environmental variables was not clear (Fig. 24B), most likely because of the low number of sites sampled. However, differences in algal community structure among groups were broadly consistent with a wave-exposure gradient and groups were subjectively named according to their relative exposure levels. The Banks Peninsula North sites and the two sites from the eastern side of Flea Bay (Hectors Wall and Flea East) made up the moderately exposed group, whereas the sites on the western side of Flea Bay were divided into two groups; the most sheltered site (Rockpool Point) formed one group, whereas the more exposed outer sites (Outer West and Tern Rock) formed the other. Secchi and Sediment were correlated with PC1 (Fig. 24B) which corresponded to the higher turbidity and higher percentage cover of sediment at the Banks Peninsula North sites. There was a general gradient in species composition along PC1, from moderately exposed sites with *Macrocystis pyrifera* and *Ecklonia radiata* to exposed sites dominated by *Lessonia variegata* (Fig. 24C). However, Fetch was strongly correlated with PC2 and reflected the differences between the sheltered site (Rockpool Point) and the other sites. The species most strongly correlated with PC2 included *C. flexuosum* and *Xiphophora gladiata*, which were more abundant at Rockpool Point, and *Durvillaea willana*, which was more abundant at the exposed western sites at Flea Bay.

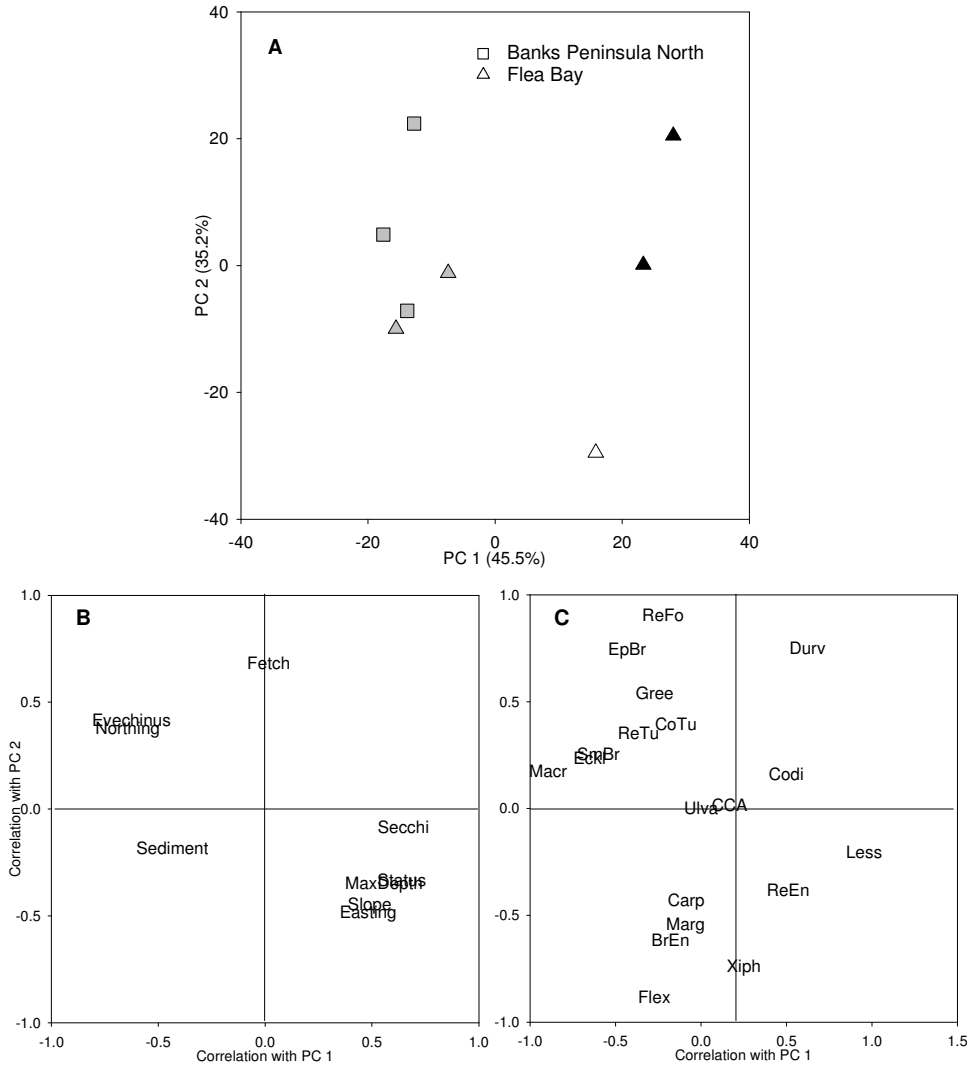

Figure 24. Principal coordinates analysis of sites sampled in the Banks bioregion, based on fourth-root transformed biomass of 23 macroalgal groups (A). Bi-plots give correlations between principal coordinates axes and environmental variables (B) and original macroalgal species groups (C) (see Table 1 for macroalgal group codes). Sites shaded according to groupings identified at the 75% similarity level. Black = exposed, grey = moderately exposed, white = sheltered.

Banks Peninsula North

Large brown algae extended to a maximum depth of 8 m at Banks Peninsula North sites and all fleshy macroalgae were rare in the deepest stratum (10–12 m). *Carpophyllum maschalocarpum* formed a patchy band in the shallow depth stratum, with *Marginariella urvilliana*, *D. antarctica* and *Macrocystis pyrifera* also occurring (Fig. 25A). At this depth *Haliotis iris* was abundant (3.5 ± 2.0/m^2), along with the stalked ascidian *Pyura pachydermatina* (16 ± 7.0/m^2) and the mussel *Perna canaliculus* (Fig. 25B,C). The brown algal species *Glossophora kunthii*, *Desmarestia ligulata*, *Halopteris* sp. and *Microzonia velutina* were also common in the shallow subtidal. *Macrocystis pyrifera* and *C. flexuosum* were the dominant macroalgal species at 4–6 m of depth and *Ecklonia radiata* also occurred at this depth. Below 6 m, large brown algae were rare and the substratum was mainly covered by sediment and solitary ascidians (Fig. 25C). Red foliose and red turfing algae were rare at all sites and only small amounts of *Rhodophyllis gunnii*, *Anotrichium crinitum* and *Plocamium* spp. were found at 4–6 m and 7–9 m. Low numbers of *Evechinus chloroticus* were recorded at all depths; however, patches of *E. chloroticus* were common in the shallow subtidal at c. 3 m of depth (NS, pers. obs.). Similarly, patches of *H. iris* (< 125 mm shell length) were also observed at this depth. *Trochus viridis* occurred at moderate numbers at mid-depths, whereas low numbers of *Cellana stellifera*, *Cookia sulcata* and *Turbo smaragdus* were also found at depths down to 9 m (Fig. 25B).

Flea Bay

Algal community structure at the sheltered site (Rockpool Point) was comparable to that at sheltered sites in Northern locations (e.g. Long Bay) with low algal diversity, a shallow band of *Carpophyllum maschalocarpum*, and *C. flexuosum* forests dominating the deeper strata (Fig. 25A). One exception was the occurrence of *Lessonia variegata* in the shallow subtidal. No red foliose, red turfing or green algal species were recorded at this site and coralline turf was relatively rare. *Cookia sulcata* and *Trochus viridis* were abundant across all depths and *Haliotis iris* was common in the deepest strata (7–9 m and 10–12 m) (Fig. 25B). Crustose coralline algae were the dominant encrusting form at all depths; however, the percentage cover of sediment was high in the deepest strata (Fig. 25C). Moderately exposed sites (eastern Flea Bay) had relatively low biomass of macroalgae at all depths, which may be due to shading effects as both sites were south facing with steeply sloping reefs. *Carpophyllum maschalocarpum*, *Durvillaea willana* and *Marginariella urvilliana* dominated the shallow stratum, whereas *C. flexuosum* and *Macrocystis pyrifera* dominated at 4–6 m. Low numbers of *Ecklonia radiata* and *Marginariella urvilliana* (sheltered morphology; Adams 1994) were present at 10–12 m. Red foliose, red turfing and green algal species were rare at all depths, and the percentage cover of crustose coralline algae declined with depth and that of sediment increased (Fig. 25C). *Perna canaliculus* and *Pyura pachydermatina* were abundant at shallow depths. *Trochus viridis* was abundant at all depths and low numbers of *Cookia sulcata*, *Haliotis iris* and *Calliostoma punctulatum* also occurred (Fig. 25B). Exposed western Flea Bay sites (Tern Rock and Outer West) were dominated by *Carpophyllum maschalocarpum*, *L. variegata* and *D. willana* at 0–2 m, and *C. maschalocarpum* at 4–6 m, whereas all fleshy macroalgae were rare at greater depths (Fig. 25A). Crustose coralline

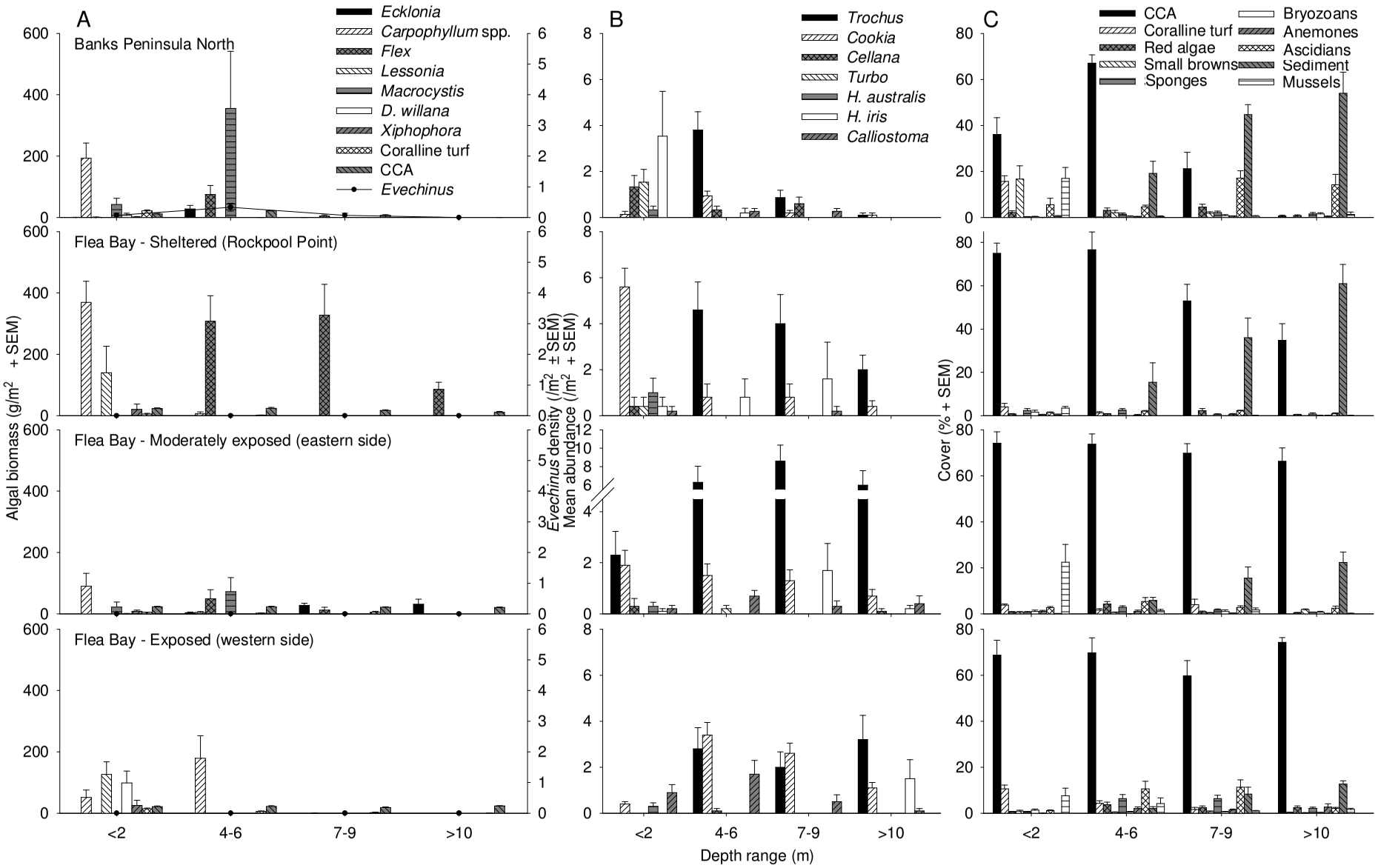

Figure 25. Depth-related patterns in biomass (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for site groups within the Banks bioregion. Sites from each location are grouped according to the exposure groups identified in Fig. 24 (see section 3.4.6 for explanation of groupings).

algae were the dominant substratum cover at all depths although sponges and solitary ascidians had a relatively high percentage cover in the deeper strata (Fig. 25C). *Pyura pachydermatina* was abundant at 4–6 m (28.2 ± 11.9/m^2) and 7–9 m (13.3 ± 7.2/m^2). Red foliose algae were more common at these sites, particularly as epiphytes on *P. pachydermatina*, e.g. *Callophyllis hombroniana* and *Hymenocladia sanguinea*. Large specimens of *H. iris* (up to 145 mm shell length) were common at 10–12 m.

3.4.7 Buller bioregion

All sites at Cape Foulwind and Karamea were highly exposed to large southwesterly swells, and had shallow reefs (< 11 m maximum depth) with high sandscour and turbidity. Algal and benthic community structure at these locations was unique at the national scale (Figs 2 and 9). Most key habitat-forming species were absent (e.g. *Ecklonia radiata*, *Carpophyllum* spp.) and the reefs were dominated by encrusting invertebrates (Fig. 10). Cluster analysis revealed no clear site groupings associated with any clear spatial or environmental gradients (Fig. 26A). However, several environmental variables were correlated with PC1, and suggested a gradient in community structure between inshore sites and two sites (Fishing Rod Reef and South Seal Rocks) located on offshore rockstacks (known as 'Three Steeples') at Cape Foulwind, which are surrounded by clearer, deeper water and have lower wave-exposure estimates as they have some protection from the prevailing southwesterly swell (Fig. 26B). Secchi was negatively correlated with PC1, whereas Fetch was positively correlated with it, being higher at inshore sites. Evechinus was also negatively correlated with PC1 and was only recorded at the two offshore sites. The algal groups responsible for this pattern appeared to be red turfing algae, ephemeral brown algae (e.g. *Endarachne binghamiae* and *Glossophora kunthii*) and brown encrusting algae, which were more common at offshore sites, whereas *Durvillaea willana*, red foliose algae and crustose coralline algae were more common at the inshore sites (Fig. 26C). Additional information on the reef communities and habitat types found at these sites is given in Shears (2007).

Karamea

Large brown macroalgae were absent from all the Karamea sites and the shallow stratum (< 2 m) was dominated by the mussel *Perna canaliculus*, crustose coralline algae, red foliose and red turfing algae (e.g. *Ballia callitrichia* and *Echinothamnion* sp.) (Fig. 27A). The brown algae *Glossophora kunthii*, *Halopteris* sp. and *Endarachne binghamiae* were also present (Appendix 5). *Ulva* spp. were also common on mussels at Little Wanganui Inlet. At greater depths, macroalgae were rare except for a low percentage cover of crustose coralline algae. Instead the substratum was dominated by encrusting invertebrates (sponges, ascidians and bryozoans), bare rock and sediment (Fig. 27C). At 10–12 m, the majority of the substratum was bare rock, most likely owing to high levels of sandscour. Mobile macroinvertebrates were rare at Karamea sites, with *Stichaster australis* and *Patiriella* spp. being the most common (Fig. 27B).

Cape Foulwind

The sites at Cape Foulwind exhibited a similar pattern in algal community structure to that of Karamea sites, except that *Durvillaea willana* occurred in the shallow stratum at Granite Spot, and crustose coralline algae and red

turfing algae extended to greater depths (Fig. 27A). A short turfing *Halopteris* species (probably *H. congesta*) dominated the shallow stratum at most sites. *Gymnogongrus humilis* and *Ballia callitrichia* were the dominant red foliose algal species in the shallow stratum, although *Plocamium* spp., *Echinothamnion* sp. and *Lophurella hookeriana* were also common (Appendix 5). *Sargassum sinclairii* and *Codium convolutum* were locally abundant at South Seal Rocks. The deeper strata were dominated by sediment, bare rock, the mussel *Xenostrobus pulex*, bryozoans and ascidians (Fig. 27C). Barnacles extended into the shallow subtidal and the hydroid *Amphisbetia bispinosa* ('mussel beard') was relatively common across all depths. *Haliotis iris* was abundant in the deepest stratum, occurring in patches on bare rock. The starfish species *Stichaster australis* (> 1/m^2) and *Patiriella* spp. occurred at relatively high densities across all depths (Fig. 27B).

3.4.8 Westland bioregion

There was a clear distinction in algal community structure between the sites at Open Bay Islands and sites at the mainland locations (Fig. 8A). Algal community structure at the mainland locations in Westland was broadly similar to that of the Buller locations, with stands of large brown algae being rare and short red foliose and turfing algae dominating (Fig. 3). In contrast, large brown algae were

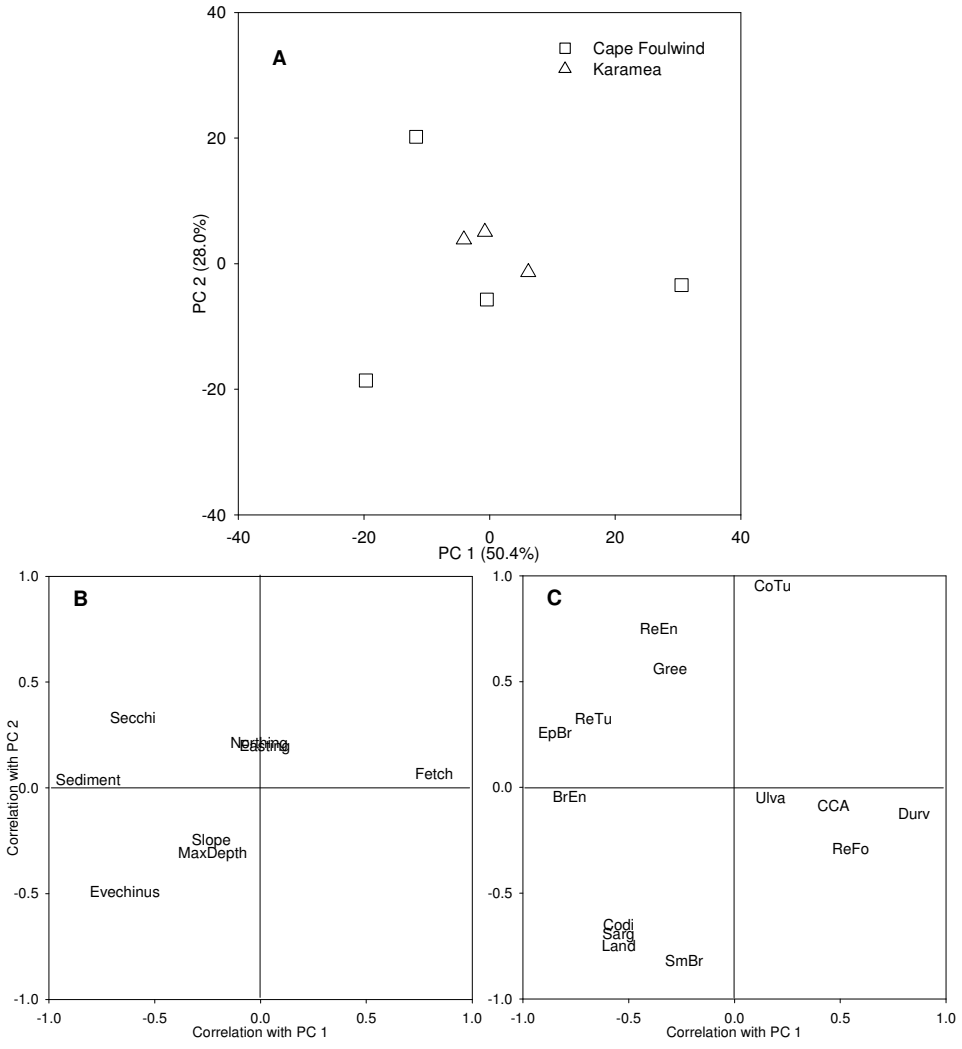

Figure 26. Principal coordinates analysis of Buller sites based on fourth-root transformed biomass of 23 macroalgal groups (A). Bi-plots give correlations between principal coordinates axes and environmental variables (B) and original macroalgal species groups (C) (see Table 1 for macroalgal group codes).

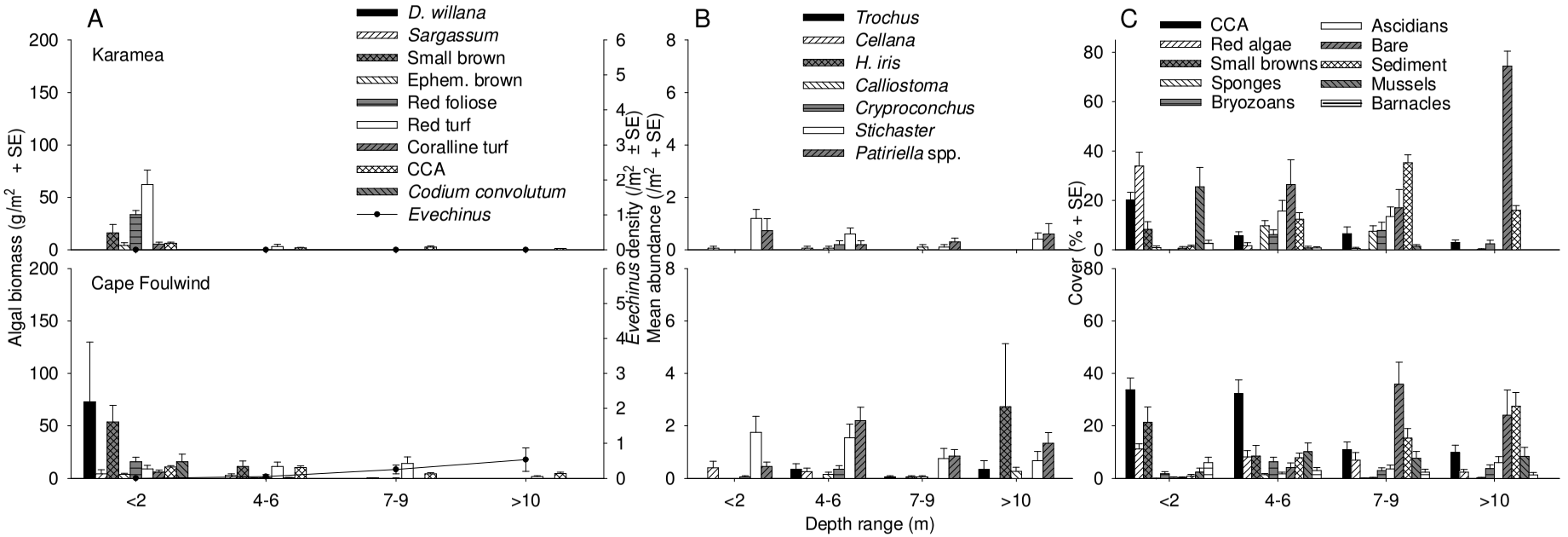

Figure 27. Depth-related patterns in biomass (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for locations within the Buller bioregion.

abundant at Open Bay Islands, and these sites were more closely grouped to Fiordland sites (Fig. 2). There was a strong negative correlation between PC1 and Secchi, which reflected the coastal–offshore gradient between locations (Fig. 28B). Evechinus was also negatively correlated with PC1 owing to its higher abundances at Open Bay Islands. The higher abundances of *Ecklonia radiata*, *Landsburgia quercifolia*, *Carpophyllum flexuosum* and *Sargassum sinclairii* at Open Bay Islands was reflected by their negative correlation with PC1 (Fig. 28C). Red turfing algae and small brown algae were positively correlated with PC1 and these generally were recorded at higher biomasses at the mainland locations. Additional information on the reef communities and habitat types found at these sites is given in Shears (2007).

Open Bay Islands

The organisation of algal assemblages at Open Bay Islands differed considerably from the other highly exposed West Coast locations, with *Ecklonia radiata* and *Landsburgia quercifolia* dominating at shallow depths (Fig. 29A). However, the sites sampled were located in small embayments or areas where there was some shelter from the large southwesterly swell, particularly the NE Taumaka site. *Ecklonia radiata* and *L. quercifolia* had a short (< 50 cm total length), leathery wave-adapted morphology at SE Popotai. *Carpophyllum flexuosum* and *Sargassum sinclairii* were common at 4–6 m,

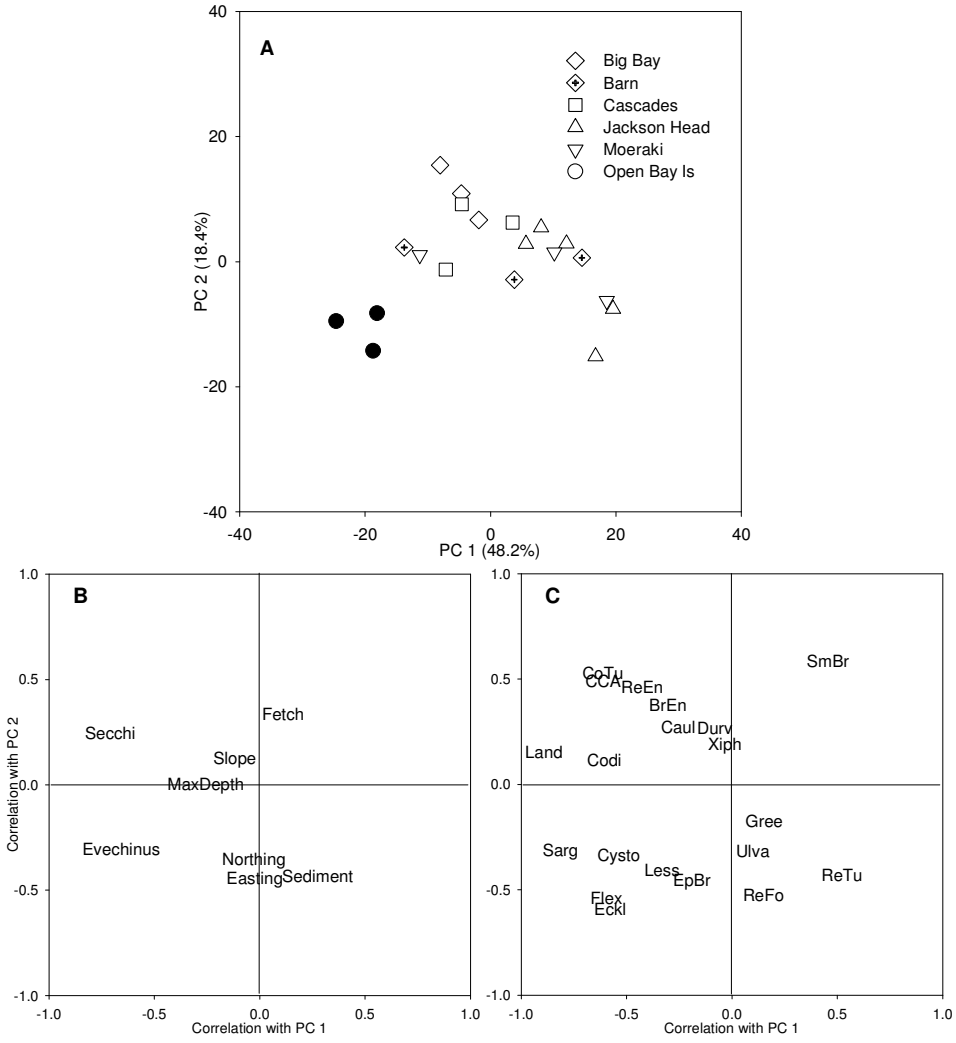

Figure 28. Principal coordinates analysis of Westland sites based on fourth-root transformed biomass of 23 macroalgal groups (A). Bi-plots give correlations between principal coordinates axes and environmental variables (B) and original macroalgal species groups (C) (see Table 1 for macroalgal group codes). Sites shaded according to grouping at the 65% similarity level.

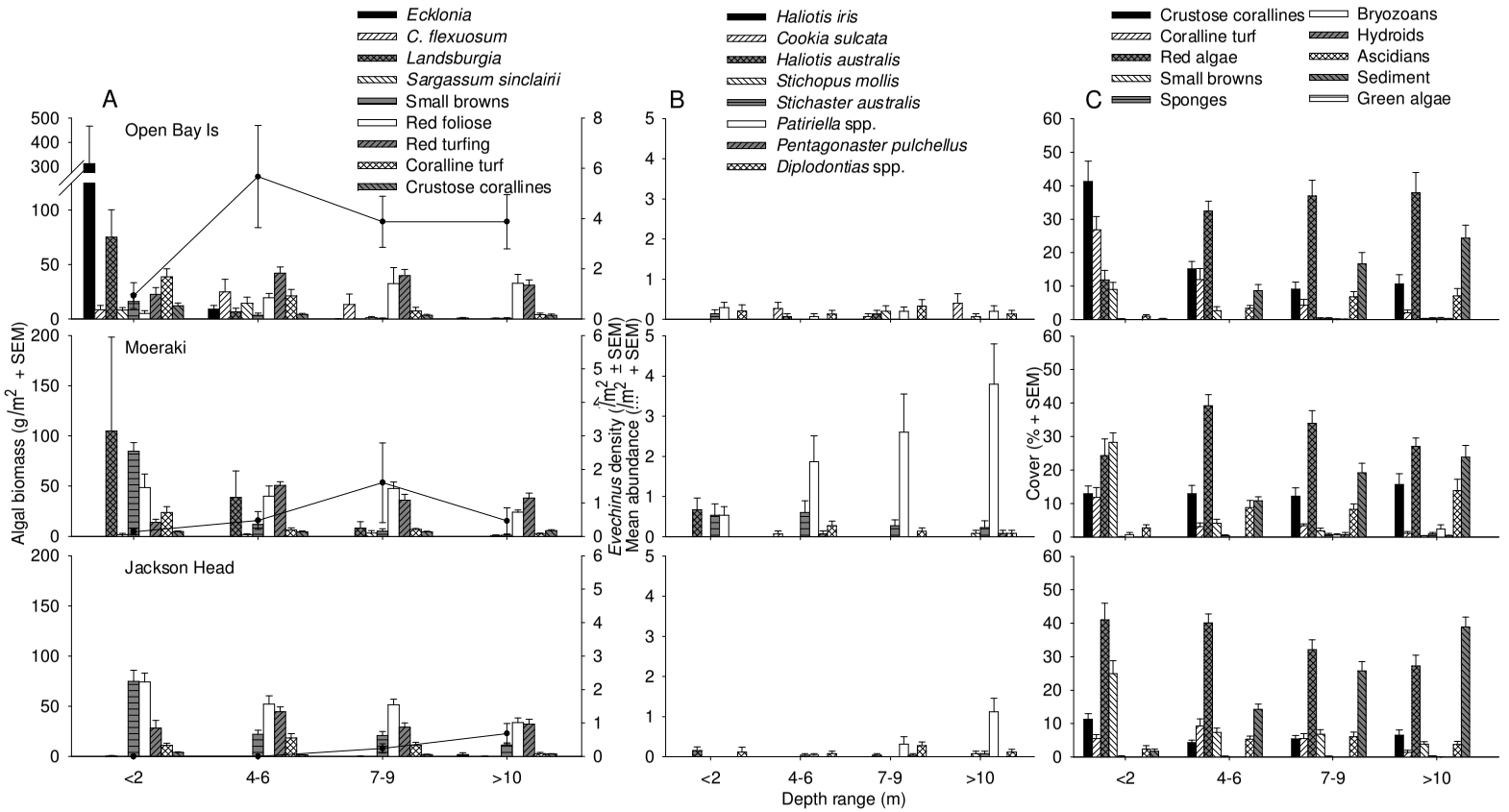

Figure 29. Depth-related patterns in biomass (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for sites at Open Bay Islands, Moeraki and Jackson Head within the Westland bioregion. Note: Open Bay Islands sites were distinct from sites in all other Westland locations at the 65% similarity level (Fig. 28).

red foliose (predominantly *Asparagopsis armata*, *Rhodophyllis gunnii* and *Anotrichium crinitum*) and red turfing algae were abundant at all depths, and *Evechinus chloroticus* occurred in dense patches in the deeper strata (7–9 m and 10–12 m). Mobile macroinvertebrates occurred at low numbers (Fig. 29B), although *Turbo smaragdus* was common in the < 2 m depth stratum at NE Taumaka (2.4 ± 2.2/m^2), suggesting this site is relatively protected from large swells. Numerous *Astrostole scabra* were observed feeding on *E. chloroticus* at 10–12 m. The dominant substratum covers were crustose coralline algae, coralline turf, red algae and, to a lesser extent, small brown algae (predominantly *Microzonia velutina*) at shallow depths, and red algae, ascidians (mostly solitary species) and sediment in the deeper strata (Fig. 29C).

Moeraki and Jackson Head

Depth-related patterns in algal community structure and substratum cover were similar for Moeraki and Jackson Head sites (Fig. 29). Large brown algae were rare (although *Landsburgia quercifolia* and *Sargassum sinclairii* were common at Arnott Point) and the reef was covered by a diverse foliose and turfing algal community (Fig. 29A). The immediate subtidal was dominated by a short algal turf assemblage, predominantly *Echinothamnion* sp., *Lophurella hookeriana*, *Halopteris* sp., with coralline turf, crustose coralline algae and red turfing algae. *Glossophora kunthii*, *Microzonia velutina*, *Plocamium* spp., *Asparagopsis armata*, *Codium convolutum* and *Colpomenia sinuosa* were also common (Appendix 5). At greater depths, the percentage cover of coralline turf declined, and sediment and solitary ascidians covered most of the substratum (Fig. 29C). The dominant red foliose algae were *Plocamium* spp., *Euptilota formosissima*, *Anotrichium crinitum*, *Lophurella hookeriana, Rhodophyllis gunnii* and *Ballia callitrichia*. The small browns *Carpomitra costata*, *Halopteris* spp. and *Microzonia velutina* were common, and *Spatoglossum chapmanii* and a *Dictyota* sp. were also present. Individual *Evechinus chloroticus* were large (> 100 mm TD, Appendix 6) and most abundant in the deeper strata (Fig. 29A). *Patiriella* spp. was the most abundant mobile macroinvertebrate species, particularly at Moeraki sites (Fig. 29B). Other mobile macroinvertebrates occurred at low numbers, e.g. *Stichopus mollis*, *Pentagonaster pulchellus*, *Diplodontias* spp., *Coscinasterias muricata* and *Stichaster australis*.

Cascades, Barn and Big Bay

Algal community structure at these locations was generally similar to that of Moeraki and Jackson Head (Fig. 30A), although *L. quercifolia* and *S. sinclairii* tended to be more common, particularly at Crayfish Rocks (Big Bay). In general, the biomass of *L. quercifolia* tended to be highest at locations with greater water clarity, e.g. Crayfish Rocks and Barn Island. Small brown algae and red foliose algae dominated the < 2 m depth stratum at most sites, while red turfing algae, crustose corallines, coralline turf and sediment dominated at greater depths (Fig. 30B). *Evechinus chloroticus* was most abundant in the deepest strata and formed patches of urchin barrens habitat (areas up to 10–30 m^2) at Crayfish Rocks. A number of algal species were particularly abundant at the Crayfish Rocks site, e.g. *Caulerpa brownii* and *Dictyota* spp. As for Moeraki and Jackson Head sites, *Patiriella* spp. was the most abundant mobile macroinvertebrate, although *Haliotis australis* was common in the < 2 m depth strata at Barn sites, and patches of *Haliotis iris* were recorded in the 7–9 m depth stratum at the Cascades sites (Fig. 30A).

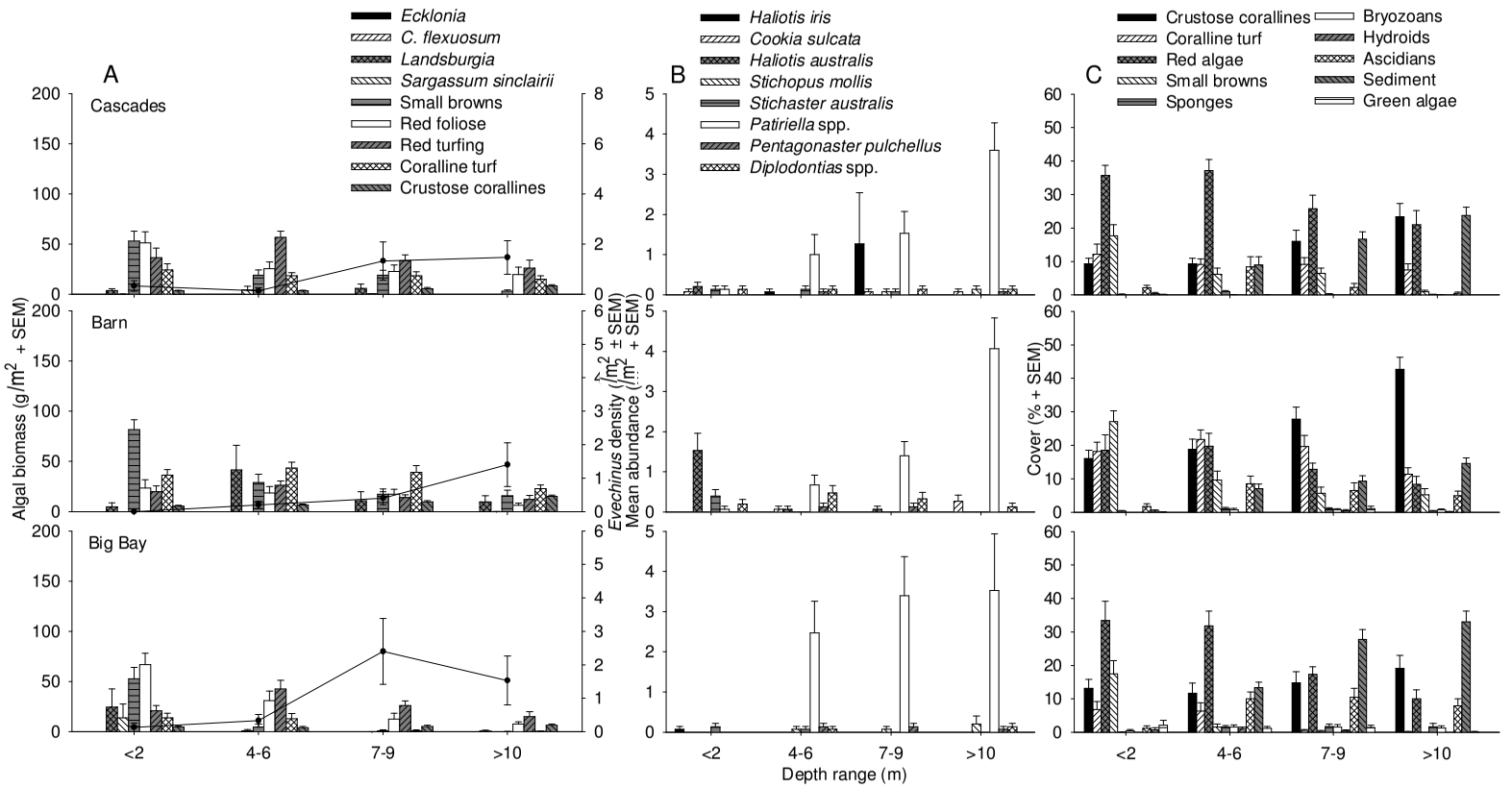

Figure 30. Depth-related patterns in biomass (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for sites at Cascades, Barn and Big Bay within the Westland bioregion.

3.4.9 Chalmers bioregion

Algal community structure at Otago Peninsula and Catlins was distinctive from other locations (Fig. 2), and several large brown algal species common in Southern locations were notably absent, e.g. *Ecklonia radiata*, *Carpophyllum flexuosum*, *Marginariella* spp. and *Macrocystis pyrifera*. All sites sampled in this bioregion were relatively steeply sloping and highly exposed to southerly swells. There was little variation in algal community structure among sites (Fig. 31A) and there were no clear patterns associated with environmental variables (Fig. 31B). The Tuhawaiki site (far left of ordination) had the lowest wave exposure and highest percentage cover by sediment, and had several species that were not found at other sites, e.g. *Caulerpa flexilis*, *Cystophora platylobium*, *Xiphophora gladiata* and *Landsburgia quercifolia*, which were negatively correlated with PC1 (Fig. 31C).

The immediate subtidal (< 2 m) was dominated by a forest of *Durvillaea willana* (Fig. 32A), consisting of plants up to 3 m tall with stipes up to 150 mm in diameter. The forests extended to depths of c. 3 m and had a unique understorey assemblage dominated by mats of *Ballia callitrichia*, coralline turf and crustose coralline algae. Several other red algal species were common in this habitat, including *Camontagnea hirsuta*, *Plocamium cirrhosum*, *Callophyllis calliblepharoides*, *Heterosiphonia concinna*, *Lophurella hookeriana* and *Hymenena durvillaei*.

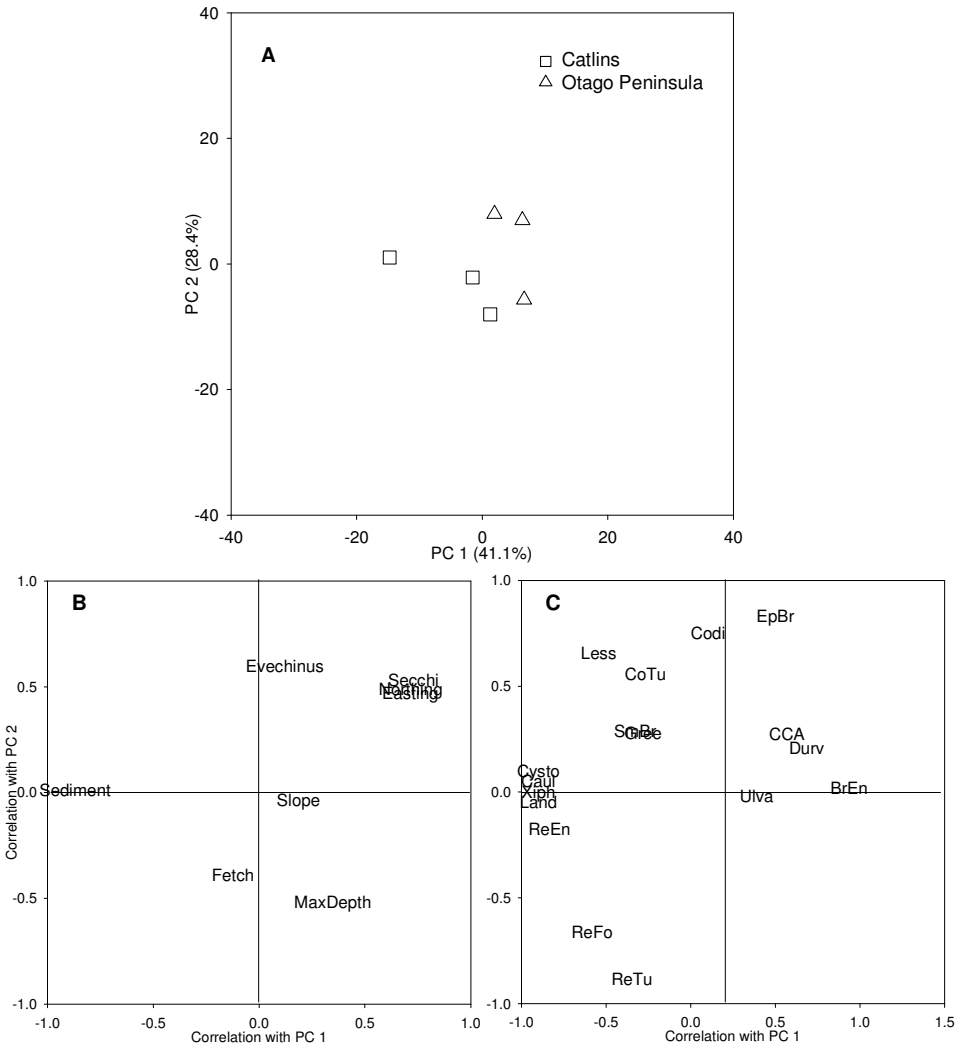

Figure 31. Principal coordinates analysis of sites sampled in the Chalmers bioregion, based on fourth-root transformed biomass of 23 macroalgal groups (A). Bi-plots give correlations between principal coordinates axes and environmental variables (B) and original macroalgal species groups (C) (see Table 1 for macroalgal group codes).

Mussels (predominantly *Perna canaliculus*) were also common in this stratum (Fig. 32C), along with *Haliotis australis* and *Cryptoconchus porosus* (Fig. 32B). At greater depths, *Lessonia variegata* was the dominant large brown alga, and co-occurred with a diverse assemblage of red foliose algal species including *Callophyllis hombroniana*, *C. ornata*, *Cladhymenia oblongifolia*, *Curdiea flabellata*, *Euptilota formosissima*, *Hymenena palmata*, *Laingia hookeri*, *Rhodymenia obtusa*, *Schizoseris dichotoma* and *Streblocladia glomerulata* (Appendix 5: Table A5.2). Very low numbers of *Landsburgia quercifolia* and *Cystophora platylobium* were recorded. Green algae such as *Ulva* spp., *Caulerpa flexilis* and *Cladophora* spp. were occasionally recorded and *Codium convolutum* was common at Otago Peninsula sites. *Evechinus chloroticus* was rare (only one recorded), and other grazing invertebrates including *Haliotis australis*, *H. iris* and *Scutus breviculus* occurred in low numbers (Fig. 32B). *Haliotis australis* was the most common grazing invertebrate, and was found at all depths sampled. Starfishes, including *Pentagonaster pulchellus*, *Diplodontias* spp., *Stichaster australis* and the ophiuroid *Ophiopsammus maculata*, were found at low numbers (< 1/m^2). The percentage cover of crustose coralline algae was relatively low at these locations, with the substratum being covered largely by red algae, sediment and a suite of encrusting invertebrates, in particular sponges, bryozoans and solitary ascidians (Fig. 36C). The percentage cover of red foliose algae tended to be higher at the Catlins, whereas the percentages cover of crustose coralline algae, sponges and ascidians were higher at Otago Peninsula. The ascidian *Pyura pachydermatina* was abundant at depths greater than 4 m.

3.4.10 Fiordland bioregion

Sites from Fiordland locations were divided into four groups at the 70% similarity level (Fig. 33A), although Weka Point (Preservation Inlet) was separated from all other sites at the 55% similarity level. There were no clear differences in algal community structure among Fiordland locations; instead, groupings broadly corresponded to the position of sites in each fiord (outer, mid and inner), which was correlated with Slope, Sediment, Fetch and Evechinus along PC1 (Fig. 33B). Inner-fiord sites were more steeply sloping and had higher percentages cover of sediment, whereas outer-fiord sites had more gradually sloping reefs, and higher wave exposure and abundances of *Evechinus chloroticus. Landsburgia quercifolia*, *Lessonia variegata*, *Xiphophora gladiata* and *Carpophyllum flexuosum* were positively correlated with PC1 and had higher biomasses at outer-fiord sites, whereas *Ecklonia radiata*, *Macrocystis pyrifera*, red foliose algae, *Ulva* spp. and coralline turf were more typical of mid- and inner-fiord sites (Fig. 33C). Weka Point was grouped separately from other Fiordland sites, largely due to low biomasses of all macroalgal groups except *C. flexuosum*.

Bligh Sound

The inner-fiord sites at Bligh Sound had low algal biomass across all depths (Fig. 34A). Coralline turf dominated all depths (Fig. 34A, C). Red turfing algae also dominated the shallow stratum (< 2 m), and *Sargassum sinclairii*, *Cystophora retroflexa*, *Pterocladiella capillacea*, *Adamsiella angustifolia* and *Hormosira banksii* were also present. In the deeper strata, *Ecklonia radiata*, *S. sinclairii*, *C. retroflexa*, *Codium gracile*, *Asparagopsis armata*, *Dictyota papenfussii* and *Caulerpa brownii* were common. *Evechinus chloroticus* was not recorded, and

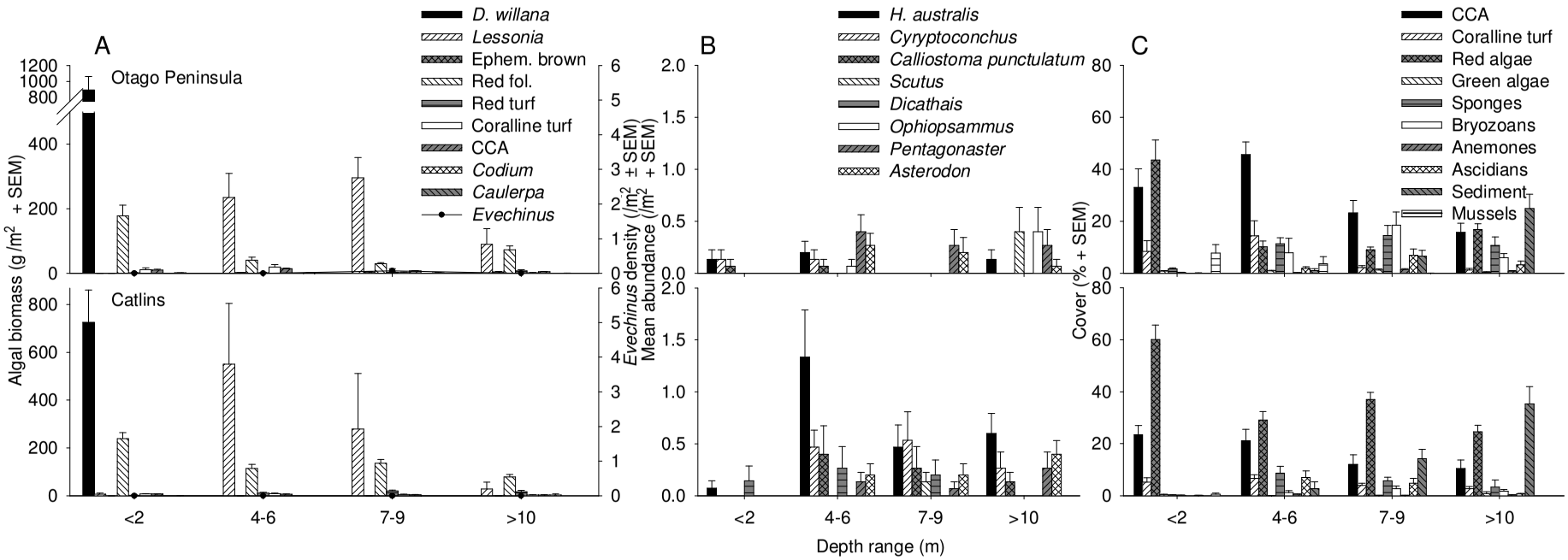

Figure 32. Depth-related patterns in biomass (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for locations within the Chalmers bioregion.

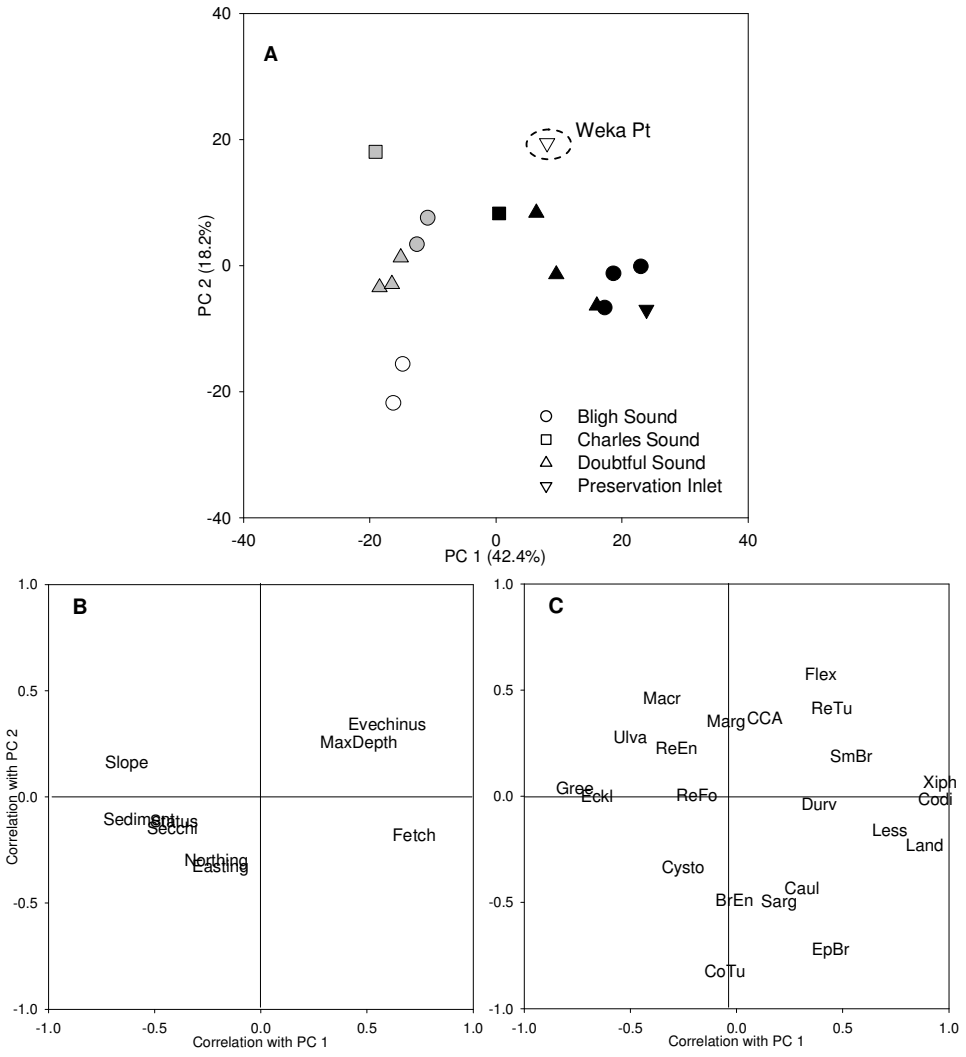

Figure 33. Principal coordinates analysis of sites sampled in the Fiordland bioregion, based on fourth-root transformed biomass of 23 macroalgal groups (A). Bi-plots give correlations between principal coordinates axes and environmental variables (B) and original macroalgal species groups (C) (see Table 1 for macroalgal group codes). Weka Point was distinct from other sites at the 55% similarity level. Remaining sites are shaded according to groupings identified at the 70% similarity level and reflect their relative positions in each fiord. Inner = white, mid = grey, outer = black.

Stichopus mollis was the only common mobile macroinvertebrate (Fig. 34B). Encrusting invertebrates were rare in the shallow stratum, but sponges and ascidians were common in the deepest strata (Fig. 34C).

The mid-fiord sites also had relatively low algal biomass across all depths (Fig. 34A). Large brown algae were rare in the 0–2 m stratum, except for the occasional patch of plants of *Macrocystis pyrifera* ($0.8 \pm 0.5/m^2$), and the substratum was dominated by crustose corallines, coralline turf, red algae (e.g. *P. capillacea*) (Fig. 34C). *Perna canaliculus* also covered a small proportion of the substratum (< 5%). At greater depths, *Ecklonia radiata* and *Carpophyllum flexuosum* formed a sparse assemblage and *Evechinus chloroticus* was present in low numbers. Red foliose algal species were also common in the deeper strata, e.g. *Asparagopsis armata*, *Anotrichium crinitum*, *Plocamium* spp., *Rhodophyllis gunnii* and *Euptilota formosissima*. The green algae *Codium gracile* and *Caulerpa brownii*, and the small brown algae *Zonaria* spp. and *Halopteris* sp., were also common. *Marginariella urvilliana* occurred at low numbers at 10–12 m and had a distinct sheltered morphology, with broad fronds (Adams 1994). Coralline turf, red foliose algae and sediment dominated the substratum in the

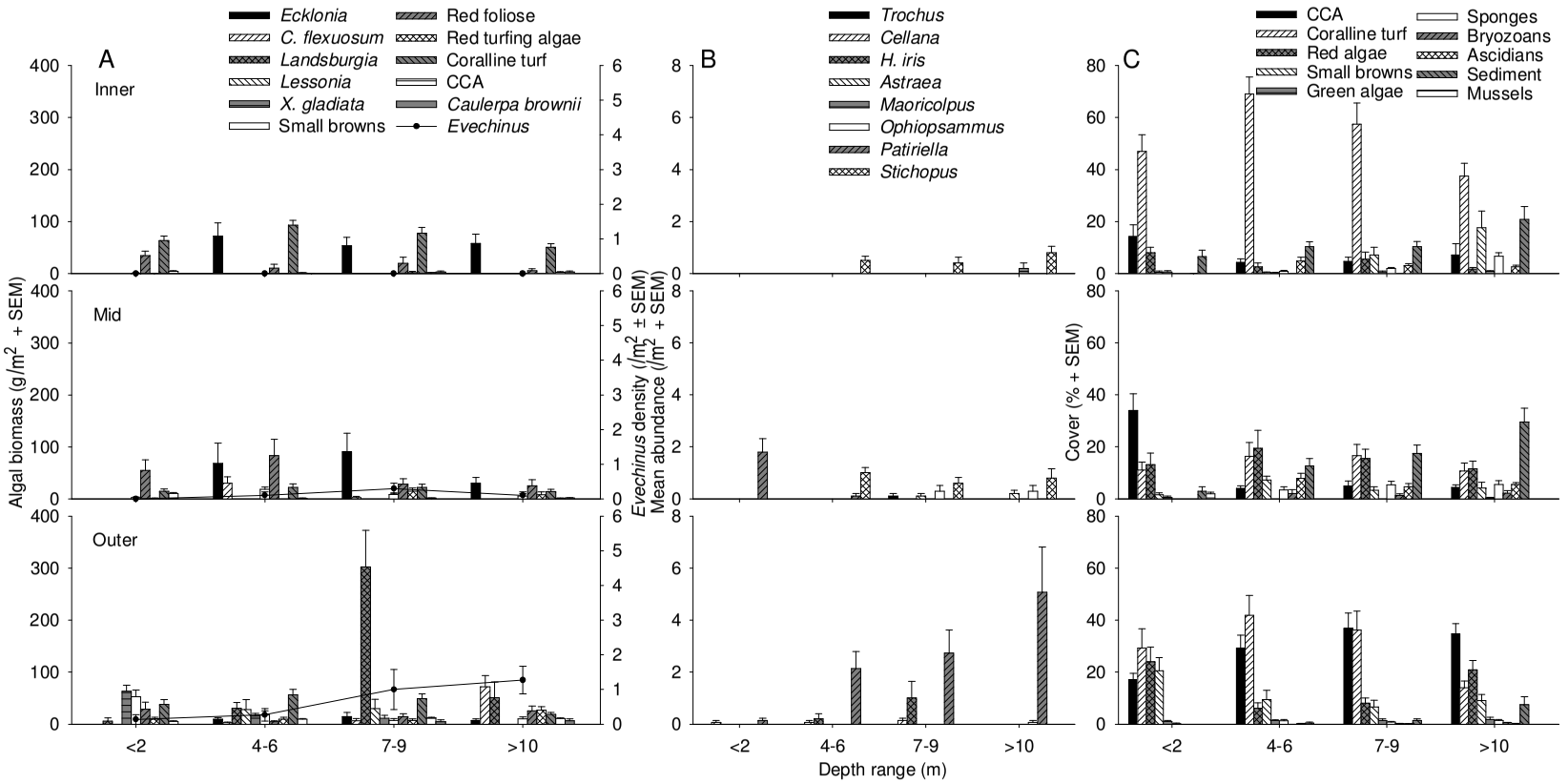

Figure 34. Depth-related patterns in biomass of (g AFDW/m^2) of dominant macroalgal groups and density of *Evechinus chloroticus* (A), density of common mobile invertebrates (B) and cover of common encrusting forms (C) for site groups at Bligh Sound within the Fiordland bioregion.

deepest strata, although sponges, ascidians and bryozoans were also common (Fig. 34C). *Patiriella* spp. occurred at shallow depths, whereas *Stichopus mollis* and *Ophiopsammus maculata* were common in the deeper strata (Fig. 34B).

The outer, coastal sites at Bligh Sound had extensive stands of large *Xiphophora gladiata* (up to 80 cm total length) in the shallow stratum and extending down to c. 4 m depth (Fig. 34A). *Durvillaea willana* was also present in low numbers in the immediate subtidal, along with a variety of red turfing and smaller brown algal species (e.g. *Camontagnea hirsuta*, *Lophurella hookeriana*, *Plocamium* spp., *Halopteris* sp., *Colpomenia sinuosa*, *Microzonia velutina* and *Glossophora kunthii*). At 4–6 m, *X. gladiata* was interspersed with *Lessonia variegata*, *Landsburgia quercifolia*, *Ecklonia radiata*, red foliose algae (e.g. *Asparagopsis armata*, *Plocamium* spp., *R. gunnii*), small brown algae (e.g. *Halopteris* sp., *Dictyota papenfussii*, *Carpomitra costata*, *Zonaria* spp.), green algae (*Caulerpa brownii*, *Codium convolutum*) and coralline turf. The morphology of *E. radiata* was characteristic of highly wave exposed sites, having short stipes and long primary laminae. *Landsburgia quercifolia* dominated at 7–9 m and co-occurred with short *Carpophyllum flexuosum* plants (< 50 cm total length) at 10–12 m. The substratum was dominated by crustose corallines, coralline turf, red algae, small brown algae and the green alga *Caulerpa brownii* (Fig. 34C). Encrusting invertebrates and sediment covered a small proportion of the reef (< 1%). Individual *Evechinus chloroticus* were large and they increased in abundance with depth, typically being found around the base of large boulders or rocky outcrops. *Haliotis iris* also occurred in isolated patches at some sites (Fig. 34B). *Patiriella* spp. was the most common mobile invertebrate and its abundance also increased with depth.

Charles Sound

At the mid-fiord site (Charles inner), large brown algae were absent from the shallow stratum and a mixture of red (*Gigartina livida*, *Polysiphonia* spp., *Pterocladiella capillacea*) and green (*Ulva* spp., *Cladophora* sp.) algae dominated (Fig. 35A). Mussels (*Mytilus* sp.) were also recorded in this stratum, but they covered only a small proportion of the reef (< 5%). At 4–6 m, crustose coralline algae and coralline turf dominated, with small amounts of *Ecklonia radiata*, *Carpophyllum flexuosum* and *Macrocystis pyrifera* present. In the deeper strata (7–9 m and 10–12 m), *E. radiata* dominated. Plants of *E. radiata* were large (up to 100 cm total length) and they resembled a forest more typical of Northern locations. Crustose coralline algae were the dominant substratum cover in the deeper strata, and sponges, bryozoans and ascidians covered a small percentage of the substratum (Fig. 35A). Mobile macroinvertebrates were absent from the shallow stratum, but at greater depths *Trochus viridis*, *Astraea heliotropium* and *Stichopus mollis* were common (Fig. 35C). At the outer Charles Sound site (Charles outer), *Durvillaea willana* and *Xiphophora gladiata* dominated the 0–2 m depth stratum (Fig. 35A). Crustose corallines were the dominant cover beneath the *D. willana*, and *Ballia callitrichia*, *Camontagnea hirsuta* and *Ulva* spp. were also common. *Ecklonia radiata* and *Carpophyllum flexuosum* were the dominant large brown algal species at greater depths, forming a sparse assemblage interspersed with *Caulerpa brownii* and red foliose algal species (e.g. *Euptilota formosissima*, *Rhodymenia* sp., *Plocamium* spp., *Rhodophyllis gunnii*, *Asparagopsis armata*). *Marginariella urvilliana* was also common at

4–6 m. The substratum in the deepest strata was covered by a mixture of crustose corallines, coralline turf, red algae, sponges, ascidians, bryozoans and sediment (Fig. 35C). *Patiriella* spp. was the only commonly recorded mobile invertebrate species across all depths (Fig. 35B).

Doubtful Sound

Three sites were sampled in outer Doubtful Sound, and three in the mid-fiord area at the intersection between Thompson and Doubtful Sounds. At mid-fiord sites, the shallow zone was comparable to the mid-fiord site in Charles Sound, with an absence of large brown algae, a dominance of red foliose algae (*Polysiphonia* spp., *Gigartina* spp., *Gracilaria chilensis*, *Delisea elegans*), and green algae (*Chaetomorpha aerea*, *Cladophora* spp., *Ulva* spp.) (Fig. 35A). However, barnacles and mussels (*Perna canaliculus* and *Mytilus* sp.) were also dominant in this depth stratum (5–50% cover). *Evechinus chloroticus* was absent from the shallow stratum, but most abundant at 4–6 m, where large brown algae were rare and the substratum was dominated by crustose corallines, coralline turf, red foliose algae and sediment (Fig. 35C). *Ecklonia radiata* was the dominant large brown algae at greater depths (7–9 m and 10–12 m), but was generally sparse, and coralline turf and red foliose algae (e.g. *Euptilota formosisssima*, *Rhodymenia* sp., *Plocamium* spp., *Rhodophyllis gunnii* and *Asparagopsis armata*) dominated. *Carpophyllum flexuosum*, *Marginariella urvilliana* (sheltered morphology) and *Sargassum verruculosum* were also present in low densities in the deeper strata. The substratum was dominated by a red foliose algal mat, coralline turf and sediment, with a low percentage cover of sponges and ascidians (Fig. 39C). *Patiriella* spp. was common in the shallow stratum, but rarer at greater depths, where *Stichopus mollis* tended to be more common (Fig. 35B). Herbivorous gastropods were rare.

At sites located at the entrance of Doubtful Sound, the algal communities at all depths were characterised by a mixture of large brown algae, red foliose algae and green algae (Fig. 35A). The algal assemblages in the shallow stratum were similar to those of the outer Bligh Sound sites, with *Xiphophora gladiata* and *Glossophora kunthii* being abundant, along with coralline turf and several short turfing algal species (e.g. *Halopteris* sp. (probably *H. congesta*), *Microzonia velutina*, *Lophurella hookeriana*). *Lessonia variegata* and *Landsburgia quercifolia* were also common in the shallow stratum at some of the outer sound sites. *Lessonia variegata* was most common in the 4–6 m stratum, whereas *Landsburgia quercifolia* and *Carpophyllum flexuosum* were common at all depths excluding the 0–2 m stratum. *Ecklonia radiata* occurred in low numbers at all depths but was most abundant in the deepest stratum. Red foliose algae such as *Euptilota formosissima*, *Plocamium* spp., *Rhodophyllis gunnii*, *Anotrichium crinitum* and *Delisea elegans* were common at all depths, whereas *Caulerpa brownii* was most abundant at 10–12 m. *Evechinus chloroticus* occurred in dense patches in the 4–6 m and 7–9 m depth strata. Mobile macroinvertebrates were rare except for *Patiriella* spp. and *Ophiopsammus maculata* (Fig. 35B). The percentage cover of sponges and bryozoans tended to increase with depth, whereas the cover of coralline turf declined with depth (Fig. 35C).

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