

### 3. Comments on selected species

Ecological features, such as habitat, feeding habit, and breeding patterns of some of the recorded species in the study area are described in the following section, with some taxonomic comments. The term low zone indicates the range from 50 to 100 cm above the chart datum, middle zone indicates the range from 100 to 150 cm, and high zone indicates the range above 150 cm (see Fig. 1d). A numeral attached to a species name denotes the species code in the List of recorded species (Section 2). The Japanese name is shown after each scientific name.

#### 2. *Ischnochiton boninensis* ウスヒザラガイ

Found on the rock surface in the low zone and under cobbles on pool bottoms in the middle zone.

#### 4. *Acanthopleura japonica* ヒザラガイ

The commonest chiton in the study area. Three forms are included in this species (Sasaki and Hamaguchi 2002). All of these were seen in the study area but they were not recorded separately.

#### 5. *Acanthopleura loochooana* リュウキュウヒザラガイ

Found on the rock surface in the low zone and in pools of the middle and high zones.

#### 7. *Acanthochitona achates* ヒメケハダヒザラガイ

The second commonest chiton in the study area found on the rocks in exposed low and middle zones. The related sheltered-shore species, *Acanthochitona defilippii* was not recorded in this study.

#### 12. *Cellana nigrolineata* マツバガイ

Individuals of <2 cm shell-length were found mainly in pools, whereas larger individuals were found on the rock surface of the middle and high zones. The mantle response (Abe 1983) of this species was observed when in contact with muricid gastropods, such as *Thais clavigera*.

#### 15. *Patelloida saccharina lanx* ウノアシ

Individuals of <5 mm shell-length were observed in high density in the low zone, whereas the larger individuals were sparsely distributed in the middle and high zones.

17. *Lottia kogamogai* コガモガイ

18. *Lottia tenuisculpta* コモレビコガモガイ

19. *Lottia lindbergi* オボロヅキコガモガイ

At the start of our study these three limpets (17, 18, and 19) were treated as one species, *Collisella heroldi*, but were subsequently divided (Sasaki & Okutani 1994). This discrimination occurred from 1990 onwards within the framework of our surveys. The results in Table 2, Fig. 2, and Fig. 3 are described as recorded in each year.

20. *Nipponacmea fuscoviridis* クサイロアオガイ

Common on rock surface that were exposed at low tide in the middle and high zones.

21. *Nipponacmea gloriosa* サクラアオガイ

Individuals of <1 cm shell-length were found on the rock surface in the low zone and under cobbles in pools of the middle zone.

22. *Nipponacmea nigrans* クモリアオガイ

Individuals of <1 cm shell-length were found under cobbles in pools of the middle and high zones.

23. *Nipponacmea schrenckii* アオガイ

Individuals of <1 cm shell-length were found on the rock surface in the low zone and under cobbles in pools of the middle zone.

24. *Haliotis discus discus* クロアワビ

A juvenile appeared once in 1992 near the low tide level at the wave-exposed tip of the platform.

25. *Haliotis diversicolor aquatilis* トコブシ

This boulder-shore abalone was rare in the study area, and only individuals of <2 cm shell-length were found. Larger individuals (>3 cm shell-length) of the related species, *Haliotis varia*, were common in the study area.

27. *Tugali decussata* シロスソカケ

29. *Macroschisma dilatatum* ヒラスカシガイ

These limpets (27 and 29) were found under the canopies of *Sargassum* species in the low zone.

38. *Trochus maculatus* ニシキウズ

All the individuals of this species belonged to *T. maculatus* form *verrucosus*, whereas *T. maculatus* proper, which has a more southerly distribution was not recorded in the study area.

43. *Fossarina picta* チビアシヤ

Usually found within the empty shells of oysters and barnacles, and sometimes within rock crevices.

49. *Broderipia iridescens* ハナザラ

Found exclusively on the wall of a hole inhabited by the sea urchin, *Anthocidaris crassispina* in the lowest zone near the wave-exposed tip of the platform.

52. *Calliostoma unicum* エビスガイ

Found in the low zone at the wave-exposed tip of the platform. This species feeds on sea anemones around the study site (T. Kato, personal communication).

53. *Conotalopia mustelina* アワジチグサ

Found on ramified brown algae in the low zone and within the empty shells of oysters and barnacles in the middle zone.

58. *Astraliium haematragum* ウラウズガイ

Found on the rock surface in the low zone, while limited to pools of the middle zone.

60. *Turbo coronatus coreensis* スガイ

Found mainly in pools of the landward sheltered area.

61. *Turbo stenogyrus* コシダカサザエ

Found under the canopy of algae or in pools in the low zone.

63. *Nerita albicilla* アマオブネガイ

Individuals of <5 mm in shell-length were observed aggregating within empty oyster shells in the low zone, while larger individuals were found in pools of the middle zone.

65. *Nerita plicata* キバアマガイ

This tropical neritid occasionally appeared on rocks in the high zone at the base of the landward cliff.

66. *Phenacolepas unguiformis* ツメナリミヤコドリ

Exclusively found in anoxic environments under boulders in large pools of the landward sheltered area.

70. *Clypeomorus bifasciata* カヤノミカニモリ

Limited to the sandy bottom of shallow pools in the landward sheltered area. Inter-annual fluctuation in density was obvious.

71. *Ittibittium parcum* オオシマチグサカニモリ

Densely distributed on *Sargassum*, coralline algae, and the sandy substratum of large pools in the landward sheltered area.

72. *Diala semistriata* スズメハマツボ

Occasionally found in the same habitat as *Ittibittium parcum*.

73. *Planaxis sulcatus* ゴマフニナ

Commonly found over an extensive range of the high and middle zones. Juveniles were aggregated within empty oyster shells in the low zone.

76. *Littoraria undulata* ホソスジウズラタマキビ

Juveniles of this tropical littorinid were occasionally found around the base of the landward cliff.

77. *Peasiella habeii* コビトウラウズガイ

Small-sized littorinid that was often densely distributed over the middle and the high zones. Individuals were observed on the bottom of shallow pools, within the empty shells of oysters and barnacles, and in rock crevices.

78. *Nodilittorina radiata* アラレタマキビ

Distributed on the landward cliff, and on the platform of the high and middle zones. Individuals of <5 mm shell-height were observed on the platform, while larger individuals were limited to the landward cliff.

79. *Nodilittorina trochoides* イボタマキビ

Found on the landward cliff and the highest part of the platform. The population comprised exclusively individuals of <5 mm shell-height.

80. *Nodilittorina vidua* タイワントマキビ

Distributed on the platform in the middle and high zones. This species was found at lower levels and in lower densities than the other *Nodilittorina* species, usually in aggregations of several individuals.

81. *Littorina brevicula* タマキビ

Found at the base of the landward cliff and on the platform of the middle and high zones. Only individuals of <5 mm shell-height were found in the study area, whereas larger individuals were more common in the inner area of Tanabe Bay.

82. *Barleeia angustata* チャツボ

Found on *Sargassum* in large pools of the landward sheltered area. High inter-annual fluctuations in density were observed.

86. *Hipponix conica* キクスズメ

Exclusively found on the shells of other gastropods such as *Haliotis varia*, *Tectus pyramis*, and *Thais bronni*; probably feeding on the tissue, mucus, or feces of these gastropod hosts (Matsunaga 1964).

95. *Cypraea annulus* ハナビラダカラ

108. *Cypraea moneta* キイロダカラ

Solitary individuals of these cowries (95 and 108) appeared on occasions. during one cold winter (January 1985), abundant dead shells of both species were observed in pools.

115. *Gyroscalea lamellosa* ネジガイ

116. *Epitonium japonicum* ヒメネジガイ

These two species (115 and 116) are parasites of coelenterates (Okutani 2000). In our surveys, they were found buried in sand near to the sea anemone, *Anthopleura japonica*, at low tide.

118. *Alexania inazawai* イナザワハベガイ

Found on rare occasions near the sea anemone, *Haripranella lineata*, which is the host of this parasitic snail (Habe 1943). It was also found among pebbles around pools of the landward sheltered area. One female was laying eggs at an underside of a cobble in May 2001.

119. *Vitreolina auratas* キンイロセトモノガイ

120. *Vitreolina langfordi* ムラサキウニヤドリニナ

These two species (119 and 120) are parasites of sea urchins (Okutani 2000) and were found exclusively on *Anthocardaris crassispina* in the study area.

121. *Apicalia habeii* ヤツデヒトデヤドリニナ

One individual was found on *Costenasterias acutispina*, which is a host sea star of this parasitic snail (Okutani 2000) in the low zone.

123. *Ergalatax contractus* ヒメヨウラク

Found in the low zone and in pools of the middle zone, often aggregating on the carrion of fishes.

124. *Muricodrupa fusca* レイシダマシモドキ

Found mainly in pools in the middle and high zones. This species was observed feeding on *Planaxis sulcatus* and *Siphonaria japonica*.

130. *Morula granulata* レイシダマシ

Only the juveniles and sub-adults with incomplete shell mouths were observed during the early period of the study but adults with a thickened lip appeared thereafter.

142. *Thais clavigera* イボニシ

Two types of this species, one with pointed nodules and the other with round nodules (Abe 1985), appeared in the study area, but were not recorded separately.

144. *Coralliophila squamosissima* カゴメサンゴヤドリ

This snail is parasitic to coelenterates (Okutani 2000), and was found near the sea anemone, *Anthopleura japonica*, in the low zone.

145. *Euplica scripta* フトコロガイ

Found in pools and under the canopy of macrophytes in the middle and low zones. One individual was observed moving its proboscis on a filamentous algae. In aquariums, this species grazes on microscopic green algae attached to glass (H. Usuki, personal communication).

149. *Mitrella bicincta* ムギガイ

Found on macrophytes in the low zone and under cobbles in pools of the middle zone.

150. *Zafra pumila* ノミニナ

Found on rare occasions under cobbles in large pools of the landward sheltered area.

156. *Reticunassa fratercula* クロスジムシロ

Found on sand in large pools of the landward sheltered area. Once observed feeding on the gastropod, *Ittibittium parcum*.

158. *Japeuthria ferrea* イソニナ

Mainly found in the notches facing the landward sheltered area. This species actively crawls out into pools at high tide and feeds on limpets such as *Cellana toreuma* (S. Abe, personal communication).

175. *Haloa japonica* ブドウガイ

Found on foliose green algae such as *Monostroma*, *Enteromorpha*, and *Ulva* in the landward sheltered area.

176. *Smaragdinella sieboldi* タテジワミドリガイ

Exclusively found within the empty shells of oysters and barnacles in the middle zone.

178. *Ercolania boodlea* アリモウミウシ

Found on rare occasions densely aggregated on the bottom of pools or on the green alga, *Boodlea*.

193. *Doriopsilla miniata* ダイダイウミウシ

Aggregations of several individuals were often observed under the canopy of *Sargassum* in the low zone.

196. *Onchidella kurodai* ヒメアワモチ

Found on rare occasions on the sponge, *Halichondria okadai*, which has the same black color as this onchidid.

197. *Peronia* sp. イソアワモチ近似種

Found on green algae. The related larger species, *Peronia* sp. aff. *verruculata* (*sensu* Ueshima [2007]) was not recorded in the study area.

198. *Siphonaria acmaeoides* シロカラマツガイ

This siphonarid limpet was mainly found in shallow pools of the high zone.

200. *Siphonaria sirius* キクノハナガイ

Individuals of <1 cm shell-length were found densely aggregated in the low zone, whereas the larger individuals were observed sparsely distributed in the middle and high zones. Large individuals often formed greenish scars on the rock surface, indicating their homing behavior.

201. *Nucula paulula* マメクルミガイ

This minute bivalve was embedded in the sandy bottoms of pools in the landward sheltered area.

209. *Mytilus coruscus* イガイ

Solitary large individuals were often found in the low zone near the wave-exposed tip of the platform.

210. *Mytilus galloprovincialis* ムラサキイガイ

Individuals of <1 cm shell-length were found sporadically within dense aggregations of *Septifer virgatus* in the low zone near the wave-exposed tip of the platform.

212. *Hormomya mutabilis* ヒバリガイモドキ

Dense aggregations of this sessile bivalve were observed on horizontal rock substrata in the low and middle zones. Inter-annual fluctuations in density and size structure were obvious. Size was relatively uniform within each aggregation. Individuals of <2 mm shell-length were observed among tufts of calcareous algae. Muricid gastropods were often aggregated on and feeding on colonies of small individuals of this species (<1 cm shell-length).

213. *Septifer bilocularis* クジャクガイ

Found attached to rocks in the low and middle zones. Dense aggregations were observed within notches, and on cliffs that were shaded from sunlight and sheltered from waves.

214. *Septifer virgatus* ムラサキインコ

Mainly distributed in dense aggregations of individuals of various sizes in the low zone near the wave-exposed tip of the platform. This species often coexisted with a colonial cirriped, *Capitulum mitella*. Kawai and Tokeshi (2004) reported that the *S. virgatus* is favorably affected by *C. mitella*. Solitary individuals in the landward area were probably detached and transported from the main habitat. Eggs after the one-cell stage were not observed in the gonads of these females, nor the females of *Hormomya mutabilis*, throughout the breeding season (Ohgaki 1996, personal observation), suggesting external fertilization and planktonic development in these species.

216. *Modiolus nipponicus* ヒバリガイ



Solitary reddish-brown juveniles (<1 cm shell-length) were found on rare occasions near the wave-exposed tip of the platform.

220. *Pinctada martensii* アコヤガイ

Found in the low zone or in pools of the middle zone.

221. *Isognomon acutirostris* ヘリトリアオリ

This tropical bivalve was found within rock crevices of the middle and high zones. Only small individuals (<5 mm shell-length) were observed on rare occasions during the early period of the study, but the larger individuals commonly appeared subsequently.

229. *Saccostrea kegaki* ケガキ

Widely distributed over the study area except for pools and the lowest zone. Mass settlement of juveniles occurred every several years.

231. *Dendostrea crenulifera* ノコギリガキ

Found in the low zone, particularly on cliffs sheltered from waves.

232. *Lasaea undulata* チリハギガイ

This minute red bivalve was found in rock crevices, under oyster shells, or among the byssus threads of mussels. The frequency of occurrence decreased, after the procedure of breaking rocks to find cryptic species was stopped in 2002.

235. *Claudiconcha japonica* セミアサリ

Found within rock crevices or colonies of the polychaete, *Pomatoleios kraussi*, forming a calcareous tube. Population density decreased during the course of the study, which corresponded to the decline in this coexisting polychaete.

236. *Gafrarium dispar* イナミガイ

237. *Gafrarium divaricatum* ケマンガイ

238. *Protothaca jedoensis* オニアサリ

239. *Ruditapes variegatus* ヒメアサリ

Solitary individuals of these venerid bivalves (236–239) were occasionally found on the sandy or pebbly bottoms of large pools in the landward sheltered area.

240. *Irus mitis* マツカゼガイ

Individuals of <1 cm shell-length were found on rare occasions within rock crevices and in the colony of the polychaete, *Pomatoleios kraussi*.