

## A SMALL COLLECTION OF GASTROPODS AND BIVALVES FROM THE ANAMBAS AND NATUNA ISLANDS, SOUTH CHINA SEA

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**ABSTRACT.** – Ninety-one species of gastropods and 43 species of bivalves were collected during a week-long expedition to the Anambas and Natuna Islands in the South China Sea. The majority of specimens were from sheltered intertidal habitats including coral reefs, rocky shores and mangroves. SCUBA and bottom trawls augmented collecting efforts. Based on the number of localities where each species was collected, *Nerita undata* (Neritidae), *Clypeomorus batillariaeformis* (Cerithiidae), *Thais distinguenda* (Muricidae) and *Thais squamosa* (Muricidae) were the most common and widespread intertidal gastropods. The epibyssate *Barbatia foliata* (Arcidae) and the sand-dwelling intertidal *Atactodea striata* (Mesodesmatidae) were the most common and widespread bivalves based on the frequency of occurrence at each sampling site. Molluscs from subtidal soft bottom substrata and specialized habitats were poorly represented. Freshwater species were also largely lacking.

**KEY WORDS.** – Gastropod, bivalve, Anambas, Natuna, South China Sea.

### INTRODUCTION

The Anambas and Natuna archipelagos in the South China Sea comprise two isolated groups of Indonesian islands on the Sunda Shelf located midway between the Malay peninsula and the island of Borneo. The two archipelagos consist of more than 50 rather hilly islands of which the largest is Pulau Bunguran that rises to about 1000 metres above sea level. The two groups of islands are historically well-known to seafarers plying the Singapore-Hong Kong route. Recent discoveries of oil and natural gas in the Natunas (Anonymous, 1998; Suhartanto et al., 2001), and regular dive ecotours to the vicinity of the Anambas Islands from Singapore have also raised public awareness of the existence of these islands.

However, the marine flora and fauna of the Anambas and Natuna islands in the shallow waters of the South China Sea remain largely undocumented. Several published accounts concerning the animals of the islands are, to our knowledge, all land based (Miller, 1901; Oberholser, 1917, 1932; Smedley, 1928; Chasen, 1934, 1935). The often stated assumption is that the composition and diversity of marine organisms living in the coastal zone of Southeast Asia will not differ significantly from those of the other islands in the Indo-West Pacific Province. This study gives an account of

the common gastropods and bivalves collected during a short eight-day expedition to the main islands in March 2002. While the necessarily short duration of the expedition and the small number of non-specialist participants imposed a significant limitation on sampling, and hence the interpretation of data, the species list generated is probably the first of its kind. It is hoped that the omissions from the list will provide impetus for further biological exploration and documentation of molluscan diversity in this part of the world.

### MATERIALS AND METHODS

Of the eight coastal localities sampled in the Anambas and Natuna archipelagos, five were centred around Pulau Jemaja, Mubur, Siantan and Bajau in the Anambas (Fig. 1). The remaining three collections were carried out either on or near Pulau Laut, Pulau Panjang and Pulau Batu Bilis in the vicinity of Pulau Bunguran (Greater Natuna Island) (Fig. 1). No collections were made on Pulau Midai, Pulau Subi Besar and Pulau Serasan although these islands are considered to be part of the Natuna Archipelago. Haphazard sampling was carried out intertidally by hand during approaching spring low tides for a period of eight days between 12 and 19 March 2002. At the same time, day and night SCUBA dives were

conducted to examine subtidal habitats. Subtidal benthic trawls were also undertaken from a small vessel. Mixed tides with a prevailing diurnal component characterise both the Anambas and Natuna Archipelagos (Wyrtki, 1961; United Kingdom Hydrographic Office, 2003). The tidal range is small, varying between 1 m and 1.5 m (Admiralty Tide Tables, 2004). A number of opisthobranchs were collected and principally comprised the following phyllidiid species, identified following Brunckhorst (1993), Yonow (1996) and Fahrner & Schrödl (2000), that is: *Phyllidia coelestis* Bergh,

1905, *P. elegans* Bergh, 1869, *P. varicosa* Lamarck, 1801, *Phyllidiella pustulosa* (Cuvier, 1804), *Phyllidiella* sp., and *Fryeria* sp. Several other coral reef species remain undetermined. Incidental, cursory collections were also carried out in freshwater streams.

Preserved intact individuals and shells were sorted and identified using published handbooks, guides and monographs (Tables 1, 2). Gastropods were identified by K.S. Tan and bivalves by W. Kastoro.

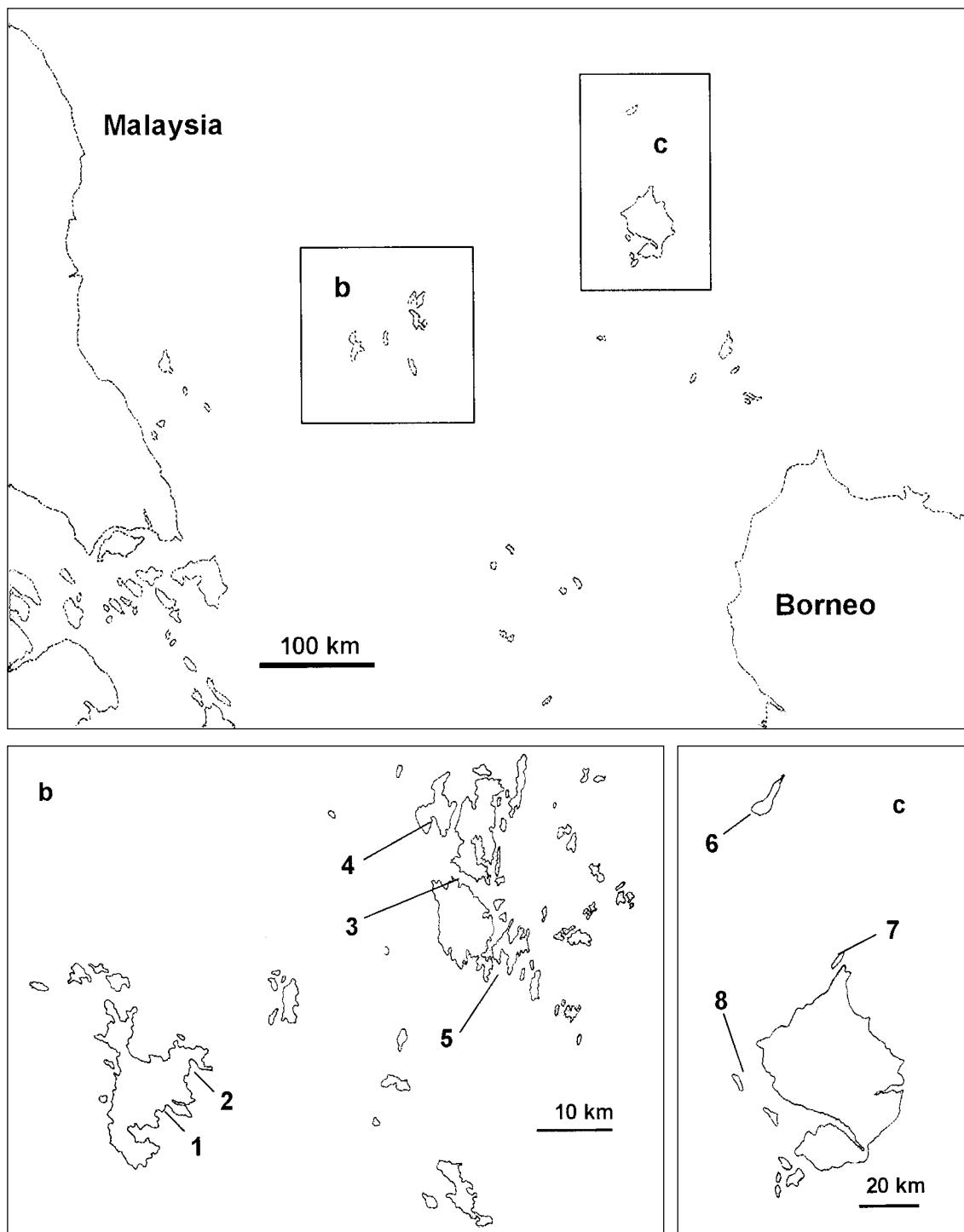


Fig. 1. Sampling location in the Anambas (inset b) and Natuna (inset c) Islands, South China Sea. Sampling was carried out at five locations in the Anambas Islands and three locations in the Natuna Islands. For details, refer to Table 1.

Table 1. Gastropods from the Anambas and Natuna Islands, South China Sea. Locations 1–5 are in the Anambas group of islands; locations 6–8 are in the Greater Natuna group of islands (see Fig. 1). 1: Teluk Tiru, Pulau Jemaja; 2: Teluk Jebung, Pulau Jemaja; 3: Pulau Kecik and Selat Peninting, between Pulau Matak and Pulau Siantan; 4: Teluk Airbandung, Pulau Mubur; 5: Teluk Dumang, Pulau Behala, south of Pulau Bajau; 6: Pulau Laut, North Natuna Ids.; 7: Pulau Panjang, off north coast of Pulau Bunguran; 8: Pulau Batu Bilis, off west coast of Pulau Bunguran.

Species	Family	Location	Remarks	Reference
<i>Cellana radiata</i> (Born)	Nacellidae	3, 7	Common, intertidal rocks	Powell, 1973; Dharma, 1988
<i>Monodonta labio</i> (Linnaeus)	Trochidae	3, 5, 8	Common, intertidal rocks	Dharma, 1988; Tan & Chou, 2000
<i>Tectus cf. triserialis</i> (Lamarck)	Trochidae	1, 4, 7	Uncommon, subtidal reefs	Dharma, 1988; Wilson, 1993
<i>Trochus maculatus</i> Linnaeus	Trochidae	1, 2, 3, 6	Common, intertidal rocks	Dharma, 1988; Tan & Chou, 2000
<i>Turbo bruneus</i> (Röding)	Turbinidae	1, 3	Common, intertidal rocks	as <i>T. setosus</i> in Dharma, 1988; Tan & Chou, 2000
<i>Clithon ovalaniensis</i> (Lesson)	Neritidae	2	Common, in estuaries	Brandt, 1974; Starmühlner, 1976; Tan & Chou, 2000
<i>Nerita albicilla</i> Linnaeus	Neritidae	1, 3, 6	Common, low intertidal	Dharma, 1988; Tan & Chou, 2000
<i>Nerita costata</i> Gmelin	Neritidae	5, 8	Common, high intertidal	Cernohorsky, 1972; Dharma, 1988
<i>Nerita polita</i> Linnaeus	Neritidae	1, 2, 3, 8	Common, intertidal rocks and sand	Cernohorsky, 1972; Dharma, 1988
<i>Nerita squamulata</i> Le Guillou	Neritidae	2, 3, 8	Common, intertidal rocks and sand	Cernohorsky, 1972; possibly as <i>N. signata</i> in Dharma, 1988
<i>Nerita undata</i> Linnaeus	Neritidae	1, 2, 3, 5, 7, 8	Common, intertidal rocks	Dharma, 1988; Tan & Chou, 2000
<i>Neritina pulligera</i> (Linnaeus)	Neritidae	1	Common, freshwater streams	Brandt, 1974; Starmühlner, 1976
<i>Echinolittorina feejeensis</i> (Reeve)	Littorinidae	2, 3, 6	Common, intertidal rocks	Reid, 2001; Williams, Reid & Littlewood, 2003
<i>Littoraria scabra</i> (Linnaeus)	Littorinidae	1, 2, 3, 7	Common mangrove trees	Reid, 1986
<i>Littoraria intermedia</i> (Philippi)	Littorinidae	2	Uncommon, mangrove trees	Reid, 1986
<i>Littoraria undulata</i> (Gray)	Littorinidae	6	On rocks	Reid, 1986
<i>Planaxis sulcatus</i> (Born)	Planaxidae	1, 7, 8	Common, intertidal rocks	Houbrick, 1987
<i>Planaxis niger</i> Quoy & Gaimard	Planaxidae	3, 5	Uncommon, under intertidal rocks	Cernohorsky, 1972
<i>Cerithidea cingulata</i> (Gmelin)	Potamididae	1	In mangroves	Brandt, 1974; Houbrick, 1984
<i>Terebralia palustris</i> (Linnaeus)	Potamididae	1	In mangroves	Brandt, 1974; Houbrick, 1991
<i>Terebralia sulcata</i> (Born)	Potamididae	1, 2, 6	With <i>Cerithium coralium</i> in mangroves	Houbrick, 1991; Tan, 2000
<i>Cerithium column</i> Sowerby	Cerithiidae	6	Uncommon	Houbrick, 1992
<i>Cerithium coralium</i> Kiener	Cerithiidae	1, 2, 6, 7	Common, in mangroves	Houbrick, 1992
<i>Cerithium echinatum</i> Lamarck	Cerithiidae	3	Uncommon	Houbrick, 1992
<i>Cerithium nodulosum</i> Bruguière	Cerithiidae	3, 7	Uncommon	Houbrick, 1992
<i>Cerithium traillii</i> Sowerby	Cerithiidae	1	Common	Houbrick, 1992
<i>Cerithium zonatum</i> (Wood)	Cerithiidae	2	Uncommon	Houbrick, 1992
<i>Clypeomorus batillariaeformis</i> Habe & Kosuge	Cerithiidae	1, 3, 6, 7, 8	Common	Houbrick, 1985
<i>Clypeomorus bifasciata</i> (Sowerby)	Cerithiidae	8	Common	Houbrick, 1985
<i>Clypeomorus pellucida</i> (Hombron & Jacquinot)	Cerithiidae	1, 2, 6	Uncommon	Houbrick, 1985
<i>Clypeomorus petrosa</i> (Wood)	Cerithiidae	2, 3, 7, 8	Common	Houbrick, 1985
<i>Clypeomorus purpurastoma</i> Houbrick	Cerithiidae	3	Common	Houbrick, 1985
<i>Rhinoclavis vertagus</i> (Linnaeus)	Cerithiidae	6, 8	Common	Houbrick, 1978
<i>Strombus urceus</i> (Linnaeus)	Strombidae	1, 6	Shells only	Tan & Chou, 2000

Species	Family	Location	Remarks	Reference
<i>Cypraea arabica</i> Linnaeus	Cypraeidae	1, 2, 6	Common	Tan & Chou, 2000
<i>Cypraea errores</i> Linnaeus	Cypraeidae	1	Common	Tan & Chou, 2000
<i>Cypraea carneola</i> Linnaeus	Cypraeidae	6	Uncommon, subtidal rocks	Lorenz & Hubert, 2000
<i>Natica gualtieriana</i> Récluz	Naticidae	6	Uncommon	Cernohorsky, 1972
<i>Polinices tumidus</i> (Swainson)	Naticidae	2	Uncommon?	Cernohorsky, 1972
<i>Chicoreus torrefactus</i> (Sowerby)	Muricidae	3, 6	Common	Houart, 1992
<i>Cronia margariticola</i> (Broderip)	Muricidae	2, 7, 8	Common	Tan, 2000
<i>Drupa rubusidaeus</i> Röding	Muricidae	6	Uncommon	Emerson & Cernohorsky, 1973
<i>Drupella cornus</i> (Röding)	Muricidae	3, 4, 6	Common	Cernohorsky, 1972
<i>Morula anaxares</i> (Kiener)	Muricidae	2, 3	Common	Tan, 2000
<i>Morula funicula</i> (Wood)	Muricidae	3	Common	Tan, 2000
<i>Morula fusca</i> (Küster)	Muricidae	2, 6, 7, 8	Common	Tan, 2000
<i>Morula musiva</i> (Kiener)	Muricidae	3	Common	Tan, 2000
<i>Morula spinosa</i> (H. & A. Adams)	Muricidae	5	Uncommon	Tan, 2000
<i>Thais distinguenda</i> (Dunker & Zelebor)	Muricidae	1, 2, 3, 6, 7	Common	Tan, 2000
<i>Thais squamosa</i> (Pease)	Muricidae	1, 2, 3, 6, 7, 8	Common	Tan, 2000
<i>Vitularia miliaris</i> (Gmelin)	Muricidae	3	Uncommon	Cernohorsky, 1980
<i>Pictocolumbella ocellata</i> (Link)	Columbellidae	1, 3, 6, 7	Common	deMaintenon, 1999
<i>Pyrene varians</i> (Sowerby)	Columbellidae	6	Uncommon	Cernohorsky, 1972
<i>Cantharus fumosus</i> (Dillwyn)	Buccinidae	3, 8	Common	Cernohorsky, 1972
<i>Engina alveolata</i> (Kiener)	Buccinidae	1, 2, 3, 6	Common	Cernohorsky, 1972
<i>Engina siderea</i> (Reeve)	Buccinidae	1	Uncommon	Cernohorsky, 1978
<i>Pugilina</i> sp. 1	Melongenidae	2		
<i>Pugilina</i> sp. 2	Melongenidae	2		
<i>Vexillum sanguisugum</i> (Linnaeus)	Costellariidae	1	Shells only	Cernohorsky, 1971
<i>Vexillum vulpeculum</i> (Linnaeus)	Costellariidae	2	Shells only	Cernohorsky, 1971
<i>Nassarius arcularia</i> (Linnaeus)	Nassariidae	1, 6, 7, 8	Common	Cernohorsky, 1984
<i>Nassarius coronatus</i> (Bruguière)	Nassariidae	1, 7		Cernohorsky, 1984
<i>Nassarius luridus</i> (Gould)	Nassariidae	2, 6, 7	Common	Cernohorsky, 1984
<i>Nassarius olivaceus</i> (Bruguière)	Nassariidae	2		Cernohorsky, 1984
<i>Fasciolaria trapezium</i> (Linnaeus)	Fasciolariidae	7	Shells only	Cernohorsky, 1978
<i>Latirus nodatus</i> (Gmelin)	Fasciolariidae	6	Common, subtidal	Cernohorsky, 1978
<i>Latirus polygonus</i> (Gmelin)	Fasciolariidae	6	Subtidal	Cernohorsky, 1978
<i>Mitra eremitarum</i> Röding	Mitridae	7	Intertidal	Cernohorsky, 1971
<i>Mitra chrysostoma</i> Broderip	Mitridae	2, 7	Intertidal	Cernohorsky, 1971
<i>Mitra cucumerina</i> Lamarck	Mitridae	3	Shells only	Cernohorsky, 1971
<i>Mitra</i> sp.	Mitridae	3		
<i>Conus eburneus</i> Hwass	Conidae	7	Intertidal	Röckel et al., 1995
<i>Conus marmoreus</i> Linnaeus	Conidae	2	Intertidal	Röckel et al., 1995
<i>Conus miliaris</i> Hwass	Conidae	2	Shells only	Röckel et al., 1995
<i>Conus musicus</i> Hwass in Bruguière	Conidae	4	Subtidal	Röckel et al., 1995
<i>Conus mustelinus</i> Hwass	Conidae	3, 7	Subtidal	Röckel et al., 1995
<i>Conus tessulatus</i> Born	Conidae	8	Shells only	Röckel et al., 1995
<i>Conus varius</i> Linnaeus	Conidae	6	Shells only	Röckel et al., 1995
<i>Conus vexillum</i> Gmelin	Conidae	7	Intertidal	Röckel et al., 1995
<i>Pythia scarabaeus</i> (Linnaeus)	Ellobiidae	2	Intertidal	Cernohorsky, 1978
<i>Melampus flavus</i> (Gmelin)	Ellobiidae	2	Intertidal	Cernohorsky, 1978
<i>Siphonaria atra</i> Quoy & Gaimard	Siphonariidae	2, 3, 7	Intertidal	Tan & Chou, 2000
<i>Siphonaria guamensis</i> Quoy & Gaimard	Siphonariidae	6	Intertidal	Tan & Chou, 2000
<i>Siphonaria javanica</i> Lamarck	Siphonariidae	1, 3	Intertidal	Tan & Chou, 2000
<i>Onchidium verruculatum</i> Cuvier	Onchidiidae	1, 2, 5	Intertidal	Hyman, 1999
<i>Phyllidia coelestis</i> Bergh	Phyllidiidae	1, 3	Subtidal	Brunckhorst, 1993; Yonow, 1996
<i>Phyllidia elegans</i> Bergh	Phyllidiidae	2, 6	Subtidal	Brunckhorst, 1993; Yonow, 1996
<i>Phyllidia varicosa</i> Lamarck	Phyllidiidae	1, 3	Subtidal	Brunckhorst, 1993; Yonow, 1996
<i>Phyllidiella</i> cf. <i>granulatus</i> Brunckhorst	Phyllidiidae	3	Subtidal	Brunckhorst, 1993; Yonow, 1996
<i>Phyllidiella pustulosa</i> (Cuvier)	Phyllidiidae	1, 2, 3, 6	Intertidal and subtidal	Brunckhorst, 1993; Yonow, 1996
<i>Fryeria</i> cf. <i>menindie</i> Brunckhorst	Phyllidiidae	2	Subtidal	Brunckhorst, 1993

Table 2. Bivalves from the Anambas and Natuna Islands, South China Sea. For location details, refer to Table 1 and Fig. 1.

Species	Family	Location	Remarks	Reference
<i>Barbatia foliata</i> (Forsskål)	Arcidae	1, 2, 3, 8	On/in dead corals	Hylleberg & Kilburn, 2003
<i>Barbatia amygdalumtostum</i> (Röding) ( <i>fusca</i> Bruguière of authors)	Arcidae	1, 3	On/in dead corals	Hylleberg & Kilburn, 2003
<i>Barbatia virescens</i> (Reeve)	Arcidae	1, 2	On dead corals	Kira, 1965
<i>Acar plicatum</i> (Dillwyn)	Arcidae	8	Shells only	Kira, 1965; Lamprell & Healy, 1998
<i>Arca avellana</i> Lamarck	Arcidae	1	Attached to rocks adjacent to fringing mangrove	Lamprell & Healy, 1998
<i>Septifer bilocularis</i> (Linnaeus)	Mytilidae	2, 3	On coral rubble	Kira, 1965
<i>Hormomya mutabilis</i> (Gould)	Mytilidae	2, 3	On rocks near mangroves	Kira, 1965
<i>Modiolus auriculatus</i> (Krauss)	Mytilidae	1	In sandy mudflats near mangroves	Lamprell & Healy, 1998
<i>Gregariella striata</i> (Hanley)	Mytilidae	2	Coral rubble	Lee & Morton, 1985
<i>Lithophaga nasuta</i> (Philippi)	Mytilidae	2	In dead corals	Lamprell & Healy, 1998
<i>Pteria chinensis</i> (Leach)	Pteriidae	2, 7	In fringing <i>Porites</i> reef	Lamprell & Healy, 1998
<i>Pinctada maculata</i> (Gould)	Pteriidae	2	On dead corals	Lamprell & Healy, 1998
<i>Electroma ovata</i> (Quoy & Gaimard)	Pteriidae	1, 2	In coral rubble	Lamprell & Healy, 1998
<i>Isognomon perna</i> (Linnaeus)	Isognomonidae	1, 2, 3	In coral rubble	Lamprell & Healy, 1998
<i>Isognomon legumen</i> (Gmelin)	Isognomonidae	1, 3	In coral rubble	Lamprell & Healy, 1998
<i>Isognomon isognomon</i> (Linnaeus)	Isognomonidae	1, 3, 7	In coral rubble, intertidal	Lamprell & Healy, 1998
<i>Isognomon nucleus</i> (Lamarck)	Isognomonidae	3	On rocks in mangroves	Lamprell & Healy, 1998
<i>Isognomon acutirostris</i> (Dunker)	Isognomonidae	3, 5, 6	On intertidal rocks	Habe, 1968
<i>Malleus albus</i> Lamarck	Malleidae	1	Subtidal, trawled	Lamprell & Healy, 1998
<i>Malvufundus regulus</i> (Forsskål)	Malleidae	1, 2	Coral rubble	Lamprell & Healy, 1998
<i>Limaria fragilis</i> (Gmelin)	Limidae	3	Coral rubble	Lamprell & Whitehead, 1992
<i>Amusium pleuronectes</i> (Linnaeus)	Pectinidae	8	Subtidal, trawled	Lamprell & Whitehead, 1992
<i>Comptopallium radula</i> (Linnaeus)	Pectinidae	3	Shells only	Lamprell & Whitehead, 1992
<i>Annachlamys macassarensis</i> (Chenu)	Pectinidae	2	Shells only	Lamprell & Whitehead, 1992
<i>Chlamys squamosa</i> (Gmelin)	Pectinidae	2	Shells only	Lamprell & Whitehead, 1992
<i>Chlamys madrepolarium</i> (Sowerby)	Pectinidae	3	Shells only	Lamprell & Whitehead, 1992
<i>Spondylus squamosus</i> Schreibers	Spondylidae	2	Intertidal	Lamprell & Healy, 1998
<i>Chama limbula</i> Lamarck	Chamidae	2, 3	Coral rubble	Lamprell & Whitehead, 1992
<i>Trapezium bicarinatum</i> (Schumacher)	Trapeziidae	1	Coral rubble	Lamprell & Whitehead, 1992
<i>Polymesoda expansa</i> (Mousson)	Corbiculidae	1	Intertidal mud in mangroves	Morton, 1984
<i>Fragum hemicardium</i> (Linnaeus)	Cardiidae	2	Subtidal, trawled	Lamprell & Whitehead, 1992
<i>Laevicardium biradiatum</i> (Bruguiere)	Cardiidae	2	Subtidal, trawled	Lamprell & Whitehead, 1992
<i>Acrosterigma flava</i> (Linnaeus)	Cardiidae	2	Coral rubble	Lamprell & Whitehead, 1992
<i>Tridacna maxima</i> (Röding)	Tridacnidae	1, 2	Reef	Rosewater, 1965
<i>Scutarcopagia scobinata</i> (Linnaeus)	Tellinidae	2	Shells only	Lamprell & Whitehead, 1992
<i>Cyclotellina remedies</i> (Linnaeus)	Tellinidae	1	Shells only	Lamprell & Whitehead, 1992
<i>Tellinella staurella</i> (Lamarck)	Tellinidae	8	Shells only	Lamprell & Whitehead, 1992
<i>Asaphis violascens</i> (Forsskål)	Psammobiidae	8	Sandy shore	Willan, 1993
<i>Gari elongata</i> (Lamarck)	Psammobiidae	2	Brackish water stream	Willan, 1993
<i>Donax cuneatus</i> Linnaeus	Donacidae	1	Coral reef	Lamprell & Whitehead, 1992
<i>Atactodea striata</i> (Gmelin)	Mesodesmatidae	1, 2, 3, 8	Sandy shore	Lamprell & Whitehead, 1992
<i>Davila plana</i> (Hanley)	Mesodesmatidae	1, 2, 3	Sandy shore	Lamprell & Whitehead, 1992
<i>Saxicavella</i> sp.	Hiatellidae	1	Sandy mudflat	Cox et al., 1969

## RESULTS

Ninety-one species of prosobranch and pulmonate gastropods in 24 families (Table 1) and 43 species of bivalves in 18 families (Table 2) were identified. Six species of phyllidiid nudibranchs were also included in the gastropod list. Amongst the gastropods, the Cerithiidae and Muricidae were each represented by 12 species. Cones (Conidae) and nerites (Neritopsina) were also relatively common, and represented by eight and seven species, respectively. The remaining 20 families of gastropods each comprised between one and four species. The Strombidae, Costellariidae, Mitridae and Conidae were either entirely or partially represented only by shells. The Patellogastropoda was represented by a single species of *Cellana*, while neogastropods comprised nearly half of all species identified. The pulmonates were typified rather predictably by onchidiids (*Onchidium verruculatum*), *Siphonaria* spp. and ellobiids (*Pythia*, *Melampus*). Based on the number of localities where each species was collected, *Nerita undata* (Neritidae), *Clypeomorus batillariaeformis* (Cerithiidae), *Thais distinguenda* (Muricidae) and *Thais squamosa* (Muricidae) were the most common and widespread intertidal gastropods.

In the case of the Bivalvia, the Arcidae, Mytilidae, Isognomonidae and Pectinidae were each represented by five species (Table 2). However, nearly all pectinid species collected were shells, with the exception of the subtidal scallop *Amusium pleuronectes* of which a number of specimens were obtained alive subtidally by trawling. All three tellinid species listed in Table 2 were also identified from shells. Eight other families were represented by single species but, surprisingly, anomidiids, ostreids and plicatulids were absent from the collection. The epibyssate bivalve *Barbatia foliata* (Arcidae) and the sand-dwelling intertidal *Atactodea striata* (Mesodesmatidae) were the most common and widespread species based on the frequency of occurrence at each sampling site.

## DISCUSSION

One hundred and twenty-five gastropod and 43 bivalve species were recorded from Darvel Bay off southeast Sabah, Borneo (Shabdin et al., 1998). About 170 molluscan species have been identified from Christmas Island (Indian Ocean) (Tomlin, 1934). Three hundred and nine gastropod and 118 bivalve species were recognized from Hainan Island, South China Sea (Hasegawa et al., 2001). More than 350 species of shelled molluscs were recorded from Pulau Seribu and Jakarta Bay (Roberts et al., 1982). Some 895 prosobranch and 485 opisthobranch gastropods and 339 bivalve species have been recorded from Guam (Carlson & Hoff, 2003; Paulay, 2003; Smith, 2003), and 1,031 gastropod species were identified by Fukuda (1993, 1994, 1995) from the Ogasawara (Bonin) Islands. Clearly the relatively low diversity of 134 gastropod and bivalve species obtained from this expedition represents only a small fraction of the actual marine molluscan diversity present in the Anambas and Natuna archipelagos. A large proportion of the identified gastropods and bivalves

were conspicuous, common epibenthic inhabitants of intertidal habitats. Quite undoubtedly the number of gastropod and bivalve species recorded will be significantly higher if more sophisticated and focused collecting regimes are employed over a longer period of time. In particular, intertidal and subtidal soft-bottom inhabiting gastropods and bivalves appear to have been inadequately sampled. Ranellids, cymatiids, muricine gastropods, olivids and terebrids were unrepresented in the collection. "Micromolluscs" (gastropods and bivalves of less than 5 mm in size), characterized by species of Rissoidae, Triphoridae and Pyramidellidae, were also lacking. Infaunal bivalve groups including lucinids, venerids and tellinids were either conspicuously absent or only represented by a few shells. It seems unlikely that representatives of these families are non-existent on the islands. The skewed and opportunistic nature of sampling is also highlighted by the fact that while the intertidal gastropod macrofauna on rocky shores is relatively well-represented in the collection, there were no oyster (sensu lato, including members of the Anomiidae, Ostreidae and Plicatulidae) nor vermetid specimens. Similarly, it is unlikely that the widely distributed Indo-Pacific high-shore littorinid gastropod *Echinolittorina trochoides* is absent from the sites visited. Bivalve species living in specialized habitats were not sampled (e.g., galeommatids, teredinids), as was the case for ascoglossan nudibranchs which are unrepresented in the collection. Nevertheless, the species lists provide a first insight into the marine molluscan fauna found of a remote region of the South China Sea.

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