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Bathymetric Distribution Pattern of Echinoderms in the Sado Strait, the Japan Sea

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Abstract

Echinoderms were sampled by trawling at 9 stations in the Sado Strait, the Japan Sea from 19-21 July, 1993. These sampling stations covered the continental shelf area and the floor of the basin, depths ranging from 100 to 530 m. A total of 28 species was recorded, including rare species of one asteroid and one ophiuroid which are briefly described. The faunal representatives were categorized into two groups separated at a depth of around 200 m ; the upper group characterized by temperate water species belonging to the Indo-West Pacific element, and the lower group of cold water species dominated by circumpolar and Bering-Okhotsk elements such as *Ophiura sarsi sarsi* which occurred with a large biomass. The species richness was higher in the southern area than the northern area. These bathymetric distribution patterns are discussed in relation to the water temperature and the bottom sediment conditions.

Key words: distribution, echinoderms, fauna, Japan Sea, *Ophiura sarsi sarsi*, Sado Strait

Introduction

The scientific research on the echinoderm fauna along the south-eastern coasts of the Japan Sea was started at the beginning of the twentieth century by the expedition of the United States Fisheries Steamer *Albatross* (AGASSIZ and CLARK 1907). Detailed taxonomical studies on echinoderms taken during this expedition were conducted by CLARK (1911), OHSHIMA (1915) and FISHER (1911, 1928, 1930). In respect to the Sado Strait, situated in the middle part of the Japan Sea where the present study was carried out, the echinoderm fauna has been reported by HAYASHI (1957) for the Asteroidea and IRIMURA (1979) for the Ophiuroidea. HONMA and KITAMI (1978, 1995) detailed the echinoderm fauna around the Sado Marine Biological Station in the waters adjacent to the strait.

Recently, KURIHARA (1996) reported the distribution of sea-stars in relation to water temperature and sediment composition in Wakasa Bay. However, the faunal description of echinoderms has mainly been emphasized in the Japan Sea to date, and little is known of their distribution and abundance, particularly in relation to the hydrographical and topographical features. Echinoderms are, however ecologically important and a numerically dominant group in benthic communities (GAGE and TYLER 1991).

The purpose of this study is to clarify the species composition, distribution and abundance of echinoderms, which are important constituents among the benthic fauna, in relation to the environmental characteristics such as sediments and bottom water temperature in the Sado Strait.

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Materials and Methods

The Sado Strait is located between Honshu Island and Sado Island in the middle part of the Japan Sea, and can be divided into three regions, northern, central and southern parts, according to their topographical features. In the northern part of the strait, a flat sea floor shallower than 100 m extends under the influence of sediment deposition carried by large rivers. In the central part, a deep level sea bottom called the "Sado Basin" occupies a vast area and reaches a maximum depth of 530 m. The marginal areas surrounding the basin form a transitional zone with steep slopes from the continental shelf. The topography of the southern part is complex. A small bank of about 100 m depth with a bottom condition of rocks or boulders is situated at the southern entrance of the basin. At the western side of the bank, the sea bottom slopes down steeply toward the deep trough.

In order to cover these different regions, 9 stations were established on a north-south transect

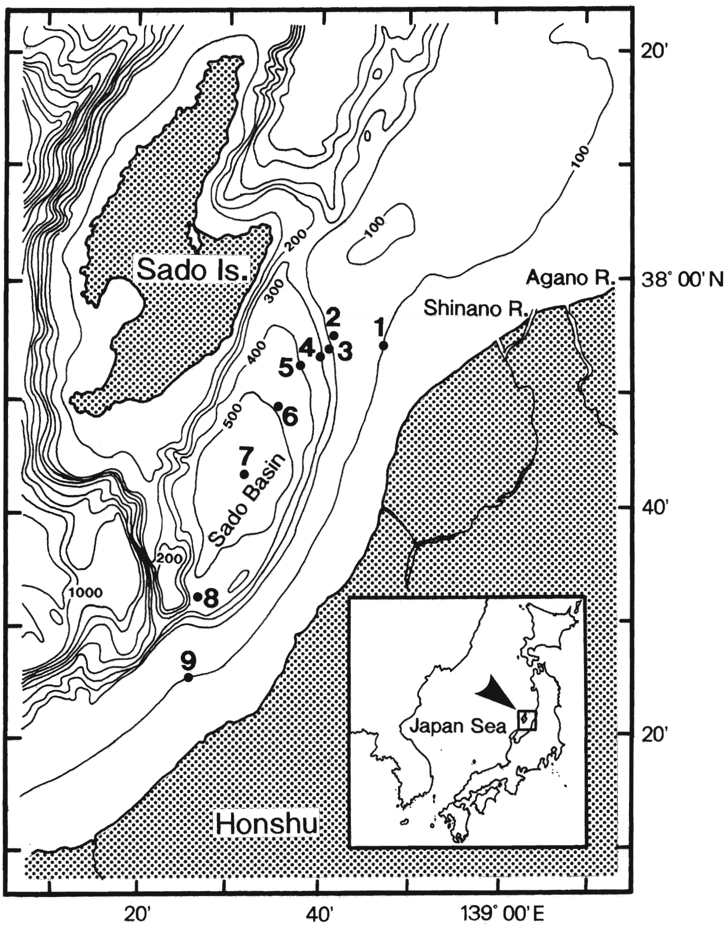

Fig. 1. Locations of the sampling stations by trawling and depth contours in the Sado Strait.

line along the strait, which ranges in depth from 100 to 530 m (Fig. 1). Sampling was conducted using the R.V. *Mizuho-Maru* of the Japan Sea National Fisheries Research Institute on 19-21 July 1993. For collecting organisms, an Agassiz type beam trawl with a 2 m wide and 0.45 m high mouth opening was used. The mean trawling speed on the bottom along the bathymetric contour was about 1 knot and the duration of each trawl lasted for 10 to 20 minutes. Information on each trawling station is given in Table 1.

Table 1. List of sampling stations in the R.V. *Mizuho-Maru* cruise on 19-21 July 1993.

Station	Date	Ship position					Depth (m)
1	21July '93	37° 54.42′ N	138° 46.67′ E	–	37° 54.58′ N	138° 46.51′ E	104–107
2	21July '93	37° 55.27′ N	138° 41.04′ E	–	37° 55.63′ N	138° 40.94′ E	170–175
3	21July '93	37° 52.79′ N	138° 40.37′ E	–	37° 52.86′ N	138° 39.99′ E	266–300
4	21July '93	37° 53.35′ N	138° 39.81′ E	–	37° 53.61′ N	138° 39.77′ E	307–309
5	21July '93	37° 51.90′ N	138° 38.06′ E	–	37° 52.02′ N	138° 37.78′ E	420
6	20July '93	37° 49.31′ N	138° 35.54′ E	–	37° 49.63′ N	138° 35.73′ E	486–496
7	19July '93	37° 43.11′ N	138° 32.07′ E	–	37° 43.30′ N	138° 32.66′ E	530
8	20July '93	37° 32.43′ N	138° 27.10′ E	–	37° 32.65′ N	138° 26.76′ E	416–432
9	20July '93	37° 25.15′ N	138° 25.71′ E	–	37° 25.06′ N	138° 25.62′ E	97–98

The megabenthos collected was immediately separated from the catch by washing through a 1 mm mesh sieve, and then fixed with 10% formaldehyde solution in seawater on board. After return to the laboratory on land, animals from each haul were sorted according to species and preserved in 70% ethanol. Their body size and total wet weight, after blotting to remove any alcohol preservative, were measured.

The density was calculated from the width of the trawl (2 m) and the distance it traveled in order to compare echinoderm abundance among the sampling stations. Because the area covered by the trawls ranged from 426 to 1867 m^2, the density is expressed as the number of individuals per 1000 m^2 for convenience.

At all the stations, sediment samples for the analysis of grain-size and organic contents were also taken with a 0.05 m^2 Smith-McIntyre grab sampler. Grain size was analyzed using a series of standard sieves. Organic carbon and nitrogen contents were measured using a C/N analyzer (Yanagimoto, C/N Corder Model MT-5). CTD measurements were conducted at Stn.7, the deepest point of the basin.

Results

1 Hydrographic condition

Figure 2 shows the vertical profiles of temperature and salinity measured by CTD at Stn. 7. The temperature was 21℃ or higher at depths shallower than 20 m, below which temperature decreased gradually with depth. Between depths of 180 and 250 m it decreased suddenly indicating a strong thermocline. Below this the temperature gradually declined again to a value of 0.6℃ at the bottom. At the surface layer shallower than depths of 20 m, relatively low salinities of less than 34 psu were observed. In the deeper area the salinity increased gradually and below the depths of 250 m it showed a quite constant value of about 34.07 psu.

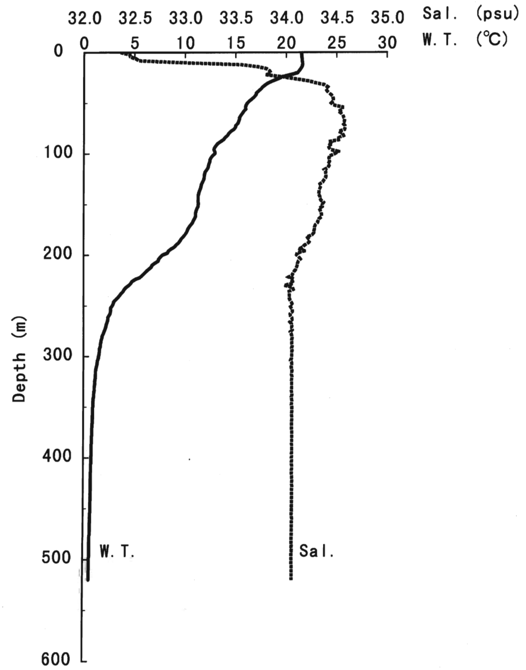

Fig. 2 . Vertical profiles of water temperature and salinity derived from CTD measurements at Stn. 7.

2 Bottom sediment condition

Figure 3 shows the changes in the silt-clay content, total carbon and total nitrogen in the surface layer of the bottom sediments with the bathymetric profile of the study area from the northern Stn. 1 to the southern Stn. 9.

At the central part of the basin, the bottom deeper than 400 m had well-sorted fine sediments ; silt-clay occupied nearly 100% of the total weight of the sediment with the highest Md ϕ value of 4.50 ϕ . The northern shallow area on the continental shelf had a similar sediment condition. In contrast, the silt-clay content indicated low values at Stns. 3 and 4 located on the steep slopes around the basin and at Stns. 8 and 9, the southern area of the strait. The sediments at these localities were poorly sorted having high sorting coefficients of 0.80-1.60. The southern area had much lower Md ϕ values and higher sorting coefficients, compared with the slope areas. The coarsest sediment was obtained at Stn. 8 (silt-clay content: 27.2% and Md ϕ : 2.54 ϕ).

There was a close correlation between the silt-clay content and the organic content. The total carbon and nitrogen contents showed the highest values at the floor of the basin, and were low at stations on the steep slopes and the southern region. The sediment at the northernmost Stn. 1 was a little different in nature from the other stations ; the organic content was relatively low in spite of the high silt-clay content.

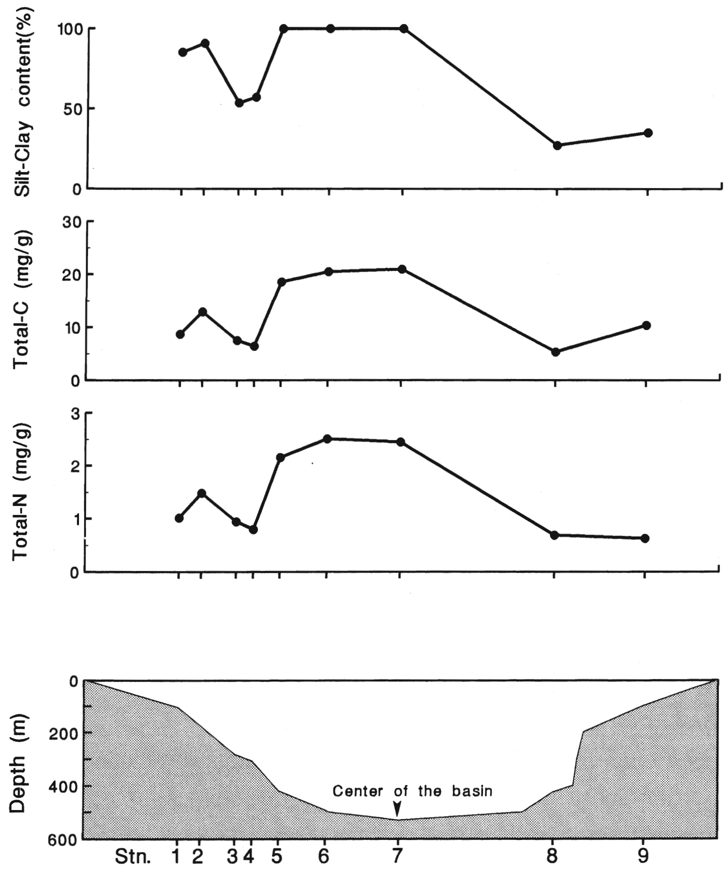

Fig. 3 . Changing patterns of the silt-clay content and organic content (total carbon and total nitrogen) in the surface layer of the bottom sediments with the bathymetric profile.

3 Species collected in the survey

Twenty-eight species belonging to five classes in the phylum Echinodermata were obtained by trawling. Asteroidea and Ophiuroidea were the dominant classes consisting of 12 and 10 species respectively. The other classes contained one to four species. Details of the species with the number of individuals per haul sampled at each station are shown in Appendix 1. Systematics of each class of echinoderms are based on the following : Kogo (1974) for Crinoidea, Clark and Downey (1992) for Asteroidea, Irimura *et al.* (1995) for Ophiuroidea, Shigei (1986) for Echinoidea and Imaoka (1995) for Holothuroidea. Species of taxonomical interest obtained in this survey (indicated by asterisks in the Appendix 1) are briefly described here.

Odontohenricia sp. aff. *hayashii* ROWE et ALBERTSON, 1988 (Plate 1, fig. A)

Odontohenricia was established by ROWE and ALBERTSON (1988) from the type species *Odontohenricia endeavouri* sampled from Australia. Four species have been described in this genus and characterized by the occurrence of a large, hyaline-tipped recurved spine at the apex of the jaw angle. In Japanese waters *O. hayashii* has been described by only one specimen from Sagami Bay. The specimen found in this survey apparently belongs to this genus because of the unique spine at the apex of the jaw, and is closely related to *O. hayashii*. Further studies are needed to know whether the present specimen is an anomalous form of *O. hayashii* or a new species. One specimen (R=60 mm, r= 9 mm) was caught. Color in life is reddish orange.

Ophiopenia disacantha H. L. CLARK, 1911 (Plate 1, fig. B)

CLARK (1911) established this species based on a specimen from the cruise by *Albatross* in the Bering Sea. He also reported two specimens at the northeastern point off the Sado Island about 264 to 300 m deep during the same cruise. Thereafter no records have been reported in the Japan Sea with the exception of reports in the East Sea, Korea (RHO 1979; SHIN and KOH 1993) . One specimen (disk diameter= 7 mm) was caught. Color in life is purplish brown.

Strongylocentrotus sp. (Plate 1, fig. C)

Although this echinoid is commonly distributed in the north from the Noto Peninsula on the Japan Sea side and the Cape Inubo on the Pacific side, it is still under taxonomical consideration. It will be identified as either *Strongylocentrotus pallidus* SARS or *Strongylocentrotus sachalinicus* DÖDERLEIN in the future (SHIGEI 1989). Eight specimens were caught. The test diameter reaches more than 90 mm.

4 Faunal abundance and distribution

In this survey a total of 14004 individuals of echinoderms were collected at all the stations except for the northernmost Stn. 1 where no echinoderms were sampled. The total biomass is strongly dominated by three species of Ophiuroidea (*Ophiura sarsi sarsi*, *Ophiura leptoctenia* and *Ophiothrix panchyendyta*) and one species of Asteroidea (*Crossaster papposus japonicus*) which comprised 97% in abundance and 96 % in biomass. *O. sarsi sarsi* (Plate 1, fig. D) was the most dominant species of all echinoderms collected, both numerically and by wet weight. This species occurred in depths below 200 m, especially on the slopes around the basin. The largest catch was obtained at Stn. 3, reaching nearly 6000 ind. /1000m^2 and 11.9kg/1000m^2 (Fig. 4B). The second most dominant species in the basin, *O. leptoctenia*, is a very similar species to *O. sarsi sarsi* from which it is distinguished by a more slight and smaller size with acicular arm comb. It had the trend to distribute in deeper areas (>300 m) than *O. sarsi sarsi*. The highest density which was more than 500 ind. /1000m^2 was recorded at Stns. 4 and 8 (Fig. 4C). The relatively large ophiuroid *O. panchyendyta* (Plate 1, fig. E) was caught exclusively in the zone shallower than 200 m deep. Its density was more than 100 ind. /1000m^2 at Stn. 9 (Fig. 4A). Of all the asteroids collected, the biomass of *Crossaster papposus japonicus* (Plate 1, fig. F) was the largest. It was

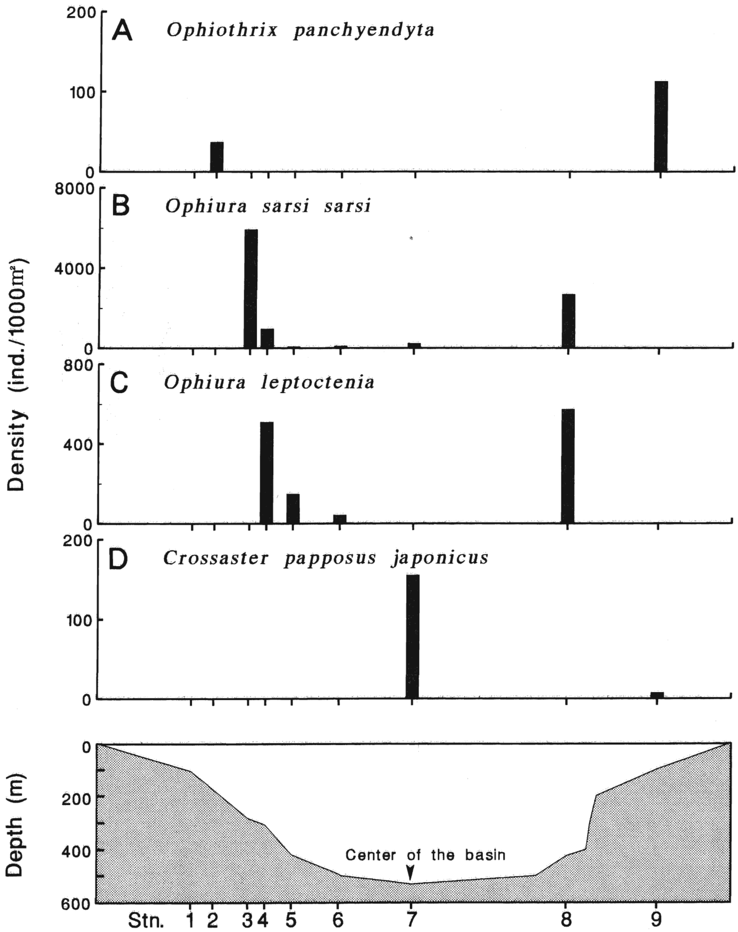

Fig. 4 . Densities (ind./1000m^2) of ophiuroids and an asteroid which were abundantly found in the study area with the bathymetric profile.

particularly abundant at Stn. 7, the center of the basin, with 155 ind./1000m^2 and 0.8 kg /1000m^2 (Fig. 4D).

Figure 5 shows the result of cluster analysis by similarity index (C'_λ) of MORISITA (1971) using the abundance of species occurring at each sampling station, except for Stn.1 where no echinoderms were obtained. The dendrogram was drawn using the program by KOBAYASHI (1995). The similarity index indicated the highest value of 1.14 between Stns. 2 and 9, because all the species collected at Stn. 2 were also present at Stn. 9. The other stations were categorized into one cluster characterized by the dominant occurrence of *O. sarsi sarsi* or *O. leptoctenia*. Among these stations the index between Stns. 4 and 6 showed a relatively high value because of the similar occurrence pattern of the two ophiuroids (*O. sarsi sarsi* and *O. leptoctenia*). The difference in the faunal composition was apparent between stations below and above about 200 m.

Species richness was relatively high at stations in the southern region of the strait, compared with those in the main part of the basin and northern regions (Fig. 6A). In the southern region additional species of asteroids and echinoids caused the increase in total species number of

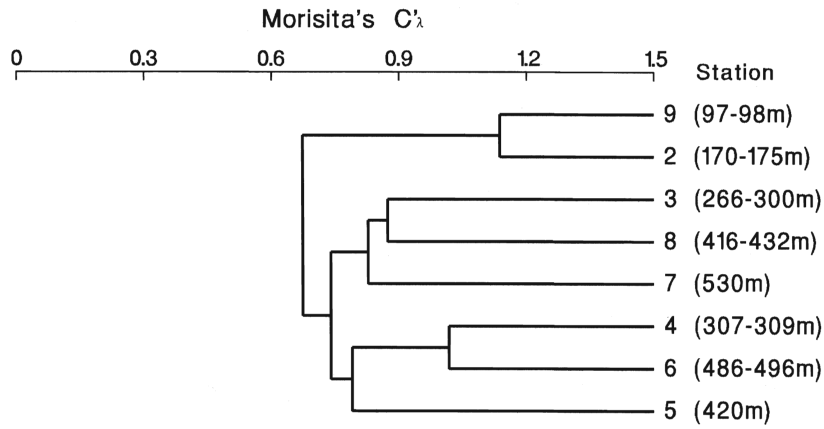

Fig. 5 . Dendrogram based on between-station similarities (Morisita's C'$_\lambda$) calculated from the abundance data (ind./1000m^2) of whole echinoderm species.

echinoderm fauna. For example, five out of the seven species of asteroids including an extremely rare species for Japan, mentioned before, were only collected at Stn. 9.

The Shannon diversity index (H') showed almost the same trend as species richness except for the stations where the great biomass of *O. sarsi sarsi* was observed. The diversity index was highest at the southernmost Stn. 9 where the largest number of species was collected (Fig. 6B).

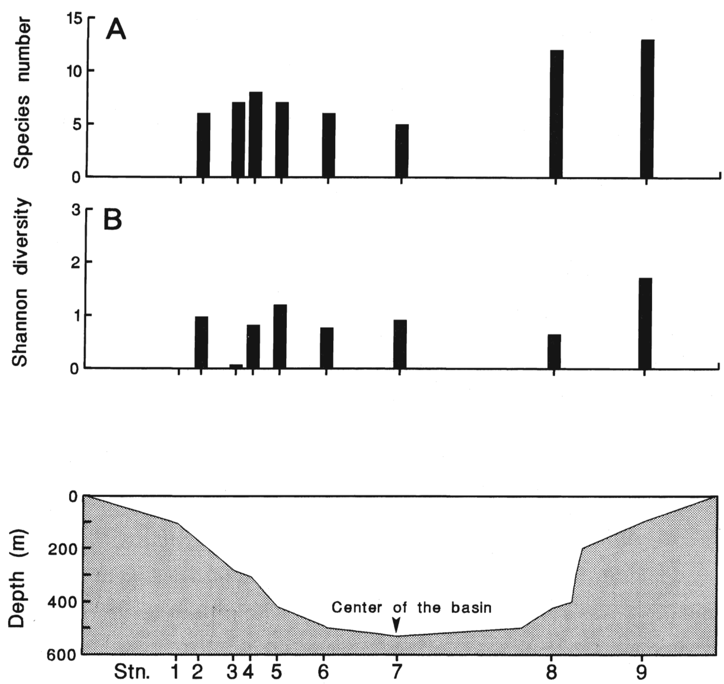

Fig. 6 . Species richness expressed in terms of the number of species (A), and the Shannon diversity index H'(B) with the bathymetric profile.

The H' of Stn. 8 , characterized by the large biomass of *O. sarsi sarsi*, showed a value less than half of that of Stn. 9 in spite of the nearly same number of species, because the H' index is affected not only by species number but also by abundance. The lowest value of H' at Stn. 3 is also explained by the nature of this index.

Discussion

The CTD measurement of this study showed a strong thermocline between the depths of 180 and 250 m. According to NAGANUMA (1985), the upper layer is influenced by the Tsushima Warm Current and its hydrographic conditions fluctuate considerably, while the lower layer is occupied by the hydrographically homogeneous cold water with a narrow range of temperature all the year round, called "Proper Water Mass of the Japan Sea". The existence of these remarkably distinct water mass is one of the important oceanographic features of the Japan Sea.

OKACHI (1954) first emphasized this permanent thermocline as an important boundary for demersal fish communities in the Sado Strait. Later NISHIMURA (1966) found a similar boundary in a detailed examination of the faunal and ecological characteristics of both fish and invertebrates, and classified them into the upper "Okaba" and the lower "Taraba" groups which consist of seven communities. He also pointed out as one of the remarkable features of the fauna in the Japan Sea that both the northern and southern elements coexist horizontally but segregate vertically.

Conspicuous differrences in the members of the echinoderm fauna were observed between stations situated above and below the thermocline. This well corresponds with Nishimura's Okaba and Taraba communities, which consist of tropical to temperate species and subarctic species respectively. Therefore, we attempted to classify the echinoderm species collected in the strait into the following five elements according to NISHIMURA (1981) with a slight modification. Information about the geographical distribution of each taxon was mainly referred from MATSUMOTO (1917), D'YAKONOV (1950, 1954), SHIGEI (1986) and IRIMURA (1990).

Ⅰ. Circumpolar elements, cold water species occurring in the North Atlantic Ocean, the Arctic Ocean and the North Pacific Ocean : *Leptychaster arcticus*, *Pseudarchaster parelii*, *Ctenodiscus crispatus*, *Ophiura sarsi sasri*, *Ophiopholis japonica*, *Ophiopholis aculeata* and *Strongylocentrotus* sp. (?) .

Ⅱ. Bering-Okhotsk elements, cold water species ranging from the Bering Sea or the Okhotsk Sea to Japan : *Leptychaster propinquus*, *Asterias amurensis*, *Ophiopenia disacantha* and *Heliometra glacialis maxima*.

Ⅲ. Bering-American elements, cold water species ranging from the Bering Sea to Japan and to the western coast of USA : *Leptychaster anomalus*, *Lophaster furcilliger*, *Ophiura leptoctenia*, *Amphioplus macraspis* and *Brisaster latifrons*.

Ⅳ. Indo-West Pacific elements, temperate-tropical species ranging from the Indian Ocean or Malaysian waters to Japan : *Astrocladus coniferus coniferus*, *Ophiothrix panchyendyta* and *Temnopleurus reevesii*.

Ⅴ. East Asian elements, both cold and temperate species known from the east coast of the middle latitudes of Asia including endemic species in Japanese waters : *Astropecten* sp. (?), *Cheiraster oxyacanthus*, *Crossaster papposus japonicus*, *Henricia exigua*, *Odontohenricia* sp. aff. *hayashii*

(?), *Ophiacantha omoplata*, *Stegophiura sladeni*, *Stereocidaris japonica* and *Molpadia roretzii*.

The Indo-West Pacific element such as *O. panchyendyta* and *A. coniferus coniferus* (Plate 1, fig. G) showed an occurrence confined to above the thermocline. The echinoderm fauna in the upper zone around the strait is characterized by these temperate water species. In fact, the occurrence of the tropical sea-stars, *Fromia indica* and *Linckia multifora* which are usually found south of Okinawa Islands, has been reported from the shallow coastal area in Toyama Bay (HAYASHI 1938). On the other hand, the cold water species, which are composed of the elements of a northern affinity in the Bering Sea or the Arctic Ocean, occupy the areas below the thermocline. The dense distribution of *O. sarsi sarsi*, a typical circumpolar element, was recognized in this zone and this seems to be a general feature on the upper bathyal zone around northern Japanese waters as FUJITA and OHTA (1990) have reported the same phenomenon.

In depths of 100 to 200 m corresponding to the Okaba communities II and III by NISHIMURA (1966), some of the cold water species were unexpectedly found in this survey. *C. crispatus*, a typical circumboreal sea-star, penetrated the thermocline and extended its distributional area to a depth of 100 m. Although this species was categorized within the fauna of the deeper Taraba communities by NISHIMURA (1966), it is adapted to a wide range of physical conditions such as temperature and pressure(ALTON 1966), which results in its occurrence in the shallower zone of the strait. Therefore, we can say that both temperate and eurythermal cold water species are intermingled in the lower Okaba communities, forming the ecotone of the echinoderm fauna.

In this survey the species diversity measured by species number and diversity index (H') tended to indicate high values on coarse sediments compared with that of fine soft bottoms. The diversity was particularly high at Stn. 9, where the coarsest bottom materials with pebbles and boulders occurred, which were not included in analyzing the sediments but were caught up in trawling. The increase in diversity at this station is mainly due to the appearance of species confined in this area, such as the sea-stars of the genus *Henricia* or *Odontohenricia*, the basket-star *A. coniferus coniferus* and the cidaroid sea-urchin *S. japonica* (Plate 1, fig. H). Some of these species are known to be closely associated with coarse sediments for their habitat or prey ; the gorgonocephalid, a kind of basket-star which feeds on suspended matter collected using its extendable branched arms on rocks or corals (WARNER 1982), and the sea-urchin belonging to the genus *Stereocidaris* which feeds on sponges, bryozoans or hydroids (RIDDER and LAWRENCE 1982). It is likely that the coarse sediments such as stones or boulders offer a variety of micro-habitats for many organisms or their prey and promote the species diversity.

Near the mouths of the Shinano River and the Agano River (Stn.1), no echinoderms were sampled in the present survey. In addition, the sediment analysis revealed a lower content of organic matter than usually predicted from the grain size. HOSHINO (1956) reported the abnormal distribution of mud containing rich sulfide, by which it becomes blue in color, in the depths shallower than 100 m at the mouth of the Shinano River. Although he described the bottom with blue mud as an indication of good fishing grounds, this may not be applicable to favorable habitats of echinoderms. Besides these chemical properties of sediment, it is possible that other environmental conditions such as the deposition speed and freshwater run-off, which are quite peculiar to the river mouth areas, may affect the benthic fauna.

The faunal distribution pattern is controlled by both physical and biological environments.

Therefore, we mainly focused on the water temperature and sedimental grain size as environmental factors in this study. However in order to understand the whole distribution pattern of echinoderms, we need more detailed study on the faunal description together with detailed information of the various environmental factors.

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佐渡海峡における棘皮動物の深度分布様式

木暮陽一・林　育夫

佐渡海峡の陸棚域から最深部における，トロールによる棘皮動物の分布調査の結果，稀種を含む28種が記録された．棘皮動物相は水深200mを境界に上下２つに大別され，上層では暖海種が出現したのに対して，下層はキタクシノハクモヒトデに代表される冷水種で占められた．また，出現種数は中・北部海域に比べ南部海域で多くなった．このような棘皮動物の分布様式に対する水温や底質の重要性について議論した．

Explanations for plate

Plate 1.

A. *Odontohenricia* sp. aff. *hayashii* ROWE et ALBERTSON, 1988

B. *Ophiopenia disacantha* H. L. CLARK, 1911

C. *Strongylocentrotus* sp.

D. *Ophiura sarsi sarsi* LÜTKEN, 1855

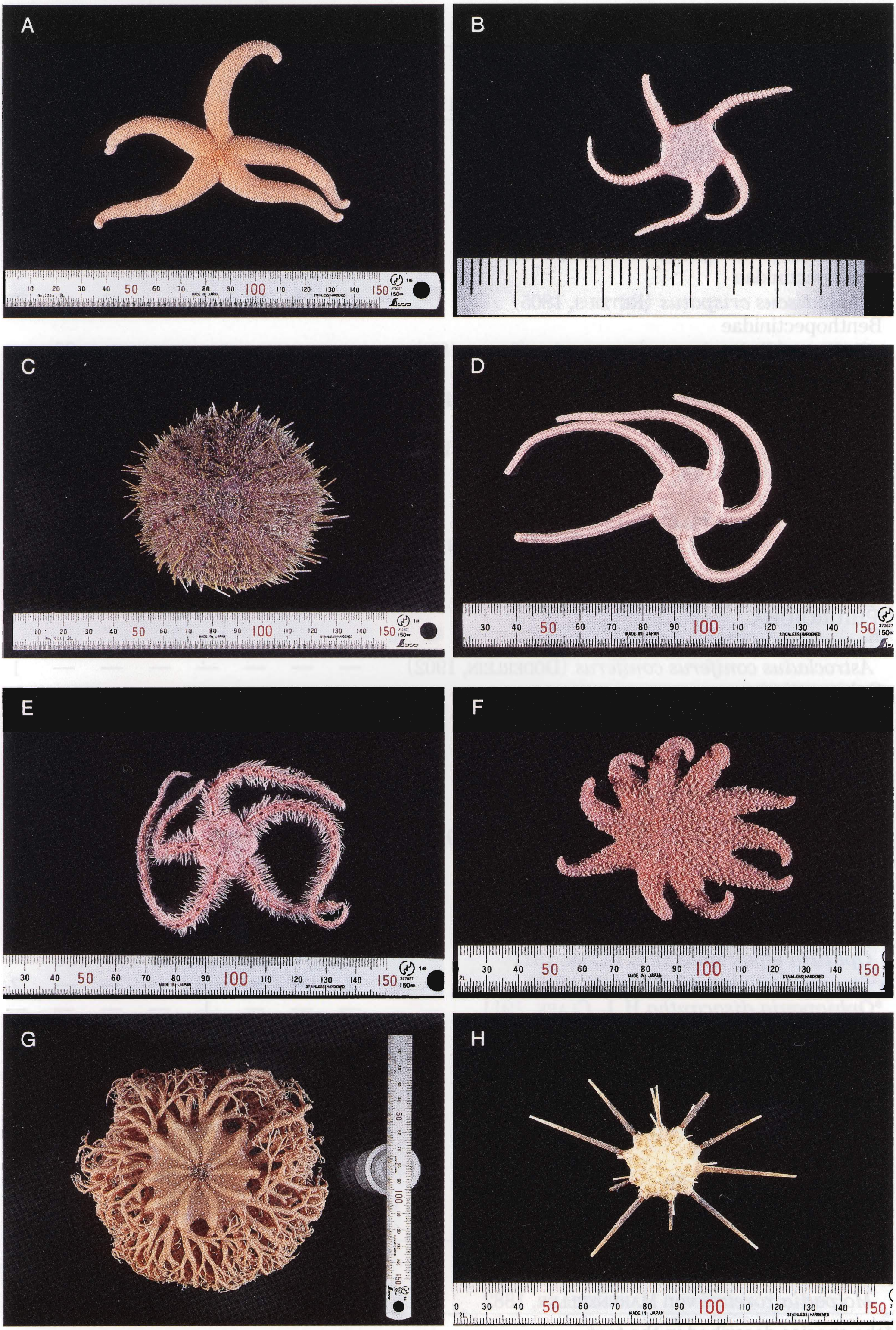
E. *Ophiothrix* (*Ophiothrix*) *panchyendyta* H. L. CLARK, 1911

F. *Crossaster papposus japonicus* (FISHER, 1911)

G. *Astrocladus coniferus coniferus* (DÖDERLEIN, 1902)

H. *Stereocidaris japonica* (DÖDERLEIN, 1885)

Plate 1



Appendix 1. List of the echinoderms with number of individuals collected in this survey.

	Station number							
	2	3	4	5	6	7	8	9
CRINOIDEA								
Antedonidae								
Heliometra glacialis maxima (A. H. CLARK, 1907)	—	—	1	4	1	12	—	—
ASTEROIDEA								
Astropectinidae								
Astropecten sp.		—	—	—	—	—	—	1
Leptychaster anomalus FISHER, 1906	—	34	1	2	—	18	—	—
Leptychaster arcticus (M. SARS, 1850)	—	3	—	—	—	—	14	—
Leptychaster propinquus FISHER, 1910	2	—	—	—	—	—	—	6
Goniopectinidae								
Ctenodiscus crispatus (RETZIUS, 1805)	21	28	25	45	—	12	40	25
Benthopectinidae								
Cheiraster (*Christopheraster*) *oxyacanthus* (SLADEN, 1889)	—	—	—	—	—	—	23	—
Goniasteridae								
Pseudarchaster parelii (DÜBEN et KOREN, 1846)	—	1	1	—	—	—	29	—
Solasteridae								
Crossaster papposus japonicus (FISHER, 1911)	—	—	1	—	1	287	—	3
Lophaster furcilliger FISHER, 1905	—	—	—	—	—	—	9	—
Echinasteridae								
Henricia exigua HAYASHI, 1940	—	—	—	—	—	—	—	1
**Odontohenricia* sp. aff. *hayashii* ROWE et ALBERTOSON, 1988	—	—	—	—	—	—	—	1
Asteriidae								
Asterias amurensis LÜTKEN, 1871	—	—	—	—	—	—	—	1
OPHIUROIDEA								
Gorgonocephalidae								
Astrocladus coniferus coniferus (DÖDERLEIN, 1902)	—	—	—	—	—	—	—	1
Ophiacanthidae								
Ophiacantha omoplata H. L. CLARK, 1911	—	—	—	—	—	—	1	—
Ophiactidae								
Ophiopholis japonica LYMAN, 1879	2	—	—	—	1	—	1	1
Ophiopholis aculeata LINNAEUS, 1767	—	—	—	—	1	—	—	—
Amphiuridae								
Amphioplus (*Amphioplus*) *macraspis* (H. L. CLARK, 1911)	—	—	24	5	—	—	—	—
Ophiothricidae								
Ophiothrix (*Ophiothrix*) *panchyendyta* H. L. CLARK, 1911	51	—	—	—	—	—	—	48
Ophiuridae								
Ophiura sarsi sarsi LÜTKEN, 1855	—	6734	919	73	109	436	3442	—
Ophiura leptoctenia H. L. CLARK, 1911	—	—	495	136	55	—	736	—
Stegophiura sladeni (DUNCAN, 1879)	2	—	—	—	—	—	—	2
**Ophiopenia disacantha* H. L. CLARK, 1911	—	—	—	1	—	—	—	—
ECHINOIDEA								
Cidaridae								
Stereocidaris japonica (DÖDERLEIN, 1885)	—	—	—	—	—	—	7	36
Temnopleuridae								
Temnopleurus reevesii (GRAY, 1855)	1	—	—	—	—	—	—	9
Strongylocentrotidae								
**Strongylocentrotus* sp.	—	—	—	—	—	—	8	—
Schizasteridae								
Brisaster latifrons (A. AGASSIZ, 1898)	—	10	—	—	—	—	—	—
HOLOTHUROIDEA								
Molpadiidae								
Molpadia roretzii von MARENZELLER, 1882	—	1	—	—	—	—	3	—

*the species described in the text