

List of shore molluscs along the south-west coast of the Kii Peninsula, 2007–2008

Shun-ichi Ohgaki

129-1 Shimoyashiki, Tanabe, Wakayama 646-0032, Japan

Shore molluscan assemblages were investigated at 22 sites along the south-west coast of the Kii Peninsula (33°27'–34°16' N, 135°04'–135°59' E, Fig. 1) during the period from May to June in 2007 and 2008. All the surveys were undertaken by the same person, the present author.

The method of survey was a kind of semi-quantitative timed search (STS, Fig. 2). An area between high tide and low tide levels corresponding to 200 m of coastline was defined as a survey plot. Each site was investigated during 2h at spring low tide. Searching started at one end of the plot and proceeded through a meandering path toward the opposite end. The maximum density (no./m²) of all molluscan species encountered along the trail was evaluated in the field and assigned to one of the following classes: I (1), II (2–9), III (10–99), IV (100–999), V (1000–5000). Juveniles were recorded provided they were identifiable. The result is shown in Table 1.

At site OG (Fig. 1), both the semi-quantitative timed search (STS) and a dispersed quadrat survey (DQS) were carried out for the same 200-m coastline (Fig. 2). In the DQS, thirty-one 50 × 50 cm quadrats were located in the survey area at 10-m vertical and 20-m horizontal intervals relative to the shoreline. Within each quadrat, the numbers of all molluscan species were counted in the field. The surveys were first by STS on 4th June, by DQS on 5, 17, and 18th June, and again by STS on 19th June, 2008. All the censuses were undertaken by the present author. The result is shown in Table 2.

The hydrographic condition of the study area was examined based on temperature, salinity, and transparency of winter and summer for the period from 1985 to 2005 (Table 3). The data at 36 offshore stations (2–20km from the coast) were obtained from the database of the Wakayama Prefectural Fisheries Experimental Station (WPFES).

The environmental condition of the 22 sites for shore malacofauna was also examined (Table 4). Temperature, salinity, and transparency at the offshore station nearest to each of the 22 sites (Fig. 1) were cited from the database of WPFES for the period from 2003 to 2007, five years preceding the shore molluscan survey. Based on topographical openness and wind direction and strength, a wave exposure index (EI) was calculated according to Keddy (1982; *Aquat Biol* 14, 41–68). The shore census area (intertidal plot embracing 200-m coastline) was measured using nautical charts. The predominant type of rock at each study site was classified into four categories, i.e., stratified sedimentary rock, deformed sedimentary rock, metamorphic rock, and igneous rock based on the surface geological map of Wakayama and the author's field observation. When more than 25% of the substratum was mudstone, the plot was regarded as "mudstone-rich shore".

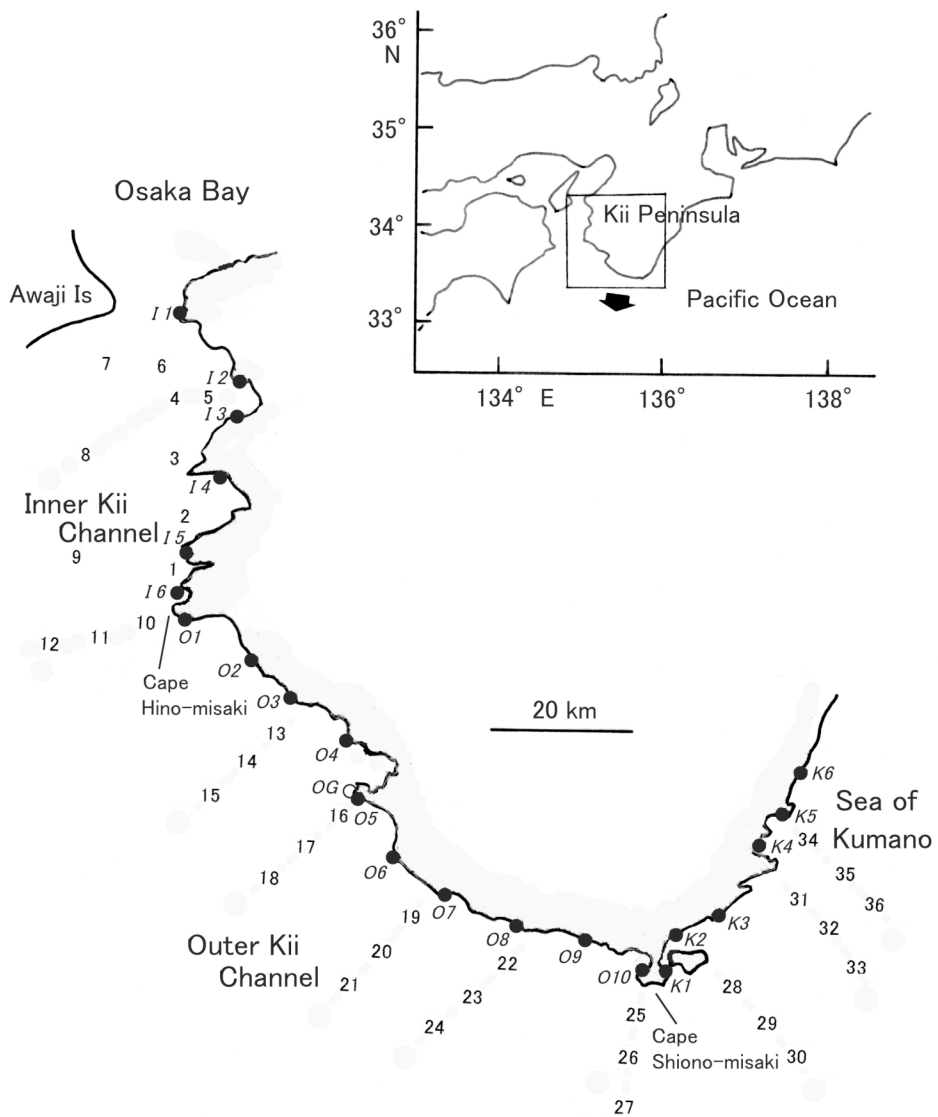


Fig. 1. Study area. Solid circles with a code indicate the sites where shore molluscan assemblages were investigated. Numerals on the sea show the stations of Wakayama Prefectural Fisheries Experimental Station for hydrographic data.

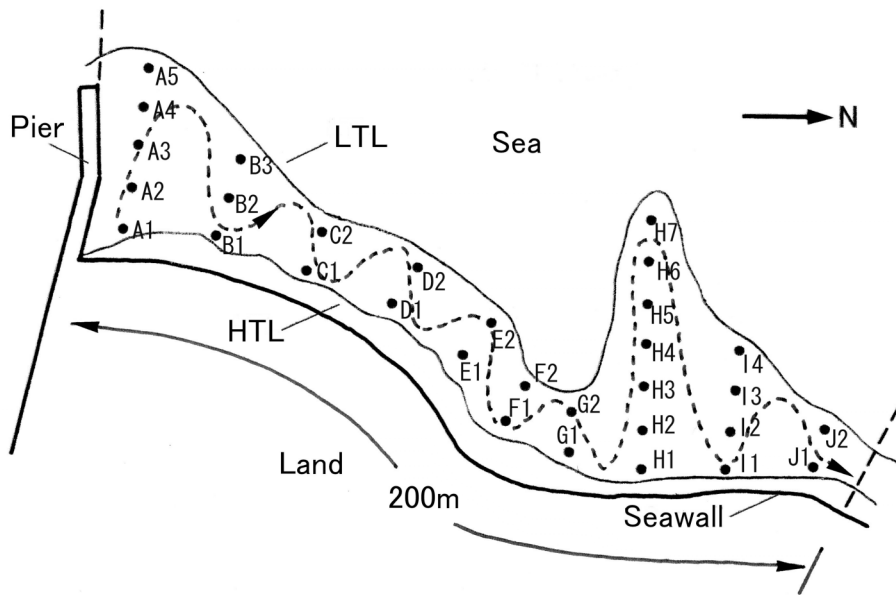


Fig. 2. Design of the methodological survey at site OG. The meandering path between low tide level (LTL) and high tide level (HTL) is the approximate course of the semi-quantitative timed search. Solid circles with a code show the points where quadrats of 50×50 cm were located in the dispersed quadrat survey.

Legends for tables

Table 1.

List of molluscan species recorded in the geographic surveys and their density. *Italic numbers in the first column are species codes.* The five density classes I to V (see text) are shown as 1 to 5, respectively. GD, geographic distribution. The south and north limits of the range of the geographic groups were: the northern species (N), $> 30^{\circ}\text{N}$, $> 35^{\circ}\text{N}$; the southern species (S), $< 30^{\circ}\text{N}$, $< 35^{\circ}\text{N}$; the limited range species (L), $30^{\circ}\text{--}35^{\circ}\text{N}$, $30^{\circ}\text{--}35^{\circ}\text{N}$; the extended-range species, $<30^{\circ}\text{N}$, $>35^{\circ}\text{N}$; respectively. MB, mobility; FH, feeding habit; H, herbivore; C, carnivore; F, filter feeder; O, omnivore; Sn, snail-form species that moves actively; Lp, limpet-form species that moves less actively than snails; Se, sedentary species; blank, others or unknown.

Table 2.

List of molluscan species recorded in the methodological survey and their density. *Italic numbers in the first column are species codes.* The abbreviations GD, FH, and MB are as in Table 1. In the column of HT (habitat), B (boulder), Cr (cryptic environment), or P (pool) is shown when the species is related to one of these habitats. A1 to J2 are the site codes in the dispersed quadrat survey (Fig. 2), below which density of each species (no./ 50×50 cm) is shown. STS1 and STS2 indicate the first and second semi-quantitative timed searches, respectively. In the columns of STS1 and STS2, density classes are shown as in Table 1.

Table 3.

Hydrographic data at the offshore stations 1 to 36 (Fig. 1). The values in February and August during the period from 1985 to 2005 of water temperature and salinity at 50-m depth, and water transparency are shown.

Table 4.

Environmental condition at 22 sites for geographic malacofaunal survey. Mean monthly values during the period from 2003 to 2007 of temperature at surface layer, salinity at surface layer, and transparency at the offshore station nearest to each of the 22 sites (Fig. 1) are shown. EI, exposure index. SA, shore area. The actual value of EI is the presented value $\times 100 \text{ km} \cdot \text{m}^2/\text{s}^2$ and that of SA is the presented value $\times 100 \text{ m}^2$. RT, rock type shown as Ss (stratified sedimentary rock), Sd (deformed sedimentary rock), M (metamorphic rock), and I (igneous rock). In the column of MS (mudstone), "+" means that mudstone covers $> 25\%$, and "-" $< 25\%$ of the substratum.

Table 1													
	Species	Japanese name	GD	FH	MB	I 1	I 2	I 3					
	Polyplacophora												
1	<i>Ischnochiton comptus</i>	usu-hizaragai	E	H	Lp								
2	<i>Ischnochiton boninensis</i>	hosousu-hizaragai	E	H	Lp								
3	<i>Placiphorella stimpsoni</i>	babagase	N	O	Lp			2					
4	<i>Acanthopleura japonica</i>	hizaragai	N	O	Lp	3	3	3					
5	<i>Acanthopleura loochooana</i>	ryukyu-hizaragai	S	H	Lp								
6	<i>Onithochiton hirasei</i>	nisiki-hizaragai	L		Lp	1		2					
7	<i>Notoplax conica</i>	hitode-hizaragai	L		Lp								
8	<i>Acanthochitona defilippi</i>	kehada-hizaragai	L		Lp	2							
9	<i>Acanthochitona achates</i>	himekehada-hizaragai	E	H	Lp	2	2	2					
10	<i>Acanthochitona dissimilis</i>	biroudo-hizaragai	L	H	Lp			1					
	Gastropoda												
11	<i>Scutellastra flexuosa</i>	tutanohagai	S	H	Lp		1						
12	<i>Cellana grata</i>	bekkougasa	E	H	Lp		2	2					
13	<i>Cellana nigrolineata</i>	matubagai	L	H	Lp	2	2	3					
14	<i>Cellana toreuma</i>	yomegakasa	E	H	Lp	3	3	3					
15	<i>Patelloida saccharina</i>	unoasi	S	H	Lp	3		3					
16	<i>Patelloida pygmaea</i>	himekozara	E	H	Lp	3	1	1					
17	<i>Nipponacmea schrenkii</i>	aogai	N	H	Lp	2		2					
18	<i>Lottia lindbergi</i>	oboroduki-kogamogai	N	H	Lp								
19	<i>Lottia langfordi</i>	kikukozara	L	H	Lp								
20	<i>Lottia kogamogai</i>	kogamogai	E	H	Lp	2	3	3					
21	<i>Lottia tenuisculpta</i>	komorebi-kogamogai	E	H	Lp		2	3					
22	<i>Nipponacmea gloriosa</i>	sakura-aogai	L	H	Lp								
23	<i>Nipponacmea fuscoviridis</i>	kusairo-aogai	E	H	Lp			2					
24	<i>Nipponacmea nigrans</i>	kumori-aogai	N	H	Lp	2							
25	<i>Nipponacmea concinna</i>	koudaka-aogai	N	H	Lp	2							
26	<i>Nipponacmea teramachii</i>	hososuji-aogai	L	H	Lp	1							
27	<i>Haliotis varia</i>	iboanago	S	H	Lp								
28	<i>Haliotis diversicolor</i>	tokobusi	E	H	Lp								
29	<i>Scutus anguis</i>	ryukyu-otomegasa	S		Lp								
30	<i>Montfortula pictra</i>	susokakegai	L		Lp	2	3	2					
31	<i>Macroschisma dilatatum</i>	hirasukasigai	N		Lp								
32	<i>Chlorostoma lischkei</i>	kubogai	N	H	Sn	3							
33	<i>Chlorostoma xanthostigma</i>	kumanokogai	E	H	Sn								
34	<i>Omphalius rusticus</i>	kosidakagangara	N	H	Sn		2	1					
35	<i>Omphalius pfeifferi</i>	bateira	N	H	Sn								
36	<i>Omphalius nigerrimus</i>	himekubogai	S	H	Sn								
37	<i>Trochus maculatus</i>	nisikiuzu	S	H	Sn								
38	<i>Trochus rota</i>	uzu-itimonji	S	H	Sn								
39	<i>Tectus pyramis</i>	gin-takahama	S	H	Sn								
40	<i>Monodonta labio</i>	isidatami	N	H	Sn	3	3	3					
41	<i>Clanculus microdon</i>	kuromakiage-ebisu	L	H	Sn			1					
42	<i>Fossarina picta</i>	chibiasiya	N	H	Sn								
43	<i>Monodonta perpulexa</i>	kubire-kurozuke	N	H	Sn		1	1					

Table 1 (continued)																			
	I 4	I 5	I 6	O 1	O 2	O 3	O 4	O 5	O 6	O 7	O 8	O 9	O 10	K 1	K 2	K 3	K 4	K 5	K 6
1	3		3	3	3	2	2	2	2		2	3	2	3	3	3			2
2					2					2					1				
3																	1		
4	3	3	3	2	2	3	3		2	2	3	2	2	3	3	2	3	2	2
5		2	2	3		2	2	2	2	3	2	3	3	2		2	2		
6		2	1	2	2	2	2	2	2	2	1	1	2	2			2	1	
7										1									
8						1								2	3			1	
9		2	2			2	2	2	2	2	2			2		2	2	2	1
10																			
11	1						2		2	2	2	2	2		1		1		
12	3	3	3	3	2	3	2	3	3	4	3	3	3	3	3	3	3	3	3
13	2	3	3	3	3	2	3	3	2		2	2	2	2	3	2	3	3	2
14	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
15	2	2	3	2	3	2	3	3	3	3	3	4	2	4	3	2		2	3
16			3	2	2	2	3		1		1	1		3		3	2	2	2
17			3	3	1	3		3	4		3	1	3		2	3	2	2	2
18			1																
19														2					
20	3	2	3	2	3	2	2	2	3	3		3		3		3	3	3	3
21	2	1	2	3		2	1		2		2			2				2	2
22				2		2	2		2	2		2							
23	4	3	3	1	3	3	2	2	3	3	3	2	2			3		3	2
24					3	2	2									2			2
25					2		2		2		2					2	1	3	
26																			
27							2			2				2					
28			1	1		1		1							2				
29													2			1			
30	2	2	2	2	2	2	2	2	3	2	1	2	2	3	2	2	3	2	2
31														1					
32			1		2	1				2		1		2		2	2		2
33			2		2					1		1		2		2		2	
34			2																
35						1													1
36			2		2				3	2	3	2		3				2	
37				3						2	3	2	2						
38				2	2	1	1		2	2	2	3	2	2				2	2
39							2			2									
40	1	3	3	3	4	3	3	4	3	3	3	4	3	3	3	3	4	3	3
41																			
42				1															
43		3	3			3			3	3	3			2		3	3	3	

Table 1 (continued)								
	Species	Japanese name	GD	FH	MB	I 1	I 2	I 3
44	<i>Monodonta neritoides</i>	kurodukegai	E	H	Sn			3
45	<i>Diloma suavis</i>	mekuragai	S	H	Sn		1	
46	<i>Stomatella impertusa</i>	himeawabi	S	H	Lp			
47	<i>Calliostoma unicum</i>	ebisugai	N	C	Sn			
48	<i>Conotalopia mustelina</i>	awaji-chigusa	N	H	Sn			
49	<i>Astlarium haematragum</i>	urauzugai	L	H	Sn			
50	<i>Turbo stenogyrus</i>	kosidaka-sazae	S	H	Sn			
51	<i>Turbo coronatus</i>	sugai	N	H	Sn	2	3	3
52	<i>Nerita albicilla</i>	amaobune	S	H	Sn	2	1	
53	<i>Nerita japonica</i>	amagai	L	H	Sn			
54	<i>Cerithium dialeucum</i>	kourogi	S		Sn	1		
55	<i>Planaxis sulcatus</i>	gomafunina	S	H	Sn			
56	<i>Batillaria cumingii</i>	hosouminina	N	D, F	Sn			
57	<i>Peasiella habeii</i>	kobito-urauzu	E	H	Sn	3	3	5
58	<i>Nodilittorina radiata</i>	arare-tamakibi	N	H	Sn	4	3	5
59	<i>Nodilittorina trochoides</i>	ibo-tamakibi	S	H	Sn			
60	<i>Nodilittorina vidua</i>	taiwan-tamakibi	S	H	Sn		1	
61	<i>Littorina brevicula</i>	tamakibi	E	H	Sn	4	2	4
62	<i>Hipponix foliacea</i>	kawachidori	S		Se	1		
63	<i>Crepidula onyx</i>	simamenou-funegai	N	E	Lp		2	
64	<i>Dendropoma planorbis</i>	mijin-mukade	S	F	Se			
65	<i>Serpulorbis imbricatus</i>	oohebigai	N	F	Se	2	1	2
66	<i>Cypraea carneora</i>	kutimurasaki-dakara	S		Sn			
67	<i>Cypraea errones</i>	natsume-modoki	S		Sn			
68	<i>Cypraea artuffeli</i>	chairo-kinuta	S		Sn			
69	<i>Cypraea gracilis</i>	medakaragai	E		Sn			
70	<i>Cypraea boivini</i>	ominaesi-dakara	S		Sn			
71	<i>Cypraea caputserpentis</i>	hanamaruyuki	S	H	Sn			
72	<i>Cymatium parthenopeum</i>	kakobora	S	C	Sn			
73	<i>Gyroscala lamellosa</i>	nejigai	S	P	Sn			
74	<i>Cronia margariticola</i>	une-reisidamasi	S	C	Sn			
75	<i>Ergalatax contractus</i>	hime-youraku	E	CS	Sn	2		
76	<i>Muricodrupa fusca</i>	reisidamasi-modoki	S	C	Sn			
77	<i>Morula musiva</i>	sima-reisidamasi	S	C	Sn		2	
78	<i>Morula granulata</i>	reisidamasi-modoki	S	C	Sn			
79	<i>Morula iostoma</i>	itomaki-reisidamasi	S	C	Sn		1	
80	<i>Morula funiculata</i>	kurofu-reisidamasi	S	C	Sn			
81	<i>Morula tosana</i>	tosa-reisi	L		Sn			
82	<i>Drupa ricinus</i>	siroiga-reisi	S	C	Sn			
83	<i>Mancinella bufo</i>	taiwann-reisi	S	C	Sn			
84	<i>Thais clavigera</i>	ibonisi	N	C	Sn	3	3	4
85	<i>Thais kyteistina</i>	kurifu-reisi	E	C	Sn		2	2
86	<i>Thais bronni</i>	reisigai	N	C	Sn		2	2
87	<i>Euplica scripta</i>	futokorogai	S	H	Sn			2
88	<i>Anachis misera</i>	bosatsugai	L	C	Sn	2		

Table 1 (continued)																			
	I 4	I 5	I 6	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	K1	K2	K3	K4	K5	K6
44																	3		
45		3	3	1		3	2	3	3	3	2	3	2	3		2	2	2	1
46								1											
47																	1		
48							3												
49											1				2		2	1	
50						1				1			1	2					1
51					2		3	2			2		2		2				2
52		1	3	3	3	3	3	3	3	3	2	3	3	3	2	2		3	2
53	2		2		3						2	3		3		3	3	2	
54																			
55			3	4	3		4	4						3	2				
56														3					
57			3	3	4	2	3	3		3		4		3	4	2		2	2
58	4	4	4	4	4	4	4	5	4	3	4	4	4	4	4	5	4	4	4
59		3	3	2				4	4	2	3	3	3	2		2		2	
60	3	1	2		3	2		3			2	2		1	2	2			
61		3			2		4	1							2		3		2
62							2												
63																			
64										4	5	4							
65	2	1	1	2	2	2	2	1			2				2	2	3		2
66													1						
67										1									
68					1														
69					1									1					
70							2												
71					1		2	2		2				1					
72			1																
73															1				
74			2	2	2	1	2	3	2	1	2	2	2	2	1	2			
75				1	1	1									2		2		
76					2		2								2				2
77	3	2	3	2	2	2	3	2	2	2	1	3	2	2	2	2	2	2	2
78							1	2	2	3	2	2	2	2					
79							2			2									
80				1															
81																		1	
82										1			1						
83										1			1						
84	3	3	3	3	2	2	2	2	2	2	3	3	2	2	4	2	3	3	2
85	2		2				2		1						2				
86	3	3	2	1			2			1					2		1		
87		2		2	3		2	2			2			1		1			
88																1			

Table 1 (continued)								
	Species	Japanese name	GD	FH	MB	I 1	I 2	I 3
89	<i>Pyrene testudinaria</i>	matsumusigai	L	C	Sn			
90	<i>Mitrella bicincta</i>	mugigai	E	C	Sn			
91	<i>Mitrella lischkei</i>	siragegai	S		Sn			
92	<i>Chanthrus mollis</i>	siwahora-damasi	L		Sn			
93	<i>Cantharus undosa</i>	sujikuro-horadamasi	S		Sn			
94	<i>Japeuthria ferrea</i>	isonina	S	C	Sn	2		
95	<i>Strigatella scutula</i>	yatategai	S	C	Sn			
96	<i>Conus flavidus</i>	kinukatugi-imo	S	C	Sn			
97	<i>Turridrupa bijubata</i>	kuroitomaki-harabuto	S	C	Sn			
98	<i>Aplysia juliana</i>	amakusa-amefurasi	E	H	Sn			
99	<i>Aplysia kurodai</i>	amefurasi	E	H	Sn	2		1
100	<i>Aplysia parvula</i>	kuroheri-amefurasi	E	H	Sn			
101	<i>Aplysia oculifera</i>	midori-amefurasi	S	H	Sn			
102	<i>Platydoris speciosa</i>	kumogata-umiushi	S	C	Sn			
103	<i>Siphonaria japonica</i>	karamatsugai	N	H	Lp	3	2	1
104	<i>Siphonaria sirius</i>	kikunohanagai	N	H	Lp	1	2	2
105	<i>Siphonaria acmaeoides</i>	sirokaramatsu	L	H	Lp			
	Bivalvia							
106	<i>Arca avellana</i>	funegai	E	F	Se			
107	<i>Barbatia lima</i>	egai	E	F	Se			
108	<i>Barbatia virescens</i>	karigane-egai	E	F	Se	1	2	2
109	<i>Xenostrobus atratus</i>	kuroguti	L	F	Se		3	5
110	<i>Mytilus galloprovincialis</i>	murasaki-igai	N	F	Se		5	5
111	<i>Septifer bilocularis</i>	kujakugai	S	F	Se			2
112	<i>Hormomya mutabilis</i>	hibarigai-modoki	S	F	Se		5	
113	<i>Septifer keenae</i>	hime-igai	N	F	Se			
114	<i>Septifer virgatus</i>	murasaki-inko	N	F	Se	1	1	
115	<i>Modiolus nipponicus</i>	hibarigai	N	F	Se			
116	<i>Pinctada martensii</i>	akoyagai	S	F	Se			
117	<i>Pinctada margaritifera</i>	kurochougai	S	F	Se			
118	<i>Pinctada maculata</i>	midori-aori	S	F	Se			
119	<i>Isognomon perna</i>	kaisi-aori	S	F	Se			
120	<i>Isognomon legumen</i>	siro-aori	S	F	Se			
121	<i>Isognomon acutirostris</i>	heritori-aori	S	F	Se			
122	<i>Plicatula australis</i>	kasuri-ishigakimodoki	S		Se			
123	<i>Hyotissa chemnitzii</i>	benigaki	S	F	Se			
124	<i>Crassostrea nippona</i>	iwagaki	N	F	Se		3	3
125	<i>Saccostrea mordax</i>	ohagurogaki	S	F	Se			
126	<i>Crassostrea gigas</i>	magaki	E	F	Se		3	
127	<i>Saccostrea kegaki</i>	kegaki	E	F	Se		5	5
128	<i>Cardita leana</i>	tomayagai	E	F	Se		1	
129	<i>Chama japonica</i>	kikuzarugai	E	F	Se		1	
130	<i>Pseudochama retroversa</i>	saruno-kasira	S	F	Se		1	
131	<i>Chama ambigua</i>	hitoe-giku	L	F	Se			
132	<i>Claudiconcha japonica</i>	semiasari	S	F	Se		1	
133	<i>Ruditapes philippinarum</i>	asari	N	F		1		

Table 1 (continued)																			
	I 4	I 5	I 6	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	K1	K2	K3	K4	K5	K6
89					2								1						
90										1									
91																	1		
92					2			1				2							
93													2						
94			3	2	3	2		2	2		3	3	2	3		2	3	2	
95						1				1									
96												1							
97										1									
98			1				1												
99																			2
100			1																
101							1								2				
102					1													1	1
103		3	2					2	2	2		2		2	2	2			2
104	2	3	3	3	3	4	3	4	3	3	2	3		3	3	3	2	3	3
105											1	3							3
106																1		1	
107																2			
108	2		1		2		3	2		2		1	2	1				3	
109							5												
110																			
111	3	3	4	3	4	4	3	1	3	3		2	3	3	2	2	3	2	3
112							5			3								4	
113																1			
114	3	3	4		1	1	3	4	4	3	4	4		4	3	5	5	4	1
115																		1	
116										2			1						
117												1							
118							2	1											
119												2	2						
120													1						
121								2							1				1
122																		1	
123							3												
124							1											2	
125			3		2	1	4	3	4	4	4	4	4	4					3
126																			
127	4	4	4				5			4	3	3		4	4	2	4	4	2
128			1				1		1					2				1	1
129				1			1												
130																			
131				1															
132	2	1	2																
133																			

Table 2								
	Species	Japanese name	GD	FH	MB	HT	A1	A2
	Polyplacophora							
1	<i>Ischnochiton comptus</i>	usu-hizaragai	E	H	Lp	B		
2	<i>Acanthopleura japonica</i>	hizaragai	N	O	Lp			
3	<i>Acanthopleura loochooana</i>	ryukyu-hizaragai	S	H	Lp			
4	<i>Onithochiton hirasei</i>	nisiki-hizaragai	S		Lp			
5	<i>Acanthochitona achates</i>	himekehada-hizara	N	H	Lp			1
	Gastropoda							
6	<i>Scutellastra flexuosa</i>	tutanohagai	E	H	Lp			
7	<i>Cellana grata</i>	bekkougasa	N	H	Lp			
8	<i>Cellana nigrolineata</i>	matsubagai	N	H	Lp			
9	<i>Cellana toreuma</i>	yomegakasa	N	H	Lp			2
10	<i>Patelloida saccharina</i>	unoasi	S	H	Lp			4
11	<i>Patelloida pygmaea</i>	himekozara	N	H	Lp			2
12	<i>Nipponacmea schrenkii</i>	aogai	N	H	Lp	B		
13	<i>Lottia kogamogai</i>	kogamogai	N	H	Lp			
14	<i>Lottia tenuisculpta</i>	komorebi-kogamogai	E	H	Lp			
15	<i>Nipponacmea fuscoviridis</i>	kusairo-aogai	E	H	Lp			2
16	<i>Haliotis varia</i>	iboanago	S	H	Lp			
17	<i>Montfortula pictra</i>	susokakegai	L		Lp			
18	<i>Chlorostoma lischkei</i>	kubogai	N	H	Sn	B		
19	<i>Chlorostoma xanthostigma</i>	kumanokogai	N	H	Sn	B		
20	<i>Omphalius nigerrimus</i>	himekubogai	L	H	Sn	B		
21	<i>Nerita albicilla</i>	amaobune	S	H	Sn			36
22	<i>Nerita japonica</i>	amagai	L	H	Sn			
23	<i>Trochus rota</i>	uzu-itimonnji	S	H	Sn			
24	<i>Monodonta labio</i>	isidatami	N	H	Sn			4
25	<i>Fossarina picta</i>	tibiasiya	N	H	Sn	Cr		
26	<i>Diloma suavis</i>	mekuragai	S	H	Sn			
27	<i>Angaria neglecta</i>	katabegai	E	H	Sn			
28	<i>Turbo coronatus</i>	sugai	N	H	Sn			2
29	<i>Peasiella habeii</i>	kobito-urauzu	E	H	Sn			
30	<i>Nodilittorina radiata</i>	arare-tamakibi	N	H	Sn			44
31	<i>Nodilittorina trochoides</i>	ibo-tamakibi	S	H	Sn			
32	<i>Nodilittorina vidua</i>	taiwan-tamakibi	S	H	Sn			
33	<i>Littorina brevicula</i>	tamakibi	N	H	Sn			2
34	<i>Crepidula gravispinosus</i>	awabune	S	F	Se			
35	<i>Hipponix foliacea</i>	kawatidori	S		Se			
36	<i>Serpulorbis imbricatus</i>	oohebigai	N	F	Se			
37	<i>Pinctada maculata</i>	midori-aori	S	F	Se			
38	<i>Cronia margariticola</i>	une-reisidamasi	S	C	Sn			
39	<i>Morula musiva</i>	sima-reisidamasi	S	C	Sn			
40	<i>Morula granulata</i>	reisidamasi	S	C	Sn			
41	<i>Thais clavigera</i>	ibonisi	N	C	Sn			
42	<i>Thais kyteistina</i>	kurihu-reisi	N	C	Sn			
43	<i>Thais bronni</i>	reisigai	N	C	Sn			

Table 2 (continued)																
	A3	A4	A5	B1	B2	B3	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2
1																
2		7	4		8	1					5	1	1		3	2
3					3						4			1	3	
4								1		1				1		
5			1		1			1				2		3		1
6		1														
7											2		7			
8													6		1	
9		2	9		3		1	8	41			49	3	33	14	71
10	1	91	100	2	21	75	1	95	52		66	31	12	54	9	75
11		1							1							
12																
13		3	3		2				8			3			1	
14					1				2				3		1	
15			1										4			
16								1		1						
17		1	1		2						3	1				
18																
19																
20																
21	16				10		5	6	17				3		1	
22				1												
23										5						
24							2						6		9	
25			7		5											
26			7					1				6				4
27																
28	2						2									
29				71	27		65	135	2							
30				217			165					5				
31																
32																
33				2												
34																
35																
36	2															
37																
38	2							2	1					1		
39		1			2			3	6			1				2
40										1						
41		2	2		5			3	1			2	5	2		1
42																
43																

Table 2 (continued)															
	H1	H2	H3	H4	H5	H6	H7	I1	I2	I3	I4	J1	J2	STS1	STS2
1														2	
2		4				11			2	2	5	1	5	2	3
3					1							2		2	2
4							2							2	2
5			1			1						7	3	2	2
6				1	1						1				1
7		1									3			3	3
8		8							1	2		1		3	3
9			21	2			2		5	17		23		3	3
10		12	41	51		155			85	55	35	9	52	4	4
11												2			2
12														2	3
13		7	1	5	4	10			5	2	1		2	2	2
14						2					1		9	2	2
15														2	3
16														2	2
17					1				3				7	2	3
18														2	1
19															3
20														2	3
21														2	3
22														2	
23														3	3
24								4						3	3
25		4											2		2
26												1	1	3	4
27															1
28															3
29		8		24	6	4			88	43	1		5	2	4
30	123				7			41						5	4
31	13							3						2	3
32					5									3	2
33								1							
34														1	
35														1	
36														2	2
37														1	
38														2	1
39		2												2	4
40														2	2
41		4				3			2				8	3	3
42															1
43													3		

Table 2 (continued)								
	Species	Japanese name	GD	FH	MB	HT	A1	A2
44	<i>Zafra pumila</i>	nominina	E	C	Sn	Cr		
45	<i>Chanthrus mollis</i>	siwa-horadamasi	L		Sn			
46	<i>Japeuthria ferrea</i>	isonina	E	C	Sn	B		
47	<i>Siphonaria japonica</i>	karamatugai	N	H	Lp			
48	<i>Siphonaria sirius</i>	kikuno-hanagai	E	H	Lp			5
49	<i>Siphonaria acmaeoides</i>	siro-karamatu	S	H	Lp	P		
	Bivalvia							
50	<i>Barbatia virescens</i>	karigane-egai	E	F	Se			
51	<i>Xenostrobus atratus</i>	kuroguchi	N	F	Se	Cr		
52	<i>Septifer bilocularis</i>	kujakugai	S	F	Se			3
53	<i>Hormomya mutabilis</i>	hibarigai-modoki	S	F	Se			
54	<i>Septifer virgatus</i>	murasaki-innko	N	F	Se			
55	<i>Pinctada martensii</i>	akoyagai	E	F	Se			
56	<i>Isognomon acutirostris</i>	heritori-aori	S	F	Se	Cr		
57	<i>Crassostrea nippona</i>	iwagaki	N	F	Se			
58	<i>Saccostrea mordax</i>	ohagurogaki	S	F	Se			
59	<i>Saccostrea kegaki</i>	kegaki	E	F	Se			
60	<i>Dendostrea crenulifera</i>	nokogiri-gaki	S	F	Se			
61	<i>Lasaea undulata</i>	tirihagi	E	F	Se	Cr		

Table 2 (continued)																
	A3	A4	A5	B1	B2	B3	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2
44																
45										1						
46																
47									1							
48	9		2		17	32		130	7			60		21		10
49				2			1									
50																
51																
52	2				1		16	4	21			1			1	1
53						15										
54																
55																
56																
57																
58		58	78	1	1	1	20		1		46		7	1		
59		265	16	19		199	2		8		5	1	2			
60																
61																

Table 2 (continued)															
	H1	H2	H3	H4	H5	H6	H7	I1	I2	I3	I4	J1	J2	STS1	STS2
44															2
45															
46														2	2
47			2	3										2	2
48			15	14					9	3		3		4	4
49			4	5										3	2
50														2	2
51		1						2						2	
52						1	1		6				1	4	3
53															
54						51					4			3	3
55														1	
56								1						2	
57														1	
58		15			43	41				1	63		88	4	5
59		129	16	67	43	66			2	5	12		98	5	4
60							1								1
61		1													

Table 3						
Statiions	Water temperature (°C)		Salinity (psu)		Transparency (m)	
	Feb.	Aug.	Feb.	Aug.	Feb.	Aug.
1	14.26	22.05	34.22	34.15	12	11
2	13.61	22.04	34.06	34.06	10	10
3	13.38	22.35	33.98	33.97	7	9
4	12.63	22.16	33.71	33.90	7	9
5	12.28	23.30	33.58	33.32	6	7
6	11.90	22.81	33.45	33.59	6	7
7	11.34	21.84	33.12	33.77	6	7
8	13.01	21.80	33.88	33.99	9	9
9	13.08	22.51	33.95	34.06	12	11
10	13.53	22.26	33.98	34.11	14	12
11	14.48	22.23	34.26	34.27	16	13
12	14.80	22.21	34.39	34.26	15	12
13	15.76	22.26	34.55	34.28	18	15
14	16.11	21.54	34.56	34.35	19	19
15	16.51	21.08	34.62	34.39	20	20
16	16.26	21.42	34.63	34.36	20	20
17	16.65	21.42	34.65	34.41	21	20
18	16.81	21.65	34.67	34.41	21	20
19	16.72	21.77	34.66	34.34	22	21
20	16.88	21.76	34.66	34.37	21	21
21	17.06	22.01	34.67	34.34	21	21
22	16.94	22.11	34.68	34.30	22	22
23	17.25	22.22	34.69	34.32	23	22
24	17.92	22.62	34.71	34.34	24	23
25	17.39	22.16	34.68	34.29	21	22
26	18.09	22.90	34.72	34.37	22	24
27	18.46	23.78	34.72	34.38	23	26
28	15.69	18.49	34.64	34.46	23	18
29	17.06	20.35	34.67	34.42	24	22
30	17.61	21.60	34.71	34.40	24	24
31	15.56	18.55	34.66	34.49	18	15
32	15.72	18.65	34.66	34.46	21	18
33	16.10	18.92	34.67	34.48	22	19
34	15.47	18.61	34.65	34.43	18	15
35	15.68	18.69	34.66	34.46	20	19
36	15.76	18.51	34.66	34.49	20	19

Table 4										
Site	Water temp.(°C)		Salinity (psu)		Transparency (m)		E I	SA	RT	MS
	Feb.	Aug.	Feb.	Aug.	Feb.	Aug.				
I 1	10.3	24.8	32.9	32.7	6.8	7.8	145	106	Ss	+
I 2	10.9	26.7	33.0	32.5	8.3	7.8	6	16	M	–
I 3	11.2	26.8	33.2	32.5	8.3	8.6	1	39	M	–
I 4	13.8	26.9	34.1	33.0	9.0	12.4	24	52	Sd	–
I 5	13.7	26.8	34.1	33.0	10.4	10.8	10	32	Sd	–
I 6	14.0	27.0	34.0	33.0	11.5	12	1	80	Sd	+
O1	15.2	27.4	34.6	32.9	14.0	13.8	24	76	Sd	+
O2	15.3	27.3	34.4	33.4	11.8	13.6	31	185	Sd	+
O3	16.2	27.6	34.5	33.4	16.4	14.2	32	40	Sd	+
O4	15.9	28.2	34.5	33.4	13.8	11.2	8	180	Ss	–
O5	17.5	27.4	34.8	33.6	21.6	18	9	144	Ss	+
O6	17.8	27.5	34.0	32.9	21.7	17.6	37	43	Ss	+
O7	18.0	27.5	33.3	32.3	21.4	17.2	7	52	Sd	–
O8	17.3	27.7	34.7	33.7	22.6	23	137	54	Sd	–
O9	17.6	28.0	34.7	33.7	21.5	22.9	213	81	Sd	+
O10	17.8	28.2	34.7	33.6	20.4	22.8	62	81	I	–
K1	17.7	27.1	34.7	33.5	22.1	20.4	6	52	I	–
K2	17.3	26.0	34.7	33.3	23.5	18	9	180	Ss	+
K3	16.7	25.9	34.7	33.2	19.5	16.4	142	99	Ss	+
K4	16.0	26.2	34.6	32.7	15.6	13.5	2	45	Ss	+
K5	15.9	26.5	34.4	32.5	15.8	14.2	56	90	I	–
K6	15.9	26.5	34.4	32.5	15.8	14.2	34	216	Ss	+