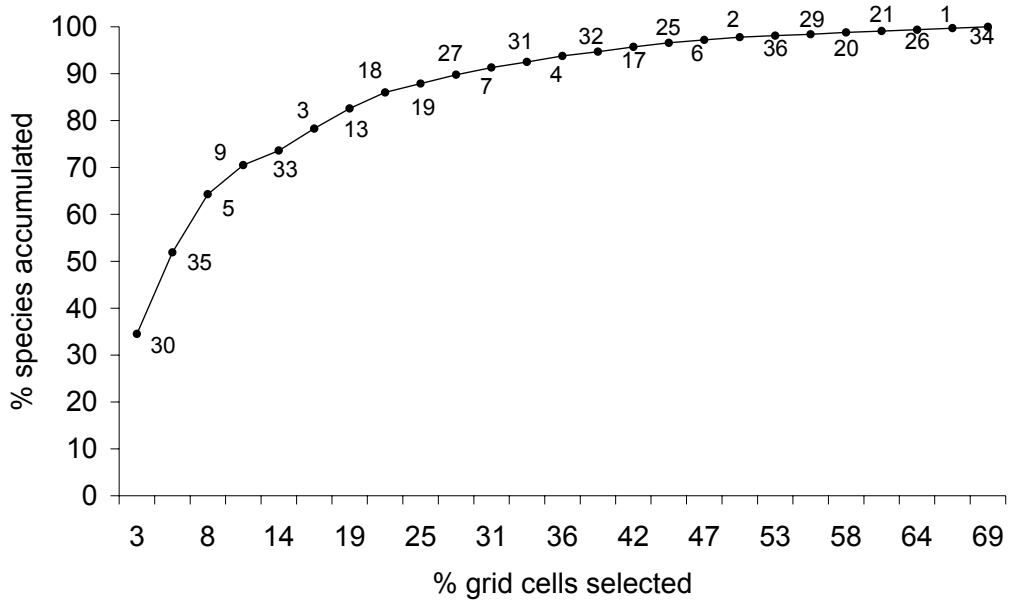

Fig. 4. Percentage of all species progressively accumulated in grid cells selected by the C-Plan conservation reserve selection process. Grid cells were selected in order of their contribution to the conservation goal of each species being represented at least once in a reserve (quantified as summed irreplaceability value). Identity of grid cells selected is shown on the species accumulation curve (refer to Fig. 1).

Table 2. Grid cells selected to conserve representatives of all species in Brisbane Water estuary.

Grid cell selected	% species accumulated
30	34.5
35	51.9
5	64.3
9	70.5
33	73.6
3	78.3
13	82.6
18	86
19	87.9
27	89.8
7	91.3
31	92.5
4	93.8
32	94.7
17	95.7
25	96.6
6	97.2
2	97.8
36	98.1
29	98.4
20	98.8
21	99.1
26	99.4
1	99.7
34	100

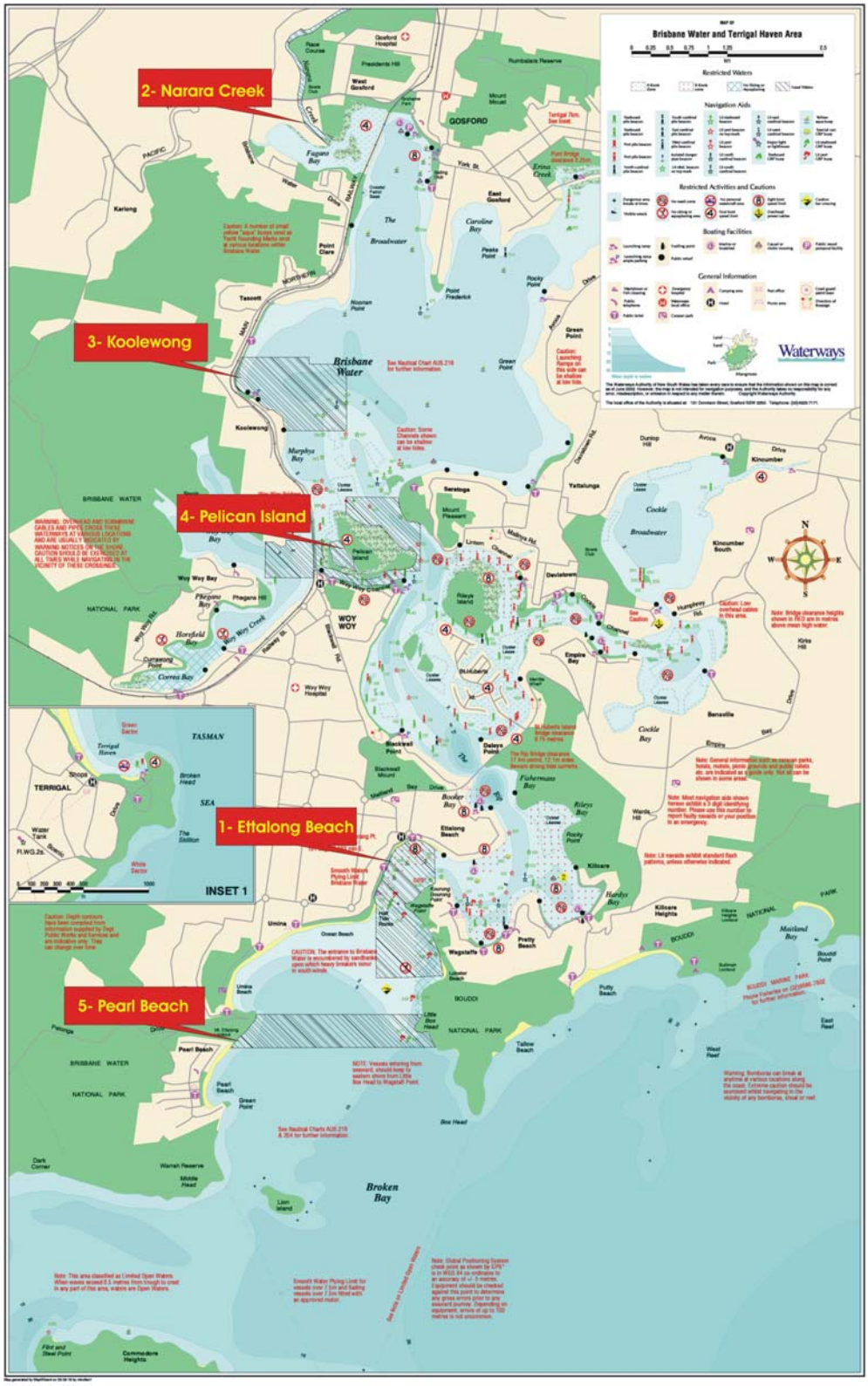

Fig. 5. The top five grid cells (numbered 1-5) for representing the macroinvertebrate and algal species of Brisbane Water estuary.

Discussion

Spatial variation in biodiversity of Brisbane Water estuary

This study involved a very detailed sampling of a range of habitats in Brisbane Water estuary. Unlike hierarchical studies of spatial variation in estuarine biodiversity that involve a random selection of sampling locations separated by varying distances, this study divided the estuary into 1 x 1 km grids and sampled all habitats occurring within each grid. This sampling strategy is likely to provide a more comprehensive assessment of spatial variation in macroinvertebarte biodiversity throughout the estuary, and a more comprehensive data set for testing the importance of environmental factors in explaining the distribution of this biodiversity.

Many different habitats occur in Brisbane Water estuary and most habitats were present in most grid cells. Of the 36 grid cells sampled subtidal unvegetated substrates was present in 36 grid cells, intertidal mud flats were present in 33 grid cells, *Zostera capricorni* seagrass meadows were present in 30 grid cells, intertidal hard substrates were present in 28 grid cells, and mangroves were present in 27 grid cells. The large species richness of macroinvertebrates of Brisbane Water estuary is likely to be related to the number of habitats occurring in each grid cell and the influence of environmental variation throughout the estuary.

The biodiversity of macroinvertebrates of Brisbane Water estuary showed considerable spatial variation, for all species combined and for each habitat surveyed. These patterns are based on a single sampling event. Other studies have concluded that temporal variation in macroinvertebrate assemblages is small relative to sptial variation (Edgar and Barrett, 2002; Ysebaert and Herman, 2002; Dauvin et al., 2004) while other studies have found significant temporal variation (Noren and Lindegarth, 2005). An earlier study in Brisbane Water estuary also found considerable temporal variation in the biodiversity of macroinvertebrates of *Zostera capricorni* seagrass meadows and unvegetated subtidal sediments (Gladstone, 2006). Further sampling over an extended period of time may refine the spatial patterns established in the study. However, it is likely that the major spatial patterns will be similar to those

revealed by the present study because the spatial patterns appeared to reflect large-scale environmental variation in the estuary. For example, distinct assemblages occurred at the entrances to the creeks entering the estuary, at the seaward boundary of the estuary, and in the central section of the estuary.

Environmental variables underlying spatial variation in assemblages of macroinvertebrates in subtidal unvegetated sediments

The multivariate analyses of the macroinvertebrate assemblages suggested an underlying geographical pattern. Groups of grid cells (based on similarity in assemblage structure) appeared to separate from one another according to their position within the sea-estuary-creek gradient. This result accords with other studies that have shown estuary-wide variation in macroinvertebrate assemblages (Constable, 1999; Ysebaert and Herman, 2002; Hirst, 2004).

Analysis of spatial variation in a range of environmental variables suggested that spatial variation of macroinvertrebrate assemblages at the scale of kms was correlated with spatial variation in concentration of phaeopigments in the sediment; concentration of chlorophyll a in surface water; and pH of surface water. Phaeopigments are the breakdown products of chlorophyll and provide food to benthic organisms (Mu et al., 2002). Other studies have also shown that chlorophyll a (Ysebaert and Herman, 2002) and phaeopigments (Mu et al., 2002) are important determinant of macroinvertebrate assemblage structure.

Spatial variation in conservation value

Automtaed, goal-orientated conservation planning software (of the type used in this study) provide an objective measure of the relative importance of a site in achieving a specified conservation objective (Margules and Pressey, 2000). These automated approaches to conservation planning eliminate the issues that arise with ad hoc or subjective planning decisions because they require planners and stakeholders to specifify a priori their conservation objectives. A common outcome of a conservation planning exercise is the identification of priority areas to be declared as nature

reserves or marine protected areas (Gladstone, 2007). Conservation objectives can include the protection of representative examples of different elements of biodiversity, such as species, assemblages, habitats or ecosystems. This study undertook a simulated conservation planning exercise to achive the a priori objective of identiftying the grid cells that were most important for the protection of species. The data set was based on the spatial patterns of species, and therefore did not include any data on the ecological processes or environmental factors underlying species viability.

In common with the the results of similar studies in other ecosystems (Ward et al., 1999; Gladstone, 2002, 2007), this study found that a large area (69%) of Brisbane Water estuary would be required to be protected to conserve representatives of all species. The large areas required generally reflect the observation that many species within a planning area occur only in a limited number of sites or conversely, many sites are occupied by at least one species that occurs nowhere else in the planning area. The large number of sites required to achieve a conservation objective may be a function of sampling intensity, and continued sampling may find additional species in a site. However, additional sampling also finds locally rare species (Schlacer et al., 1998; Gladstone, 2007) and it appears from other studies that an initial, well designed sampling strategy provides a good indication of the relative importance of a site (Bennendorrf and Davis, 2002). It is therefore likely that the large area of Brisbane Water estuary required to conserve representatives of all species is a real result.

Despite the requirement for a large area of Brisbane Water estuary being required to conserve representative examples of all species, a majority of species (74%) can be represented in a network of conservation reserves covering only 14% of the area of Brisbane Water estuary. The grid cells selected also included examples of all habitats, therefore ensuring representation of both species and habitats. As mentioned earlier, these assemblages are subject to considerable temporal variation, so the actual identity of the grid cells could change. However, the spread of grid cells selected across the estuary suggests that the pattern is likely to be a real pattern reflecting the environmental diversity of the estuary.

The entrance to Narara Creek (grid cell 35) was identified as an important site for representing the species diversity of Brisbane Water estuary, being selected as the second most important grid cell in the estuary. However, the catchment of Narara Creek is used for a range of human uses and it is possible that the long-term conservaton value of gid cell 35 could be reduced by activities that have a significant negative impact on the biodiversity of macroinvertebrates.

Management implications

Conservation of the biodiversity of Brisbane Water estuary must be based on the objective of maintaining the existing spatial patterns of biodiversity. This can be done by conserving the ecological processes and environmental factors underlying the spatial patterns in biodiversity, by managing human uses to minimize changes to these factors and processes.

The identification of a suite of environmental variables underlying the spatial variation in biodiversity (sediment phaeopigments; surface water chlorophyll a; pH) suggests that management should attempt to ensure minimal disturbance to their natural patterns of variation. Human activities likely to alter these variables therefore need careful assessment and management.

Five grid cells were identified as being highly important for the representation of the species biodiversity of Brisbane Water estuary macroinvertebrates: Ettalong, Narara Creek, Koolewong, Woy Woy Bay-Pelican Island; and Umina. These grid cells require a high priority for management action to minimize impacts of human activities.

The grid cell with the second-highest conservation value occurred in Narara Creek. This area will require special management attention, if the high conservation value is to be conserved, due to the range of human uses currently occurring along the banks and within the catchment of Narara Creek.

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Appendixes

Appendix 1. Species recorded in each grid cell (G1-G36) (1 recorded, 0 not recorded).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Chlorophyta	*Codium fragile*	0	0	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Chlorophyta	*Ulva lactuca*	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Chlorophyta	*Enteromorpha intestinalis*	1	0	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Chlorophyta	*Enteromorpha* sp.1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	1
Chlorophyta	*Enteromorpha* sp.2	1	0	1	1	1	0	1	0	1	0	0	0	1	0	1	1
Phaeophyta	*Padina pavonea*	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Phaeophyta	*Hormosira banksii*	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0
Phaeophyta	*Sargassum* sp.1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Phaeophyta	*Colpomenia sinuosa*	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0
Phaeophyta	Encrusting brown algae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	*Amphiroa anceps*	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
Rhodophyta	*Gigartina* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	*Laurencia* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Corallinaceae sp.	1	1	1	0	1	0	1	1	0	0	0	0	1	0	1	1
Rhodophyta	*Gracilaria* sp.1	1	0	1	1	1	1	1	1	0	0	0	0	1	0	0	1
Rhodophyta	*Gracilaria* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Rhodophyta	*Callophycos* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	*Champia viridis*	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1
Rhodophyta	*Plocamium* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Foraminifera	Foramnifera sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Purple sponge	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1
Porifera	Sponge	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0
Ectoprocta	Dark red bryozoa	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Ectoprocta	White bryozoa	1	1	1	0	0	0	1	1	1	0	0	1	1	0	1	1
Chordata	*Pyura stolonifera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidian sp.1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Chordata	Ascidian sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	*Oulactis muscosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Cnidaria	*Actinia tenebrosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	*Cnidopus verater*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Platyhelminthes	Platyhelminthes	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Nematoda	Nematoda sp.1	1	0	1	0	1	1	0	1	1	0	0	1	0	0	0	1
Nematoda	Nematoda sp.2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Nemertea	Nemertean	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	1
Annelida	Earthworm	1	1	1	1	1	0	1	1	1	0	0	0	0	0	0	1
Annelida	*Barantolla lepete*	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Annelida	*Capitella* sp.	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1
Annelida	*Notomastus* sp.1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Annelida	*Notomastus* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Aphelochaeta* sp.	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Annelida	*Caulleriella* sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Chaetozone setosa*	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Annelida	*Cirriformia c.f. capensis*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Annelida	*Eunice aphroditois*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Annelida	*Marphysa* sp.1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Annelida	*Nematonereis unicornis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Marphysa* sp.2	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0
Annelida	*Glycera* sp.1	0	1	0	1	0	0	0	1	1	0	0	1	1	0	0	0
Annelida	*Hemipodia c.f. yenourensis or simplex*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Annelida	*Goniadella* sp.1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0
Annelida	*Augeneria verdis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Lumbrineris* sp.1 *(c.f. gulielmi or setosa)*	1	0	0	1	0	0	1	1	1	0	0	0	1	1	1	1
Annelida	*Lumbrineris* sp.2 *(c.f. sphaerocephala)*	1	0	0	1	0	0	1	0	1	0	0	0	0	1	0	1
Annelida	*Magelona* sp.1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Annelida	*Magelona dakini*	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	0
Annelida	*Maldane sarsi*	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1
Annelida	*Nephtys australiensis*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Annelida	*Nephtys inornata*	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Annelida	*Nephtys longipes*	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Annelida	*Australanereis ehlersi*	0	0	0	1	1	0	1	1	1	0	0	1	0	0	0	0
Annelida	*Ceratonereis australis*	1	0	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Annelida	*Ceratonereis pseudierythraeansis*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Simplisetia aequisetis*	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1
Annelida	*Armandia intermedia*	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1
Annelida	*Ophelia multibranchia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Travisia* sp.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Annelida	*Leitoscoloplos normalis*	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
Annelida	*Leodamas johnstonei*	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Annelida	*Phylo felix*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Annelida	*Owenia australis*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Annelida	*Aricidea* sp.	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1
Annelida	*Pectinaria antipoda*	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	0
Annelida	*Paranaitis inflata*	0	0	0	1	1	1	0	0	0	1	1	1	1	0	1	0
Annelida	*Phyllodoce novaehollandiae*	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Annelida	*Phyllodoce* sp.1	0	0	1	0	0	1	1	1	0	1	1	0	1	0	1	1
Annelida	*Pilargis* sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Annelida	*Sigambra parva*	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1
Annelida	*Pisionidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Lepidonotus* sp.	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Annelida	*Parahalosydna chrysostichtus*	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Annelida	*Paralepidonotus ampuliferus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Annelida	*Bispira* sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Annelida	*Branchiomma* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Euchone variabilis*	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0
Annelida	*Euchone limnicola*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Annelida	*Galeolaria caespitosa*	1	1	1	0	0	0	1	1	1	0	0	1	1	0	1	1
Annelida	*Leanira* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Sigalion bandaeensis*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Annelida	*Sthenelais* sp.	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0
Annelida	*Boccardiella* sp.	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Annelida	*Boccardiella* sp. MoV 383	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
Annelida	*Malacaceros divisos*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Microspio c.f. occipitalis*	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
Annelida	*Prionospio multicristata*	1	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1
Annelida	*Spirorbidae* sp.	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Annelida	*Exogone africana*	0	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0
Annelida	*Odontosyllis trilinea*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Annelida	*Paraehlersia* sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Annelida	*Pionosyllis* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Syllis (Typosysyllis)* sp.1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Annelida	*Syllis (Typosysyllis)* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Lysilla sp. or Amaena* sp.	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1
Annelida	*Pista australis*	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Annelida	*Pseudostreblosoma serratum*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Annelida	*Rhinothelepus lobatus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Streblosoma acymatum*	1	1	0	1	0	1	1	1	0	0	0	1	1	0	1	1
Annelida	*Terebellides narribri*	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0
Annelida	Orange-red tubeworm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sipuncula	*Phascolionidae* sp.1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Sipuncula	*Phascolionidae* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Catomerus polymerus*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Arthropoda	*Chamaesipho tasmanica*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Arthropoda	*Chathamalus antennatus*	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Arthropoda	*Elminius covertus*	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	0
Arthropoda	*Hexaminius* sp.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Hexaminius* sp.2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Arthropoda	*Austrobalanus imperator*	1	1	1	0	0	0	1	1	1	0	0	0	1	0	0	1
Arthropoda	*Tesseropora rosea*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Arthropoda	*Tetraclitella purpurascens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Copepoda* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Cymadusa filosa*	1	1	0	0	1	1	1	1	0	0	0	1	1	0	1	1
Arthropoda	*Anothidae* sp.	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	1
Arthropoda	*Calliopiidae* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Caprellidae* sp.1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	*Caprellidae* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Arthropoda	*Corophium* sp.1	1	1	0	0	1	1	0	1	1	0	1	0	1	0	0	1
Arthropoda	*Exoediceros fossor*	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Arthropoda	*Protohyale rupicola*	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Arthropoda	*Erichthonius* sp.	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1
Arthropoda	*Melita plumulosa*	1	1	1	0	1	1	1	1	1	0	0	1	0	0	0	1
Arthropoda	*Victoriopisa australiensis*	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Oedicerotidae* sp.1	0	0	0	1	1	1	0	0	1	0	1	1	0	0	0	0
Arthropoda	*Paracalliope australis*	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Arthropoda	*Gammaropsis sp.*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Arthropoda	*Limnoporeia kingi*	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	1
Arthropoda	*Limnoporeia* sp.	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	*Platyischnous mirabilis*	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	*Talitridae* sp.	1	1	0	1	1	1	1	1	1	0	0	0	1	0	0	1
Arthropoda	*Urohaustorius* sp.	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	*Bodotriidae* sp.1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Bodotriidae* sp.2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Bodotriidae* sp.3	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Arthropoda	*Cyclapsis* sp.1	0	0	0	1	1	1	0	0	0	1	1	0	0	1	0	0
Arthropoda	*Diastylidae* sp.1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Gynodiastylidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Alpheus lobidens*	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	*Biffarius arenosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Diogenes custos*	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Arthropoda	*Ebalia c.f. tuberculosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Ilyograpsus paludicola*	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Amarinus lacustris*	1	1	0	0	1	1	1	1	1	0	0	0	1	0	1	1
Arthropoda	*Halicarcinus ovatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Australopax tridentata*	0	0	1	0	1	1	0	1	0	0	0	1	1	0	1	1
Arthropoda	*Enigmaplax littoralis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Arthropoda	*Heloecius cordiformis*	0	1	0	0	0	1	0	1	1	0	0	1	0	0	0	1
Arthropoda	*Macropthalmus crassipes*	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1
Arthropoda	*Mictyris longicarpus*	0	0	0	1	1	1	1	1	0	0	0	1	0	0	1	0
Arthropoda	*Palaemon intermedius*	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Metapenaeus c.f. bennettae*	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	1
Arthropoda	*Pilumnopeus serratifrons*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Actaecia* sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Anthuridae* sp.	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0
Arthropoda	*Cyathura* sp.1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	Janiridae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Scyphacidae sp.1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Paraerceis sculpta*	1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Arthropoda	Sphaeomatidae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	Sphaeomatidae sp.2	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1
Arthropoda	Sphaeomatidae sp.3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Sphaeomatidae sp.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Sphaeomatidae sp.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Apseudidae sp.	1	0	0	1	0	0	1	1	1	0	0	1	1	0	0	1
Arthropoda	Tanaidae sp.1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1
Arthropoda	Cylindroleberidae sp.1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	Sarsiellidae sp.1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	Sarsiellidae sp.2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Anadaria trapezia*	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Mollusca	*Hemidonax pictus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Fulvia tenuicostata*	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0
Mollusca	*Condylocardiidae* sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Neolepton* sp.1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Mollusca	Leptonidae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mollusca	*Leptonidae* sp.1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Borniola* sp.	1	1	0	1	0	1	0	0	1	0	0	1	0	1	0	1
Mollusca	Galeommatidae sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Mysella vitrea*	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0
Mollusca	*Arthritica helmsi*	1	0	0	1	1	1	1	0	1	0	0	1	0	0	1	0
Mollusca	*Lissarca* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cavatidens omissa*	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1
Mollusca	*Thyasira peroniana*	1	1	0	1	0	1	1	0	0	1	0	1	1	0	0	0
Mollusca	Lucinidae sp.	1	0	1	0	1	0	0	1	1	0	0	0	1	0	0	1
Mollusca	*Wallucina assimilis*	0	1	1	1	0	1	0	1	1	1	0	1	1	0	0	0
Mollusca	*Lutraria rhynchaena*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	*Mactra jacksonensis*	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0
Mollusca	*Spisula trigonella*	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Mollusca	*Corbula tunicata*	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0
Mollusca	*Musculus* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Musculus varicosus*	0	1	0	1	0	1	0	1	1	0	0	0	1	0	1	0
Mollusca	*Mytilus edulus planulatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Trichomusculus barbatus*	1	1	1	0	0	0	1	1	1	0	0	0	1	0	0	1
Mollusca	*Xenostrobus pulex*	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Mollusca	*Xenostrobus securis*	1	1	1	0	1	0	1	1	1	0	0	1	0	0	0	1
Mollusca	*Saccostrea glomereta*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Laturnula creccina*	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	1
Mollusca	*Laturnula martinica*	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Mollusca	*Laturnula tasmanica*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Pholas australasiae*	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Mollusca	*Solemya australis*	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Solemya velesiana*	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0
Mollusca	*Solen correctus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Donacidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Psammobiidae sp.1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Psammobiidae sp.2	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Soletellina biradiata*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	*Theora fragilis*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Mollusca	*Racra pellicula*	0	1	0	1	0	0	1	0	0	1	0	0	1	0	1	1
Mollusca	*Tellina deltoidalis*	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	Tellinidae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Alathyria profuga*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Placamen placidum*	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	*Glauconome* sp.	0	0	1	1	0	1	1	0	0	0	0	0	0	1	0	1
Mollusca	*Circe scripta*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Dosinia crocea*	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Mollusca	*Dosinia sculpta*	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	0
Mollusca	*Eumarcia fumigata*	0	1	1	1	0	1	0	0	1	0	0	1	1	1	0	0
Mollusca	*Irus crebrelamellatus*	0	0	1	1	1	1	0	0	0	0	0	1	1	0	1	1
Mollusca	*Katelysia rhytiphora*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Mollusca	*Paphia undulata*	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0
Mollusca	*Paphies cuneata*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mollusca	*Tapes dorsatus*	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
Mollusca	*Tapes watlingi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Salinator fragilis*	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Mollusca	*Salinator solida*	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
Mollusca	*Badepigrus pupoides*	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Mollusca	*Psilaxis* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cominella lineolata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Calopia* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Mollusca	*Trigonostoma bicolor*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Mollusca	*Batillaria australis*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Pyrazus ebeninus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cacozeliana granarium*	0	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0
Mollusca	*Gazameda gunnii*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Mollusca	*Conus papilliferus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mollusca	*Austrodrilla beraudiana*	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Mollusca	*Cypraea* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cassidula zonata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Ophicardelus ornatus*	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Mollusca	*Ophicardelus quoyi*	0	1	1	0	0	1	1	1	1	0	0	1	1	0	0	1
Mollusca	*Ophicardelus sulcatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Elysia sp. (Opistobranch* sp.1*)*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	*Clypidina rugosa*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Mollusca	*Montfortula rugosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Liloa brevis*	1	1	1	0	0	1	0	1	1	0	0	1	1	0	1	0
Mollusca	*Tatea huonensis*	1	1	0	0	1	1	0	1	1	0	0	1	0	0	0	1
Mollusca	*Tatea rufilabris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Nozeba tobazica*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Epitonium parspeciosum*	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0
Mollusca	*Epitonium perplexum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Epitonium tennellum*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Alaba monile*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Alaba opiniosa*	0	0	1	1	0	1	1	1	0	0	0	1	1	1	1	0
Mollusca	*Alaba translucida*	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1
Mollusca	*Bembicium auratum*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Bembicium nanum*	0	1	1	0	0	0	0	1	1	0	0	0	1	0	1	0
Mollusca	*Littoraria luteola*	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Littorina scabra*	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Mollusca	*Nodilittorina unifasciata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Engina australis*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Zafra regulus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Mollusca	*Dicathais orbita*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Morula marginalba*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Mollusca	*Bedeva hanleyi*	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	*Nassaruis burchardi*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Nassaruis jonasi*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Mollusca	*Cellana tramoserica*	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Mollusca	*Neverita didyma*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Natica pseustus*	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1
Mollusca	*Polinices putealis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Nerita atramentosa*	1	0	1	1	1	0	1	0	1	0	0	0	1	0	1	1
Mollusca	*Smaragdia souverbiana*	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Cinnalepete cinnamoema*	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0
Mollusca	*Onchidella patelloides*	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1
Mollusca	*Onchidina australis*	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1
Mollusca	*Patelloida latistrigata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Patelloida mimula*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Ringicula doliaris*	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1	1
Mollusca	*Retusa* sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mollusca	*Agatha simplex*	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Mollusca	*Linopyrga ceria*	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Linopyrga pascoei*	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Linopyrga* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Paregila henni*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cylichnina iredaleane*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Bittium lacertium*	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Cryptassiminea* sp.	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Mollusca	*Truncatella guerinii*	0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G1***	***G2***	***G3***	***G4***	***G5***	***G6***	***G7***	***G8***	***G9***	***G10***	***G11***	***G12***	***G13***	***G14***	***G15***	***G16***
Mollusca	*Acteocina fusiformis*	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0
Mollusca	*Acteocina* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Siphonaria denticulata*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Siphonaria diemensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Siphonaria funiculata*	1	0	1	0	0	0	1	1	1	0	0	0	1	0	0	0
Mollusca	*Siphonaria zelandica*	0	0	0	0	0	0	1	1	1	0	0	1	1	0	1	1
Mollusca	*Liotella pulcherrima*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Stenothyra* sp.1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1
Mollusca	*Ataxocerithium serotinum*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Pseudoliotia micans*	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1
Mollusca	*Pseudoliotia speciosa*	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0
Mollusca	*Austrocochlea porcata*	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
Mollusca	*Calthalotia fragum*	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0
Mollusca	*Prothalotia comtessie*	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0
Mollusca	*Leiopyrga lineolaris*	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Talopena goloriola*	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Chiton pelliserpentis*	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Mollusca	*Chiton* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Ischnochiton elongatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Compressidens plax*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Compressidans platyceras*	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Echinodermata	*Patiriella exigua*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinodermata	Asteroid sp.1	0	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0
Echinodermata	Asteroid sp.2	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0	0
Echinodermata	Asteroid sp.3	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0
Echinodermata	Holothurian sp.	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Echinodermata	Ophiuroidea sp.1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1
Echinodermata	Ophiuroidea sp.2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Platyhelminthes	Platyhelminthes	1	0	1	1	0	1	1	0	1	0	0	1	0	0
Nematoda	Nematoda sp. 1	0	1	0	0	1	1	1	0	1	1	0	1	0	0
Nematoda	Nematoda sp. 2	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Nemertea	Nemertean	1	1	1	1	0	1	0	0	1	0	1	1	1	1
Annelida	Earthworm	1	0	1	1	1	0	0	1	1	0	1	1	1	0
Annelida	*Barantolla lepete*	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Annelida	*Capitella* sp.	1	1	1	1	0	1	1	0	1	0	0	1	0	0
Annelida	*Notomastus* sp.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Annelida	*Notomastus* sp.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Aphelochaeta* sp.	0	1	1	0	1	0	0	0	1	1	1	0	0	1
Annelida	*Caulleriella* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Chaetozone setosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Cirriformia c.f. capensis*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Annelida	*Eunice aphroditois*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Marphysa* sp.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Nematonereis unicornis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Annelida	*Marphysa* sp.2	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Annelida	*Glycera* sp.1	1	0	0	0	0	0	0	1	0	1	1	1	0	0
Annelida	*Hemipodia c.f. yenourensis or simplex*	1	1	1	0	0	0	0	0	1	0	0	1	0	1
Annelida	*Goniadella* sp.1	1	0	1	0	0	0	0	0	0	0	0	1	1	0
Annelida	*Augeneria verdis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annelida	*Lumbrineris* sp.1 *(c.f. gulielmi or setosa)*	1	1	1	0	0	1	0	0	1	0	0	1	1	1
Annelida	*Lumbrineris* sp.2 *(c.f. sphaerocephala)*	1	1	1	0	1	0	0	1	0	1	1	1	0	1
Annelida	*Magelona* sp.1	0	1	0	0	0	0	0	0	1	0	0	0	0	1
Annelida	*Magelona dakini*	1	0	0	0	1	0	0	0	0	1	0	1	1	0
Annelida	*Maldane sarsi*	1	1	1	0	0	0	0	0	0	1	1	1	1	1
Annelida	*Nephtys australiensis*	1	1	1	1	1	0	0	1	1	1	1	1	1	1
Annelida	*Nephtys inornata*	0	0	0	0	1	0	1	1	0	1	0	0	0	1
Annelida	*Nephtys longipes*	0	0	1	0	0	0	0	0	0	0	0	1	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Annelida	*Australanereis ehlersi*	0	0	1	1	1	0	0	0	1	0	1	1	0	1
Annelida	*Ceratonereis australis*	1	1	1	0	1	1	1	0	1	1	0	1	0	0
Annelida	*Ceratonereis pseudierythraeansis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Annelida	*Simplisetia aequisetis*	1	1	1	1	1	1	0	1	1	1	1	1	1	1
Annelida	*Armandia intermedia*	1	1	1	1	1	1	1	0	1	1	1	1	0	1
Annelida	*Ophelia multibranchia*	0	0	0	0	0	0	0	1	0	0	1	0	1	1
Annelida	*Travisia* sp.	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Annelida	*Leitoscoloplos normalis*	0	1	1	1	0	0	1	0	1	1	1	1	0	1
Annelida	*Leodamas johnstonei*	0	0	1	0	0	0	0	0	1	1	0	1	0	0
Annelida	*Phylo felix*	1	0	1	1	0	0	0	0	0	0	0	1	0	0
Annelida	*Owenia australis*	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Annelida	*Aricidea* sp.	0	1	0	1	1	1	1	1	0	1	1	1	1	1
Annelida	*Pectinaria antipoda*	0	1	0	1	0	1	0	0	0	1	0	0	0	0
Annelida	*Paranaitis inflata*	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Annelida	*Phyllodoce novaehollandiae*	1	1	0	0	1	1	0	1	1	1	1	1	1	1
Annelida	*Phyllodoce* sp.1	0	1	1	0	1	1	0	0	0	1	1	0	0	0
Annelida	*Pilargis* sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Annelida	*Sigambra parva*	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Annelida	*Pisionidae* sp.1	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Annelida	*Lepidonotus* sp.	1	0	1	1	0	1	1	0	0	0	0	0	0	0
Annelida	*Parahalosydna chrysostichtus*	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Paralepidonotus ampuliferus*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Annelida	*Bispira* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annelida	*Branchiomma* sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Annelida	*Euchone variabilis*	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Annelida	*Euchone limnicola*	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Galeolaria caespitosa*	1	0	1	0	0	0	0	1	1	0	1	1	0	1
Annelida	*Leanira* sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Annelida	*Sigalion bandaeensis*	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Annelida	*Sthenelais* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Annelida	*Boccardiella* sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Annelida	*Boccardiella* sp. MoV 383	0	0	0	1	0	0	0	1	1	1	0	0	0	0
Annelida	*Malacaceros divisos*	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Microspio c.f. occipitalis*	1	0	1	0	0	0	0	0	0	1	0	0	0	0
Annelida	*Prionospio multicristata*	1	1	1	1	0	1	0	0	1	0	1	1	1	0
Annelida	*Spirorbidae* sp.	1	1	1	1	1	1	1	1	1	0	1	0	1	0
Annelida	*Exogone africana*	1	0	0	1	1	0	1	1	0	1	1	0	1	1
Annelida	*Odontosyllis trilinea*	1	1	0	0	1	0	0	1	0	1	0	0	1	1
Annelida	*Paraehlersia* sp.	1	0	1	1	0	0	0	0	1	0	0	1	0	0
Annelida	*Pionosyllis* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annelida	*Syllis (Typosysyllis)* sp.1	1	1	0	0	0	0	0	1	0	0	0	1	0	0
Annelida	*Syllis (Typosysyllis)* sp.2	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Annelida	*Lysilla sp. or Amaena* sp.	1	1	1	1	0	0	0	0	1	0	0	1	0	0
Annelida	*Pista australis*	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Annelida	*Pseudostreblosoma serratum*	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Annelida	*Rhinothelepus lobatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	*Streblosoma acymatum*	1	1	1	1	0	1	0	0	1	0	1	1	0	0
Annelida	*Terebellides narribri*	0	0	0	0	0	0	1	0	0	1	1	1	0	0
Annelida	Orange-red tubeworm	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sipuncula	*Phascolionidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sipuncula	*Phascolionidae* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Catomerus polymerus*	1	1	1	0	1	1	0	1	1	1	1	1	1	1
Arthropoda	*Chamaesipho tasmanica*	1	1	1	0	1	1	0	1	1	1	1	1	1	1
Arthropoda	*Chathamalus antennatus*	1	1	0	0	1	1	0	1	1	1	1	1	0	1
Arthropoda	*Elminius covertus*	0	1	0	0	0	1	1	1	1	1	1	1	0	0
Arthropoda	*Hexaminius* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Hexaminius* sp.2	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	*Austrobalanus imperator*	1	0	0	0	1	0	0	1	1	0	1	0	0	1
Arthropoda	*Tesseropora rosea*	0	0	1	0	0	0	0	0	1	0	1	0	0	1
Arthropoda	*Tetraclitella purpurascens*	1	0	0	0	0	0	0	0	0	1	1	0	0	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Arthropoda	*Copepoda* sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	*Cymadusa filosa*	1	1	1	0	0	1	0	0	1	1	1	1	1	1
Arthropoda	*Anothidae* sp.	0	1	0	0	1	0	0	1	0	0	0	0	1	0
Arthropoda	*Calliopiidae* sp.	0	0	0	1	1	0	0	1	1	1	0	0	0	0
Arthropoda	*Caprellidae* sp.1	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Arthropoda	*Caprellidae* sp.2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Arthropoda	*Corophium* sp.1	1	0	0	1	1	1	0	1	1	1	1	1	0	0
Arthropoda	*Exoediceros fossor*	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	*Protohyale rupicola*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	*Erichthonius* sp.	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Arthropoda	*Melita plumulosa*	1	1	1	1	1	1	1	1	1	1	0	1	0	1
Arthropoda	*Victoriopisa australiensis*	0	1	0	1	1	0	0	0	1	1	0	0	0	0
Arthropoda	*Oedicerotidae* sp.1	1	0	0	1	0	0	0	0	1	0	0	1	0	1
Arthropoda	*Paracalliope australis*	0	1	0	0	0	0	1	1	0	1	0	0	0	0
Arthropoda	*Gammaropsis sp.*	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Arthropoda	*Limnoporeia kingi*	1	1	1	1	0	1	0	0	1	0	0	1	0	0
Arthropoda	*Limnoporeia* sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Platyischnous mirabilis*	0	0	1	1	1	0	0	0	0	1	0	0	0	1
Arthropoda	*Talitridae* sp.	1	1	1	1	0	1	0	1	1	0	1	1	0	0
Arthropoda	*Urohaustorius* sp.	0	0	1	1	1	0	0	0	0	1	0	0	0	1
Arthropoda	*Bodotriidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Bodotriidae* sp.2	0	0	1	0	0	0	0	0	0	1	1	0	0	0
Arthropoda	*Bodotriidae* sp.3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Cyclapsis* sp.1	0	1	0	0	0	0	1	0	0	0	1	1	0	0
Arthropoda	*Diastylidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Gynodiastylidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Alpheus lobidens*	0	0	0	0	0	0	0	1	0	1	0	0	1	0
Arthropoda	*Biffarius arenosa*	0	0	0	0	0	0	0	0	0	1	1	0	1	1
Arthropoda	*Diogenes custos*	0	0	0	1	0	0	0	0	0	1	1	1	1	1
Arthropoda	*Ebalia c.f. tuberculosa*	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Arthropoda	*Ilyograpsus paludicola*	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Arthropoda	*Amarinus lacustris*	1	1	1	1	0	1	1	1	1	0	0	1	1	1
Arthropoda	*Halicarcinus ovatus*	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	*Australopax tridentata*	1	1	0	0	1	1	1	1	1	1	1	1	1	0
Arthropoda	*Enigmaplax littoralis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Heloecius cordiformis*	0	1	0	1	0	0	1	1	0	1	0	0	0	1
Arthropoda	*Macropthalmus crassipes*	1	1	0	1	0	1	0	0	1	0	0	1	0	0
Arthropoda	*Mictyris longicarpus*	0	1	1	1	0	0	0	1	0	1	0	1	1	1
Arthropoda	*Palaemon intermedius*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	*Metapenaeus c.f. bennettae*	0	0	1	1	0	1	0	1	0	0	0	1	1	0
Arthropoda	*Pilumnopeus serratifrons*	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Arthropoda	*Actaecia* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Anthuridae* sp.	1	1	1	1	0	0	0	1	0	1	1	1	0	0
Arthropoda	*Cyathura* sp.1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	Janiridae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	Scyphacidae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	*Paraerceis sculpta*	1	1	0	1	1	1	0	1	1	1	0	0	0	0
Arthropoda	Sphaeomatidae sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Sphaeomatidae sp.2	0	0	0	1	0	0	0	0	1	1	1	0	0	0
Arthropoda	Sphaeomatidae sp.3	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Arthropoda	Sphaeomatidae sp.4	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Arthropoda	Sphaeomatidae sp.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Apseudidae sp.	0	1	1	0	1	0	0	1	0	0	1	1	1	1
Arthropoda	Tanaidae sp.1	1	1	0	0	1	1	0	1	0	1	1	0	0	1
Arthropoda	Cylindroleberidae sp.1	0	0	0	0	1	0	1	1	0	1	1	1	0	0
Arthropoda	Sarsiellidae sp.1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Arthropoda	Sarsiellidae sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Anadaria trapezia*	1	1	1	1	1	1	1	1	0	1	0	1	0	1
Mollusca	*Hemidonax pictus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mollusca	*Fulvia tenuicostata*	1	0	1	0	0	0	0	0	1	0	1	1	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Mollusca	*Condylocardiidae* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Neolepton* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Leptonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Leptonidae* sp.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Borniola* sp.	1	0	0	1	0	0	1	1	0	1	0	1	0	0
Mollusca	Galeommatidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Mysella vitrea*	0	0	0	1	0	0	0	0	1	1	1	0	0	1
Mollusca	*Arthritica helmsi*	0	1	1	1	1	1	1	1	1	1	1	1	1	0
Mollusca	*Lissarca* sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Cavatidens omissa*	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Thyasira peroniana*	1	1	1	0	0	1	1	1	1	1	1	1	1	0
Mollusca	Lucinidae sp.	1	1	1	1	0	0	0	0	0	1	0	0	0	0
Mollusca	*Wallucina assimilis*	1	1	1	0	1	0	0	1	0	1	1	0	0	0
Mollusca	*Lutraria rhynchaena*	1	1	1	0	1	0	1	0	0	1	0	1	1	0
Mollusca	*Mactra jacksonensis*	0	0	0	1	0	0	0	1	0	1	1	0	1	0
Mollusca	*Spisula trigonella*	1	1	1	1	1	1	1	1	1	1	1	0	0	1
Mollusca	*Corbula tunicata*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mollusca	*Musculus* sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Musculus varicosus*	1	1	1	0	0	0	1	1	0	0	0	1	0	1
Mollusca	*Mytilus edulus planulatus*	1	0	0	0	0	0	0	0	0	1	1	0	0	0
Mollusca	*Trichomusculus barbatus*	1	0	0	0	1	0	0	1	1	0	1	0	0	1
Mollusca	*Xenostrobus pulex*	1	1	0	0	0	1	0	1	1	1	0	0	0	0
Mollusca	*Xenostrobus securis*	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Mollusca	*Saccostrea glomereta*	1	1	1	0	1	1	0	1	1	1	1	1	1	0
Mollusca	*Laturnula creccina*	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Laturnula martinica*	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Mollusca	*Laturnula tasmanica*	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Pholas australasiae*	0	0	0	1	0	0	0	1	0	0	0	0	0	0
Mollusca	*Solemya australis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Solemya velesiana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Mollusca	*Solen correctus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Donacidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	Psammobiidae sp.1	0	0	0	0	0	0	1	0	0	0	1	1	0	0
Mollusca	Psammobiidae sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Soletellina biradiata*	1	1	1	0	0	1	1	1	0	0	1	1	0	0
Mollusca	*Theora fragilis*	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Mollusca	*Racra pellicula*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Tellina deltoidalis*	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	Tellinidae sp.1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mollusca	*Alathyria profuga*	0	0	0	0	0	0	0	1	1	0	0	1	0	0
Mollusca	*Placamen placidum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Glauconome* sp.	1	1	0	0	1	1	0	1	1	1	0	0	0	0
Mollusca	*Circe scripta*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Dosinia crocea*	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	*Dosinia sculpta*	1	1	1	1	1	1	0	1	1	1	1	0	1	1
Mollusca	*Eumarcia fumigata*	0	0	0	0	0	1	0	1	0	1	1	0	1	0
Mollusca	*Irus crebrelamellatus*	1	1	0	0	0	0	1	1	0	1	0	0	0	0
Mollusca	*Katelysia rhytiphora*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Paphia undulata*	0	1	1	0	0	1	0	0	0	1	1	1	0	0
Mollusca	*Paphies cuneata*	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Tapes dorsatus*	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Tapes watlingi*	1	1	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Salinator fragilis*	1	1	0	1	1	1	1	1	1	1	1	1	1	0
Mollusca	*Salinator solida*	0	0	0	0	0	1	0	0	0	1	0	0	1	0
Mollusca	*Badepigrus pupoides*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mollusca	*Psilaxis* sp.	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cominella lineolata*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Calopia* sp.	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	*Trigonostoma bicolor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Batillaria australis*	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Mollusca	*Pyrazus ebeninus*	0	0	0	1	0	0	0	0	1	0	1	0	0	0
Mollusca	*Cacozeliana granarium*	1	1	1	1	0	0	0	0	0	0	1	0	1	1
Mollusca	*Gazameda gunnii*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Conus papilliferus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Austrodrilla beraudiana*	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Cypraea* sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cassidula zonata*	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Mollusca	*Ophicardelus ornatus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	*Ophicardelus quoyi*	1	1	1	1	1	0	1	1	1	1	1	1	1	0
Mollusca	*Ophicardelus sulcatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Elysia sp. (Opistobranch* sp.1*)*	1	1	1	0	1	1	1	0	1	1	1	1	1	1
Mollusca	*Clypidina rugosa*	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Mollusca	*Montfortula rugosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Liloa brevis*	1	1	1	1	0	0	0	0	1	0	1	1	1	1
Mollusca	*Tatea huonensis*	1	1	0	1	0	1	1	1	1	1	0	0	0	1
Mollusca	*Tatea rufilabris*	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Nozeba tobazica*	0	0	0	1	1	0	1	0	0	0	1	0	1	0
Mollusca	*Epitonium parspeciosum*	0	1	0	1	0	0	1	0	0	0	0	0	1	0
Mollusca	*Epitonium perplexum*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Epitonium tennellum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Alaba monile*	0	0	1	0	0	0	1	0	0	0	0	0	1	1
Mollusca	*Alaba opiniosa*	0	1	0	0	0	0	0	1	0	1	0	1	1	1
Mollusca	*Alaba translucida*	0	1	1	1	1	0	1	1	1	1	1	0	1	1
Mollusca	*Bembicium auratum*	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Mollusca	*Bembicium nanum*	1	0	0	0	1	0	1	1	0	1	1	1	1	1
Mollusca	*Littoraria luteola*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Littorina scabra*	1	1	1	0	0	0	0	0	1	0	0	0	0	0
Mollusca	*Nodilittorina unifasciata*	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Mollusca	*Engina australis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Mollusca	*Zafra regulus*	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Mollusca	*Dicathais orbita*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Morula marginalba*	0	0	0	0	0	0	0	0	0	0	1	1	0	1
Mollusca	*Bedeva hanleyi*	1	1	1	1	1	1	1	1	1	0	1	0	1	1
Mollusca	*Nassaruis burchardi*	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Mollusca	*Nassaruis jonasi*	0	1	1	0	1	1	1	0	0	0	0	0	0	0
Mollusca	*Cellana tramoserica*	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Mollusca	*Neverita didyma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Natica pseustus*	0	0	0	0	1	0	0	0	0	1	1	0	0	0
Mollusca	*Polinices putealis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Nerita atramentosa*	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Mollusca	*Smaragdia souverbiana*	0	0	1	0	0	0	1	0	0	1	0	0	0	0
Mollusca	*Cinnalepete cinnamoema*	1	1	0	0	1	0	1	1	1	1	0	0	1	0
Mollusca	*Onchidella patelloides*	1	0	0	0	1	0	0	0	0	0	0	1	0	0
Mollusca	*Onchidina australis*	1	1	0	0	0	1	1	0	0	0	0	0	0	0
Mollusca	*Patelloida latistrigata*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Patelloida mimula*	1	1	1	0	1	1	1	1	1	1	1	1	1	0
Mollusca	*Ringicula doliaris*	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Mollusca	*Retusa* sp.	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	*Agatha simplex*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Linopyrga ceria*	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	*Linopyrga pascoei*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Linopyrga* sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	*Paregila henni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Cylichnina iredaleane*	0	0	1	0	0	0	0	0	0	1	0	0	1	0
Mollusca	*Bittium lacertium*	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Mollusca	*Cryptassiminea* sp.	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusca	*Truncatella guerinii*	1	0	0	0	0	1	1	0	1	0	0	0	0	0
Mollusca	*Acteocina fusiformis*	1	0	0	1	1	0	0	0	0	1	0	0	1	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G17***	***G18***	***G19***	***G20***	***G21***	***G22***	***G23***	***G24***	***G25***	***G26***	***G27***	***G28***	***G29***	***G30***
Mollusca	*Acteocina* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Siphonaria denticulata*	1	0	1	0	1	1	0	1	1	0	1	1	0	1
Mollusca	*Siphonaria diemensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Siphonaria funiculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Siphonaria zelandica*	1	0	0	0	0	0	0	0	0	0	1	1	0	1
Mollusca	*Liotella pulcherrima*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Stenothyra* sp.1	1	1	0	1	1	1	1	1	1	1	0	0	0	0
Mollusca	*Ataxocerithium serotinum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Pseudoliotia micans*	1	1	1	1	0	1	0	1	1	1	1	1	1	1
Mollusca	*Pseudoliotia speciosa*	0	1	1	0	1	0	0	0	1	0	1	0	0	1
Mollusca	*Austrocochlea porcata*	1	1	1	0	1	0	1	1	1	1	1	1	1	1
Mollusca	*Calthalotia fragum*	1	1	1	1	1	0	0	0	1	1	1	1	1	0
Mollusca	*Prothalotia comtessie*	1	1	1	1	0	1	0	0	1	0	0	1	0	0
Mollusca	*Leiopyrga lineolaris*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Talopena goloriola*	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Mollusca	*Chiton pelliserpentis*	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Mollusca	*Chiton* sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	*Ischnochiton elongatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	*Compressidens plax*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mollusca	*Compressidans platyceras*	0	0	0	0	0	0	1	0	0	1	1	0	0	1
Echinodermata	*Patiriella exigua*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Echinodermata	Asteroid sp.1	1	0	0	1	0	0	0	1	1	0	0	0	0	0
Echinodermata	Asteroid sp.2	0	1	1	0	0	0	0	0	0	0	0	1	0	0
Echinodermata	Asteroid sp.3	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Echinodermata	Holothurian sp.	0	0	0	0	1	0	1	1	0	0	1	0	0	0
Echinodermata	Ophiuroidea sp.1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Echinodermata	Ophiuroidea sp.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Chlorophyta	*Codium fragile*	0	0	0	0	1	0
Chlorophyta	*Ulva lactuca*	0	1	1	0	0	0
Chlorophyta	*Enteromorpha intestinalis*	0	1	1	0	0	0
Chlorophyta	*Enteromorpha* sp.1	0	0	1	0	0	0
Chlorophyta	*Enteromorpha* sp.2	0	1	0	0	0	0
Phaeophyta	*Padina pavonea*	0	0	0	0	0	0
Phaeophyta	*Hormosira banksii*	0	0	0	0	0	0
Phaeophyta	*Sargassum* sp.1	0	1	1	0	0	0
Phaeophyta	*Colpomenia sinuosa*	0	1	0	0	0	0
Phaeophyta	Encrusting brown algae sp.1	0	1	0	0	0	0
Rhodophyta	*Amphiroa anceps*	0	1	1	0	0	0
Rhodophyta	*Gigartina* sp.1	0	0	1	0	0	0
Rhodophyta	*Laurencia* sp.1	0	1	1	0	0	0
Rhodophyta	Corallinaceae sp.	0	1	1	0	0	0
Rhodophyta	*Gracilaria* sp.1	0	1	1	0	0	0
Rhodophyta	*Gracilaria* sp.2	0	0	0	0	0	0
Rhodophyta	*Callophycos* sp.	0	1	1	0	0	0
Rhodophyta	*Champia viridis*	0	0	1	0	0	0
Rhodophyta	*Plocamium* sp.	0	0	0	0	0	0
Foraminifera	Foramnifera sp.1	0	0	0	0	0	0
Porifera	Purple sponge	0	1	1	0	0	0
Porifera	Sponge	0	0	1	0	1	1
Ectoprocta	Dark red bryozoa	0	0	1	0	0	0
Ectoprocta	White bryozoa	0	1	1	0	0	0
Chordata	*Pyura stolonifera*	0	0	0	0	0	0
Chordata	Ascidian sp.1	0	1	1	0	0	0
Chordata	Ascidian sp.2	0	0	0	0	0	0
Cnidaria	*Oulactis muscosa*	0	1	0	0	0	0
Cnidaria	*Actinia tenebrosa*	0	0	1	0	0	0
Cnidaria	*Cnidopus verater*	0	0	1	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Platyhelminthes	Platyhelminthes	0	0	0	0	0	0
Nematoda	Nematoda sp.1	1	0	0	1	1	0
Nematoda	Nematoda sp.2	0	0	0	0	0	0
Nemertea	Nemertean	1	0	0	0	1	0
Annelida	Earthworm	1	0	0	1	0	1
Annelida	*Barantolla lepete*	1	0	0	1	1	1
Annelida	*Capitella* sp.	1	0	0	0	0	0
Annelida	*Notomastus* sp.1	1	0	0	1	1	1
Annelida	*Notomastus* sp.2	0	0	0	0	1	0
Annelida	*Aphelochaeta* sp.	0	0	0	0	1	0
Annelida	*Caulleriella* sp.	0	0	0	0	0	0
Annelida	*Chaetozone setosa*	0	0	0	0	0	0
Annelida	*Cirriformia c.f. capensis*	0	0	0	0	1	0
Annelida	*Eunice aphroditois*	0	0	0	0	0	0
Annelida	*Marphysa* sp.1	0	0	0	1	0	0
Annelida	*Nematonereis unicornis*	0	0	0	0	1	1
Annelida	*Marphysa* sp.2	1	0	0	0	0	0
Annelida	*Glycera* sp.1	0	0	0	0	0	0
Annelida	*Hemipodia c.f. yenourensis or simplex*	1	1	0	0	0	0
Annelida	*Goniadella* sp.1	0	0	0	0	1	0
Annelida	*Augeneria verdis*	0	0	0	1	1	0
Annelida	*Lumbrineris* sp.1 *(c.f. gulielmi or setosa)*	1	0	0	0	0	0
Annelida	*Lumbrineris* sp.2 *(c.f. sphaerocephala)*	0	0	0	1	1	1
Annelida	*Magelona* sp.1	0	0	0	0	1	0
Annelida	*Magelona dakini*	0	0	0	0	0	0
Annelida	*Maldane sarsi*	0	0	0	0	0	0
Annelida	*Nephtys australiensis*	1	0	0	1	1	1
Annelida	*Nephtys inornata*	0	0	0	0	0	0
Annelida	*Nephtys longipes*	0	1	0	0	0	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Annelida	*Australanereis ehlersi*	1	0	0	0	0	1
Annelida	*Ceratonereis australis*	1	0	0	1	1	1
Annelida	*Ceratonereis pseudierythraeansis*	1	0	0	0	0	0
Annelida	*Simplisetia aequisetis*	1	0	0	1	1	1
Annelida	*Armandia intermedia*	1	0	0	1	0	1
Annelida	*Ophelia multibranchia*	0	0	0	0	0	0
Annelida	*Travisia* sp.	1	0	0	0	0	0
Annelida	*Leitoscoloplos normalis*	0	0	0	1	1	1
Annelida	*Leodamas johnstonei*	0	0	0	0	1	1
Annelida	*Phylo felix*	0	0	0	0	0	0
Annelida	*Owenia australis*	1	0	0	1	1	1
Annelida	*Aricidea* sp.	1	0	0	0	0	0
Annelida	*Pectinaria antipoda*	0	0	0	0	0	1
Annelida	*Paranaitis inflata*	0	0	0	1	0	0
Annelida	*Phyllodoce novaehollandiae*	1	0	0	0	1	0
Annelida	*Phyllodoce* sp.1	0	0	0	0	1	0
Annelida	*Pilargis* sp.	0	0	0	1	0	0
Annelida	*Sigambra parva*	0	0	0	0	0	0
Annelida	*Pisionidae* sp.1	1	0	0	0	0	0
Annelida	*Lepidonotus* sp.	0	0	0	0	0	0
Annelida	*Parahalosydna chrysostichtus*	0	0	0	0	0	0
Annelida	*Paralepidonotus ampuliferus*	0	0	0	0	0	0
Annelida	*Bispira* sp.	0	0	0	0	0	0
Annelida	*Branchiomma* sp.	0	0	0	0	0	0
Annelida	*Euchone variabilis*	0	0	0	0	0	0
Annelida	*Euchone limnicola*	0	0	0	0	0	0
Annelida	*Galeolaria caespitosa*	0	1	1	0	0	0
Annelida	*Leanira* sp.	0	0	0	0	0	0
Annelida	*Sigalion bandaeensis*	0	0	0	0	0	0
Annelida	*Sthenelais* sp.	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Annelida	*Boccardiella* sp.	0	0	0	0	0	0
Annelida	*Boccardiella* sp. MoV 383	0	0	0	0	1	1
Annelida	*Malacaceros divisos*	0	0	0	0	0	0
Annelida	*Microspio c.f. occipitalis*	1	0	0	1	1	1
Annelida	*Prionospio multicristata*	1	0	0	0	0	0
Annelida	*Spirorbidae* sp.	1	0	0	0	1	1
Annelida	*Exogone africana*	0	0	0	0	0	0
Annelida	*Odontosyllis trilinea*	1	0	0	0	0	0
Annelida	*Paraehlersia* sp.	1	0	0	0	0	0
Annelida	*Pionosyllis* sp.	0	0	0	0	0	0
Annelida	*Syllis (Typosysyllis)* sp.1	1	0	0	0	0	0
Annelida	*Syllis (Typosysyllis)* sp.2	0	0	0	0	0	0
Annelida	*Lysilla sp. or Amaena* sp.	0	0	0	0	0	0
Annelida	*Pista australis*	0	0	0	0	0	0
Annelida	*Pseudostreblosoma serratum*	0	0	0	0	0	0
Annelida	*Rhinothelepus lobatus*	0	0	0	0	1	1
Annelida	*Streblosoma acymatum*	1	0	0	0	0	0
Annelida	*Terebellides narribri*	0	0	0	0	0	0
Annelida	Orange-red tubeworm	0	0	1	0	0	0
Sipuncula	*Phascolionidae* sp.1	0	0	0	0	0	0
Sipuncula	*Phascolionidae* sp.2	0	0	0	0	1	0
Arthropoda	*Catomerus polymerus*	0	1	1	0	1	0
Arthropoda	*Chamaesipho tasmanica*	0	1	0	0	1	0
Arthropoda	*Chathamalus antennatus*	0	1	1	0	1	0
Arthropoda	*Elminius covertus*	0	0	0	0	1	1
Arthropoda	*Hexaminius* sp.1	0	0	0	0	0	0
Arthropoda	*Hexaminius* sp.2	0	0	0	0	1	0
Arthropoda	*Austrobalanus imperator*	0	0	0	0	0	0
Arthropoda	*Tesseropora rosea*	0	1	1	0	0	0
Arthropoda	*Tetraclitella purpurascens*	0	1	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Arthropoda	*Copepoda* sp.	1	0	0	0	0	0
Arthropoda	*Cymadusa filosa*	1	0	1	1	1	0
Arthropoda	*Anothidae* sp.	1	0	0	1	0	1
Arthropoda	*Calliopiidae* sp.	0	0	0	1	0	0
Arthropoda	*Caprellidae* sp.1	0	0	0	0	0	0
Arthropoda	*Caprellidae* sp.2	0	0	0	0	0	0
Arthropoda	*Corophium* sp.1	1	0	0	1	1	1
Arthropoda	*Exoediceros fossor*	1	1	1	0	0	0
Arthropoda	*Protohyale rupicola*	0	0	0	0	0	0
Arthropoda	*Erichthonius* sp.	0	0	0	0	0	0
Arthropoda	*Melita plumulosa*	1	0	0	0	1	1
Arthropoda	*Victoriopisa australiensis*	0	0	0	1	1	1
Arthropoda	*Oedicerotidae* sp.1	1	0	0	0	1	1
Arthropoda	*Paracalliope australis*	0	0	0	0	1	0
Arthropoda	*Gammaropsis sp.*	0	0	0	0	1	1
Arthropoda	*Limnoporeia kingi*	1	0	0	0	0	0
Arthropoda	*Limnoporeia* sp.	0	0	0	0	1	1
Arthropoda	*Platyischnous mirabilis*	0	1	1	1	0	0
Arthropoda	*Talitridae* sp.	1	1	1	1	1	1
Arthropoda	*Urohaustorius* sp.	1	1	0	0	0	0
Arthropoda	*Bodotriidae* sp.1	0	0	0	0	0	0
Arthropoda	*Bodotriidae* sp.2	0	0	0	0	1	1
Arthropoda	*Bodotriidae* sp.3	0	0	0	0	0	0
Arthropoda	*Cyclapsis* sp.1	0	0	0	0	1	0
Arthropoda	*Diastylidae* sp.1	0	0	0	0	1	1
Arthropoda	*Gynodiastylidae* sp.1	1	0	0	0	0	0
Arthropoda	*Alpheus lobidens*	0	0	0	1	0	0
Arthropoda	*Biffarius arenosa*	0	0	0	0	0	0
Arthropoda	*Diogenes custos*	1	1	0	0	0	0
Arthropoda	*Ebalia c.f. tuderculosa*	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Arthropoda	*Ilyograpsus paludicola*	0	0	0	0	1	0
Arthropoda	*Amarinus lacustris*	0	0	0	1	0	0
Arthropoda	*Halicarcinus ovatus*	0	0	0	0	0	0
Arthropoda	*Australopax tridentata*	1	0	0	0	0	0
Arthropoda	*Enigmaplax littoralis*	0	0	0	0	0	0
Arthropoda	*Heloecius cordiformis*	0	0	0	0	0	0
Arthropoda	*Macropthalmus crassipes*	1	0	0	0	0	0
Arthropoda	*Mictyris longicarpus*	0	0	0	0	0	0
Arthropoda	*Palaemon intermedius*	0	0	0	0	0	0
Arthropoda	*Metapenaeus c.f. bennettae*	1	0	0	0	0	0
Arthropoda	*Pilumnopeus serratifrons*	0	0	0	0	0	0
Arthropoda	*Actaecia* sp.	0	0	0	0	0	0
Arthropoda	*Anthuridae* sp.	0	1	0	0	0	0
Arthropoda	*Cyathura* sp.1	0	0	0	0	0	0
Arthropoda	Janiridae sp.1	0	0	0	0	0	0
Arthropoda	Scyphacidae sp.1	0	0	0	0	0	0
Arthropoda	*Paraerceis sculpta*	1	0	0	1	1	1
Arthropoda	Sphaeomatidae sp.1	0	0	0	1	0	0
Arthropoda	Sphaeomatidae sp.2	0	0	0	1	1	1
Arthropoda	Sphaeomatidae sp.3	0	0	0	0	0	1
Arthropoda	Sphaeomatidae sp.4	0	0	0	0	1	0
Arthropoda	Sphaeomatidae sp.5	0	0	0	0	0	1
Arthropoda	Apseudidae sp.	0	0	0	0	0	0
Arthropoda	Tanaidae sp.1	1	0	0	0	0	1
Arthropoda	Cylindroleberidae sp.1	0	0	0	1	0	0
Arthropoda	Sarsiellidae sp.1	0	0	0	0	0	0
Arthropoda	Sarsiellidae sp.2	0	0	0	0	0	0
Mollusca	*Anadaria trapezia*	0	0	0	0	0	1
Mollusca	*Hemidonax pictus*	0	0	0	0	0	0
Mollusca	*Fulvia tenuicostata*	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Mollusca	*Condylocardiidae* sp.	0	0	0	0	0	0
Mollusca	*Neolepton* sp.1	0	0	0	0	0	0
Mollusca	Leptonidae	0	0	0	0	0	0
Mollusca	*Leptonidae* sp.1	0	0	0	0	0	0
Mollusca	*Borniola* sp.	0	0	0	0	0	1
Mollusca	Galeommatidae sp.	0	0	0	0	0	0
Mollusca	*Mysella vitrea*	0	0	0	0	0	1
Mollusca	*Arthritica helmsi*	1	0	0	1	1	1
Mollusca	*Lissarca* sp.	0	0	0	0	0	0
Mollusca	*Cavatidens omissa*	0	0	0	1	0	0
Mollusca	*Thyasira peroniana*	0	0	0	0	0	1
Mollusca	Lucinidae sp.	0	0	0	0	0	0
Mollusca	*Wallucina assimilis*	0	0	0	0	1	1
Mollusca	*Lutraria rhynchaena*	1	0	0	1	1	1
Mollusca	*Mactra jacksonensis*	0	1	0	0	0	0
Mollusca	*Spisula trigonella*	0	0	0	1	1	1
Mollusca	*Corbula tunicata*	0	0	0	0	0	0
Mollusca	*Musculus* sp.	0	0	0	0	0	0
Mollusca	*Musculus varicosus*	0	0	0	0	0	0
Mollusca	*Mytilus edulus planulatus*	0	1	0	0	0	0
Mollusca	*Trichomusculus barbatus*	0	0	0	0	0	0
Mollusca	*Xenostrobus pulex*	0	0	0	0	1	0
Mollusca	*Xenostrobus securis*	0	0	0	1	1	0
Mollusca	*Saccostrea glomereta*	0	1	0	0	1	1
Mollusca	*Laturnula creccina*	0	0	0	1	0	1
Mollusca	*Laturnula martinica*	0	0	0	0	1	1
Mollusca	*Laturnula tasmanica*	0	0	0	0	1	0
Mollusca	*Pholas australasiae*	1	0	0	0	0	0
Mollusca	*Solemya australis*	0	0	0	0	0	1
Mollusca	*Solemya velesiana*	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Mollusca	*Solen correctus*	0	0	0	0	0	0
Mollusca	Donacidae sp.	0	1	0	0	0	0
Mollusca	Psammobiidae sp.1	0	0	0	0	0	0
Mollusca	Psammobiidae sp.2	0	0	0	0	0	0
Mollusca	*Soletellina biradiata*	0	0	0	1	1	1
Mollusca	*Theora fragilis*	0	0	0	0	0	0
Mollusca	*Racra pellicula*	0	0	0	1	0	0
Mollusca	*Tellina deltoidalis*	1	0	0	1	1	1
Mollusca	Tellinidae sp.1	0	0	0	0	0	1
Mollusca	*Alathyria profuga*	0	0	0	1	1	1
Mollusca	*Placamen placidum*	0	0	0	0	0	0
Mollusca	*Glauconome* sp.	0	0	0	1	1	0
Mollusca	*Circe scripta*	0	0	0	0	0	0
Mollusca	*Dosinia crocea*	0	0	0	1	0	1
Mollusca	*Dosinia sculpta*	1	0	0	0	1	0
Mollusca	*Eumarcia fumigata*	0	0	0	1	0	0
Mollusca	*Irus crebrelamellatus*	0	0	0	0	1	0
Mollusca	*Katelysia rhytiphora*	0	0	0	0	0	0
Mollusca	*Paphia undulata*	0	0	0	0	0	0
Mollusca	*Paphies cuneata*	0	0	0	0	0	0
Mollusca	*Tapes dorsatus*	0	0	0	0	1	0
Mollusca	*Tapes watlingi*	0	0	0	0	0	1
Mollusca	*Salinator fragilis*	1	0	0	1	1	1
Mollusca	*Salinator solida*	0	0	0	1	0	1
Mollusca	*Badepigrus pupoides*	0	0	0	0	0	0
Mollusca	*Psilaxis* sp.	1	0	0	0	0	0
Mollusca	*Cominella lineolata*	0	0	0	0	0	0
Mollusca	*Calopia* sp.	0	0	0	0	0	0
Mollusca	*Trigonostoma bicolor*	1	0	0	0	0	0
Mollusca	*Batillaria australis*	1	0	0	1	1	1

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Mollusca	*Pyrazus ebeninus*	0	0	0	0	1	0
Mollusca	*Cacozeliana granarium*	0	0	0	1	0	1
Mollusca	*Gazameda gunnii*	0	0	0	0	0	0
Mollusca	*Conus papilliferus*	0	0	0	0	0	0
Mollusca	*Austrodrilla beraudiana*	0	0	0	0	1	1
Mollusca	*Cypraea* sp.	0	0	0	0	0	0
Mollusca	*Cassidula zonata*	0	0	0	1	1	1
Mollusca	*Ophicardelus ornatus*	0	0	0	0	0	0
Mollusca	*Ophicardelus quoyi*	0	0	0	0	0	0
Mollusca	*Ophicardelus sulcatus*	0	0	0	0	0	0
Mollusca	*Elysia sp. (Opistobranch* sp.1*)*	0	0	0	1	0	1
Mollusca	*Clypidina rugosa*	0	1	1	0	0	0
Mollusca	*Montfortula rugosa*	0	0	1	0	0	0
Mollusca	*Liloa brevis*	0	0	0	0	0	0
Mollusca	*Tatea huonensis*	1	0	0	1	1	0
Mollusca	*Tatea rufilabris*	0	0	0	1	1	0
Mollusca	*Nozeba tobazica*	0	0	0	1	1	1
Mollusca	*Epitonium parspeciosum*	0	0	0	0	0	0
Mollusca	*Epitonium perplexum*	0	0	0	1	1	1
Mollusca	*Epitonium tennellum*	0	0	0	0	0	1
Mollusca	*Alaba monile*	0	0	0	0	0	1
Mollusca	*Alaba opiniosa*	0	0	0	0	0	1
Mollusca	*Alaba translucida*	1	0	0	1	1	1
Mollusca	*Bembicium auratum*	1	0	0	0	1	0
Mollusca	*Bembicium nanum*	0	1	0	0	0	0
Mollusca	*Littoraria luteola*	0	0	0	0	0	0
Mollusca	*Littorina scabra*	1	0	0	0	0	0
Mollusca	*Nodilittorina unifasciata*	0	1	1	0	0	0
Mollusca	*Engina australis*	0	0	0	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Mollusca	*Zafra regulus*	0	0	0	0	0	0
Mollusca	*Dicathais orbita*	0	0	1	0	0	0
Mollusca	*Morula marginalba*	0	1	1	0	0	0
Mollusca	*Bedeva hanleyi*	1	0	0	0	1	0
Mollusca	*Nassaruis burchardi*	1	0	0	1	1	0
Mollusca	*Nassaruis jonasi*	1	0	0	1	0	1
Mollusca	*Cellana tramoserica*	0	1	1	0	0	0
Mollusca	*Neverita didyma*	0	0	0	0	0	0
Mollusca	*Natica pseustus*	0	1	0	1	0	0
Mollusca	*Polinices putealis*	0	0	0	1	1	1
Mollusca	*Nerita atramentosa*	0	1	0	0	0	0
Mollusca	*Smaragdia souverbiana*	0	0	0	0	0	1
Mollusca	*Cinnalepete cinnamoema*	0	0	0	0	0	0
Mollusca	*Onchidella patelloides*	0	0	0	0	0	0
Mollusca	*Onchidina australis*	0	0	0	0	1	1
Mollusca	*Patelloida latistrigata*	0	1	0	0	0	0
Mollusca	*Patelloida mimula*	0	0	0	0	1	0
Mollusca	*Ringicula doliaris*	1	0	0	0	0	0
Mollusca	*Retusa* sp.	0	1	0	0	0	0
Mollusca	*Agatha simplex*	0	0	0	1	1	1
Mollusca	*Linopyrga ceria*	0	0	0	1	1	1
Mollusca	*Linopyrga pascoei*	0	0	0	0	0	0
Mollusca	*Linopyrga* sp.	0	0	0	1	1	1
Mollusca	*Paregila henni*	0	0	0	0	0	0
Mollusca	*Cylichnina iredaleane*	0	0	0	1	0	0
Mollusca	*Bittium lacertium*	1	0	0	0	1	1
Mollusca	*Cryptassiminea* sp.	1	0	0	1	1	1
Mollusca	*Truncatella guerinii*	0	0	0	0	1	0
Mollusca	*Acteocina fusiformis*	0	1	0	0	0	0
Mollusca	*Acteocina* sp.2	0	0	1	0	0	0

Appendix 1. Species recorded in each grid cell (G1-G36).

Phylum	***Species***	***G31***	***G32***	***G33***	***G34***	***G35***	***G36***
Mollusca	*Siphonaria denticulata*	0	1	1	0	0	0
Mollusca	*Siphonaria diemensis*	0	0	1	0	0	0
Mollusca	*Siphonaria funiculata*	0	1	1	0	0	0
Mollusca	*Siphonaria zelandica*	0	1	0	0	0	0
Mollusca	*Liotella pulcherrima*	0	1	0	0	0	0
Mollusca	*Stenothyra* sp.1	0	0	0	1	1	0
Mollusca	*Ataxocerithium serotinum*	0	0	0	0	0	0
Mollusca	*Pseudoliotia micans*	1	0	0	0	1	0
Mollusca	*Pseudoliotia speciosa*	0	0	0	0	0	0
Mollusca	*Austrocochlea porcata*	1	1	1	0	0	0
Mollusca	*Calthalotia fragum*	1	0	0	0	0	0
Mollusca	*Prothalotia comtessie*	1	0	0	0	0	0
Mollusca	*Leiopyrga lineolaris*	0	0	0	0	0	0
Mollusca	*Talopena goloriola*	0	0	0	0	0	0
Mollusca	*Chiton pelliserpentis*	0	1	1	0	0	0
Mollusca	*Chiton* sp.2	0	0	0	0	0	0
Mollusca	*Ischnochiton elongatus*	0	0	0	0	0	0
Mollusca	*Compressidens plax*	0	0	0	0	0	0
Mollusca	*Compressidans platyceras*	0	0	0	0	1	0
Echinodermata	*Patiriella exigua*	0	0	1	0	0	0
Echinodermata	Asteroid sp.1	0	0	0	0	0	0
Echinodermata	Asteroid sp.2	0	0	0	0	0	0
Echinodermata	Asteroid sp.3	0	0	0	0	0	0
Echinodermata	Holothurian sp.	1	1	0	0	0	0
Echinodermata	Ophiuroidea sp.1	1	0	0	0	0	0
Echinodermata	Ophiuroidea sp.2	0	0	0	0	0	0

Appendix 2. Habitats present in each grid cell throughout Brisbane Water estuary (G1-G36). Locations of grid cells are shown in Fig. 1. 1: recorded, 0: not recorded.

Grid cell	Mangrove	*Zostera capricorni* seagrass	Intertidal hard substrate	Subtidal unvegetated sediment	Intertidal unvegetated sediment
G1	1	1	1	1	1
G2	1	1	1	1	1
G3	1	1	1	1	1
G4	0	1	1	1	1
G5	1	1	1	1	1
G6	1	1	1	1	1
G7	1	1	1	1	1
G8	1	1	1	1	1
G9	1	1	1	1	1
G10	0	0	0	1	0
G11	0	0	0	1	0
G12	1	1	1	1	1
G13	1	1	1	1	1
G14	0	0	0	1	0
G15	0	1	1	1	1
G16	1	1	1	1	1
G17	1	1	1	1	1
G18	1	1	1	1	1
G19	1	1	1	1	1
G20	1	1	0	1	1
G21	1	1	1	1	1
G22	1	1	1	1	1
G23	1	1	0	1	1
G24	1	1	1	1	1
G25	1	1	1	1	1
G26	1	1	1	1	1
G27	1	1	1	1	1
G28	1	1	1	1	1

Appendix 2 continued. Habitats present in each grid cell throughout Brisbane Water estuary (G1-G36). Locations of grid cells are shown in Fig. 1. 1: recorded, 0: not recorded.

Grid cell	Mangrove	*Zostera capricorni* seagrass	Intertidal hard substrate	Subtidal unvegetated sediment	Intertidal unvegetated sediment
G29	1	1	1	1	1
G30	0	1	1	1	1
G31	0	1	0	1	1
G32	0	0	1	1	1
G33	0	0	1	1	1
G34	1	1	0	1	1
G35	1	1	1	1	1
G36	1	0	0	1	1