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## The species composition and distribution of macrobenthic communities in the intertidal zone of Vietnam

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**Abstract:** The species composition and vertical distribution of macrobenthic intertidal communities of Vietnam are described in various locations from the Gulf of Thailand in the south to the Gulf of Tonkin in the north. The intertidal biota is described in connection with environmental factors, such as features of substrata and wave action, influence of decrease in sea water salinity and also specific factors (tide pools, terrestrial vegetation). The macrobenthos of hard substrata is the richest in qualitative and quantitative composition, and the population of soft substrata is the poorest. The intertidal zone of dead coral reefs has no analogues in the boreal waters. At least, 1664 species, subspecies or varieties of macrobenthos (278 species of plants and 1386 species of animals) are found in the intertidal zone of Vietnam. Red algae dominate among plants (154 species), and gastropods (334 species) and decapods (275 species) prevail among animals. The paper uses both published and unpublished results of the investigations carried out in the intertidal zone of Vietnam from the 1950s to 2005.

**Key words:** macrobenthos, species composition, distribution, community, intertidal zone, Vietnam.

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The intertidal zone is the area between the high and low tide marks. The boundary position between the two main habitats of life (air and water) is a unique feature of the intertidal zone, also defined as the amphibiotic zone. Organisms that live in this zone experience daily and seasonal fluctuations of temperature and changes in salinity and moisture and they must be able to tolerate extreme environmental changes.

The intertidal zone, being a more accessible zone of the sea, has traditionally played a key role in the life of marine organisms inhabiting the Indo-Pacific region. Many intertidal mollusks, crustaceans, echinoderms, and algae are edible; fossil corals are used for building, and sea shells for making various ornaments and souvenirs. Intertidal zone population is one of important objects of marine ecological/environmental studies.

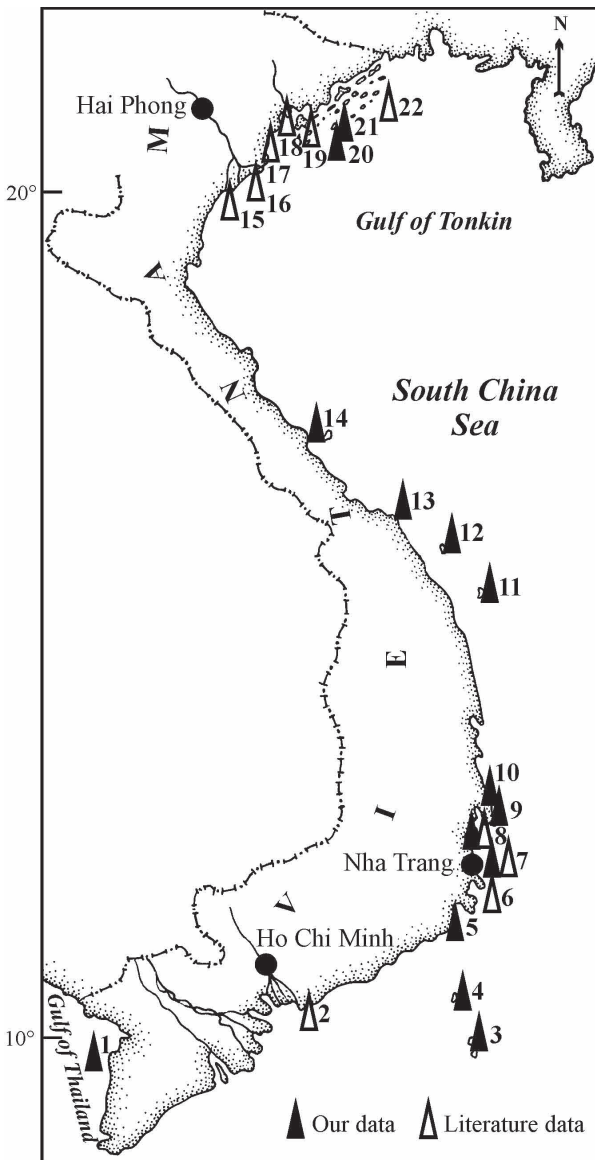
The first information on the belt-forming communities was obtained in the 1950s for the intertidal zone of Cap Saint-Jacques (at present, Vung Tau) on the southern coast of Vietnam by P.-H. Fischer (Fischer, 1952). Later on, a detailed study was conducted of the intertidal zone of mainly rocky reefs in Nha Trang Bay by Tran-ngoc Loi (Tran-ngoc Loi, 1967) and Pham-Hoang Ho (Pham-Hoang Ho, 1958a, b, 1962–1963, 1964). But Pham-Hoang Ho studied mainly phyto-cenoses, and his publications are in details analyzed by Tran-ngoc Loi. In 1961 a Soviet-Vietnamese expedition under the leadership and with participation of E.F. Gurjanova studied the intertidal zone of the Gulf of Tonkin (Gurjanova, Chang Hiu Phuong, 1972). Several Soviet-Vietnamese expeditions over the seashore and coastal waters were undertaken in 1980–1984 (southern Vietnam), including the trip of the R/V *Akademik Alexander Nesmeyanov* in 1984 to Nam Du Archipelago and Thu Island, and in 1988 (along the entire coast of Vietnam, R/V *Professor Bogorov*) by the Institute of Marine Biology, Far East Science Center, the USSR Academy of Science (at present, A.V. Zhirmunsky Institute of Marine Biology, Far Eastern Branch of the Russian Academy of Sciences) and the Institute of Marine Research of the National Science Center of the Socialist Republic of Vietnam (at present, Institute of Oceanography, Vietnam Academy of Science and Technology). The results of these expeditions were published in several papers (Gulbin et al., 1987(1988); Gulbin et al., 1988; Kussakin et al., 1988; Nguyen Van Chung et al., 1988; Kostina et al., 1990, 1992; Gulbin, Kussakin, 1991; Kostina, Vasina, 1991; Kostina, 2008, 2010a, b, 2011b). In 2005 intertidal investigations were conducted during the trip of the R/V *Akademik Oparin* in Nha Trang and Van Phong bays. The present work summarizes the results of intertidal studies carried out in Vietnam from the 1950s to 2005, and based on the own data and the data from publications, most of which were written by the authors of the present work.

## Materials and methods

The investigations, both our own and those described in the literature, were conducted on the continental coast and islands of Vietnam from the Nam Du Archipelago (9°40'57.5" N, 104°21'10.8" E), situated in the Gulf of Thailand, to Co To Island (20°58'01.6" N, 107°45'45.0" E), situated in the Gulf of Tonkin (Fig. 1; Table 1).

Sampling was commonly carried out at low tides; sometimes, however, samples had to be collected at high equatorial tides. Belt transects (perpendicularly to the coastline) were used to estimate the distribution of intertidal communities. The coastline along each transect was divided into three subzones, namely the upper, middle and lower subzones. The subdivision of the intertidal zone was done according to the Vaillant's principle of vertical stratification in the intertidal

zone (Vaillant, 1891). The boundaries of the upper, middle, and lower subzones were determined as the highest tide mark, the mean high water level of equatorial tide and the mean low water level of equatorial tide, and the lowest possible tide mark respectively. Irregular semi-diurnal tides are characteristic of the Catwick Islands (highest tide 3.3 m); regular diurnal tides are characteristic of Thu Island and the north-western part of the Gulf of Tonkin (the highest tide on Thu Island is 2.6 m, 3.9 m on Danh Do La and Dao Trao islands, 3.3 m at the Van Uc Estuary, and 4 m on Cat Ba and Co To islands, and Be Bank); in some locations of the Bai Tu Long Archipelago the highest tides can reach 4.5 m; irregular diurnal tides are typical for Re and Cham islands, Gio Islet, Tien Sa Peninsula, and Nha Trang Bay (the highest tide is 2.4, 2.3, 3.4, 1.6, and 2.5 m respectively). The communities were distinguished by dominating (usually belt-forming) species of macrobenthos. The distribution of species in the intertidal communities was provisionally estimated by eye.



**Fig. 1.** A schematic map of the main studied locations in the intertidal zone of Vietnam. 1 – Nam Du Archipelago, 2 – Vung Tau, 3 – Catwick Islands, 4 – Thu Island, 5 – Cape Dinh, 6 – Pecheurs Islets, 7 – Nha Trang, 8 – Binh Cang Bay, 9 – Van Phong Bay, 10 – Ro Bay, 11 – Re Island, 12 – Cham Island, 13 – Tien Sa Peninsula, 14 – Gio Islet; the Red River Delta: 15 – Day Estuary, 16 – Ba Lat Estuary, 17 – Van Uc Estuary, 18 – Cam Estuary; 19 – Cat Ba Island, 20 – Danh Do La Island, 21 – Dao Trao Island, 22 – Co To Island. Detailed information about the sampling locations contains in Table 1.

Table 1

## Sampling locations in the intertidal zone of Vietnam

Location	Latitude, N°	Longitude, E°	Substratum	References
Nam Du Archipelago, Gulf of Thailand				
Bo Tra (Bo Dap) Islet	9.647730	104.390174	Blocky-bouldery-gravelly	
	9.659244	104.360375	Rocky	
	9.678994	104.346556	Boulders and pebble with underlying sand	Gulbin et al., 1987(1988); our data, 1984
Nam Du Islet	9.691685	104.355107	Sandy	
	9.692721	104.355654	Boulders and small rocky blocks with underlying sand	
	9.704291	104.353938	Boulders and gravel with underlying sand, rare rocky blocks	
Mok (Moc) Islet	9.725308	104.354760	Rocky-blocky-bouldery	
Gian (Tre) Islet	9.741729	104.364056	Bouldery-pebbly	
Catwick Islands				
Petite (Little) Catwick	9.995101	109.049789	Rocky	Kostina et al., 1992; our data, 1988
Grande Catwick	10.055923	108.897901		
Cap Saint-Jacques (Vung Tau)	10.383333*	107.116667*	Rocky Silted sand with admixture of breakstone	Fischer, 1952
Sud (Tranh) Islet	10.489852	108.963692	Sandy	Gulbin et al., 1987 (1988); our data, 1984

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
	10.509748	108.967619	Rocky-blocky-bouldery	Kostina et al., 1992; our data, 1988
Thu (Phu Quy) Island	10.512238	108.966525	Rocky blocks with underlying sand	Gulbin et al., 1987 (1988); our data, 1984
	10.545865	108.955860	Rocky	
	10.552858	108.946215	Rocky blocks with underlying sand	
Cape Dinh (Padaran)	11.369978*	109.020036*	Rocky	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1981
			Rocky blocks with underlying sand	
Thon Son Hai	11.421749	109.012952	Dead coral reef	
Noi Islet, Pecheurs Islets	12.045563*	109.327124*	Rocky	Tran-ngoc Loi, 1967
Bau Than Bay	12.168081*	109.208148*	Dead coral reef	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
			Silted-sandy and sandy	
Mot Island	12.177447*	109.274349*	Rocky	
			Bouldery	
Tam Island	12.179919*	109.245292*	Boulders with underlying sand	Kussakin et al., 1988; our data, 1980–1981
			Old barges	
	12.185988	109.225815	Rocky-blocky-bouldery	Our data, 2005
Mieu Island	12.190024*	109.226358*	Pebbley	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
			Boulders with underlying sand	
	12.194175*	109.234153*	Rocky	Tran-ngoc Loi, 1967

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Tre Island	12.190823*	109.288911*	Silted-sandy and sandy	Kussakin et al., 1988; our data, 1980–1981
	12.228662*	109.243808*	Boulders with underlying sand	
Dam Chinh Bay	12.193314	109.323928	Silted sand with admixture of shell and rare gravel	
Gieng Da (Me) Bay	12.224403*	109.238799*	Boulders with underlying sand	Tran-ngoc Loi, 1967
Cape Chut	12.208124*	109.216091*	Rocky	
Nha Trang Bay				
Than Islet (Rocher Noir)	12.235661*	109.233150*	Rocky	
Cape Hon Chong	12.272942*	109.206835*	Rocky	
Rua (Tortue) Islet	12.288892*	109.243641*	Dead coral reef Rocky	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
Bai Tien Beach	12.302275*	109.240075*	Dead coral reef	
Cape Mong Ga (Khe Ga)	12.305395*	109.242221*	Rocky	Tran-ngoc Loi, 1967
Cai Sung Bay	12.374781	109.301679	Rocky	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
Nha Phu Bay, Binh Cang Bay	12.377880	109.302132	Dead coral reef	
Thi Island	12.389468*	109.230409*	Dead coral reef Silted-sandy and sandy	
Trong (Giua) Islet	12.400253*	109.222988*	Silted-sandy and sandy	Kussakin et al., 1988; our data, 1980–1981

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Tan Thuy	12.435716*	109.164131*	Silted sand with admixture of shell, clay and mud, rocky blocks	Tran-ngoc Loi, 1967
	12.442757	109.169109	Silted sand with admixture of shell and rare gravel	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
Van Phong Bay				
Cai Ban Bay	12.478428*	109.294956*	Boulders with underlying sand and admixture of coral debris	Our data, 1984
Lon Island	12.550318	109.407318	Rocky	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1982
	12.627774	109.350529		
	12.551156	109.396224	Rocky blocks with underlying sand	Kussakin et al., 1988; our data, 1981
	12.563111	109.383915	Rocky-blocky-bouldery	Our data, 2005
Tre Bay	12.6*	109.36667*	Pebbley	Kussakin et al., 1988;
			Dead coral reef	Nguyen Van Chung et al., 1988;
			Silted-sandy and sandy	our data, 1980–1982
Hon Khoi Peninsula	12.599590	109.339739	Boulders and pebble with underlying sand	Kussakin et al., 1988; our data, 1981
	12.605447	109.334540	Rocky	Our data, 2005
Hon Khoi Peninsula	12.574144*	109.244576*	Boulders with underlying sand	Kussakin et al., 1988;
	12.589905*	109.226954*	Dead coral reef	our data, 1980–1981

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Hon Gom Peninsula				
	12.575449	109.428198	Rocky-blocky-bouldery	
Cua Be Strait	12.575951	109.426902	Sand with admixture of silt, rocky blocks	Our data, 2005
	12.576055	109.427320	Sandy	
Thu Bay	12.601933	109.414524	Rocky blocks with underlying sand	Kussakin et al., 1988; our data, 1980–1981
Van Bay				
Do Islet	12.643920	109.376119	Rocky-blocky-bouldery	Our data, 2005
Ong Island				
			Dead coral reef	
			Pebbly	Kussakin et al., 1988;
	12.650649*	109.397971*	Boulders with underlying sand	Nguyen Van Chung et al., 1988; our data, 1980–1982
			Silted-sandy and sandy	
Mon Bay				
	12.659616*	109.408614*	Boulders with underlying sand	Kussakin et al., 1988; our data, 1980–1981
Nai Bay	12.685321	109.395147	Dead coral reef	
Co Co Strait				
Lutin Bay				
Sang Islet	12.646840*	109.343614*	Bouldery	
			Boulders with underlying sand	Kussakin et al., 1988; our data, 1981
Ke Bay	12.663915	109.349871	Dead coral reef	
Lon Strait				
	12.657237	109.335407	Boulders with underlying sand	Our data, 2005
Cape Co Co				
	12.663071*	109.328729*	Rocky	Kussakin et al., 1988; our data, 1981
			Silted-sandy and sandy	



Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Ben Goi Bay	12.650728	109.214006	Dead coral reef	Kussakin et al., 1988; our data, 1981
Me Islet	12.635863*	109.300699*	Rocky	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1980–1981
			Dead coral reef	
			Bouldery	
			Boulders with underlying sand	
			Silted-sandy and sandy	
Cum Meo Islet	12.641999*	109.218963*	Dead coral reef	Kussakin et al., 1988; our data, 1984
Ke Islet	12.643803*	109.316290*	Sand with admixture of silt, pebble and boulders	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1981
			Boulders with underlying sand	
Bip Islet	12.718656	109.295637	Dead coral reef	
Trau Nam Bay	12.775635	109.355167	Silted-sandy and sandy	Kussakin et al., 1988; our data, 1981
			Silted sand with admixture of shell and rare gravel	
Nua Islet	12.830350*	109.393395*	Bouldery Rocky blocks and boulders with underlying sand	

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Ro Bay	12.862821	109.432643	Rocky blocks with underlying sand	Kussakin et al., 1988; our data, 1981
	12.863208	109.433769	Sandy	Our data, 1981
	12.876679	109.419961	Dead coral reef	Kussakin et al., 1988; Nguyen Van Chung et al., 1988; our data, 1981
	12.881351*	109.433206*	Rocky	
Nu Islet	Location unknown		Boulders with underlying sand	Kussakin et al., 1988; our data, 1980–1981
Re (Ly Son) Island	15.377606	109.140336	Sandy	
	15.380585	109.139886	Dead coral reef	
Cham (Lao) Island	15.943044	108.511996	Sandy	
	15.943879	108.509057	Rocky-blocky-bouldery	
	15.944612	108.507264	Rocky	Kostina et al., 1992; our data, 1988
Tien Sa (Son Tra) Peninsula	16.112668	108.313534	Rocky-blocky-bouldery	
	16.117936	108.336818		
Gio (Co) Islet	17.156424	107.347997	Rocky-blocky-bouldery	
	17.160454	107.346462	Sandy	
Gulf of Tonkin				
The Red River Delta				
Day Estuary	19.915824*	106.075230*		
Ba Lat Estuary	20.223252*	106.504919*	Clayed silt	Gurjanova, Chang Hiu Phuong, 1972
	20.252914*	106.593238*		

Table 1 (Continued)

Location	Latitude, N°	Longitude, E°	Substratum	References
Con Lo Beach	20.475223*	106.615066*	Bouldery	
Van Uc Estuary	20.678614*	106.718807*	Clayed silt	
Dai Hop Beach	20.687273*	106.717372*	Silted sand with admixture of shell and clay (flats are covered by silt)	Gurjanova, Chang Hiu Phuong, 1972
Bang La Beach	20.706680*	106.749617*		
Trang Cat, An Kim Hai Canal	20.797171*	106.771874*	Clayed silt	
Dinh Vu, Cam Estuary	20.806462*	106.787481*		
Bai Tu Long Archipelago				
Danh Do La (Ngoc Vung) Island	20.828148	107.349637		
Dao Trao (Van Canh) Island	20.872666	107.337309	Stony debris, coralline limestone, and shell covered by silt	Kostina et al., 1992; our data, 1988
Cat Ba Island	20.8*	106.999722*	Rocky	
Be Bank	Location unknown		Silted-sandy Rocky	Gurjanova, Chang Hiu Phuong, 1972
Tran Ca Bank			Silted-sandy	
Co To Island	20.960547*	107.763679*	Rocky	
	20.967103*	107.762497*	Sand with admixture of silt and rare boulders	

\*Approximate location or location according to Geo URI (Uniform Resource Identifier for geographic locations).

Metal 250 and 500 cm<sup>2</sup> frames were used for sampling on loose substrata and 100, 250, and 500 cm<sup>2</sup> frames on hard substrata. Smaller frames were chosen for sampling in communities with small and more or less uniformly distributed organisms, and larger ones, for communities with fairly large or randomly distributed and rarely found organisms. We took two or three samples from each community. To remove bottom deposits from macrobenthic samples, we used a set of soil sieves. The collected samples were analyzed, all the organisms were registered and, after drying on a filter paper, weighed using pharmaceutical scales accurate to 10 mg; large plants were weighed on a technical balance accurate to 1 g. The obtained data were extrapolated for 1 m<sup>2</sup>. The collections were fixed in 75% alcohol or 4% formalin.

The list of macrobenthos of the intertidal zone of Vietnam (see Appendix) was compiled from literature data and also from unpublished data of the authors. In addition to the literature directly related to the subject, the literature on some groups of macrobenthos of South China Sea was also used (Starobogatov, 1972; Strelzov, 1972; Latypov, 1986, 1988, 2007, 2014; Kalugina-Gutnik et al., 1988; Gulbin, Tran Dinh Nam, 1989; Kalashnikov, 1989; Levin, Dao Tan Ho, 1989; Murina, 1989, 2007; Zevina et al., 1992; Kussakin, Malyutina, 1993; Malyutina, 1994; Gulbin, Evseev, 1997; Moshchenko, 1997; Evseev, Lutaenko, 1998; Poltarukha, 2006, 2013; Dautova et al., 2007; Āuriš, 2007; Marin, Nguyen Thi Hai Thanh, 2007; Marin, Savinkin, 2007; Poltarukha, Dautova, 2007; Marin, 2008, 2012; Poltarukha, Zvyagintsev, 2008; Grintsov, Poltarukha, 2010; Kostina, 2011a; Latypov, Selin, 2011; Adrianov, Maiorova, 2012; Antokhina et al., 2012; Britayev, Antokhina, 2012; Chertoprud et al., 2012a, b; Martynov, Korshunova, 2012; Sirenko, 2012, 2016; Titlyanov, Titlyanova, 2012; Mekhova, Britayev, 2015; Zvonareva et al., 2015; Chaban, 2016; Chernyshev, 2016).

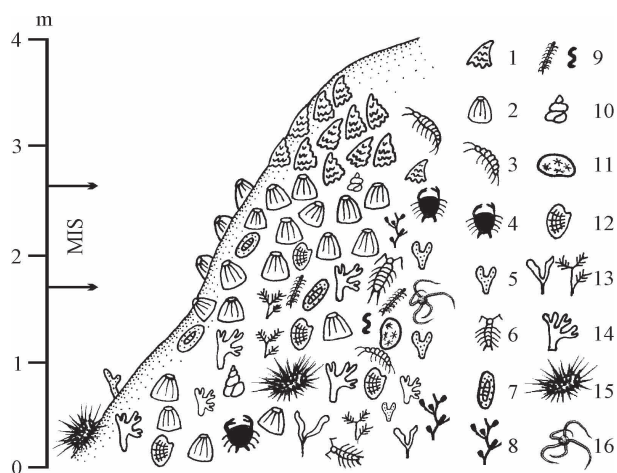
## **Intertidal zone of hard substrata**

### **Rocky intertidal zone**

The rocky intertidal zone was studied along the entire coast of Vietnam, from Nam Du Archipelago (Gulf of Thailand) in the south to Co To Island (Gulf of Tonkin) in the north (Table 1). This type of the intertidal zone is represented by rocky coast with a rather steep slope (30–90°) exposed to almost permanent wave action. The intertidal zone is 3–15 m wide. The vertical stratification of communities is well marked. The species composition and the dominant species of macrobenthic communities vary on different coasts, especially in the lower intertidal subzone depending on what algae or coral communities are developed here. But sedentary epifaunal forms dominate on the rocky intertidal zone.

The communities found in the supratidal zone and the upper intertidal subzone tend to exhibit poor species composition of macrobenthic fauna and flora. On the Nam Du Islet (Nam Du Archipelago), Catwick Islands, and Cham Island, a community dominated by the oyster *Saccostrea scyphophilla* (Fig. 2) forms a 0.5–1.5 m wide belt. The total biomass of macrobenthos can reach up to 12 kgWW m<sup>-2</sup>, and *S. scyphophilla* makes up to 99% of the total biomass (Table 2). The subdominant group is represented by the barnacles *Tetraclita squamosa* or *Chthamalus malayensis*. Plantlets (0.7–1 cm high) of the red alga *Gelidium crinale* and the green alga *Valoniopsis pachynema* form patches up to 0.01–0.03 m<sup>2</sup> in area. In addition to quantitatively recorded species, this community includes the following motile organisms: the brachyuran crabs *Grapsus tenuicrustatus*, *Eriphia scabricula*, and *Percnon* sp., the gastropods *Echinolittorina millegrana*, *Dendropoma planorbis*, and *Vermetus tokyoensis*, as well as polychaetes and amphipods living in empty barnacle and oyster shells. On some capes of Cham Island, a community dominated by the gastropods *Cellana testudinaria*, *E. millegrana*, *Nerita albicilla*, and *Nerita* sp. is found in the upper subzone instead of the *S. scyphophilla* community; the gastropods do not form a belt (the total biomass of mollusks is about 660 gWW m<sup>-2</sup>).

To the north-west of the Gulf of Tonkin (Cat Ba and Co To islands, and Be Bank), the supratidal zone is inhabited by the littorinid species *Tectarius* sp. and the brachyuran crab *Nanosarman minutum*, which on the coasts protected from wave action spread to the middle intertidal subzone. There is a modification of the *S. scyphophilla* community dominated by *S. scyphophilla*+*Amphibalanus amphitrite* in the upper intertidal subzone. The other sessile species of the community include *Saccostrea echinata*, the barnacle *Ibla* sp., the mussels *Septifer* sp. and *Brachidontes* sp., and other bivalves (*Barbatia* sp. and *Pteria* sp.). Numerous small motile invertebrates: the brachyuran crabs *Parasesarma pictum*, *Myomenippe hardwickii*, *Halicarcinus orientalis*, *Eriphia*



**Fig. 2.** Scheme of distribution of macrobenthos in the rocky intertidal zone (Grande Catwick, Catwick Islands). 1 – *Saccostrea scyphophilla*, 2 – *Megabalanus tintinnabulum*, 3 – Amphipoda, 4 – Decapoda, 5 – Spongia, 6 – Isopoda, 7 – Polyplocophora, 8 – Hydrozoa, 9 – Polychaeta, 10 – Gastropoda, 11 – Zoantharia, 12 – Bivalvia, 13 – algae, 14 – Scleractinia, 15 – Echinoidea, 16 – Ophiuroidea. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.

Table 2

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper intertidal subzone of the rocky intertidal zone, in the *Saccostrea scyphophilla* belt-forming community

Taxa	Taxonomic group	Grande Catwick, Catwick Islands		Cham Island	
		B	N	B	N
ANIMALS					
<i>Saccostrea scyphophilla</i>	Bi	12000.0	200	10008.0	1240
<i>Tetraclita squamosa</i>	Ci	–	–	590.0	160
<i>Isognomon ephippium</i>	Bi	–	–	48.0	480
<i>Septifer virgatus</i>	Bi	–	–	40.0	320
<i>Metopograpsus messor</i>	De	–	–	28.0	40
<i>Brachidontes mutabilis</i>	Bi	–	–	18.0	160
<i>Ibla cumingi</i>	Ci	–	–	12.2	160
<i>Entacmaea quadricolor</i>	Ac	–	–	12.0	200
<i>Trochus maculatus</i>	Ga	–	–	4.0	320
<i>Cellana testudinaria</i>	Ga	–	–	3.2	200
<i>Syllis hyalina</i>	Po	–	–	0.5	40
<i>Hyale</i> sp.	Am	0.4	120	–	–
<i>Dynamenella trachydermata</i>	Is	–	–	0.4	40
Total biomass		12000.4		10764.3	

**Notes.** See Tables 2, 4–22. Taxonomic groups: Rh – Rhodophyta, Och – Ochrophyta, Ch – Chlorophyta, Tra – Tracheophyta, Sp – Spongia, Hy – Hydrozoa, Ac – Actinaria, Sc – Scleractinia, Zo – Zoantharia, Pr – Priapulida, Po – Polychaeta, Si – Sipuncula, Ci – Cirripedia, St – Stomatopoda, Cu – Cumacea, Ta – Tanaidacea, Is – Isopoda, Am – Amphipoda, De – Decapoda, Pol – Polyplacophora, Ga – Gastropoda, Bi – Bivalvia, Br – Brachiopoda, As – Asteroidea, Oph – Ophiuroidea, Ech – Echinoidea, Ho – Holothuroidea, Asc – Ascidiacea, Act – Actinopterygii. The sign «+» designates species found within the limits of a considered community, but their abundance is not registered, the sign «–» means that species is not found or quantity is not counted.

*smithii*, *Metopograpsus thukubar*, and *Pinnotheres* sp., the porcelain crab *Petrolisthes* sp., and others nestle among sessile animals. There are also crustose coralline red algae. On the surf coasts, the coralline alga *Lithothamnion* spreads from the supratidal zone to the middle intertidal subzone, *S. echinata* disappears, and motile forms of invertebrates are absent (Gurjanova, Chang Hiu Phuong, 1972).

At Vung Tau, a belt-forming community, also dominated by the littorinid species *Tectarius antonii*, is found in the supratidal zone and the upper intertidal subzone (Fischer, 1952). On Thu Island, the population of the upper intertidal subzone is very poor. Only the littorinid species *Echinolittorina millegrana* and *T. antonii* very rarely occur in the rocky cracks.

The supratidal zone and the upper intertidal subzone from Cape Dinh to Ro Bay are occupied by belt-forming communities of Littorinidae and Littorinidae+Chthamalidae. The latter community spreads out to the upper part of the middle intertidal subzone (Fig. 3; Table 3). In the *Echinolittorina millegrana*+*Nodilittorina pyramidalis* community, the dominant and subdominant species can alternate themselves. *E. millegrana* prevails on Mieu and Lon (southern part) islands, Me Islet (Ben Goi Bay), and Cape Co Co, and in Cai Sung Bay, and *N. pyramidalis* is a quite common dominant species on Cape Dinh, Mot, Mieu, and Lon (north-eastern part) islands, Rua Islet (Nha Trang Bay), and in Ro Bay. Below the belt of Littorinidae, the *Chthamalus malayensis* community with predominance of the gastropod species



**Fig. 3.** The rocky intertidal zone in Tre Bay (Lon Island, Van Phong Bay). **A** – the general view, **B** – the upper intertidal subzone, **C** – belt of oysters in the middle intertidal subzone. Photograph by Alexey V. Chernyshev.

Table 3

Generalized scheme of the vertical distribution of the macrobenthic communities in the rocky and rocky-blocky-bouldery intertidal zones of Nha Trang and Van Phong bays (after Tran-ngoc Loi, 1967 and Kussakin et al., 1988)

Over depths 0, m	Intertidal subzone	Storey	Belt-forming communities
3.0	Supratidal zone		Belt of Littorinidae
2.5	Upper intertidal subzone	Upper	
2.0		Lower	Belt of Littorinidae+Chthamalidae (Tetraclitidae or Balanidae)
1.6	Middle intertidal subzone	Upper	
1.35		Lower	Belt of Ostreidae
1.1	Lower intertidal subzone	Upper	
0.7		Lower	Belt of the algal mosaic ( <i>Sargassum</i> , <i>Padina</i> , <i>Turbinaria</i> , the calcareous red algae, and others)
0			Belt of Cnidaria (Scleractinia, Alcyonacea, <i>Millepora</i> )

*N. pyramidalis* and *Patelloida saccharina* occurs. The red rock crab *Grapsus grapsus* can migrate all the way down the subtidal zone across the intertidal zone.

On Mieu Island (north-eastern part), Noi (Pecheurs Islets) and Than (Nha Trang Bay) islets, Cape Chut, Cape Hon Chong, and Cape Mong Ga (Table 1), a belt-forming community dominated by another littorinid species can be found, namely *Tectarius antonii*+*Echinolittorina miliaris*. In some locations, *Echinolittorina novaezelandiae* is also a dominant species. Usually just below belt of *Tectarius*, the upper subzone is occupied by the red alga *Bangia fuscopurpurea*, the green alga *Monostroma nitidum*, and the brown algae *Asteronema breviarticulatum*+*Chnoospora minima* communities. The projective cover of the bottom with algae comes up to 60–80%. However, in the north-eastern part of Mieu Island and on Cape Chut, these algal communities are absent (Tran-ngoc Loi, 1967).

In the middle intertidal subzone of Catwick Islands, a community dominated by the barnacle *Megabalanus tintinnabulum* forms a belt 3 m wide. The total biomass of macrobenthos is up to 11 kgWW m<sup>-2</sup> (Table 4), and *M. tintinnabulum* makes up above 90% of the total biomass. Red algae dominate among plants, and sponges and *Megabalanus* sp. prevail among animals. In addition to quantitatively recorded algae, there are the red algae *Asteromenia anastomosans*, *Asparagopsis taxiformis*, *Acrochaetium catenulatum*, *Jania pumila*, *Ceramium*



Table 4

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the middle intertidal subzone of the rocky intertidal zone, in the belt-forming communities of Cirripedia

Taxa	Taxonomic group	Catwick Islands				Cham Island	
		Petite Catwick		Grande Catwick		B	N
		B	N	B	N		
PLANTS							
<i>Hypnea pannosa</i>	Rh	–		176.4		–	
<i>Gelidium</i> sp.	Rh	+		135.0		–	
<i>Liagora</i> sp.	Rh	106.0		–		–	
<i>Gymnogongrus griffithsiae</i>	Rh	–		69.1		–	
<i>Polysiphonia</i> sp.	Rh	–		48.3		–	
<i>Gelidium crinale</i>	Rh	–		24.0		–	
<i>Lobophora variegata</i>	Och	+		13.3		–	
<i>Gayliella flaccida</i>	Rh	–		6.7		–	
<i>Cladophora</i> sp.	Ch	–		0.3		–	
Total biomass of plants		106.0		473.1			
ANIMALS							
<i>Megabalanus tintinnabulum</i>	Ci	11200.0	450	3745.0	467	–	–
<i>Tetraclita squamosa</i>	Ci	+	+	–	–	6200.0	440
<i>Saccostrea scyphophilla</i>	Bi	–	–	–	–	3600.0	320
<i>Megabalanus</i> sp.	Ci	–	–	890.0	33	–	–
<i>Geodia</i> sp.	Sp	+		364.0		–	
<i>Halichondria</i> sp.	Sp	+		346.7		–	
<i>Septifer virgatus</i>	Bi	–	–	–	–	178.4	720
<i>Isognomon ephippium</i>	Bi	–	–	–	–	90.0	240
<i>Amphibalanus reticulatus</i>	Ci	–	–	81.7	533	–	–
<i>Leiosolenus levigatus</i>	Bi	–	–	5.0	33	42.8	160
<i>Metopograpsus messor</i>	De	–	–	–	–	30.0	680
<i>Balanus</i> sp.	Ci	–	–	26.7	267	–	–
<i>Brachidontes mutabilis</i>	Bi	–	–	–	–	18.0	160
<i>Actaea</i> sp.	De	–	–	14.7	33	–	–
Xanthidae	De	–	–	13.7	33	–	–
<i>Cellana testudinaria</i>	Ga	+	+	–	–	12.0	1000
<i>Perinereis cultrifera</i>	Po	–	–	–	–	11.8	600
Blenniidae	Act	–	–	–	–	10.4	80
<i>Nerita albicilla</i>	Ga	–	–	–	–	10.4	80
<i>Pachygrapsus minutus</i>	De	–	–	–	–	9.2	400
<i>Entacmaea quadricolor</i>	Ac	–	–	–	–	8.0	80

Table 4 (Continued)

Taxa	Taxonomic group	Catwick Islands				Cham Island	
		Petite Catwick		Grande Catwick		B	N
		B	N	B	N		
<i>Ischyrocerus</i> sp.	Am	+	+	7.0	867	–	–
<i>Allorchestes</i> sp.	Am	0.8	240	7.0	147	–	–
<i>Heteropanope glabra</i>	De	–	–	7.0	50	3.2	40
<i>Ibla cumingi</i>	Ci	–	–	–	–	4.0	40
Goneplacidae	De	–	–	3.3	17	–	–
<i>Spirobranchus giganteus</i>	Po	–	–	–	–	3.1	80
<i>Elasmopus</i> sp.	Am	–	–	2.9	1093	–	–
<i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>nigrescens</i>	Si	–	–	–	–	2.8	40
<i>Dynoides amblysinus</i>	Is	0.2	120	2.4	447	–	–
<i>Pilumnus</i> sp.	De	+	+	2.0	13	0.4	80
<i>Marphysa sanguinea</i>	Po	–	–	–	–	1.8	40
<i>Pontogeneia</i> sp.	Am	–	–	1.7	67	–	–
<i>Palola siciliensis</i>	Po	–	–	1.7	33	–	–
<i>Nereis nicholli</i>	Po	+	+	1.3	100	–	–
<i>Lasaea undulata</i>	Bi	1.2	200	–	–	–	–
<i>Tetralia glaberrima</i>	De	1.2	40	–	–	–	–
<i>Dynamenella trachydermata</i>	Is	0.3	80	0.5	733	–	–
<i>Cirolana</i> sp.	Is	0.2	40	0.5	700	–	–
<i>Lachnopus subacutus</i>	De	–	–	–	–	0.4	40
<i>Sesarma</i> sp.	De	–	–	–	–	0.4	80
<i>Nereis</i> sp.	Po	–	–	0.5	233	–	–
<i>Syllis variegata</i>	Po	–	–	0.5	213	–	–
Tanaidacea	Ta	0.4	200	0.1	240	–	–
<i>Notoplax</i> sp.	Pol	0.4	40	–	–	–	–
<i>Amakusanthura</i> sp.	Is	0.3	80	0.1	67	–	–
<i>Reishia luteostoma</i>	Ga	+	+	0.3	67	–	–
<i>Caprella</i> sp.	Am	–	–	0.3	33	–	–
<i>Lysidice collaris</i>	Po	–	–	0.2	67	–	–
<i>Syllis hyalina</i>	Po	–	–	0.1	67	–	–
<i>Chrysopetalum debile</i>	Po	–	–	0.1	33	–	–
<i>Autolytus orientalis</i>	Po	–	–	0.1	33	–	–
<i>Maera</i> sp.	Am	–	–	0.1	30	–	–
Total biomass of animals		11205.0		5527.2		10237.1	
Total biomass		11311.0		6000.3		10237.1	

*vietnamense*, *Champia parvula*, and encrusting coralline red algae, the brown alga *Dictyota implexa* and the green algae *Dictyosphaeria versluisii*, *D. cavernosa* and *Valoniopsis pachynema*. Algal plantlets (0.5–0.9 cm high) of *Polysiphonia* sp., *Gelidiella acerosa*, *Lobophora variegata*, *Liagora* sp., and others are often found in the shells of barnacles and bodies of spongia with the projective cover of 60–100%. On the Catwick Islands, the sponge *Clathria (Thalysias) ramosa*, the scleractinian coral *Tubastraea coccinea*, the soft coral *Zoanthus* sp., diverse polychaetes (*Eunice kobeensis*, *Leodice antennata*, *Harmothoe asiatica*, *Parasphaerosyllis indica*, *Syllis gracilis*, *Dorvillea* sp., *Cirriformia semicineta*), the barnacle *Chthamalus malayensis*, the little shore crab *Pachygrapsus minutus*, the species of gastropods (*Dendropoma planorbis*, *Drupa morum*, *Inquisitor varicosa*, *Diodora quadriradiata*, and *Mancinella alouina*), the brittle star *Ophiactis savignyi*, and some other invertebrates may also be found in the middle intertidal subzone. About 50% of barnacles on the Catwick Islands are dead.

On Grande Catwick, a community dominated by the scleractinian coral *Tubastraea coccinea* develops is recorded in rock clefts. The biomass of corals *T. coccinea* and *Stylophora pistillata* makes up 95% of the total biomass of macrobenthos (Table 5). Algae are not found in the community.

The belt-forming community of the barnacle *Tetraclita squamosa* and the oyster *Saccostrea scyphophilla* is well developed in the middle intertidal subzone of Cham Island (Table 4). Algae are absent in the community. The animal biomass is up to 10 kgWW m<sup>-2</sup>. The dominant species make up above 95% of the total biomass of macrobenthos.

On Nam Du Islet, the upper part of the middle intertidal subzone is occupied by the modification of the *Megabalanus tintinnabulum* community, the belt-forming community of *M. tintinnabulum* and the red alga *Laurencia* sp. The total biomass of macrobenthos reaches 3255 gWW m<sup>-2</sup> in the community. Among the accompanying species of algae, the red algae *Centroceras clavulatum* and *Leveillea jungermannioides* frequently occur, and among the animals, barnacle *Chthamalus malayensis*, rare Amphipoda, Polychaeta, and Actiniaria may be found in the community. The lower part of the middle intertidal subzone is inhabited by another algal community, a belt-forming community dominated by the brown alga *Turbinaria decurrens* with the total biomass of macrobenthos up to 4500 gWW m<sup>-2</sup>. The community also includes the red algae *Laurencia* spp. and *L. jungermannioides*, *Jania spectabilis*, *Amphiroa fragilissima*, and others, species of Amphipoda, Polychaeta, Ophiuroidea, and *Cerithium* (Gastropoda).

On Thu Island, there are no distinct belts, and the distribution of communities is mosaic, with a slight predominance of the brown alga *Padina boryana* observed in the upper part of the middle intertidal subzone. Algal species also include the red

Table 5

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the middle intertidal subzone of the rocky intertidal zone, in the *Tubastraea coccinea* community (Grande Catwick, Catwick Islands)

Taxa	Taxonomic group	B	N
ANIMALS			
<i>Tubastraea coccinea</i>	Sc	1500.0	
<i>Stylophora pistillata</i>	Sc	448.0	
<i>Leiosolenus levigatus</i>	Bi	20.0	80
Calcarea	Sp	8.0	
<i>Sabia conica</i>	Ga	2.0	40
<i>Diodora quadriradiata</i>	Ga	2.0	40
<i>Ophiactis savignyi</i>	Oph	1.2	80
<i>Ischyrocerus</i> sp.	Am	0.8	80
<i>Autolytus orientalis</i>	Po	0.8	40
<i>Lysidice collaris</i>	Po	0.6	40
<i>Elasmopus</i> sp.	Am	0.4	40
<i>Sertularella</i> sp.	Hy	0.4	
<i>Dynamenella trachydermata</i>	Is	0.2	200
<i>Syllis variegata</i>	Po	0.2	80
<i>Amakusanthura</i> sp.	Is	0.1	40
<i>Cirolana</i> sp.	Is	0.1	40
<i>Dynoides amblysinus</i>	Is	0.1	40
Total biomass		1984.9	

algae *Gelidiella acerosa* and *Centroceras clavulatum* and the brown alga *Hydroclathrus clathratus* and animals are represented only by the gastropod *Drupa* sp. The belt of the brown alga *Sargassum mclurei*, with the biomass above 4 kgWWm<sup>2</sup>, develops in the lower part of the middle subzone. Sponges and gastropods predominate in the community.

At Vung Tau, the belt-forming community dominated by the oyster *Saccostrea cucullata* is characteristic for habitats with weak wave action. On wave-exposed coasts, settlements of the barnacle *Tetraclita porosa* develop. Settlements of the gastropod *Nerita albicilla* are also frequent in the middle intertidal subzone on rocks (Fischer, 1952).

From Cape Dinh to Ro Bay, on Than Islet, Cape Chut and Cape Mong Ga, a belt-forming community dominated by the barnacle *Chthamalus malayensis* develops in the middle intertidal subzone. Below the belt of barnacles, there is a belt of

the oyster *Saccostrea cucullata*. On Noi Islet and Cape Hon Chong, the *Cb. malayensis* community spreads mainly in the lower part of the upper intertidal subzone with separate settlements in the middle subzone. In the north-eastern part of Mieu Island, the *S. cucullata* community occupies most part of the middle intertidal subzone forming a 60 cm wide belt. A community dominated by the red alga *Dermonea virens* and the green alga *Chaetomorpha antennina* has a patchy distribution in the middle intertidal subzone of Noi and Than islets, Cape Hon Chong and Cape Mong Ga (Tran-ngoc Loi, 1967).

On Mieu and Lon (southern part and Tre Bay) islands, Me Islet, in Cai Sung Bay and on Cape Co Co, the lower part of the middle intertidal subzone and almost the whole upper part of the lower intertidal subzone of rocks are occupied by a belt-forming 60–75 cm wide community dominated by another species of oysters, namely *Saccostrea scyphophilla* (Fig. 3). In some locations, the barnacle *Tetraclita* belt may be found between *Chthamalus* and *Saccostrea*. And besides, zones subject to strong surf action are inhabited by *Tetraclita squamosa*, whereas *T. porosa* develops in more sheltered areas. *Chthamalus* is sometimes replaced by *Megabalanus tintinnabulum*. Among dead oysters, diverse species of Polychaeta, Decapoda, and Bivalvia can frequently be found.

To the north-west of the Gulf of Tonkin (Cat Ba and Co To islands, and Be Bank), dense settlements of the barnacle *Balanus* sp. occur in the middle intertidal subzone. The brachyuran crab *Nanosesarma minutum* and rare *Ibla* sp. barnacles are accompanying the dominant species (Gurjanova, Chang Hiu Phuong, 1972).

On Nam Du Islet, the species composition of macrobenthos is very poor in the lower intertidal subzone. The brown alga *Lobophora variegata* makes up to 95% of total algal biomass, which is quite low (143 gWWm<sup>-2</sup>), and among animals only species of Polychaeta occur.

On Thu Island, the lower intertidal subzone is occupied by a belt-forming community dominated by the brown alga *Sargassum feldmannii* with the total macrobenthic biomass of about 1500 gWWm<sup>-2</sup>. The green algae *Caulerpa racemosa* and *Hali-medea bikinensis* are prevailing species of algae and among animals only Polychaeta, Amphipoda, and Isopoda may be found, with a very small share (0.08 gWWm<sup>-2</sup>) in the community.

On the Catwick Islands, communities of the middle intertidal subzone dominated by barnacles spread along the lower intertidal subzone. The total animal biomass is above 10 kgWW m<sup>-2</sup> (Table 6). In addition to quantitatively recorded species of algae, the red algae *Peyssonnelia* sp., *Acrochaetium catenulatum*, *Ceramium vietnamense*, *Ahnfeltiopsis quinhonensis*, *Ceratodictyon repens*, *C. scoparium*, *Gelidiella myrioclada*, and *Jania pumila*, the brown alga *Neoralfsia expansa* and the green alga *Chlorodesmis hildebrandtii* occur in these communities. The red alga *Hypnea nidulans*

Table 6

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos  
in the lower intertidal subzone of the rocky intertidal zone,  
in the *Megabalanus* communities (Catwick Islands)

Taxa	Taxonomic group	Petite Catwick		Grande Catwick	
		B	N	B	N
PLANTS					
<i>Gayliella flaccida</i>	Rh	222.0		–	
<i>Dictyosphaeria cavernosa</i>	Ch	191.8		–	
<i>Asteromenia anastomosans</i>	Rh	–		43.2	
<i>Gelidium crinale</i>	Rh	–		24.0	
Total biomass of plants		413.8		67.2	
ANIMALS					
<i>Megabalanus tintinnabulum</i>	Ci	–	–	10840.0	3280
<i>Megabalanus</i> sp.	Ci	9600.0	440	–	–
<i>Eupilumnus actumnoides</i>	De	524.0	440	–	–
<i>Drupa morum</i>	Ga	380.0	40	+	+
Calcarea	Sp	360.0		–	
Xanthidae	De	1.2	40	8.0	40
<i>Sertularia</i> sp.	Hy	3.2		+	
<i>Syllis variegata</i>	Po	1.3	240	–	–
<i>Nereis nichollsi</i>	Po	1.1	200	–	–
<i>Ischyrocerus</i> sp.	Am	0.8	1360	–	–
Tanaidacea	Ta	0.8	1200	–	–
<i>Leodice antennata</i>	Po	0.8	40	–	–
<i>Diodora quadriradiata</i>	Ga	0.8	40	–	–
<i>Reishia luteostoma</i>	Ga	0.8	40	–	–
<i>Dynamenella trachydermata</i>	Is	–	–	0.7	160
<i>Syllis gracilis</i>	Po	0.5	320	–	–
<i>Plaxiphora</i> sp.	Pol	–	–	0.4	80
<i>Schizotricha</i> sp.	Hy	–		0.4	
<i>Phascolosoma (Phascolosoma) nigrescens</i>	Si	0.4	80	–	–
<i>Notoplax</i> sp.	Pol	0.4	80	–	–
<i>Chrysopetalum debile</i>	Po	0.3	40	–	–
<i>Maera</i> sp.	Am	0.2	80	–	–
<i>Cirolana</i> sp.	Is	–	–	0.1	40
<i>Dynoides amblysinus</i>	Is	–	–	0.1	40
Total biomass of animals		10876.6		10849.7	
Total biomass		11290.4		10916.9	

may occupy shells of large mollusks. The projective cover of rocks by crustose coral-line red algae is 70–80%. The sponges *Tedania* (*Tedania*) *anhelans*, *Spongia* sp., and *Gelliodes* sp., the scleractinian corals *Tubastraea coccinea* and *Pocillopora verrucosa*, various species of Decapoda and Echinoidea, the gastropods *Menathais tuberosa*, *Mancinella alouina*, and *Latirolagena smaragdulus*, the bivalve mollusk *Tridacna* sp. are also found among animals in the lower intertidal subzone on the Catwick Islands. The corals *T. coccinea* and *P. verrucosa* spread in the subtidal zone where they create continuous fields.

At Vung Tau, the lower intertidal subzone of rocks is mainly inhabited by diverse brown algae, sessile invertebrates (species of Serpulidae, Cirripedia, and oysters), and by the gastropods (*Monodonta canalifera*, *Patelloida saccharina*, *Cellana testudinaria*, *C. bifasciata*, *Reishia luteostoma*, *Pictocolumbella ocellata*, *Mitra scutulata*, and others) (Fischer, 1952).

The macrobenthos of the lower intertidal subzone below the belt of oysters varies from Cape Dinh to Ro Bay. For example, the sedentary gastropod *Thylacodes* sp. (up to 1350 gWWm<sup>-2</sup>) often forms a belt over coral communities of Lon Island. The true limpet *Scutellastra flexuosa* and the chiton *Acanthochitona fascicularis* may be found in the *Thylacodes* community.

On Mieu and Lon (southern part and Tre Bay) islands, Me Islet, in Cai Sung Bay and on Cape Co Co, rocky cracks filled with sand and small stony debris host a diverse fauna of invertebrates: gastropods (*C. testudinaria*, *P. saccharina*, *Nerita undata*, *N. albicilla*, *Planaxis sulcatus*, *Thalessa aculeata*, *Mancinella armigera*, *R. luteostoma*, *Drupa ricinus*, *Tenguella musiva*, *Chicoreus brunneus*, *P. ocellata*, and *Conus sponsalis*), bivalve mollusks (*Barbatia foliata*, *B. cometa*, *Striarca symmetrica*, *Trapezia speciosa*, *Ostrea* sp., *Saccostrea scyphophilla*, *Isognomon perna*, *I. isognomum*, *Septifer excisus*, *Malleus legumen*, *Leiosolenus malaccanus*, *Pinctada margaritifera*, *Spondylus sinensis*, and *Periglypta reticulata*), the chiton *Liolophura* sp., the barnacle *Capitulum mitella*, the porcelain crab *Petrolisthes boscii*, and the sea urchin *Actinopyga echinites*.

The lower part of the lower intertidal subzone, the subtidal fringe, and the subtidal zone are inhabited by colonies of various scleractinian corals forming massive reef structures. For instance, the scleractinian corals *Montipora angulata*, *Goniastrea pectinata*, *G. retiformis*, *G. aspera*, *Favia speciosa*, *F. favus*, *F. pallida*, *Acropora secale*, *A. divaricata*, *A. hyacinthus*, *A. robusta*, *Porites lobata*, *Leptastrea purpurea*, *Pocillopora damicornis*, and *P. verrucosa* are the main reef builders on Mieu Island. In Cai Sung Bay and other areas, besides, the scleractinian corals *Stylophora pistillata*, *Acropora digitifera*, *Fungia fungites*, *F. scutaria*, *Porites australiensis*, *G. aspera*, *Galaxea fascicularis*, and colonies of the hydrocoral *Millepora platyphylla* occur. Diverse species of gastropods (*C. testudinaria*, *N. albicilla*, *Planaxis sulcatus*, *Thalessa*

*aculeata*, *Tenguella granulata*, *Purpura persica*, *Mauritia arabica*, *Cantharus* sp., and others), bivalve mollusks (*Arca ventricosa*, *Chama* sp., *Leiosolenus lima*, *L. levigatus*, *L. malaccanus*, *S. scyphophilla*, *Gastrochaena* sp., and *Pinctada* sp.), sponges, sea cucumbers, small brittle stars, crabs (*Brachyura* and *Anomura*), shrimps (*Alpheidae*), and ascidians live in the coral communities. Less often, sipunculid worms, polychaetes, the barnacles *Megabalanus tintinnabulum* and *Capitulum mitella*, the coral fishes *Gobiodon*, and the brown alga *Lobophora* sp. can be found living among coral branches. Numerous highly mobile blennioid fishes of the genus *Salaria* swarm below the water surface. However, though the species diversity of animals is high in the coral communities, the total animal biomass without corals is extremely low ( $95 \text{ gWWm}^{-2}$ ). From Cape Dinh to Ro Bay, a wide belt of *Sargassum* develops in the lower intertidal subzone.

In Cai Sung Bay, there is a dead coral plateau with rare rocky blocks. This part of the plateau is inhabited by several species of sea cucumbers, the sea urchin *Eremopyga* sp., several species of sponges, brachyuran crabs, and sipunculid worms, *Clibanarius* sp. and other hermit crabs, the mantis shrimp *Gonodactylus* sp., the gastropods *Thalessa aculeata* and *Turbo bruneus*, and the bivalve mollusks *Chama brassica*, *A. ventricosa*, *Septifer bilocularis*, *Isognomon perna*, *Pinna saccata*, *Pinctada imbricata fucata*, *Lithophaga caperata*, *Barbatia foliata*, and *Modiolus auriculatus*. Occasionally several species of opisthobranchs, amphipods, and a few shrimps occur. The limestone calyces of dead corals are inhabited by the polychaete *Hediste diversicolor* up to 60 cm long and by moray eels. There are a few algal species (the green algae *Valonia*, the brown algae *Padina*, the red alga *Gymnogongrus griffithsiae*, and others) in the upper part of the plateau. In the lower part, algae are more diverse (the green algae *Caulerpa microphyta*, *Boodlea struveoides*, and *Anadyomene plicata*, and the red algae *Palisada perforata*, *Laurencia tenera*, *Gracilaria canaliculata*, and *Gelidiella acerosa*), and their total biomass is up to  $300 \text{ gWWm}^{-2}$ . The total animal biomass reaches  $4500 \text{ gWWm}^{-2}$ , and bivalve and gastropod mollusks prevail among animals (more than 65% and about 30% of the total biomass respectively). Bivalves include *Striarca symmetrica*, *A. ventricosa*, *Adula* sp., *Rocellaria* sp., *Cardita variegata*, *Isognomon perna*, *I. isognomum*, *M. auriculatus*, *Malleus legumen*, and *Leiosolenus malaccanus*. Among gastropods, *Conus* sp. and *Turbo bruneus* predominate and sometimes *Cerithium* sp. and *Drupa* sp. are found. Species of Decapoda, Holothuroidea, Polychaeta, and Amphipoda frequently occur below a belt of oysters in the lower intertidal subzone of Cai Sung Bay.

On Noi Islet, there are communities of *Megabalanus tintinnabulum*+*Lobophora variegata*, the worm snail *Dendropoma corrodens*, the green alga *Chaetomorpha antennina*, and other organisms that do not form belts. The main belt-forming communities are represented by the crustose coralline algae *Hydrolithon*, *Neogoniolithon*,



and *Lithophyllum* and algal turf dominated by the red alga *Gelidium pusillum*. The subtidal fringe is inhabited by scleractinian corals. On Cape Chut, association of the brown algae *Sargassum polycystum*, *Turbinaria ornata*, and *Padina boryana* form a belt in the upper part of the lower subzone, and colonies of scleractinian corals form settlements in the lower part of subzone. Reef-building scleractinian corals with diverse accompanying fauna and flora flourish in the north-eastern part of Mieu Island. A belt of crustose coralline algae *Lithophyllum* and *Peyssonnelia* is also quite extended. The low intertidal subzone of Than Islet is mainly occupied by a belt-forming *M. tintinnabulum*+*Tetraclita squamosa* community. On Cape Hon Chong, *Sargassum mcclurei*+*Sargassum polycystum* form a belt, and most part of the lower intertidal subzone is inhabited by colonies of the hydrocoral *Millepora platyphylla*, reef-building scleractinian corals and species of Alcyonaria. On Cape Mong Ga, a belt-forming community dominated by the barnacle *M. tintinnabulum* and the brown alga *Lobophora variegata*, and a belt of the crustose coralline algae *Hydrolithon* and *Neogoniolithon* spread along the lower intertidal subzone. Communities of the brown algae *Sargassum aquifolium* and *Dictyota friabilis* are also widespread here (Tran-ngoc Loi, 1967).

A community of the barnacle *Tetraclita squamosa* is developed both in the middle intertidal subzone and in the lower intertidal subzone on Cham Island. The species composition of macrobenthos is characterized by rather low diversity. The brown algae *L. variegata*, *Sargassum* sp., *Turbinaria ornata*, and *Padina australis*, the green algae *Dictyosphaeria cavernosa* and *Caulerpa racemosa*, the red algae *Peyssonnelia* sp., *Lithothamnion* sp., and other crustose red algae are found in the lower intertidal subzone. Macrophytic algae may often be observed as destroyed thalli, plantlets, or only rhizoids in the rocky intertidal zone. The green alga *Phyllocladon anastomosans* may dwell on the colonies of hard scleractinian corals. Among animals, in addition to the dominant species, the sponge *Gelliodes* sp., the soft zoantharian coral *Palythoa tuberculosa*, the sipunculid worm *Phascolosoma (Phascolosoma) scolops*, the brachyuran crab *Chlorodiella* sp., the gastropod mollusk *Clypeomorus bifasciata*, and the bivalve mollusk *Saccostrea scyphophilla* frequently occur in the lower rocky intertidal subzone of Cham Island.

To the north-west of the Gulf of Tonkin (Cat Ba and Co To islands, and Be Bank), the crustose coralline alga *Lithothamnion* forms a belt and provides a variety of habitats for numerous Loricata (Gurjanova, Chang Hiu Phuong, 1972).

### Rocky-blocky-bouldery intertidal zone

The rocky-blocky-bouldery intertidal zone (Thu, Mieu, Lon, and Cham islands, Mok (Nam Du Archipelago), Do (Van Bay), and Gio islets, Hon Gom Peninsula (Cua Be Strait) and Tien Sa Peninsula) (Table 1) is characterized by rocky blocks

and boulders in the upper and middle intertidal subzones, rocks with a slope up to 90°, rocky blocks and boulders with underlying sand in the lower intertidal subzone. The intertidal zone may reach 20–30 m in width. There are belt-forming communities in the upper and middle intertidal subzones and in the lower intertidal subzone communities are arranged in a patchy pattern. Dominant species vary in the communities from site to site, but, similarly to the rocky intertidal zone, epifauna prevails here.

In the southern part of Vietnam, in the upper intertidal subzone of Thu Island, macrobenthic animals inhabit only tide pools, but a rather rich composition of animals and plants is typical for the middle intertidal subzone. The green algae *Halimeda opuntia*, *H. discoidea*, *Caulerpa serrulata*, *C. racemosa*, *C. taxifolia*, *C. sertularioides*, and *Dictyosphaeria cavernosa* form a basis of the belt-forming community. Other algae include Rhodophyta (*Mastophora rosea*, *Gelidium* sp., *Laurencia corymbosa*, and *Melyvonnea erubescens*) and Phaeophyceae (*Dictyota* sp.). The seagrass *Thalassia* sp. grows on sandy patches, which split rocky bottom. The middle intertidal subzone of Thu Island is abundant with diverse corals (*Heliopora coerulea*, *Pocillopora verrucosa*, *Porites lutea*, *Goniastrea pectinata*), gastropods (*Monetaria moneta*, *Monodonta labio*, *Conus ebraeus*, *Tenguella granulata*, *Reticutriton pfeifferianus*, *Vasum turbinellus*, *Trochus maculatus*, opisthobranchs, and others), sponges, hermit crabs, the brittle stars *Ophiocoma erinaceus* and *Amphipholis squamata*, and the isopod *Joeropsis* sp.

In the lower intertidal subzone, the belt of algae can reach 10–15 m in width. Sandy patches splitting the rocky bottom off Thu Island are frequently occupied by red algae (*Mastophora rosea*, *Laurencia corymbosa*, *Melyvonnea erubescens*, *Lithophyllum okamurae*, *Asteromenia anastomosans*, *Centroceras clavulatum*, *Gelidium* sp., and others) and green algae (*Caulerpa taxifolia*, *C. racemosa*, *Halimeda opuntia*, *H. discoidea*, and *Boodlea struveoides*). The brown alga *Sargassum* sp. is found as destroyed thalli. The total algal biomass is 500–600 gWWm<sup>-2</sup>. A diversity of hard corals (*Montipora digitata*, *M. spongodes*, *Porites australiensis*, and *Heliopora coerulea*), polychaetes (*Nereiphylla castanea*, *Paralentia annamita*, *Typosyllis maculata*, *Cirriformia semicineta*, *Terebellides stroemii*, and *Leodice antennata*), isopods (*Aphantolana sphaeromiformis*, *Paracilicæa asiatica*, *Cerceis pravipalma*, *Zuzara digitata*, and *Z. curtispina*), gastropods (*Clypeomorus bifasciata*, *Pictocolumbella ocellata*, *Drupella rugosa*, *Conus lividus*, *C. ebraeus*, *Menathais tuberosa*, and others), brittle stars (*Ophiocoma erinaceus* and *Amphipholis squamata*), the chiton *Ischnochiton* sp., free-living flatworms of the order Tricladida, mantis shrimps, amphipods, and decapods inhabit the lower intertidal subzone of Thu Island.

On Mieu and Lon islands, Do Islet, and in Cua Be Strait, the supratidal zone and the upper intertidal subzone are inhabited by a community of

gastropod mollusks Littorinidae (Fig. 4) with the rather low total biomass of macrobenthos (about 30 gWWm<sup>-2</sup>). The gastropods *Nodilittorina pyramidalis*, *Echinolittorina feejeensis*, and *Peasiella* sp. predominate. Besides, *Tenguella musiva* and *Nerita undata* (Gastropoda), the bivalve mollusk *Isognomon* sp., the barnacle *Tetraclita* sp., hermit crabs, and goose barnacles are found in the community. The lightfoot crabs of the genus *Grapsus* and the fishes of the genus *Salarias* are traveling across the intertidal zone.

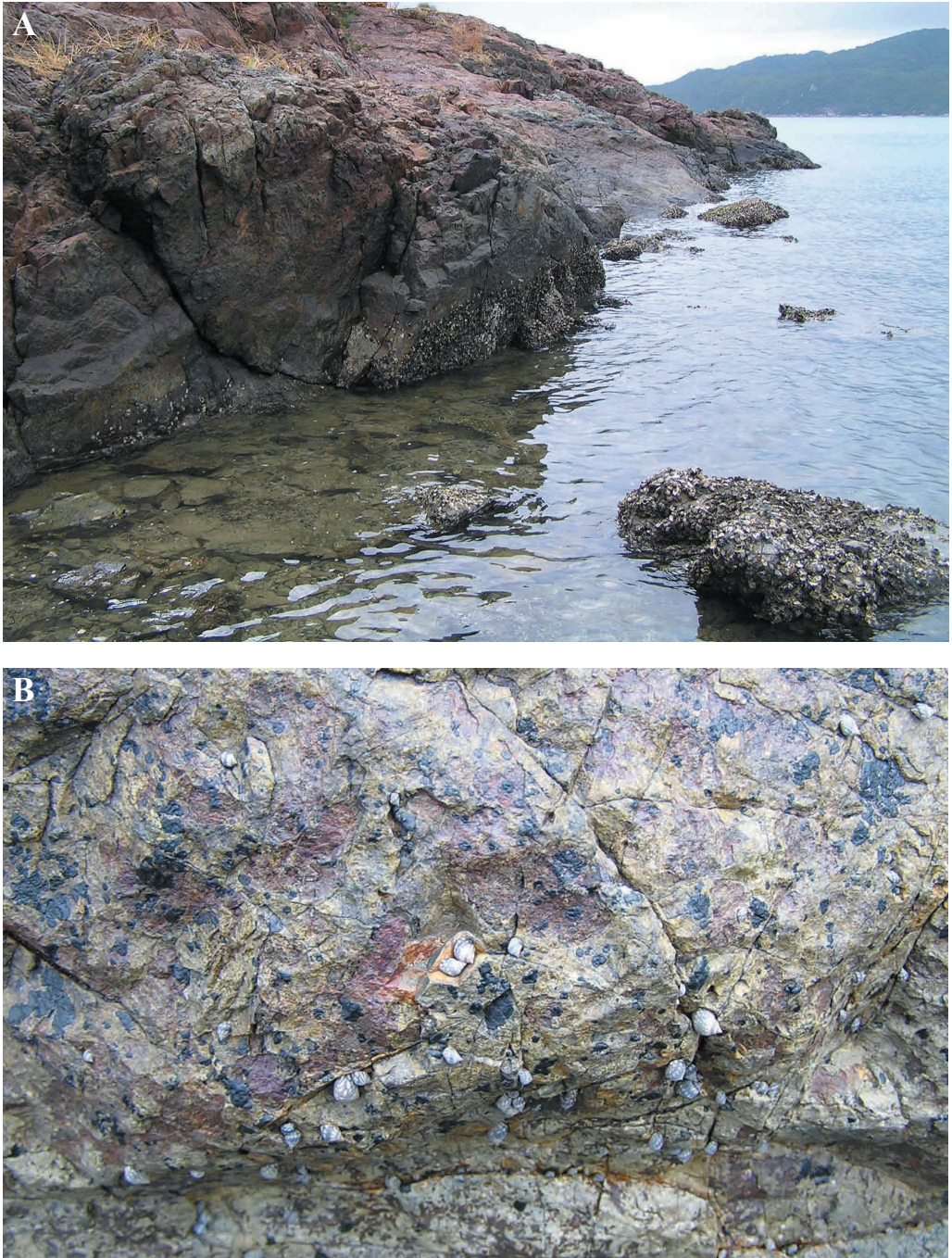
Settlements of the barnacle *Chthamalus* sp. are found in the upper part of the middle intertidal subzone. The lower part of the subzone is occupied by a belt-forming community of the oyster *Saccostrea cucullata* up to 75 cm wide with the biomass of dominant species reaching 290 gWWm<sup>-2</sup>. Below *Chthamalus* and over *Saccostrea*, sometimes *Tetraclita* settlements occur (Fig. 5).

The upper part of the lower intertidal subzone is occupied by the bivalve mollusk *Malleus regula*. Among other animals, various species of Gastropoda and Stomatopoda frequently occur, and species of Polychaeta are uncommon. The population of the lower part of the lower intertidal subzone differs between Nha Trang and Van Phong bays. Colonies of the hydrocoral *Millepora platyphylla*, reef-building scleractinian corals and species of Alcyonaria form dense accumulations in Van Phong Bay (Fig. 6). In Nha Trang Bay, a belt of algal mosaic dominated by the brown algae of the genera *Sargassum* and *Padina* and calcareous red and green algae are observed between oysters and corals. Members of Gastropoda, Stomatopoda, Hydrozoa, and Echinodermata form accompanying fauna in the communities of the lower intertidal subzone.

In the central part of Vietnam, on Cham Island, a community dominated by the gastropod species *Echinolittorina millegrana* forms a 3–5 m wide belt, and *E. millegrana* makes up 99% of the total community biomass in the upper intertidal subzone. The gastropods *Nerita albicilla*, *Mancinella alouina*, *Cellana testudinaria*, *Drupella margariticola*, *D. rugosa*, *Conus* sp., and others, and the brachyuran crab *Grapsus tenuicrustatus* are accompanying species.

On Tien Sa Peninsula, a community of the oyster *Saccostrea scyphophilla* forms a 5–7 m wide belt. The barnacle *Pollicipes* sp. and the gastropod *Nerita albicilla* also prevail in the community (Fig. 7; Table 7). The *S. scyphophilla* community also includes the barnacle *Scalpellum typicum*, the brachyuran crab *Grapsus tenuicrustatus*, hermit crabs, and the gastropods *Mancinella alouina* and *Monodonta labio*. On Gio Islet, a belt-forming community dominated by the barnacle *Tetraclita squamosa* and abundant with gastropods (*N. albicilla* and *Planaxis sulcatus*) and crabs (*G. tenuicrustatus*) develops in the upper intertidal subzone.

A rich composition of macrobenthos is typical for the middle intertidal subzone. On Cham Island and Gio Islet, the *S. scyphophilla* community forms



**Fig. 4.** The rocky-blocky-bouldery intertidal zone on Do Islet (Van Bay, Van Phong Bay). **A** – the general view, **B** – the upper intertidal subzone. Photograph by Alexey V. Chernyshev.



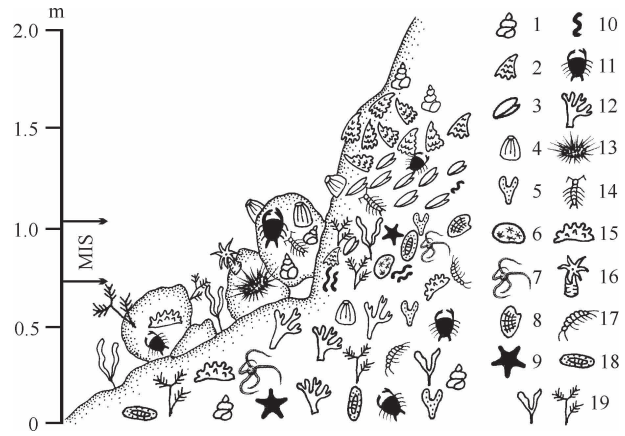
**Fig. 5.** The rocky-blocky-bouldery intertidal zone on Mieu Island. Photograph by Alexey V. Chernyshev.



**Fig. 6.** The rocky-blocky-bouldery intertidal zone on the south-western coast of Hon Gom Peninsula (Cua Be Strait, Van Phong Bay). **A** – the general view, **B** – coral reef in the lower intertidal subzone. Photograph by Alexey V. Chernyshev.

a 5–8 m wide belt. The total biomass of macrobenthos may reach up to 11.5 kgWW m<sup>-2</sup> (Table 8). Algae are absent in this community with an exception of the calcareous red alga *Lithothamnion* sp. covering boulders and rocky blocks on Gio Islet. The species composition of the community is rather diverse, but gastropods and hermit crabs mainly prevail. Numerous small specimens of brachyuran crabs occur under boulders covered by the sponge *Timea* sp. on Gio Islet.

On Tien Sa Peninsula, there are two communities in the middle intertidal subzone. A community of the red algae



**Fig. 7.** Scheme of distribution of macrobenthos in the rocky-blocky-bouldery intertidal zone (Tien Sa Peninsula). 1 – Gastropoda, 2 – *Saccostrea scyphophilla*, 3 – *Pollicipes* sp., 4 – Cirripedia, 5 – Spongia, 6 – Zoantharia, 7 – Ophiuroidea, 8 – Bivalvia, 9 – Asteroidea, 10 – Polychaeta, 11 – Decapoda, 12 – Scleractinia, 13 – Echinoidea, 14 – Isopoda, 15 – Holothuroidea, 16 – Actiniaria, 17 – Amphipoda, 18 – Polyplacophora, 19 – algae and seagrasses. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.

**Table 7**

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper intertidal subzone of the rocky-blocky-bouldery intertidal zone

Taxa	Taxonomic group	Tien Sa Peninsula					
		Gio Islet		northward of Cape Lutin		south-eastern part	
		B	N	B	N	B	N
<b>ANIMALS</b>							
<i>Tetraclita squamosa</i>	Ci	2501.0	300	–	–	–	–
<i>Saccostrea scyphophilla</i>	Bi	–	–	2500.0	68	1200.0	136
<i>Pollicipes</i> sp.	Ci	–	–	535.0	170	–	–
<i>Planaxis sulcatus</i>	Ga	455.0	300	+	+	56.6	64
<i>Nerita albicilla</i>	Ga	110.0	100	117.5	90	–	–
<i>Cellana vitiensis</i>	Ga	–	–	24.6	60	–	–
<i>Chthamalus malayensis</i>	Ci	–	–	–	–	17.0	840
<i>Echinolittorina millegrana</i>	Ga	–	–	+	+	5.4	280
<i>Sesarma</i> sp.	De	–	–	0.1	10	–	–
<i>Perinereis cultrifera</i>	Po	–	–	0.1	10	–	–
Total biomass		3066.0		3177.3		1279.0	

*Gelidiella acerosa*+*Gelidium crinale* is found northward of Cape Lutin (Table 8). The algal flora includes encrusting coralline red algae that cover significant areas of rocky walls, blocks, and boulders, as well as the green alga *Dictyosphaeria cavernosa*, the brown algae *Lobophora variegata*, *Neoralsia expansa*, and *Turbinaria ornata*, and others. The sea cucumber *Holothuria* sp., colonies of the soft coral *Palythoa tuberculosa* of the order Zoantharia, and the sea urchin *Echinothrix calamaris* dominate among animals. In addition to quantitatively recorded species, other holothurians, *Holothuria* (*Mertensiothuria*) *hilla* and *H.* (*Thymiosycia*) *impatiens*, the polychaete *Nereis nichollsi*, the barnacle *Tetraclita squamosa*, the isopod *Ligia* sp., the amphipod *Hyale* sp., the gastropods *Cellana testudinaria*, *Tenguella granulata*, *Drupella margariticola*, and some opisthobranchs, the bivalve mollusk *Barbatia foliata*, and the sea star *Echinaster* sp. are found in the algal community.

In the south-eastern part of Tien Sa Peninsula, a community dominated by the barnacle *Pollicipes* sp. develops. Very diverse plants, especially red algae (*G. acerosa*, *G. crinale*, *Palisada parvipapillata*, and encrusting coralline red algae), and the seagrass *Thalassia* sp. are recorded in the community. Nevertheless, many algae are found only in the form of destroyed thalli (the green algae *D. cavernosa* and *Neomeris annulata*), plantlets (the brown algae *Padina australis* and *Sargassum* sp.), or rhizoids (*T. ornata*). The sea snail *Echinolittorina millegrana* is the first numerous animal species (more than 2300 ind. m<sup>-2</sup>). The chitons *Lucilina* sp. and *Plaxiphora* sp.

Table 8

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the middle intertidal subzone of the rocky-blocky-bouldery intertidal zone

Taxa	Taxonomic group	Tien Sa Peninsula					
		Cham Island		northward of Cape Lutin		south-eastern part	
		B	N	B	N	B	N
PLANTS							
<i>Gelidiella acerosa</i>	Rh	–		256.0		+	
<i>Gelidium crinale</i>	Rh	–		210.0		+	
Coralline red algae	Rh	–		40.0		+	
<i>Lithothamnion</i> sp.	Rh	–		24.0		–	
<i>Sargassum</i> sp.	Och	–		18.0		+	
<i>Jania</i> sp.	Rh	–		4.0		–	
<i>Padina australis</i>	Och	–		2.0		+	
<i>Asparagopsis taxiformis</i>	Rh	–		0.5		–	
Total biomass of plants				554.5			



Table 8 (Continued)

Taxa	Taxonomic group	Cham Island		Tien Sa Peninsula			
				northward of Cape Lutin		south-eastern part	
		B	N	B	N	B	N
ANIMALS							
<i>Saccostrea scyphophilla</i>	Bi	8400.0	560	–	–	+	+
<i>Nerita albicilla</i>	Ga	1620.0	360	+	+	40.0	33
<i>Mancinella alouina</i>	Ga	964.0	160	+	+	+	+
Paguridae	De	284.8	40	–	–	+	+
<i>Pollicipes</i> sp.	Ci	–	–	–	–	233.3	67
<i>Conus</i> sp.	Ga	220.0	40	–	–	–	–
<i>Holothuria</i> sp.	Ho	–	–	204.0	20	–	–
<i>Palythoa tuberculosa</i>	Zo	–	–	155.6	–	–	–
<i>Echinothrix calamaris</i>	Ech	–	–	130.6	20	–	–
Actiniaria	Ac	–	–	84.0	120	–	–
<i>Drupella rugosa</i>	Ga	84.0	80	20.0	40	+	+
<i>Echinolittorina millegrana</i>	Ga	–	–	0.6	20	53.3	2367
<i>Monodonta labio</i>	Ga	–	–	–	–	50.0	33
<i>Leiosolenus levigatus</i>	Bi	–	–	42.0	80	–	–
<i>Planaxis sulcatus</i>	Ga	–	–	–	–	33.3	100
<i>Cellana toreuma</i>	Ga	–	–	0.4	20	15.3	40
<i>Spirobranchus giganteus</i>	Po	–	–	14.2	280	–	–
<i>Petrosia</i> sp.	Sp	–	–	3.2	–	–	–
<i>Haliclona</i> sp.	Sp	–	–	2.0	–	–	–
<i>Brachidontes mutabilis</i>	Bi	–	–	2.0	20	–	–
<i>Palola siciliensis</i>	Po	–	–	1.2	40	–	–
<i>Calcinus</i> sp.	De	–	–	1.0	20	–	–
<i>Isognomon isognomum</i>	Bi	0.8	40	–	–	–	–
<i>Zozymodes cavipes</i>	De	–	–	0.8	20	–	–
<i>Pachygrapsus minutus</i>	De	–	–	0.4	24	–	–
<i>Lepidonotus tenuisetosus</i>	Po	–	–	0.4	20	–	–
Photidae	Am	–	–	0.2	24	–	–
<i>Lanocira anasicula</i>	Is	–	–	0.2	20	–	–
<i>Perinereis</i> sp.	Po	–	–	0.2	8	–	–
<i>Lysidice collaris</i>	Po	–	–	0.2	8	–	–
<i>Pilumnus</i> sp.	De	–	–	0.1	8	–	–
Total biomass of animals		11573.6		663.3		425.2	
Total biomass		11573.6		1217.8		425.2	

are frequently found on boulders and under them. Other animals of the *Pollicipes* community include the barnacle *Tetrachita squamosa* and gastropods (*Cellana testudinaria*, *Nerita plicata*, and *N. insculpta*).

Mass development of algae and invertebrates, specifically hard corals, characterizes the lower intertidal subzone of the rocky-blocky-bouldery intertidal zone. The lower intertidal subzone of Tien Sa Peninsula hosts diverse algae (the red algae *Asparagopsis taxiformis*, *Peyssonnelia* sp., *Amphiroa* spp., *Gelidium crinale*, *Gelidium* sp., *Jania* sp., *Gelidiella acerosa*, *Dichotomaria marginata*, *Gymnogongrus* sp., *Palisada parvipapillata*, *Hypnea pannosa*, *H. nidulans*, *Lithophyllum okamurae*, *Laurencia brachyclados*, and others; the brown algae *Padina boryana*, *Lobophora variegata*, and *Dictyota* sp., the green algae *Dictyosphaeria cavernosa*, *Caulerpa microphysa*, and *Codium repens*). The projective cover of rocky blocks and boulders by encrusting coralline red algae is 50–60%. Some brown algae are found in form of destroyed thalli (*Turbinaria ornata*) and plantlets (*Sargassum* sp. and *Padina australis*). Colonies of the reef-building scleractinian corals *Acropora cytherea*, *A. hyacinthus*, *A. robusta*, *Pocillopora verrucosa*, and *Platygyra lamellina* spread out to the subtidal zone. The other inhabitants of the lower intertidal subzone of Tien Sa Peninsula include the sponge *Amphimedon* sp., the barnacle *Chthamalus malayensis*, the amphipods *Ampithoe* and *Maera*, the brachyuran crabs *Leptodius exaratus*, *Actaeodes tomentosus*, *Tetralia glaberrima*, *Trapezia areolata*, and *Domecia hispida*, the chitons *Cryptoplax* sp. and *Notoplax* sp., the gastropods *Trochus maculatus* and *Polia undosa*, the sea cucumbers *Holothuria* (*Halodeima*) *atra* and *H. (Semperothuria) cinerascens*, the brittle star *Ophiactis savignyi*, and other groups of invertebrates.

On Gio Islet, the macrobenthic population is generally similar to that of Tien Sa Peninsula. Apart from the algae listed above, the lower intertidal subzone of Gio Islet is inhabited by the red algae *Ceratodictyon scoparium* and *Lithothamnion* sp., the brown alga *Dictyota implexa*, and the green algae *Dictyosphaeria versluysii* and *Neomeris annulata*. The total algal biomass is about 2 kgWW m<sup>-2</sup>, mainly due to development of the green alga *Dictyosphaeria cavernosa* with a projective cover of bottom reaching 100%. Algae form patches 0.5–6 m<sup>2</sup> in area. Animals also include the sponge *Gelliodes* sp., the gastropods *Mauritia arabica* and *Scutus antipodes*, and the sea cucumber *Holothuria (Platyperona) difficilis*.

### Blocky intertidal zone

The species composition and distribution of macrobenthic communities in the blocky intertidal zone are generally similar to the same parameters for the rocky and rocky-blocky-bouldery intertidal zones. However, the vertical stratification of the communities is on the whole less conspicuous in the blocky intertidal than in

the rocky intertidal. Even the opposite sides of the same rocky blocks at low tide are exposed to different levels of wave action, insolation, temperature, moistening, and other environmental factors. Besides, sand often accumulates between blocks and boulders and makes up a habitat with favorable conditions for infaunal species.

The blocky intertidal zone was studied only in very few sites on the southern coast of Vietnam: on Bo Tra Islet (Nam Du Archipelago), Thu and Lon islands, at Cape Dinh, in Thu and Ro bays (Table 1; Fig. 8). Communities dominated by the gastropods of the genus *Echinolittorina* and the barnacles of the genus *Chthamalus* develop occasionally, but a belt of oysters occupies a significant part of the upper intertidal subzone.

On Thu Island, only a few species of gastropods (*Echinolittorina millegrana*, *Nerita balteata*, *N. albicilla*, and *N. plicata*) may occasionally be found in the upper intertidal subzone.

At Cape Dinh, *E. millegrana* and *Chthamalus malayensis* form mixed settlements instead of separate belts. The communities are characterized by rather low biomass of animals (18.8, 5.7, and 8.5 gWW m<sup>-2</sup> for *E. millegrana*, *Nodilittorina pyramidalis*, and *Ch. malayensis* respectively).



**Fig. 8.** The rocky blocks on the south-western coast of Lon Island (Van Phong Bay). Photograph by Alexey V. Chernyshev.

In Thu Bay, a belt of the gastropod mollusk *Patelloida saccharina* and a belt of *Tetraclita* barnacles develop immediately below *Chthamalus* and above the oysters. The species composition of macrobenthic communities here is rather poor, and the total biomass of macrobenthos is quite low (in communities dominated by *Echinolittorina millegrana* and dominated by *Chthamalus malayensis* the biomass is about 45–50 gWW m<sup>-2</sup>, and in a community dominated by *P. saccharina* – 85 gWW m<sup>-2</sup>).

On Lon Island, a community dominated by *Tetraclita* barnacles with the biomass of the dominant species making up 308 gWW m<sup>-2</sup> occurs in the upper intertidal subzone. *E. millegrana* and *Ch. malayensis* are among the prevailing species and the gastropods *Nerita albicilla* and *Scutellastra flexuosa* are also abundant in the *Tetraclita* community. In Ro Bay, macrobenthos is not found in the upper subzone.

On Thu Island, the oyster *Saccostrea scyphophilla* community with the accompanying mollusks *Perna* sp. (Bivalvia) and *Nerita albicilla* (Gastropoda) develops on rocky blocks in the middle intertidal subzone. The total biomass of macrobenthos is above 3300 gWW m<sup>-2</sup>. A belt-forming community dominated by the brown alga *Padina boryana* occupies the lower part of the middle intertidal subzone. Other algal species include the green algae *Cladophora catenata* and *Caulerpa racemosa*, the brown algae *Dictyota dichotoma* and *Sargassum polycystum*, the red alga *Mastophora rosea*, and some others. Amphipoda, Decapoda, Gastropoda, and Polychaeta species may frequently be found in the community.

At Cape Dinh and on Lon Island, a belt of *S. scyphophilla* develops in the middle intertidal subzone and the upper part of the lower intertidal subzone. In the middle subzone, the biomass of the oyster varies from 4420 gWW m<sup>-2</sup> at Cape Dinh to 10600 gWW m<sup>-2</sup> on Lon Island. In the lower intertidal subzone, the biomass of the oyster is only 574 gWW m<sup>-2</sup> (Lon Island). The total biomass of macrobenthos can reach over 12 kgWW m<sup>-2</sup>, and *S. scyphophilla* makes up to 85% of the total biomass in the community (Table 9). The barnacle *Megabalanus tintinnabulum* is also numerous among animals. The gastropods *Thylacodes* sp. and *Thalessa aculeata*, the bivalve mollusks *Barbatia cometa*, *Malleus legumen*, and *Septifer bilocularis*, the brachyuran crab *Forestiana scabra*, the polychaetes *Palola siciliensis* and *Lysidice collaris*, sponges, and amphipods are abundant groups in the *S. scyphophilla* community in the middle intertidal subzone and the upper part of the lower intertidal subzone.

In the lower part of the lower intertidal subzone, the coralline red algae *Lithophyllum* and *Lithothamnion* and diverse species of scleractinian corals are distributed forming patches at bases of blocks. At Cape Dinh, a community dominated by the brown alga *Sargassum aquifolium* with a rather rich species composition of macrobenthos develops. The total biomass of *Sargassum* is 2086 gWW m<sup>-2</sup>.

Table 9

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the blocky intertidal zone, in the *Saccostrea scyphophilla* community (Lon Island, Van Phong Bay)

Taxa	Taxonomic group	Middle intertidal subzone		Lower intertidal subzone	
		B	N	B	N
PLANTS					
<i>Monostroma</i> sp.	Ch	–		5.9	
Total biomass of plants				5.9	
ANIMALS					
<i>Saccostrea scyphophilla</i>	Bi	10600.0	1540	574.2	20
<i>Megabalanus tintinnabulum</i>	Ci	1360.0	200	318.7	160
<i>Haliclona</i> sp.	Sp	208.5		12.0	
<i>Thylacodes</i> sp.	Ga	–	–	176.2	220
<i>Forestiana scabra</i>	De	–	–	71.6	20
<i>Barbatia cometa</i>	Bi	57.5	60	–	–
<i>Thalessa aculeata</i>	Ga	26.3	5	–	–
<i>Palola siciliensis</i>	Po	–	–	19.4	100
<i>Malleus legumen</i>	Bi	16.8	230	45.2	220
<i>Tenguella granulata</i>	Ga	15.7	15	–	–
<i>Leiosolenus levigatus</i>	Bi	11.7	235	14.8	180
<i>Arca</i> sp.	Bi	10.4	21	–	–
<i>Pachycheles stevensii</i>	De	–	–	9.6	–
<i>Anemonia</i> sp.	Ac	8.4	–	–	–
<i>Clypeomorus inflata</i>	Ga	–	–	8.4	20
<i>Platypodia alcocki</i>	De	–	–	8.2	20
<i>Septifer bilocularis</i>	Bi	7.8	275	3.9	20
<i>Isognomon australica</i>	Bi	7.6	150	–	–
<i>Tenguella musiva</i>	Ga	7.3	8	–	–
<i>Metopograpsus messor</i>	De	1.8	35	4.9	140
<i>Clibanarius ransoni</i>	De	–	–	4.8	140
<i>Leiosolenus lima</i>	Bi	3.7	12	1.3	20
<i>Actaea</i> sp.	De	–	–	3.6	20
<i>Cyclodius granulatus</i>	De	3.1	25	–	–
<i>Lysidice collaris</i>	Po	0.1	30	2.9	200
<i>Isognomon</i> sp.	Bi	2.6	10	–	–
<i>Lyncina carneola</i>	Ga	2.6	25	–	–

Table 9 (Continued)

Taxa	Taxonomic group	Middle intertidal subzone		Lower intertidal subzone	
		B	N	B	N
<i>Siphonaria</i> sp.	Ga	1.1	55	2.3	40
<i>Pseudonereis gallapagensis</i>	Po	2.0	55	1.0	20
Polyplacophora	Pol	–	–	2.0	20
<i>Drupa</i> sp.	Ga	–	–	1.4	20
<i>Irus irus</i>	Bi	1.3	60	0.8	20
<i>Pilumnopus makianus</i>	De	1.0	25	–	–
<i>Alpheus</i> sp.	De	–	–	1.0	20
<i>Perinereis cultrifera</i>	Po	0.8	25	–	–
<i>Echinolittorina millegrana</i>	Ga	0.8	30	–	–
<i>Clithon oualaniense</i>	Ga	0.7	5	–	–
Syllidae	Po	0.6	167	+	+
<i>Pinnotheres boninensis</i>	De	0.5	10	–	–
<i>Pseudonereis variegata</i>	Po	0.4	25	–	–
<i>Patelloida saccharina</i>	Ga	0.3	5	–	–
<i>Alpheus pubescens</i>	De	0.2	5	–	–
Amphipoda	Am	0.1	25	1.1	800
<i>Ceratonereis mirabilis</i>	Po	–	–	0.04	20
<i>Ophiactis savignyi</i>	Oph	–	–	0.02	20
Total biomass of animals		12361.6		1289.56	
Total biomass		12361.6		1295.36	

The surfaces of blocks, the space between them, and the underlying sand are inhabited by a rather diverse fauna: sponges (*Geodia* sp. and *Halichondria* sp.), sea anemones, sipunculid worms, polychaetes (*Lysidice collaris*, *Eunice afra*, *Perinereis nuntia brevicirris*, *Nereis* sp., and others), barnacles (*Capitulum mitella*, *Balanus* sp., and *Tetraclita* sp.), mantis shrimps (*Gonodactylus* sp. and others), hermit crabs (*Calcinus laevimanus* and *Clibanarius virescens*), brachyuran crabs (*Eriphia smithii*, *Ocypode kuhlii*, *Leptodius exaratus*, *Tetralia glaberrima*, *Grapsus longitarsis*, and others), sea urchins (*Echinometra mathaei* and others), sea cucumbers (*Stichopus chloronotus*, *Chiridota rigida*, *Holothuria (Halodeima) atra*, and *Polycheira rufescens*), brittle stars (*Ophiocoma erinaceus* and others), and sea stars (*Linckia laevigata* and others). Mollusca is the most diverse group of invertebrates in the *Sargassum* beds. It contains the chiton *Cryptoplax larvaeformis*, gastropods (*Cellana testudinaria*, *C. toreuma*, *Scutus unguis*, *Trochus maculatus*, *Nerita albicilla*, *N. costata*, *N. plicata*,

*N. polita*, *Planaxis sulcatus*, *Echinolittorina millegrana*, *Monetaria annulus*, *Cypraea* spp., *Ovula ovum*, *Cantharus* sp., *Tenguella musiva*, *T. granulata*, *Drupa morum*, *D. rubusidaeus*, *D. ricinus*, *Drupella margariticola*, *D. cornus*, *Purpura persica*, *Thalessa aculeata*, *Mancinella echinata*, *M. alouina*, *Reishia luteostoma*, *Mitra ambigua*, *Conus ebraeus*, *C. miles*, and *Aplysia* sp.), and bivalves (*Barbatia virescens*, *B. amygdalumtosum*, *Pinctada imbricata fucata*, *P. radiata*, *Cardita variegata*, *Leiosolenus malaccanus*, *Isognomon isognomum*, *I. perna*, *Atactodea striata*, *Arca ventricosa*, *Malleus legumen*, *Gastrochaena cuneiformis*, *Tridacna maxima*, *Spondylus tenuispinosus*, *S. lamarckii*, *Atrina strangei*, and *Mesodesma* sp.).

On Thu Island, the green algae *Ulva reticulata*, *Caulerpa racemosa*, *C. serrulata*, and *C. taxifolia*, the brown algae *Sargassum polycystum*, *S. ilicifolium*, *Padina australis*, and *Dictyota implexa*, and many others grow in a patchy pattern in the lower intertidal subzone. The total algal biomass is above 1780 gWW m<sup>-2</sup> (up to 99% of the total macrobenthic biomass). The same groups of invertebrates as in the middle intertidal subzone are found here. The most numerous among gastropods are *Nerita plicata*, *Monetaria moneta*, and *Pictocolumbella ocellata*.

### Bouldery intertidal zone

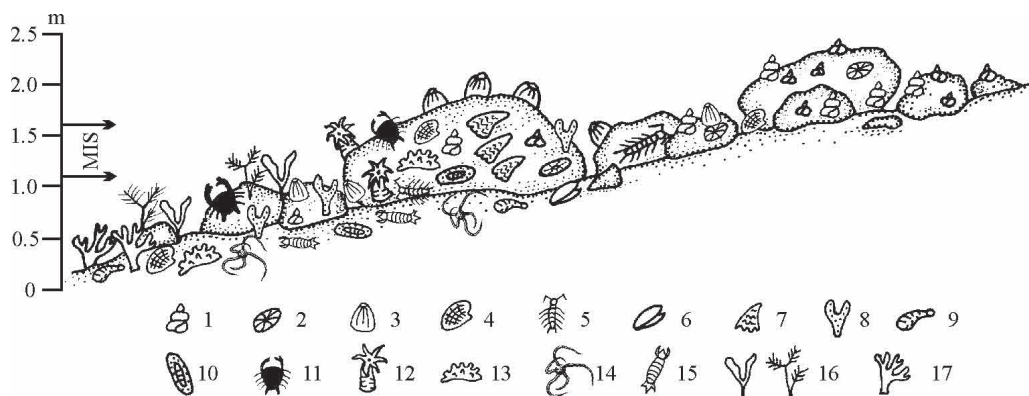
The bouldery type of the intertidal zone was studied in the Gulf of Thailand (Gian Islet, Nam Du Archipelago), from the coastal area southeast of Nha Trang to Ro Bay (Mot Island, Me (Ben Goi Bay), Sang (Co Co Strait), and Nua islets), as well as on the west coast of the Gulf of Tonkin (Con Lo Beach) (Table 1). The vertical distribution of belt-forming communities of the bouldery intertidal zone has almost the same general pattern as in the rocky-blocky-bouldery intertidal zones. However, in the *Nodilittorina* belts gastropods belonging to the family Neritidae often dominate, together with species of the gastropod family Littorinidae. Besides, there is a decrease in the biomass of dominant species in the belt-forming communities of oysters and barnacles, whereas the biodiversity of macrobenthos is higher in all communities including the belt-forming communities of the littorinid and neritid species. Various groups of invertebrates inhabit the bouldery intertidal zone due to large number of sheltered and moisturized refuges among boulders. The macrobenthos of the southern locations and the sites of the Gulf of Tonkin has many mutual species.

The upper intertidal subzone is inhabited by a greater number of species of gastropods (*Echinolittorina millegrana*, *Nodilittorina pyramidalis*, *Nerita chamaeleon*, *N. undata*, *N. albicilla*, *N. insculpta*, *N. balteata*, *Turritella bacillum*, *Siphonaria* spp., *Patelloida saccharina*, *Monodonta labio*, *Planaxis sulcatus*, *Cel-lana toreuma*, *Clypeomorus bifasciata*, *C. batillariaeformis*, *Batillaria sordida*, *Drupella*

*margariticola*, *Tenguella granulata*, *Reishia clavigera*, *R. luteostoma*, and many others) (Fig. 9). Settlements of oysters *Saccostrea cucullata* (in the Gulf of Thailand), *Saccostrea scyphophilla* (from Nha Trang to Ro Bay) or *Saccostrea echinata* (in the Gulf of Tonkin) may also be found in the upper intertidal subzone. Communities dominated by the gastropods *Nerita polita* and *Clypeomorus batillariaeformis* are sometimes situated below the belt of littorinids.

On Con Lo Beach, *Aegiceras corniculatum* mangrove shrubs develop in the supratidal zone and the upper intertidal subzone. The mangrove jingle shell *Enigmonia aenigmatica* is usually found attached to the leaves or branches of *Aegiceras*. The mangrove community hosts many motile animals: brachyuran crabs (*Leptodius exaratus*, *Parasesarma pictum*, *Gaetice depressus*, *Metopograpsus thukubar*, *Hemigrapsus sanguineus*, and others), hermit crabs, and shrimps, which are also distributed in the middle and even in the lower intertidal subzones. The intertidal barnacle *Chthamalus challengerii* is a common species on Con Lo Beach (Gurjanova, Chang Hiu Phuong, 1972).

In the upper part of the middle intertidal subzone, settlements of the barnacle *Chthamalus malayensis* develop on the tops of boulders. The bivalves *Barbatia cometa* and *Isognomon perna* also live in this subzone on Mot Island, Me, Sang, and Nua islets. The gastropod *Cellana* sp., rare Amphipoda, and the red alga *Hypnea aspera* occur on Gian Islet. *Amphibalanus amphitrite* settlements may be found on Con Lo Beach (Gurjanova, Chang Hiu Phuong, 1972).



**Fig. 9.** Scheme of distribution of macrobenthos in the bouldery intertidal zone (from Nha Trang to Ro Bay). 1 – Gastropoda (mainly Littorinidae+Neritidae), 2 – Patellogastropoda, 3 – Cirripectida, 4 – Bivalvia, 5 – Isopoda, 6 – *Capitulum mitella*, 7 – *Saccostrea scyphophilla*, 8 – Spongia, 9 – Sipuncula, 10 – Polyplacophora, 11 – Decapoda, 12 – Actiniaria, 13 – Holothuroidea, 14 – Ophiuroidea, 15 – Stomatopoda, 16 – algae, 17 – Scleractinia. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.



A belt of oyster *Saccostrea scyphophilla* occupies the lower part of the middle intertidal subzone and the upper part of the lower intertidal subzone on Mot Island, Me, Sang, and Nua islets. The fauna of this community is very abundant and diverse: there are some species of sponges, sea anemones, sipunculid worms, the barnacles *Capitulum mitella* and *Tetraclita porosa*, the mantis shrimp *Gonodactylus* sp., the isopod *Dynamenopsis* sp., the shrimp *Alpheus* sp., the brachyuran crabs *Actaeodes tomentosus*, *Novactaea modesta*, *Heteropanope glabra*, *Pilumnopus makianus*, *Xanthodius* sp., *Criocarcinus superciliosus*, *Grapsus longitarsis*, *Plagusia squamosa*, *Percnon planissimum*, *Epixanthus corrosus*, *E. frontalis*, and *Nanosesarma minutum*, the porcelain crab *Petrolisthes* sp., some species of hermit crabs, chitons, the gastropods *Cellana testudinaria*, *C. toreuma*, *Nerita polita*, *N. albicilla*, *N. undata*, *Littoraria scabra*, *Luria isabella*, *Echinolittorina millegrana*, *Nodilittorina pyramidalis*, *Planaxis sulcatus*, *Monodonta labio*, *Clypeomorus batillariaeformis*, *C. pellucida*, *Mastonia rubra*, *Mauritia arabica*, *Peristernia nassatula*, *Vasum turbinellus*, *Thalessa aculeata*, *Tenguella musiva*, *T. granulata*, *Morula anaxares*, *Drupella margariticola*, *Nassa* sp., *Mitra* sp., *Conus coronatus*, *C. capitaneus*, *Clanculus* sp., and *Siphonaria* sp., the bivalves *Barbatia foliata*, *B. cometa*, *Arca ventricosa*, *Modiolus auriculatus*, *Isognomon isognomum*, *I. perna*, *I. nucleus*, *I. australica*, *Saccostrea scyphophilla*, *Cardita variegata*, *Septifer bilocularis*, *Leiosolenus malaccanus*, *L. levigatus*, *L. lima*, *Atactodea striata*, *Chama pacifica*, and *Malleus legumen*, the brittle stars *Ophiocoma erinaceus* and *O. scolopendrina*, and the sea cucumbers *Stichopus horrens*, *Holothuria (Semperothuria) cinerascens*, and *Holothuria* sp. The animal biomass is about 4400 gWW m<sup>-2</sup> in the oyster community, and oysters make up more than 97% of the total biomass. A belt-formig community dominated by the barnacle *Tetraclita porosa* develops immediately below the community dominated by oysters.

The lower part of the lower intertidal subzone is inhabited by communities of corals or algal communities, in which corals do not develop. The scattered thickets of the brown alga *Padina* may be found usually below oysters and *T. porosa*. Communities dominated by *Sargassum polycystum* and *S. congkinhii* also develop in the bouldery intertidal zone. There are many different species of algae (the brown algae *Dictyota implexa*, *Padina* sp., and *Turbinaria ornata*, the red alga *Laurencia tropica*, and the green algae *Halimeda opuntia*, *H. discoidea*, *Caulerpa serrulata*, and *C. racemosa*) in the communities. Besides corals and animals of the oyster belt, the brachyuran crab *Leptodius exaratus*, the gastropod *Monetaria annulus*, and the sponge *Callyspongia (Callyspongia) monilata* are frequently found in the *Sargassum* beds.

On Con Lo Beach, many other species inhabit the lower intertidal subzone (the gastropods *Lottia pelta*, *Lunella coronata*, *Clypeomorus batillariaeformis*, *Rhino-clavis sinensis*, *Murex* sp., *Nerita balteata*, *Chlorostoma xanthostigma*, *Muricodrupa fiscella*, *Nassarius pullus*, *N. hirtus*, *Nassarius* sp., *Batillaria australis*, *Eriphia smithii*,

*Trochus maculatus*, *Haliotis diversicolor*, *H. ovina*, and others; the bivalve mollusk *Venerupis variegata*, barnacle *Capitulum mitella*, the sea cucumbers *Holothuria* (*Mertensiothuria*) *leucospilota* and *Polychaeta rufescens*, the sea urchins *Echinometra mathaei*, *Temnopleurus toreumaticus*, and *Diadema setosum*, and other invertebrates) (Gurjanova, Chang Hiu Phuong, 1972).

### **Pebbly beaches**

The pebbly beaches were studied on Mieu, Lon, and Ong islands (Table 1). The species composition of macrobenthos is quite poor at these sites. In the upper intertidal subzone, a community dominated by the gastropod *Supplanaxis niger* develops. Besides the dominant species, the isopod *Ligia exotica*, the brachyuran crabs *Epixanthus* spp. and *Cyclograpsus intermedius*, amphipods and turbellarians may be found. The total biomass of macrobenthos reaches 170 gWW m<sup>-2</sup>, and *S. niger* makes up to 90% of the total biomass.

In the middle intertidal subzone and the upper part of the lower subzone, a community of the gastropod species Cerithiidae+*Nerita* spp. occurs. The total biomass of macrobenthos is about 350 gWW m<sup>-2</sup>. *Clypeomorus batillariaeformis*, *Cerithium traillii* (Cerithiidae), and *Nerita albicilla*, *N. polita*, *N. undata*, *N. chamaeleon* (Neritidae) often occur. The barnacle *Capitulum mitella*, the brachyuran crab *Thalamita danae*, the hermit crabs *Clibanarius cruentatus* and *C. merguensis*, the gastropods *Cellana testudinaria* and *Reishia luteostoma*, the bivalves *Isognomon nucleus*, *Modiolus auriculatus*, *Barbatia fusca*, and *Saccostrea scyphophilla* are also found on the pebbly beaches.

### **Artificial substrata**

On Tam Island (Table 1), the *Saccostrea scyphophilla* community is found on the bottoms and sides of old barges abandoned on the shore and immersed in the water. The total animal biomass can reach 10 kgWW m<sup>-2</sup> on the bottoms of the barges, and the oyster makes up about 93% of the total biomass of macrobenthos in the community. Various sponges and other bivalve mollusks (*Barbatia cometa*, *B. foliata*, *Arca navicularis*, *Isognomon australica*, *Isognomon* spp., *Modiolus auriculatus*, *Septifer bilocularis*, *Leiosolenus levigatus*, *L. malaccanus*, and *Coralliophaga* sp.) also cover the bottoms of the barges. The gastropods *Thalessa aculeata*, *Tenguella granulata*, and *T. musiva* are the second by biomass (up to 480 gWWm<sup>-2</sup>) after *Bivalvia* in the *S. scyphophilla* community. The barnacle *Megabalanus tintinnabulum* and several species of Polychaeta, Actiniaria, and Decapoda frequently occur in the upper parts of the sides of the barges.

## Intertidal zone of mixed substrata

### Bouldery intertidal zone with underlying sand

The bouldery intertidal zone with underlying sand is studied from the coastal area southeast of Nha Trang to Ro Bay in many locations (Tam, Mieu, Tre (Gieng Da Bay and the northern part of island), Lon (Tre Bay), and Ong islands, Hon Khoi Peninsula, Me and Ke (Ben Goi Bay), Sang (Co Co Strait), Nua, and Nu islets, Mon and Cai Ban bays, and Lon Strait), as well as in the Gulf of Thailand (Nam Du Islet, Nam Du Archipelago) (Table 1; Fig. 10). It is a gently sloping shoreline 15–50 m wide. Wave action is generally weak. Topographical dissection creates refugia for many motile forms. Infauna is especially well developed and its biomass exceeds one of the epifauna by four times. The species composition of macrobenthos is diverse, which is also typical for the bouldery intertidal zone, but the species richness increases due to abundance of infaunal invertebrates and epifaunal species living in protected or concealed microhabitats. Numerous species of gastropods, mantis shrimps, some species of polychaetes, and other inhabitants refuge under boulders and in tide pools. Sea cucumbers with fairly large body size frequently occur on the sand among boulders. The vertical distribution of the communities exhibits insignificant stratification, and patchy distribution of macrobenthos is typical for this intertidal zone. Besides, most part of the lower intertidal subzone is composed of sand with separate boulders. Therefore, there is no belt of corals (only small colonies are found on some boulders), and the belt of algae is as a rule very poorly developed. Mangrove vegetation develops in the upper intertidal subzone of some islands.

On Nam Du Islet, the macrobenthos of the upper intertidal subzone is impoverished as compared to the other subzones, but has the highest biomass (about 1890 gWW m<sup>-2</sup>). Most species, such as the gastropod mollusks *Planaxis sulcatus*, *Supplanaxis niger*, *Nerita balteata*, *N. albicilla*, *Monodonta labio*, *Cellana toreuma*, *C. testudinaria*, and many others, as well as decapods live under boulders. A belt-forming community of the oyster *Saccostrea scyphophilla* (above 1225 gWW m<sup>-2</sup>) sometimes develops on the largest rocky blocks. Macrophytic algae are absent.

The middle intertidal subzone is dominated by the same species of gastropods as in the upper intertidal subzone, with the biomass about 375 gWW m<sup>-2</sup>. The total biomass of macrobenthos is above 1300 gWW m<sup>-2</sup>. Distinct belts of the dominant species are commonly absent. Settlements of the crustose brown alga *Neoralfsia expansa* are observed nearly everywhere in the upper part of the subzone.



**Fig. 10.** The bouldery intertidal zone with underlying sand in Lon Strait (Van Phong Bay, 1 km southward of Cape Co Co). **A** – the general view, **B** – the middle intertidal subzone. Photograph by Alexey V. Chernyshev.

A community of low-growing species of algae develops from the lower part of the middle intertidal subzone to the lower intertidal subzone on Nam Du Islet. This community is formed by the red algae *Gelidiella* sp., *Gelidium pusillum*, *Centroceras clavulatum*, *Hypnea esperi*, *Polysiphonia* sp., crustose Corallinaceae species, the brown algae *Lobophora variegata* and *Neoralgsia expansa*, and some others. Patches of large specimens of algae (the brown alga *Turbinaria ornata* and the red alga *Laurencia obtusa*) are occasionally found in the lower part of the middle subzone and in the lower intertidal subzone. Gastropoda, Decapoda, and Polychaeta species dominate among animals in the lower intertidal subzone.

Belt-forming communities dominated by the gastropod *Echinolittorina milligrana* and the barnacle *Chthamalus malayensis* occupy the upper intertidal subzone from Nha Trang to Ro Bay. The biomass of *Ch. malayensis* can reach about 6 kgWW m<sup>-2</sup> (Tre Bay in Lon Island). Sometimes rare patches of the brown alga *N. expansa* occur in these communities. Settlements of the gastropod *Supplanaxxis niger* are found from the upper to the middle intertidal subzone in Gieng Da Bay of Tre Island (Tran-ngoc Loi, 1967).

A broad belt of the oyster *Saccostrea scyphophilla*, often together with the barnacle *Megabalanus tintinnabulum*, develops on boulders in the middle intertidal subzone. The biomass of the oyster varies from 1750 to 2550 gWW m<sup>-2</sup>, and the density is 188–240 ind. m<sup>-2</sup> in different areas. In Gieng Da Bay, the mollusks *Nerita albicilla* (Gastropoda), *Isognomon perna* and *Saccostrea cucullata* (Bivalvia) form belts which spread to the lower intertidal subzone (Tran-ngoc Loi, 1967).

In the upper part of the lower intertidal subzone, the biomass of *S. scyphophilla* decreases, but the role of accompanying fauna increases due to development of various gastropods, holothurians, sponges, brittle stars, and decapods in the community (Table 10). In addition to quantitatively recorded species, there is a great biodiversity of intertidal animals under boulders, between them, and on sandy "islets" (coral polyps of the orders Zoantharia and Actiniaria, flatworms of the class Turbellaria, sipunculid worms, the polychaetes *Perinereis vancaurica*, *P. nuntia*, *Pseudonereis gallapagensis*, *Glycera capitata*, *Bharwania goodei*, and *Spirobranchus giganteus*, the barnacle *Tetraclita porosa*, crustaceans of the order Tanaidacea, the isopod *Cymodoce longistylis*, the brachyuran crabs *Macromedaeus nudipes*, the hermit crabs *Dardanus megistos*, *Clibanarius virescens*, and *C. eurysternus*, chitons, the gastropods *Scutellastra flexuosa*, *Cellana testudinaria*, *Patelloida saccharina*, *Turbo bruneus*, *Nerita costata*, *N. chamaeleon*, *Planaxis sulcatus*, *Clypeomorus batillariaeformis*, *C. irrorata*, *Pictocolumbella ocellata*, *Pollia undosa*, *Morula aspera*, *Tenguella granulata*, *Sabia conica*, *Mitra litterata*, *Conus chaldaeus*, *Chicoreus brunneus*, *Mauritia arabica*, *Siphonaria* sp., *Bulla* sp., and *Aplysia* sp., the bivalves *Barbatia foliata*, *B. cometa*, *Striarca symmetrica*, *Leiosolenus malaccanus*, *Lithophaga caperata*, *Isognomon isognomum*, *I. perna*, *Septifer*

Table 10

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the low intertidal subzone of the bouldery intertidal zone with underlying sand, in the *Saccostrea scyphophilla* community (Ben Goi and Ro bays)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Cladophora laetevirens</i>	Ch	59.0	
<i>Herposiphonia secunda</i> var. <i>tenella</i>	Rh	5.9	
<i>Mastophora pacifica</i>	Rh	0.1	
Total biomass of plants		65.0	
ANIMALS			
<i>Saccostrea scyphophilla</i>	Bi	501.5	38
Holothuroidea	Ho	64.0	35
<i>Nerita polita</i>	Ga	33.3	46
<i>Callyspongia</i> ( <i>Callyspongia</i> ) <i>monilata</i>	Sp	28.9	
<i>Ophiocoma scolopendrina</i>	Oph	9.1	2
<i>Drupa</i> sp.	Ga	8.6	11
<i>Conus coronatus</i>	Ga	6.4	2
<i>Nerita albicilla</i>	Ga	5.6	8
<i>Pilumnus vesperilio</i>	De	3.1	2
<i>Tenguella musiva</i>	Ga	2.6	3
<i>Monetaria annulus</i>	Ga	2.0	2
<i>Mitrella scripta</i>	Ga	1.4	5
<i>Clibanarius merguensis</i>	De	1.2	6
<i>Drupella margariticola</i>	Ga	1.1	3
<i>Percnon planissimum</i>	De	1.1	2
<i>Leptodius exaratus</i>	De	0.3	3
<i>Modiolus auriculatus</i>	Bi	0.3	3
<i>Nicolea venustula</i>	Po	0.2	35
<i>Arca ventricosa</i>	Bi	0.2	2
<i>Nassarius</i> sp.	Ga	0.2	2
<i>Perinereis cultrifera</i>	Po	0.1	–
Amphipoda	Am	0.1	–
<i>Thalamita prymna</i>	De	0.1	–
Paguridae	De	0.05	2
<i>Ceratonereis mirabilis</i>	Po	0.04	5

Table 10 (Continued)

Taxa	Taxonomic group	B	N
<i>Platynereis dumerilii</i>	Po	0.03	6
<i>Eurythoe complanata</i>	Po	0.02	2
<i>Cerithium</i> sp.	Ga	0.01	2
<i>Halicarcinus orientalis</i>	De	0.01	2
Total biomass of animals		672.21	
Total biomass		737.26	

*excisus*, *Cardita variegata*, *Malleus legumen*, *Coralliophaga* sp., *Pinctada maculata*, *Brachidontes setiger*, *Asaphis violascens*, *Gafrarium pectinatum*, *Gastrochaena cuneiformis*, *Jouannetia cumingii*, *Chama pacifica* and *Ch. dunkeri*, the brittle stars *Ophiolepis cincta cincta* and *Ophiocoma erinaceus*, and fishes). On Lon Island, the total animal biomass is 1160 gWW m<sup>-2</sup> under boulders at the level of the *S. scyphophilla* belt. On Tam Island, the total animal biomass is 150 gWW m<sup>-2</sup>. On Nua Islet, the brittle star *O. erinaceus* makes up to 90% of the total animal biomass.

In the lower part of the lower intertidal subzone, there are diverse algae immediately below the *S. scyphophilla* belt. On Lon Island, the biomass of the brown alga *Padina australis* is up to 750 gWW m<sup>-2</sup>. Other algae here include the brown algae *Dictyota friabilis* and *Sphacelaria rigidula*, the red algae *Chondria repens*, *Centroceras clavulatum*, *Herposiphonia secunda* var. *tenella*, *Mastophora pacifica*, and *Gayliella flaccida*, and the green alga *Cladophora laetevirens*. Apart from the animals listed for the upper part of the subzone, the lower part of the subzone is also inhabited by diverse gastropods (*Monodonta labio*, *Nerita polita*, *N. undata*, *Clypeomorus pellucida*, *C. petrosa chemnitziana*, *Erronea erronea*, and *Mitrella scripta*), polychaetes (*Lumbrieneris heteropoda*, *Nicolea venustula*, and *Platynereis dumerilii*), decapods (*Halicarcinus orientalis*, *Leptodius exaratus*, *Macromedaeus quinquedentatus*, *Epixanthus frontalis*, *Eriphia smithii*, *Thalamita crenata*, *Grapsus tenuicrustatus*, and *Calcinus laevimanus*), bivalves (*Chama croceata* and *Isognomon legumen*), and the brittle star *Ophiocoma scolopendrina*. On Lon Island, the total animal biomass is up to 400 gWW m<sup>-2</sup> on boulders, and the gastropods *M. labio* and *Clypeomorus batillariaeformis* are dominant species. On Nua Islet, the total animal biomass is 165 gWW m<sup>-2</sup> on the sand, and *O. scolopendrina* makes up above 70% of the animal biomass. In Cai Ban Bay, the belt of the brown algae *Padina australis*+*Sargassum polycystum*+*Sargassum congkinhii* develops. There are also the red alga *Laurencia tropica*, the brown algae *Dictyota implexa* and *Turbinaria ornata*, the green algae *Halimeda opuntia*, *H. discoidea*, *Caulerpa serrulata*, and *C. racemosa*.

On Ke Islet (Ben Goi Bay), the intertidal zone is up to 30 m wide. The upper intertidal subzone is composed of sand, and occupied by rather sparse thickets of *Avicennia* sp. and *Rhizophora* sp. mangrove trees. The mangroves reach 70–200 cm in height. The mangrove periwinkle *Littoraria scabra* commonly occurs on the seaward edge of the mangrove trunks, at 1–1.5 m above the bottom. Inhabitants of sandy beaches also include the polychaetes *Perinereis cultrifera* and *Bhawania goodei*, the shrimp *Alpheus strenuus strenuus*, the small brachyuran crab *Epixanthus frontalis*, some amphipod species, the gastropods *Nerita polita*, *Planaxis sulcatus*, *Clypeomorus irrorata*, and *Morula anaxares*, the bivalve mollusk *Asaphis violascens*, and the sea cucumbers of the family Synaptidae. The total animal biomass is about 50 gWW m<sup>-2</sup>.

Just below the mangrove thickets, there is a sandy gently sloping tidal flat about 30 m wide at low tide. Boulders (10–20 cm diameter) lie scattered on the underlying sand. In the upper and middle intertidal subzones, numerous burrows of the hermit crab *Coenobita* sp. (from 5 to 15 ind. m<sup>-2</sup>) are found in the sand.

The tidal flat may appear lifeless at low tide; only a distinct belt of oyster *Saccostrea scyphophilla* can be seen on the boundary of the middle and lower intertidal subzones. Actually, this intertidal site is inhabited by diverse groups of animals which tend to burrow into soft substratum or to hide under boulders (sipunculid worms, the polychaetes *P. cultrifera* and *Ceratonereis mirabilis*, the mantis shrimp *Gonodactylus chiragra*, the shrimp *Alpheus* sp., the porcelain crab *Petrolisthes asiaticus*, the brachyuran crabs *Epixanthus frontalis*, *Leptodius exaratus*, *Uca* (*Tubuca*) *urvillei*, and *Pilumnus vespertilio*, the gastropod *Nerita polita*, the bivalve mollusk *Asaphis violascens*, the brittle star *Ophiocoma scolopendrina*, and the sea cucumber *Holothuria* sp.). The total animal biomass is about 6600 gWW m<sup>-2</sup> on boulders, and oysters make up to 99% of the biomass. Under boulders, the total animal biomass is 1160 gWW m<sup>-2</sup>, and *A. violascens* makes up about 84% of the biomass.

In the lower intertidal subzone, large aggregations of the sea urchin *Diadema setosum* may be found at the water's edge. Animals living under boulders and members of sand-dwelling infauna are very diverse. Besides the animals listed for the boundary between the middle and lower intertidal subzones, this subzone includes the sponge *Gelliodes fibulata*, the polychaete *Thelepus plagiostoma*, chitons, the gastropods *Haliotis asinina*, *Cellana toreuma*, *Nerita albicilla*, *N. chamaeleon*, *Trochus maculatus*, *Monetaria annulus*, *Scutus unguis*, *Cantharus* sp., *Nassarius graphiterus*, *Drupella margariticola*, *Tenguella musiva*, *Mitra scutulata*, *Conus coronatus*, *C. musicus*, *Siphonaria atra*, and nudibranchs, the bivalve mollusks *Isognomon perna*, *I. isognomum*, *Saccostrea scyphophilla*, *Arca ventricosa*, *Barbatia cometa*, *B. amygdaluntostum*, *Atrina strangei*, *A. vexillum*, *Pinctada radiata*, *Cardita variegata*, *Modiolus auriculatus*, *Septifer bilocularis*, *Gafrarium divaricatum*, and *Venus* sp.,



the sea star *Echinaster luzonicus*, the sea cucumbers *Holothuria* (*Halodeima*) *atra*, *Chiridota rigida*, and *Holothuria* spp. The blennioid fishes of the genus *Salarias* are often found living on the sandy bottom or in empty shells. The moray eels *Echidna nebulosa* and *Gymnothorax pictus* occur among boulders and sometimes in tide pools. The gobiid fishes inhabit the lower intertidal subzone of Ke Islet at the water's edge.

### Intertidal zone of dead coral reefs

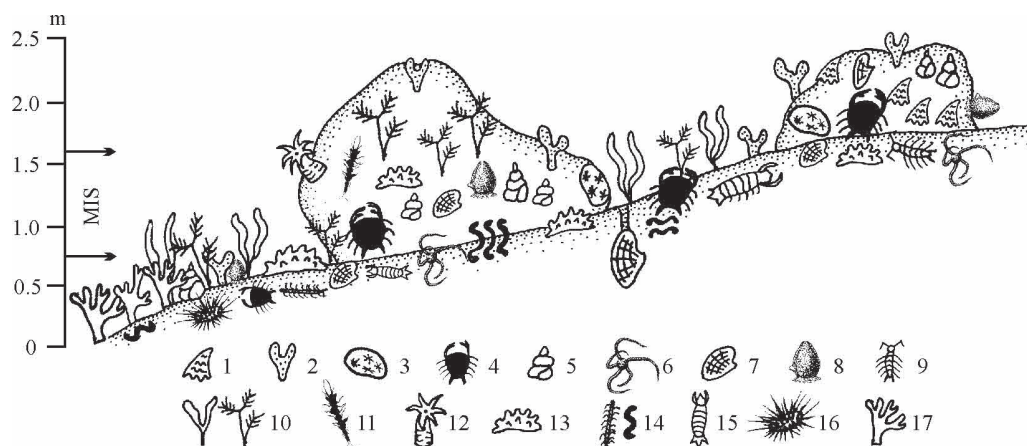
The intertidal zone of dead coral reefs was found in many places from Cape Dinh on the south to Re Island on the north (Table 1). This type of the intertidal zone is usually represented by gently sloping coasts exposed to weak wave action. The intertidal zone is up to a few hundred meters wide. The plateau of a dead coral reef covered with sand (often with admixture of silt) with rare boulders is generally situated in the middle and lower subzones. In the upper intertidal subzone, a reef is covered with clean coarse sand with coral rubble and pieces of mollusk shells. This beach may have quite a steep slope (25–30°). Communities are generally characterized by patchy distribution and rarely have distinct dominant species. The mixed type of bottom deposits, dissected microrelief, and the presence of tide pools, burrows, cracks, and holes in a dead coral reef creates favorable conditions for the development of diverse macrobenthos, particularly cryptofauna (including fairly large Stomatopoda, Isopoda, Caridea, Polychaeta, Gastropoda, Bivalvia, various coral reef fishes, fishes of Muraenidae, and even sea snakes). In some silted bays protected from wave action, mangroves can develop. Settlements of *Littoraria scabra* may be found on stems and branches of mangrove trees.

On Re Island, the intertidal zone of dead coral reef in a sheltered lagoon is about 1 km wide. The plateau is covered with silted sand with rare boulders (Fig. 11). Communities are characterized by patchy distribution.

In the upper intertidal subzone, a *Saccostrea scyphophilla* community with the total biomass of macrobenthos up to 3500 gWW m<sup>-2</sup> is found on hard substrata (Fig. 12; Table 11). The sponge *Suberites* sp. and the gastropods *Nerita plicata* and *N. insculpta* prevail on boulders. Colonies of the coral polyp *Zoanthus* sp. inhabit patches of sand accumulation between boulders. Algae are absent; however, the animal species composition is rather diverse in the upper subzone. In addition to quantitatively recorded species, the sponge *Callyspongia* sp., the isopods *Ligia* sp. and *Dynamenella trachydermata*, the brachyuran crabs *Calappa hepatica*, *Thalamita admete*, and others, numerous species of gastropods (*Nerita albicilla*, *Conus ebraeus*, *Monetaria annulus*, *M. moneta*, *Polia fumosa*, *Drupella margariticola*, and others), bivalve mollusks *Atrina pectinata* and *Perna serratula*, the brittle star *Ophiocoma* (*Breviturma*) *brevipes*, the quite large sea cucumbers *Synapta maculata* and *Holothuria* (*Mertensiothuria*) *leucospilota* frequently occur on dead corals.



**Fig. 11.** The intertidal zone of dead coral reef in the lagoon of Re Island.



**Fig. 12.** Scheme of distribution of macrobenthos in the intertidal zone of dead coral reef (Re Island). 1 – *Saccostrea scyphophilla*, 2 – *Spongia*, 3 – *Zoantharia*, 4 – *Decapoda*, 5 – *Gastropoda*, 6 – *Ophiuroidea*, 7 – *Bivalvia*, 8 – *Ascidiacea*, 9 – *Isopoda*, 10 – algae and seagrasses, 11 – *Tanaidacea*, 12 – *Actinaria*, 13 – *Holothuroidea*, 14 – *Polychaeta*, 15 – *Stomatopoda*, 16 – *Echinoidea*, 17 – *Scleractinia*. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.

Table 11

 Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos  
 in intertidal zone of dead coral reef (Re Island)

Taxa	Taxonomic group	Upper intertidal subzone		Middle intertidal subzone		Lower intertidal subzone
		B	N	B	N	
PLANTS						
<i>Thalassia hemprichii</i>	Tra	–		1787.5		+
Total biomass of plants				1787.5		
ANIMALS						
<i>Saccostrea scyphophilla</i>	Bi	2000.0	283	–	–	–
<i>Suberites</i> sp.	Sp	793.4		1545.0		+
<i>Holothuria (Halodeima) atra</i>	Ho	–	–	1050.0	25	+
<i>Zoanthus</i> sp.	Zo	333.3	667	58.5	265	–
Paguridae	De	0.3	3	322.7	565	+
<i>Nerita plicata</i>	Ga	112.9	42	–	–	–
<i>Ophiocoma (Breviturma) dentata</i>	Oph	–	–	96.5	15	–
<i>Nerita insculpta</i>	Ga	75.7	247	–	–	+
Stomatopoda	St	–	–	49.8	40	–
<i>Clypeomorus bifasciata</i>	Ga	44.7	307	3.8	5	+
<i>Planaxis sulcatus</i>	Ga	34.2	46	–	–	–
<i>Pinctada margaritifera</i>	Bi	+	+	32.0	5	+
<i>Tenguella granulata</i>	Ga	–	–	30.5	15	+
<i>Pilumnus vesperilio</i>	De	–	–	17.5	5	–
<i>Echinolittorina millegrana</i>	Ga	12.1	58	–	–	–
<i>Ophiocoma scolopendrina</i>	Oph	11.7	3	–	–	–
<i>Cerithium columna</i>	Ga	10.1	41	–	–	–
<i>Leiosolenus levigatus</i>	Bi	–	–	9.5	15	+
<i>Polia undosa</i>	Ga	9.2	7	–	–	–
<i>Eupilumnus actumnoides</i>	De	–	–	7.2	15	–
<i>Leptodius exaratus</i>	De	–	–	3.5	15	–
Ascidiacea	Asc	3.5		2.3		+
<i>Alpheus</i> sp.	De	+	+	2.8	95	+
<i>Cirratulus cirratus</i>	Po	–	–	1.8	75	+
Decapoda	De	–	–	1.7	70	–
Tanaiacea	Ta	–	–	1.3	100	–
<i>Ophiactis savignyi</i>	Oph	1.3	13	–	–	–
<i>Metopograpsus messor</i>	De	–	–	1.1	15	–

Table 11 (Continued)

Taxa	Taxonomic group	Upper intertidal subzone		Middle intertidal subzone		Lower intertidal subzone
		B	N	B	N	
<i>Perinereis cultrifera</i>	Po	–	–	0.8	100	+
<i>Ceratonereis mirabilis</i>	Po	–	–	0.6	40	+
<i>Lysidice unicornis</i>	Po	–	–	0.6	40	+
<i>Eurythoe complanata</i>	Po	–	–	0.4	5	+
<i>Gonodactylus chiragra</i>	St	–	–	0.2	5	+
<i>Palola siciliensis</i>	Po	–	–	0.1	5	–
Total biomass of animals		3442.4		3240.2		
Total biomass		3442.4		5027.7		

The middle intertidal subzone is covered with the seagrass *Thalassia hemprichii* (about 1790 gWW m<sup>-2</sup>). In this community, there is a rich diversity of algae (the red algae *Tricleocarpa cylindrica*, *Ceratodictyon spongiosum*, *Laurencia corymbosa*, *Lithophyllum okamurae*, *Centroceras clavulatum*, many species of *Gracilaria*, and others; the green algae *Halimeda opuntia*, *H. discoidea*, *Dictyosphaeria cavernosa*, *Ulva* sp., *Anadyomene plicata*, *Boergesenia forbesii*, many species of *Caulerpa*; the brown algae *Sargassum ilicifolium*, *S. polycystum*, and *Hormophysa cuneiformis*). The sponge *Suberites* sp. and the sea cucumber *Holothuria* (*Halodeima*) *atra* make up about 80% of the total biomass of animals. Diverse polychaetes (*Perinereis cultrifera*, *Cirratulus cirratus*, *Ceratonereis mirabilis*, *Lysidice unicornis*, and others), the coral polyp *Zoanthus* sp., hermit crabs, and shrimps dwell on the rhizomes and roots of *T. hemprichii*. The total biomass of macrobenthos is above 5 kgWW m<sup>-2</sup>.

The plant species composition of the lower intertidal subzone is almost similar to that of the middle subzone. Algae inhabit boulders, coral rubble, and such habitats as calcareous tubes of sedentary polychaetes or live corals with the projective cover of substrate up to 70–100%. As for animals, colonies of the hard corals *Porites lobata* and *P. lutea* form extensive settlements. The large (up 50 cm in diameter) sea anemone *Gyrostoma* sp. and the sea cucumber *H. (H.) atra* are often found here. The corals and boulders are partly covered with sponges (*Suberites* sp., *Clathria* (*Thalysias*) *erecta*, *Spirastrella* sp., *Gelliodes* sp., *Amphimedon* sp., and *Raspailia* sp.) and colonial ascidians. Diverse polychaetes, brachyuran crabs (*Phymodius* sp., *Calcinus* sp., and others) and hermit crabs, gastropods (*Conus ebraeus*, *C. flavidus*, *C. lividus*, *Monetaria annulus*, *M. moneta*, *Drupella margariticola*, *Canarium mutabile*, *Mauritia arabica*, *Erosaria helvola*, and others), bivalve mollusks (*Leiosolenus levigatus* and *Pinctada margaritifera*), sea urchins, coral reef fishes and moray eels are numerous in cracks and holes of dead corals.

Southward of Re Island (from Cape Dinh to Ro Bay), the macrobenthic species composition of the communities of dead coral reefs differs from that of Re Island. At Thon Son Hai (6 km northward of Cape Dinh), the intertidal zone of dead coral reef is about 300 m wide. It is an open coast exposed to almost permanent wave action. The upper intertidal subzone here represents beaches of coarse sand. On the boundary of the upper and middle subzones, a reef flat starts, slightly sloping towards the open sea. The reef crest is exposed at low tide, and the outer edge of the reef slope steeply drops into the sea. Almost the entire plateau is covered with the sea water layer up to 10 cm deep even at low tide, and forms a giant tide pool.

In the upper intertidal subzone, macrobenthos is found only on the uppermost edge of the reef. Here a belt-forming community is developed, dominated by the gastropod *Clypeomorus batillariaeformis* and the green alga *Cladophora laetevirens* (Table 12). The red alga *Parviphycus adnatus* and the brown alga *Dictyosphaeria versluysii* also occur.

Table 12

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the lower part of the upper intertidal subzone of dead coral reef, in the *Clypeomorus batillariaeformis*+*Cladophora laetevirens* community (Thon Son Hai)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Cladophora laetevirens</i>	Ch	418.0	
<i>Valonia aegagropila</i>	Ch	158.0	
<i>Palisada perforata</i>	Rh	13.7	
Total biomass of plants		589.7	
ANIMALS			
<i>Clypeomorus batillariaeformis</i>	Ga	874.0	2940
<i>Nerita albicilla</i>	Ga	13.6	80
<i>Septifer</i> sp.	Bi	3.9	40
<i>Modiola</i> sp.	Bi	1.1	80
<i>Cerithium</i> sp.	Ga	1.0	40
<i>Perinereis nigropunctata</i>	Po	0.2	20
<i>Lysidice collaris</i>	Po	0.2	20
Amphipoda	Am	0.1	100
<i>Ceratonereis mirabilis</i>	Po	0.1	40
Total biomass of animals		894.0	
Total biomass		1483.7	

A belt of the seagrass *Thalassia hemprichii*, 30 m wide, spreads along the middle intertidal subzone (Table 13). The projective cover of the bottom by *Thalassia* is about 70%. Among seagrass thickets, a wide variety of algae may be found. The red alga *Palisada perforata* and the green alga *Halimeda tuna* dominate this community among algae. As for animals, the bivalves *Anadara antiquata* and *Modiolus auriculatus* prevail. Below the belt of *Thalassia*, a community dominated by the red alga *P. perforata* and the bivalve mollusk *Chama croceata* develops (Table 14). The brittle star *Ophiocoma scolopendrina* is subdominant in the community.

**Table 13**

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper part of the middle intertidal subzone of dead coral reef, in the *Thalassia hemprichii* community (Thon Son Hai)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Thalassia hemprichii</i>	Tra	2279.3	
<i>Palisada perforata</i>	Rh	145.8	
<i>Halimeda tuna</i>	Ch	142.9	
<i>Dictyosphaeria versluysii</i>	Och	72.2	
<i>Caulerpa serrulata</i>	Ch	63.0	
<i>Valonia aegagropila</i>	Ch	31.9	
<i>Spyridia filamentosa</i>	Rh	24.9	
<i>Hypnea esperi</i>	Rh	14.9	
<i>Gracilaria arcuata</i>	Rh	14.9	
<i>Chondrophycus articulatus</i>	Rh	10.8	
<i>Gelidiella acerosa</i>	Rh	0.8	
<i>Laurencia decumbens</i>	Rh	0.7	
<i>Caulerpa fastigiata</i>	Ch	0.7	
<i>Rhipidosiphon javensis</i>	Ch	0.3	
Total biomass of plants		2812.2	
ANIMALS			
<i>Anadara antiquata</i>	Bi	80.7	7
<i>Modiolus auriculatus</i>	Bi	65.3	13
<i>Conus ebraeus</i>	Ga	60.7	7
<i>Stylissa flexibilis</i>	Sp	20.9	
<i>Eurythoe complanata</i>	Po	10.0	7
<i>Callyspongia (Cladochalina) fibrosa</i>	Sp	8.0	
<i>Pilumnus rufopunctatus</i>	De	3.5	13
Amphipoda	Am	3.0	2133

Table 13 (Continued)

Taxa	Taxonomic group	B	N
<i>Codakia punctata</i>	Bi	2.5	7
<i>Gonodactylus chiragra</i>	St	1.8	13
<i>Calcinus gaimardii</i>	De	1.3	13
<i>Alpheus pacificus</i>	De	1.2	7
<i>Clathria</i> sp.	Sp	0.8	
<i>Ceratonereis mirabilis</i>	Po	0.3	33
<i>Lysidice collaris</i>	Po	0.2	13
Sipuncula	Si	0.2	40
<i>Septifer bilocularis</i>	Bi	0.1	7
<i>Leodice antennata</i>	Po	0.1	7
<i>Tellina staurella</i>	Bi	0.1	7
<i>Lysidice unicornis</i>	Po	0.1	7
Total biomass of animals		260.7	
Total biomass		3072.9	

Table 14

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the lower part of the middle intertidal subzone and the upper part of the lower intertidal subzone of dead coral reef, in the *Chama macerophylla*+*Palisada perforata* community (Thon Son Hai)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Palisada perforata</i>	Rh	392.0	
<i>Chondrophyucus articulatus</i>	Rh	28.1	
<i>Valonia aegagropila</i>	Ch	28.0	
<i>Hypnea esperi</i>	Rh	9.2	
<i>Anadyomene plicata</i>	Ch	0.5	
Total biomass of plants		457.8	
ANIMALS			
<i>Chama macerophylla</i>	Bi	486.0	20
<i>Ophiocoma scolopendrina</i>	Oph	224.0	40
Ascidacea	Asc	20.2	
<i>Gonodactylus chiragra</i>	St	2.7	1
Amphipoda	Am	2.1	860
<i>Ceratonereis mirabilis</i>	Po	0.1	20
Total biomass of animals		735.1	
Total biomass		1192.9	

In the upper part of the lower intertidal subzone, there is a community of mixed algae (algal mosaic). The red algae *Acrocystis nana* and *Chondrophycus articulatus* dominate the community (Table 15). A brown seaweed *Sargassum polycystum* community occupies most of the lower intertidal subzone. The polychaete *Eurythoe complanata* is a dominant species among animals (Table 16). The most numerous invertebrates are the polychaetes and amphipods. Diverse decapods (*Plagusia immaculata*, *Thalamita crenata*, *Leptodius exaratus*, *Pilumnus vesperilio*, *Chlorodiella nigra*, *Eriphia smithii*, *Alpheus* sp., and others), gastropods (*Monetaria annulus*, *M. moneta*, *Erronea erronea*, *Drupella margariticola*, *Tenguella granulata*, *Bursa granulata*, *Mitra scutulata*, *Engina lineata*, *Cyclope neritea*, *Clypeomorus irrorata*, *Monoplex gemmatus*, *Conus ebraeus*, *C. coronatus*, and *Aplysia* sp.), bivalves (*Acar plicata*, *Isognomon perna*, *Gafrarium pectinatum*, and *Chama croceata*), echinoderms (*Echinometra*

Table 15

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper part of the lower intertidal subzone of dead coral reef, in the *Acrocystis nana*+*Chondrophycus articulatus* community (Thon Son Hai)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Acrocystis nana</i>	Rh	107.0	
<i>Chondrophycus articulatus</i>	Rh	93.9	
<i>Hypnea esperi</i>	Rh	80.4	
<i>Sargassum polycystum</i>	Och	57.1	
<i>Gelidiella acerosa</i>	Rh	9.6	
<i>Gracilaria canaliculata</i>	Rh	2.6	
<i>Gelidium spathulatum</i>	Rh	0.8	
<i>Hydroclathrus clathratus</i>	Och	0.2	
<i>Caulerpa fastigiata</i>	Ch	0.2	
Total biomass of plants		352.4	
ANIMALS			
<i>Pinctada radiata</i>	Bi	58.7	20
<i>Nereis falcaria</i>	Po	0.4	200
<i>Halicarcinus messor</i>	De	0.3	20
<i>Ceratonereis mirabilis</i>	Po	0.2	40
<i>Latirus</i> sp.	Ga	0.2	20
Amphipoda	Am	0.2	20
<i>Leodice antennata</i>	Po	0.1	40
Total biomass of animals		60.1	
Total biomass		412.5	



*mathaei* and *Ophiocoma scolopendrina*), and some other groups of invertebrates are also found in the *Sargassum* community. Small colonies of the reef-building scleractinian corals *Montipora*, *Porites*, *Goniastrea*, *Favia*, and *Isopora palifera* occur along the edge of the reef in the intertidal zone of Thon Son Hai.

Table 16

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the lower part of the lower intertidal subzone of dead coral reef, in the *Sargassum polycystum*+*Eurythoe complanata* community (Thon Son Hai)

Taxa	Taxonomic group	B	N
PLANTS			
<i>Sargassum polycystum</i>	Och	937.0	
<i>Dictyosphaeria versluysii</i>	Och	114.4	
<i>Padina australis</i>	Och	85.2	
<i>Caulerpa racemosa</i>	Ch	84.1	
<i>Caulerpa serrulata</i>	Ch	58.9	
<i>Valonia aegagropila</i>	Ch	20.7	
<i>Palisada perforata</i>	Rh	14.1	
<i>Hypnea esperi</i>	Rh	6.5	
<i>Asteromenia anastomosans</i>	Rh	5.4	
<i>Bornetella sphaerica</i>	Rh	1.9	
<i>Caulerpa fastigiata</i>	Ch	0.9	
<i>Gelidiella acerosa</i>	Rh	0.4	
<i>Caulerpa sertularioides</i>	Ch	0.2	
<i>Caulerpa taxifolia</i>	Ch	0.1	
Total biomass of plants		1329.0	
ANIMALS			
<i>Eurythoe complanata</i>	Po	146.0	60
<i>Holothuria (Halodeima) atra</i>	Ho	61.9	20
<i>Pseudosuberites lobulatus</i>	Sp	9.0	
<i>Psammis cavipes</i>	De	7.5	20
<i>Leodice antennata</i>	Po	4.2	2320
Amphipoda	Am	3.9	3600
Sipuncula	Si	2.2	40
<i>Gonodactylus chiragra</i>	St	0.8	20
<i>Lysidice unicornis</i>	Po	0.1	100
<i>Terebellides stroemii</i>	Po	0.1	20
Total biomass of animals		235.6	
Total biomass		1565.6	

From Bau Than Bay northward the brachyuran crabs *Ocypode ceratophthalmus*, *O. convexa*, and *O. cordimanus* inhabit the upper intertidal subzone of wave-exposed sandy beaches. On sandy-silted beaches with admixture of coral rubble and shells (Hon Khoi Peninsula and Hon Gom Peninsula (Nai Bay)), a community dominated by the gastropods of the family Cerithiidae (*Clypeomorus batillariae-formis* or *Strobiligera inflata*) is found. The total animal biomass of the community can reach 665 gWW m<sup>-2</sup>. Besides the dominating gastropods, the community includes the hermit crab *Clibanarius ransoni*, the brachyuran crabs (*Thalamita crenata*, *Actaea amoyensis*, *Metopograpsus messor*, and *Uca (Austruca) annulipes*), the gastropods (*Nerita chamaeleon* and *Drupella margariticola*), the polychaete *Perinereis cultrifera*, and the bivalve mollusks (*Asaphis violascens*, *Brachidontes mutabilis*, and *Gafrarium pectinatum*). Below Cerithiidae a belt-forming community dominated by *Nerita* gastropods (*N. chamaeleon*, *N. albicilla*, and *N. balteata*)+*Planaxis sulcatus* develops. The total animal biomass is as high as 280 gWW m<sup>-2</sup>, and diverse mollusks make up 80% of the biomass. The community comprises quite common species of gastropods (*Echinolittorina millegrana*, *Nodilittorina pyramidalis*, *Littoraria scabra*, *Natica vitellus*, *Cerithium traillii*, *Cellana toreuma*, *Supplanaxis niger*, and *Tenguella musiva*), bivalve mollusks (*Gafrarium dispar*, *Atrina strangei*, and *Atactodea striata*), polychaetes (*Lysidice unicornis* and *Marphysa mossambica*), sipunculid worms, the hermit crab *Calcinus gaimardii*, relatively small-sized crabs (*Th. crenata* and others), and occasionally nudibranchs and sea cucumbers. Patches of *Batillaria zonalis* and settlements of *Chthamalus malayensis* sometimes occur.

On the boundary between the upper and middle intertidal subzones, a community dominated by the bivalve mollusks *Anadara antiquata* and *Gafrarium pectinatum* sometimes develops instead of *Chthamalus malayensis*. The community is abundant with various bivalves (*Chama brassica*, *Saccostrea scyphophilla*, *Vasticardium elongatum enode*, and *Tellina palatum*), which make up more than 99% of the total biomass of macrobenthos (up to 1850 gWW m<sup>-2</sup>). Sometimes the algae *Gracilaria canaliculata*, *Hypnea esperi*, and *Cladophoropsis membranacea* may be found.

In Bau Than Bay and other areas from Cape Dinh to Ro Bay, the flora and fauna are exceptionally diverse. Communities dominated by the bivalve mollusks *Modiolus auriculatus*, *Leiosolenus levigatus*, *Gafrarium pectinatum*, and *Barbatia foliata* are typical for the middle intertidal subzone on coral plateaus covered with sand. The species composition of these communities is rather diverse, but mollusks, polychaetes, and algae basically prevail. Other bivalve mollusks are represented by rather common species (*Arca ventricosa*, *Barbatia fusca*, *B. foliata*, *B. virescens*, *Isognomon perna*, *I. isognomum*, *Chama croceata*, *Modiolus auriculatus*, *Fragum fragum*, *Leiosolenus malaccanus*, *L. lischkei*, *Tridacna maxima*, *Septifer bilocularis*, *Pinctada radiata*, *Tellina palatum*, *T. remies*, *Semele zebuensis*,

*Pinna muricata*, and others). The average biomass of bivalves varies between 445 and 750 gWW m<sup>-2</sup>, but makes up to 70–80% of the total animal biomass. The communities often include diverse species of gastropods (*Turbo bruneus*, *Nerita albicilla*, *N. chamaeleon*, *N. undata*, *Monodonta labio*, *Erronea erronea*, *Clypeomorus batillariaeformis*, *C. petrosa chemnitziana*, *Cerithium traillii*, *Monoplex pilearis*, *Polia undosa*, *Pictocolumbella ocellata*, *Coralliophila monodonta*, *Conus ebraeus*, *Striarca symmetrica*, *Rhinoclavis articulata*, *Semiricinula muricina*, *Nudibranchia*, and others). *Drupella margariticola* and *Aplysia* sp. are the most numerous gastropods. Polychaetes are represented by a fairly large number of species (*Palola siciliensis*, *Perinereis cultrifera*, *P. nigropunctata*, *Spirobranchus kraussii*, *Paralepidonotus ampulliferus*, *Lepidonotus carinulatus*, *Glycera alba*, *Dasybranchus caducus*, and *Eurythoe complanata*). Algae are also diverse in the middle intertidal subzone, especially red and green algae (the red algae *Tricleocarpa cylindrica*, *Gracilaria canaliculata*, *Gelidiella lubrica*, *Gelidium spathulatum*, *Hypnea esperi*, *H. pannosa*, *Laurencia brachyclados*, and *Centroceras gasparrinii*, the green algae *Valonia aegagropila*, *Rhizoclonium grande*, *Dictyosphaeria cavernosa*, and *Cladophoropsis sundanensis*, and others). *Gonodactylus chiragra* of Stomatopoda, the brittle stars *Ophiactis savignyi* and *Ophiocoma (Breviturma) brevipes*, the starfish *Archaster typicus*, the sea cucumber *Stichopus chloronotus*, numerous brachyuran crabs (*Chlorodiella laevissima*, *Nanosesarma minutum*, *Thalamita crenata*, *Leptodius exaratus*, *Macromedaeus nudipes*, *Metopograpsus messor*, *Paractaea rufopunctata*, and *Menaethius monoceros*), porcelain crabs, and the shrimp *Alpheus lobidens* inhabit holes and cracks in coral reefs.

In the middle intertidal subzone of Hon Khoi Peninsula, a community dominated by the red alga *Palisada perforata* occurs with the total biomass of macrobenthos up to 400 gWW m<sup>-2</sup> and spreads out to the lower intertidal subzone. The fauna is strongly dominated by Decapoda. The hermit crab *Clibanarius ransonii* makes up above 45% of the total biomass of macrobenthos and 90% of the total biomass of animals. The brachyuran crabs *Leptodius exaratus*, *Nanosesarma tweediei*, *N. minutum*, and *Ilyoplax pusilla*, the polychaete *Ceratonereis mirabilis*, rather large sea slug *Aplysia* sp., the bivalve mollusk *Codakia* sp., the sponge *Clathria* sp., and sipunculid worms are also found on peninsula.

The macrobenthic communities of the lower intertidal subzone of dead coral reefs are generally not clearly separated from the communities located in the middle intertidal subzone, but inhabitants of the lower subzone are much more diverse than dwellers of the middle subzone. For instance, on Hon Khoi Peninsula, immediately below *Palisada perforata*, a community dominated by the red alga *Tolyptocladia glomerulata* and the sea cucumber *Holothuria (Halodeima) edulis* develops. This community also includes the red algae *Chondrophycus articulatus*, *Palisada parvipapillata*, and *Gelidiella acerosa*. The *T. glomerulata*+*H. (H.) edulis* community

are dominated by the gastropods *Clypeomorus petrosa chemnitziana* and *Drupella margariticola*, the bivalve mollusk *Arca ventricosa*, and the brachyuran crab *Leptodius exaratus*. The polychaetes *Perinereis cultrifera* and *Ceratonereis mirabilis*, the shrimp *Alpheus* sp., the brachyuran crabs *Nanosesarma tweediei*, *Metopograpsus messor*, and *Macromedaeus nudipes*, the gastropods *Tenguella musiva*, *Triphora* sp., and *Pythia* sp., sipunculid worms and some other groups of invertebrates may also be found in the lower intertidal subzone of Hon Khoi Peninsula. The total biomass of macrobenthos in the community may exceed  $1 \text{ kgWW m}^{-2}$ .

On Rua Islet (Nha Trang Bay), the *Sargassum* community dominated by *S. mcclurei*, *S. miyabei*, and *S. polycystum* may be found locally. Other numerous species include the gastropod *Turbo bruneus*, the bivalve mollusks *Leiosolenus malaccanus*, *Botula cinnamomea*, and *Rocellaria* sp., decapods, and holothurians. The total biomass of macrobenthos in the *Sargassum* community is rather high (above  $4850 \text{ gWW m}^{-2}$ ).

On Bai Tien Beach, there is a community of *Sargassum* and red algae. Among the dense underbrush of *Sargassum* sp., *Laurencia tenera*, *Palisada perforata*, and *P. parvipapillata* develop. Sometimes the community comprises other red algae (*Gelidiella acerosa*, *Hypnea valentiae*, *Centroceras clavulatum*, *Anotrichium tenue*, *Leveillea jungermannioides*, *Boodlea struveoides*, and others). The gastropods *Conus coronatus* and *Erronea erronea* prevail among animals. The total biomass of macrobenthos is above  $1280 \text{ gWW m}^{-2}$ . Another community found on Bai Tien Beach is a belt-forming algal mosaic community dominated by the brown alga *Padina australis*, the green alga *Halimeda tuna*, and Rhodophyta. Typical for the lower intertidal subzone red algae include *Palisada parvipapillata*, *Laurencia tenera*, *L. microcladia*, *L. jungermannioides*, *Ceramium cingulatum*, *Hypnea pannosa*, *Gelidium crinale*, *Jania adhaerens*, and *Mastophora pacifica*. Other algae are represented by the brown alga *Dictyota dichotoma* and the green algae *Boergesenia forbesii* and *Phyllocladion anastomosans*. Prevailing animals are barnacles and bivalve mollusks. The total biomass of macrobenthos may reach  $1200 \text{ gWW m}^{-2}$  in this algal community.

Live corals may be found in the lower part of the lower intertidal subzone in some areas. For instance, colonies of the hydrocoral *Millepora platyphylla*, the reef-building scleractinian corals (*Acropora digitifera*, *Porites lobata*, species of *Pocillopora*, *Favia*, *Psammocora*, and *Echinopora*), as well as corals that do not form reefs (*Dendrophyllia*) occur in Bau Than Bay.

Polychaetes, sipunculid worms, hermit crabs, and the bivalve mollusk *Atactodea striata* inhabit sandy areas of the middle and lower intertidal subzones. These areas are also characterized by quite numerous brachyuran crabs (up to  $240 \text{ ind. m}^{-2}$  and above  $325 \text{ gWW m}^{-2}$ ).

High macrophyte diversity is observed in the communities of dead coral reefs in Bau Than Bay, on Bai Tien Beach, Rua Islet, Thi Island, and on Hon Khoi Peninsula, while very few algae are recorded on Lon Island, Me, Cum Meo, and Bip islets, in Ke, Nai, Ben Goi, and Ro bays. The fauna of these communities creates a patchwork of diverse groups of intertidal inhabitants in all study areas from Cape Dinh to Ro Bay. The species composition of animals depends on the topography of the coral plateau, the degree of wave action, and the degree of coral reef coverage by silted or pure sand. Animals recorded in the lower intertidal subzone, apart from those listed above, include sponges (*Cinachyrella australiensis*, *Haliclona* (*Gellius*) *ridleyi*, *H. (G.) cymaeformis*, *H. (G.) amboinensis*, *Haliclona* sp., and *Biemna fortis*), polychaetes (*Iphione muricata*, *Scoloplos* (*Leodamas*) *uniramus*, *Bhawania goodei*, *Palola siciliensis*, *Spirobranchus giganteus*, *Pista cristata*, *Leocrates claparedii*, *Lysidice collaris*, *Loimia medusa*, *Neanthes pachychaeta*, *Syllis* sp., and *Dodecaceria fistulicola*), decapods (*Thalamita danae*, *Th. prymna*, *Petrolisthes asiaticus*, *Actaeodes tomentosus*, *Calcinus laevimanus*, *Clibanarius lineatus*, *C. arethusa*, *C. merguiensis*, *Coenobita rugosus*, *Dardanus megistos*, and *Alpheus lobidens*), gastropods (*Scutus unguis*, *Trochus maculatus*, *Mauritia arabica*, *Canarium urceus*, *Polinices mammilla*, *Mammilla melanostoma*, *Clypeomorus pellucida*, *Pollia undosa*, *Mitrella scripta*, *Nassarius graphiterus*, *Mitra ambigua*, *Nerita* sp., *Chicoreus brunneus*, *Tectus pyramis*, *Thalessa aculeata*, *Drupella rugosa*, and *Conus consors*), bivalves (*Gafrarium dispar*, *G. pectinatum*, *Modiolus auriculatus*, *Brachidontes mutabilis*, *Tellina clathrata*, *Dosinia exasperata*, *Spondylus sinensis*, *Isognomon legumen*, and *Pinctada nigra*), and echinoderms (*Linckia laevigata*, *Archaster typicus*, *Echinaster luzonicus*, *Ophiocoma* (*Breviturma*) *dentata*, *Ophiarthrum elegans*, *Heterocentrotus mamillatus*, *Holothuria* sp., *Holothuria* (*Halodeima*) *atra*, *H. (Mertensiothuria) leucospilota*, and *Actinopyga echinites*).

## Intertidal zone of loose substrata

### Marine silty-sandy and sandy beaches

Marine silty-sandy and sandy beaches are usually composed of silted mixed-grained sand with admixture of shells, gravel, pebbles, and dead coral fragments. Such coasts are rather widely represented on the shores of bays and islands in southern (Bau Than and Trau Nam bays, Tre, Thi, Lon, and Ong islands, Trong (Binh Cang Bay), Me and Ke islets (Ben Goi Bay), and Cape Co Co) and northern (Co To Island, Be and Tran Ca banks) Vietnam (Table 1). Sometimes mangrove thickets develop in the upper part of the intertidal zone on heavily silted beaches with shells. The species composition of macrobenthos is generally more abundant and diverse on heavily silted beaches with lots of shells than on slightly silted or sandy gravelly beaches.

In southern Vietnam, slightly silted beaches of the upper intertidal subzone are occasionally inhabited by crabs or the polychaetes *Perinereis nuntia* and others, with the total animal biomass within 20 gWW m<sup>-2</sup>. Heavily silted beaches are characterized by an abundant fauna with a predominance of gastropods (*Nerita polita*, *N. chamaeleon*, *N. albicilla*, *Planaxis sulcatus*, *Echinolittorina millegrana*, *Clypeomorus batillariaeformis*, *C. pellucida*, *Cerithium traillii*, *Drupella margariticola*, *Semiricinula muricina*, *Reishia luteostoma*, *Cellana toreuma*) and bivalve mollusks (*Barbatia foliata*, *B. cometa*, *Pinctada margaritifera*, *Saccostrea scyphophilla*, *Septifer bilocularis*, *Loxoglypta transculpta*, *Gari elongata*, *Ruditapes philippinarum*). The total biomass of mollusks can reach 920 gWW m<sup>-2</sup>. In mangrove thickets, mollusks prevail, too, and Cerithiidae are mainly dominant on the sand (Table 17). These habitats

**Table 17**

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper intertidal subzone of marine silted-sandy beaches with admixture of shell, in the Cerithiidae community (southern Vietnam)

Taxa	Taxonomic group	B	N
ANIMALS			
Gastropoda	Ga	2680.4	2740
Including			
<i>Cerithium traillii</i>	Ga	169.4	140
<i>Nerita albicilla</i>	Ga	26.6	18
<i>Clypeomorus pellucida</i>	Ga	16.6	15
<i>Drupella margariticola</i>	Ga	10.1	16
<i>Planaxis sulcatus</i>	Ga	6.1	93
<i>Nerita chamaeleon</i>	Ga	3.4	3
<i>Nerita polita</i>	Ga	3.0	8
<i>Cerithium</i> sp.	Ga	2.6	3
<i>Littoraria scabra</i>	Ga	0.2	1
<i>Cellana toreuma</i>	Ga	0.1	1
Bivalvia	Bi	87.5	73
Including			
<i>Loxoglypta transculpta</i>	Bi	65.0	57
<i>Asaphis violascens</i>	Bi	22.0	16
<i>Scoloplos</i> sp.	Po	2.2	31
Decapoda	De	1.9	20
<i>Chthamalus malayensis</i>	Ci	0.3	–
Amphipoda	Am	0.1	4
Total biomass		3097.4	

also host a wide variety of bivalve mollusks (*Pinctada margaritifera*, *Gafrarium pectinatum*, *Brachidontes setiger*, *Parapholas quadrizonata*, *Botula cinnamomea*, *Leiosolenus malaccanus*, *Malleus legumen*, *Dosinia troscheli*, and others) and crustaceans.

The middle intertidal subzone of silted-sandy beaches is dominated by bivalves (*Modiolus auriculatus*, *Brachidontes striatulus*, *B. setiger*, *B. mutabilis*, *Isognomon nucleus*, *I. ephippium*, *I. perna*, *I. isognomum*, *Ruditapes philippinarum*, *Gafrarium dispar*, *G. pectinatum*, *G. divaricatum*, *Asaphis violascens*, *Pinna muricata*, *Arca ventricosa*, *Striarca symmetrica*, *Venus cassinaeformis*, *Rocellaria* sp., *Chama pacifica*, *Pegophysema bialata*, *Coralliophaga* sp., *Corbula* sp., *Ostrea* sp., *Septifer excisus*, *S. bilocularis*, *Atactodea striata*, *Venerupis variegata*, and *Saccostrea scyphophilla*). Gastropods are second in terms of biomass (Table 18). In addition to quantitatively

**Table 18**

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the middle intertidal subzone of marine silted-sandy beaches with admixture of shell (southern Vietnam)

Taxa	Taxonomic group	B	N
ANIMALS			
Bivalvia	Bi	185.9	98
Gastropoda	Ga	55.0	87
Including			
<i>Clypeomorus pellucida</i>	Ga	8.9	8
<i>Drupella margariticola</i>	Ga	8.1	11
<i>Drupa</i> sp.	Ga	5.1	3
<i>Monetaria annulus</i>	Ga	4.5	2
<i>Nerita albicilla</i>	Ga	4.4	2
<i>Rhinoclavis aspera</i>	Ga	3.3	22
<i>Nerita polita</i>	Ga	2.2	1
<i>Nerita chamaeleon</i>	Ga	2.2	1
<i>Semiricinula muricina</i>	Ga	2.0	1
<i>Erronea erronea</i>	Ga	1.7	1
<i>Cerithium</i> sp.	Ga	1.3	3
<i>Aplysia</i> sp.	Ga	1.0	1
<i>Triphora</i> sp.	Ga	0.1	1
<i>Voluta</i> sp.	Ga	0.1	1
<i>Murex</i> sp.	Ga	0.1	1
<i>Natica</i> sp.	Ga	0.1	1

Table 18 (Continued)

Taxa	Taxonomic group	B	N
<i>Ophiocoma scolopendrina</i>	Oph	14.4	5
<i>Haliclona (Gellius) cymaeformis</i>	Sp	13.5	
Holothuroidea	Ho	7.0	9
Actiniaria	Ac	5.1	15
Polychaeta	Po	4.2	102
Including			
<i>Iphione muricata</i>	Po	0.1	1
<i>Lysidice unicornis</i>	Po	0.1	1
<i>Perinereis cultrifera</i>	Po	0.1	1
<i>Cirratulus</i> sp.	Po	0.1	3
<i>Linopherus paucibranchiata</i>	Po	0.1	3
<i>Scoloplos</i> sp.	Po	0.1	3
<i>Epixanthus frontalis</i>	De	1.2	4
<i>Penaeus latisulcatus</i>	De	0.9	1
<i>Clibanarius eurysternus</i>	De	0.7	11
<i>Heteropanope glabra</i>	De	0.3	5
<i>Alpheus strenuus strenuus</i>	De	0.2	1
<i>Leptodius exaratus</i>	De	0.1	1
<i>Nanosesarma minutum</i>	De	0.1	4
<i>Thalamita prymna</i>	De	0.1	1
<i>Dardanus deformis</i>	De	0.1	1
Total biomass		302.9	

recorded species, *Littoraria scabra*, *Planaxis sulcatus*, and *Terebralia sulcata* may be found here. Mollusks make up above 90% of the total biomass of macrobenthos. Besides, the middle subzone is inhabited by brittle stars, sponges, sipunculid worms, shrimps, hermit crabs (*Clibanarius longitarsus*, *Coenobita rugosus*, and others), brachyuran crabs (*Thalamita crenata*, *Ocypode cordimanus*, *O. convexa*, *Ozius lobatus*, *Ashtoret lunaris*, *Mictyris longicarpus*, and others), sea cucumbers (*Holothuria (Thymiosycia) impatiens*, *Synaptula* sp., and *Anapta* sp.), polychaetes, the inarticulate brachiopod *Lingula* sp., sea anemones, sea urchins, amphipods, and isopods, and others groups of invertebrates. Algal species include the green alga *Avrainvillea erecta* and the brown alga *Padina boryana*; the epiphytic green alga *Cladophoropsis membranacea* grows in the middle intertidal subzone.



A community dominated by the seagrass *Enhalus acoroides* with the total biomass about 4 kgWW m<sup>-2</sup> sometimes occurs in the lower intertidal subzone. The flora of the community comprises the seagrass *Halodule pinifolia* and the red alga *Hydrolithon farinosum*. Prevailing animals include gastropods (*Drupella margariticola*, *Monetaria annulus*, *Erronea erronea*, and *Vexillum rugosum*) and bivalve mollusks (*Barbatia foliata*, *Anadara antiquata*, *Modiolus auriculatus*, and *Isognomon perna*). Sea urchins of the family Loveniidae and common and hermit crabs also frequently occur in the *E. acoroides* community.

Some sandy beaches are dominated by the gastropod *Rhinoclavis aspera*, others, by the bivalve mollusk *Atactodea striata* and many various crab species. However, the total animal biomass is commonly less than 50 gWW m<sup>-2</sup> in these communities. On the other hand, the animal biomass exceeding 2150 gWW m<sup>-2</sup> is recorded in the community dominated by the colonial soft coral *Zoantharia* (Table 19).

The population of silty-sandy beaches with a strong admixture of shells includes diverse fauna in the lower intertidal subzone: sponges (*Halichondria (Halichondria) cartilaginea*, *Haliclona* sp., and *Callyspongia (Callyspongia) monilata*), polychaetes (*Eurythoe complanata*, *Thelepus plagiostoma*, and *Scoloplos (Leodamas) uniramis*), the mantis shrimp *Gonodactylus chiragra*, the shrimp *Alpheus bisincisus*, hermit crabs (*Clibanarius virescens*, *C. lineatus*, and *C. cruentatus*), brachyuran crabs (*Thalamita danae*, *Th. crenata*, *Pilumnus vespertilio*, *Epixanthus frontalis*, *Ozium rugulosus*, *Mictyris longicarpus*, *Metopograpsus messor*, *M. oceanicus*, *Macrophthalmus (Macrophthalmus)*

Table 19

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the upper part of the lower intertidal subzone of marine silted-sandy beaches, in the community of *Zoantharia* (southern Vietnam)

Taxa	Taxonomic group	B	N
ANIMALS			
<i>Zoantharia</i>	Zo	1632.8	1380
<i>Modiolus auriculatus</i>	Bi	391.1	100
<i>Nerita chamaeleon</i>	Ga	38.1	20
<i>Anadara antiquata</i>	Bi	28.9	20
<i>Holothuria (Thymiosyca) impatiens</i>	Ho	27.1	40
<i>Drupella margariticola</i>	Ga	25.6	20
<i>Biemna fortis</i>	Sp	6.1	
<i>Thelepus plagiostoma</i>	Po	1.9	20
Total biomass		2151.6	

*brevis*, *Leptodius exaratus*, and *Ocypode ceratophthalmus*), the chiton *Tonicia* sp., gastropods (*Haliotis ovina*, *Trochus maculatus*, *Angaria delphinus*, *Volegalea cochlidium*, *Erronea erronea*, *Nerita polita*, *N. chamaeleon*, *N. albicilla*, *N. undata*, *Planaxis sulcatus*, *Canarium urceus*, *Cypraea* sp., *Mitrella scripta*, *Cerithium traillii*, *Clypeomorus pellucida*, *Strobiligera inflata*, *Monoplex pilearis*, *Nassarius pullus*, *Drupella margariticola*, *Muricodrupa fuscilla*, *Reishia luteostoma*, *Aplysia* sp., and *Siphonaria sirius*), bivalve mollusks (*Gafrarium pectinatum*, *G. dispar*, *Striarca symmetrica*, *Arca ventricosa*, *Barbatia cometa*, *B. foliata*, *Spondylus* sp., *Chama macerophylla*, *Modiolus philippinarum*, *M. auriculatus*, *Atactodea striata*, *Isognomon isognomonum*, *I. nucleus*, *I. australica*, *Septifer bilocularis*, *Electroma virens*, *Atrina strangei*, *Saccostrea scyphophilla*, *Dendostrea sandvichensis*, *D. folium*, *Limaria perfragilis*, *Pinctada margaritifera*, *P. radiata*, *P. nigra*, and *Gafrarium pectinatum*), the sea star *Archaster typicus*, brittle stars (*Ophiolipsis superba*, *O. cincta cincta*, and *Ophiactis savignyi*), sea urchins (*Prionocidaris baculosa* and *Echinometra mathaei*), and the sea cucumber *Holothuria* (*Thymiosycia*) *impatiens*.

In the northern Vietnam (Co To Beach on Co To Island), the supratidal zone and the upper intertidal subzone of slightly silted sandy beaches are mainly inhabited by terrestrial and freshwater members of Pulmonata, Arachnoidea, Myriapoda, the mud lobster *Thalassina anomala*, a common dweller of the mangrove swamps, the brachyuran crabs belonging to the genus *Sesarma*, the hermit crabs of the genus *Coenobita*, and the isopod *Ligia* sp. The crab *Epixanthus frontalis* is sometimes found under seagrass wrack and rare boulders. The crabs *Ocypode ceratophthalmus*, *Scopimera bitympa*, *Perisesarma eumolpe*, and *Parasesarma plicatum* occasionally occur in the lower part of the upper intertidal subzone, as well as in southern Vietnam. *Dotilla wichmanni*, *Metopograpsus thukubar* and the gastropod *Cerithideopsisilla cingulata* (up to 300 ind. m<sup>-2</sup>) are more widespread species.

In the middle intertidal subzone, the light-blue soldier crab *Mictyris longicarpus* lives on the sandy beach, and occasionally the mud shrimp *Callinassa* sp., the mangrove swimming crab *Thalamita crenata*, the polychaetes *Chaetopterus* sp. and *Ophelina* sp., the bivalve mollusks *Gomphina* sp., *Donax faba*, and *Anomalocardia* sp., and the gastropods *Neritina* sp. and *Cerithideopsisilla cingulata* may be found there.

The lower intertidal subzone is characterized by dense accumulation of species, including subtidal species. The bivalves *Circe* sp., *Meretrix meretrix*, *Corbula ovalina*, *Arca* sp., and *Placamen isabellina*, the sea stars *Astropecten scoparius* and *Archaster typicus*, the sea urchins *Laganum* sp. and *Temnopleurus toreumaticus*, the sea cucumbers *Cucumaria frondosa japonica* and *Holothuria* (*Mertensiothuria*) *leucospilota*, the gastropods *Umbonium thomasi*, *Trochus* sp., *Nassarius bellulus*, *Strombus* sp., *Haliotis diversicolor*, and *H. ovina*, the brachyuran crabs *Portunus* (*Portunus*)

*pelagicus*, *Ashtoret lunaris*, *Macrophthalmus* (*Macrophthalmus*) *brevis*, and *Eurycarcinus orientalis*, the mantis shrimp *Cloridopsis scorpio*, small hermit crabs, scattered settlements of the polychaete *Diopatra neapolitana*, the sedentary polychaetes of the family Sabellidae, and small fishes *Siganus fuscescens*, *Arothron stellatus*, and *Pomadasy* sp. are recorded on the slightly silted sandy Co To Beach (Gurjanova, Chang Hiu Phuong, 1972).

In the Gulf of Tonkin, the silty-sandy Be and Tran Ca banks (Bai Tu Long Archipelago), disconnected from the shore and fully covered with water at equatorial tides, were also studied. The upper intertidal subzone is absent on the banks.

A continuous belt of seagrass *Cymodocea* sp. is spread along the middle and lower intertidal subzones. Prevailing species of macrobenthos on Be and Tran Ca banks are generally similar to those of Co To Beach, but apart from the animals mentioned for the beach, the *Cymodocea* sp. community also includes the following species: the brachyuran crabs *Uca* sp., *Macrophthalmus* (*Macrophthalmus*) *crassipes*, *M. dilatatus sulcatus*, *M. (Mareotis) tomentosus*, the shrimps of the family Alpheidae, the bivalves *Solen* sp., *Dosinia* sp., and *Macoma* sp., the sipunculid worm *Sipunculus* (*Sipunculus*) *nudus*, and the polychaetes *Chaetopterus variopedatus*.

Besides, the middle intertidal subzone and the upper part of the lower intertidal subzone are occupied by a community of the sedentary polychaetes of the family Sabellidae and the seagrass *Halophila beccarii*. Other members of the community include: rich crab fauna (*Macrophthalmus* (*Macrophthalmus*) *convexus*, *M. (Paramareotis) erato*, *M. (Mareotis) pacificus*, *M. (Mareotis) definitus*, *Metaplex longipes*, *M. sheni*, *Tmethypocoelis ceratophora*, *Ilyoplax orientalis*, *Metopograpsus quadridentatus*, *Pinnotheres* sp., *Polyonyx* sp., *Ebalia* sp., *Rhizopa gracilipes*, *Camptandrium sexdentatum*, *Charybdis* (*Charybdis*) *anisodon*, *Benthopanope eucratoides*, *Typhlocarcinus* sp., *Neoxenophthalmus obscurus*, *Perisesarma bidens*, *Eurycarcinus* sp., and others), gastropods (*Drupella rugosa*, *Indothais blanfordi*, *Turritella bacillum*, *Mitra* sp., *Nassarius pullus*, *Nassarius* sp., and others), bivalve mollusks (*Placuna placenta*, *Codakia* sp., *Laternula anatina*, *Cyclina sinensis*, *Gafrarium* sp., *Mactra* sp., and others), polychaetes (*Lanice conchilega* and others), species of Ophiuroidea, the numerous juvenile horseshoe crabs *Tachypleus*, and other animals.

A community dominated by another seagrass species, *Halophila ovalis*, occurs in the lower part of the lower intertidal subzone. It contains the sponge *Tethya japonica*, sea pens, sea cucumbers, shrimps, the brachyuran crabs *Thalamita* spp., *Serfukiensis*, and others, the gastropod *Laevistrombus turturella*, the bivalve mollusk *Pinna* sp., the sea anemone *Halcampella maxima*, numerous sea star *Astropecten scoparius* and fishes *Pomadasy* sp. (Gurjanova, Chang Hiu Phuong, 1972).

### Estuarine-lagoonal intertidal zone

The estuarine-lagoonal intertidal zones are located in sheltered places, such as bays and inlets, with weak wave action and low salinity of water. Bottom deposits of estuarine beaches mainly consist of silted sand or clayed silt with admixture of shells, gravel, stony and dead coral debris. In the Gulf of Tonkin, sedimentary deposits make up to 30 cm in thickness on the mudflats. Mangroves as a rule develop in the upper part of the intertidal zone. Estuarine beaches were studied in some areas of southern (Tre Island (Dam Chinh Bay), innermost parts of Binh Cang and Ben Goi bays, and at Vung Tau) and northern (the Red River Delta, Danh Do La and Dao Trao islands) Vietnam. A coastal lagoon is described in an unnamed bay of Hon Gom Peninsula (Cua Be Strait) (Table 1).

A typical coastal lagoon 1 m deep on Hon Gom Peninsula is located 15 m off the intertidal zone, cut off from the open sea by a sandbar and connected to the sea by a narrow channel. The sea water flows out of the lagoon during low tide, while from the opposite side a small stream flows into the lagoon. The lagoon is surrounded on one side by rocky blocks and on the other side by sand (Fig. 13). The bottom of the lagoon is covered by silted sand. Mangrove trees grow along a sandbank. The rocky blocks above the water's edge are only covered with littorinids and very rare oysters (mainly dead). Below the water's edge, *Diadema* sea urchins may sometimes be found in cracks and crevices. Burrows of crabs are seen on the sand in the upper intertidal subzone, but the lagoon bottom appears absolutely lifeless. The blennioid fishes *Salarias* swim in the water.

In southern Vietnam, the upper intertidal subzone of estuarine beaches is mainly inhabited by gastropods. A community dominated by *Cerithium coralium* occurs in the innermost parts of Binh Cang Bay (Nha Phu Bay), at Tan Thuy (Table 20). In addition to quantitatively recorded species, there are also numerous brachyuran crabs *Uca* spp., the gastropod species *Neritina* sp., *Cerithium* sp., and *Littoraria melanostoma*. The gastropod species *Littoraria scabra* occurs on trunks of the mangroves *Sonneratia*, *Avicennia* and *Rhizophora* (Tran-ngoc Loi, 1967). In Trau Nam Bay (the innermost parts of Ben Goi Bay), a community dominated by *Clithon oualaniense*+*Cerithideopsisilla cingulata* develops. The population is much more diverse and quantitatively abundant in Dam Chinh Bay than in Binh Cang and Trau Nam bays.

The middle intertidal subzone is inhabited poorer than the upper subzone. In the innermost part of Dam Chinh Bay, the total biomass of macrobenthos is 22.5 gWW m<sup>-2</sup>. Prevailing species include polychaetes, the inarticulate brachiopod *Lingula* sp., sipunculid worms, and the bivalve mollusk *Tellina clathrata*. Only the fiddler crab *Uca (Gelasimus) vocans* and small sipunculid worms may be



**Fig. 13.** A lagoon on the south-western coast of Hon Gom Peninsula (Cua Be Strait, Van Phong Bay). Photograph by Alexey V. Chernyshev.

found in Trau Nam Bay. The macrobenthos of Nha Phu Bay is relatively diverse. For example, it includes the rare seagrass *Halodule uninervis* (810 gWW m<sup>-2</sup>). Several species of mollusks (the bivalves *T. clathrata*, *Gonimyrtea* sp., and *Ctena delicatula*, and the gastropod species *Clithon oualaniense*, *Indothais javanica*, *Cerithium coralium*, and *Assimineea* sp.) dominate, with the total biomass above 70 gWW m<sup>-2</sup> and density up to 1000 ind. m<sup>-2</sup>. Polychaetes, sipunculid worms, the hermit crab *Clibanarius eurysternus*, common crabs, and occasionally the bivalves *Pitar sulfureus* and *Anadara gubernaculum*, and the gastropods *Drupella rugosa* and *Ergaea walshi* may also be found in the innermost part of Binh Cang Bay.

At Tan Thuy, a belt dominated by the oyster *Striostrea margaritacea* and the tube-building polychaete *Pomatoceros caeruleus* develops on mangrove trunks. A community of the small-sized (up to 3 mm) barnacles *Chinochthamalus scutelliformis* is observed on mangrove trunks with the projective cover up to 100%. On some mangroves, where settlements of oysters are sparse, a community dominated by the red algae *Bostrychia tenella* and *Catenella nipae* develops (Tran-ngoc Loi, 1967).

Table 20

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos  
in the upper intertidal subzone of estuarine beaches

Taxa	Taxonomic group	Dam Chinh Bay, Tre Islet		Nha Phu Bay, Binh Cang Bay		Trau Nam Bay, Ben Goi Bay	
		B	N	B	N	B	N
ANIMALS							
<i>Nerita albicilla</i>	Ga	278.6	320	–	–	–	–
<i>Isognomon isognomum</i>	Bi	185.0	100	–	–	–	–
<i>Drupa</i> sp.	Ga	153.8	80	–	–	–	–
<i>Clithon oualaniense</i>	Ga	–	–	3.9	120	152.6	2992
<i>Nerita polita</i>	Ga	89.6	160	–	–	–	–
<i>Natica</i> sp.	Ga	83.0	100	–	–	–	–
<i>Cerithideopsisilla cingulata</i>	Ga	–	–	–	–	80.8	100
<i>Cerithium coralium</i>	Ga	–	–	79.0	565	–	–
<i>Assimineia</i> sp.	Ga	75.0	1220	0.4	20	–	–
<i>Echinolittorina millegrana</i>	Ga	50.8	640	–	–	–	–
<i>Patelloida saccharina</i>	Ga	34.2	40	–	–	–	–
Paguridae	De	5.8	40	–	–	–	–
<i>Mictyris longicarpus</i>	De	–	–	–	–	5.8	7
<i>Tellina clathrata</i>	Bi	–	–	5.4	10	–	–
<i>Aplysia</i> sp.	Ga	–	–	–	–	3.1	2
<i>Perinereis nuntia</i>	Po	–	–	2.2	95	0.2	3
<i>Macrophthalmus</i> ( <i>Macrophthalmus</i> ) <i>brevis</i>	De	–	–	1.9	10	–	–
Total biomass		875.8		92.8		242.5	

Communities dominated by bivalve mollusks (*Anadara antiquata* in Dam Chinh Bay and *Gafrarium pectinatum* in Trau Nam Bay) occupy the lower intertidal subzone (Table 21). In Nha Phu Bay, both epifauna and infauna are diverse. Frequently occurring animals include the gastropod species *Drupella rugosa* with its egg masses, the hermit crab *Clibanarius* sp., the brachyuran crabs *Chlorodiella nigra* and *Benthopanope eucratoides*, and *Balanus* barnacles (attached to molluskan shells and dead branches of mangroves). Among other species recorded in the lower intertidal subzone, there are polychaetes, amphipods, and oligochaetes, the gastropods *Nerita chamaeleon*, *Clithon oualaniense*, *Mitra* sp., *Indothais javanica*, and *Drupella margariticola*, the bivalve mollusks *Anadara gubernaculum*, *A. antiquata*,

Table 21

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the lower intertidal subzone of estuarine beaches

Taxa	Taxonomic group	Dam Chinh Bay, Tre Islet		Trau Nam Bay, Ben Goi Bay	
		B	N	B	N
ANIMALS					
<i>Anadara antiquata</i>	Bi	85.4	7	–	–
<i>Gafrarium pectinatum</i>	Bi	–	–	43.4	23
<i>Rhinoclavis aspera</i>	Ga	29.7	260	–	–
<i>Archaster typicus</i>	As	27.4	13	–	–
<i>Polinices mammilla</i>	Ga	–	–	13.2	60
<i>Dosinia troscheli</i>	Bi	10.1	87	0.3	4
Polychaeta	Po	–	–	9.4	–
<i>Nassarius pullus</i>	Ga	8.9	7	–	–
Decapoda	De	–	–	7.9	10
<i>Lingula</i> sp.	Br	–	–	5.0	15
<i>Anomalodiscus squamosus</i>	Bi	3.4	7	–	–
<i>Clithon oualaniense</i>	Ga	2.8	20	–	–
<i>Venus</i> sp.	Bi	0.7	13	–	–
<i>Dodecaceria fistulicola</i>	Po	0.4	7	–	–
<i>Loxoglypta transculpta</i>	Bi	0.3	7	0.3	4
Total biomass		169.1		79.5	

*Anomalodiscus squamosus*, *Arca* sp., *Placuna placenta*, *Ostrea* sp., and shallow-water fishes. Patches of the green alga *Ulva flexuosa* and the seagrass *Thalassina anomala* are found on silted sand in the lower intertidal subzone of Tan Thuy (Tran-ngoc Loi, 1967). At Vung Tau, mangrove trunks are covered by rare individuals of the barnacle *Chthamalus* cf. *stellatus* and numerous scabra periwinkles *Littoraria scabra* (Fischer, 1952).

In northern Vietnam, the intertidal zone with mangrove thickets is found in many areas along the shore of the Red River Delta (estuaries of the Day, Van Uc, Cam rivers, the main channel of the Red River Ba Lat, An Kim Hai Canal), and on Danh Do La and Dao Trao islands (Table 1).

Marine, freshwater, and air-breathing aquatic invertebrates occur within mangrove forests (the mangrove trees *Sonneratia caseolaris*, *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Ceriops* sp., *Avicennia marina*, and others) of the Red River Delta.

The supratidal zone and the upper intertidal subzone are inhabited by the animals that can rise above the average level of tropical tides (the brachyuran crabs (*Uca* (*Austruca*) *lactea*, *U.* (*Tabuca*) *forcipata*, *U.* (*T.*) *arcuata*, *Uca* sp., *Perisesarma eumolpe*, *P. bidens*, *Parasesarma moluccense*, *Sesarma dehaani*, *Neosarmatium smithi*, *Tmethypocoelis ceratophora*, *Metaplox elegans*, *M. longipes*, *Helice tridens*, *Macrophthalmus* (*Macrophthalmus*) *brevis*, and *Paracleistostoma depressum*), the gastropods (*Littorinopsis* sp., *Littoraria melanostoma*, *Neritina violacea*, *Terebralia sulcata*, and *Cerithideopsilla cingulata*), including the pulmonate gastropods *Ellobium* sp. and *Onchidium* sp. The crabs of the genera *Metaplox*, *Uca*, *Sesarma*, and *Macrophthalmus*, as well as *Ilyoplax orientalis*, *Camptandrium sexdentatum*, *Deiratonotus cristatum*, and others may migrate all the way down the intertidal zone to the sublittoral fringe. The sipunculid worm *Phascolosoma* sp., the brachyuran crabs *Sarmatium crassum*, *Scylla serrata*, and *Clistocoeloma merguense*, the gastropod *Assimineia* sp., turbellarian flatworms, and the mudskipper *Boleophthalmus* sp. are found from the lower part of the upper intertidal subzone to the middle intertidal subzone.

The brachyuran crabs *Ilyoplax pingi* and *Episesarma mederi*, the gastropods *Nerita* sp. and *Nassarius* sp., the bivalve mollusk *Cyclina sinensis*, and echiurid worms occur on the boundary between the upper and middle intertidal subzones and in the upper part of the middle intertidal subzone. The seagrass *Halophila beccarii*, bivalve mollusks (*Laternula anatina*, *Codakia* sp., *Placuna placenta*, and others), the inarticulate brachiopod *Lingula anatina* and brachyuran crabs (*Uca* (*Tabuca*) *dussumieri* and *Metopograpsus quadridentatus*) are frequently recorded in the middle intertidal subzone.

Various crabs (*Metopograpsus latifrons*, *Orithyia sinica*, *Neoxenophthalmus obscurus*, *Parasesarma batavianum*, and *Metaplox sheni*) and the common button top shell *Umbonium* sp. are found both in the middle and lower intertidal subzones. Most part of the lower intertidal subzone to the subtidal zone is inhabited by the brachyuran crabs *Philyra olivacea*, *Rhizophora gracilipes*, *Portunus* (*Portunus*) *pelagicus*, *Varuna litterata*, and *Serfukiensis*, hermit crabs, and the horseshoe crab *Tachypileus tridentatus*. These subzones also host the gastropod *Natica* sp. and the mantis shrimp *Cloridopsis scorpio* (Gurjanova, Chang Hiu Phuong, 1972).

In the Red River Delta, extensive estuarine beaches Dai Hop and Bang La (Table 1) are devoid of mangrove vegetation. Macrobenthic population is poorer on these beaches than in the areas of mangrove forests, though the species composition of the lower intertidal subzone is similar. The upper and middle intertidal subzones are not protected from sunlight by higher plants, but in the supratidal zone the salt tolerant vine *Ipomoea pes-caprae* (bayhops) and the coastal form of the screw pine *Pandanus tectorius* may be found. Sometimes the mud-crabs *Helice tridens* and *Helice* sp., the pebble-crab *Philyra* sp., and the sand-bubbler crab *Dotilla wichmanni* form dense aggregations extending across sandy beaches.



In the upper intertidal subzone, the brachyuran crabs *Scopimera bitympana*, *S. globosa*, and *Parasesarma pictum* are common on sandy shores, and salt marsh grasses are occupied by the crabs *Uca (Tubuca) arcuata*, *U. (T.) forcipata*, *U. (Austruca) lactea*, *Uca* sp., *Macrophthalmus (Paramareotis) erato*, and *Eurycarcinus orientalis* may also be found here. The horned ghost crab *Ocypode ceratophthalmus* has been observed to burrow in areas where the sand is soft enough. The bivalve mollusk *Glaucanome cerea* (collected by native people) occurs in red clay deposits.

The middle intertidal subzone is inhabited by extensive aggregations of the infaunal bivalve mollusk *Corbula* sp., the crabs *Macrophthalmus dilatatus sulcatus* and *Mictyris longicarpus*, and the saltwater clam *Meretrix meretrix*. The sedentary polychaete *Diopatra neapolitana* is recorded in the middle and lower intertidal subzones.

In the lower intertidal subzone, the crabs *Philyra olivacea*, *Camptandrium sexdentatum*, *Neoxenophthalmus obscurus*, *Macrophthalmus (Mareotis) tomentosus*, *Orithyia sinica*, and *Metaplex sheni*, the hermit crabs of the family Paguridae, echiurid worms, *Natica* gastropods, mantis shrimps of Squillidae, and young horseshoe crabs live on the surface of the thick layer of silt. Numerous crustaceans belonging to the groups Tanaidacea, Penaeidae, and Mysidacea, as well as the crab *Dorippoides facchino* inhabit fine deposits of silt. Commercial species of crabs, *Portunus (Portunus) pelagicus* and *P. (P.) trituberculatus*, occur at the water's edge, as they cannot survive out of water for long periods. Sea pens are found in the subtidal fringe (Gurjanova, Chang Hiu Phuong, 1972).

On Danh Do La and Dao Trao islands, the estuarine intertidal zone is up to 200 m wide and located in inlets (Table 1). The macrobenthos of the intertidal zone is impoverished, the vertical distribution of the communities exhibits insignificant stratification, and a patchy pattern of macrobenthic distribution is typical for these locations. Soft bottom substrata provide habitats for various infaunal species of Polychaeta and Sipuncula. Members of epifauna (oysters and barnacles) inhabit hard substrata and trunks, branches, and roots of mangrove trees. Macrophytes are almost absent, as the sea water has near zero transparency.

Thickets of the mangrove plant *Aegiceras* sp. and solitary shrubs of mangroves covered by sea water during high tides can be observed in the upper intertidal subzone (Fig. 14). On Dao Trao Island, a community dominated by *Dendostrea folium* forms a belt on mangrove trunks with the total biomass of macrobenthos above 2700 gWW m<sup>-2</sup> (Fig. 15; Table 22). The bivalve mollusks *Gafrarium pectinatum*, *Dicyathifer manni*, and *Kellia* sp. and the gastropod *Nerita insculpta* settle on trunks, branches, and roots of mangroves. Stony and coral debris are inhabited by the oyster *Saccostrea echinata*, and the barnacles *Amphibalanus reticulatus* and *Chthamalus malayensis*. In addition to quantitatively recorded species, plenty of gastropods (*Nerita signata*, *Lunella granulata*, and *Planaxis sulcatus*) and their egg

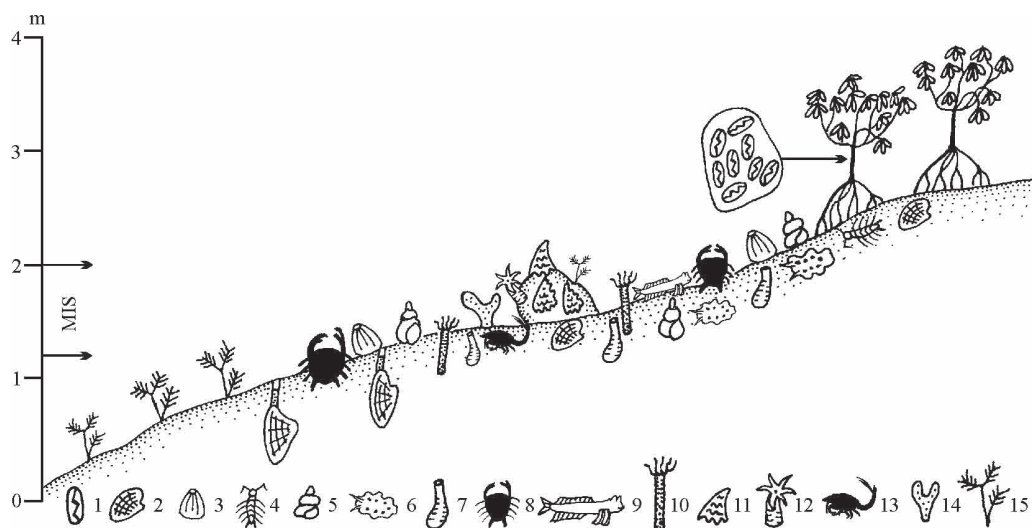
masses, the bivalve mollusk *Placuna placenta*, the isopod *Ligia* sp., and the brachyuran crab *Metopograpsus* sp. may also be found in the upper intertidal subzone on Danh Do La Island. The macrobenthic population of Danh Do La Island is poorer than that on Dao Trao Island, but the species compositions of the estuarine intertidal zones in general are similar for both islands. A community of the bivalve mollusks *Isognomon ephippium*+*Brachidontes mutabilis* is found in stony debris. Other bivalve species (*P. placenta*, *Kellia* sp., *Dicyathifer manni*, and others), gastropods (*Nerita insculpta* and *N. balteata*), brachyuran crabs (*Heteropanope glabra* and a few species of *Sesarma*), and some other invertebrates frequently occur in the upper intertidal subzone of Danh Do La Island (Fig. 16).

In the middle intertidal subzone of Dao Trao Island, plantlets of the red algae *Gelidium*, *Peyssonnelia*, and the green alga *Cladophora* may be observed. A belt-forming community dominated by the oyster *Saccostrea echinata* develops on stony and coral debris, and *S. echinata* makes up 80% of the animal bio-



**Fig. 14.** The mangrove shrubs in the upper intertidal subzone of Danh Do La Island (Bai Tu Long Archipelago, Gulf of Tonkin).

mass (Table 22). In addition to quantitatively recorded species, the sea anemone *Diadumene lineata*, the barnacle *Tetraclita squamosa*, the gastropods *Planaxis sulcatus*, *Drupella margariticola*, *Nerita signata*, and pulmonate gastropods are recorded in the *S. echinata* community. The crabs *Thalamita crenata* and *Metopograpsus* sp. are hiding into cracks and crevices of stony and coral debris and under them. On Danh Do La Island, algae are absent, and a community of the bivalve mollusks *Gafrarium pectinatum*+*Anomalodiscus squamosus* forms a mosaic of patches on stony debris. The dominant species make up about 80% of the total biomass of macrobenthos. Gastropods (*Clypeomorax batillariaeformis*, *Nassarius pulvis*, *N. olivaceus*, *Volegalea cochlidium*, *Neohaustator fortilirata*,



**Fig. 15.** Scheme of distribution of macrobenthos in the estuarine intertidal zone (Dao Trao Island, Bai Tu Long Archipelago, Gulf of Tonkin). 1 – *Dendostrea folium*, 2 – Bivalvia, 3 – Cirripedia, 4 – Isopoda, 5 – Gastropoda, 6 – Onchidiidae, 7 – Sipuncula, 8 – Decapoda, 9 – Blenniidae, 10 – Polychaeta, 11 – *Saccostrea echinata*, 12 – Actiniaria, 13 – Cumacea, 14 – Spongia, 15 – algae. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.

**Table 22**

Biomass (B, gWW m<sup>-2</sup>) and density (N, ind. m<sup>-2</sup>) of macrobenthos in the intertidal zone of estuarine beaches (Gulf of Tonkin)

Taxa	Taxonomic group	Dao Trao Island				Danh Do La Island			
		Upper intertidal subzone		Middle intertidal subzone		Upper intertidal subzone		Middle intertidal subzone	
		B	N	B	N	B	N	B	N
<b>PLANTS</b>									
<i>Gelidium</i> sp.	Rh	–		50.0		–		–	
<i>Cladophora</i> sp.	Ch	–		6.4		–		–	
Total biomass of plants				56.4					
<b>ANIMALS</b>									
<i>Dendostrea folium</i>	Bi	2733.0	400	–	–	–	–	–	–
<i>Saccostrea echinata</i>	Bi	+	+	706.2	80	–	–	–	–
<i>Gafrarium pectinatum</i>	Bi	+	+	44.8	4	+	+	550.0	40
<i>Anomalodiscus squamosus</i>	Bi	+	+	17.3	28	+	+	420.0	80
<i>Isognomon ephippium</i>	Bi	–	–	–	–	250.0	40	–	–

Table 22 (Continued)

Taxa	Taxonomic group	Dao Trao Island				Danh Do La Island			
		Upper intertidal subzone		Middle intertidal subzone		Upper intertidal subzone		Middle intertidal subzone	
		B	N	B	N	B	N	B	N
<i>Brachidontes mutabilis</i>	Bi	–	–	6.0	8	180.0	20	68.0	120
<i>Neotrapezium sublaevigatum</i>	Bi	–	–	+	+	–	–	82.0	60
<i>Barbatia foliata</i>	Bi	–	–	–	–	–	–	80.0	20
<i>Nerita albicilla</i>	Ga	+	+	0.1	4	–	–	60.0	20
<i>Batillaria zonalis</i>	Ga	–	–	50.0	80	–	–	–	–
<i>Clypeomorus bifasciata</i>	Ga	+	+	50.0	80	–	–	+	+
<i>Mictyris longicarpus</i>	De	–	–	6.0	8	–	–	–	–
Thalassinidae	De	–	–	3.6	4	–	–	–	–
<i>Septifer virgatus</i>	Bi	–	–	3.4	8	–	–	–	–
<i>Semele cordiformis</i>	Bi	–	–	3.2	4	–	–	–	–
<i>Suberites</i> sp.	Sp	–	–	2.1	–	–	–	–	–
<i>Uca (Tubuca) dussumieri</i>	De	–	–	1.8	4	–	–	–	–
<i>Golfingia (Golfingia) elongata</i>	Si	–	–	0.1	4	–	–	1.0	20
<i>Thysanocardia catharinae</i>	Si	–	–	1.0	20	–	–	–	–
Grapsidae	De	–	–	–	–	–	–	1.0	20
<i>Tharyx</i> sp.	Po	–	–	–	–	–	–	0.8	100
<i>Leonnates persicus</i>	Po	–	–	–	–	–	–	0.6	60
<i>Trapezium bicarinatum</i>	Bi	–	–	0.6	4	–	–	–	–
<i>Phascolosoma (Phascolosoma) scolops</i>	Si	–	–	0.4	8	–	–	–	–
<i>Terebella ebrenbergi</i>	Po	–	–	0.2	4	–	–	–	–
<i>Tapes literatus</i>	Bi	–	–	0.2	4	–	–	–	–
<i>Arabella mutans</i>	Po	–	–	0.1	4	–	–	–	–
<i>Perinereis cultrifera</i>	Po	–	–	0.1	4	–	–	–	–
<i>Antillesoma antillarum</i>	Si	–	–	0.1	4	–	–	+	+
Priapulida	Pr	–	–	0.04	4	–	–	–	–
<i>Tellina diaphana</i>	Bi	–	–	0.04	2	–	–	–	–
<i>Onuphis eremita</i>	Po	–	–	0.04	2	–	–	–	–
<i>Bhawania cryptocephala</i>	Po	–	–	0.02	4	–	–	–	–
<i>Lysidice unicornis</i>	Po	–	–	0.02	4	–	–	–	–

Table 22 (Continued)

Taxa	Taxonomic group	Dao Trao Island				Danh Do La Island			
		Upper intertidal subzone		Middle intertidal subzone		Upper intertidal subzone		Middle intertidal subzone	
		B	N	B	N	B	N	B	N
Cumacea	Cu	–	–	0.02	2	–	–	–	–
<i>Lumbrineris shiinoi</i>	Po	–	–	0.02	2	–	–	–	–
Total biomass of animals		2733.0		879.5		430.0		1263.4	
Total biomass		2733.0		953.9		430.0		1263.4	

*Leiosolenus levigatus*, and others), sea anemones, mantis shrimps, hermit crabs and diverse brachyuran crabs, sipunculid worms, polychaetes (*Nereiphylla castanea*, *Heteromastus similis*, *Aphelochaeta multifilis*, and *Axiobella* sp., and others), the fishes of the family Blenniidae, and other euryhaline inhabitants, able to tolerate estuarine environments, are found in the middle intertidal subzone.

The lower intertidal subzone is heavily silted, and macrobenthos is practically absent here. Only the plantlets of the red algae *Peyssonnelia* sp., *Bostrychia tenella*, and *Wurdemannia miniata* and the green alga *Cladophora papenfussii* occur at the entrance to the inlet on Dao Trao Island.



Fig. 16. In the intertidal zone of Danh Do La Island (Bai Tu Long Archipelago, Gulf of Tonkin).

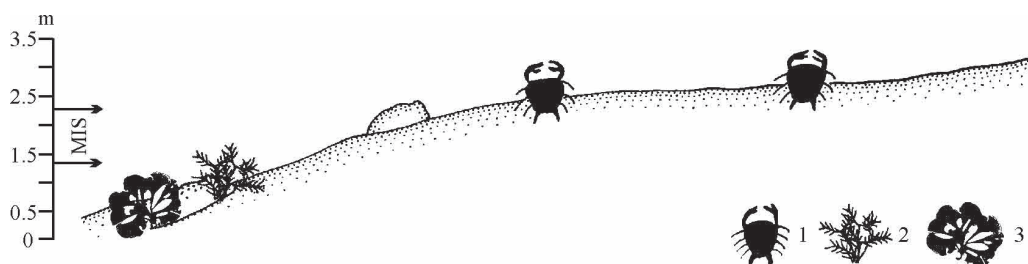
### Wave-exposed sandy beaches

Wave-exposed sandy beaches were studied on the Nam Du (Nam Du Archipelago), Sud, and Gio islets, Re and Cham islands, Hon Gom Peninsula (Cua Be Strait) and in Ro Bay (Table 1). These beaches are composed of clean, perfectly sorted sand, sometimes with fragments of dead corals, shells, and rare boulders. The intertidal zone is about 30–50 m wide. Wave action is almost permanent. The population is generally rather poor and uniform. These locations are either wholly devoid of macrobenthos or inhabited by mainly motile animals, which are difficult to count. The total biomass of macrobenthos is less than few hundred gWW m<sup>-2</sup>. The macrobenthos is slightly richer in the lower intertidal subzone.

In the supratidal zone and the upper and middle intertidal subzones, brachyuran crabs (*Ocypode ceratophthalmus*, *O. convexa*, *Scopimera globosa*, and others) and hermit crabs (*Clibanarius ransonii*, *C. arethusa*, *C. longitarsus*, *Calcinus gaimardii*, *Dardanus deformis*, *Coenobita rugosus*, and others) prevail (Figs. 17, 18). In the middle intertidal subzone, Polychaeta and Amphipoda may be found. On Sud Islet, there is a belt of the green alga *Cladophora* sp.

In some of the studied locations, the species composition of the lower intertidal subzone is fairly diverse. On Sud Islet, there are typical belt-forming communities dominated by the seagrasses *Cymodocea rotundata* and *Thalassia hemprichii* jointly with the brown alga *Sargassum polycystum*. These communities also commonly include the brown alga *Lobophora variegata*, the red algae *Gracilaria canaliculata* and *G. coronopifolia*, the green alga *Halimeda macroloba*, and the seagrass *Halophila ovalis*. The biomass of plants reaches 645 gWW m<sup>-2</sup>. Numerous and diverse sponges, isopods, echinoderms, and others group of invertebrates prevail among animals on Sud Islet.

On Re Island, boulders lying on the sand are abundantly covered with the red algae *Hypnea*, *Peyssonnelia*, *Laurencia*, *Asteromenia*, *Acanthophora*, *Amphiroa*, *Gracilaria*, and *Galaxaura*, the green algae *Ulva*, *Caulerpa*, *Chaetomorpha*, *Halimeda*, *Codium*,



**Fig. 17.** Scheme of distribution of macrobenthos on wave-exposed sandy beach of Gio Islet. 1 – *Ocypode ceratophthalmus*, 2 – *Jania* sp., 3 – *Padina australis*. Vertical scale – range over depths 0. MIS – the middle intertidal subzone.



**Fig. 18.** Sandy beach in the south-western coast of Hon Gom Peninsula (Van Phong Bay). **A** – the general view, **B** – burrows of crabs at the upper border of the intertidal zone. Photograph by Alexey V. Chernyshev.

*Neomeris*, *Rhipidosiphon*, *Cladophora*, and *Dictyosphaeria*, the brown algae *Padina*, *Dictyota*, and the species of the genus *Sargassum*. The projective cover of the boulders by the algae is up to 100%. Animals of these communities include mainly the gastropods *Latirus barclayi*, *Pictocolumbella ocellata*, *Tenguella granulata*, *Clypeomorvus bifasciata*, *Conus lividus*, *Trochus maculatus*, *Nerita albicilla*, and *Aplysia* sp., the bivalve mollusk *Pinctada margaritifera*, the sea urchins *Diadema setosum*, *Toxopneustes pileolus*, *Echinothrix diadema*, and *Tripneustes ventricosus*, the sea cucumber *Holothuria* (*Thymiosycia*) *impatiens*, the sponge *Suberites* sp., polychaetes *Leodice antennata* and *Loimia medusa*, the sipunculid worm *Phascolosoma* (*Phascolosoma*) *nigrescens*, amphipods, and the diverse crabs.

On Nam Du Islet, the macrobenthos is comprised of the gastropods *Pyramidella* sp., bivalve mollusks, polychaetes (up to 650 gWW m<sup>-2</sup>), and isopods; macrophyte algae are absent. On Cham Island, there are the alga *Padina australis* and the sea cucumber *H. (Th.) impatiens*. On Gio Islet, bushes of the algae *P. australis* and *Jania* sp. are found on rare boulders in the lower intertidal subzone (Fig. 17).

## Tide pools

Tide pools are observed on hard substrata in a few locations (Petite Catwick, Thu and Lon islands, Rua (Nha Trang Bay) and Gio islets, Tien Sa Peninsula (the south-eastern part of the peninsula), Bai Tien Beach, and Cai Sung Bay) (Table 1). They are 2–7 m long and 0.2–1.5 m deep. The population of tide pools is generally poor. At Petite Catwick, a community of the gastropods *Dendropoma planorbis*+*Vermetus tokyoensis* inhabits perennial depositions of tubes of sedentary polychaetes. The oyster *Saccostrea scyphophilla* is also a prevailing species. The total animal biomass in the community is up to 5650 gWW m<sup>-2</sup>. The bivalve mollusk *Isognomon ephippium* on Thu Island and *S. scyphophilla* on Tien Sa Peninsula form settlements on the walls of tide pools.

Some tide pools northward of Cape Lutin are characterized by a very diverse species composition of macrobenthos. The gastropods *Planaxis sulcatus* and *Echinolittorina millegrana* live on the walls of the tide pools, and the bottom is covered with calcareous red algae forming a 30–50% projective cover. The brown algae *Turbinaria ornata*, *Padina australis*, *Lobophora variegata*, *Sargassum* (plantlets), and the red alga *Asparagopsis taxiformis* are found here. There are also colonies of the zoanthid *Palythoa tuberculosa*, the holothurians *Holothuria* (*Semperothuria*) *cinerascens*, *H. (Thymiosycia) impatiens*, and *H. (Mertensiothuria) hilla*, the gastropods *Mancinella alouina*, *Cellana vitiensis*, *Nerita albicilla*, and others.

The constant presence of sea water, a specific feature of tide pools, creates favourable conditions for diverse fishes (*Terapon jarbua*, *Amblyglyphidodon curacao*,



*Abudefduf saxatilis*, *Labroides dimidiatus*, *Dascyllus* sp., *Pomacentrus* sp., *Istigobius* sp., and others) and invertebrates, which are typical both for the lower intertidal subzone and subtidal zone of Petite Catwick, Thu Island, Gio Islet, and Tien Sa Peninsula (for instance, the brittle stars *Ophiocoma erinaceus* and *Amphipholis squamata*).

In Cai Sung Bay, diverse and abundant bottom dwellers are observed in shallow, but quite large in area tide pools of a dead coral plateau. Two species of echinoderms (the large sea cucumber *Holothuria (Mertensiothuria) leucospilota* and the brittle star *Ophiocoma scolopendrina*) prevail here in numbers.

In tide pools of dead coral reefs on Bai Tien Beach, Lon Island, and Rua Islet, the gastropod species *Conus coronatus* and *Turbo bruneus* are often found under boulders. Among other numerous animals are bivalves (*Pinctada margaritifera*, *Isognomon isognomum*, *I. perna*, *Acar plicata*, *Chama pacifica*, *Rocellaria* sp., *Cardita variegata*, *Coralliophaga* sp., and others), sea anemones, sipunculid worms, sea cucumbers, brittle stars, and decapod crustaceans. The total biomass of animals is above 1470 gWW m<sup>-2</sup>. Seagrass beds dominated by *Enhalus acoroides* and *Thalassia hemprichii* often cover the silty-sandy bottom of tide pools. Animals found in these beds include the gastropod *Drupella margariticola* and the bivalve mollusks *Arca ventricosa*, *Tellina carnicolor*, *Striarca symmetrica*, *Leiosolenus malaccanus*, and *Marteisia striata*. The total macrobenthic biomass is a little less than 2 kgWW m<sup>-2</sup>.

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Appendix

The list of macrobenthos of the intertidal zone of Vietnam

Some groups have not been identified (sponges of Calcarea, Turbellaria, Priapulida, Cumacea, Tanaidacea, Mysidacea, and colonial ascidians) or are partly identified (calcareous algae, Actiniaria, Zoantharia, Sipuncula, Polychaeta, Amphipoda, Stomatopoda, Decapoda, Polyplacophora, Holothuroidea, Ophiuroidea, and fishes).

Locations: 1 – Gulf of Thailand, 2 – Mekong River mouth – Can Gio – Vung Tau, 3 – Catwick Islands, 4 – Thu Island, 5 – Cape Dinh – Ro Bay – O Loan Lagoon, 6 – Cape Ba Lang An – Re Island, 7 – Cham Island, 8 – Da Nang – Tien Sa Peninsula, 9 – Gio Islet, 10 – Gulf of Tonkin, 11 – location unknown; the sign «\*» designates species found on Con Dao Islands.

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<b>PLANTS</b>											
Phylum OCHROPHYTA											
Class PHAEOPHYCEAE											
Order DICTYOTALES											
Family Dictyotaceae											
<i>Dictyota dichotoma</i> (Hudson) J.V. Lamouroux				+	+						
<i>Dictyota friabilis</i> Setchell					+						
<i>Dictyota implexa</i> (Desfontaines) J.V. Lamouroux [= <i>D. divaricata</i> ]			+	+	+				+		
<i>Dictyota mertensii</i> (Martius) Kützing											+
<i>Dictyota</i> spp.				+	+	+		+	+		
<i>Lobophora variegata</i> (J.V. Lamouroux) Womersley ex E.C. Oliveira [= <i>Pocockiella variegata</i> ]	+		+	+	+	+	+	+	+		
<i>Lobophora</i> sp.					+						
<i>Padina australis</i> Hauck				+	+	+	+	+	+		
<i>Padina boryana</i> Thivy [= <i>P. commersonii</i> , <i>P. tenuis</i> ]				+	+			+	+		
<i>Padina gymnospora</i> (Kützing) Sonder											+
<i>Padina</i> sp.					+						
Order ECTOCARPALES											
Family Acinetosporaceae											
<i>Feldmannia irregularis</i> (Kützing) Hamel					+						
<i>Feldmannia mitchelliae</i> (Harvey) H.-S. Kim [= <i>Giffordia mitchelliae</i> ]					+						
Family Chordariaceae											
<i>Chilionema ocellatum</i> (Kützing) Kornmann					+						
<i>Kuetzingiella elachistaeformis</i> (Heydrich) M. Balakrishnan et Kinkar [= <i>Feldmannia elachistaeformis</i> ]					+						
<i>Myrionema strangulans</i> Greville					+						
Family Scytosiphonaceae											
<i>Chnoospora implexa</i> J. Agardh					+						
<i>Chnoospora minima</i> (Hering) Papenfuss					+						
<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbès et Solier					+						
<i>Hydroclathrus clathratus</i> (C. Agardh) M. Howe				+	+						
<i>Hydroclathrus tenuis</i> C.K. Tseng et Lu					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order FUCALES											
Family Sargassaceae											
<i>Hormophysa cuneiformis</i> (J.F. Gmelin) P.C. Silva [= <i>H. articulata</i> ]						+					
<i>Polycladia</i> sp.					+						
<i>Sargassum aquifolium</i> (Turner) C. Agardh [= <i>S. binderi</i> , <i>S. crassifolium</i> ]					+						
<i>Sargassum congkinhii</i> Pham-Hoàng Hô					+						
<i>Sargassum denticarpum</i> T. Ajisaka											+
<i>Sargassum feldmannii</i> Pham-Hoàng Hô					+	+					
<i>Sargassum hemiphyllum</i> (Turner) C. Agardh					+						
<i>Sargassum ilicifolium</i> (Turner) C. Agardh [= <i>S. cristaefolium</i> , <i>S. duplicatum</i> , <i>S. sandei</i> ]					+	+	+				
<i>Sargassum mclurei</i> Setchell					+	+					
<i>Sargassum miyabei</i> Yendo [= <i>S. kjellmanianum</i> ]					+						
<i>Sargassum oligocystum</i> Montagne											+
<i>Sargassum polycystum</i> C. Agardh					+	+	+				
<i>Sargassum</i> spp.					+	+	+	+	+	+	
<i>Turbinaria conoides</i> (J. Agardh) Kützing					+						
<i>Turbinaria decurrens</i> Bory		+									
<i>Turbinaria ornata</i> (Turner) J. Agardh		+			+	+	+	+			
Order RALFSIALES											
Family Neoralfsiaceae											
<i>Neoralfsia expansa</i> (J. Agardh) P.-E. Lim et H. Kawai ex Cormaci et G. Furnari [= <i>Ralfsia expansa</i> ]		+	+		+				+		
Family Mesosporaceae											
<i>Mesospora schmidtii</i> Weber-van Bosse					+						
Order SCYTOTHAMNALES											
Family Asteronemataceae											
<i>Asteronema breviararticulatum</i> (J. Agardh) Ouriques et Bouzon [= <i>Feldmannia breviararticulata</i> ]						+					
Order SPHACELARIALES											
Family Sphacelariaceae											
<i>Sphacelaria novae-hollandiae</i> Sonder						+					
<i>Sphacelaria rigidula</i> Kützing [= <i>S. furcigera</i> ]						+					
Phylum RHODOPHYTA											
Class BANGIOPHYCEAE											
Order BANGIALES											
Family Bangiaceae											
<i>Bangia fuscopurpurea</i> (Dillwyn) Lyngbye						+					
<i>Bangia tanakai</i> Pham-Hoàng Hô						+					
<i>Pyropia suborbiculata</i> (Kjellman) J.E. Sutherland, H.G. Choi, M.S. Hwang et W.A. Nelson [= <i>Porphyra suborbiculata</i> ]						+					



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Class COMPSOPOGONOPHYCEAE											
Order ERYTHROPELTIDALES											
Family Erythrotrichiaceae											
<i>Erythrotrichia parietalis</i> T. Tanaka											+
Class FLORIDEOPHYCEAE											
Order ACROCHAETIALES											
Family Acrochaetiaceae											
<i>Acrochaetium catenulatum</i> M. Howe				+							
<i>Acrochaetium pulchellum</i> Børgesen											+
<i>Acrochaetium robustum</i> Børgesen											+
<i>Acrochaetium sancti-thomae</i> Børgesen											+
<i>Acrochaetium</i> spp.				+							+
Order BONNEMAISONIALES											
Family Bonnemaisioniaceae											
<i>Asparagopsis taxiformis</i> (Delile) Trevisan de Saint-Léon [= <i>Falkenbergia hillebrandii</i> ]				+		+		+	+	+	
Order CERAMIALES											
Family Ceramiaceae											
<i>Centroceras clavulatum</i> (C. Agardh) Montagne		+			+	+	+				
<i>Centroceras gasparrinii</i> (Meneghini) Kützing [= <i>C. inerme</i> ]											+
<i>Ceramium cingulatum</i> Weber-van Bosse											+
<i>Ceramium macilentum</i> J. Agardh [= <i>C. mazatlanense</i> ]											+
<i>Ceramium procumbens</i> Setchell et N.L. Gardner											+
<i>Ceramium vietnamense</i> Pham-Hoàng Hô											+
<i>Ceramium</i> sp.		+									+
<i>Gayliella flaccida</i> (Harvey ex Kützing) T.O. Cho et L.J. McIvor [= <i>Ceramium gracillimum</i> f. <i>intermedium</i> ]											+
<i>Gayliella taylorii</i> (E.Y. Dawson) T.O. Cho et S.M. Boo [= <i>Ceramium taylorii</i> ]											+
Family Dasyaceae											
<i>Dasya anastomosans</i> (Weber-van Bosse) M.J. Wynne [= <i>Dasyopsis pilosa</i> ]											+
Family Delesseriaceae											
<i>Caloglossa bengalensis</i> (G. Martens) R.J. King et Puttock [= <i>C. adnata</i> ]											+
<i>Taenioma perpusillum</i> (J. Agardh) J. Agardh											+
Family Rhodomelaceae											
<i>Acanthophora spicifera</i> (M. Vahl) Børgesen											+
<i>Acrocystis nana</i> Zanardini											+
<i>Amansia glomerata</i> C. Agardh [= <i>Melanamansia glomerata</i> ]											+
<i>Bostrychia binderi</i> Harvey											+
<i>Bostrychia tenella</i> (J.V. Lamouroux) J. Agardh											+
<i>Bryocladia cervicornis</i> (Kützing) F. Schmitz											+
<i>Chondria repens</i> Børgesen											+
<i>Chondrophyucus articulatus</i> (C.K. Tseng) K.W. Nam [= <i>Laurencia articulata</i> ]											+
<i>Herposiphonia insidiosa</i> (Greville ex J. Agardh) Falkenberg											+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Herposiphonia secunda</i> var. <i>tenella</i> (C. Agardh) Ambronn					+						
<i>Laurencia brachyclados</i> Pilger					+			+			
<i>Laurencia corymbosa</i> J. Agardh				+	+	+	+				
<i>Laurencia decumbens</i> Kützing [= <i>L. pygmaea</i> ]					+						
<i>Laurencia microcladia</i> Kützing					+						
<i>Laurencia obtusa</i> (Hudson) J.V. Lamouroux	+										
<i>Laurencia obtusa</i> var. <i>densa</i> Yamada					+						
<i>Laurencia tenera</i> C.K. Tseng					+						
<i>Laurencia tropica</i> Yamada					+	+					
<i>Laurencia</i> spp.	+			+		+					
<i>Leveillea jungermannioides</i> (Hering et G. Martens) Harvey	+				+						
<i>Neosiphonia harlandii</i> (Harvey) M.S. Kim et I.K. Lee							+				
<i>Palisada concreta</i> (A.B. Cribb) K.W. Nam [= <i>Chondrophycus concretus</i> ]						+					
<i>Palisada parvipapillata</i> (C.K. Tseng) K.W. Nam [= <i>Chondrophycus parvipapillatus</i> , <i>Laurencia parvipapillata</i> ]			+		+			+			
* <i>Palisada perforata</i> (Bory) K.W. Nam [= <i>P. papillosa</i> , <i>Laurencia papillosa</i> , <i>L. perforata</i> ]					+	+	+				
<i>Palisada thuyoides</i> (Kützing) Cassano, Senties, Gil-Rodríguez et M.T. Fujii [= <i>Laurencia paniculata</i> ]						+					
<i>Polysiphonia coacta</i> C.K. Tseng						+					
<i>Polysiphonia fragilis</i> Suringar						+					
<i>Polysiphonia subtilissima</i> Montagne						+					
<i>Polysiphonia</i> spp.	+		+		+						
<i>Tolypocladia glomerulata</i> (C. Agardh) F. Schmitz						+					
<i>Tolypocladia</i> sp.						+					
Family Spyridiaceae											
<i>Spyridia filamentosa</i> (Wulfen) Harvey						+					
Family Wrangeliaceae											
<i>Anotrichium tenue</i> (C. Agardh) Nägeli [= <i>Griffithsia tenue</i> ]						+					
<i>Griffithsia japonica</i> Okamura											+
<i>Griffithsia metcalfei</i> C.K. Tseng						+					
<i>Spongoconium caribaeum</i> (Børgesen) M.J. Wynne [= <i>Mesothamnion caribaeum</i> ]						+					
<i>Wrangelia argus</i> (Montagne)						+					
Order COLACONEMATALES											
Family Colaconemataceae											
<i>Colaconema gracile</i> (Børgesen) Ateweberhan et Prud'homme van Reine [= <i>Acrochaetium gracile</i> ]						+					
Order CORALLINALES											
Family Corallinaceae											
<i>Amphiroa foliacea</i> J.V. Lamouroux						+					
<i>Amphiroa fragilissima</i> (Linnaeus) J.V. Lamouroux	+					+					
<i>Amphiroa</i> spp.							+	+	+		
<i>Hydrolithon farinosum</i> (J.V. Lamouroux) Penrose et Y.M. Chamberlain [= <i>Melobesia farinosa</i> , <i>Foshiella farinosa</i> ]						+					

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Hydrolithon reinboldii</i> (Weber-van Bosse et Foslie) Foslie					+						
<i>Hydrolithon samoëense</i> (Foslie) Keats et Y.M. Chamberlain [= <i>Lithophyllum samoëense</i> ]					+						
<i>Hydrolithon</i> sp.					+						
<i>Jania acutiloba</i> (Decaisne) J.H. Kim, Guiry et H.-G. Choi [= <i>Cheilosporum jungermannioides</i> ]					+						
<i>Jania adhaerens</i> J.V. Lamouroux [= <i>J. decussato-dichotoma</i> ]					+						
<i>Jania capillacea</i> Harvey					+						
<i>Jania pumila</i> J.V. Lamouroux			+								
<i>Jania rubens</i> (Linnaeus) J.V. Lamouroux					+						
<i>Jania spectabilis</i> (Harvey ex Grunow) J.H. Kim, Guiry et H.-G. Choi [= <i>Cheilosporum spectabile</i> ]	+										
<i>Jania</i> spp.			+	+	+				+	+	
<i>Lithophyllum okamurae</i> Foslie					+	+	+		+		
<i>Lithophyllum</i> sp.					+						
<i>Mastophora pacifica</i> (Heydrich) Foslie [= <i>Lithoporella pacifica</i> ]					+						
<i>Mastophora rosea</i> (C. Agardh) Setchell [= <i>M. macrocarpa</i> ]					+	+					
<i>Neogoniolithon oblimans</i> (Heydrich) P.C. Silva [= <i>N. myriocarpum</i> ]					+						
<i>Neogoniolithon trichotomum</i> (Heydrich) Setchell et L.R. Mason [= <i>Lithophyllum trichotomum</i> ]					+						
Order GELIDIALES											
Family Gelidiaceae											
<i>Gelidiophycus divaricatus</i> (G. Martens) G.H. Boo, J.K. Park et S.M. Boo [= <i>Gelidium divaricatum</i> ]					+						
<i>Gelidium crinale</i> (Hare ex Turner) Gaillon	+		+		+			+	+		
<i>Gelidium crinale</i> var. <i>perpusillum</i> Piccone et Grunow					+						
<i>Gelidium pulchellum</i> (Turner) Kützing					+						
<i>Gelidium pusillum</i> (Stackhouse) Le Jolis	+				+						
<i>Gelidium spathulatum</i> (Kützing) Bornet					+						
<i>Gelidium</i> spp.			+	+	+				+	+	+
Family Gelidiellaceae											
<i>Gelidiella acerosa</i> (Forsskål) Feldmann et Hamel			+	+	+				+		
<i>Gelidiella lubrica</i> (Kützing) Feldmann et Hamel					+						
<i>Gelidiella myrioclada</i> (Børgesen) Feldmann et Hamel			+		+						
<i>Gelidiella</i> sp.	+										
<i>Parviphycus adnatus</i> (E.Y. Dawson) B. Santelices [= <i>Gelidiella adnata</i> ]					+						
Family Pterocladaceae											
<i>Pterocladia caloglossoides</i> (M. Howe) Santelices [= <i>Pterocladia parva</i> ]					+						
Order GIGARTINALES											
Family Gigartinaceae											
<i>Chondracanthus intermedius</i> (Suringar) Hommersand											+
Family Caulacanthaceae											
<i>Catenella nipae</i> Zanardini					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Cystocloniaceae											
<i>Hypnea aspera</i> Kützinger [= <i>H. boergesenii</i> ]	+				+						
<i>Hypnea cervicornis</i> J. Agardh					+	+					
<i>Hypnea esperi</i> Bory ( <i>nomen illegitimum</i> )	+		+		+						
<i>Hypnea nidulans</i> Setchell			+					+			
<i>Hypnea pannosa</i> J. Agardh			+		+			+			
<i>Hypnea valentiae</i> (Turner) Montagne					+	+					
<i>Hypnea</i> sp.						+					
Family Phylloporaceae											
<i>Abnfeltiopsis flabelliformis</i> (Harvey) Masuda [= <i>Gymnogongrus flabelliformis</i> ]					+						
<i>Abnfeltiopsis pygmaea</i> (J. Agardh) P.C. Silva et DeCew [= <i>Gymnogongrus pygmaeus</i> ]					+						
<i>Abnfeltiopsis quinbonensis</i> (Pham-Hoàng Hô) Masuda [= <i>Gymnogongrus quinbonensis</i> ]			+								
<i>Abnfeltiopsis serenei</i> (E. Y. Dawson) Masuda [= <i>Gymnogongrus serenei</i> ]					+						
<i>Gymnogongrus griffithsiae</i> (Turner) Martius			+		+						
<i>Gymnogongrus</i> sp.								+			
Family Solieriaceae											
<i>Kappaphycus alvarezii</i> (Doty) Doty ex P.C. Silva											+
<i>Wurdemannia miniata</i> (Sprengel) Feldmann et Hamel										+	
Order GRACILARIALES											
Family Gracilariaceae											
<i>Gracilaria arcuata</i> Zanardini					+	+					
<i>Gracilaria blodgettii</i> Harvey											+
<i>Gracilaria bursa-pastoris</i> (S.G. Gmelin) P.C. Silva						+					
<i>Gracilaria canaliculata</i> Sonder [= <i>G. crassa</i> ]				+	+	+					
<i>Gracilaria coronopifolia</i> J. Agardh				+	+						
<i>Gracilaria edulis</i> (S.G. Gmelin) P.C. Silva											+
<i>Gracilaria eucheumatoides</i> Harvey [= <i>Hydropuntia eucheumatoides</i> ]								+			
<i>Gracilaria reptans</i> (Weber-van Bosse) P.C. Silva					+						
<i>Gracilaria salicornia</i> (C. Agardh) E.Y. Dawson						+					
<i>Gracilaria spinulosa</i> (Okamura) C.F. Chang et B.M. Xia											+
<i>Gracilaria tenuistipitata</i> C.F. Chang et B.M. Xia					+						
<i>Gracilaria vermiculophylla</i> (Ohmi) Papenfuss											+
Order HALYMENIALES											
Family Halymeniaceae											
<i>Grateloupia asiatica</i> S. Kawaguchi et H.W. Wang					+						
<i>Grateloupia filicina</i> (J.V. Lamouroux) C. Agardh					+						
<i>Grateloupia ramosissima</i> Okamura					+						
<i>Halymenia dilatata</i> Zanardini					+						
<i>Halymenia maculata</i> J. Agardh					+						
<i>Yonagunia formosana</i> (Okamura) Kawaguchi et Masuda [= <i>Carpopeltis formosana</i> ]					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order HAPALIDIALES											
Family Hapalidiaceae											
<i>Lithothamnion</i> spp.			+		+		+	+	+	+	
<i>Melyvonnea erubescens</i> (Foslie) Athanasiadis et D.L. Ballantine [= <i>Lithothamnion erubescens</i> ]					+	+					
Order HILDENBRANDIALES											
Family Hildenbrandiaceae											
<i>Hildenbrandia rubra</i> (Sommerfelt) Meneghini [= <i>H. prototypus</i> ]						+					
<i>Hildenbrandia</i> sp.						+					
Order NEMALIALES											
Family Galaxauraceae											
<i>Dichotomaria marginata</i> (J. Ellis et Solander) Lamarck [= <i>Galaxaura clavigera</i> , <i>G. marginata</i> ]							+		+		
<i>Galaxaura divaricata</i> (Linnaeus) Huisman et R.A. Townsend [= <i>G. fasciculata</i> ]							+				
<i>Galaxaura filamentosa</i> R.C.Y. Chou							+				
<i>Galaxaura rugosa</i> (J. Ellis et Solander) J.V. Lamouroux [= <i>G. glabriuscula</i> ]								+	+	+	+
<i>Tricleocarpa cylindrica</i> (J. Ellis et Solander) Huisman et Borowitzka [= <i>Galaxaura fastigiata</i> ]							+	+			
Family Liagoraceae											
<i>Dermonema virens</i> (J. Agardh) Pedroche et Ávila Ortíz [= <i>D. frappieri</i> ]								+			
<i>Ganonema farinosum</i> (J.V. Lamouroux) K.C. Fan et Yung C. Wang [= <i>Liagora farinosa</i> ]								+			
<i>Izziella orientalis</i> (J. Agardh) Huisman et Schils [= <i>Liagora orientalis</i> ]								+			
<i>Liagora ceranoides</i> J.V. Lamouroux								+			
<i>Liagora</i> spp.								+		+	
Order NEMASTOMATALES											
Family Schizymeniaceae											
<i>Titanophora weberae</i> Børgesen [= <i>T. pulchra</i> ]								+			
Order PEYSSONNELIALES											
Family Peyssonneliaceae											
<i>Peyssonnelia rubra</i> (Greville) J. Agardh								+			
<i>Peyssonnelia</i> spp.								+	+	+	+
<i>Ramicrusta calcea</i> (Heydrich) K.R. Dixon [= <i>Peyssonnelia calcea</i> ]								+			
<i>Sonderophycus capensis</i> (Montagne) M.J. Wynne [= <i>Peyssonnelia gunniana</i> ]								+			
Order RHODYMENIALES											
Family Champiaceae											
<i>Champia parvula</i> (C. Agardh) Harvey								+	+		
<i>Champia vieillardii</i> Kützing									+		
Family Hymenocladaceae											
<i>Asteromenia anastomosans</i> (Weber-van Bosse) G.W. Saunders, C.E. Lane, C.W. Schneider et Kraft [= <i>Rhodymenia anastomosans</i> ]								+	+	+	+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Lomentariaceae											
<i>Ceratodictyon intricatum</i> (C. Agardh) R.E. Norris [= <i>Gelidiopsis intricata</i> ]	+				+						
<i>Ceratodictyon repens</i> (Kützinger) R.E. Norris [= <i>Gelidiopsis repens</i> ]				+						+	
<i>Ceratodictyon scoparium</i> (Montagne et Millardet) R.E. Norris [= <i>Gelidiopsis scoparia</i> ]				+						+	
<i>Ceratodictyon spongiosum</i> Zanardini					+	+					
Phylum CHLOROPHYTA											
Class ULVOPHYCEAE											
Order BRYOPSIDALES											
Family Bryopsidaceae											
<i>Bryopsis pennata</i> J.V. Lamouroux					+						
Family Caulerpaceae											
<i>Caulerpa chemnitzia</i> (Esper) J.V. Lamouroux [= <i>C. peltata</i> ]											+
<i>Caulerpa fastigiata</i> Montagne					+	+	+				
<i>Caulerpa lentillifera</i> J. Agardh							+				
<i>Caulerpa macrodisca</i> Decaisne [= <i>C. peltata</i> var. <i>macrodisca</i> ]										+	
<i>Caulerpa mexicana</i> Sonder ex Kützinger							+				
<i>Caulerpa microphysa</i> (Weber-van Bosse) Feldmann					+			+	+		
<i>Caulerpa nummularia</i> Harvey ex J. Agardh											+
<i>Caulerpa racemosa</i> (Forsskål) J. Agardh					+	+	+	+		+	
<i>Caulerpa serrulata</i> (Forsskål) J. Agardh					+	+	+				
<i>Caulerpa sertularioides</i> (S.G. Gmelin) M. Howe					+	+					
<i>Caulerpa taxifolia</i> (M. Vahl) C. Agardh					+	+	+			+	
<i>Caulerpa verticillata</i> J. Agardh					+						
<i>Caulerpella ambigua</i> (Okamura) Prud'homme van Reine et Lokhorst					+						
Family Codiaceae											
<i>Codium arabicum</i> Kützinger							+				
<i>Codium geppiorum</i> O.C. Schmidt [as <i>C. geppii</i> ]					+						
<i>Codium repens</i> P. Crouan et H. Crouan								+	+	+	
Family Derbesiaceae											
<i>Halicystis pyriformis</i> Levring					+						
Family Dichotomosiphonaceae											
<i>Avrainvillea erecta</i> (Berkeley) A. Gepp et E.S. Gepp					+						
Family Halimedaceae											
<i>Halimeda bikinensis</i> W.R. Taylor					+						
<i>Halimeda cuneata</i> Hering						+					
<i>Halimeda discoidea</i> Decaisne					+	+	+				
<i>Halimeda macroloba</i> Decaisne					+	+					
<i>Halimeda opuntia</i> (Linnaeus) J.V. Lamouroux					+	+	+				
<i>Halimeda tuna</i> (J. Ellis et Solander) J.V. Lamouroux					+						
Family Udoteaceae											
<i>Chlorodesmis hildebrandtii</i> A. Gepp et E.S. Gepp					+						
<i>Penicillus sibogae</i> A. Gepp et E.S. Gepp						+					
<i>Rhipidosiphon javensis</i> Montagne [= <i>Udotea javensis</i> ]						+	+				

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order CLADOPHORALES											
Family Cladophoraceae											
<i>Chaetomorpha antennina</i> (Bory) Kützing					+						
<i>Chaetomorpha indica</i> (Kützing) Kützing					+						
<i>Chaetomorpha javanica</i> Kützing					+						
<i>Chaetomorpha linum</i> (O.F. Müller) Kützing [= <i>Ch. crassa</i> ]						+					
<i>Cladophora albida</i> (Nees) Kützing					+						
<i>Cladophora catenata</i> Kützing				+							
<i>Cladophora herpestica</i> (Montagne) Kützing [= <i>Cladophoropsis herpestica</i> ]					+						
<i>Cladophora laetevirens</i> (Dillwyn) Kützing					+						
<i>Cladophora papenfussii</i> Pham-Hoàng Hô										+	
<i>Cladophora perpusilla</i> Skottsberg et Levring					+						
<i>Cladophora vagabunda</i> (Linnaeus) Hoek [= <i>C. inserta</i> ]					+						
<i>Cladophora</i> spp.		+	+	+	+					+	
<i>Rhizoclonium grande</i> Børgesen					+						
<i>Rhizoclonium riparium</i> (Roth) Harvey [= <i>Rh. kernerii</i> ]					+						
Family Anadyomenaceae											
<i>Anadyomene plicata</i> C. Agardh					+	+					
<i>Anadyomene wrightii</i> Harvey ex J.E. Gray					+						
Family Boodleaceae											
<i>Boodlea composita</i> (Harvey) F. Brand					+						
<i>Boodlea struveoides</i> M. Howe				+	+						
<i>Cladophoropsis membranacea</i> (Hofman Bang ex C. Agardh) Børgesen					+						
<i>Cladophoropsis sundanensis</i> Reinbold				+	+						
<i>Phyllocladon anastomosans</i> (Harvey) Kraft et M.J. Wynne [= <i>Struvea delicatula</i> , <i>S. anastomosans</i> ]					+		+				
Family Siphonocladaceae											
<i>Boergesenia forbesii</i> (Harvey) Feldmann					+	+					
<i>Dictyosphaeria cavernosa</i> (Forsskål) Børgesen		+	+	+	+	+	+	+	+	+	
<i>Dictyosphaeria versluysii</i> Weber-van Bosse [= <i>D. setchellii</i> ]		+		+	+					+	
Family Valoniaceae											
<i>Valonia aegagropila</i> C. Agardh					+						
<i>Valonia fastigiata</i> Harvey ex J. Agardh						+					
<i>Valonia ventricosa</i> J. Agardh					+						
<i>Valonia</i> sp.				+	+						
<i>Valoniopsis pachynema</i> (G. Martens) Børgesen			+					+			
Order DASYCLADALES											
Family Dasycladaceae											
<i>Bornetella oligospora</i> Solms-Laubach					+						
<i>Bornetella sphaerica</i> (Zanardini) Solms-Laubach					+						
<i>Neomeris annulata</i> Dickie					+			+	+		
<i>Neomeris vanbosseae</i> M. Howe						+					

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order ULOTRICHALES											
Family Monostromataceae											
<i>Monostroma nitidum</i> Wittrock [= <i>Porphyra crispata</i> ]					+						
<i>Monostroma</i> sp.					+						
Order ULVALES											
Family Ulvaceae											
<i>Ulva clathrata</i> (Roth) C. Agardh [= <i>Enteromorpha clathrata</i> ]					+						
<i>Ulva flexuosa</i> Wulfen [= <i>Enteromorpha tubulosa</i> ]					+						
<i>Ulva intestinalis</i> Linnaeus [= <i>Enteromorpha intestinalis</i> ]					+						
<i>Ulva kylinii</i> (Bliding) H.S. Hayden, Blomster, Maggs, P.C. Silva, M.J. Stanhope et J.R. Waaland [= <i>Enteromorpha kylinii</i> ]					+						
<i>Ulva lactuca</i> Linnaeus					+	+					
<i>Ulva reticulata</i> Forsskål					+		+				
<i>Ulva</i> spp. [= <i>Enteromorpha</i> sp.]			+		+		+				
Family Ulvellaceae											
<i>Ulvella viridis</i> (Reinke) R. Nielsen, C.J. O'Kelly et B. Wysor [= <i>Entocladia viridis</i> ]					+						
Phylum TRACHEOPHYTA											
Class MONOCOTS											
Order ALISMATALES											
Family Hydrocharitaceae											
<i>Enhalus acoroides</i> (Linnaeus) Royle					+						
<i>Halophila beccarii</i> Ascherson					+						+
<i>Halophila ovalis</i> (R. Brown) J.D. Hooker				+							+
<i>Halophila ovata</i> Gaudichaud					+						
<i>Halophila</i> sp.											+
<i>Thalassia hemprichii</i> (Ehrenberg) Ascherson					+	+	+				
<i>Thalassia</i> spp.					+	+	+		+		
Family Cymodoceaceae											
<i>Cymodocea rotundata</i> Ascherson et Schweinfurth					+	+					
<i>Cymodocea</i> sp.											+
<i>Halodule pinifolia</i> (Miki) den Hartog					+						
<i>Halodule uninervis</i> (Forsskål) Ascherson [= <i>H. tridentata</i> , <i>Diplanthera uninervis</i> ]					+						+
ANIMALS											
Phylum PORIFERA (=SPONGIA)											
Class DEMOSPONGIAE											
Order TETRACTINELLIDA											
Family Geodiidae											
<i>Geodia</i> spp.				+		+					
Family Tetillidae											
<i>Cinachyrella australiensis</i> (Carter, 1886) [= <i>Cinachyra australiensis</i> ]					+						
Order CLIONAIDA											
Family Placospongiidae											
<i>Placospongia carinata</i> (Bowerbank, 1858)					+						



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Spirastrellidae											
<i>Spirastrella</i> sp.											+
Order SUBERITIDA											
Family Suberitidae											
<i>Aptos suberitoides</i> (Brøndsted, 1934) [= <i>A. aaptos</i> var. <i>nigra</i> ]											+
<i>Pseudosuberites lobulatus</i> (Lévi, 1961)											+
<i>Suberites</i> spp.				+		+		+			+
Family Halichondriidae											
<i>Amorphinopsis foetida</i> (Dendy, 1889)											+
<i>Halichondria</i> ( <i>Halichondria</i> ) <i>cartilaginea</i> (Esper, 1794) [= <i>H. symbiotica</i> ]											+
<i>Halichondria</i> spp.				+		+					
Order TETHYIDA											
Family Tethyidae											
<i>Tethya japonica</i> Sollas, 1888											+
<i>Xenospongia patelliformis</i> Gray, 1858											+
Family Timeidae											
<i>Timea</i> sp.											+
Order SCOPALINIDA											
Family Scopalinidae											
<i>Stylissa carteri</i> (Dendy, 1889) [= <i>Acantbella aurantiaca</i> ]											+
<i>Stylissa flexibilis</i> (Lévi, 1961) [= <i>Ptilocaulis flexibilis</i> ]											+
<i>Stylissa</i> sp.											+
Order POECILOSCLERIDA											
Family Desmacididae											
<i>Desmapsamma anchorata</i> (Carter, 1882) [= <i>Desmacidon reptans</i> ]											+
Family Microcionidae											
<i>Clathria</i> ( <i>Thalysias</i> ) <i>erecta</i> (Thiele, 1899) [= <i>Rhaphidophylus erectus</i> ]											+
<i>Clathria</i> ( <i>Thalysias</i> ) <i>ramosa</i> (Kieschnick, 1896)											+
<i>Clathria</i> sp.											+
<i>Ophlitaspongia</i> sp.											+
Family Mycalidae											
<i>Mycale</i> ( <i>Aegogropila</i> ) <i>crassissima</i> (Dendy, 1905)											+
<i>Mycale</i> ( <i>Carmia</i> ) <i>phyllophila</i> Hentschel, 1911											+
Family Tedaniidae											
<i>Tedania</i> ( <i>Tedania</i> ) <i>anbelans</i> (Vio in Olivi, 1792) [= <i>T. digitata</i> ]											+
<i>Tedania</i> ( <i>Tedania</i> ) <i>brevispiculata</i> Thiele, 1903											+
Order BIEMNIDA											
Family Biemnidae											
<i>Biemna fortis</i> (Topsent, 1897)											+
Family Rhabderemiidae											
<i>Rhabderemia</i> sp. [as <i>Rb. conulosa</i> ]											+
Order AXINELLIDA											
Family Raspailiidae											
<i>Raspailia</i> sp.											+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order HAPLOSCLERIDA											
Family Callyspongiidae											
<i>Callyspongia</i> ( <i>Callyspongia</i> ) <i>monilata</i> (Ridley, 1884) [= <i>Dactylochalina monilata</i> ]						+					
<i>Callyspongia</i> ( <i>Cladochalina</i> ) <i>fibrosa</i> (Ridley et Dendy, 1886)						+					
<i>Callyspongia</i> ( <i>Toxochalina</i> ) <i>robusta</i> (Ridley, 1884)						+					
<i>Callyspongia</i> sp.								+			
Family Chalinidae											
<i>Haliclona</i> ( <i>Gellius</i> ) <i>amboinensis</i> (Lévi, 1961) [= <i>Gellius amboinensis</i> ]						+					
<i>Haliclona</i> ( <i>Gellius</i> ) <i>cymaeformis</i> (Esper, 1794) [= <i>Gellius cymaeformis</i> ]						+					
<i>Haliclona</i> ( <i>Gellius</i> ) <i>ridleyi</i> (Hentschel, 1912) [= <i>Gellius ridleyi</i> ]						+					
<i>Haliclona</i> spp. [= <i>Gellius</i> sp.]				+		+			+		
Family Niphatidae											
<i>Amphimedon</i> spp.								+		+	+
<i>Gelliodes callista</i> de Laubenfels, 1954						+					
<i>Gelliodes fibulata</i> (Carter, 1881)						+					
<i>Gelliodes</i> spp.				+				+	+		+
Family Petrosiidae											
<i>Petrosia</i> sp.										+	
Order DICTYOCERATIDA											
Family Spongiidae											
<i>Spongia</i> ( <i>Spongia</i> ) <i>officinalis</i> Linnaeus, 1759						+					
<i>Spongia</i> sp.				+							
Family Thorectidae											
<i>Fasciospongia turgida</i> (Lamarck, 1814) [= <i>Polyfibrospongia australis</i> ]						+					
Family Dysideidae											
<i>Dysidea</i> sp.						+					
Order CHONDRILLIDA											
Family Chondrillidae											
<i>Chondrilla australiensis</i> Carter, 1873 [= <i>Chondrillastra australiensis</i> ]						+					
Phylum CNIDARIA											
Class HYDROZOA											
Order LEPTOTHECATA											
Family Aglaopheniidae											
<i>Aglaophenia cupressina</i> Lamouroux, 1816						+					
<i>Macrorhynchia philippina</i> Kirchenpauer, 1872 [= <i>Lytocarpus philippinus</i> ]						+					
Family Halopterididae											
<i>Schizotricha</i> sp.				+							
Family Sertulariidae											
<i>Dynamena crisioides</i> Lamouroux, 1824 [= <i>D. tubuliformis</i> ]						+					
<i>Sertularella</i> sp.				+							
<i>Sertularia</i> sp.				+							

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order ANTHOATHECATA											
Family Milleporidae											
<i>Millepora dichotoma</i> var. <i>dichotoma</i> (Forsskål, 1775) [= <i>M. dichotoma</i> ]				+	+						
<i>Millepora dichotoma</i> var. <i>intricata</i> (Milne Edwards, 1860) [= <i>M. intricata</i> ]					+						
<i>Millepora dichotoma</i> var. <i>tenera</i> (Boschma, 1949) [= <i>M. tenera</i> , <i>M. tenella</i> ]					+						
<i>Millepora platyphylla</i> Hemprich et Ehrenberg, 1834	+			+	+						
Family Oceaniidae											
<i>Corydendrium parasiticum</i> (Linnaeus, 1767)					+						
Family Pennariidae											
<i>Pennaria disticha</i> Goldfuss, 1820 [= <i>Halocordyle disticha</i> ]					+						
Class ANTHOZOA											
Order ACTINIARIA											
Family Halcampoididae											
<i>Halcampella maxima</i> Hertwig, 1888											+
Family Actiniidae											
<i>Anemonia</i> sp.					+						
* <i>Entacmaea quadricolor</i> (Leuckart in Rüppell et Leuckart, 1828)					+		+				+
<i>Gyrostoma</i> sp.							+				
Family Stichodactylidae											
<i>Heteractis aurora</i> (Quoy et Gaimard, 1833)					+						
<i>Heteractis malu</i> (Haddon et Shackleton, 1893)					+						
<i>Stichodactyla gigantea</i> (Forsskål, 1775) [= <i>Stoichactis kenti</i> ]					+						
Family Diadumenidae											
<i>Diadumene lineata</i> (Verrill, 1869) [= <i>Haliplanella luciae</i> ]											+
Family Sagartiidae											
* <i>Sagartianthus indosinensis</i> Carlgren, 1943											
Order SCLERACTINIA											
Family Acroporidae											
<i>Acropora abrotanoides</i> (Lamarck, 1816) [= <i>A. rotumana</i> , <i>A. danai</i> ] +					+						
<i>Acropora aspera</i> (Dana, 1846)						+					
* <i>Acropora cytherea</i> (Dana, 1846)					+	+			+		
<i>Acropora digitifera</i> (Dana, 1846)					+	+					
<i>Acropora divaricata</i> (Dana, 1846)						+					
* <i>Acropora florida</i> (Dana, 1846)					+						
<i>Acropora formosa</i> (Dana, 1846)						+					
<i>Acropora gemmifera</i> (Brook, 1892)						+					
<i>Acropora humilis</i> (Dana, 1846)						+					
* <i>Acropora hyacinthus</i> (Dana, 1846)					+	+			+		
<i>Acropora millepora</i> (Ehrenberg, 1834)	+					+					
<i>Acropora muricata</i> (Linnaeus, 1758) [= <i>A. arbuscula</i> ]						+					
<i>Acropora robusta</i> (Dana, 1846)	+				+	+			+		
<i>Acropora secale</i> (Studer, 1878) [= <i>A. concinna</i> , <i>A. diversa</i> ]						+					

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Acropora subulata</i> (Dana, 1846)					+						
<i>Acropora tenuis</i> (Dana, 1846)					+						
<i>Acropora</i> spp. [as <i>A. tubicinarina</i> ]					+		+				
<i>Astreopora listeri</i> Bernard, 1896					+						
<i>Astreopora myriophthalma</i> (Lamarck, 1816)					+						
<i>Isopora palifera</i> (Lamarck, 1816) [= <i>Acropora palifera</i> ]					+						
<i>Montipora angulata</i> (Lamarck, 1816) [= <i>M. ramosa</i> ]					+						
<i>Montipora caliculata</i> (Dana, 1846)					+						
<i>Montipora compressa</i> (Linnaeus, 1766) ( <i>nomen dubium</i> ) [as <i>Acropora compressa</i> ]					+						
<i>Montipora digitata</i> (Dana, 1846)					+						
<i>Montipora efflorescens</i> Bernard, 1897					+						
<i>Montipora foliosa</i> (Pallas, 1766) [as <i>M. prolifera</i> ]					+						
* <i>Montipora hispida</i> (Dana, 1846)	+				+						
<i>Montipora informis</i> Bernard, 1897					+						
<i>Montipora monasteriata</i> (Forskål, 1775)					+						
<i>Montipora spongodes</i> Bernard, 1897					+						
<i>Montipora stellata</i> Bernard, 1897 [= <i>M. solanderi</i> ]					+						
<i>Montipora studeri</i> Vaughan, 1907 ( <i>nomen dubium</i> ) [as <i>Acropora studeri</i> ]					+						
<i>Montipora turtlensis</i> Veron et Wallace, 1984					+						
<i>Montipora</i> sp.					+						
Family Agariciidae											
<i>Gardineroseris pavonoides</i> Latypov, 2011 ( <i>nomen nudum</i> )					+						
<i>Leptoseris mycetoseroides</i> Wells, 1954					+						
<i>Pachyseris speciosa</i> (Dana, 1846)					+						
* <i>Pavona decussata</i> (Dana, 1846) [= <i>P. crassa</i> , <i>P. lata</i> ]					+	+					
<i>Pavona frondifera</i> (Lamarck, 1816)					+						
<i>Pavona varians</i> Verrill, 1864					+						
Family Dendrophylliidae											
<i>Balanophyllia</i> ( <i>Balanophyllia</i> ) <i>gemmifera</i> Klunzinger, 1879					+						
<i>Cladopsammia gracilis</i> (Milne Edwards et Haime, 1848) [= <i>Dendrophyllia gracilis</i> ]					+						
<i>Dendrophyllia</i> sp.					+						
<i>Tubastraea coccinea</i> Lesson, 1829					+						
<i>Turbinaria calicularis</i> Bernard, 1896 ( <i>nomen dubium</i> )					+						
<i>Turbinaria contorta</i> Bernard, 1896					+						
<i>Turbinaria crater</i> (Pallas, 1766) ( <i>nomen dubium</i> )					+						
<i>Turbinaria mollis</i> Bernard, 1896 ( <i>nomen dubium</i> )					+						
<i>Turbinaria peltata</i> (Esper, 1794)					+						
Family Oculinidae											
<i>Galaxea astreata</i> (Lamarck, 1816) [= <i>G. clavus</i> ]					+						
<i>Galaxea fascicularis</i> (Linnaeus, 1767)		+			+						
<i>Galaxea</i> sp.									+		

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Fungiidae											
<i>Ctenactis echinata</i> (Pallas, 1766) [= <i>Fungia echinata</i> ]					+						
<i>Fungia concinna</i> Verrill, 1864					+						
<i>Fungia fungites</i> (Linnaeus, 1758)					+						
<i>Fungia repanda</i> Dana, 1846					+						
<i>Fungia scutaria</i> Lamarck, 1801					+						
<i>Herpolitha limax</i> (Esper, 1797)					+						
<i>Pleuractis paumotensis</i> (Stutchbury, 1833)					+						
<i>Podabacia crustacea</i> (Pallas, 1766)					+						
<i>Polyphyllia talpina</i> (Lamarck, 1801)					+						
<i>Sandalolitha robusta</i> (Quelch, 1886)					+						
Family Mussidae											
<i>Acanthastrea echinata</i> (Dana, 1846) [= <i>A. spinosa</i> ]					+						
<i>Lobophyllia hemprichii</i> (Ehrenberg, 1834)					+						
<i>Lobophyllia robusta</i> Yabe et Sugiyama, 1936					+						
<i>Symphyllia recta</i> (Dana, 1846) [= <i>S. nobilis</i> ]					+						
<i>Symphyllia sinuosa</i> (Quoy et Gaimard, 1833) [as <i>Meandrina sinuosa</i> ]					+						
Family Faviidae											
<i>Cyphastrea chalcidicum</i> (Forskål, 1775)					+						
<i>Diploastrea heliopora</i> (Lamarck, 1816)					+						
<i>Echinopora lamellosa</i> (Esper, 1795)					+						
<i>Echinopora</i> sp.					+						
<i>Favia camranensis</i> Latypov, 2013					+						
<i>Favia fava</i> (Forskål, 1775)					+	+					
<i>Favia maxima</i> Veron, Pichon et Wijsman-Best, 1977					+						
<i>Favia pallida</i> (Dana, 1846)				+	+						
<i>Favia rotumana</i> (Gardiner, 1899)					+						
<i>Favia speciosa</i> (Dana, 1846)					+						
<i>Favia veroni</i> Moll et Best, 1984					+						
<i>Favia</i> spp.					+			+			
<i>Favites abdita</i> (Ellis et Solander, 1786)					+						
<i>Favites complanata</i> (Ehrenberg, 1834)					+						
<i>Favites valenciennesi</i> (Milne Edwards et Haime, 1849) [= <i>Favia valenciennesi</i> ]					+						
<i>Favites virens</i> (Dana, 1846)					+						
<i>Favites</i> spp. [as <i>F. spectabilis</i> ]					+			+			
<i>Goniastrea aspera</i> Verrill, 1865 [as <i>G. incrustans</i> ]					+						
<i>Goniastrea edwardsi</i> Chevalier, 1971					+						
<i>Goniastrea favulus</i> (Dana, 1846)					+						
<i>Goniastrea pectinata</i> (Ehrenberg, 1834) [= <i>G. quoyi</i> ]					+	+					
<i>Goniastrea retiformis</i> (Lamarck, 1816)				+	+						
<i>Goniastrea</i> spp.					+			+			
<i>Leptastrea pruinosa</i> Crossland, 1952					+						
<i>Leptastrea purpurea</i> (Dana, 1846)					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
* <i>Leptoria phrygia</i> (Ellis et Solander, 1786)				+	+						
<i>Oulophyllia aspera</i> Quelch, 1886					+						
* <i>Platygyra daedalea</i> (Ellis et Solander, 1786)				+							
<i>Platygyra lamellina</i> (Ehrenberg, 1834)									+		
<i>Platygyra sinensis</i> (Milne Edwards et Haime, 1849) [= <i>Meandrina stricta</i> ]					+						
Family Merulinidae											
* <i>Hydnophora exesa</i> (Pallas, 1766)				+	+						
<i>Hydnophora microconos</i> (Lamarck, 1816)					+						
<i>Hydnophora rigida</i> (Dana, 1846) [= <i>Merulina laxa</i> ]					+						
<i>Hydnophora</i> sp.									+		
<i>Merulina ampliata</i> (Ellis et Solander, 1786) [= <i>M. vaughani</i> ]				+	+						
Family Pectiniidae											
<i>Oxypora lacera</i> (Verrill, 1864)					+						
<i>Pectinia lactuca</i> (Pallas, 1766)					+						
<i>Pectinia paeonia</i> (Dana, 1846)					+						
Family Trachyphylliidae											
<i>Trachyphyllia geoffroyi</i> (Audouin, 1826) [as <i>T. amarantum</i> ]					+						
Family Pocilloporidae											
<i>Pocillopora damicornis</i> (Linnaeus, 1758)		+		+	+						
<i>Pocillopora eydouxi</i> Milne Edwards et Haime, 1860					+						
<i>Pocillopora kelleheri</i> Veron, 2000					+						
<i>Pocillopora verrucosa</i> (Ellis et Solander, 1786) [= <i>P. danae</i> ]				+	+	+			+		
<i>Pocillopora</i> spp.					+				+		
<i>Seriatopora hystrix</i> Dana, 1846 [= <i>S. angulata</i> ]					+						
<i>Seriatopora</i> sp.									+		
<i>Stylophora pistillata</i> (Esper, 1797) [= <i>S. mordax</i> ]				+	+						
Family Poritidae											
<i>Goniopora lobata</i> Milne Edwards et Haime, 1851					+						
<i>Goniopora stutchburyi</i> Wells, 1955					+						
<i>Goniopora</i> sp. [as <i>G. malaccensis</i> ]					+						
<i>Porites annae</i> Crossland, 1952					+						
<i>Porites australiensis</i> Vaughan, 1918				+	+						
<i>Porites deformis</i> Nemenzo, 1955					+						
<i>Porites lobata</i> Dana, 1846					+	+					
<i>Porites lutea</i> Milne Edwards et Haime, 1860					+	+	+				
<i>Porites nigrescens</i> Dana, 1848					+						
* <i>Porites rus</i> (Forskål, 1775) [= <i>P. convexa</i> ]					+	+					
<i>Porites</i> spp. [as <i>P. mucronata</i> ]					+				+		
Family Thamnasteriidae											
<i>Psammocora contigua</i> (Esper, 1797)					+						
<i>Psammocora</i> sp.					+						
Family Siderastreidae											
<i>Pseudosiderastrea tayamai</i> Yabe et Sugiyama, 1935					+						
Family Euphyllidae											
<i>Physogyra lichtensteini</i> (Milne Edwards et Haime, 1851)					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order ZOANTHARIA											
Family Zoanthidae											
<i>Zoanthus cavernarum</i> Pax et Müller, 1957					+						
<i>Zoanthus cyanoides</i> Pax et Müller, 1957					+						
<i>Zoanthus erythrochlora</i> Pax et Müller, 1957					+						
<i>Zoanthus robustus</i> Carlgren, 1950					+						
<i>Zoanthus vietnamensis</i> Pax et Müller, 1957					+						
<i>Zoanthus</i> spp.			+		+	+					
Family Sphenopidae											
<i>Palythoa anthoplax</i> Pax et Müller, 1957					+						
<i>Palythoa stephensoni</i> Carlgren, 1937					+						
<i>Palythoa titanophila</i> Pax et Müller, 1957					+						
<i>Palythoa tuberculosa</i> Klunzinger, 1877								+	+		
Order ANTIPATHARIA											
Family Antipathidae											
<i>Cirripathes</i> cf. <i>anguina</i> (Dana, 1846)					+						
Order ALCYONACEA											
Family Alcyoniidae											
<i>Lobophytum gazellae</i> Moser, 1919 [= <i>L. roxasi</i> ]					+						
<i>Sarcophyton cinereum</i> Tixier-Durivault, 1946 [= <i>S. poculiforme</i> ]					+						
<i>Sarcophyton crassocaule</i> Moser, 1919 [= <i>Lobophytum carnatum</i> , <i>L. undatum</i> ]					+						
<i>Sarcophyton trocheliophorum</i> von Marenzeller, 1886					+						
<i>Sinularia flexibilis</i> (Quoy et Gaimard, 1833)					+						
<i>Sinularia fungoides</i> Thomson et Henderson, 1906					+						
<i>Sinularia gyrosa</i> (Klunzinger, 1877)					+						
<i>Sinularia macropodia</i> (Hickson et Hiles, 1900)					+						
<i>Sinularia pedunculata</i> Tixier-Durivault, 1945					+						
<i>Sinularia polydactyla</i> (Eherenberg, 1834)					+						
<i>Sinularia querciformis</i> (Pratt, 1903)					+						
<i>Sinularia ramosa</i> Tixier-Durivault, 1945					+						
<i>Sinularia rigida</i> Dana, 1846					+						
<i>Sinularia whiteleggei</i> Lüttschwager, 1914					+						
<i>Sinularia</i> sp.					+						
Family Ellisellidae											
<i>Junceella juncea</i> (Pallas, 1766)					+						
Family Gorgoniidae											
<i>Rumphella aggregata</i> (Nutting, 1910)					+						
Family Nephtheidae											
<i>Dendronephthya gigantea</i> Verrill, 1864 [= <i>Spongodes gigantea</i> ]					+						
<i>Litophyton arboreum</i> Forskål, 1775					+						
Family Subergorgiidae											
<i>Subergorgia suberosa</i> (Pallas, 1766)					+						
Order HELIOPORACEA											
Family Helioporidae											
<i>Heliopora coerulea</i> (Pallas, 1766)					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Phylum NEMERTEA											
Class PALAEONEMERTEA											
Order TUBULANIFORMES											
Family Cephalotrichellidae											
<i>Balionemertes</i> sp.						+					
Family Cephalotrichidae											
<i>Cephalothrix suni</i> in lit.		+				+					
Class NEONEMERTEA											
Order HETERONEMERTEA											
Family Lineidae											
* <i>Dushia</i> sp.							+				
<i>Eousia verticivaria</i> Gibson, 1990		+					+				
<i>Lineus binigrilinearis</i> Gibson, 1990								+			
<i>Lineus</i> cf. <i>caputornatus</i> Takakura, 1898		+						+			
<i>Notospermus</i> sp.		+						+			
Order MONOSTILIFERA											
Family Poseidonemertidae											
<i>Diplomma serpentina</i> (Stimpson, 1855)		+					+				+
Family Oerstediiidae											
<i>Eumonostilifera</i> sp.								+			
Family Tetrastemmatidae											
<i>Tetrastemma</i> ex gr. <i>roseocephalum</i> (Yamaoka, 1947)											+
Phylum SIPUNCULA											
Class PHASCOLOSOMATIDEA											
Order ASPIDOSIPHONIFORMES											
Family Aspidosiphonidae											
<i>Aspidosiphon</i> ( <i>Aspidosiphon</i> ) <i>elegans</i> (Chamisso et Eysenhardt, 1821)								+			
<i>Aspidosiphon</i> ( <i>Aspidosiphon</i> ) <i>muelleri</i> Diesing, 1851									+		
<i>Aspidosiphon</i> ( <i>Paraspidosiphon</i> ) <i>laevis</i> de Quatrefages, 1865										+	
<i>Aspidosiphon</i> ( <i>Paraspidosiphon</i> ) <i>parvulus</i> Gerould, 1913											+
* <i>Aspidosiphon</i> ( <i>Paraspidosiphon</i> ) <i>steenstrupii</i> Diesing, 1859		+							+		
<i>Aspidosiphon</i> ( <i>Paraspidosiphon</i> ) <i>tenuis</i> Sluiter, 1886 [= <i>A. (P.) ambonensis</i> ]		+								+	
<i>Cloeosiphon aspergillus</i> (de Quatrefages, 1865)										+	
Order PHASCOLOSOMATIFORMES											
Family Phascolosomatidae											
<i>Antillesoma antillarum</i> (Grübe et Oersted, 1858)								+			+
<i>Apionsoma</i> ( <i>Apionsoma</i> ) <i>trichocephalus</i> Sluiter, 1902									+		+
<i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>albolineatum</i> (Baird, 1868)		+						+			+
<i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>arcuatum</i> (Gray, 1828)				+							
* <i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>nigrescens</i> (Keferstein, 1865) [= <i>Phascolosoma varians</i> ]		+		+		+	+	+			+
* <i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>pacificum</i> Keferstein, 1866									+		
<i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>perlucens</i> Baird, 1868									+		
* <i>Phascolosoma</i> ( <i>Phascolosoma</i> ) <i>scolops</i> (Selenka et de Man, 1883)		+						+			+
<i>Phascolosoma</i> spp.		+									+



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Class SIPUNCULIDEA											
Order GOLFINGIIFORMES											
Family Golfingiidae											
<i>Golfingia</i> ( <i>Golfingia</i> ) <i>elongata</i> (Keferstein, 1862)											+
<i>Thysanocardia catharinae</i> (Grübe, 1868)	+				+						+
Family Themistidae											
<i>Themiste</i> ( <i>Lagenopsis</i> ) <i>lageniformis</i> (Baird, 1868) [= <i>Dendrostomum signifer</i> ]					+						
Order SIPUNCULIFORMES											
Family Sipunculidae											
<i>Siphonosoma australe</i> (Keferstein, 1865)					+						+
<i>Siphonosoma cumanense</i> (Keferstein, 1867)					+						
* <i>Sipunculus</i> ( <i>Sipunculus</i> ) <i>nudus</i> Linnaeus, 1766					+						+
Phylum ANNELIDA											
Class POLYCHAETA											
Order PHYLLODOCIDA											
Family Phyllodocidae											
<i>Nereiphylla castanea</i> (Marenzeller, 1879) [= <i>Genetyllis castanea</i> ]				+							+
<i>Phyllodoce tenuissima</i> Grube, 1878					+						
Family Acoetidae											
<i>Acoetes melanonota</i> (Grube, 1876) [= <i>Polyodontes melanonotus</i> ]											+
<i>Polyodontes lupinus</i> (Stimpson, 1856) [as <i>P. pleei</i> ]											+
<i>Polyodontes tidemani</i> Pflugfelder, 1932											+
Family Aphroditidae											
<i>Laetmonice hystrix</i> (Savigny in Lamarck, 1818) [= <i>Hermione hystrix</i> ]					+						
Family Iphionidae											
<i>Iphione muricata</i> (Lamarck, 1818)					+						
Family Polynoidae											
<i>Harmothoe asiatica</i> Uschakov et Wu, 1962			+								
<i>Lepidonotus carinulatus</i> (Grube, 1870)					+						
<i>Lepidonotus tenuisetosus</i> (Gravier, 1902)									+		
<i>Lepidonotus</i> sp.					+						
<i>Paralentia annamita</i> (Fauvel, 1934)				+							
<i>Paralepidonotus ampulliferus</i> (Grube, 1878)					+						
<i>Thormora johnstoni</i> (Kinberg, 1856) [= <i>Lepidonotus johnstoni</i> ]					+						
Family Glyceridae											
<i>Glycera alba</i> (O.F. Müller, 1776)					+						
<i>Glycera capitata</i> Örsted, 1843					+						
Family Chrysopetalidae											
<i>Bhawania cryptocephala</i> Gravier, 1901											+
<i>Bhawania goodei</i> Webster, 1884						+					
<i>Chrysopetalum debile</i> (Grube, 1855) [= <i>Ch. ehlersi</i> ]			+								
Family Hesionidae											
<i>Leocrates claparedii</i> (Costa in Claparède, 1868)					+						
<i>Parabesione</i> sp.					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Nereididae											
<i>Ceratonereis (Composetia) costae</i> (Grube, 1840) [= <i>Nereis costae</i> ]					+						
<i>Ceratonereis mirabilis</i> Kinberg, 1865					+	+					
<i>Hediste diversicolor</i> (O.F. Müller, 1776) [= <i>Nereis viridis</i> ]					+						
<i>Leonnates persicus</i> Wesenberg-Lund, 1949											+
<i>Neanthes pachychaeta</i> (Fauvel, 1918) [= <i>Ceratonereis pachychaeta</i> ]					+						
<i>Nereis falcaria</i> (Willey, 1905)					+						
<i>Nereis nicholli</i> Kott, 1951			+					+			
<i>Nereis</i> spp.			+		+						
<i>Perinereis cultrifera</i> (Grube, 1840)					+	+	+	+		+	
<i>Perinereis floridana</i> (Ehlers, 1868) [= <i>P. cultrifera</i> var. <i>floridana</i> ]					+						
<i>Perinereis nigropunctata</i> (Horst, 1889)					+						
<i>Perinereis nuntia</i> (Lamarck, 1818) [= <i>Ceratonereis nuntia</i> ]					+						
<i>Perinereis nuntia brevicirris</i> (Grube, 1867)					+						
<i>Perinereis vancaurica</i> (Ehlers, 1868)					+						
<i>Perinereis</i> sp.								+			
<i>Platynereis dumerilii</i> (Audouin et Milne Edwards, 1834)					+						
<i>Platynereis pulchella</i> Gravier, 1901					+						
<i>Pseudonereis gallapagensis</i> Kinberg, 1865					+						
<i>Pseudonereis variegata</i> (Grube, 1857)					+						
Nereididae gen. sp.											+
Family Syllidae											
<i>Autolytus orientalis</i> Willey, 1905			+								
<i>Parasphaerosyllis indica</i> Monro, 1937			+								
<i>Syllis gracilis</i> Grube, 1840			+								
<i>Syllis hyalina</i> Grube, 1863 [= <i>Typosyllis aciculata orientalis</i> ]			+					+			
<i>Syllis variegata</i> Grube, 1860 [= <i>Typosyllis variegata</i> ]			+								
<i>Syllis</i> sp.					+						
<i>Trypanosyllis zebra</i> (Grube, 1860)					+						
<i>Typosyllis maculata</i> Imajima, 1966				+							
Syllidae gen. sp.					+						
Order AMPHINOMIDA											
Family Amphinomidae											
<i>Eurythoe complanata</i> (Pallas, 1766)					+	+					
<i>Linopherus paucibranchiata</i> (Fauvel, 1932) [= <i>Pseudeurythoe paucibranchiata</i> ]					+						
Amphinomidae gen. sp.											+
Order EUNICIDA											
Family Eunicidae											
<i>Eunice afra</i> Peters, 1854					+						
<i>Eunice aphroditois</i> (Pallas, 1788)					+						
<i>Eunice coccinea</i> Grube, 1878					+						
<i>Eunice gracilis</i> Grube, 1866					+						
<i>Eunice grubei</i> Gravier, 1900					+						
<i>Eunice kobiensis</i> McIntosh, 1885			+								

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Eunice tubifex</i> Crossland, 1904					+						
<i>Eunice</i> sp.					+						
<i>Leodice antennata</i> Savigny in Lamarck, 1818 [= <i>Eunice antennata</i> ]			+	+	+	+					
<i>Lysidice collaris</i> Grube, 1870			+		+			+			
<i>Lysidice unicornis</i> (Grube, 1840) [= <i>Nematonereis unicornis</i> ]					+	+				+	
<i>Marphysa mossambica</i> (Peters, 1854)					+						
<i>Marphysa sanguinea</i> (Montagu, 1815)								+			
<i>Nicidion cincta</i> Kinberg, 1865 [= <i>Eunice cincta</i> ]					+						
<i>Palola siciliensis</i> (Grube, 1840) [= <i>Palolo siciliensis</i> , <i>Eunice siciliensis</i> ]			+		+	+		+			
Family Onuphidae											
<i>Diopatra neapolitana</i> Delle Chiaje, 1841					+						+
<i>Onuphis eremita</i> Audouin et Milne Edwards, 1833											+
Family Lumbrineridae											
<i>Lumbrineris heteropoda</i> (Marenzeller, 1879)					+						
<i>Lumbrineris shiinoi</i> Gallardo, 1968											+
Family Oeononidae											
<i>Arabella mutans</i> (Chamberlin, 1919) [= <i>A. novocrinita</i> ]											+
Family Dorvilleidae											
<i>Dorvillea</i> sp.				+							
Order TERESELLIDA											
Family Terebellidae											
<i>Lanice conchilega</i> (Pallas, 1766)											+
<i>Loimia medusa</i> (Savigny in Lamarck, 1818)					+	+					
<i>Nicolea venustula</i> (Montagu, 1818)					+						
<i>Pista cristata</i> (O.F. Müller, 1776)					+						
<i>Terebella ebrenbergi</i> Gravier, 1906											+
<i>Thelepus plagiostoma</i> (Schmarda, 1861)					+						
Family Cirratulidae											
<i>Aphelochaeta multifilis</i> (Moore, 1909) [= <i>Tharyx multifilis</i> ]											+
<i>Cirratulus cirratus</i> (O.F. Müller, 1776)								+			
<i>Cirratulus</i> sp.					+						
<i>Cirriformia semicineta</i> (Ehlers, 1905)			+	+							
<i>Dodecaceria fistulicola</i> Ehlers, 1901					+						
<i>Tharyx</i> sp.											+
Family Trichobranchidae											
<i>Terebellides stroemii</i> Sars, 1835				+	+						
Order SABELLIDA											
Family Sabellidae											
Sabellidae gen. sp.											+
Family Sabellariidae											
<i>Idanthyrsus pennatus</i> (Peters, 1854) [= <i>Pallasia pennata</i> ]					+						
Family Serpulidae											
<i>Neodexiospira foraminosa</i> (Bush in Moore et Bush, 1904) [= <i>Spirorbis foraminosus</i> ]					+						
<i>Pomatoceros caeruleus</i> (Schmarda, 1861)					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Salmacina incrustans</i> Claparède, 1870					+						
<i>Serpula vermicularis</i> Linnaeus, 1767					+						
<i>Spirobranchus giganteus</i> (Pallas, 1766)					+		+	+			
<i>Spirobranchus kraussii</i> (Baird, 1865) [= <i>Pomatoleios kraussii</i> ]					+						
<i>Spirorbis</i> ( <i>Spirorbis</i> ) <i>spirorbis</i> (Linnaeus, 1758) [= <i>S. borealis</i> ]					+						
Serpulidae gen. sp.			+								
Order ECHIUROIDEA											
Family Echiuridae											
<i>Ochetostoma erythrogrammon</i> Leuckart et Rüppell, 1828					+						
Echiuridae gen. sp.											+
Order uncertain											
Family Chaetopteridae											
<i>Chaetopterus variopedatus</i> (Renier, 1804)											+
<i>Chaetopterus</i> sp.											+
Family Orbiniidae											
<i>Scoloplos</i> ( <i>Leodamas</i> ) <i>uniramus</i> Day, 1961					+						
<i>Scoloplos</i> sp.					+						
Orbiniidae gen. sp.											+
Family Capitellidae											
<i>Dasybranchus caducus</i> (Grube, 1846)					+						
<i>Heteromastus similis</i> Southern, 1921											+
Family Maldanidae											
<i>Axiobella</i> sp.											+
Family Opheliidae											
<i>Armandia lanceolata</i> Willey, 1905					+						
<i>Ophelina</i> sp. [= <i>Ammotrypane</i> sp.]											+
<i>Polyophthalmus pictus</i> (Dujardin, 1839)					+						
Phylum ARTHROPODA											
Class MEROSTOMATA											
Order XIPHOSURIDA											
Family Limulidae											
<i>Tachypleus tridentatus</i> (Leach, 1819)											+
<i>Tachypleus</i> sp.											+
Class MAXILLOPODA											
Order IBLIFORMES											
Family Iblidae											
<i>Ibla cumingi</i> Darwin, 1851					+		+				+
<i>Ibla</i> sp.											+
Order LEPADIFORMES											
Family Poecilasmatidae											
<i>Octolasmis angulata</i> (Aurivillius, 1894)											+
<i>Octolasmis cor</i> (Aurivillius, 1892)											+
Order SCALPELLIFORMES											
Family Scalpellidae											
<i>Scalpellum typicum</i> Broch, 1947										+	
Family Lithotryidae											
<i>Lithotrya nicobarica</i> Reinhardt, 1850						+					+

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Pollicipedidae											
<i>Capitulum mitella</i> (Linnaeus, 1758) [= <i>Mitella mitella</i> , <i>Pollicipes mitella</i> ]	+	+			+						+
<i>Pollicipes pollicipes</i> (Gmelin, 1790) [= <i>Mitella pollicipes</i> ]					+			+			
<i>Pollicipes</i> sp.									+		
Order SESSILIA											
Family Archaeobalanidae											
<i>Acasta sulcata</i> Lamarck, 1818	+				+		+	+			+
<i>Euacasta dofleini</i> (Kruger, 1911)											+
<i>Euacasta sporillus</i> (Darwin, 1854) [= <i>Acasta sporillus</i> ]											+
* <i>Solidobalanus socialis</i> (Hoek, 1883)					+						+
Family Balanidae											
<i>Amphibalanus amphitrite</i> (Darwin, 1854) [= <i>Balanus amphitrite</i> ]					+						+
<i>Amphibalanus reticulatus</i> (Utinomi, 1967) [= <i>Balanus reticulatus</i> ]				+							+
<i>Balanus</i> spp.		+	+		+						+
<i>Megabalanus occator</i> (Darwin, 1854)			+								
<i>Megabalanus tintinnabulum</i> (Linnaeus, 1758) [= <i>Balanus tintinnabulum</i> ]	+		+		+						
<i>Megabalanus</i> sp.				+							
Family Chthamalidae											
<i>Caudoeuraphia caudata</i> (Pilsbry, 1916) [= <i>Chthamalus caudatus</i> ]					+						
<i>Chinochthamalus scutelliformis</i> (Darwin, 1854) [= <i>Chamaesipho scutelliformis</i> ]	+				+		+	+			+
<i>Chthamalus challengerii</i> Hoek, 1883					+						+
<i>Chthamalus malayensis</i> Pilsbry, 1916	+		+	+	+		+	+			+
<i>Chthamalus moro</i> Pilsbry, 1916	+										
<i>Chthamalus stellatus</i> (Poli, 1791)			+								
<i>Chthamalus</i> spp.					+						+
<i>Microeuraphia withersi</i> (Pilsbry, 1916) [= <i>Chthamalus withersi</i> ]	+				+		+	+			+
<i>Tetrachthamalus sinensis</i> Ren, 1980					+			+			+
Family Pyrgomatidae											
* <i>Cantellius iwayama</i> (Hiro, 1983)					+		+				
Family Tetracitidae											
<i>Tesseropora alba</i> Ren et Liu, 1979					+						+
* <i>Tetracitella japonica</i> Pilsbry, 1916	+	+	+	+	+	+	+	+	+	+	+
<i>Tetracitella porosa</i> Darwin, 1854			+		+						
* <i>Tetracitella squamosa</i> (Bruguère, 1789)	+	+	+	+	+	+	+	+	+	+	+
<i>Tetracitella</i> spp.	+			+	+						
<i>Tetracitella costata</i> (Darwin, 1854)					+		+				
* <i>Tetracitella divisa</i> (Nilsson-Cantell, 1921)								+			
<i>Yamaguchiella coerulescens</i> (Spengler, 1790) [= <i>Tetracitella coerulescens</i> ]	+										

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Class MALACOSTRACA											
Order STOMATOPODA											
Family Gonodactylidae											
<i>Gonodactylaceus glabrous</i> (Brooks, 1886) [= <i>Gonodactylus glaber</i> ]					+						
<i>Gonodactylellus viridis</i> (Serène, 1954)					+						
<i>Gonodactylus chiragra</i> (Fabricius, 1781)					+	+				+	
<i>Gonodactylus smithii</i> Pocock, 1893					+						
<i>Gonodactylus</i> sp. [as <i>G. brooksi</i> ]					+						
Family Protosquillidae											
<i>Chorisquilla excavata</i> (Miers, 1880) [= <i>Gonodactylus excavatus</i> ]					+						
<i>Haptosquilla glyptocercus</i> (Wood-Mason, 1875) [= <i>Gonodactylus glyptocercus</i> ]					+						
* <i>Haptosquilla stoliura</i> (Müller, 1887)					+					+	
Family Pseudosquillidae											
<i>Pseudosquilla ciliata</i> (Fabricius, 1787)					+						
Family Squillidae											
<i>Alima neptuni</i> (Linnaeus, 1768)					+						
<i>Cloridina pelamidae</i> (Blumstein, 1970)											+
<i>Cloridopsis scorpio</i> (Latreille, 1828) [= <i>Squilla scorpio</i> ]											+
<i>Oratosquillina gravieri</i> (Manning, 1978)											+
<i>Oratosquillina interrupta</i> (Kemp, 1911)											+
Family Takuidae											
* <i>Taku spinosocarinatus</i> (Fukuda, 1909)					+						
Order AMPHIPODA											
Family Photidae											
Photidae gen. sp.										+	
Family Isaeidae											
Isaeidae gen. sp.					+						
Family Pontogeneiidae											
<i>Pontogeneia</i> sp.					+						
Family Hyalidae											
<i>Allorchestes</i> sp.					+						
<i>Hyale</i> spp.					+	+			+		
Family Ampithoidae											
<i>Ampithoe</i> spp.					+	+			+	+	
Family Gammaridae											
<i>Maera</i> spp.					+		+		+		
<i>Elasmopus</i> sp.					+						
Family Amphilochidae											
<i>Gitanopsis</i> sp.							+				
Family Haustoriidae											
Haustoriidae gen. sp.							+				
Family Ampeliscidae											
<i>Ampelisca</i> sp.							+				
Family Ischyroceridae											
<i>Erichthonius</i> sp.							+				
<i>Ischyrocerus</i> sp.										+	

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Caprellidae											
<i>Caprella</i> sp.				+							
Order ISOPODA											
Family Cirolanidae											
<i>Aphantolana sphaeromiformis</i> (Hansen, 1890) [= <i>Metacirolana sphaeromiformis</i> ]				+	+						
<i>Cirolana erodiae</i> Bruce, 1986											+
<i>Cirolana</i> sp.			+								
<i>Excirolana orientalis</i> (Dana, 1853)					+						
<i>Metacirolana</i> sp.											+
Family Corallanidae											
<i>Corallana hirsuta</i> Schioedte et Meinert, 1879					+						
<i>Lanocira anasicula</i> Jones, 1982					+				+		
<i>Lanocira gardineri</i> Stebbing, 1904									+		
<i>Lanocira</i> sp.					+						
Family Leptanthuridae											
<i>Leptanthura orientalis</i> Barnard, 1925				+							
Family Expanathuridae											
<i>Panathura</i> spp.				+					+		
Family Gnathiidae											
<i>Elaphognathia rangifer</i> Monod, 1926					+						
<i>Gnathia</i> spp.					+						+
Family Sphaeromatidae											
<i>Cerceis pravipalma</i> Harrison et Holdich, 1982				+	+	+		+			
<i>Chitonosphaera lata</i> (Nishimura, 1968)											+
<i>Cymodoce longistylis</i> Miers, 1884					+						
<i>Cymodoce pelsarti</i> Tattersall, 1922					+						+
<i>Cymodoce tribullis</i> Harrison et Holdich, 1984				+							
<i>Dynamenella liochroea</i> Harrison et Holdich, 1982					+						
<i>Dynamenella trachydermata</i> Harrison et Holdich, 1982				+	+	+	+	+			
<i>Dynamenopsis</i> sp.					+						
<i>Dynoides amblysinus</i> (Pillai, 1954) [= <i>Clanella brucei</i> ]				+							
<i>Dynoides harrisoni</i> Kussakin et Malyutina, 1993											+
<i>Paracerceis holdichi</i> Kussakin et Malyutina, 1993					+						
<i>Paracilicaea asiatica</i> Kussakin, Malyutina et Rostomov, 1990				+							
<i>Paradella octaphymata</i> Harrison et Holdich, 1982					+						
<i>Paraleptosphaeroma brucei</i> Kussakin et Malyutina, 1993											+
<i>Sphaeroma terebrans</i> Bate, 1866					+						
<i>Zuzara digitata</i> Harrison et Holdich, 1984				+							
<i>Zuzara curtispina</i> Harrison et Holdich, 1984				+							
Sphaeromatidae gen. sp.				+							
Family Limnoriidae											
<i>Limnoria indica</i> Becker et Kampf, 1958									+		
<i>Limnoria multipunctata</i> Menzies, 1957				+							+
<i>Limnoria tuberculata</i> Sowinsky, 1884											+
<i>Limnoria</i> sp.				+							
<i>Paralimnoria andrewsi</i> (Calman, 1910)									+		

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Anthuridae											
<i>Amakusanthura</i> sp.				+							
Family Joeropsididae											
<i>Joeropsis</i> spp.					+				+		
Family Janiridae											
<i>Caecijaera kussakini</i> Malyutina, 1994					+						+
Family Ligiidae											
<i>Ligia exotica</i> Roux, 1828						+					
<i>Ligia oceanica</i> (Linnaeus, 1767)						+					
<i>Ligia</i> spp.			+				+		+		+
Order DECAPODA											
Family Penaeidae											
<i>Penaeus latisulcatus</i> Kishinouye, 1896 [= <i>Melicertus latisulcatus</i> ]						+					
Penaeidae gen. sp.											+
Family Stenopodidae											
<i>Stenopus hispidus</i> (Olivier, 1811)						+					
Family Palaemonidae											
<i>Cuapetes grandis</i> (Stimpson, 1860) [= <i>Kemponia grandis</i> ]						+					
<i>Neoanchistus cardiodytes</i> Bruce, 1975						+					
<i>Palaemonella aliska</i> Marin, 2008 [= <i>Palaemonella</i> sp.]						+					
<i>Philarius condi</i> Marin, 2012						+					
Family Alpheididae											
<i>Alpheus bisincisus</i> de Haan, 1849						+					
<i>Alpheus deuteropus</i> Hilgendorf, 1879						+					
<i>Alpheus edwardsii</i> (Audouin, 1826) [= <i>A. audouini</i> ]						+					
<i>Alpheus gracilipes</i> Stimpson, 1860						+					
<i>Alpheus lobidens</i> de Haan, 1849 [= <i>A. crassimanus</i> ]						+					
<i>Alpheus lottini</i> Guérin-Ménéville, 1838						+					
<i>Alpheus obesomanus</i> Dana, 1852 [= <i>A. lutini</i> ]						+					
<i>Alpheus pacificus</i> Dana, 1852						+					
<i>Alpheus pubescens</i> de Man, 1908						+					
<i>Alpheus serenei</i> Tiwari, 1964						+					
<i>Alpheus strenuus strenuus</i> Dana, 1852 [= <i>A. strenuus</i> ]						+					
<i>Alpheus</i> spp.						+		+			
<i>Synalpheus pescadorensis</i> Coutière, 1905						+					
Alpheididae gen. sp.											+
Family Callianassidae											
<i>Callianassa</i> sp.											+
Family Thalassinidae											
<i>Thalassina anomala</i> Herbst, 1804 [= <i>Th. scorpionides</i> ]						+					+
Thalassinidae gen. sp.											+
Family Palinuridae											
<i>Panulirus</i> sp.						+					
Family Galatheidae											
<i>Allogalathea elegans</i> (Adams et White, 1848) [= <i>Galathea elegans</i> ]						+					
<i>Galathea platycheles</i> Miyake, 1953						+					



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Munididae											
<i>Munida</i> sp.					+						
Family Porcellanidae											
<i>Pachycheles stevensii</i> Stimpson, 1858					+						
<i>Petrolisthes asiaticus</i> (Leach, 1820)					+						
<i>Petrolisthes boscii</i> (Audouin, 1826)					+						
<i>Petrolisthes tomentosus</i> (Dana, 1852) [= <i>P. penicillatus</i> ]					+						
<i>Petrolisthes</i> spp.					+					+	
<i>Polyonyx</i> sp.										+	
<i>Porcellana</i> sp.					+						
Family Coenobitidae											
<i>Coenobita cavipes</i> Stimpson, 1858					+						
<i>Coenobita rugosus</i> H. Milne Edwards, 1837					+						
<i>Coenobita</i> spp.					+		+			+	
Family Diogenidae											
<i>Calcinus gaimardii</i> (H. Milne Edwards, 1848)					+						
<i>Calcinus laevimanus</i> (Randall, 1840) [= <i>C. herbsti</i> ]					+						
<i>Calcinus latens</i> (Randall, 1840) [as <i>C. lateens</i> ]					+						
<i>Calcinus</i> spp.							+		+		
<i>Clibanarius arethusa</i> de Man, 1888					+						
<i>Clibanarius corallinus</i> (H. Milne Edwards, 1848)					+						
<i>Clibanarius cruentatus</i> (H. Milne Edwards, 1848)					+						
<i>Clibanarius eurysternus</i> (Hilgendorf, 1879)					+						
<i>Clibanarius lineatus</i> (H. Milne Edwards, 1848)					+						
<i>Clibanarius longitarsus</i> (de Haan, 1849)					+						
<i>Clibanarius merguensis</i> de Man, 1888					+						
<i>Clibanarius ransoni</i> Forest, 1953					+						
<i>Clibanarius snelli</i> Buitendijk, 1937					+						
<i>Clibanarius striolatus</i> Dana, 1852					+						
<i>Clibanarius virescens</i> (Krauss, 1843)					+						
<i>Clibanarius</i> sp.					+						
<i>Dardanus deformis</i> (H. Milne Edwards, 1836) [= <i>Pagurus deformis</i> , as <i>Calcinus deformis</i> ]					+						
<i>Dardanus guttatus</i> (Olivier, 1812) [= <i>Pagurus guttatus</i> ]					+						
<i>Dardanus lagopodes</i> (Forskål, 1775) [= <i>Pagurus sanguinolentus</i> ]					+						
<i>Dardanus megistos</i> (Herbst, 1804) [= <i>Pagurus megistos</i> , <i>P. punctulatus</i> ]					+						
Family Paguridae											
<i>Pagurus</i> sp. [as <i>P. impatiens</i> ]					+						
Paguridae gen. spp.					+	+	+	+		+	
Family Raninidae											
<i>Ranina ranina</i> (Linnaeus, 1758)					+						
Family Calappidae											
<i>Calappa hepatica</i> (Linnaeus, 1758)					+	+					
<i>Calappa philargius</i> (Linnaeus, 1758)					+						
<i>Cycloes granulosa</i> de Haan, 1837					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Matutidae											
<i>Ashtoret lunaris</i> (Forskål, 1775) [= <i>Matuta lunaris</i> ]					+						+
<i>Matuta victor</i> (Fabricius, 1781)					+						
Family Carpiliidae											
<i>Carpilius convexus</i> (Forskål, 1775)					+						+
<i>Carpilius corallinus</i> (Herbst, 1783)					+						
Family Dacryopilumnidae											
<i>Dacryopilumnus rathbunae</i> Balss, 1932					+						
Family Dairidae											
<i>Daira perlata</i> (Herbst, 1790)					+						
Family Dorippidae											
<i>Dorippoides facchino</i> (Herbst, 1785) [= <i>Dorippe astuta</i> ]											+
Family Eriphiidae											
<i>Eriphia scabricula</i> Dana, 1852				+				+			
<i>Eriphia smithii</i> MacLeay, 1838 [as <i>E. laevimana smithii</i> ]					+						+
Family Menippidae											
<i>Myomenippe hardwickii</i> (Gray, 1831) [as <i>M. granulosa</i> ]											+
<i>Sphaerozcius scaber</i> (Fabricius, 1798)				+							
Family Oziidae											
<i>Epixanthus corrosus</i> A. Milne-Edwards, 1873						+					
<i>Epixanthus frontalis</i> (H. Milne Edwards, 1834)						+					+
<i>Epixanthus</i> sp.						+					
<i>Eupilumnus actumnoides</i> (A. Milne Edwards, 1873) [= <i>Globopilumnus actumnoides</i> ]				+			+				
<i>Eupilumnus globosus</i> (Dana, 1852) [= <i>Globopilumnus globosus</i> ]						+					
<i>Lydia annulipes</i> (H. Milne Edwards, 1834) [= <i>Euxanthus rugulosus</i> ]						+					
<i>Ozius lobatus</i> Heller, 1865						+					
<i>Ozius rugulosus</i> Stimpson, 1858						+					
<i>Ozius tuberculatus</i> H. Milne Edwards, 1834						+					
Family Goneplacidae											
Goneplacidae gen. sp.				+							
Family Leucosiidae											
<i>Ebalia</i> sp.											+
<i>Nucia tuberculosa</i> A. Milne-Edwards, 1874						+					
<i>Oreophorus</i> ( <i>Oreophorus</i> ) <i>patella</i> (Alcock, 1896)						+					
<i>Philyra olivacea</i> Rathbun, 1909											+
<i>Philyra</i> sp.											+
Family Epialtidae											
<i>Criocarcinus superciliosus</i> (Linnaeus, 1767)						+					
<i>Menaethius monoceros</i> (Latreille, 1825)						+	+				
<i>Pisa lanata</i> (Lamarck, 1801) [as <i>P. lamaia</i> ]						+					
Family Hymenosomatidae											
<i>Halicarcinus messor</i> (Stimpson, 1858) [= <i>Rhynchoplax messor</i> ]						+					
<i>Halicarcinus orientalis</i> Sakai, 1932						+					+
Family Inachidae											
<i>Oncinopus araneus</i> (de Haan, 1839)						+					

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Majidae											
<i>Schizophrys aspera</i> (H. Milne Edwards, 1834)					+						
Family Orithyiidae											
<i>Orithyia sinica</i> (Linnaeus, 1771) [=as <i>O. mammillaris</i> ]											+
Family Pilumnidae											
<i>Actumnus setifer</i> (de Haan, 1835)					+						
<i>Benthopanope eucratoides</i> (Stimpson, 1858) [= <i>Heteropanope (Pilumnopeus) eucratoides</i> ]					+						+
<i>Benthopanope pearsei</i> (Rathbun, 1932) [= <i>Heteropanope pearsei</i> , as <i>Parapilumnus pearsi</i> ]					+						
<i>Eurycarcinus orientalis</i> A. Milne-Edwards, 1867											+
<i>Eurycarcinus</i> sp.											+
<i>Glabropilumnus dispar</i> (Dana, 1852)					+						
<i>Glabropilumnus laevimanus</i> (Dana, 1852) [= <i>Pilumnus laevimanus</i> ]					+						
<i>Heteropanope glabra</i> Stimpson, 1858			+		+		+				+
<i>Nanopilumnus barbatus</i> (A. Milne-Edwards, 1873) [= <i>Pilumnus barbatus</i> ]					+						
<i>Pilumnopeus makianus</i> (Rathbun, 1931) [= <i>Heteropanope makianus</i> ]					+						
<i>Pilumnus rufopunctatus</i> Stimpson, 1858					+						
<i>Pilumnus scabriusculus</i> Adams et White, 1849					+						
<i>Pilumnus tomentosus</i> Latreille, 1825					+						
<i>Pilumnus trispinosus</i> (Sakai, 1965) [= <i>Parapilumnus trispinosus</i> ]					+						
<i>Pilumnus vespertilio</i> (Fabricius, 1793)					+	+					
<i>Pilumnus</i> spp.			+					+	+		
<i>Rhizopa gracilipes</i> Stimpson, 1858											+
<i>Ser fukiensis</i> Rathbun, 1931											+
<i>Typblocarcinus</i> sp.											+
Family Portunidae											
<i>Carupella banlaensis</i> Tien, 1969											+
<i>Charybdis (Charybdis) anisodon</i> (de Haan, 1850)											+
<i>Charybdis (Charybdis) annulata</i> (Fabricius, 1798)											+
<i>Charybdis (Charybdis) hellerii</i> (A. Milne-Edwards, 1867)											+
<i>Podophthalmus vigil</i> (Fabricius, 1798)											+
<i>Portunus sanguinolentus</i> (Herbst, 1783)					+						
<i>Portunus (Portunus) pelagicus</i> (Linnaeus, 1758)					+						+
<i>Portunus (Portunus) trituberculatus</i> (Miers, 1876)											+
<i>Scylla paramamosain</i> Estampador, 1949			+		+						
<i>Scylla serrata</i> (Forskål, 1775) [= <i>S. tranquebarica</i> var. <i>oceanica</i> , <i>S. oceanica</i> ]					+						+
<i>Thalamita admete</i> (Herbst, 1803)						+					
<i>Thalamita crenata</i> Rüppell, 1830					+						+
<i>Thalamita danae</i> Stimpson, 1858					+						+
<i>Thalamita kotoensis</i> Tien, 1969											+
<i>Thalamita prymna</i> (Herbst, 1803)					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Thalamita sima</i> H. Milne Edwards, 1834					+						+
<i>Thalamita</i> spp.					+						+
Family Domeciidae											
<i>Domecia hispida</i> Eydoux et Souleyet, 1842									+		
Family Tetraliidae											
<i>Tetralia glaberrima</i> (Herbst, 1790)			+		+				+		
<i>Tetralia heterodactyla</i> Heller, 1861					+						
<i>Tetralia nigrolineata</i> Serène et Pham, 1957 [as <i>T. glaberrima</i> var. <i>nigrolineata</i> ]					+						
Family Trapeziidae											
<i>Trapezia areolata</i> Dana, 1852					+				+		
<i>Trapezia cymodoce</i> (Herbst, 1801)					+						
<i>Trapezia guttata</i> Rüppell, 1830 [as <i>T. cymodoce guttata</i> ]					+						
<i>Trapezia rufopunctata</i> (Herbst, 1799)					+						
<i>Trapezia speciosa</i> Dana, 1852					+						
Family Xanthidae											
<i>Actaea amoyensis</i> (de Man, 1879)					+						
<i>Actaea polyacantha</i> (Heller, 1861)					+						
<i>Actaea rueppellii</i> (Krauss, 1843)					+						
<i>Actaea</i> spp.			+		+						
<i>Actaeodes tomentosus</i> (H. Milne Edwards, 1834) [= <i>Actaea tomentosa</i> ]					+				+	+	
<i>Atergatis floridus</i> (Linnaeus, 1767)					+						
<i>Atergatis integerrimus</i> (Lamarck, 1818)					+						
<i>Chlorodiella cytherea</i> (Dana, 1852)					+						
<i>Chlorodiella laevissima</i> (Dana, 1852)					+						
<i>Chlorodiella nigra</i> (Forskål, 1775)					+						
<i>Chlorodiella</i> sp.									+		
<i>Chlorodopsis pilumnoides</i> (White, 1848)					+						
<i>Cyclodius granulatus</i> (Targioni-Tozzetti, 1877) [as <i>Chlorodopsis granulata</i> ]					+						
<i>Epiactaea margaritifera</i> (Odhner, 1925) [= <i>Actaea margaritifera</i> ]					+						
<i>Etisus laevimanus</i> Randall, 1840					+						
<i>Forestiana scabra</i> (Odhner, 1925) [= <i>Actaea scabra</i> ]					+						
<i>Lachnopus subacutus</i> (Stimpson, 1858) [= <i>Lioxantho tumidus</i> ]					+				+		
<i>Leptodius exaratus</i> (H. Milne Edwards, 1834) [= <i>Xantho (Leptodius) exaratus</i> ]					+	+			+	+	+
<i>Liomera caelata</i> (Odhner, 1925)					+						
<i>Liomera laevis</i> (A. Milne-Edwards, 1873)					+						
<i>Liomera monticulosa</i> (A. Milne-Edwards, 1873)					+						
<i>Liomera rugipes</i> (Heller, 1861)					+						
<i>Liomera semigranosa</i> de Man, 1888					+						
<i>Macromedaeus nudipes</i> (A. Milne-Edwards, 1867) [= <i>Xantho (Leptodius) nudipes</i> ]					+						
<i>Macromedaeus quinquentatus</i> (Krauss, 1843) [= <i>Xantho (Leptodius) euglyptus</i> ]					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Novactaea modesta</i> (de Man, 1888) [= <i>Actaeodes modesta</i> ]					+						
<i>Paractaea rufopunctata</i> (H. Milne Edwards, 1834) [= <i>Actaea rufopunctata</i> ]					+						
<i>Phymodius monticulosus</i> (Dana, 1852)					+						
<i>Phymodius</i> sp.							+				
<i>Pilodius nigrocrinitus</i> Stimpson, 1859 [= <i>Chlorodopsis melanochira</i> ]					+						
<i>Pilodius pugil</i> Dana, 1852 [as <i>Chlorodopsis pugil</i> ]					+						
<i>Pilodius</i> sp.								+			
<i>Platypodia alcocki</i> Buitendijk, 1941					+						
<i>Psaumis cavipes</i> (Dana, 1852) [= <i>Actaea cavipes</i> ]					+						
<i>Pseudoliomera helleri</i> (A. Milne-Edwards, 1865) [= <i>Actaea helleri</i> ]					+						
<i>Pseudoliomera speciosa</i> (Dana, 1852) [= <i>Actaea speciosa</i> ]					+						
<i>Pseudoliomera variolosa</i> (Borradaile, 1902) [= <i>Actaea variolosa</i> ]					+						
<i>Xanthias lamarckii</i> (H. Milne Edwards, 1834)					+						
<i>Xanthias punctatus</i> (H. Milne Edwards, 1834)					+						
<i>Xanthodius</i> sp.					+						
<i>Zosimus aeneus</i> (Linnaeus, 1758) [= <i>Zozymus aeneus</i> ]					+						
<i>Zozymodes cavipes</i> (Dana, 1852)					+				+		
<i>Zozymodes pumilus</i> (Hombron et Jacquinot, 1846) [= <i>Zozymus pumilus</i> ]					+						
Xanthidae gen. sp.											+
Family Grapsidae											
<i>Grapsus grapsus</i> (Linnaeus, 1758)						+					
<i>Grapsus longitarsis</i> Dana, 1851 [= <i>G. subquadratus</i> ]						+					
<i>Grapsus tenuicrustatus</i> (Herbst, 1783)				+	+		+	+	+	+	
<i>Metopograpsus latifrons</i> (White, 1847)			+		+						+
<i>Metopograpsus messor</i> (Forskål, 1775)					+	+	+				
<i>Metopograpsus oceanicus</i> (Hombron et Jacquinot, 1846)					+						
<i>Metopograpsus quadridentatus</i> Stimpson, 1858											+
<i>Metopograpsus thukuhar</i> (Owen, 1839)											+
<i>Metopograpsus</i> sp. [as <i>M. dentatus</i> ]											+
<i>Pachygrapsus minutus</i> A. Milne Edwards, 1873				+	+		+	+			
<i>Pachygrapsus planifrons</i> de Man, 1888					+						
Grapsidae gen. spp.			+								+
Family Percnidae											
<i>Percnon planissimum</i> (Herbst, 1804)						+					
<i>Percnon</i> spp.				+				+			
Family Plagusiidae											
<i>Plagusia immaculata</i> Lamarck, 1818						+					
<i>Plagusia squamosa</i> (Herbst, 1790) [= <i>P. tuberculata</i> ]						+					
Family Sesarmidae											
<i>Clistocoeloma merguense</i> de Man, 1888											+
<i>Episesarma mederi</i> (H. Milne Edwards, 1853) [= <i>Sesarma taeniolata</i> ]											+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Episesarma palawanense</i> (Rathbun, 1914)		+			+						
<i>Nanosesarma batavicum</i> (Moreira, 1903)		+									
<i>Nanosesarma edamense</i> (de Man, 1887)					+						
<i>Nanosesarma minutum</i> (de Man, 1887) [= <i>N. gordonii</i> ]		+			+					+	
<i>Nanosesarma tweediei</i> (Serène, 1967)					+						
<i>Neosarmatium smithi</i> (H. Milne Edwards, 1853) [= <i>Sesarma smithi</i> ]											+
<i>Parasesarma batavianum</i> (de Man, 1890) [= <i>Sesarma bataviana</i> ]											+
<i>Parasesarma moluccense</i> (de Man, 1892) [as <i>Sesarma moluccensis</i> ]											+
<i>Parasesarma pictum</i> (de Haan, 1835) [as <i>Sesarma picta</i> ]											+
<i>Parasesarma plicatum</i> (Latreille, 1803) [= <i>Sesarma plicata</i> ]		+									+
<i>Parasesarma ungulatum</i> (H. Milne Edwards, 1853)					+						
<i>Perisesarma bidens</i> (de Haan, 1835) [= <i>Sesarma bidens</i> ]					+						+
<i>Perisesarma eumolpe</i> (de Man, 1895) [= <i>Sesarma eumolpe</i> ]					+						+
<i>Perisesarma indiarum</i> (Tweedie, 1940) [as <i>Sesarma bidens indiarum</i> ]					+						
<i>Sarmatium crassum</i> Dana, 1851											+
<i>Sesarma dehaani</i> H. Milne Edwards, 1853											+
<i>Sesarma obtusifrons</i> Dana, 1851					+						
<i>Sesarma</i> spp.								+	+		+
Family Varunidae											
<i>Cyclograpsus intermedius</i> Ortmann, 1894					+						
<i>Gaetice depressus</i> (de Haan, 1833)											+
<i>Helicana wuana</i> (Rathbun, 1931) [= <i>Helice wuana</i> ]											+
<i>Helice tridens</i> (de Haan, 1835)											+
<i>Helice</i> sp.											+
<i>Hemigrapsus sanguineus</i> (de Haan, 1835)											+
<i>Metaplax elegans</i> de Man, 1888											+
<i>Metaplax longipes</i> Stimpson, 1858					+						+
<i>Metaplax sheni</i> Gordon, 1930											+
<i>Metaplax</i> sp.											+
<i>Varuna litterata</i> (Fabricius, 1798)											+
Family Camptandriidae											
<i>Baruna socialis</i> Stebbing, 1904 [= <i>Leipocten sordidulum</i> ]					+						
<i>Camptandrium sexdentatum</i> Stimpson, 1858											+
<i>Deiratonotus cristatum</i> (de Man, 1895) [= <i>Paracleistostoma cristatum</i> ]											+
<i>Ilyogynnis microcheirum</i> (Tweedie, 1937) [= <i>Paracleistostoma microcheirum</i> ]											+
<i>Mortensenella forceps</i> Rathbun, 1909											+
<i>Paracleistostoma depressum</i> de Man, 1895											+
Family Dotillidae											
<i>Dotilla wichmanni</i> de Man, 1892											+
<i>Ilyoplax</i> cf. <i>formosensis</i> Rathbun, 1921					+						

## Macrobenthic communities of the intertidal zone

Continued

Taxa	Location											
	1	2	3	4	5	6	7	8	9	10	11	
<i>Ilyoplax orientalis</i> (de Man, 1888)												+
<i>Ilyoplax pingi</i> Shen, 1932												+
<i>Ilyoplax punctata</i> Tweedie, 1935			+									
<i>Ilyoplax pusilla</i> (de Haan, 1835)						+						
<i>Scopimera bitympana</i> Shen, 1930												+
<i>Scopimera globosa</i> (de Haan, 1835) [= <i>S. tuberculata</i> ]						+						+
<i>Scopimera longidactyla</i> Shen, 1932												+
<i>Tmethypocoelis ceratophora</i> (Koelbel, 1897)												+
Family Macrophthalmidae												
<i>Macrophthalmus</i> ( <i>Macrophthalmus</i> ) <i>brevis</i> (Herbst, 1804) [= <i>M. simdentatus</i> ]						+						+
<i>Macrophthalmus</i> ( <i>Macrophthalmus</i> ) <i>convexus</i> Stimpson, 1858												+
<i>Macrophthalmus</i> ( <i>Macrophthalmus</i> ) <i>crassipes</i> H. Milne Edwards, 1852												+
<i>Macrophthalmus</i> ( <i>Macrophthalmus</i> ) <i>milloti</i> Crosnier, 1965						+						
<i>Macrophthalmus</i> ( <i>Mareotis</i> ) <i>crinitus</i> Rathbun, 1913												+
<i>Macrophthalmus</i> ( <i>Mareotis</i> ) <i>definitus</i> Adams et White, 1849												+
<i>Macrophthalmus</i> ( <i>Mareotis</i> ) <i>pacificus</i> Dana, 1851												+
<i>Macrophthalmus</i> ( <i>Mareotis</i> ) <i>tomentosus</i> Eyedoux et Souleyet, 1842												+
<i>Macrophthalmus</i> ( <i>Paramareotis</i> ) <i>erato</i> de Man, 1888												+
<i>Macrophthalmus dilatatus sulcatus</i> H. Milne Edwards, 1852 [as <i>M. dilatatus</i> ]												+
Family Mictyridae												
<i>Mictyris brevidactylus</i> Stimpson, 1858						+						
<i>Mictyris longicarpus</i> Latreille, 1806						+						+
Family Ocypodidae												
<i>Ocypode ceratophthalmus</i> (Pallas, 1772) [= <i>O. ceratophthalma</i> ]						+		+		+		+
<i>Ocypode convexa</i> Quoy et Gaimard, 1824						+						
<i>Ocypode cordimanus</i> Latreille, 1818						+						
<i>Ocypode kublii</i> de Haan, 1835						+						
<i>Ocypode</i> sp.												+
<i>Uca</i> ( <i>Austruca</i> ) <i>annulipes</i> (H. Milne Edwards, 1837)						+						
<i>Uca</i> ( <i>Austruca</i> ) <i>lactea</i> (de Haan, 1835)						+						+
<i>Uca</i> ( <i>Gelasimus</i> ) <i>borealis</i> Crane, 1975						+						
<i>Uca</i> ( <i>Gelasimus</i> ) <i>tetragonon</i> (Herbst, 1790)						+						
<i>Uca</i> ( <i>Gelasimus</i> ) <i>vocans</i> (Linnaeus, 1758) [= <i>U. marionis</i> ]						+						+
<i>Uca</i> ( <i>Paraleptuca</i> ) <i>crassipes</i> (White, 1847)						+						
<i>Uca</i> ( <i>Tubuca</i> ) <i>arcuata</i> (de Haan, 1835)						+						+
<i>Uca</i> ( <i>Tubuca</i> ) <i>dussumieri</i> (H. Milne Edwards, 1852) [= <i>U. (Dultuca) dussumieri</i> ]												+
<i>Uca</i> ( <i>Tubuca</i> ) <i>flamula</i> Crane, 1975											+	
<i>Uca</i> ( <i>Tubuca</i> ) <i>forcipata</i> (Adams et White, 1849)											+	
<i>Uca</i> ( <i>Tubuca</i> ) <i>paradussumieri</i> Bott, 1973											+	
<i>Uca</i> ( <i>Tubuca</i> ) <i>rosea</i> (Tweedie, 1937)											+	
<i>Uca</i> ( <i>Tubuca</i> ) <i>urvillei</i> (H. Milne Edwards, 1852)											+	
<i>Uca</i> spp. [as <i>Uca dubia</i> ]						+						+

Continued

Taxa	Location											
	1	2	3	4	5	6	7	8	9	10	11	
Family Xenophthalmidae												
<i>Neoxenophthalmus obscurus</i> (Henderson, 1893) [= <i>Xenophthalmus obscurus</i> ]												+
Family Pinnotheridae												
<i>Pinnotheres boninensis</i> Stimpson, 1858					+							
<i>Pinnotheres obscurus</i> Stimpson, 1858					+							+
<i>Pinnotheres</i> sp.												+
Phylum MOLLUSCA												
Class POLYPLACOPHORA												
Order CHITONIDA												
Family Chitonidae												
<i>Liolophura</i> sp.					+							
<i>Lucilina lamellosa</i> (Quoy et Gaimard, 1835)					+							
<i>Lucilina tenuicostata</i> Sirenko, 2016												+
<i>Lucilina</i> sp.												+
<i>Onithochiton helena vietnamensis</i> Sirenko, 2016												+
<i>Onithochiton stracki</i> Sirenko, 2012					+							
<i>Rhyssoplax pulcherrimus</i> (Sowerby II, 1842)					+							
<i>Tonicia</i> sp.					+							
Family Acanthochitonidae												
<i>Acanthochitona britayevi</i> Sirenko, 2012					+							
<i>Acanthochitona fascicularis</i> (Linnaeus, 1767) [= <i>A. communis</i> ]					+							
<i>Acanthochitona</i> sp.					+							
<i>Notoplax</i> spp.				+							+	
Family Cryptoplacidae												
<i>Cryptoplax larvaeformis</i> (Burrow, 1815)					+							
<i>Cryptoplax</i> spp.					+						+	
Family Ischnochitonidae												
<i>Ischnochiton</i> sp.					+							
Family Mopaliidae												
* <i>Plaxiphora bucklandnicksi</i> Sirenko, 2012					+							
<i>Plaxiphora</i> spp.				+							+	
Class GASTROPODA												
Clade PATELLOGASTROPODA												
Family Patellidae												
<i>Scutellastra flexuosa</i> (Quoy et Gaimard, 1834) [= <i>Patella flexuosa flexuosa</i> ]					+							
<i>Scutellastra optima</i> (Pilsbry, 1927) [= <i>Patella stellaeformis optima</i> ]					+							
Family Acmaeidae												
<i>Acmaea</i> sp.												+
Family Lottiidae												
<i>Lottia pelta</i> (Rathke, 1833) [= <i>Acmaea pelta</i> ]												+
<i>Patelloida saccharina</i> (Linnaeus, 1758) [= <i>Acmaea saccharina</i> ]	+	+		+	+							+
<i>Patelloida striata</i> Quoy et Gaimard, 1834					+							
Lottiidae gen. sp.					+							
Family Nacellidae												
<i>Cellana rota</i> (Gmelin, 1791) [= <i>C. variegata</i> , <i>Patella aster</i> ]					+	+						
<i>Cellana testudinaria</i> (Linnaeus, 1758) [= <i>Patella testudinaria</i> ]	+	+	+		+			+	+	+		



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Cellana toreuma</i> (Reeve, 1854)	+				+		+	+			
<i>Cellana vitiensis</i> Powell, 1973 [= <i>C. sagittata</i> ]								+	+		
<i>Cellana</i> spp. [as <i>C. amussitata</i> ]	+				+						+
Clade VETIGASTROPODA											
Family Fissurellidae											
<i>Diodora quadriradiata</i> (Reeve, 1850)				+							
<i>Scutus anatinus</i> (Donovan, 1820) [= <i>S. australis</i> ]						+					
<i>Scutus antipodes</i> Montfort, 1810 [= <i>S. elongatus</i> ]						+			+		
<i>Scutus unguis</i> (Linnaeus, 1758)						+					
Family Haliotidae											
<i>Haliotis asinina</i> Linnaeus, 1758	+					+					
<i>Haliotis diversicolor</i> Reeve, 1846											+
<i>Haliotis ovina</i> Gmelin, 1791	+					+					+
<i>Haliotis varia</i> Linnaeus, 1758						+					
Family Tegulidae											
<i>Chlorostoma xanthostigma</i> (A. Adams, 1853) [= <i>Tegula xanthostigma</i> ]											+
<i>Tectus conus</i> (Gmelin, 1791)							+				
* <i>Tectus niloticus</i> (Linnaeus, 1767) [= <i>Trochus niloticus</i> ]						+	+				
<i>Tectus pyramis</i> (Born, 1778)	+					+					
<i>Tegula rustica colliculus</i> Sowerby III, 1913									+		
Family Trochidae											
<i>Clanculus denticulatus</i> (Gray, 1827)	+										
<i>Clanculus edentulus</i> (A. Adams, 1853) [= <i>Euchelus edentulus</i> ]	+					+					
<i>Clanculus samoensis</i> (Hombron et Jacquinot, 1848) [= <i>C. atropurpureus</i> ]	+					+					
<i>Clanculus</i> sp.						+					
<i>Eurytrochus danieli</i> (Crosse, 1862)						+					
<i>Monodonta canalifera</i> Lamarck, 1816			+								
<i>Monodonta labio</i> (Linnaeus, 1758)	+				+	+		+	+		+
<i>Monodonta</i> sp.						+					
<i>Trochus intextus</i> Kiener, 1850 [= <i>T. sandwichiensis</i> ]						+					+
<i>Trochus maculatus</i> Linnaeus, 1758	+				+	+	+	+	+	+	+
<i>Umboonium thomasi</i> (Crosse, 1863)											+
<i>Umboonium vestiarius</i> (Linnaeus, 1758)						+					
<i>Umboonium</i> sp.											+
Family Turbinidae											
<i>Angaria delphinus</i> (Linnaeus, 1758)	+					+					
<i>Astralium rhodostomum</i> (Lamarck, 1822) [= <i>Astraea rhodostoma</i> ]						+					
<i>Astralium</i> sp.						+					
<i>Lunella coronata</i> (Gmelin, 1791) [= <i>Turbo coronatus</i> ]											+
<i>Lunella granulata</i> (Gmelin, 1791)											+
<i>Turbo bruneus</i> (Röding, 1798)	+					+					
<i>Turbo chrysostrabus</i> Linnaeus, 1758						+					
<i>Turbo</i> sp.									+		

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Clade NERITIMORPHA											
Family Neritidae											
<i>Clithon faba</i> (Sowerby I, 1836)					+						
<i>Clithon oualaniense</i> (Lesson, 1831) [= <i>Theodoxus oualaniense</i> ]					+						
<i>Nerita albicilla</i> Linnaeus, 1758	+	+		+	+	+	+	+	+	+	
<i>Nerita balteata</i> Reeve, 1855 [= <i>N. lineata</i> ]	+	+		+	+						+
<i>Nerita chamaeleon</i> Linnaeus, 1758					+						
<i>Nerita costata</i> Gmelin, 1791		+		+	+						
<i>Nerita insculpta</i> Récluz, 1841						+	+	+			+
<i>Nerita plicata</i> Linnaeus, 1758					+	+	+	+			
<i>Nerita polita</i> Linnaeus, 1758					+						
<i>Nerita signata</i> Lamarck, 1822 [= <i>N. squata</i> ]											+
<i>Nerita squamulata</i> Le Guillou, 1841					+						
<i>Nerita undata</i> Linnaeus, 1758					+						
<i>Nerita</i> spp.					+		+				+
<i>Neritina auriculata</i> Lamarck, 1816					+						
<i>Neritina cornucopia</i> (Benson, 1836)					+						
<i>Neritina violacea</i> (Gmelin, 1791) [= <i>N. crepidularia</i> ]											+
<i>Neritina</i> spp.					+						+
<i>Theodoxus</i> sp.					+						
Clade CAENOGASTROPODA											
Family Cerithiidae											
<i>Cerithium citrinum</i> Sowerby II, 1855		+		+							
<i>Cerithium columna</i> Sowerby I, 1834					+	+		+			
<i>Cerithium coralium</i> Kiener, 1841 [= <i>C. ustum</i> ]					+						
<i>Cerithium punctatum</i> Bruguière, 1792 [= <i>C. piperitum</i> ]		+		+	+						
<i>Cerithium traillii</i> Sowerby II, 1855 [= <i>Clypeomorus traillii</i> ]					+						
<i>Cerithium zonatum</i> (Wood, 1828) [= <i>C. gentile</i> ]					+						
<i>Cerithium</i> sp.					+						
<i>Clypeomorus batillariaeformis</i> Habe et Kosuge, 1966 [= <i>C. moniliferum</i> , <i>Cerithium moniliferum</i> , <i>C. obscurum</i> ]		+			+						+
<i>Clypeomorus bifasciata</i> (Sowerby II, 1855) [= <i>C. morus</i> , <i>Cerithium morus</i> , <i>C. gemmulatum</i> ]			+	+	+	+	+	+			+
<i>Clypeomorus inflata</i> (Quoy et Gaimard, 1834)					+						
<i>Clypeomorus irrorata</i> (Gould, 1849) [= <i>Cerithium repletulum</i> ]					+						
<i>Clypeomorus nympha</i> Houbrick, 1985 [= <i>Cerithium sejunctum</i> ]											+
<i>Clypeomorus pellucida</i> (Hombron et Jacquinet, 1852) [= <i>Cerithium patulum</i> ]					+						
<i>Clypeomorus petrosa chemnitziana</i> (Pilsbry, 1901) [= <i>Cerithium chemnitzianum</i> ]					+						
<i>Clypeomorus subbrevicula</i> (Oöstingh, 1925) [= <i>Cerithium subbreviculum</i> ]					+						
<i>Clypeomorus</i> sp.					+						
<i>Rhinoclavis articulata</i> (A. Adams et Reeve, 1850)			+		+						
<i>Rhinoclavis aspera</i> (Linnaeus, 1758)					+						
<i>Rhinoclavis sinensis</i> (Gmelin, 1791) [= <i>Cerithium sinensis</i> ]					+						+
<i>Rhinoclavis vertagus</i> (Linnaeus, 1767)					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Modulidae											
<i>Indomodulus tectum</i> (Gmelin, 1791)					+						
Family Batillariidae											
<i>Batillaria australis</i> (Quoy et Gaimard, 1834)					+						+
<i>Batillaria sordida</i> (Gmelin, 1791) [= <i>Cerithium bornii</i> , as <i>Clypeomorus bornei</i> ]											+
<i>Batillaria zonalis</i> (Bruguière, 1792)					+						+
Family Planaxidae											
<i>Planaxis sulcatus</i> (Born, 1778)		+	+		+	+	+	+	+	+	+
<i>Supplanaxis niger</i> (Quoy et Gaimard, 1833) [= <i>Planaxis niger</i> ]		+			+						
Family Potamididae											
<i>Cerithidea quoyii</i> (Hombron et Jacquinot, 1848)					+						
<i>Cerithidea sinensis</i> (Philippi, 1848)					+						
<i>Cerithideopsilla cingulata</i> (Gmelin, 1791) [= <i>Cerithidea cingulata</i> ]					+						+
<i>Cerithideopsilla djadjariensis</i> (K. Martin, 1899)					+						
<i>Cerithideopsilla microptera</i> (Kiener, 1842)					+						
<i>Terebralia palustris</i> (Linnaeus, 1767)					+						
<i>Terebralia sulcata</i> (Born, 1774)					+						+
Family Thiaridae											
<i>Sermyla riqueti</i> (Grateloup, 1840)					+						
Family Turritellidae											
<i>Neobaustator fortilirata</i> (Sowerby III, 1914) [= <i>Turritella fortilirata</i> ]											+
<i>Turritella bacillum</i> Kiener, 1844					+						+
Family Calyptraeidae											
<i>Ergaea walshi</i> (Reeve, 1859) [= <i>Crepidula scabies</i> ]					+						
Family Cypraeidae											
<i>Cypraea tigris</i> Linnaeus, 1758					+						
<i>Cypraea</i> spp.					+		+				
<i>Erosaria erosa</i> (Linnaeus, 1758)					+						
<i>Erosaria helvola</i> (Linnaeus, 1758)					+	+					
<i>Erosaria lamarckii</i> (Gray, 1825)					+						
<i>Erosaria poraria</i> (Linnaeus, 1758)					+						
<i>Erronea erronea</i> (Linnaeus, 1758)					+						
<i>Luria isabella</i> (Linnaeus, 1758)					+						
<i>Lyncina carneola</i> (Linnaeus, 1758)					+	+					
<i>Lyncina vitellus</i> (Linnaeus, 1758) [= <i>Cypraea vitellus</i> ]					+						
* <i>Mauritia arabica</i> (Linnaeus, 1758) [= <i>Monetaria arabica</i> , <i>Cypraea arabica</i> ]		+			+	+	+				+
<i>Mauritia scurra</i> (Gmelin, 1791) [as <i>M. amarata</i> ]					+						
<i>Monetaria annulus</i> (Linnaeus, 1758) [= <i>Cypraea annulus</i> ]					+	+				+	
<i>Monetaria caputserpentis</i> (Linnaeus, 1758) [= <i>Erosaria caputserpentis</i> ]					+	+					
<i>Monetaria moneta</i> (Linnaeus, 1758)					+	+	+			+	
<i>Purpuradusta fimbriata</i> (Gmelin, 1791) [= <i>Palmadusta fimbriata</i> ]					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Ovulidae											
<i>Ovula ovum</i> (Linnaeus, 1758) [= <i>Amphiperas ovum</i> ]					+						
Family Littorinidae											
<i>Echinolittorina feejeensis</i> (Reeve, 1857)					+						
<i>Echinolittorina melanacme</i> (E.A. Smith, 1876) [= <i>Littorina melanacme</i> ]											+
<i>Echinolittorina miliaris</i> (Quoy et Gaimard, 1833) [= <i>Nodilittorina granularis</i> , <i>Littorina granularis</i> , <i>Tectarius granularis</i> ]					+	+					+
<i>Echinolittorina millegrana</i> (Philippi, 1848) [= <i>Nodilittorina millegrana</i> ]		+	+	+	+	+	+	+			
<i>Echinolittorina novaezelandiae</i> (Reeve, 1857) [= <i>Tectarius novae-zelandiae</i> ]						+					
<i>Echinolittorina pascua</i> (Rosewater, 1970)						+					
<i>Echinolittorina vidua</i> (Gould, 1859) [= <i>Littorina ventricosa</i> ]		+				+					
<i>Littoraria arduiniiana</i> (Heude, 1885)						+					
<i>Littoraria articulata</i> (Philippi, 1846)						+					
<i>Littoraria carinifera</i> (Menke, 1830)						+					
<i>Littoraria intermedia</i> (Philippi, 1846)						+					
<i>Littoraria lutea</i> (Philippi, 1847)						+					
<i>Littoraria melanostoma</i> (Gray, 1839) [= <i>Littorina melanostoma</i> , <i>Mélarbaphe melanostoma</i> ]						+					+
<i>Littoraria pallescens</i> (Philippi, 1846)						+					
<i>Littoraria scabra</i> (Linnaeus, 1758) [= <i>Littorina scabra</i> ]		+				+	+	+	+		+
<i>Littoraria undulata</i> (Gray, 1839) [= <i>Littorina undulata</i> ]						+					
<i>Littorinopsis</i> sp.											+
<i>Nodilittorina pyramidalis</i> (Quoy et Gaimard, 1833)					+	+					
<i>Peasiella</i> sp.						+					
<i>Tectarius antonii</i> (Philippi, 1846) [= <i>Tectininus nodulosus</i> ]		+	+		+	+					
<i>Tectarius</i> spp.						+					+
Family Tonnidae											
<i>Tonna sulcosa</i> (Born, 1778)						+					
Family Naticidae											
<i>Mammilla melanostoma</i> (Gmelin, 1791) [= <i>Polinices melanostoma</i> ]						+					
<i>Natica vitellus</i> (Linnaeus, 1758)						+					
<i>Natica</i> spp.						+					+
<i>Notocochlis gualteriana</i> (Récluz, 1844)						+					
<i>Polinices flemingianus</i> (Récluz, 1844)						+					
<i>Polinices mammilla</i> (Linnaeus, 1758) [= <i>P. tumidus</i> ]		+				+					
<i>Tanea areolata</i> (Récluz, 1844) [= <i>Natica areolata</i> ]						+					
Naticidae gen. sp.						+					
Family Assimineidae											
<i>Assiminea</i> spp.						+					+
<i>Metassiminea philippinica</i> (O. Böettger, 1887)						+					
Assimineidae gen. sp.						+					

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Stenothyridae											
<i>Stenothyra</i> sp.					+						
Family Strombidae											
<i>Canarium mutabile</i> (Swainson, 1821) [= <i>Strombus mutabilis</i> ]						+		+			
<i>Canarium urceus</i> (Linnaeus, 1758) [= <i>Strombus urceus</i> ]					+						
<i>Conomurex lubuanus</i> (Linnaeus, 1758) [= <i>Strombus lubuanus</i> ]					+						
<i>Laevistrombus turturella</i> (Röding, 1798) [= <i>Strombus isabella</i> ]										+	
* <i>Lambis lambis</i> (Linnaeus, 1758) [= <i>Pterocera lambis</i> ]				+	+						
<i>Lambis scorpius</i> (Linnaeus, 1758) [= <i>Pterocera scorpius</i> ]				+							
<i>Lambis</i> sp.								+			
<i>Strombus</i> spp.					+					+	
Family Bursidae											
<i>Bursa asperrima</i> Dunker, 1862					+						
<i>Bursa bufonia</i> (Gmelin, 1791)					+						
<i>Bursa granulata</i> (Röding, 1798) [= <i>B. granifera</i> ]					+						
<i>Bursa</i> sp.					+						
Family Ranellidae											
<i>Cymatium</i> sp.					+						
<i>Gutturium muricinum</i> (Röding, 1798) [= <i>Cymatium muricinum</i> ]					+						
<i>Gyrineum bituberculare</i> (Lamarck 1816) [as <i>Argobuccinum bituberculare</i> ]					+						
<i>Monoplex gemmatus</i> (Reeve, 1844) [= <i>Cymatium gemmatum</i> , <i>Septa gemmata</i> ]					+						
<i>Monoplex pilearis</i> (Linnaeus, 1758) [= <i>Cymatium pileare</i> , as <i>Lampusia pileare</i> ]					+						
<i>Monoplex vespaceus</i> (Lamarck, 1822) [= <i>Cymatium vespaceum</i> , as <i>Turritriton vespaceum</i> ]					+						
<i>Reticutriton pfeifferianus</i> (Reeve, 1844) [= <i>Cymatium pfeifferianum</i> ]							+				
Family Personidae											
<i>Distorsio anus</i> (Linnaeus, 1758)					+						
Family Epitoniidae											
<i>Epitonium</i> sp.					+						
Family Hipponicidae											
<i>Antisabia foliacea</i> (Quoy et Gaimard, 1835)					+						
<i>Sabia conica</i> (Schumacher, 1817) [= <i>Hipponix conicus</i> ]				+	+						
Family Vermetidae											
<i>Dendropoma corrodens</i> (d'Orbigny, 1841) [= <i>D. annulatus</i> ]					+						
<i>Dendropoma planorbis</i> (Dunker, 1860) [= <i>Vermetus planorbis</i> , as <i>Spirolyphus planorbis</i> ]		+	+		+			+			
<i>Dendropoma</i> spp.		+			+						
<i>Thylacodes</i> sp. [= <i>Serpulorbis</i> sp.]					+						
<i>Vermetus tokyoensis</i> (Pilsbry, 1895) [= <i>Macrophragmus tokyoensis</i> ]				+				+			
Family Olividae											
<i>Oliwa oliwa</i> (Linnaeus, 1758)					+						
<i>Oliwa</i> sp.					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Terebridae											
<i>Terebra</i> sp.					+						
Family Buccinidae											
<i>Cantharus</i> sp. [as <i>C. punctulatus</i> ]					+						
<i>Engina lineata</i> (Reeve, 1846)					+						
<i>Engina mendicaria</i> (Linnaeus, 1758)					+						
<i>Pollia fumosa</i> (Dillwyn, 1817) [= <i>Cantharus fumosus</i> ]	+				+	+		+			
<i>Pollia undosa</i> (Linnaeus, 1758) [= <i>Cantharus undosus</i> ]					+	+	+	+			
Family Columbellidae											
<i>Euplica scripta</i> (Lamarck, 1822) [= <i>E. versicolor</i> , <i>Columbella versicolor</i> ]	+			+	+						
<i>Euplica</i> sp.					+						
<i>Mitrella essingtonensis</i> (Reeve, 1859) [= <i>Pyrene essingtonensis</i> , <i>Columbella essingtonensis</i> ]	+										
<i>Mitrella puella</i> (Sowerby I, 1844) [= <i>Pyrene iodostoma</i> , <i>Columbella iodostoma</i> ]	+										
<i>Mitrella scripta</i> (Linnaeus, 1758) [= <i>Pyrene scripta</i> ]					+	+					
<i>Pardalinops testudinaria</i> (Link, 1807) [= <i>Pyrene pardarlina</i> , <i>P. testudinaria</i> , <i>Columbella pardalina</i> ]				+	+	+					
<i>Pictocolumbella ocellata</i> (Link, 1807) [= <i>Pyrene ocellata</i> , <i>Columbella fulgurans</i> , as <i>Pyrene fulgurans</i> ]		+		+	+	+		+			
<i>Pyrene punctata</i> (Bruguière, 1789) [= <i>P. discors</i> , as <i>Columbella discors</i> ]					+	+					
<i>Pyrene splendidula</i> (Sowerby I, 1844)	+										
<i>Pyrene</i> sp.					+						
<i>Zemitrella sulcata</i> (Hutton, 1873) [= <i>Columbella varians</i> ]					+						
Family Fascioliariidae											
<i>Fusinus filiosus</i> (Schubert et Wagner, 1829) [= <i>Latirus filiosus</i> ]	+										
<i>Latirolagena smaragdulus</i> (Linnaeus, 1758)				+							
<i>Latirus barclayi</i> (Reeve, 1847)							+				
<i>Latirus polygonus</i> (Gmelin, 1791)						+					
<i>Latirus</i> spp. [= <i>Lathyrus</i> sp.]						+	+		+		
<i>Nodolatirus nodatus</i> (Gmelin, 1791) [= <i>Latirus nodatus</i> ]						+					
<i>Peristernia nassatula</i> (Lamarck, 1822)						+					
<i>Peristernia ustulata</i> (Reeve, 1847)					+						
<i>Turrilatirus turritus</i> (Gmelin, 1791) [= <i>Latirus turritus</i> ]						+					
Family Melongenidae											
<i>Volegalea cochlidium</i> (Linnaeus, 1758) [= <i>Pugilina pugilina</i> , as <i>P. cochlidium</i> , <i>Galeodes pugilina</i> ]					+						+
Family Nassariidae											
<i>Cyclope neritea</i> (Linnaeus, 1758) [= <i>Nassa nerita</i> ]					+						
<i>Nassarius bellulus</i> (A. Adams, 1852)											+
<i>Nassarius gaudiosus</i> (Hinds, 1844)					+						
<i>Nassarius graphiterus</i> (Hombron et Jacquinot, 1848) [= <i>N. luridus</i> ]					+						
<i>Nassarius hirtus</i> (Kiener, 1834)											+
<i>Nassarius olivaceus</i> (Bruguière, 1789) [= <i>N. taeniis</i> ]					+						+

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Nassarius pullus</i> (Linnaeus, 1758) [= <i>N. thersites</i> ]					+						+
<i>Nassarius</i> spp. [= <i>Nassa</i> sp., <i>Alectrion</i> sp., <i>Hima</i> sp., as <i>Nassarius corculata</i> , <i>N. pertus</i> ]					+						+
Family Muricidae											
<i>Chicoreus brunneus</i> (Link, 1807) [= <i>Murex adustus</i> ]					+						
<i>Chicoreus capucinus</i> (Lamarck, 1822) [= <i>Murex capucinus</i> ]					+						
<i>Chicoreus microphyllus</i> (Lamarck, 1816) [= <i>Murex microphyllus</i> ]					+						
<i>Chicoreus</i> sp.					+						
<i>Coralliophila bulbiformis</i> (T.A. Conrad, 1837) [= <i>C. gibbosa</i> ]					+						
<i>Coralliophila monodonta</i> (Blainville, 1832) [= <i>C. madreporarum</i> , <i>Quoyula madreporarum</i> ]					+						
<i>Coralliophila violacea</i> (Kiener, 1836) [= <i>C. neritoidea</i> ]					+						
<i>Coralliophila</i> sp.					+						
<i>Drupa morum</i> Röding, 1798			+	+	+						
<i>Drupa nodus</i> Gmelin, 1791					+	+					
<i>Drupa ricinus</i> (Linnaeus, 1758) [= <i>Ricinula arachnoides</i> ]					+						
<i>Drupa rubusidaeus</i> Röding 1798					+						
<i>Drupa</i> spp. [as <i>D. muricoides</i> ]					+	+					
<i>Drupella cornus</i> (Röding, 1798) [= <i>Drupa elata</i> ]					+						
<i>Drupella margariticola</i> (Broderip in Broderip et Sowerby, 1833) [= <i>Cronia margariticola</i> , <i>Drupa margariticola</i> , <i>Morula margariticola</i> , as <i>M. undata</i> ]	+				+	+	+	+	+		+
<i>Drupella rugosa</i> (Born, 1778) [= <i>Murex rugosa</i> , <i>Thais rugosa</i> , <i>Morula concatenata</i> , <i>Drupa concatenata</i> ]					+	+		+	+		+
<i>Drupina grossularia</i> (Röding, 1798) [= <i>Drupa grossularia</i> ]					+						
<i>Ergalatax</i> sp.					+						
<i>Indothais blanfordi</i> (Melvill, 1893) [= <i>Thais (Thaisella) blanfordi</i> ]											+
<i>Indothais gradata</i> (Jonas, 1846) [= <i>Thais (Thaisella) gradata</i> ]					+						
<i>Indothais javanica</i> (Philippi, 1848) [= <i>Thais (Thaisella) javanica</i> ]					+						
<i>Magilus antiquus</i> Montfort, 1810 [= <i>M. maillardi</i> , as <i>Coralliobia maillardi</i> ]					+						
<i>Mancinella alouina</i> (Röding, 1798) [= <i>Thais mancinella</i> ]			+		+			+	+		
<i>Mancinella armigera</i> Link, 1807 [= <i>Thais armigera</i> ]			+		+						
<i>Mancinella echinata</i> (Blainville, 1832) [= <i>Thais echinata</i> ]					+						
<i>Mancinella echinulata</i> (Lamarck, 1822) [= <i>Thais echinulata</i> ]	+				+						
<i>Menathais tuberosa</i> (Röding, 1798) [= <i>Thais pica</i> , <i>Th. tuberosa</i> ]			+	+	+						
<i>Morulaanaxares</i> (Kiener, 1836) [= <i>Drupaanaxares</i> ]					+						
<i>Morula aspera</i> (Lamarck, 1816)					+						
<i>Morula biconica</i> (Blainville, 1832) [= <i>Drupa biconica</i> ]					+						
<i>Murex pecten</i> Lightfoot, 1786 [= <i>M. triremis</i> ]					+						+
<i>Murex</i> spp.					+						+
<i>Muricodrupa fiscella</i> (Gmelin, 1791) [= <i>Drupa fiscella</i> , <i>D. decussata</i> , <i>Morula fiscella</i> , <i>Cronia fiscella</i> , as <i>C. decussata</i> ]					+						+
<i>Nassa sarta</i> (Bruguière, 1789)					+						
<i>Nassa</i> sp.					+						
<i>Oppomorus purpureocinctus</i> (Preston, 1909) [= <i>Engina purpureocincta</i> ]					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Pascula ochrostoma</i> (Blainville, 1832) [= <i>Drupa ochrostoma</i> ]					+						
<i>Purpura persica</i> (Linnaeus, 1758) [= <i>P. rudolphi</i> , <i>Thais rudolphi</i> ]					+						
<i>Reishia clavigera</i> (Küster, 1860) [= <i>Thais clavigera</i> ]											+
<i>Reishia luteostoma</i> (Holten, 1803) [= <i>Thais luteostoma</i> , as <i>Purpura luteostoma</i> ]		+	+		+						+
<i>Semiricinula muricina</i> (Blainville, 1832) [= <i>Cronia muricina</i> ]					+						
<i>Semiricinula turbinoides</i> (Blainville, 1832)					+						
<i>Tenguella granulata</i> (Duclos, 1832) [= <i>Morula granulata</i> , <i>Drupa granulata</i> , <i>D. tuberculata</i> ]					+	+	+	+	+		+
<i>Tenguella musivoa</i> (Kiener, 1835) [= <i>Morula musivoa</i> , as <i>Drupa musivoa</i> ]		+			+		+				+
<i>Thais</i> sp.					+						
<i>Thalessa aculeata</i> (Deshayes, 1844) [= <i>Thais aculeata</i> ]		+			+	+	+				
Family Costellariidae											
<i>Vexillum rugosum</i> (Gmelin, 1791)					+						
<i>Vexillum virgo</i> (Linnaeus, 1767) [= <i>V. cruentatum</i> ]					+						
Family Mitridae											
<i>Mitra ambigua</i> Swainson, 1829					+						
<i>Mitra chrysalis</i> Reeve, 1844					+						
<i>Mitra ferruginea</i> Lamarck, 1811					+						
<i>Mitra fraga</i> Quoy et Gaimard, 1833					+						
<i>Mitra litterata</i> Lamarck, 1811 [= <i>Strigatella litterata</i> ]					+						
<i>Mitra paupercula</i> (Linnaeus, 1758) [= <i>M. zebra</i> ]					+						
<i>Mitra scutulata</i> (Gmelin, 1791) [= <i>Strigatella scutulata</i> ]			+		+						
<i>Mitra</i> spp.					+						+
Family Pseudomelatomidae											
<i>Inquisitor varicosa</i> (Reeve, 1843)				+							
Family Turbinellidae											
<i>Vasum turbinellus</i> (Linnaeus, 1758)					+	+					
Family Volutidae											
<i>Voluta</i> sp.					+						
Family Conidae											
<i>Conus arenatus</i> Hwass in Bruguière, 1792					+						
<i>Conus capitaneus</i> Linnaeus, 1758					+						
<i>Conus chaldaeus</i> (Röding, 1798)					+	+					
<i>Conus consors</i> Sowerby I, 1833					+						
<i>Conus coronatus</i> Gmelin, 1791					+						
<i>Conus distans</i> Hwass in Bruguière, 1792					+						
<i>Conus ebraeus</i> Linnaeus, 1758					+	+	+		+		
<i>Conus eburneus</i> Hwass in Bruguière, 1792					+						
<i>Conus flavidus</i> Lamarck, 1810					+	+			+		
<i>Conus lividus</i> Hwass in Bruguière, 1792					+	+	+				
<i>Conus marmoreus</i> Linnaeus, 1758					+						
<i>Conus miles</i> Linnaeus, 1758					+						
<i>Conus muriculatus</i> Sowerby I, 1833 [= <i>C. sugillatus</i> ]					+						
<i>Conus musicus</i> Hwass in Bruguière, 1792 [= <i>C. ceylanensis</i> ]					+						



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Conus nussatella</i> Linnaeus, 1758					+						
<i>Conus pulicarius</i> Hwass in Bruguière, 1792					+						
<i>Conus rattus</i> Hwass in Bruguière, 1792					+						
<i>Conus sponsalis</i> Hwass in Bruguière, 1792				+	+						
<i>Conus striatus</i> Linnaeus, 1758					+						
<i>Conus textile</i> Linnaeus, 1758					+						
<i>Conus</i> spp.				+	+		+				
Family Eulimidae											
<i>Eulima</i> sp.					+						
<i>Melanella soliduloides</i> (Habe, 1951) [= <i>Balcis soliduloides</i> ]					+						
Family Triphoridae											
<i>Mastonia rubra</i> (Hinds, 1843)		+			+						
<i>Mastonia</i> sp.					+						
<i>Strobiligera inflata</i> (Watson, 1880) [= <i>Cerithium inflatum</i> ]					+						
<i>Triphora</i> sp. [= <i>Triphoris</i> sp.]					+						
Clade HETEROBRANCHIA											
Family Pyramidellidae											
<i>Milda</i> sp.					+						
<i>Otopleura auriscati</i> (Holten, 1802)					+						
<i>Pyramidella</i> sp.		+									
Pyramidellidae gen. sp.					+						
Family Siphonariidae											
<i>Siphonaria atra</i> Quoy et Gaimard, 1833 [= <i>S. atra</i> var. <i>coreensis</i> ]					+						
<i>Siphonaria corrugata</i> Reeve, 1856					+						
<i>Siphonaria japonica</i> (Donovan, 1824) [= <i>S. cochleariformis</i> ]					+						
<i>Siphonaria sirius</i> Pilsbry, 1894					+						
<i>Siphonaria subatra</i> Pilsbry, 1904					+						
<i>Siphonaria</i> spp.		+			+					+	
Family Bullidae											
<i>Bulla</i> sp.					+						
Family Haminoeidae											
<i>Atys naucum</i> (Linnaeus, 1758)					+						
<i>Phanerophthalmus smaragdinus</i> (Rüppel et Leuckart, 1828)					+						
Family Aplysiidae											
<i>Aplysia</i> spp.					+	+					
Family Plakobranchidae											
<i>Elysia pusilla</i> (Bergh, 1872)					+						
<i>Elysia</i> sp.					+						
Family Bornellidae											
<i>Bornella stellifer</i> (A. Adams et Reeve in A. Adams, 1848) [= <i>B. arborescens</i> , <i>B. digitata</i> ]					+						
Family Cadlinidae											
<i>Aldisa</i> sp. [as <i>A. nhatrangensis</i> ]					+						
Family Chromodorididae											
<i>Chromodoris quadricolor</i> (Rüppel et Leuckart, 1830) [= <i>Glossodoris quadricolor</i> ]					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Dendrodorididae											
<i>Dendrodoris elongata</i> Baba, 1936					+						
Family Discodorididae											
<i>Platydoris cruenta</i> (Quoy et Gaimard, 1832)					+						
Family Facelinidae											
<i>Pteraeolidia ianthina</i> (Angas, 1864)					+						
Family Hexabranchidae											
<i>Hexabranchus sanguineus</i> (Rüppell et Leuckart, 1830) [= <i>H. marginatus</i> ]					+						
Family Ellobiidae											
<i>Cassidula nucleus</i> (Gmelin, 1791)					+						
<i>Ellobium chinensis</i> Pfeiffer, 1854											+
<i>Ellobium</i> sp.											+
<i>Laemodonta siamensis</i> (Morelet, 1875)					+						
<i>Pythia</i> sp.					+						
Family Onchidiidae											
<i>Onchidium</i> spp.					+						+
<i>Peronia peronii</i> (Cuvier, 1804) [= <i>Onchidium peronii</i> ]					+						
Onchidiidae gen. spp.					+						+
Class BIVALVIA											
Order ARCIDA											
Family Arcidae											
<i>Acar plicata</i> (Dillwyn, 1817) [= <i>Arca plicata</i> ]					+						
<i>Anadara antiquata</i> (Linnaeus, 1758) [= <i>Arca antiquata</i> ]					+						
<i>Anadara binakayanensis</i> (Faustino, 1932)											+
<i>Anadara granosa</i> (Linnaeus, 1758)											+
<i>Anadara gubernaculum</i> (Reeve, 1844)					+						+
<i>Anadara</i> cf. <i>satowi</i> (Dunker, 1882)											+
<i>Anadara troscheli</i> (Dunker, 1882)											+
<i>Anadara</i> sp.											+
<i>Arca navicularis</i> Bruguière, 1789 [as <i>Barbatia navicularis</i> ]					+		+				
<i>Arca ventricosa</i> Lamarck, 1819					+						
<i>Arca</i> spp. [as <i>A. subgranulosa</i> , <i>Barbatia imbricata</i> ]					+						+
<i>Barbatia amygdalumtostum</i> (Röding, 1798)					+						
<i>Barbatia cometa</i> (Reeve, 1844) [= <i>Arca cometa</i> ]					+		+				
<i>Barbatia foliata</i> (Forsskål, 1775) [= <i>B. lima</i> , <i>B. nivea</i> , <i>Arca nivea</i> ]					+		+	+			+
<i>Barbatia fusca</i> (Bruguière, 1789) [= <i>B. bicolorata</i> , <i>Arca bicolorata</i> ]					+						
<i>Barbatia virescens</i> (Reeve, 1844)					+						
<i>Barbatia</i> spp.					+						+
<i>Striarca symmetrica</i> (Reeve, 1844)					+						
Order MYTILIDA											
Family Mytilidae											
<i>Adula</i> sp.					+						
<i>Botula cinnamomea</i> (Gmelin, 1791) [= <i>Botulopa silicula</i> ]					+						
<i>Brachidontes mutabilis</i> (Gould, 1861) [= <i>Hormomya mutabilis</i> ]					+		+	+			+
<i>Brachidontes setiger</i> (Dunker, 1857) [= <i>Modiolus setigera</i> ]					+						

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Brachidontes striatulus</i> (Hanley, 1843) [= <i>Modiola striatula</i> ]					+						
<i>Brachidontes</i> sp.											+
<i>Leiosolenus levigatus</i> (Quoy et Gaimard, 1835) [= <i>Lithodomus levigatus</i> , <i>Lithophaga laevigata</i> ]			+		+	+	+	+			+
<i>Leiosolenus lima</i> (Jousseume in Lamy, 1919) [= <i>Lithophaga lima</i> ]					+						
<i>Leiosolenus lischkei</i> M. Huber, 2010 [= <i>Lithophagus curtus</i> , as <i>Lithophaga curta</i> ]					+						
<i>Leiosolenus malaccanus</i> (Reeve, 1857) [= <i>Lithophaga malaccana</i> ]					+		+				
<i>Leiosolenus</i> sp.					+						
<i>Lithophaga caperata</i> (Philippi, 1849) [= <i>L. straminea</i> , <i>L. zitteliana</i> ]					+						
<i>Lithophaga teres</i> (Philippi, 1846)					+						
<i>Modiola</i> sp.					+						
<i>Modiolus auriculatus</i> (Krauss, 1848) [= <i>M. agripetus</i> , <i>Modiola auriculata</i> ]					+		+				
<i>Modiolus philippinarum</i> (Hanley, 1843)					+						
<i>Musculista senhousia</i> (Benson in Cantor, 1842)					+						
<i>Musculus nanus</i> (Dunker, 1857)											+
<i>Perna</i> spp.					+	+		+			
<i>Septifer bilocularis</i> (Linnaeus, 1758)						+		+			
<i>Septifer excisus</i> (Wiegmann, 1837)						+					
<i>Septifer virgatus</i> (Wiegmann, 1837)								+			+
<i>Septifer</i> spp.						+					+
Order PTERIIDA											
Family Pteriidae											
<i>Electroma virens</i> (Lamarck, 1819) [= <i>Avicula georgiana</i> , as <i>Pteria georgiana</i> ]						+					
<i>Pinctada imbricata fucata</i> (Gould, 1850) [= <i>P. fucata</i> ]						+					
<i>Pinctada maculata</i> (Gould, 1850)						+					
<i>Pinctada margaritifera</i> (Linnaeus, 1758)						+		+			
<i>Pinctada martensii</i> (Dunker, 1872)						+					
<i>Pinctada nigra</i> (Gould, 1850)						+					
<i>Pinctada radiata</i> (Leach, 1814) [as <i>Pinctada imbricata radiata</i> ]						+					
<i>Pinctada</i> sp.						+					
<i>Pteria avicular</i> (Holten, 1802) [= <i>P. chinensis</i> ]						+					
<i>Pteria maura</i> (Reeve, 1857) [= <i>P. coturnix</i> ]						+					
<i>Pteria</i> sp.											+
Family Malleidae											
<i>Malleus legumen</i> Reeve, 1858 [= <i>Makoufundus irregularis</i> , as <i>Parimalleus irregularis</i> ]						+					+
<i>Malleus malleus</i> (Linnaeus, 1758)						+					
<i>Malleus regula</i> (Forsskål in Niebuhr, 1775) [= <i>Makoufundus regulus</i> ]						+					
<i>Isognomon australica</i> (Reeve, 1858) [= <i>I. anomioides</i> , <i>Perna anomioides</i> ]						+					
<i>Isognomon ephippium</i> (Linnaeus, 1758) [= <i>Perna cumingii</i> ]						+	+		+		+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
<i>Isognomon isognomum</i> (Linnaeus, 1758) [= <i>I. canina</i> , <i>I. isognomon patibulum</i> , <i>Perna patibulum</i> , <i>P. canina</i> ]					+		+				
<i>Isognomon legumen</i> (Gmelin, 1791) [= <i>Perna linguaeformis</i> ]					+						
<i>Isognomon nucleus</i> (Lamarck, 1819) [= <i>Perna nucleus</i> , <i>P. pectinata</i> , as <i>I. quadrangularis</i> ]					+						
<i>Isognomon perna</i> (Linnaeus, 1767) [= <i>I. sulcata</i> , <i>Perna sulcata</i> ]					+						
<i>Isognomon</i> spp.				+	+		+				
<i>Perna serratula</i> Reeve, 1858 ( <i>nomen dubium</i> ) [as <i>Isognomon serratula</i> ]								+			
Family Pinnidae											
<i>Atrina pectinata</i> (Linnaeus, 1767) [= <i>Pinna pectinata</i> ]					+	+					
<i>Atrina strangei</i> (Reeve, 1858) [= <i>Pinna strangei</i> ]					+						
<i>Atrina vexillum</i> (Born, 1778) [= <i>Pinna nigra</i> , <i>P. vexillum</i> ]					+						
<i>Pinna muricata</i> Linnaeus, 1758 [= <i>P. semicostata</i> ]					+						
<i>Pinna saccata</i> Linnaeus, 1758					+						
<i>Pinna</i> spp. [as <i>Pinna canina</i> ]					+						+
Order OSTREIDA											
Family Ostreidae											
<i>Dendostrea folium</i> (Linnaeus, 1758) [as <i>Dendrostrea foliacea</i> , <i>Ostrea foliolum</i> ]					+						+
<i>Dendostrea sandwicensis</i> (Sowerby II, 1871) [= <i>Ostrea sandwicensis</i> ]					+						
<i>Lopha cristagalli</i> (Linnaeus, 1758) [= <i>Ostrea cristagalli</i> ]					+						
<i>Ostrea denselamellosa</i> Lischke, 1869					+						
<i>Ostrea</i> sp.					+						
<i>Saccostrea cucullata</i> (Born, 1778) [= <i>Ostrea forskali</i> , <i>O. cucullata</i> ]	+	+		+	+						
<i>Saccostrea echinata</i> (Quoy et Gaimard, 1835) [= <i>Ostrea spinosa</i> , <i>O. echinata</i> , as <i>Gryphaea echinata</i> ]			+		+						+
<i>Saccostrea scyphophilla</i> (Peron et Lesueur, 1807) [= <i>S. mordax</i> ]	+		+	+	+	+	+	+	+	+	+
<i>Striostrea margaritacea</i> (Lamarck, 1819) [= <i>Ostrea margaritacea</i> ]					+						
Family Gryphaeidae											
<i>Hyotissa hyotis</i> (Linnaeus, 1758) [= <i>Pycnodonta hyotis</i> ]					+						
Order PECTINIDA											
Family Pectinidae											
<i>Chlamys</i> sp.					+						
<i>Coralichlamys madreporarum</i> (Petit in Sowerby II, 1842) [= <i>Pecten madreporarum</i> ]					+						
<i>Laevichlamys cuneata</i> (Reeve, 1853) [= <i>Pecten irregularis</i> ]					+						
<i>Mimachlamys albolineata</i> (Sowerby II, 1842) [= <i>Pecten albolineatus</i> ]					+						
Family Spondylidae											
<i>Spondylus lamarckii</i> Chenu, 1845					+						
<i>Spondylus sinensis</i> Schreibers, 1793 [= <i>S. ducalis</i> ]					+						
<i>Spondylus squamosus</i> Schreibers, 1793 [= <i>S. cruentus</i> ]					+						
<i>Spondylus tenuispinosus</i> Sowerby II, 1847					+						
<i>Spondylus</i> sp. [as <i>S. acutangulis</i> ]					+						
Family Anomiidae											
<i>Enigmonia aenigmatica</i> (Holten, 1802) [= <i>Anomia aenigmatica</i> ]					+						+

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Placunidae											
<i>Placuna placenta</i> (Linnaeus, 1758)					+						+
<i>Placuna</i> sp.											+
Order LIMIDA											
Family Limidae											
<i>Lima lima</i> (Linnaeus, 1758)					+						
<i>Limaria fragilis</i> (Gmelin, 1791) [= <i>Lima fragilis</i> ]					+						
<i>Limaria perfragilis</i> (Habe et Kosuge, 1966) [as <i>Mantellum fragile</i> ]					+						
Order VENERIDA											
Family Veneridae											
<i>Anomalocardia</i> sp.											+
<i>Anomalodiscus squamosus</i> (Linnaeus, 1758) [= <i>Anomalocardia squamosa</i> , <i>Venus squamosa</i> ]					+						+
<i>Circe</i> spp.					+						+
<i>Cyclina sinensis</i> (Gmelin, 1791)											+
<i>Dosinia exasperata</i> (Philippi, 1847)					+						
<i>Dosinia troscheli</i> Lischke, 1873 [as <i>Phacosoma troscheli</i> ]					+						
<i>Dosinia</i> sp. [as <i>D. sinensis</i> ]											+
<i>Gafrarium dispar</i> (Holten, 1802)					+						
<i>Gafrarium divaricatum</i> (Gmelin, 1791) [= <i>Circe divaricata</i> ]					+						
<i>Gafrarium pectinatum</i> (Linnaeus, 1758) [= <i>G. tumidum</i> , <i>Circe pectinata</i> , <i>C. gibba</i> ]					+						+
<i>Gafrarium</i> sp.											+
<i>Gomphina</i> sp.											+
<i>Irus irus</i> (Linnaeus, 1758) [= <i>Venus macrophylla</i> ]					+						
<i>Irus</i> sp.											+
<i>Meretrix meretrix</i> (Linnaeus, 1758)											+
<i>Periglypta reticulata</i> (Linnaeus, 1758) [= <i>Venus reticulata</i> ]					+						
<i>Pitar sulfureus</i> Pilsbry, 1904					+						
<i>Placamen isabellina</i> (Philippi, 1849) [= <i>Chione isabellina</i> , <i>Clausimella isabellina</i> ]											+
<i>Ruditapes philippinarum</i> (Adams et Reeve, 1850) [= <i>Tapes philippinarum</i> , <i>Venerupis philippinarum</i> ]					+						+
<i>Tapes belcheri</i> Sowerby II, 1852					+						
<i>Tapes literatus</i> (Linnaeus, 1758)											+
<i>Tapes</i> sp.					+						
<i>Venerupis variegata</i> (Sowerby II, 1852) [= <i>Tapes variegata</i> ]					+						+
<i>Venerupis</i> sp.					+						
<i>Venus cassinaeformis</i> (Yokoyama, 1926) [= <i>V. foveolata</i> ]					+						
<i>Venus</i> sp.					+						
Family Trapezidae											
<i>Coralliophaga</i> spp.					+			+			
<i>Neotrapezium sublaevigatum</i> (Lamarck, 1819) [= <i>Trapezium sublaevigatum</i> ]											+
<i>Trapezium bicarinatum</i> (Schumacher, 1817)											+
<i>Trapezium oblongum</i> (Linnaeus, 1758)					+						

Taxa	Location											
	1	2	3	4	5	6	7	8	9	10	11	
Family Glauconomidae												
<i>Glauconome cerea</i> Reeve, 1844 [= <i>Glaucomya cerea</i> ]												+
Family Tellinidae												
<i>Loxoglypta transculpta</i> (Sowerby III, 1915) [as <i>Jactellina transculpta</i> ]					+							
<i>Macoma</i> sp.												+
<i>Tellina carnicolor</i> Hanley, 1846 [= <i>Clathrotellina carnicolor</i> ]					+							
<i>Tellina clathrata</i> Deshayes, 1835 [= <i>Jactellina clathrata</i> ]					+							
<i>Tellina diaphana</i> (Deshayes, 1854)												+
<i>Tellina palatum</i> Iredale, 1929 [= <i>Quidnipagus palatum</i> ]					+							
<i>Tellina remies</i> Linnaeus, 1758 [= <i>Cyclotellina remies</i> ]					+							
<i>Tellina staurella</i> Lamarck, 1818					+							
Family Donacidae												
<i>Donax faba</i> Gmelin, 1791												+
<i>Donax</i> sp.												+
Family Psammobiidae												
<i>Asaphis violascens</i> (Forsskål, 1775) [= <i>A. dichotoma</i> ]					+							
<i>Gari elongata</i> (Lamarck, 1818) [= <i>Psammotaea elongata</i> ]					+							
Family Semelidae												
<i>Semele cordiformis</i> (Holten, 1802) [as <i>S. sinensis</i> ]												+
<i>Semele zebuensis</i> (Hanley, 1844)					+							
Family Cardiidae												
<i>Fragum fragum</i> (Linnaeus, 1758) [= <i>Cardium fragum</i> ]					+							
<i>Vasticardium elongatum enode</i> (Sowerby II, 1840) [= <i>V. enode</i> ]					+							
<i>Vepriocardium</i> sp.					+							
Family Tridacnidae												
* <i>Tridacna crocea</i> Lamarck, 1819					+							
<i>Tridacna maxima</i> (Röding, 1798) [= <i>T. elongata</i> ]					+							
<i>Tridacna squamosa</i> Lamarck, 1819					+							
<i>Tridacna</i> sp.											+	
Family Ungulinidae												
<i>Cycladicama cumingii</i> (Hanley, 1846)					+							
Family Mactridae												
<i>Mactra</i> sp.												+
Family Chamidae												
<i>Chama brassica</i> Reeve, 1847					+							
<i>Chama croceata</i> Lamarck, 1819 [= <i>Ch. imbricata</i> ]					+							
<i>Chama dunkeri</i> Lischke, 1870					+							
<i>Chama macerophylla</i> Gmelin, 1791 [= <i>Ch. lazarus</i> ]					+							
<i>Chama pacifica</i> Broderip, 1835 [as <i>Ch. reflexa</i> ]					+							
<i>Chama</i> sp.					+							
Family Galeommatidae												
<i>Scintilla philippinensis</i> Deshayes, 1856 [= <i>S. reevei</i> ]					+							
Family Lasaeidae												
<i>Kellia</i> sp.												+
<i>Lasaea undulata</i> (Gould, 1861)											+	

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Mesodesmatidae											
<i>Atactodea striata</i> (Gmelin, 1791) [= <i>A. glabrata</i> , <i>Mesodesma glabrata</i> ]					+						
<i>Mesodesma</i> sp. [as <i>M. radiata</i> ]					+						
Order CARDITIDA											
Family Carditidae											
<i>Cardita variegata</i> Bruguière, 1792					+						
<i>Cardites crassicostratus</i> (Sowerby I, 1825) [= <i>Cardita curvieri</i> ]					+						
Order LUCINIDA											
Family Lucinidae											
<i>Codakia punctata</i> (Linnaeus, 1758) [= <i>Lucina punctata</i> ]					+						
<i>Codakia</i> spp.					+					+	
<i>Ctena delicatula</i> (Pilsbry, 1904)					+						
<i>Fimbria soverbii</i> (Reeve, 1842) [= <i>Corbis elegans</i> ]					+						
<i>Gonimyrtea</i> sp. [as <i>G. sajoae</i> ]					+						
<i>Pegophysema bialata</i> (Pilsbry, 1895) [as <i>Anodontia stearnsiana</i> ]					+						
Order MYIDA											
Family Corbulidae											
<i>Anisocorbula</i> sp.					+						
<i>Corbula ovalina</i> Lamarck, 1818 [= <i>Aloidis crassa</i> ]					+					+	
<i>Corbula</i> spp.					+					+	
Family Pholadidae											
<i>Martesia striata</i> (Linnaeus, 1758)					+						
<i>Jouannetia cumingii</i> (Sowerby II, 1849)					+						
<i>Parapholas quadrizonata</i> (Spengler, 1792) [= <i>Pholas quadrizonalis</i> ]					+						
Family Teredinidae											
<i>Dicyathifer mannii</i> (Wright, 1866)											+
<i>Teredo</i> sp.					+						
Order PHOLADOMYIDA											
Family Laternulidae											
<i>Laternula anatina</i> (Linnaeus, 1758)											+
Order uncertain											
Family Solenidae											
<i>Solen</i> sp.											+
Family Gastrochaenidae											
<i>Gastrochaena cuneiformis</i> Spengler, 1783 [= <i>G. gigantea</i> ]					+						
<i>Gastrochaena</i> sp.					+						
<i>Rocellaria</i> sp. [as <i>R. cuneiformis</i> ]					+						
Mollusca incertae sedis											
<i>Lemintina</i> sp.					+						
Phylum BRYOZOA											
Class GYMNOLAEMATA											
Order CTENOSTOMATIDA											
Family Arachnidiidae											
<i>Arachnoidea</i> sp.											+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order CHEILOSTOMATIDA											
Family Bugulidae											
<i>Bugula neritina</i> (Linnaeus, 1758)					+						
<i>Bugulina ditrupae</i> (Busk, 1858) [= <i>Bugula ditrupae</i> ]					+						
Family Phidoloporidae											
<i>Reteporella</i> sp. [= <i>Retepora</i> sp.]					+						
Family Schizoporellidae											
<i>Schizoporella serialis</i> (Heller, 1867) [= <i>S. violacea</i> ]					+						
Family Membraniporidae											
<i>Jellyella tuberculata</i> (Bosc, 1802) [= <i>Membranipora tuberculata</i> ]					+						
Phylum BRACHIOPODA											
Class LINGULATA											
Order LINGULIDA											
Family Lingulidae											
<i>Lingula anatina</i> Lamarck, 1801					+						+
<i>Lingula</i> sp. [as <i>Lingula unguis</i> ]					+						
Phylum ECHINODERMATA											
Class HOLOTHUROIDEA											
Order ASPIDOCHIROTIDA											
Family Holothuriidae											
<i>Actinopyga echinites</i> (Jaeger, 1833)					+						
<i>Actinopyga mauritiana</i> (Quoy et Gaimard, 1834)					+						
<i>Bobadschia vitiensis</i> (Semper, 1868) [= <i>B. tenuissima</i> ]					+						
* <i>Holothuria</i> ( <i>Halodeima</i> ) <i>atra</i> Jaeger, 1833	+				+	+	+	+	+		
* <i>Holothuria</i> ( <i>Halodeima</i> ) <i>edulis</i> Lesson, 1830					+	+					
<i>Holothuria</i> ( <i>Lessonothuria</i> ) <i>pardalis</i> Selenka, 1867					+						
<i>Holothuria</i> ( <i>Mertensiothuria</i> ) <i>hilla</i> Lesson, 1830					+			+	+		
<i>Holothuria</i> ( <i>Mertensiothuria</i> ) <i>leucospilota</i> (Brandt, 1835) [= <i>H. vagabunda</i> , as <i>Halodeima vagabunda</i> , <i>Cucumaria vagabunda</i> ]	+				+	+					+
<i>Holothuria</i> ( <i>Metriatyla</i> ) <i>scabra</i> Jaeger, 1833					+						
<i>Holothuria</i> ( <i>Platyperona</i> ) <i>difficilis</i> Semper, 1868									+	+	
<i>Holothuria</i> ( <i>Selenkothuria</i> ) <i>moebii</i> Ludwig, 1883					+						
<i>Holothuria</i> ( <i>Semperothuria</i> ) <i>cinerascens</i> (Brandt, 1835) [as <i>Halodeima cinerascens</i> ]					+				+		
* <i>Holothuria</i> ( <i>Stauropora</i> ) <i>pervicax</i> Selenka, 1867 [= <i>H. (Mertensiothuria) pervicax</i> ]					+						
<i>Holothuria</i> ( <i>Thymiosycia</i> ) <i>arenicola</i> Semper, 1868					+						
<i>Holothuria</i> ( <i>Thymiosycia</i> ) <i>gracilis</i> Semper, 1868					+						
* <i>Holothuria</i> ( <i>Thymiosycia</i> ) <i>impatiens</i> (Forskål, 1775)					+	+	+	+			
<i>Holothuria</i> spp. [as <i>H. monocaria</i> ]					+				+		
Family Stichopodidae											
<i>Stichopus chloronotus</i> Brandt, 1835					+			+			
<i>Stichopus horrens</i> Selenka, 1867 [= <i>S. variegatus</i> ]					+						



Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Order DENDROCHIROTIDA											
Family Cucumariidae											
<i>Cucumaria frondosa japonica</i> (Semper, 1868) [= <i>C. japonica</i> ]											+
Family Sclerodactylidae											
<i>Afrocucumis africana</i> (Semper, 1867)					+						
<i>Obshimella nhatrangensis</i> Levin et Dao Tan Ho, 1989					+						
Order APODIDA											
Family Chiridotidae											
<i>Chiridota rigida</i> Semper, 1867					+						
<i>Polycheira rufescens</i> (Brandt, 1835)					+					+	
Family Synaptidae											
<i>Anapta</i> sp.					+						
<i>Patinapta</i> sp.					+						
<i>Synapta maculata</i> (Chamisso et Eysenhardt, 1821)					+	+					
<i>Synapta</i> sp.					+						
<i>Synaptula</i> sp.					+						
Class ECHINOIDEA											
Order DIADEMATOIDA											
Family Diadematidae											
* <i>Diadema setosum</i> (Leske, 1778)				+	+	+					+
<i>Echinothrix calamaris</i> (Pallas, 1774)									+		
<i>Echinothrix diadema</i> (Linnaeus, 1758)						+					
<i>Eremopyga debilis</i> Mortensen, 1940					+						
<i>Eremopyga denudata</i> (de Meijere, 1902)					+						
<i>Eremopyga</i> sp.					+						
Order CAMARODONTA											
Family Echinometridae											
<i>Echinometra mathaei</i> (Blainville, 1825)					+						+
<i>Echinostrephus aciculatus</i> A. Agassiz, 1863 [= <i>E. moralis</i> ]								+			
<i>Heterocentrotus mamillatus</i> (Linnaeus, 1758)					+						
Family Toxopneustidae											
<i>Toxopneustes pileolus</i> (Lamarck, 1816)					+	+					
<i>Tripneustes gratilla</i> (Linnaeus, 1758)					+						
<i>Tripneustes ventricosus</i> (Lamarck, 1816)						+					
Family Temnopleuridae											
<i>Mespilia globulus</i> (Linnaeus, 1758)					+						
<i>Salmacis sphaeroides</i> (Linnaeus, 1758)					+						
<i>Temnopleurus toreumaticus</i> (Leske, 1778)											+
Order CIDAROIDA											
Family Cidaridae											
<i>Prionocidaris baculosa</i> (Lamarck, 1816)					+						
Order CLYPEASTEROIDA											
Family Laganidae											
<i>Laganum</i> spp.					+						+
Order SPATANGOIDA											
Family Loveniidae											
Loveniidae gen. sp.					+						

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Class ASTEROIDEA											
Order PAXILLOSIDA											
Family Astropectinidae											
* <i>Astropecten monacanthus</i> Sladen, 1883											+
<i>Astropecten scoparius</i> Müller et Troschel, 1842											+
Order VALVATIDA											
Family Asterinidae											
<i>Aquilonastra batheri</i> (Goto, 1914) [= <i>Asterina batheri</i> ]											+
Family Archasteridae											
<i>Archaster typicus</i> Müller et Troschel, 1840											+
Family Goniasteridae											
<i>Ceramaster japonicus</i> (Sladen, 1889) [= <i>Pentagonaster japonica</i> ]											+
<i>Fromia milleporella</i> (Lamarck, 1816)											+
<i>Fromia monilis</i> (Perrier, 1869)											+
Family Ophidiasteridae											
<i>Leiaster leachi</i> (Gray, 1840) [= <i>L. brevispinus</i> ]											+
<i>Linckia laevigata</i> (Linnaeus, 1758)										+	+
<i>Linckia multifora</i> (Lamarck, 1816)											+
<i>Nardoa frianti</i> Koehler, 1910											+
<i>Nardoa tuberculata</i> Gray, 1840											+
Family Oreasteridae											
<i>Choriaster granulatus</i> Lütken, 1869											+
<i>Protoreaster nodosus</i> (Linnaeus, 1758) [= <i>Oreaster modestus</i> ]											+
Family Solasteridae											
<i>Solaster</i> sp.											+
Order SPINULOSIDA											
Family Echinasteridae											
<i>Echinaster luzonicus</i> (Gray, 1840)											+
<i>Echinaster</i> sp.											+
Class OPHIUROIDEA											
Order OPHIURIDA											
Family Ophiactidae											
<i>Ophiactis savignyi</i> (Müller et Troschel, 1842)											+
Family Ophiocomidae											
<i>Ophiarthrum elegans</i> Peters, 1851											+
<i>Ophiocoma</i> ( <i>Breviturma</i> ) <i>brevipes</i> Peters, 1851 [as <i>Ophiocoma breviceps</i> ]											+
<i>Ophiocoma</i> ( <i>Breviturma</i> ) <i>dentata</i> Müller et Troschel, 1842 [= <i>O. dentata</i> ]											+
<i>Ophiocoma erinaceus</i> Müller et Troschel, 1842											+
<i>Ophiocoma pica</i> Müller et Troschel, 1842 [= <i>O. lineolata</i> ]											+
<i>Ophiocoma scolopendrina</i> (Lamarck, 1816)											+
<i>Ophiomastix annulosa</i> (Lamarck, 1816)											+
<i>Ophiomastix asperula</i> Lütken, 1869											+
<i>Ophiomastix caryophyllata</i> Lütken, 1869											+
Family Ophiomyxidae											
<i>Ophiobyrsa intorta</i> (Koehler, 1922) [= <i>Ophiobyrsella intorta</i> ]											+

Continued

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Amphiuroidae											
<i>Amphipholis squamata</i> (Delle Chiaje, 1828)				+							
Family Ophiolepididae											
<i>Ophiolepis cincta cincta</i> Müller et Troschel, 1842					+						
<i>Ophiolepis superba</i> H.L. Clark, 1915					+						
Class CRINOIDEA											
Order COMATULIDA											
Family Comatulidae											
<i>Anneissia bennetti</i> (Müller, 1841) [= <i>Comanthus bennetti</i> ]					+						
<i>Capillaster asterias</i> A.H. Clark, 1931					+						
<i>Comanthus parvicirrus</i> (Müller, 1841) [= <i>C. parvicirra</i> ]					+						
<i>Comatella stelligera</i> (Carpenter, 1888)					+						
<i>Comatula</i> cf. <i>solaris</i> Lamark, 1816											+
Family Zygometridae											
<i>Zygometra comata</i> A.H. Clark, 1911					+						
Phylum CHORDATA											
Class ASCIDIACEAE											
Order PHLEBOBRANCHIA											
Family Ascidiidae											
<i>Ascidia sydneiensis</i> Stimpson, 1855					+						
Order APLOUSOBRANCHIA											
Family Polycitoridae											
<i>Eudistoma angolanum</i> (Michaelson, 1915)					+						
<i>Eudistoma laysani</i> (Sluiter, 1900)					+						
Family Polyclinidae											
<i>Polyclinum vasculosum</i> Pizon, 1908					+						
Order STOLIDOBRANCHIA											
Family Pyuridae											
<i>Herdmania momus</i> (Savigny, 1816)					+						
Family Styelidae											
<i>Eusynstyela latericius</i> (Sluiter, 1904) [= <i>Polyandrocarpa latericius</i> ]					+						
Class ACTINOPTERYGII											
Order SCORPAENIFORMES											
Family Scorpaenidae											
<i>Pterois volitans</i> (Linnaeus, 1758)					+						
Order PERCIFORMES											
Family Acanthuridae											
<i>Acanthurus lineatus</i> (Linnaeus, 1758)					+						
<i>Acanthurus triostegus</i> (Linnaeus, 1758)					+						
<i>Ctenochaetus strigosus</i> (Bennett, 1828)					+						
<i>Naso annulatus</i> (Quoy et Gaimard, 1825)					+						
Family Gobiidae											
<i>Boleophthalmus</i> sp.											+
<i>Gobiodon</i> sp.					+						
<i>Istigobius</i> sp.				+							
<i>Periophthalmus modestus</i> Cantor, 1842 [= <i>P. cantonensis</i> ]					+						
Gobiidae gen. sp.					+						+

Taxa	Location										
	1	2	3	4	5	6	7	8	9	10	11
Family Blenniidae											
<i>Andamia heteroptera</i> (Bleeker, 1857)					+						
<i>Entomacrodus striatus</i> (Valenciennes, 1836) [= <i>Salarias fraenatus</i> ]					+						
<i>Salarias</i> sp.					+						
Blenniidae gen. sp.								+			
Family Chaetodontidae											
<i>Chaetodon trifasciatus</i> Park, 1797					+						
Family Scaridae											
<i>Chlorurus japonensis</i> (Bloch, 1789) [= <i>Callyodon blochi</i> ]					+						
<i>Scarus niger</i> Forsskål, 1775 [= <i>Callyodon niger</i> ]					+						
<i>Scarus scaber</i> Valenciennes, 1840 [= <i>Callyodon scaber</i> ]					+						
Family Pomacanthidae											
<i>Chaetodontoplus mesoleucus</i> (Bloch, 1787)					+						
<i>Pomacanthus semicirculatus</i> (Cuvier, 1831) [= <i>Pomacanthops semicirculatus</i> ]					+						
Family Pomacentridae											
<i>Abudefduf saxatilis</i> (Linnaeus, 1758)					+					+	
<i>Abudefduf sexfasciatus</i> (Lacepède, 1801)					+						
<i>Amblyglyphidodon curacao</i> (Bloch, 1787) [= <i>Abudefduf curacao</i> ]					+		+				
<i>Amphiprion percula</i> (Lacepède, 1802)					+		+				
<i>Dascyllus</i> spp.					+		+				
<i>Pomacentrus</i> spp.					+		+				
Family Haemulidae											
<i>Pomadasys</i> sp.											+
Family Labridae											
<i>Gomphosus varius</i> Lacepède, 1801					+						
<i>Hemigymnus fasciatus</i> (Bloch, 1792)					+						
<i>Hemigymnus melapterus</i> (Bloch, 1791)					+						
<i>Labroides dimidiatus</i> (Valenciennes, 1839)									+	+	
<i>Thalassoma lunare</i> (Linnaeus, 1758)					+						
Family Siganidae											
<i>Siganus fuscescens</i> (Houttuyn, 1782)											+
Family Zanclidae											
<i>Zanclus cornutus</i> (Linnaeus, 1758)					+						
Family Terapontidae											
<i>Terapon jarbua</i> (Forsskål, 1775) [= <i>Therapon jarbua</i> ]					+		+				
Order TETRAODONTIFORMES											
Family Tetraodontidae											
<i>Arothron stellatus</i> (Anonymous, 1798) [= <i>Tetraodon aerostaticus</i> ]											+
Order ANGUILLIFORMES											
Family Muraenidae											
<i>Echidna nebulosa</i> (Ahl, 1789)					+						
<i>Gymnothorax pictus</i> (Ahl, 1789) [= <i>Muraena picta</i> ]					+						
Actinopterygii incertae sedis											
Species 1 [as <i>Doganus fascifassis</i> ]											+
Species 2 [as <i>Scorpenocarpis</i> sp.]											+