July, 1963 No. 13

PUBLICATIONS
FROM
THE AKKESHI MARINE BIOLOGICAL STATION

The Zoological Environs of the Akkeshi Marine Biological Station

By
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SAPPORO, JAPAN

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(With 7 text-figures and 4 plates)

Introduction

The Akkeshi Marine Biological Station of the Hokkaido University is located in Akkeshi on the Pacific coast of the easternmost part of Hokkaido, on 43°00′N. and 144°50′E. It was founded in 1931 for the biological research of marine animals and plants at that region and its vicinity, and since that time a number of works were made in different fields of research. The main reason why this place was chosen for institution of this station lies in the fact that the station has the rich fauna and flora which are distinctly different from those of other marine biological stations as will be stated below.

It is well known that the two different main currents flow along the Japanese coast, i.e. the Oyashio, a cold current from the north and the Kuroshio, a warm current from the south. The eastern part of the Pacific coast of Hokkaido is chiefly washed by the cold Oyashio and influence of the warm Kuroshio from the south is very little in this coast. Most of the animal species found in Akkeshi Bay are boreal forms as is shown in the later pages. Clear from its high latitude it is natural that the marine fauna of the coasts of Hokkaido is generally different from that of the coasts of Honshu, Shikoku or Kyushu, comprising many boreal forms. Concerning the faunal nature of the coasts of Hokkaido itself, however, remarkable differences can be seen between different coasts. The southwestern coast of Hokkaido facing to the Pacific Ocean is mainly washed by the cold Oyashio but fairly influenced by the warm Kuroshio. A considerable number of temperate forms are distributed in this area. On the west coast of Hokkaido facing to the Japan Sea the boreal forms

Publ. Akkeshi Mar. Biol. Stat., No. 13, 1963.

are mixed with temperate ones, like on the southwestern coast above. On the northeastern coast of Hokkaido facing to the Okhotsk Sea we can see also two different elements of current, the cold one coming down from the north along the Kurile Islands and the warm one coming into through the Soya Strait from the Japan Sea. As is clear from above, boreal forms are always more or less mixed with temperate ones in most part of the coasts of Hokkaido, while the southeastern coast including Akkeshi Bay is scarcely influenced by the warm current though only a few temperate forms can be found as temporary visitors there.

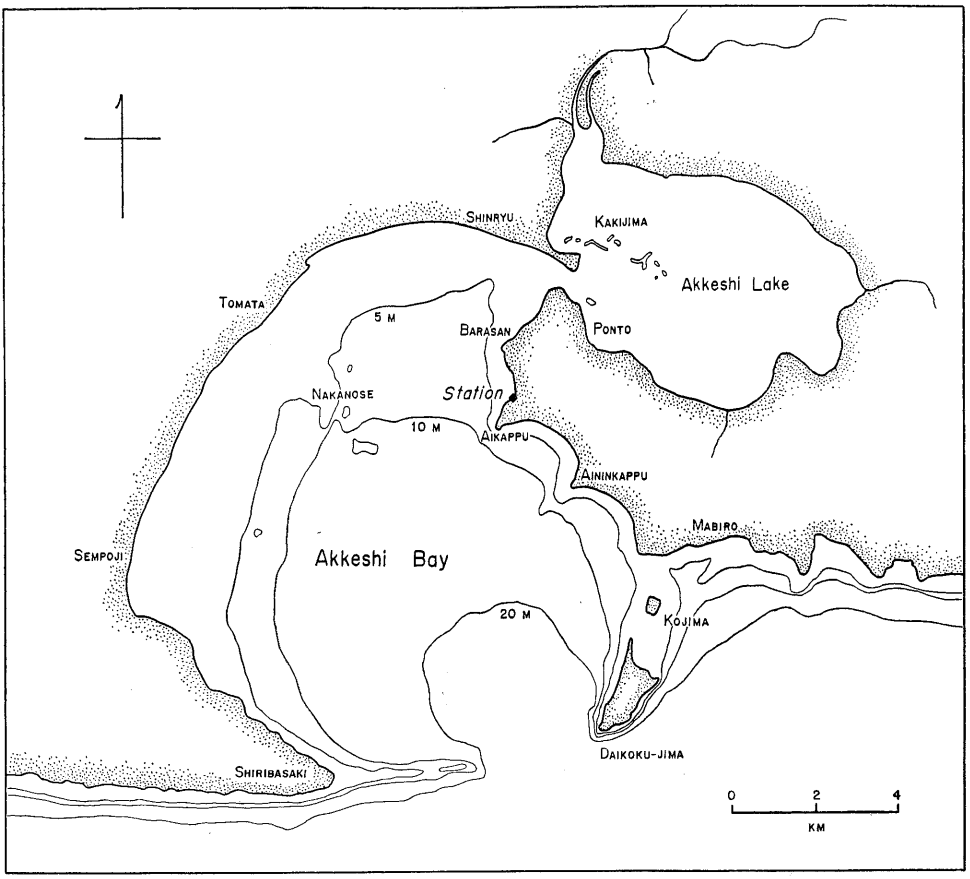

Fig. 1. Map of Akkeshi Bay and Akkeshi Lake and the environs.

As is seen in Fig. 1 Akkeshi Bay is of roughly round shape, about 10km in diameter, and opens to the Pacific Ocean south- and southeasternwards. Two small inlets, Daikokujima and Kojima lie in the mouth of the Bay. Akkeshi Bay is connected at its northern end with a shallow

lagoon named Akkeshi Lake by a narrow channel. The bay is about 30m deep at its mouth and becomes shallower toward the inner part gradually. Akkeshi Lake is very shallow and is less than 2m deep.

Most of the coast of Akkeshi Bay is of rocky shore, but sandy and muddy shores are also found. Sandy shore is found in Daikokujima and in Tsukushikoi between Aikappu and Aininkappu, and muddy shore is in Shinryu. Akkeshi Lake is a lagoon and is connected with Akkeshi Bay by a narrow channel. Bekambeushi and some other rivers pour into the Lake and the Lake is brackish showing low salinity. These natural features of environment give many diverse habitats to the marine fauna of the Bay. It is true that the marine fauna is richer in Akkeshi Bay than in the regions little apart from the Bay.

The surface water temperature in front of the Station is shown in the following table which indicates the mean value in each month for these three years, 1960–1962.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
−1.23	−1.38	−0.08	3.67	7.97	11.60	15.53	17.77	18.87	13.23	8.27	2.77

General Sketch on Marine Animals in the Bay

i) *Plankton*

Quantitative collection of marine plankton for each month in Akkeshi Bay shows a remarkable evidence that the plankton amount is very different due to month. It depends on the sudden increase of the phytoplankton and the evidence is characteristic of northern sea. The phytoplankton reach the maximum amount usually in June and July. The zooplankton are generally rich also in summer seasons. Some foraminifers occur in the Bay, and the radiolarian *Acanthometron* sp. is found off the Bay. Some dinoflagellates, *Ceratium* spp., *Gymnodinium* sp. and others are rarely found and *Noctiluca* sp. is also very rarely found. Many species of Tintinnoinea were reported by Hada from the Bay. The Hydromedusae have been worked by Uchida. The common species are: *Sarsia tubulosa, Cladonema uchidai, Urashimea globosa, Turritopsis nutricula, Nemopsis dofleini, Bougainvillia superciliaris, Polyorchis karafutoensis, Proboscidactyla flavicirrata, Eutonina indicans, Obelia* sp. and *Aglantha digitale.* Of these medusae, *Polyorchis karafutoensis* is a conspicuous medusa in the Bay, of rather large size and typical boreal one, and is abundantly found during May to July. The hydroid stage of this species remains still unknown. Of the Scyphozoa common species are: *Aurelia limbata*

and *Chrysaora helvola*. The larvae of many different animal groups are commonly found as plankton. Among them we can find: Pilidium, Müller's larva, Cyphonautes, Actinotrocha, trochophores or more developed larvae of marine annelids, Nauplius and Zoea, molluscan larvae, Pluteus, Bipinnaria and Auricularia. Several copepods are common but not yet determined. Some chaetognaths and rotifers are often found. In autumn some temperate animals are often found.

ii) *Animals in rocky shore*

Rocky shore in low tide in Akkeshi Bay shows us a great variety of marine life of different animals. Only several steps on the rocky shore make us possible to find a considerable number of animal species.

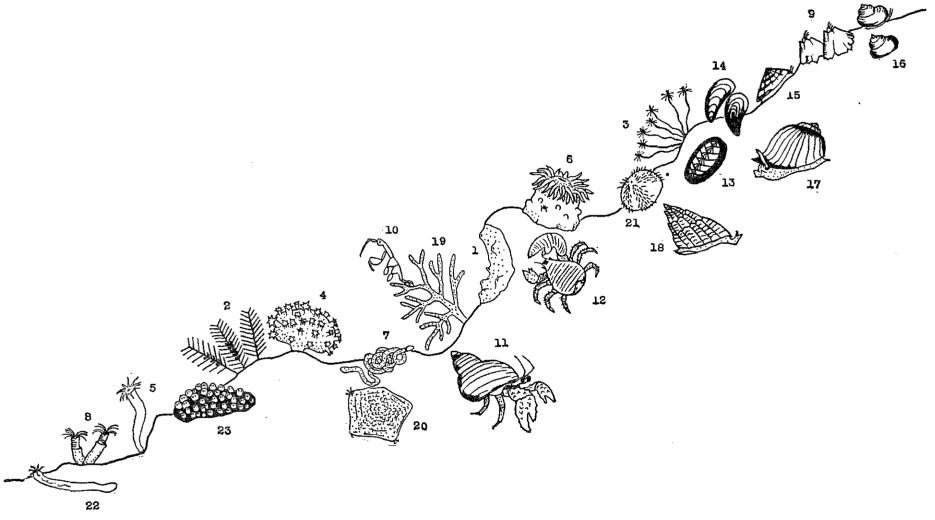

Fig. 2. Rocky shore fauna arranged in their vertical distribution. 1. *Halichondria* sp., 2. *Abietinaria costata*, 3. *Tubularia venusta*, 4. *Alcyonium pacificum*, 5. *Charisea saxicola*, 6. *Epiactis japonica*, 7. *Lineus torquatus*, 8. *Potamilla myriops*, 9. *Chthamalus dalli*, 10. *Caprella bispinosa*, 11. *Pagurus ochotensis*, 12. *Dermaturus mandtii*, 13. *Lorica albrechti*, 14. *Mytilus edulis*, 15. *Collisella pelta*, 16. *Neritrema sitkana*, 17. *Neptunea arthritica*, 18. *Buccinum schantaricum*, 19. *Bugula* sp., 20. *Asterina pectinifera*, 21. *Strongylocentrotus intermedius*, 22. *Scoliodotella uchidai*, 23. *Syndendrodoa composita*.

Sponges are found on rocks or stone surface, among them a calcareous form *Grantessa nemurensis* and some undetermined Demospongiae are commonly found. A number of hydroid polyps are very common. Common species are: *Coryne pusilla*, *Tubularia venusta*, *Hydractinia uchidai*, *Eudendrium* spp., the polyp of *Proboscidactyla flavicirrata* growing on the tube margin of the sedentary polychaete *Potamilla myriops*, *Orthopyxis*

platicarpa, Obelia dichotoma, Abietinaria costata, etc. Anthozoans are represented by the species of *Alcyonium* which are commonly found in Daikokujima and several species of actinians of which *Anthopleura kurogané* and *Epiactis japonica* are abundantly found in rocky shore. The latter species has a habit of brood-caring and shows various colour patterns in the column.

If we turn stones in low tide a number of various worms can be easily found. Turbellarians are not so common in Akkeshi Bay while we have rich fauna of nemerteans and polychaetes. The nemerteans in Akkeshi Bay were worked by Yamaoka and Iwata. They enumerated 30 species, among which the common species in rocky shore are *Procephalothrix simulus, Tubulanus punctatus, Lineus torquatus, Micrura akkeshiensis, Emplectonema gracile, Paranemertes peregrina, Oerstedia dorsalis, Amphiporus lactifloreus* and some species *Tetrastemma.* The comparative embryology of these nemerteans have been recently studied by Iwata. Several annelid worms are also commonly found. They were nice subjects for the late Dr. Okuda's embryological works. Among erranciate species the followings are common: *Harmothoë imbricata, Nereis ezoensis, Syllis* spp., *Lumbriconereis latreilli,* etc. Among sedentary ones: *Nainereis laevigata, Spio filicornis, Audouinia comosa, Potamilla myriops, Chone teres,* etc. *Potamilla myriops* is one of the common sabellid species in Hokkaido and it is used as a bait for fishing as well as *Arenicola* in muddy bottom. Besides above species there are some commonly found, though they still remain undetermined. A sipunculid, *Physcosoma scolops,* lives in gravelly bottom under stones.

The molluscs in rocky shore in Akkeshi Bay are less rich in number of species than in southern seas, but some are not rare. Among chitons *Mopalia ciliata, Lorica albrechti* and *Cryptochiton stelleri* are common. The last one is a giant chiton, all the shells of which are imbedded in the mantle. Long egg-masses in jelly of this species are often found in shore in spring time. In Gastropoda, *Collisella pelta* is a common species and some species of *Littorina* or the related genera often occur abundantly in high tide-mark. A great amount of the egg-masses of *Neritrema sitkana* can be found under stones in Aikappu in high tide in June and July. The bivalves common in rocky shore are: *Ennucula tenuis, Volsella difficilis, Mytilus edulis, Chlamys swifti,* etc.

Many crustaceans are commonly found. The common cirripeds in rocky shore are represented by *Chthamalus dalli, Balanus crenatus* and *B. cariosus.* The common isopods are *Tecticeps japonicus, Exosphaeroma oregonensis, Cymodoce japonica* and *Idotea japonica.* Several amphipod species of *Orchestia* are very common and some *Caprella* species are also

found in rocky shore among hydroid colonies or algal leaves. The decapods commonly occurring in rocky shore are: *Hemigrapsus sanguineus, Telmessus cheiragonus, Pugettia quadridens, Paralithodes brevipes, Pagurus middendorffii* and *P. pectinatus.*

Several species of bryozoans are found in shallow rocky shore, among them *Bugula* sp., *Membranipora serrilamella,* and several undetermined forms are common. A phoronid, *Phoronis hippocrepia,* is found in rocky crevices just below the tidal lines of Tsukushikoi between Aikappu and Aininkappu.

The sea-stars occurring in rocky shore are *Asterina pectinifera, Henricia tumida, Asterias amurensis* and *Leptasterias ochotensis similispinis.* Among them, *Henricia tumida* and *Leptasterias ochotensis similispinis* are the forms directly developing without pelagic larval stages. The sea-urchin in rocky shore is represented by *Strongylocentrotus intermedius. Cucumaria chronhjelmi* and *Scoliodotella uchidai* are common holothurians occurring under stones or among gravels in rocky shore.

Several species of compound ascidians commonly occur attached on rocks or stones as well as on algal leaves in shallow water. They are: *Botryllus communis, Botrylloides violaceum, Dendrodoa aggregata* and *Syndendrodoa composita.*

iii) *Animals living on marine algae or marine plants*

It is a matter of course that some animals are found together with certain marine algae or marine plants. Some common examples of these cases in Akkeshi Bay are shown in Fig. 3. The marine algae are usually found in rocky shore but *Zostera* and other marine flowering plants can be mostly found in muddy shore. The commonest animals living on these algae or plants are hydropolyps. *Coryne pusilla, Orthopyxis platicarpa, Sertularella miurensis, Abietinaria costata* and *Plumularia undulata* are the common members on several algae, and *Tubularia radiata, Obelia plana, O. dichotoma* and *Orthopyxis platicarpa* are commonly found on *Zostera* or *Phyllospadix.* Besides the hydropolyps we can find there the Stauromedusae, a serpulid polychaete, marine leeches, caprellids, bryozoans and compound ascidians. Some hydromedusae are found among the algae or plants; these are *Eperetmus typicus* and *Gonionemus oshoro.*

iv) *Animals in the bay bottom*

As described above, Akkeshi Bay is not so deep, about 30 m at the mouth and less in inner part. The details of the bay bottom are still remained unsatisfactorily known, but occasional dredgings have made

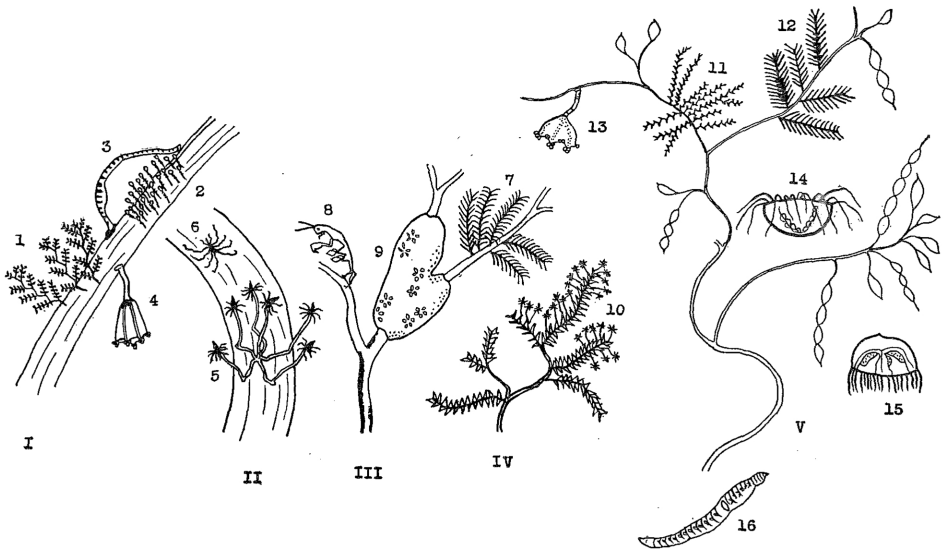

Fig. 3. Animals living on algae or marine plants. I. On *Phyllospadix iwatensis*. 1. *Obelia plana*, 2. *Orthopyxis platicarpa*, 3. *Carcinobdella* sp., 4. *Thaumatoscyphus distinctus*. II. On *Zostera marina*. 5. *Tubularia radiata*, 6. *Achelia echinata*. III. On *Fucus evanescens*. 7. *Plumularia undulata*, 8. *Caprella bispinosa*, 9. *Botryllus communis*. IV. On *Rhodomela Larix*. 10. *Coryne pusilla*. V. On or near *Cystophyllum hakodatense*. 11. *Sertularella miurensis*, 12. *Abietinaria costata*, 13. *Haliclystus borealis*, 14. *Gonionemus oshoro*, 15. *Eperetmus typicus*, 16. *Thoracophelia ezoensis*.

clear that most of the bay is of rocky bottom, but sandy and muddy bottoms can be also found. Common animals found by dredging from the bay bottom are illustrated in Fig 4. *Hydractinia uchidai* is a common hydroid which covers the surface of a gastropod shell which contains a hermit-crab. Common decapod crustaceans are *Paralithodes brevipes* and *Crangon affinis*. *Patinopecten yessoensis* is a common bivalve which is edible and is economically important. Of gastropods, *Fusitriton oregonensis* and *Neptunea arthritica*, are common and the latter is edible and collected for fish-market.

In general the most conspicuous animals dredged from the bottom of the bay are probably the following three echinoderms: *Asterias amurensis*, *Strongylocentrotus intermedius* and *Cucumaria japonica*. The sea-star *Asterias amurensis* attains to a very large size, about 17 cm in arm length. This sea-star often harbours a polychaete *Halosydnoides vittata* in its ambulacral grooves. It is very commonly distributed through the bay. The sea-urchin *Strongylocentrotus intermedius* and the sea-cucumber *Cucumaria japonica* are also very commonly found by the dredging of the bay. The brachiopod *Terebratalia coreanica* and the

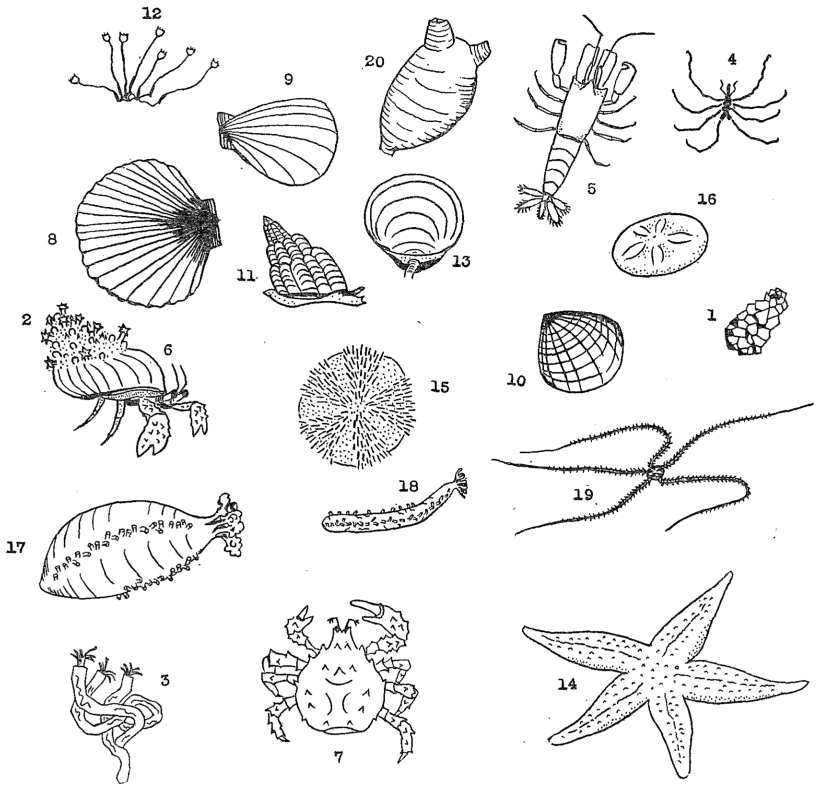

Fig. 4. Bottom fauna of Akkeshi Bay. 1. *Proteonina difflugiformis*, 2. *Hydractinia uchidai*, 3. *Hydroides ezoensis*, 4. *Achelia alaskensis*, 5. *Crangon affinis*, 6. *Pagurus ochotensis*, 7. *Paralithodes brevipes*, 8. *Patinopecten yessoensis*, 9. *Chlamys swifti*, 10. *Venerupis japonica*, 11. *Fusitriton oregonensis*, 12. *Barentsia gracilis*, 13. *Terebratalia coreanica*, 14. *Asterias amurensis*, 15. *Strongylocentrotus intermedius*, 16. *Scaphechinus griseus*, 17. *Cucumaria japonica*, 18. *Cucumaria chronhjelmi*, 19. *Amphiodia debita*, 20. *Halocynthia aurantium*.

ascidian *Halocynthia aurantium* are common animals found by dredging of some parts of the bay. It is a matter of course that several animals of the rocky shore or of sandy and muddy shores also appear by dredging from such shallow bottom as Akkeshi Bay. On the other hand, dredging from the bay bottom near the mouth of the bay often takes up some dwellers of the deeper bottom of the open sea. Among them rather common ones are the sea-anemone *Liponema multicornis* and the brittle-star *Gorgonocephalus* sp.

v) *Animals in sandy and muddy shores*

In Akkeshi Bay we find chief sandy shores on the coast between Tomata and Shinryu, at Tsukushikoi between Aikappu and Aininkappu,

and on the coast of Daikokujima. Muddy shores are at Shinryu and on the coast between Barasan and the mouth of Akkeshi Lake. It is sometimes difficult to identify the shores with each of these two categories and we find often various intermediate conditions of them.

In the typical fine sandy shores without organic matter we find plenty of individuals of the archiannelid *Saccocirrus major.*

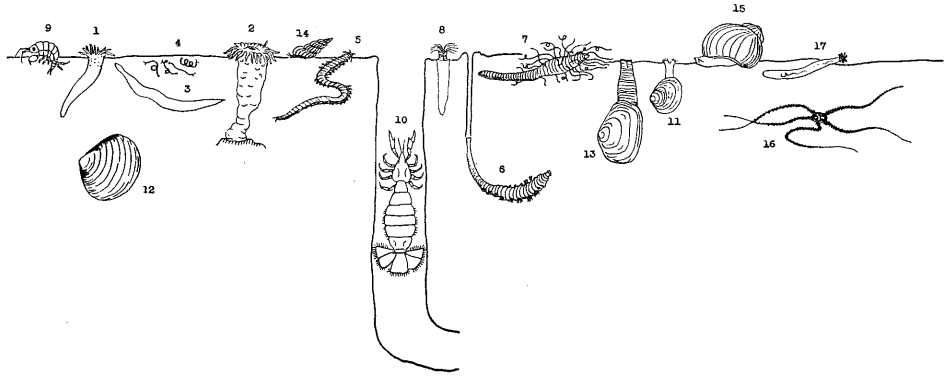

Fig. 5. Sand and mud fauna in Akkeshi Bay. 1. *Metedwardsia akkeshi,* 2. *Anthopleura kurogané,* 3. *Cerebratulus marginatus,* 4. *Saccocirrus major,* 5. *Nereis ezoensis,* 6. *Arenicola claparedii,* 7. *Cirratulus cirratus,* 8. *Chone teres,* 9. *Orchestia ditmani,* 10. *Upogebia major,* 11, *Venerupis japonica,* 12. *Spisula sachalinensis,* 13. *Mya japonica,* 14. *Batillaria cumingii,* 15. *Tectonatica janthostoma* 16. *Amphiodia debita,* 17. *Scoliodotella uchidai.*

The low-tide muddy shore at Shinryu forms a large flat where is one of the favoured collecting places in Akkeshi. The muddy flat is more or less mixed with sand and mud containing organic matter of various amount. Little piles of coiling mud castings which occur here and there indicate the presence of the lug-worm *Arenicola claparedii.* A number of holes can be found in the flat and digging deep under them makes us possible to find the bivalve *Mya japonica* or the shrimp *Upogebia major.* In digging the flat in Shinryu we can find several different burrowing animals besides above mentioned, the common ones are: the sea-anemone *Metedwardsia akkeshi,* the nemertean *Cerebratulus marginatus,* the polychaete *Cirratulus cirratus,* the bivalves *Venerupis japonica* and *Clinocardium uchidai,* the brittle-star *Amphiodia debita,* etc. On the flat in Shinryu we find sometimes egg-masses of *Tectonatica janthostoma* in the form of a round wall of jelly thickly encrusted with sand grains.

It is well known that a number of various interstitial animals make a rather specialized fauna in the sandy and muddy shores. These animals are mostly microscopic and these minute animals in Akkeshi Bay still remain nearly unknown.

vi) *Animals in Akkeshi Lake*

Akkeshi Lake is a brackish lagoon which is connected with Akkeshi Bay by a narrow channel. As the details of the physiography of the lake were described by Inukai and Nishio (1937) and Yamazi (1950), we do not repeat it here.

Fig. 6. Fauna in Akkeshi Lake. 1. *Tubularia radiata*, 2. *Obelia plana*, 3. *Polyorchis karafutoensis*, 4. *Haliplanella luciae*, 5. *Metridium senile* var. *fimbriatum*, 6. *Arenicola claparedii*, 7. *Potamilla myriops*, 8. *Phascolosoma zenibakense*, 9. *Upogebia major*, 10. *Lecythorhynchus hilgendorfi*, 11. *Hemigrapsus sanguineus*, 12. *Mya japonica*, 13. *Venerupis japonica*, 14. *Littorina brevicula*, 15. *Ostrea gigas*.

Near the mouth of the lake there can be found a number of natural oyster beds of different size. These oyster beds are chiefly made of old oyster shells and therefore they are called as Kakijima, meaning oyster inlets. The oyster is identified as *Ostrea gigas*, characterized by its large size. These oyster beds are visible over water-level at low tide, while most of them disappear at high tide. Near the low tide mark of these beds there exist living oyster individuals, and between them we can find the bivalve *Venerupis japonica*, the gastropod *Littorina brevicula*, the crab *Hemigrapsus sanguineus*, the sea-anemone *Haliplanella luciae*, etc. Around the oyster beds and near the coast of Ponto the eel-grass *Zostera* grows. To its blades the hydroid *Tubularia radiata* often attaches in

autumn, and among them the medusa *Polyorchis karafutoensis* is often swimming from April to July.

Dredging at the mouth of the lake takes up many old oyster shells, with which the hydroids *Obelia plana* and *Sertularia cupressoides*, the polychaete *Potamilla myriops*, the pycnogonid *Lecythorhynchus hilgendorfi*, etc. are commonly found together.

It is noticeable that the sea-anemone *Metridium senile* var. *fimbriatum* abundantly grows on the wooden piles in the wharf of Ponto, and the ship-worm *Bankia setacea* rarely lives boring in these piles.

Main part of the lake, except at the mouth part and around the oyster beds, is of muddy bottom. On the shallow muddy bottom at the eastern part of the lake there can be commonly found the lug-worm *Arenicola claparedii*, and the sipunculid *Phascolosoma zenibakense* is also occasionally found.

vii) *Animals living in association*

Fig. 7 shows some cases of two animals living in association in Akkeshi Bay.

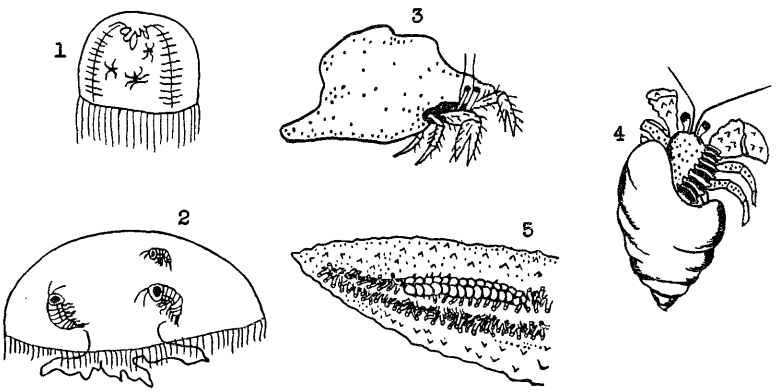

Fig. 7. Animals living in association in Akkeshi Bay. 1. *Achelia alaskensis* in *Polyorchis karafutoensis*, 2. *Hyperia galba* in *Aurelia limbata*, 3. *Pagurus pectinatus* in *Suberites* sp., 4. *Cheilonereis cyclulus* and *Pagurus ochotensis* in gastropod shell, 5. *Halosydnoides vittata* in ambulacral groove of *Asterias amurensis*.

The larvae of the pycnogonid *Achelia alaskensis* are found parasitic on the hydromedusa *Polyorchis karafutoensis*. The larvae of various stages of development are abundantly found under the subumbrella and on the wall of the manubrium of medusa. The scyphomedusa *Aurelia limbata*, a boreal medusa, often harbours the amphipod *Hyperia galba*. Several individuals of this amphipod are found attached to under the

subumbrella of the medusa. The commensal relationships between the sponge *Suberites* sp. and a hermit-crab are often recognized along the shores of Hokkaido, and a *Suberites* species which is occasionally collected from the deeper bottom of Akkeshi Bay nearly always contains a hermit-crab. Some polychaetes are known as commensal ones. In Akkeshi Bay *Cheilonereis cyclurus* is commensal with the hermit-crab *Pagurus ochotensis* in a gastropod shell and *Halosydnoides vittata* is found in the ambulacral grooves of *Asterias amurensis.*

Several more cases of the animals in various association are found in Akkeshi Bay and one can find them in the list of animal species found in Akkeshi Bay in the following pages.

List of Animal Species Found in Akkeshi Bay

Since the foundation of the Station in 1931, the marine fauna around the Station have been continuously studied by a number of specialists and many reports have been published on the marine fauna for these 30 years. Several groups, however, are still remained very poorly studied and others are incompletely known. Following is a list of the animal species ever known in Akkeshi Bay and we hope that this list will develop to a more complete one in future. Brief notes on the distribution and habitat are added for each species, as far as we know.

Phylum PROTOZOA

Among Protozoa some foraminifers and pelagic ciliates were reported by Hada (1929, 1936, 1937).

Class Rhizopoda

Foraminifera

Proteonina difflugiformis (Brady)
Lagena curta Hada
Lagena bispina Hada

Class Ciliata

Prorodon teres Ehrenberg Found in fresh, brackish and sea water.
Prorodon flavus Hada
Didinium gargantua Meunier Very rare in plankton of Akkeshi Bay.
Didinium balbianii (Fabre-Domergue) Very rare. Brackish water form.
Tiarina fusus (Claparède & Lackmann) Rare.
Tintinnidium mucicola (Claparède & Lackmann) Daday Very rae. Boreal.
Leprotintinnus pellucidus (Cleve) Jörgensen Sometimes common.
Leprotintinnus bottnicus (Nordqvist) Jörgensen Rare. Brackish water species.

Tintinnopsis beroidea Stein Very rare. Cosmopolitan species.
Tintinnopsis ampla Hada Very rare.
Tintinnopsis elongata Daday Rare.
Tintinnopsis pusilla Hada Common in October.
Tintinnopsis akkeshiensis Hada Rarely found in May-July.
Tintinnopsis angustior Jörgensen Rare during June-August.
Tintinnopsis tenuis Hada Brackish water species.
Tintinnopsis japonica Hada Common in spring.
Tintinnopsis kofoidi Hada
Tintinnopsis kofoidi var. *limnetica* Hada
Tintinnopsis radix (Imhof) Brandt Very rare.
Tintinnopsis tubulosa Levander Common in May. Boreal form.
Tintinnopsis lohmanni Laackmann Rare or common through the year. Boreal.
Tintinnopsis sufflata Hada Very rare.
Tintinnopsis rapa Meunier Rare. Circumpolar species.
Tintinnopsis diversicervica Hada Rare and sometimes common in autumn.
Tintinnopsis brevicollis Hada
Tintinnopsis baltica Brandt Rare or very rare.
Stenosemella nivalis (Meunier) Kofoid & Campbell Rare.
Codonellopsis frigida Hada Boreal.
Codonellopsis borealis Hada
Coxliella ampla (Jörgensen) Brandt Very rare. Circumpolar species.
Helicostomella fusiformis (Meunier) Jörgensen Rare.
Helicostomella subulata (Ehrenberg) Jörgensen Rare.
Favella ehrenbergi (Claparède & Lachmann) Jörgensen var. Rare.
Favella taraikaensis Hada Boreal.
Parafavella denticulata (Ehrenberg) Kofoid & Campbell Circumpolar.
Parafavella gigantea (Brandt) Kofoid & Campbell Circumpolar.
Parafavella ventricosa (Jörgensen) Kofoid & Campbell Very rare. Boreal.
Parafavella faceta Hada Very rare.
Parafavella jörgenseni Hada Very rare in winter. Boreal form.
Parafavella longidentata Hada
Parafavella pacifica Hada Rare. Boreal form.
Parafavella subcylindrica Hada Very Rare. Boreal.
Ptychocylis obtusa Brandt Rare. Boreal.
Ptychocylis drygalskii Brandt Boreal.
Ptychocylis arctica Brandt Very rare. Boreal.
Ptychocylis humilis Hada Very rare. Boreal.
Ptychocylis acuta Brandt Rare in spring and summer. Boreal.
Acanthostomella norvegica (Daday) Jörgensen Very rare.
Protorhabdonella curta (Cleve) Jörgensen
Proplectella expolita Hada
Amphorella quadrilineata (Claparède & Lachmann) Daday Temperate species.
Tintinnus tubulosus Ostenfeld Very rare in August and September.
Tintinnus rectus Wailes Common during July and August. Northern Pacific.
Tintinnus turris Kofoid & Campbell Circumpolar species.
Salpingella acuminata (Claparède & Lackmann) Jörgensen

Phylum PORIFERA

Class Calcarea

After Hôzawa & Tanita (1941)

Grantessa nemurensis Hôzawa Rather common.
Grantia uchidai Hôzawa & Tanita
Leucandra cerebrum Hôzawa & Tanita Rare.

Class Demospongiae

This group is very poorly studied and the following is our provisional identification.

Suberites sp.
Halichondria sp.
Mycale sp.

Phylum COELENTERATA

Class Hydrozoa

(Hydroids)

Hydroids are rather common in Akkeshi Bay and has been studied by Uchida, Yamada and Nagao. It seems that tiny forms may be added to the list on closer examination.

Athecata

Coryne pusilla Gärtner
Stauridiosarsia japonica Nagao
Tubularia radiata Uchida Very common on eel-grass.
Tubularia venusta Yamada Common on rocks and stones.
Hydractinia uchidai Nagao Rather common.
Stylactis conchicola Yamada
Stylactis uchidai Yamada
Eudendrium capillare Alder Cosmopolitan.
Eudendrium annulatum Norman
Eudendrium insigne Hincks
Eudendrium boreale Yamada Common.
Proboscidactyla flavicirrata Brandt On tubes of *Potamilla myriops*. Northern Pacific form.

Thecata

Halecium magellanicum (Hartlaub) Circumpolar species.
Orthopyxis platicarpa Bale Very common.
Obelia plana (M. Sars) Very common. Boreal.
Obelia dichotoma (L.) Common.
Campanularia volubilis (L.)
Campanularia urceolata Clarke Northern Pacific form.
Calycella syringa (L.)

Symplectoscyphus tricuspidatus (Alder) Boreal.
Sertularella gigantea Mereschkowsky Common. Circumpolar species.
Sertularella miurensis Stechow Very common. Only in Japan.
Sertularella tenella (Alder) Cosmopolitan.
Sertularella rugosa (L.)
Sertularella sagamina Stechow Only in Japan.
Abietinaria costata (Nutting) Very common. Circumpolar species.
Sertularia tenera G. O. Sars Common. Circumpolar species.
Sertularia cupressoides Clarke Northern Pacific form.
Selaginopsis triserialis Mereschkowsky Common at Daikokujima. Northern Pacific form.
Selaginopsis decemserialis Mereschkowsky Northern Pacific form.
Selaginopsis breitfussi (Kudelin) Circumpolar species.
Plumularia undulata Yamada Very common.

(Hydromedusae)

Anthomedusae

Sarsia tubulosa (Sars) Common. Boreal.
Hydrocoryne miurensis Stechow Only in Japan. Temperate species.
Stauridiosarsia japonica Nagao
Euphysa japonica (Maas)
Hybocodon prolifer L. Agassiz Boreal.
Climacocodon ikarii Uchida Only in Japan.
Cladonema uchidai Hirai
Stomotoca pterophylla Haeckel Temporary visitor. Temperate species.
Leuckartiara octona (Fleming) Temperate species.
Halitholus pauper Hartlaub Circumpolar species.
Catablema multicirrata Kishinouye Common.
Urashimea globosa Kishinouye Rather common in autumn. Only in Japan.
Turritopsis nutricula McCrady Abundant in October. Boreal and temperate.
Nemopsis dofleini Mass Only in Japan.
Rathkea octopunctata (M. Sars) Boreal and temperate species.
Bougainvillia superciliaris (L. Agassiz) Common. Circumpolar species.
Polyorchis karafutoensis Kishinouye Abundant during May-July. Boreal.
Proboscidactyla flavicirrata Brandt Common. Northern Pacific form.

Leptomedusae

Melicertum octocostatum (M. Sars) Rare. Boreal form.
Eutonina indicans (Romances) Very common. Circumpolar.
Staurophora mertensi Brandt Circumpolar species.

Limnomedusae

Gonionemus oshoro Uchida Abundant among eel-grass. Only in Japan. Boreal and temperate species.
Gonionemus agassizi Murbach & Shearer Circumpolar species.
Eperetmus typicus Bigelow Common in summer among marine algae. Northern Pacific form.

Trachymedusae

Aglaura hemistoma Péron & Lesueur Rare. Temperate species.

Aglantha digitale Müller Abundant in winter. Circumpolar species.

Class Scyphozoa

Stauromedusae

Haliclystus borealis Uchida Not rare. Only in Japan.
Haliclystus steinegeri Kishinouye Common in August. Northern Pacific.
Thaumatoscyphus distinctus Kishinouye Very common on the eel-grass. Northern Pacific.

Semaeostomae

Chrysaora helvola Brandt Common from June to August. Northern Pacific.
Dactylometra pacifica Goette Temperate species.
Cyanea capillata Eschscholtz Circumpolar species.
Aurelia limbata Brandt Common in summer. Circumpolar.

Class Anthozoa

Following two alcyonarians and nine actinians are known as the anthozoans from Akkeshi Bay. Other alcyonarians, some pennatularians or gorgonarians may be found from deeper bottom off the bay but not yet found at present. Stony corals, zoanthids, antipathids and cerianthids have never yet been found.

Alcyonacea

Alcyonium pacificum Yamada Commonly found at the tide-mark at Daikokujima.
Alcyonium muricatum Yamada.

Actiniaria

Metedwardsia akkeshi (Uchida) Common in a muddy flat.
Charisea saxicola Torrey Northern Pacific.
Liponema multicornis (Verrill) Boreal.
Anthopleura kurogané Uchida & Muramatsu Abundant.
Tealia felina var. *coriacea* Rapp Common. Boreal.
Epiactis japonica (Verrill) Abundant.
Aureliana sp.
Haliplanella luciae (Verrill) Common, attached to oyster shells.
Metridium senile var. *fimbriatum* Verrill Common below the tidal lines.

Phylum CTENOPHORA

Hormiphora palmata Chun Temperate species.
Bolinopsis mikado (Moser) Only in Japan.
Beroë cucumis Fabricius

Phylum PLATYHELMINTHES

Kato (1937) recorded only free-living turbellarians. Although several species of parasitic trematodes and cestodes are found in some fishes, no

exact investigation have been done on them. More turbellarians may be added to the following two ones, but our knowledge on them is now very poor to enumerate them here.

Class Turbellaria

Mirostylochus akkeshiensis Kato
Procerodes lactea Ijima & Kaburaki

Phylum NEMERTEA

Nemerteans are rather commonly found between tide marks in Akkeshi Bay and were well studied by Yamaoka (1940) and Iwata (1954).

Anopla

Cephalothrix notabilis Iwata Rather common.
Procephalothrix filiformis (Johnston) Rare.
Procephalothrix simulus Iwata Common.
Tubulanus punctatus (Takakura) Common.
Tubulanus ezoensis Yamaoka Rare.
Baseodiscus princeps (Coe) Rare. Northern Pacific form.
Lineus bilineatus (Renier) Rare. Boreal form.
Lineus spatiosus Iwata Rare.
Lineus torquatus Coe Common. Northern Pacific form.
Lineus alborostratus Takakura Rather common. Only in Japan.
Micrura magna Yamaoka Rare.
Micrura alaskensis Coe Northern Pacific form. Rare.
Micrura akkeshiensis Yamaoka Common.
Cerebratulus marginatus Renier Common in muddy sands. Boreal form.

Enopla

Emplectonema gracile (Johnston) Common. Boreal form.
Nemertellina minuta Friedrich Rare.
Paranemertes peregrina Coe Common. Northern Pacific form.
Oerstedia dorsalis (Abildgaar) Common. Boreal form.
Oerstedia polyorbis Iwata Rare.
Zygonemertes glandulosa Yamaoka Rare.
Amphiporus parvus Yamaoka Rare.
Amphiporus lactifloreus (Johnston) Common. Boreal form.
Amphiporus antifuscus Iwata Rare.
Tetrastemma sp. Rare.
Tetrastemma nigrifrons Coe Common. Northern Pacific form.
Tetrastemma coronatum (Quatrefages) Rare.
Tetrastemma pinnatum Iwata
Tetrastemma stigmatum (Stempson) Common. Only in Japan.
Tetrastemma candidum (Müller) Common. Boreal form.
Malacobdella japonica Takakura Common in mantle cavity of the bivalve, *Spisula sachalinensis*.

Phylum ASCHELMINTHES

Several free-living nematodes are commonly found in shallow water of Akkeshi Bay, but these have not been studied. There are no records of parasitic nematodes and parasitic acanthocephalans. Gastrotrichs and kinorhynchs have not yet been known, but we think it is very probable that they will be found in future on closer examination.

Rotifera

Synchaeta triophthalma Common.
Synchaeta vorax Common.
Pseudonotholca sp.

Priapulida

Priapulus caudatus (Lamarck) Rare. Circumpolar species.

Phylum ENDOPROCTA

Loxosoma okudai Yamada Attached on the sedentary polychaete, *Scalibregma inflatum.*
Loxosoma akkeshiense Yamada Attached on the sedentary polychaete, *Amphitrite cirrata.*
Pedicellina ichikawai Yamada
Barentsia discreta (Busk) Rather common.
Barentsia gracilis Sars

Phylum SIPUNCULIDA

After Okuda (1946)

Physcosoma scolops (Selenka & de Man) Rather common in the muddy or gravelly bottom.
Phascolosoma zenibakense Ikeda Boreal.
Dendrostoma hexadactylum Satô Common on the bottom in shallow water. Boreal.

Phylum ANNELIDA

Class Archiannelida

Trilobodrilus nipponicus Uchida & Okuda Common.
Saccocirrus major Pierantoni Common. Occurs in sandy flats between tidal lines.

Class Polychaeta

Polychaetes are common in various habitats in the Bay. The polychaetes of this area were chiefly studied by Okuda, but he left only an incomplete list of the species. The following is provisionally compiled by us and we hope it develops to a more complete one in future.

Errantia

Halosydnoides vittata (Grube) Commensal with *Asterias amurensis*.
Harmothoë imbricata (L.)
Phyllodoce maculata (L.) Boreal species.
Eumida sanguinea (Oersted)
Syllis sp.
Autolytus sp.
Nereis ezoensis Izuka Very common. Boreal.
Nereis virens Sars Boreal.
Cheilonereis cyclurus (Harrington) Commensal with hermit-crab.
Neanthes sp.
Nephthys caeca Fabricius
Lumbriconereis latreilli Audouin & M. Edwards On the muddy bottom in the *Zostera*-region.
Onuphis sp.

Sedentaria

Haploscoloplos kerguelensis (McIntosh)
Nainereis laevigata (Grube) Very common.
Spio filicornis (O. F. Müller) Common. In the sand of *Zostera*-bed. Boreal.
Spiophanes bombyx (Claparède)
Polydora (Carazzia) kempi Southern
Acrocirrus varidus Marenzeller
Acrocirrus uchidai Okuda
Audouinia comosa Marenzeller Very common.
Cirratulus cirratus O. F. Müller Cosmopolitan.
Stylarioides plumosa (O. F. Müller) Boreal form.
Scalibregma inflatum Rathke In the muddy bottom of the tide-mark. Cosmopolitan.
Thoracophelia ezoensis Okuda
Arenicola cristata Stimpson
Arenicola claparedii Levinsen
Sabellaria cementarium Moor Northern Pacific form.
Idanthyrsus armatus Kinberg
Schistocomus sovjeticus Annenkova
Amphitrite cirrata (O. F. Müller)
Lanassa nuda (Moore)
Potamilla myriops Marenzeller Very common.
Chone teres Bush Abundantly found in mud.
Fabricia sp.
Hydroides ezoensis Okuda
Spirorbis nipponicus Okuda
Spirorbis spirillum (L.) Often commensal with a pycnogonid, *Lecythorhynchus hilgendorfi*. Boreal form.
Serpula vermicularis L.

Class Oligochaeta

After Yamaguchi (1937)

Pachydrilus nipponicus Yamaguchi Common along the shore.

Class Hirudinea

Carcinobdella sp. Attached to *Zostera marina.*
Carcinobdella tigrina Oka
Notostomum sp. Attached to *Zostera marina.*
Piscicola sp. Attached to *Zostera marina.*

Class Echiurida

After Okuda (1946)

Echiurus echiurus (Pallas) Rare. Boreal.

Phylum MOLLUSCA

Class Solenogastres

After Okuda (1943)

Chaetoderma akkeshiensis Okuda Very rare.

Class Placophora

Tonicella lineata (Wood) Circumpolar species.
Mopalia ciliata
Lorica albrechti (Schrenck)
Cryptochiton stelleri Middendorff Northern Pacific form.

Class Pelecypoda

After Habe (1955)

Ennucula tenuis (Montagu) Very common in the shallow water in Hokkaido. Circumpolar species.
Nuculana pernula (Müller) Circumpolar species.
Cnesterium johanni (Dall)
Cnesterium notabile (Yokoyama)
Arca miyatensis (Oyama) Boreal form.
Volsella difficilis Kuroda & Habe Rather common. Northern Pacific form.
Brachidontes (Arcuatula) senhousia (Benson)
Adula falcatoides Habe
Mytilus grayanus Dunker Boreal form.
Mytilus edulis Linné
Musculus laevigatus (Gray) Boreal form.
Chlamys swifti (Bernardi) Northern Pacific form.
Patinopecten yessoensis (Jay) The economically important edible mussel in Japan. Northern Pacific species.
Monia macrochisma (Deshayes) Circumpolar species.
Ostrea (Crassostrea) gigas Thunberg An important edible oyster.
Venericardia (Cyclocardia) paucicostata (Krause) Common. Boreal.
Turtonia minuta (Fabricius) Circumpolar species
Thyasira tokunagai Kuroda & Habe
Axinopsida subquadrata (A. Adams)

Clinocardium nuttallii (Conrad)
Clinocardium californiense (Deshayes) Northern Pacific form.
Clinocardium uchidai Habe
Callista brevisiphonata (Carpenter)
Liocyma aniwana (Dall)
Protothaca (Novathaca) euglypta (Sowerby) Northern Pacific form.
Callithaca (Protocallithaca) adamsi (Reeve) Common. Boreal.
Venerupis (Amygdala) japonica (Deshayes) Very common.
Spisula (Mactromeris) voyi (Gabb) Boreal form.
Spisula sachalinensis (Schrenck) Boreal form.
Mactra sulcataria Reeve
Raeta (Raetellops) pulchella (A. Adams & Reeve) In the muddy bottom.
Nuttallia ezonis Kuroda & Habe
Macoma incongrua (v. Martens)
Peronidia venulosa (Schrenck)
Peronidia zyonoensis (Hatai & Nisiyama)
Siliqua alta (Broderip & Sowerby) Boreal.
Solen (Solenarius) krusensterni Schrenck
Hiatella orientalis (Yokoyama)
Panomya ampla Dall
Mya (Arenomya) japonica Jay Common in the muddy shore.
Cryptomya busoensis Yokoyama
Pholadidea (Penitella) chishimana Habe
Barnea (Anchomasa) manilensis inornata (Pilsbry)
Zirfaea subconstricta (Yokoyama) Temperate species.
Nettastomella japonica (Yokoyama)
Lyrodus yatsui (Moll)
Bankia (Bankia) setacea (Tryon) Northern Pacific form.
Lyonsia ventricosa Gould
Entodesma naviculoides (Yokoyama) Common. Boreal form.

Class Scaphopoda

After Habe (1955)

Siphonodentalium okudai Habe

Class Gastropoda

Prosobranchia After Habe (1958)

Acmaea (Niveotectura) pallida (Gould)
Collisella pelta (Eschscholtz) One of the commonest species. Northern Pacific form.
Collisella emydia (Dall) Northern Pacific form.
Collisella (?) *sybaritica* (Dall) Boreal form.
Margarites pilsbryi Kuroda & Habe Common in the eel-grass meadow.
Homalopoma amussitatum (Schrenck)
Homalopoma sangarense (Schrenck)
Falsicingula kurilensis (Pilsbry) Common on the leaves of eel-grass. Boreal species.
Falsicingula angustata (Pilsbry) Common on the leaves of eel-grass.
Epheria decorata (A. Adams) Boreal form.

Stenotis uchidai Habe Abundant on the eel-grass.
Littorina brevicula (Philippi) Common on oyster bed in Akkeshi Lake.
Neritrema sitkana (Philippi) Very common. Circumpolar species.
Ezolittorina squalida (Broderip & Sowerby) Common. Circumpolar species.
Batillaria cumingii (Crosse) Rather common in Akkeshi Lake. Temperate species.
Trichotropis bicarinata (Sowerby) Boreal.
Ariadna insignis (Middendorff) Circumpolar species.
Crepidula grandis Middendorff Chiefly attached on the scallop, *Patinopecten yessoensis*. Northern Pacific species.
Bulbus smithii (Brown) Circumpolar species.
Euspira pila (Pilsbry) Boreal species. Collected commonly with the fishing net of herring.
Tectonatica janthostoma (Deshayes) Boreal species.
Tectonatica hirasei (Pilsbry) Boreal species.
Lamellaria uchidai Habe
Velutina (*Velutella*) *cryptospira* Middendorff
Fusitriton oregonensis (Redfield) Abundant. Northern Pacific form.
Polytropa lamellosa (Gmelin) With the fishing net for herring. Northern Pacific form.
Polytropa freycinetii (Deshayes) Abundant. Northern Pacific form.
Boreotrophon beringi Dall
Ocenebra (*Ocinebrellus*) *adunca* (Sowerby)
Ocenebra japonica (Dunker) One of the common rocky shore dwellers.
Plicifusus (*Retifusus*) *brunneus* (Dall) Circumpolar species.
Plicifusus (*Retifusus*) *plicatus* (A. Adams) Boreal.
Neptunea (*Barbitonia*) *arthritica* (Bernardi) Very common. Boreal.
Neptunea soluta (Hermann) Boreal form.
Neptunea lyrata (Gmelin) Boreal form.
Volutharpa ampullacea (Middendorff) Boreal form.
Buccinum chishimanum Pilsbry Common. Boreal.
Buccinum polare mirandum Smith Commonly collected with fishing net. Boreal.
Buccinum undatum middendorffi Verkrüzen This species shows distinctly sexual dimorphism.
Mitrella bella (Reeve) On the eel-grass meadow of the inshore water.
Mitrella burchardi (Dunker)
Reticunassa acutidentatus (Smith)
Reticunassa fraterculus (Dunker)
Admete couthouyi (Jay) Boreal species.
Oenopota okudai Habe
Rhodopetoma erosa (Schrenck) Boreal form.
Rhodopetoma akkeshiensis Habe
Obestoma uchidai Habe
Menestho akkeshiensis Habe
Derjuginella rufofasciata (Smith) Boreal form.

Pulmonata After Habe (1958)

Siphonacmea oblongata (Yokoyama)

Opisthobranchia After Baba (1935, 1957)

Aglaia ezoensis Baba
Aplysia sibogae Bergh Temperate species.

Stiliger (Ercolania) akkeshiensis Baba
Lamellidoris (Lamellidoris) fusca (O. F. Müller) Boreal.
Acanthodoris pilosa (Abildgaard) Boreal species.
Acanthodoris uchidai Baba
Peltodoris mauritiana Bergh
Okadaia elegans Baba
Diaulula sandiegensis (Cooper) Northern Pacific form.
Dirona akkeshiensis Baba
Coryphella athadona Bergh Boreal form.
Cuthona sp.
Aeolidia papillosa (Linné) Boreal form.

Class Cephalopoda

Decapoda

Ommastrephes sloani pacificus Steenstrup Common in summer and autumn, off the Bay.

Octopoda

Polypus dofleini Wülker Boreal form.

We have some records of the collection of other undetermined cephalopods which probably migrated from the open sea into the Bay.

Phylum ARTHROPODA

Class Crustacea

Tiny crustaceans such as branchiopods, ostracods and copepods are here wholly excluded.

Cirripedia After Hiro (1935)

Lepas anatifera L. Cosmopolitan.
Lepas pectinata Spengler Cosmopolitan.
Conchoderma auritum (L.) Cosmopolitan.
Conchoderma virgatum (Spengler) Cosmopolitan.
Chthamalus dalli Pilsbry Common. Northern Pacific form.
Balanus (Balanus) rostratus Hoek Northern Pacific form.
Balanus (Balanus) crenatus Bruguière Boreal.
Balanus (Semibalanus) cariosus (Pallas) Northern Pacific form.
Coronula diadema (L.) Cosmopolitan.
Peltogasterella socialis Krüger Parasitic on the hermit-crabs, *Pagurus pectinatus* and *P. ochotensis*.
Peltogaster paguri Rathke

Mysidacea

Neomysis sp.

Isopoda

Tecticeps japonicus Iwasa Abundant. Boreal.
Exosphaeroma oregonensis (Dana) Common under the stone in tidal lines. Northern Pacific form.

Cymodoce japonica Richardson
Holotelson tuberculatus Richardson
Rocinela maculata Schioedte & Meinert
Idotea japonica Richardson Abundantly found under stones in tidal lines. Boreal.
Idotea ochotensis Brandt Boreal.
Cleantiella isopus (Grube)
Mesidotea sp.
Janilopsis longiantennata Thielemann
Tylos granulatus Miers
Ligia exotica (Roux) Temperate species.
Porcellio scaber Latreille
Athelges japonicus Shiino Parasitic on the hermit-crab, *Pagurus pectinatus*.
Argeia pugettensis Dana Parasitic on the shrimp, *Crangon affinis*.

Amphipoda After Iwasa (1939) and Utinomi (1943)

Hyperia galba (Montagu) Parasitic on some medusae. Very common.
Orchestia platensis Kröyer Under stones or among algae. Cosmopolitan.
Orchestia platensis japonica (Tattersall)
Orchestia ditmari Dershavin Boreal. Abundantly found under stones or pebbles between the tide-marks.
Orchestia solifuga Iwasa In damp place under fallen leaves.
Hyale novaezealandiae Thomson Rather common among algae near low water-mark.
Parhyale kurilensis Iwasa
Allorchestes malleolus Stebbing Among sea-weeds.
Allorchestes plumicornis (Heller) Among empty shells of oyster or on muddy bottom.
Caprella actifrons Latreille f. *neglecta* Mayer Very common.
Caprella bispinosa Mayer Very common.
Caprella aff. *borealis* Mayer Circumpolar species.
Caprella danilevskii Czerniawski Cosmopolitan.
Caprella drepanochir Mayer
Caprella laeviuscula Mayer Northern Pacific species.
Caprella obtusifrons Utinomi
Caprella paulina Mayer Circumpolar species.
Caprella venusta Utinomi

Decapoda

Pandalus kessleri Czerniavski Common, Boreal.
Crangon affinis de Haan
Upogebia major (de Haan) Rather common in muddy sand.
Pagurus brachiomatus (Thallwitz)
Pagurus ochotensis (Brandt)
Pagurus pectinatus Common.
Pagurus middendorffii Brandt Very common in tidal lines. Northern Pacific form.
Paralithodes brevipes Brandt Common. Boreal.
Paralithodes camtschatica (Tilesius) Rather rare. Boreal.
Dermaturus mandtii Brandt Rather common. Circumpolar species.
Hapalogaster grebnitzkii Schalfeew Rather rare. Northern Pacific form.
Lophomastix japonica (Duruflé) Very rare. Boreal.
Pugettia quadridens (de Haan)
Telmessus cheiragonus (Tilesius) Very common.

Erimaculus isenbechii (Brandt) Boreal species.
Hemigrapsus sanguineus (de Haan)
Hemigrapsus penicillatus (de Haan)

Class Pycnogonida

After Utinomi (1954)

Nymphon striatum Lossina-Losinsky
Phoxichilidium hokkaidoense Utinomi Common below low tide-mark, associated with hydroids.
Achelia alaskensis (Cole) The larvae are found in the hydromedusa *Polyorchis karafutoensis*. Circumpolar species.
Achelia echinata Hodge
Achelia ohshimai Utinomi
Achelia segmentata Utinomi
Lecythorhynchus hilgendorfi Böhm Very common.
Tanystylum anthomasthi Hedgpeth

Class Arachnida

In Akkeshi Bay the Arachnida are now represented by a pseudoscorpion and two mites as below.

Pseudoscorpiones After Morikawa (1958)

Halobisium orientale japonicum Morikawa Rather common in rock clafts in intertidal zone.

Acarina After Ehara (1961)

Bdella uchidai Ehara On rocks or stones in intertidal zone.
Neomolgus littoralis (L.) On rocks, stones, or under seaweeds in intertidal zone. Circumpolar species.

We can find some halacarid mites in shallow water too, but they have not yet been determined.

Class Insecta

After Tokunaga (1938)

Clunio aquilonius Tokunaga

Phylum TENTACULATA

Class Brachiopoda

After Hayasaka & Uozumi (1952)

Hemithyris psitacea woodwardi Adams
Diestothyris frontalis (Middendorff)
Terebratalia coreanica (Adams & Reeve)

Class Phoronida

Phoronis hippocrepia Wright

Class Bryozoa

The bryozoans in Akkeshi Bay are insufficiently studied and the following list contains only cheilostomatous bryozoans which were reported by Mawatari (1956). Although several cyclostomatous and ctenostomatous species are found in the bay they remain still undetermined.

Cheilostomata After Mawatari (1956)

Aetea anguina (L.)
Membranipora serrilamella Osburn
Conopeum reticulum (L.)
Hincksina onychocelloides Mawatari
Callopora lineata (L.)
Scrupocellaria scabra (van Beneden)
Bugula sp.
Hippothoa hyalina (L.)
Hippothoa divaricata Lamouroux
Stomachetosella sinuosa (Busk)
Codonellina operculata Mawatari
Porella immersa Mawatari
Porella concinna (Busk)
Siniopelta costazii (Audouin)
Siniopelta incrassata (Lamarck)

Phylum CHAETOGNATHA

Chaetognaths are inconspicuous among plankton in Akkeshi Bay. The specimens from Akkeshi Bay have not yet been identified.

Phylum ECHINODERMATA

Class Asteroidea

After Hayashi (1947)

Asterina pectinifera Müller & Troschel Common.
Henricia nipponica Uchida
Henricia tumida Verrill Common. The sea-star develops directly, without pelagic larval stages. Circumpolar species.
Distolasterias elegans Djakonov Boreal.
Lethasterias fusca Djakonov Boreal.
Asterias amurensis Lücken The commonest sea-star in Akkeshi Bay. Northern Pacific form.
Lysastrosoma anthosticta Fisher
Leptasterias ochotensis similispinis (Clark) Common in shore. The species develops directly without pelagic larval stage.

Class Ophiuroidea

The ophiuroids of Akkeshi Bay still remain very poorly known, and we can give here only two species at present.

Amphiodia debita Koehler Common.
Amphiodia uchidai Murakami

Class Echinoidea

After Ikeda (1940) and Utinomi (1960)

Strongylocentrotus intermedius (A. Agassiz) Very common. Boreal.
Echinarachnius parma (Lamark)
Scaphechinus griseus (Mortensen)

Class Holothuroidea

Stichopus japonicus Selenka Rather rare.
Cucumaria japonica Semper Very common. Boreal.
Cucumaria chronhjelmi Théel Very common. Boreal.
Scoliodotella uchidai Oguro Under stone in sandy mud, in high tidal zone.

Phylum HEMICHORDATA

Enteropneusta

Saccoglossus borealis Okuda & Yamada Very rare.

Phylum PROTOCHORDATA

Ascidiacea After Tokioka (1951)

Amaroucium glabum Verrill Attached to *Sargassum*. Circumpolar species.
Amaroucium constellatum Verrill
Didemnum (*Didemnum*) *albidum* (Verrill) Circumpolar species.
Didemnum okudai Tokioka On *Sargassum*.
Distaplia yesoensis Tokioka
Perophora japonica Oka On the stem of *Sargassum*.
Botryllus primigens Oka On laminarian leaf.
Botryllus communis Oka Attached to *Sargassum*.
Botryllus schlosseri (Pallas)
Botrylloides violaceum Oka Attached to *Sargassum*.
Polyzoa vesiculiphora Tokioka On a Lafoeid hydroid, bryozoans and egg capsules of a gastropod.
Dendrodoa aggregata Rathke Attached to the bark of wood immersed in the sea.
Syndendrodoa composita Tokioka
Styela clava Herdman.
Boltenia echinata (L.) Circumpolar species.
Halocynthia aurantium (Pallas)
Molgula redikorzevi Oka

Phylum VERTEBRATA

Class Cyclostomi

After Sato (1940)

Lampetra japonica japonica (Martens)

Class Chondrichthyes

After Sato (1937)

Prionace glauca (L.) Common in summer, in the waters off the Bay. Temperate species.
Sphyrna zygaena (L.) Very rare. Temperate species.
Isulus glaucus (Müller & Henle) Rather scarce. Temperate form.
Lamna nasus (Bonnaterre) Common in summer in the waters off the Bay.
Cetorhinus maximus (Gunner) Very rare. Circumpolar species.
Squalus suckleyi (Girard) Common in summer and late autumn, off the Bay. Boreal.
Raya isotrachys Günther Not so common, off the Bay. Boreal.

Class Osteichthyes

After Sato (1937, 1940)

Nemichthys avocetta Jordan & Gilbert Very rare.
Sardinia melanosticta (Temminck & Schlegel) Abundant in summer and early autumn. Temperate species.
Clupea pallasii Cuvier & Valenciennes Abundant in spring. Northern Pacific form.
Engraulis japonicus Temminck & Schlegel Occasionally found.
Trachurus japonicus (Temm. & Schl.) Rather rare. Temperate species.
Onchorhynchus nerka (Walbaum) Rather scarce. Northern Pacific form.
Onchorhynchus keta (Walbaum) Common in summer and autumn. Pacific form.
Onchorhynchus gorbuscha (Walbaum) Common in summer.
Onchorhynchus masou (Brevoort) Very common in summer. Boreal.
Hucho perryi (Brevoort) Boreal.
Salvelinus leucomaenis (Pallas) Common. Boreal.
Osmerus dentex Steindachner Common in late spring and summer. Circumpolar species.
Spirinchus lanceolatus (Hikita) Common in late autumn. Only in Hokkaido.
Hypomesus japonicus (Brevoort) Common in early spring and late autumn. Boreal.
Salangichthys microdon (Bleeker) Common in the Lake in spring.
Leuciscus hakonensis Günther Common.
Synaphobranchus affinis Günther Common in winter. Temperate species.
Gasterosteus aculeatus aculeatus (L.) Common. Boreal.
Pungitius pungitius (L.) Rather scarce. Circumpolar species.
Hyporhamphus sajori (Teminck & Schlegel) Scarce. Temperate species.
Cololabis saira (Brevoort) Common, off the Bay in summer and autumn.
Scomber japonicus Houttuyn Temperate species.
Thunnus thynnus (L.) Common in summer, late autumn and winter.
Scombrops boops (Houttuyn) Rather rare. Temperate species.
Trichiurus japonicus (Temminck & Schlegel) Very rare. Temperate species.
Xiphias glandius L. ? Rare. Northern Pacific form.
Cantherines modestus (Günther) Rare. Temperate species.
Cirella punctata Gray Rather scarce. Temperate species.
Ostracion immaculatum (Temm. & Schl.) Rarely found. Temperate form.
Sphaeroides borealis Jordan & Snyder Rather scarce.
Mola mola (L.) Rather common, off the Bay.
Sebastolobus macrochir (Günther) Common. Boreal.

Sebastodes schlegelii (Hilgendorf) Rather scarce. Boreal.
Sebastodes steindachneri (Hilgendorf) Common in winter, off the Bay.
Sebastodes itinus Jordan & Starks Common off the Bay in summer.
Sebastodes flammeus Jordan & Starks
Sebastodes iracundus Jordan & Starks Boreal.
Sebastodes taczanowskii (Steindachner)
Sebastichthys trivittatus (Hilgendorf) Boreal.
Hexagrammos stelleri Tilesius Rather common.
Hexagrammos octogrammus (Pallas) Common. Circumpolar species.
Hexagrammos lagocephalus (Pallas) Common in summer and autumn. Circumpolar.
Pleurogrammus monopterygius (Pallas) Scarce. Circumpolar species.
Hemilepidotus gilberti Jordan & Starks Common. Circumpolar species.
Ceratocottus namiyei Jordan & Starks Boreal.
Myoxocephalus raninus Jordan & Starks Very common. Boreal.
Myoxocephalus stelleri Tilesius ? Boreal.
Ainocottus ensiger Jordan & Starks Rather common.
Argyrocottus zanderi Herzenstein Common. Boreal.
Gymnocanthus herzensteini Jordan & Starks
Blepsias draciscus Jordan & Starks Very common. Boreal.
Hemitripterus villosus (Pallas) Common in summer. Circumpolar species.
Percis japonica (Pallas) Very rare. Boreal.
Iburina iburina (Jordan & Starks) Boreal.
Iburiella kasawae Jordan & Hubbs Only in Hokkaido.
Brachyopsis rostratus (Tilesius) Very common. Boreal.
Pallasina barbata (Steindachner) Circumpolar species.
Cyclopterichthys ventricosus (Pallas) Boreal.
Eumicrotremus orbis (Günther) Rare.
Liparis takashimaensis Nojima Common.
Cyclogaster sp.
Crystallias sp.
Echeneis nubifera Tanaka Very rare.
Echeneis brachyptera Lowe Rare. Temperate species.
Paralichthys olivaceus (Temminck & Schlegel) Temperate species.
Verasper moseri Jordan & Gilbert Common. Boreal.
Protopsetta herzensteini (Schmidt) Rather common. Boreal.
Atheresthes evermanni Jordan & Starks Abundant, off the Bay, in late autumn and winter. Boreal.
Hippoglossus hippoglossus (L.) Common in summer. Boreal.
Lepidopsetta mochigarei Snyder Boreal.
Limanda angustirostris Kitahara Boreal.
Limanda schrencki Schmidt Very common in early spring. Boreal.
Limanda iridorum Jordan & Starks Boreal.
Liopsetta pinnifasciata (Kner) Very common in winter. Boreal.
Platichthys stellatus (Pallas) Very common. Northern Pacific form.
Kareius bicoloratus (Basilewsky)
Clidoderma asperrimum (Temmink & Schlegel)
Chaenogobius annularis annularis (Gill) Common in the Lake.
Chaenogobius heptacanthus murorana (Jordan & Snyder)
Arctoscopus japonicus (Steindachner) Common in summer and late autumn. Boreal.
Enedrias nebulosus (Temminck & Schlegel) Common.

Pholis pictus (Kner) Common. Boreal.
Alecirias benjamini Jordan & Snyder Scarce. Boreal.
Opisthocentrus ocellatus (Tilesius) Boreal.
Pholidapus dybowskii (Steindachner) Very common. Boreal.
Ozorthe dictyogramma (Herzenstein) Common in summer. Boreal.
Stichaeus nozawae Jordan & Snyder Scarce. Only in Hokkaido.
Dinogunellus grigorjewi (Herzenstein) Rare. Boreal.
Lumpenus anguillaris (Pallas) Rather common in summer. Northern Pacific form.
Lumpenus fowleri Jordan & Snyder Rather common. Boreal.
Furcimanus nakamurae Tanaka Rare. Boreal.
Enchelyopus elongatus (Kner) Common. Boreal.
Ammodytes personatus Girard Rather scarce.
Hypoptychus dybowskii Steindachner Frequently found.
Bathymaster caeruleofaciatus Gilbert & Burke Circumpolar species.
Gadus macrocephalus Tilesius Abundant off the Bay in winter.
Theragra chalcogramma (Pallas) Abundant off the Bay in autumn and winter.
Eleginus navaga (Kölreuter) Common. Circumpolar species.
Physiculus japonicus Hilgendorf Temperate species.
Antimora microlepis Bean

Class Reptilia

The marine Reptilia in the region are represented by only the species *Dermochelys coriacea* Linné which is rarely found off Daikokujima.

Class Mammalia

Pinnipedia

Phoca vitulina largha Pallas Common.
Phoca fasciata Zimmermann

Besides the above the following are occasionally found in the open sea near Akkeshi Bay:

Carnivora

Enhydra latris latris Linné

Pinnipedia

Zalophus lobatus (Gray)
Otoes ursina (Linné)

Cetacea

Balaena glacialis sieboldii Gray
Balaenoptera physalus (Linné)
Balaenoptera borealis Lesson
Megaptera nodosa (Bonnaterre)
Physeter catodon Linné

Geographical Distribution of the Marine Fauna in Akkeshi Bay

As is described in the introductory chapter above, the marine fauna in Akkeshi Bay is greatly influenced by the cold current Oyashio from north and is slightly affected by the warm current. In the preceding list of the marine animals of Akkeshi Bay, the distributional nature is indicated for each species as far as we know. This indication, however, could not be made for many species because of our very limited knowledge of their distribution.

We tried to pick up some typical species designating the distribution and arrange them into the following categories: circumpolar, northern Pacific, temperate, and indigenous. The following is the list of them.

1. Circumpolar species

Pelagic Ciliata
- *Leprotintinus pellucidus*
- *Parafavella denticula*
- *Parafavella gigantea*
- *Tintinnus turris*

Hydrozoa
- *Sertularella gigantea*
- *Sertularia tenera*
- *Abietinaria costata*
- *Selaginopsis breitfussi*
- *Halitholus pauper*
- *Bougainvillia superciliaris*
- *Eutonina indicans*
- *Staurophora mertensi*
- *Aglantha digitale*

Scyphozoa
- *Cyanea capillata*
- *Aurelia limbata*

Actiniaria
- *Metridium senile*

Nemertea
- *Lineus bilineatus*
- *Cerebratulus marginatus*
- *Emplectonema gracile*
- *Oerstedia dorsalis*
- *Tetrastemma candidum*

Priapulida
- *Priapulus caudatus*

Polychaeta
- *Nereis virens*
- *Nephthys caeca*
- *Cirratulus cirratus*
- *Stylarioides plumosa*

Echiurida
- *Echiurus echiurus*

Placophora
- *Tonicella lineata*

Gastropoda
- *Neritrema sitkana*
- *Ezolittorina squalida*
- *Ariadna insignis*
- *Bulbus smithii*
- *Plicifusus brunneus*

Pelecypoda
- *Eunucula tenuis*
- *Nuculana pernula*
- *Monia macrochisma*
- *Turtonia minuta*

Crustacea
- *Caprella paulina*
- *Dermaturus mandtii*

Pantopoda
- *Achelia alaskensis*

Asteroidea
- *Henricia tumida*

Ascidia
- *Amaroucium glabum*
- *Didemnum albidum*
- *Boltenia echinata*

Pisces
- *Osmerus dentex*
- *Hexagrammos octogrammus*

Hemilepidotus gilberti
Hemitripterus villosus
Eleginus navaga

2. Northern Pacific species

Pelagic Ciliata
Tintinnus nectus
Hydrozoa
Proboscidactyla flavicirrata
Campanularia urceolata
Sertularia cupressoides
Selaginopsis triserialis
Eperetmus typicus
Scyphozoa
Haliclystus steinegeri
Chrysaora helvola
Nemertea
Lineus torquatus
Paranemertes peregrina
Tetrastemma nigrifrons
Polychaeta
Nainereis laevigata
Sabellaria cementarium
Chone teres
Placophora
Cryptochiton stelleri
Gastropoda
Collisella pelta
Crepidula grandis
Fusitriton oregonensis
Polytropa freycinetti
Diaulula sandiegensis
Pelecypoda
Volsella diffecilis
Chlamys swifti
Clinocardium californiense
Bankia setacea
Crustacea
Chthamalus dalli
Balanus rostratus
Balanus cariosus
Caprella laeviuscula
Pagurus middendorffii
Asteroidea
Asterias amurensis
Ascidia
Halocynthia aurantium
Pisces
Clupea pallasii
Onchorhynchus keta
Platichthys stellatus
Lumpenus anguillaris

3. Temperate species

Pelagic Ciliata
Amphorella quadrilineata
Hydrozoa
Hydrocoryne miurensis
Leuckartiara octona
Aglantha hemistoma
Scyphozoa
Dactylometra pacifica
Ctenophora
Hormiphora palmata
Archiannelida
Saccocirrus major
Gastropoda
Batillaria cumingii
Aplysia sibogae
Pelecypoda
Zirfaea subconstricta
Crustacea
Ligia exotica
Ascidia
Botryllus schlosseri
Pisces
Synaphobranchus affinis
Scomber japonicus
Paralichthys olivaceus
Physculus japonicus
Hyporhamphus sajori
Ostracion immaculatum

4. Indigenous species

Porifera
Grantessa nemurensis
Hydrozoa
Tubularia radiata

Tubularia venusta
Stylactis uchidai
Stylactis conchicola
Hydractinia uchidai
Eudendrium boreale
Plumularia undulata
Polyorchis karafutoensis
Scyphozoa
Haliclystus borealis
Thaumatoscyphus distinctus
Anthozoa
Alcyonium pacificum
Alcyonium muricatum
Metedwardsia akkeshi
Anthopleura kurogané
Epiactis japonica
Turbellaria
Microstylochus akkeshiensis
Nemertea
Cephalothrix notabilis
Tubulanus ezoensis
Lineus spatosus
Oerstedia polyorbis
Zygonemertes glandulosa
Endoprocta
Loxosoma okudai
Loxosoma akkeshiensis
Pedicellina ichikawai
Archiannelida
Trilobodrilus nipponicus
Polychaeta
Nereis ezoensis
Acrocirrus validus
Audouinia comosa
Potamilla myriops
Oligochaeta
Pachydrilus nipponicus
Gastropoda
Collisella pelta
Neritrema sitkana
Polytropa frecinetti
Neptunea arthritica
Acanthodoris uchidai
Scaphopoda
Siphonodentalium okudai
Pelecypoda
Patinopecten yessoensis
Ostrea gigas
Venerupis japonica
Mya japonica
Crustacea
Tectiseps japonicus
Idotea japonica
Orchestia ditmari
Pandalus kessleri
Pagurus middendorffii
Pagurus ochotensis
Telmessus cheiragonus
Pycnogonida
Phoxichilidium hokkaidoense
Achelia alaskensis
Lecythorhynchus hilgendorfi
Asteroidea
Asterina pectinifera
Henricia nipponica
Leptasterias ochotensis
Holothuroidea
Cucumaria japonica
Cucumaria chronhjelmi
Scoliodotella uchidai
Ascidia
Syndendrodoa composita
Pisces
Myxocephalus raninus
Blepsias dracisculus
Liopsetta pinnifasciata
Pholidapus dybowskii
Eleginus navaga

The rough sum totals of all species which are considerably well known from Akkeshi Bay and of the species of each categories can be indicated as below,

Total	Circumpolar	Northern Pacific	Boreal	Temperate	Others
596	54	44	132	27	336

In this table, the column "boreal" means the species of which the distributional limit is in northern oceanic region but not known so in

detail as the typical circumpolar or northern Pacific species. The sum of the species of the so-called cold water attains 230 in number and this number occupies about 39% of the total number. The typical temperate species are fairly few and take only about 5% of the total number. Most of the temperate species are temporary visitors from south and they are free-swimming animals as medusae or fishes. Other species consist of variously indigenous ones, the species widely distributed through the boreal and temperate regions of the Pacific, the cosmopolitan species, etc.

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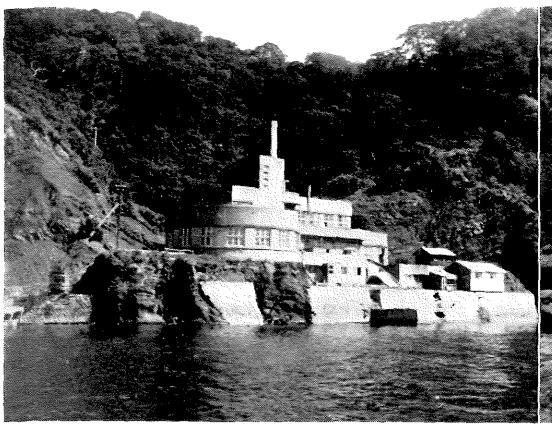
Plate I–IV

Plate I

A. Front view of the Akkeshi Marine Biological Station.
B. Aikappu in low tide.
C. Aikappu in low tide.
D. Sandy shore in Tsukushikoi between Aikappu and Aininkappu.
E. Shore in Daikokujima in low tide.
F. Shore in Daikokujima in low tide.



A

B

C

D

E

F

Plate II

A. A view of southern face of Daikokujima.

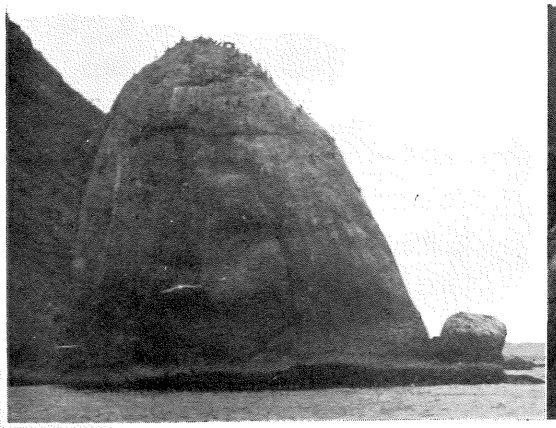
B. The same as A, more close, showing *Phalacrocorax capillatus*.

C. Kakijima in Akkeshi Lake.

D. The same as C.

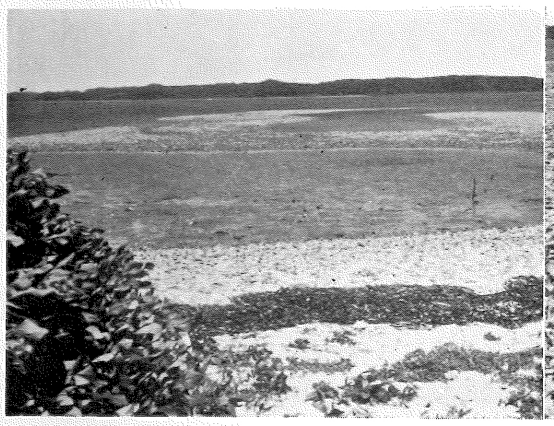
E. Oyster shells in Kakijima, with *Venerupis japonica* and *Littorina brevicula*.

F. Muddy castings of *Arenicola claparedii* in Shinryu.



A

B



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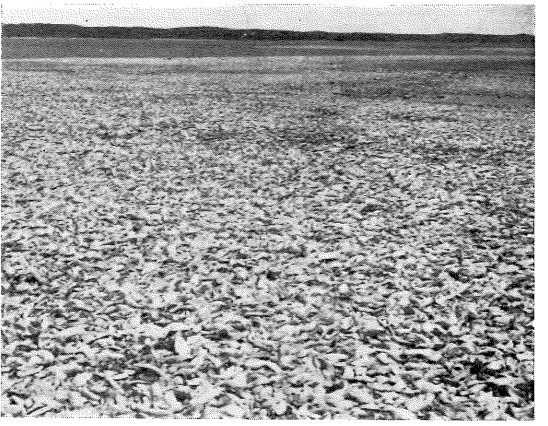

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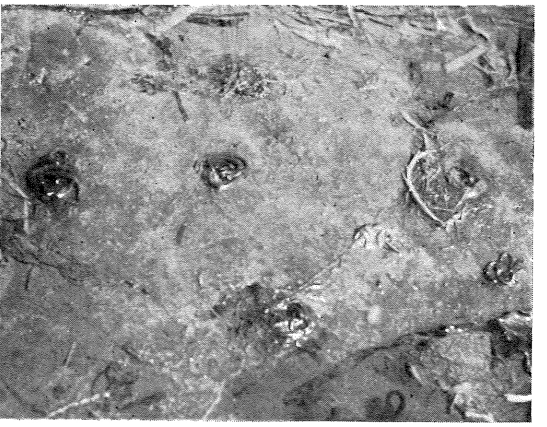


F

Plate III

A. Rocky shore in Aikappu, showing a swarm of *Neritrema sitkana*.

B. The same as A, more close.

C. *Balanus cariosus* (larger) and *Chthamalus dalli* (smaller) on a rock in Aikappu.

D. The same as C, more close.

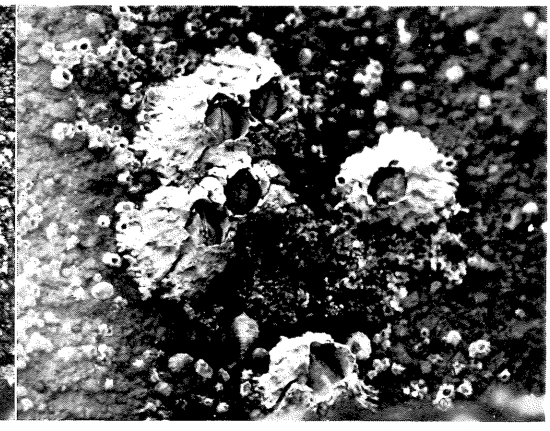
E. *Collisella pelta* on a stone in Daikokujima.

F. *Leptasterias ochotensis similispinis* in low tide in Daikokujima.

A

B

C



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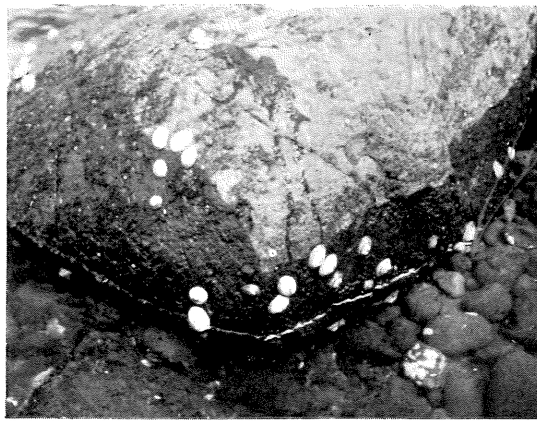


E

F

Plate IV

A. The sponge *Halichondria* sp. covering a rock in Daikokujima.

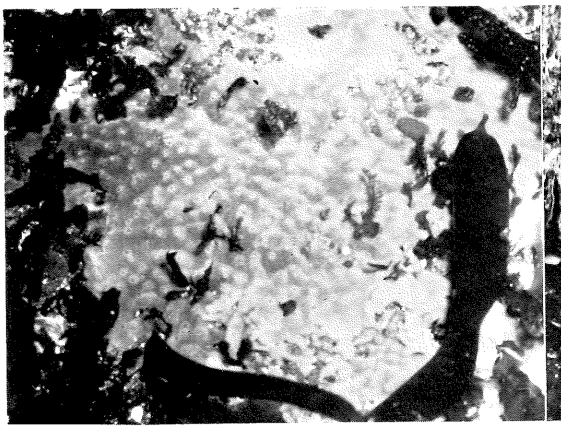
B. Colonies of *Tubularia venusta* hanging from a rock in Daikokujima.

C. Colonies of *Abietinaria costata* in low tide in Daikokujima.

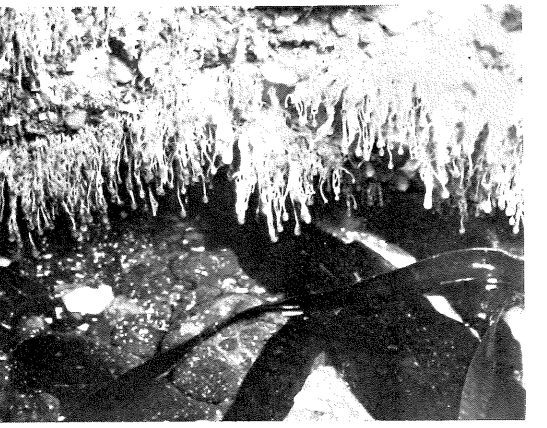
D. *Epiactis japonica* (contracted) in Shiribasaki.

E. *Potamilla myriops* expanding branchial crown in Aikappu.

F. *Asterias amurensis* and *Strongylocentrotus intermedius* in low tide in Daikokujima.



A



B

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