

3.3.7 Biodiversity of Marine Fauna on the Central West Coast

Investigators / Institutions

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Executive Summary

This study was designed to document marine fauna of the Central West Coast. It will provide quantitative information on the proportion of tropical, temperate and Western Australian endemic species of corals, crustaceans, echinoderms, fishes, molluscs and sponges occurring in this biogeographic overlap zone.

The first fieldwork component of the study at Jurien Bay and Green Head was completed in April-May 2005. The second fieldwork component, at Cervantes and Dongara, was undertaken in March 2006.

All specimens from the first field trip have been fine sorted to species level for identification. Echinoderm and fish identifications have been completed while some of the crustaceans, mollusc and sponges are still to be identified. Corals will be identified during 2006.

So far 96 fish species, 54 echinoderm species, 74 mollusc species, 25 crustacean species and 132 sponge species have been documented in this study. Four species of the isopod family Sphaeromatidae collected in this study are new records for Western Australia. Extended species ranges have been determined for nine species of echinoderms found in the area: seven northwards from the Fremantle – Rottnest area and two southwards from Dongara and Shark Bay.

The preliminary results from this study suggest a greater incidence of temperate species of fishes, molluscs, echinoderms and crustaceans in the Jurien Bay and Green Head area, confirming the dominance of temperate species in this region. Preliminary results from mollusc and echinoderm identifications show 20% and 32% of the species respectively are west coast endemics.

Fewer echinoderm species were found in the Jurien Bay and Green Head area (54 species) than in Albany (81 species) or at Rottnest Island (86 species). It may be that species of this phylum are in low numbers in this area for biological or physical reasons. Alternatively, the sampling methods may not have detected all species present. No sand habitats were sampled in this study which may have contributed to the lower species numbers. Future analyses of the data may assist with explaining this result.

A comprehensive voucher collection of identified species has been entered into the WA Museum collections database and lodged in the Museum collections.

Introduction

This study is part of a larger program to investigate ecological interactions of the coastal marine communities in the Central West Coast region of Western Australia. The focus of the Western Australian Museum (WAM) is on documentation of the fauna of the region and specifically to examine the diversity of fishes, molluscs, crustaceans, echinoderms, scleractinian corals and sponges. The WAM also contributes to identification of other significant space-occupying taxa such as ascidians, soft corals, zoanthids and anemones.

In addition to characterising habitats and identifying community biodiversity, the results obtained in this study will contribute to the program by providing data on major predators and biota associated with trophic linkages.

The methodology used in the fieldwork program also provides a basis for detecting longer term changes in the benthic communities of the region. This study will make a significant contribution to determining baseline variability in a warm temperate marine ecosystem in WA by establishing a baseline data set for comparative studies in the future.

The Central West Coast region is considered to lie in a biogeographic overlap zone that has a mixture of tropical, temperate and west coast endemic biota. Little is known about the relative proportions of these biota, but preliminary evidence suggests that temperate species dominate with a smaller proportion of tropical species and endemics. No quantitative studies have examined this question until this study which will provide new information into the abundance of species as well as their distributions, and the proportions of the biota that are tropical, temperate or endemic to the west coast.

Aims and Objectives

- To investigate benthic community biodiversity on the Central West Coast of Australia.
- Quantitatively document the fishes, molluscs, crustaceans, echinoderms, scleractinian corals and sponges of the region.
- Determine if the biota present in the Jurien Bay Marine Park is representative of the region.
- Determine the proportions of tropical, temperate and endemic biota in the region.

Methods

Four locations were selected for study, Jurien Bay and Green Head (with a focus on the Jurien Bay Marine Park), Cervantes (in the south of the Marine Park), and Dongara (north of the Marine Park). These latter two localities provide a latitudinal component to the study, testing the hypothesis that the faunal biodiversity of Jurien Marine Park is representative of adjacent areas in the Central West Coast region of WA.

Fieldwork conducted in April and May 2005 was in the Jurien Bay and Green Head areas, and was undertaken jointly with a team of CSIRO scientists led by Dr. Russ Babcock. Fieldwork in Cervantes and Dongara will be undertaken in March 2006.

Preliminary discussions with CSIRO, Murdoch and ECU collaborators determined that sampling should be undertaken on a range of sampling scales, i.e. 0.25m², 1m², 5m² and 250m². Two dominant habitats of the region would be sampled, namely limestone reefs and seagrasses. Although sand habitat is also represented in the region, fieldwork logistics and time constraints did not allow for this habitat to be sampled.

The sampling design also had a cross-shelf (distance from shore) component with inshore, midshore and offshore (exposed and sheltered) reefs sampled.

Within sites, dominant cover was recorded and targeted sampling ensured that various covers were sampled. For example at some reef sites *Sargassum* and red foliose algae occurred adjacent to *Ecklonia* dominated areas. In this case quadrats and transects were located in both floral areas. Seagrass habitats either had beds of *Amphibolis* or *Posidonia* and both types of seagrass were sampled for faunal biodiversity.

A summary of the sampling procedure is presented in Table 3.6.

Fish were surveyed by two additional methods. Trawling was undertaken in a seagrass habitat to collect cryptic fishes, and a reef site was selected as a rotenone station, to assess fish diversity not detected in visual census transects. Small cryptic fishes discovered incidentally during sorting of the quadrat material were also recorded, as were several species opportunistically observed while swimming between transects, or while assisting with other activities.

A total of 16 sites were examined at Jurien Bay and Green Head (Figure 3.42 & 3.43a,b).

Table 3.6. Fieldwork sampling program for reef and seagrass habitats at Jurien Bay and Green Head.

Taxon	Sampling scale			
	0.25m ² quadrat	1m ² quadrat	5m ² transect	250m ² transect
	Replication			
	n = 5	n = 5	n = 3	n = 3
Algae	CSIRO Harvest quadrat			
Crustaceans	CSIRO/WAM Sieved from harvested algae and rock		WAM Crustacea larger than 1cm collected for ID	
Molluscs	CSIRO/WAM Sieved from harvested algae and rock	CSIRO Molluscs larger than 1cm counted and measured <i>in situ</i>	WAM Molluscs larger than 1cm collected for ID	
Sponges	CSIRO/WAM Photographed then harvested from quadrat		WAM Sponges larger than 1cm counted, measured <i>in situ</i> and collected for ID	
Echinoderms	CSIRO/WAM Sieved from harvested algae and rock	CSIRO Echinoderms larger than 1cm counted and measured <i>in situ</i>	WAM Echinoderms larger than 1cm counted, measured <i>in situ</i> and collected for ID	
Ascidians	CSIRO Harvested from quadrat	CSIRO Ascidians larger than 1cm counted and measured <i>in situ</i>		
Corals		CSIRO Small corals e.g. <i>Plesiastrea</i> counted <i>in situ</i>	WAM Corals larger than 1cm counted and measured <i>in situ</i> , and collected for ID	
Fish				WAM Visual census
Habitat				WAM 25m ² Video transect

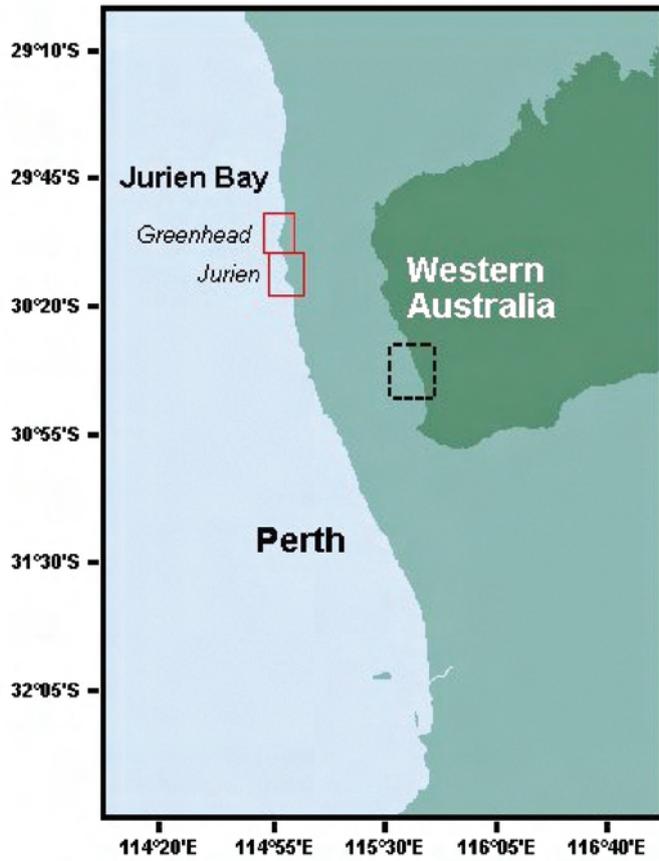


Figure 3.42: Map of Jurien Bay region

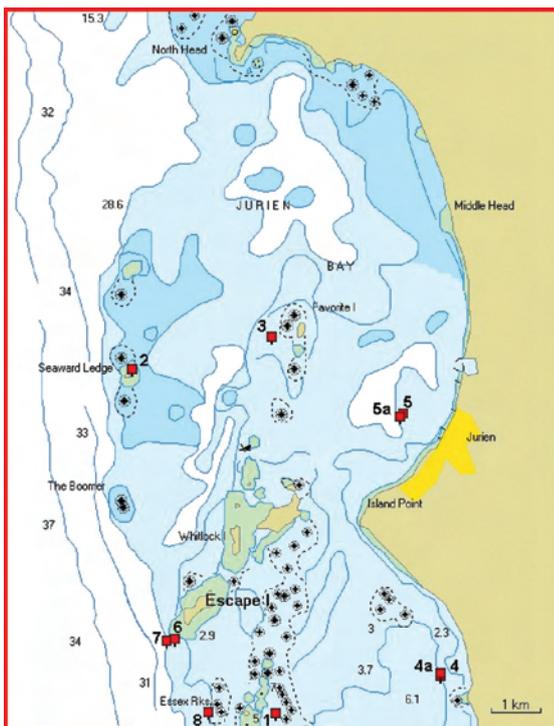


Figure 3.43a: Map of Jurien sites sampled.

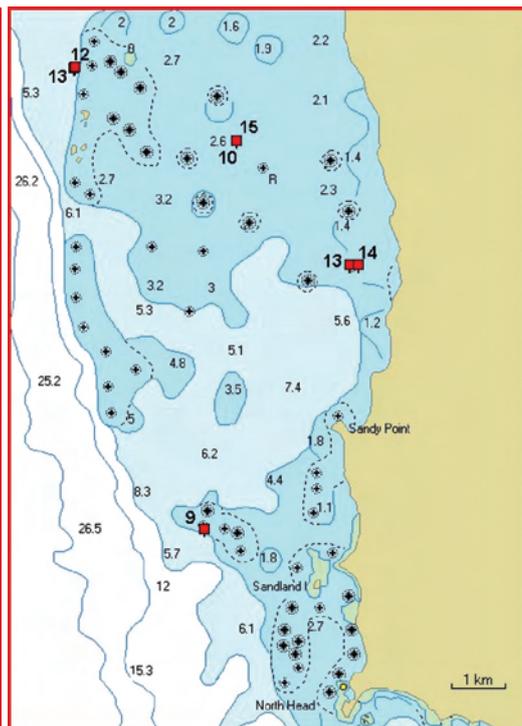


Figure 3.43b: Map of Green Head sites sampled.

Results

Full species lists for the study to date are available in:

Fromont, J., Marsh, L., Moore, G., Salotti, M., M Titelius, M., Whisson, C. (2005). Biodiversity of Marine Fauna on the Central West Coast. Second Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 46pp.

Crustaceans

A total of 25 crustacean species (excluding Amphipoda) have been identified to date, with the isopods being the most diverse (12 of the 25 species). The majority of the isopods (eight species) belong to the family Sphaeromatidae. The other two isopod families recorded, Paranthuridae and Stenetriidae, had relatively fewer species (one and three, respectively). The sponge-associated isopod *Amphoroidella elliptica* (Sphaeromatidae) was the most widespread species in the collections, occurring at five of the 16 stations sampled. The stenetriid isopod *Stenetrium* sp.1 occurred at four stations.

The order Decapoda were only slightly less diverse than the isopods, with 11 species recorded from eight families: Alpheidae, Porcellanidae, Diogenidae, Dromiidae, Majidae, Hymenosomatidae, Pilumnidae and the Trapeziidae. Only the alpheids had more than one species (four). Decapod species were not widespread, with only the porcellanid crab, *Ancylocheles gravelei*, recorded at three sites. The remaining 10 species were found at two or fewer sites.

A single species of barnacle, *Acasta* sp. (Order Sessilia: Family Archaeobalanidae) was recorded from a sponge taken from south west of Escape Island (JWAM 6) and one specimen of an unidentified mysid shrimp, Mysid sp.1 (Order Mysida) was collected from Booker Rocks (JWAM 4a).

The highest diversity of crustaceans, measured by number of species, was recorded at Booker Rocks (JWAM 4a, eight species) and inside Favourite Is. (JWAM 3, six species). Eight stations had two or less species.

Distributions are known for 17 of the identified crustacean species and 11 of these (65%) have southern distributions, four have west coast distributions (24%), and two species have a northern distribution (12%). Four new records for Western Australia have resulted for the isopod family Sphaeromatidae: *Amphoroidella elliptica*, *Cymodoce septemdentata*, *Haswellia glauerti* and *Pseudocerceis trilobite*. The single specimen of *Oxinosphaera australis* in these collections extends the range of this species north from Cottesloe, WA.

The crustaceans reported here are largely the result of incidental collection off, or in, the various sessile benthic invertebrates sampled from the transect lines and many are known associates of sponges. The sphaeromatid isopod, *Amphoroidella elliptica*, is found on the surface of sponges (Hale, 1929) and the two species of *Oxinosphaera* (Sphaeromatidae) burrow holes into sponges in which they live (Christine Hass pers. com.). Similarly, the barnacle genus *Acasta* is only found embedded in the tissue of sponges. While the alpheid shrimp are not fully identified at present, many members of the genus are known to live in association with sponges, even utilising the internal canals (Poore, 2004).

The decapod species *Halicarcinus ovatus* (Hymenosomatidae), *Pilumnus rufopunctatus* (Pilumnidae), *Fultodromia spinifera* (Dromiidae) and *Calcinus dapsiles* (Diogenidae) have been recorded from a variety of habitats including sheltering in sponges, ascidians and other sedentary marine invertebrates (Hale, 1927; Davie, 2002; Poore, 2004).

Echinoderms

Overall the species richness of echinoderms was low given the intensity of sampling. There was a total of 54 species of echinoderms: five crinoids of three families, 10 asteroids of five

families, 25 ophiuroids of seven families, nine echinoids of five families and five species of holothurians from four families.

Nine species records extend current known distributional ranges: seven northwards, mostly from the Fremantle-Rottnest area, and two southwards, one from Dongara and the other from Shark Bay.

Crinoidea: In this study the family Comasteridae, (which has several tropical and temperate species in south-western Australia and usually predominates in samples) is represented only by *Comatulella brachiolata*, not previously recorded north of the Fremantle area. Three species of the family Antedonidae and one of the family Aporometridae were found. The latter species, *Aporometra occidentalis* has not previously been recorded north of the Perth metropolitan area and is endemic to southern and south-west Australia.

Asteroidea: This class was represented by south-west Australian species. One asteriid, *Uniophora dyscrita*, has not previously been found north of Lancelin. The remainder were species expected from the Central West Coast. Three were south-west endemic species.

Ophiuroidea: Brittle stars were the most speciose echinoderm group collected, partly due to the sampling methods which facilitated the extraction of small species from samples of rock, algae and sponges. Those collected in this study consisted of 11 northern, four southern, three south-west endemics, one circum-Australian and one cosmopolitan species. One tropical species has had a small range extension southwards, (from Dongara to Jurien) while another tentatively identified species, has not previously been found south of Shark Bay. Of interest was the collection of *Amphiura ptena*, a west coast endemic species which has rarely been collected previously.

Echinoidea: Sea urchins were represented by many small juvenile specimens that are difficult to identify with certainty as they have not developed adult characters. Two species have southern Australian distributions, one is a tropical species of sand dollar (*Peronella lesueurii*) which extends to the south coast of W.A., and five are south-west Australian endemic species. One small specimen was tentatively identified as *Pseudechinus hesperus*, previously only known from Rottnest Island. A large number of juveniles were tentatively identified as *Temnopleurus michaelsoni* but no adults were found. This species has not been recorded north of Fremantle. The most common species, found at eight sites, was *Holopneustes porosissimus* and 61 of these were juveniles.

Holothuroidea: All but one of the sea cucumbers were either juveniles or very small species, with *Holothuria hartmeyeri* only represented by juveniles. One species, *Stichopus mollis*, is a widespread southern species; the remainder are endemic to the south-west, two extending to South Australia. The range of *Australocnus occiduus* is extended northwards from Rottnest Island to Jurien, *Trachythyone glebosa* has not previously been recorded on the west coast and its distributional range is now extended from Albany to Jurien. A specimen of *Taeniogyrus* was tentatively identified as *T. heterosigmus* which has only previously been recorded from Bunbury.

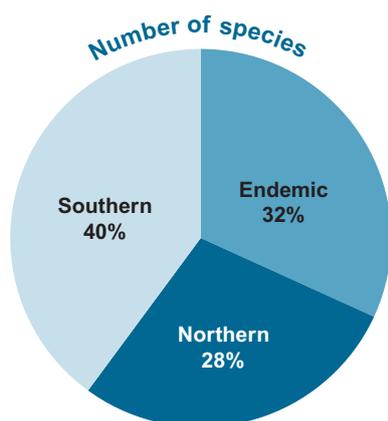


Figure 3.44: Preliminary affinities of the Jurien echinoderm fauna, based on number of species of tropical, temperate and endemic species.

The 54 species of echinoderms collected in this study was fewer than from other localities studied in south-west Australia: Albany (83 species; Marsh, 1991); Rottnest Island (86 species; Marsh and Pawson, 1993) and the Houtman Abrolhos, where the influence of the Leeuwin Current is more pronounced and tropical species predominate, where 172 species were recorded (Marsh, 1994).

Fishes

A total of 76 species of fishes (~4500 individuals) were recorded during the visual censuses. A further 20 species were added from opportunistic sightings and the trawl, rotenone and quadrat collections. The community was dominated by the wrasse *Coris auricularis*, which accounted for more than 35% of all individuals observed, and occurred at every site.

Warm-temperate species were dominant, although sub-tropical fish were numerically the most abundant (Figure 3.45). A component of the community was tropical in origin.

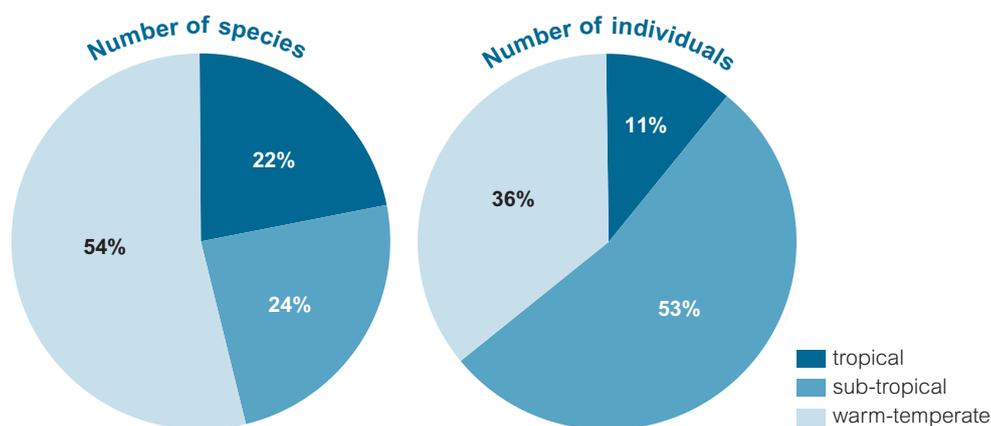


Figure 3.45: Composition of Jurien fish community, based on number of species and number of individuals. Distribution classifications after Hutchins (1994).

There was considerable variation in species richness between sites of the same habitat, but reefs were consistently more diverse than seagrass, and reef habitats maintained much higher population densities than seagrass habitats (Table 3.7).

Table 3.7. Summary of species richness and number of individuals for each site in the two major habitat groupings at Jurien.

	Seagrass		Reef	
	Mean	Range	Mean	Range
Species	10	4 – 15	22	13 – 28
Individuals	55	14 – 123	353	122 – 608

Inshore reefs (Sites 4, 5 and 13) had the greatest fish diversity and maintained the most individuals (Figure 3.46). Midshore and offshore reefs were similar in both number of species and individuals. Analysis of Similarity detected a significant difference between sites based on gradient from shore (ANOSIM (in vs. mid vs. off); $R = 0.225$; $p = 0.048$).

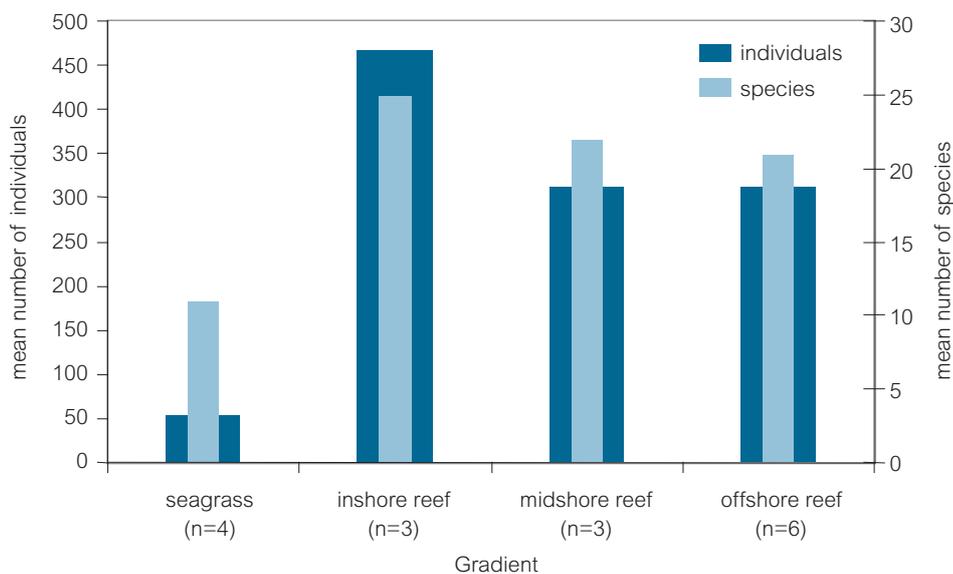


Figure 3.46: Species richness and number of individuals for each habitat (reefs as gradient from shore) at Jurien.

Similarity Percentage analysis using species abundance data indicates that several species can be considered typical of reef or seagrass habitats and contribute most towards the 'similarity' within each main habitat. Additionally, a set of species account for the detected 'dissimilarity' between the two habitat types (Table 3.8).

Table 3.8. Similarity Percentage analysis using species abundance data from the two major habitat groupings at Jurien. Listed are the five most important representative species for each habitat and the percentage each contributes to the similarity coefficient. Also listed are the five most important representative species to differentiate the habitats and the percentage each contributes to the dissimilarity coefficient.

Similarity (seagrass)		Similarity (reef)		Dissimilarity (seagrass/reef)	
Species	%	Species	%	Species	%
<i>Halichoeres browfieldi</i>	40	<i>Coris auricularis</i>	60	<i>Coris auricularis</i>	34
<i>Coris auricularis</i>	31	<i>Parma mccullochi</i>	8	<i>Parma mccullochi</i>	6
<i>Notolabrus parilus</i>	11	<i>Notolabrus parilus</i>	7	<i>Pomacentrus milleri</i>	6
<i>Apogon victoriae</i>	4	<i>Kyphosus cornelii</i>	4	<i>Apogon victoriae</i>	5
<i>Pentapodus vitta</i>	4	<i>Pomacentrus milleri</i>	3	<i>Kyphosus cornelii</i>	5

Molluscs

A total of 74 mollusc species have so far been recorded in this study, with 52 species being live-taken macro-molluscs. The remaining 22 species were micro-molluscs or freshly dead-taken. Of the 45 identified to species level, 16 were tropical (36%) and 20 were warm temperate (44%). Nine species were endemic to Western Australia (20%).

There was a notable high diversity of the gastropod families Columbellidae, Turbinidae and Trochidae. Together these families account for 26% of species recorded thus far and these appear to be widespread. *Pyrene bidentata* (Menke, 1843) has so far been found at 8 sites, *Astrarium tentorium* (Thiele, 1930) at 7 sites, and *Cantharidus lehmanni* (Menke, 1843) at 5 sites in the study area.

Porifera

So far 132 species of sponges have been identified. A reasonable proportion of these species belong to the Class Calcarea (23 species) while the remainder belong to the Class Demospongiae (109 species). The demosponges are the primary component of shallow water marine sponge faunas worldwide.

Only 12 of the 132 species could be readily given a species name and the distribution of two others (*Chondrilla* sp. 2 and *Chondrilla* sp. 3) is well known from other studies (Usher *et al.*, 2004). Of these 14 species, 6 are temperate, 5 are widespread and occur in temperate and tropical habitats, 1 is tropical and 2 are west coast endemic species. Only with further identification of species will a biogeographic analysis of the sponges of this region be possible.

The four most speciose sponge orders found to date are the Poecilosclerida (36 species), Dictyoceratida (22 species), Haplosclerida (22 species) and Halichondrida (12 species). All but the Dictyoceratida have a strong mineral component to the skeleton, with large numbers of spicules of silica dioxide often supplemented by spongin fibre. The Dictyoceratida lack spicules, have a dominant fibre skeleton (bath sponges occur in this order) and accrete sandgrains and spicules from the environment to supplement their skeletons to varying degrees.

The highest sponge diversity to date has been found around Essex Rocks and Escape Island, with site JWAM 6 (south west of Escape Island) being most diverse with 30 species recorded on the three 5m² transects. Sites JWAM 1 at North Essex and JWAM 8 at Essex Rocks were also diverse with 22 and 21 species recorded respectively. Lowest diversity was at site JWAM 2 on Seaward Ledge where no sponges were found on the transects.

Discussion

The Central West Coast region of Western Australia is considered to lie in a biogeographical overlap zone that has a mixture of tropical, temperate and endemic biota. Few studies have been undertaken in this region that combine detailed taxonomic inventories with quantitative assessment of species distribution and abundance.

At this stage of the project some phyla have been completely identified (fishes and echinoderms) while other target phyla have had varying proportions of the collected material identified (crustaceans, molluscs and sponges). Scleractinian corals and zoanthids still need to be identified.

Preliminary results from the identification of crustacean (65%) and mollusc (44%) specimens suggest the shallow water marine fauna of the region has a greater component of temperate than tropical species. The mollusc and echinoderm faunas also had a notable number of west coast endemic species (20% and 32% respectively). This dominance of temperate species is supported by the results of the fish component of the study, with 54% of fishes being warm temperate and 46% subtropical or tropical in origin.

So far 96 fish species, 54 echinoderm species, 74 mollusc species, 25 crustacean species and 132 sponge species have been identified. The number of fish species found in this study fall in the anticipated range for the area, taking into account the sampling methods used did not target cryptic species. However the 62 echinoderm species was lower than expected.

Four species of the isopod family Sphaeromatidae collected in this study are new records for Western Australia. Extended species ranges were established for nine species of echinoderms; seven northwards from the Fremantle – Rottneest area and two southwards from Dongara and Shark Bay.

Of the 96 fish species recorded in this study, 20 were collected using methods that target cryptic species (rotenone, trawl, quadrat and opportunistic sightings) not normally seen using visual censusing techniques. This clearly shows that visual censusing techniques underestimate fish biodiversity.

Burt and Anderton (1997) reported 62 species of fishes from Jurien Bay (c.f. 96 species in the present study), and included identification errors (e.g. several listed species have an eastern Australian distribution). This present study detected a far greater site diversity than that reported by Burt and Anderton (1997). Seagrass sites averaged 10 species per site (compared with 7 by Burt and Anderton, 1997) and reef sites proved to be much richer (22 species per site compared with 13). However, based on samples from the trawls, rotenone collections and WA Museum records, there is clearly an even higher diversity than either of these transect-based surveys. Hutchins (1994) reported 171 species for the area ranging from Port Denison to Jurien Bay. That number of species was achieved by surveying across different years and seasons (including effects of phenomena such as the Leeuwin Current) and with a goal of maximising diversity rather than providing a repeatable, quantified survey.

The reef sites considered to be 'inshore' (JWAM4, 5, 13) are the most important fish habitats in terms of both species richness and abundance, compared to the more exposed reefs. This is consistent with the findings of Hutchins (1994) who noted that the lagoon-like areas supported more diverse faunas than the rich macroalgal communities of the exposed reefs. By contrast, seagrass habitats are often mono-specific stands, sometimes with a dense canopy, or punctuated with patchy rocks, and contain a more depauperate fish fauna.

Very few thorough surveys of molluscs of inshore waters along the Central West Coast have been undertaken. Burt and Anderton (1997) reported 34 species of molluscs (>10mm) from Jurien Bay, in contrast to the 74 species reported in this present study. The low diversity recorded during the 1997 survey could be attributed to the size of molluscs collected and differences in methodology. A checklist by Wells and Bryce (1997) of the marine molluscs of the nearby offshore Houtman Abrolhos Islands contains 492 species.

Although preliminary at this stage of the project evidence suggests the Trochidae, Turbinidae and Columbellidae families are the most diverse and widespread molluscs in this area. Most of the species recorded from these families are grazers on epiphytes of seagrass and macroalgae which provide surfaces for colonisation, enable cover from predators, create habitat complexity and are a rich food source for many small benthic invertebrates (Edgar 1990).

The large number of calcareous sponge species found in this study is similar to previous findings in shallow temperate water environments in Western Australia. For example, McQuillan (2006) found 45 calcareous species from a total sponge fauna of 243 species in the Marmion Lagoon. We are uncertain as to why such relatively high proportions of *Calcarea* occur in temperate areas of Western Australia. Calcareous sponges are generally small and cryptic, restricted in growth by their simple construction. They have spicules made of calcium carbonate while the Demosponges have either a spongin fibre skeleton and/or spicules composed of silica dioxide. In contrast, in the tropical Dampier Archipelago where a total of 275 sponge species were recorded, only five species belonged to the *Calcarea* (Fromont, 2003). There is a marked difference in the incidence of calcareous species occurring in temperate versus tropical habitats in Western Australia and this result should be investigated further.

Burt and Anderton (1997) noted that the faunal diversity of the Central West Coast was dominated by sponges and fishes, which contributed 31% and 24% of overall species diversity respectively. The sponge component is also significant in this study with 132 species recorded so far. Many sponge species in this study could not be given a species name. Firstly, identification is reliant on very old literature requiring extensive revisions. Secondly, time constraints of the project do not allow thorough taxonomic searches or histological preparation of specimens. It is too early in the identification phase to interpret the sponge fauna of Jurien Bay and Green Head except to note that it is speciose. Whether this study will find a similar magnitude of sponge species to that of the Marmion lagoon (243 species) will be determined as identifications progress.

When the final field program is undertaken this year and invertebrate species identifications are completed, the analyses of the complete data set will begin. This will relate environmental factors to species numbers, such as whether more species occur in algal covered reef habitats versus seagrass environments, and whether an inshore to offshore abundance gradient of species or individuals exists.

This project will enable a detailed interpretation of the fauna communities surveyed at Jurien Bay and Green Head, and a comparison of localities to the south (Cervantes) and north (Dongara). This study examined seagrass communities of *Amphibolis* and *Posidonia*, and reef communities with varying suites of algae, either *Ecklonia* or *Sargassum* dominated, or with a mixture of red foliose or brown alga. This intensive quantitative sampling of both the fauna and flora of the region will build a detailed biological picture of the communities that dominate this region and their fine scale habitat associations.

References

- Burt, J.S. and Anderton, S.M. (1997). Results of the biological survey of the major benthic habitats of Jurien Bay and surrounding waters (Cervantes-Green Head). *Marine Reserve Implementation Programme: Central West Coast*. Department of Conservation and Land Management, Fremantle.
- Davie, P.J.F. (2002). Crustacea: Malacostraca: Eucarida (Part 2): Decapoda-Anomura, Brachyura. In Wells, A. & Houston, W.W.K. (eds) *Zoological Catalogue of Australia*. Vol. 19.3B. Melbourne: CSIRO Publishing, Australia xiv 641 pp.
- Edgar, G.J. (1990). The influence of plant structure on the species richness, biomass and secondary production of macrofaunal assemblages associated with Western Australia seagrass beds. *J. Exp. Mar. Biol. Ecol.* 137: 215-240.
- Fromont J. (2003). Porifera (Sponges) in the Dampier Archipelago: taxonomic affinities and biogeography. In: Wells F.E., Walker D.I. and Jones D.J. (eds), Proceedings of the Twelfth International Marine Biological Workshop. The Marine Flora and Fauna of Dampier, Western Australia. Western Australian Museum, Perth, 2: 405-417.
- Fromont, J., Marsh, L., Moore, G., Salotti, M., M Titelius, M., Whisson, C. (2005). Biodiversity of Marine Fauna on the Central West Coast. Second Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 46 pp.
- Fromont, J., Moore, G., M Titelius, M., Whisson, C. (2005). Biodiversity of Marine Fauna on the Central West Coast. First Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 10 pp.
- Hale, H.M. (1929). The Crustaceans of South Australia. Part 2: 201-380, Government Printer, Adelaide, South Australia.
- Hutchins, J.B. (1994). A survey of the nearshore reef fish fauna of Western Australia's west and south coasts – The Leeuwin Province. *Records of the Western Australian Museum Supplement No. 46*: 1-66.
- Marsh, L.M. (1991). Shallow water echinoderms of the Albany region, south-western Australia. In: Wells, F.E., Walker, D.I., Kirkman, H., and Lethbridge, R. (Eds.) (1990/91). *Proceedings of the Third International Marine Biological Workshop: The Marine Flora and Fauna of Albany, Western Australia*. Western Australian Museum, Perth. 2: 439-482.
- Marsh, L.M. (1994). Echinoderms of the Houtman Abrolhos Islands, Western Australia and their relationship to the Leeuwin Current. In: David, B., Guille, A., Feral, J.-P. and Roux, M. (Eds.) *Proceedings of the Eighth International Echinoderm Conference, Dijon/ France/ 6-10 September 1993. Echinoderms through Time*. Balkema, Rotterdam: 55-61.
- Marsh, L.M. and Pawson, D.L. (1993). Echinoderms of Rottnest Island, In: Wells, F.E., Walker, D.I., Kirkman, H. and Lethbridge, R. (Eds.). *Proceedings of the Fifth International Marine Biological Workshop. The Marine Flora and Fauna of Rottnest Island, Western Australia*. Western Australian Museum, Perth: 279-304.
- McQuillan, L. (2006). Density and cover of sponges on temperate reefs in Western Australia. MSc thesis, Edith Cowan University, Western Australia.

Poore, G.C.B. (2004). *Marine Decapod Crustacea of Southern Australia: A guide to Identification*. CSIRO Publishing, Vic, ix 574 p.

Usher, K.M., Sutton, D.C., Toze, S., Kuo, J. and Fromont, J. (2004). The biogeography and phylogeny of *Chondrilla* species (Demospongiae) in Australia. *Marine Ecology Progress Series*. 270: 117-127.

Wells, F.E. and Bryce, C.W. (1997). A preliminary checklist of the marine macromolluscs of the Houtman Abrolhos, Western Australia. Pp. 363-383. In: Wells, F.E. (Ed.) Proceedings of the Seventh International Marine Biological Workshop: The Marine Flora and Fauna of the Houtman Abrolhos Islands, Western Australia. Western Australian Museum, Perth

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Conferences, presentations and publications.

Fromont, J., Marsh, L., Moore, G., Salotti, M., M Titelius, M., Whisson, C. (2005). Biodiversity of Marine Fauna on the Central West Coast. Second Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 46 pp.

Fromont, J., Moore, G., M Titelius, M., Whisson, C. (2005). Biodiversity of Marine Fauna on the Central West Coast. First Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 10 pp.

Moore, G. (2005). Preliminary results of the fish survey at Jurien Bay and Green Head. Midwest workshop, CSIRO, 7-9th June.

It is anticipated that dissemination of the findings of this study will be achievable after the quantitative analyses have been completed, which will allow for more detailed interpretation of the results. This will occur after the second component of the fieldwork is completed.

Editor's Note: Since this report was prepared the final report for this study has been completed:

Fromont, J., C. Hass, L. Marsh, G. Moore, M. Salotti, M. Titelius and C. Whisson (2006). *Biodiversity of Marine Fauna on the Central West Coast*. Final Milestone Report to the Strategic Research Fund for the Marine Environment (SRFME), 85pp. Unpublished Report.