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THE ANTHROPOLOGICAL AND ECOLOGICAL IMPORTANCE OF TIDAL FLATS TO JAPAN AND KOREA WITH SPECIAL REFERENCE TO OYSTER-GATHERING ACTIVITIES

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ABSTRACT: Tidal flats of the estuarine ecosystems, reef flats of the coral ecosystems and mangrove ecosystems have up until now ensured the food availability of biologically diverse marine resources on a year-round basis. Traditionally, fishing-gleaning activities have been carried out on a daily basis by women, children and the aged, using non-specialized techniques or technologies on reef flats in the Ryukyu Archipelago, Japan and other coral seas in the Pacific Ocean, and on tidal flats in the Ariake Sea, Japan and along the west coast of South Korea. These flats and mangrove ecosystems are covered by the sea twice a day when the tide is at flood, and they are uncovered at ebb. Therefore, it has given people the opportunity to enjoy a supply of oysters and other marine resources two times a day since ancient times. Oyster-gathering activities through traditional fishing-gleaning strategies on tidal flats in Japan and Korea are, in this study, focused on and discussed in terms of ecological anthropology.

INTRODUCTION

Recently, magrove ecsosytems and reef and tidal flats have attracted much attention due to their various functions and values (Tabata 1999; Tabata et al. 2001). Societal concern and interest regarding tidal flat resources is also on the rise. The natural energy of the tides and the presence of fish have supported the people engaged in marine resource-gleaning activities on tidal flats and reef flats.

Traditionally, fishing-gleaning activities have been carried out on a daily basis by women, children and the aged, using non-specialized techniques or technologies on reef flats in the Ryukyu Archipelago, Japan (Takeda 1992b; 1993b; 1993c; 1994a; 1994b) and other coral seas in the Pacific Ocean (Takeda 2001; Takeda and Mad 1996), and on tidal flats in the Ariake Sea, Japan (Takeda 1993a; Takeda et al 1998) and along the west coast of South Korea (Lee and Takeda 1999; 2000; Takeda et al. 2000).

A good catch of various kinds of marine resources without being regulated by seasonality has endowed the people with self-sufficiency on tidal flats, reef flats and mangrove ecosystems since ancient times.

In this study, we focus on and discuss the backgrounds or contexts of oyster-gathering activities through the traditional fishing-gleaning strategies on tidal flats in the Ariake Sea, Japan and in Hampyong Bay, South Korea, which will be of importance for us to elucidate the ecological-anthropological significance of gathering activities in human evolution and/or survival strategies.

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Note: Discussion on this paper is open until December 25, 2001.

THE ARIAKE SEA, JAPAN

The difference in the water level due to tidal influence can be as high as 6 meters in the innermost part of the Ariake Sea (Fig. 1). The water level difference between the highest and lowest tide in this region is the biggest in Japan. The two tidal phases, with their ecologically different characteristics, have brought opportunities for local people to utilize the different resources made available (see also Takeda et al. 1998, for various fishing methods, fish and seashells).

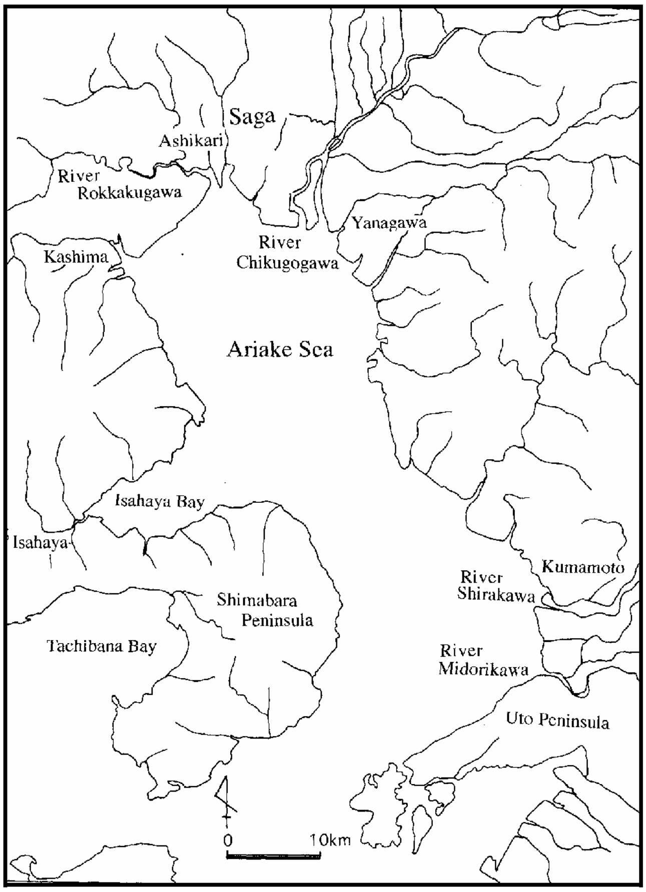


Fig. 1 The Ariake Sea: Study site in Japan

Women and men are still engaged in gleaning edible marine fauna and flora on a small scale basis on tidal flats in the Ariake Sea. Meanwhile, full-time fishermen are mostly engaged in laver aquaculture (Nakamura 1996) from autumn through winter (cold season), and other fishing activities from spring through summer (hot season). Although fishing and/or aquaculture is mainly done by men for the primary purpose of obtaining a cash income, fishing for commercial needs is also on the increase in the Ariake Sea in spite of fish decreases due to environmental degradation and over-exploitation. Until very recently, before the introduction of laver aquaculture, various kinds of fishing-gleaning activities were used. These activities have varied according to the position of the sun, the rise and set of the stars, the wax and wane of the moon, the ebb and flow of the tide, the change in wind direction, the life cycles within the sea, and so on. Refer to Takeda et al. (1998) for detailed information on traditional fishing-gleaning activities in the Ariake Sea, and Takeda and Mad (1996) for information on Palauan islanders.

There are 4 to 5 species of oysters living in the Ariake Sea. In the past, suminoegaki oysters, called sekka or hiragaki in Saga, grew abundantly in the shallow seas (above water level even during low tide) along the rivers of Shiotagawa, Rokkakugawa and Hayatsuegawa, all of which run into the Ariake Sea. In particular, oysters from the sea around Suminoe Bay were very famous together with oysters produced in Hiroshima facing the Inland Sea of Japan (Setonaikai). Another kind of oyster called magaki or shikakugaki, belonging taxonomically to the suminoegaki oyster, is now found in shallower water than that of the suminoegaki.

This aquaculture began around 1910 at the end of the Meiji era (1868-1912) with small and young shells of oysters being directly thrown into the seas. Suminoegaki oysters grow quickly and are larger than the magaki oyster, so people devoted themselves to the aquaculture of suminoegaki oysters in the Taisho era (1912-1926), intensifying the aquaculture around the beginning of the Showa era (from 1926 to now). At that time bamboo or wooden poles were put into the seas from April through May to catch young oysters with sea currents and assist in the growth of young oysters. Later they used reed stems as growing sticks, attached 3cm young oysters to the sticks and dispersed young oysters into the seas which they used as their gathering grounds from October through November. They went out to the seas when the tide was at flood, and worked to gather the oysters with special digging tools called kumade when the tide was at ebb. The harvesting of oysters was done since the following year from October to March. However, the aquaculture of suminoegaki has declined because most of the fishermen in the Ariake Sea have devoted themselves to the laver aquaculture as their dominant subsistence.

The iwagaki oyster is locally called sekka in the Isahaya Bay region. A large-scale land reclamation project took place in Isahaya Bay on April 17, 1997, neglecting the concerns of local opposition. This reclamation greatly damaged ecosystems and the traditional subsistence activities not only around Isahaya Bay, but also in most of the Ariake Sea. Before the reclamation, boiled or raw sekka oysters were sold in abundance from small huts along the main road as a special product in winter, but only a few people open such shops now.

Oyster shells have also been used in other ways. Oranges have been cultivated on a large scale in Tara Town near Kashima. People have used burnt and crushed oyster shells and dried starfish as natural fertilizer in the orange fields to prevent the fields from becoming acidic. Oyster-shell pieces melt gradually into the soil unlike chemical fertilizer, and stabilize the soil acidity for a long period.

Oyster-gathering activities have been carried out largely by individuals in the Ariake Sea. This has caused difficulty in obtaining quantitative data on the gathering activities to elucidate the gathering efficience, skill according to age ranges and so on. It is, however, hoped that further study will be done in the near future.

HAMPYONG BAY, SOUTH KOREA

Various kinds of the fishing-gathering way of life and daily activity patterns according to the specific characteristics of tidal flats is also seen in Hampyong Bay, South Korea (Fig. 2 and Fig. 3 for the gleaning-fishing grounds). The fluctuation between water level during high and low tides extends up to 10 meters in depth. In tidal flats and shallow seas in this region, various fishing-gleaning activities have been observed such as traditional fishing-gleaning practices with which flat head, oyster, octopus, medium-sized shrimp, mullet, sea bass, croaker, ilisha, mud skipper, filipino venus, lugworm and so on are caught. Today, Hampyong Bay has become a major place for commercial fishing. The tideland provides support for the people during the slack season and leads the inhabitants to a life of half-farming and half-fishing subsistence (Lee and Takeda 1999).

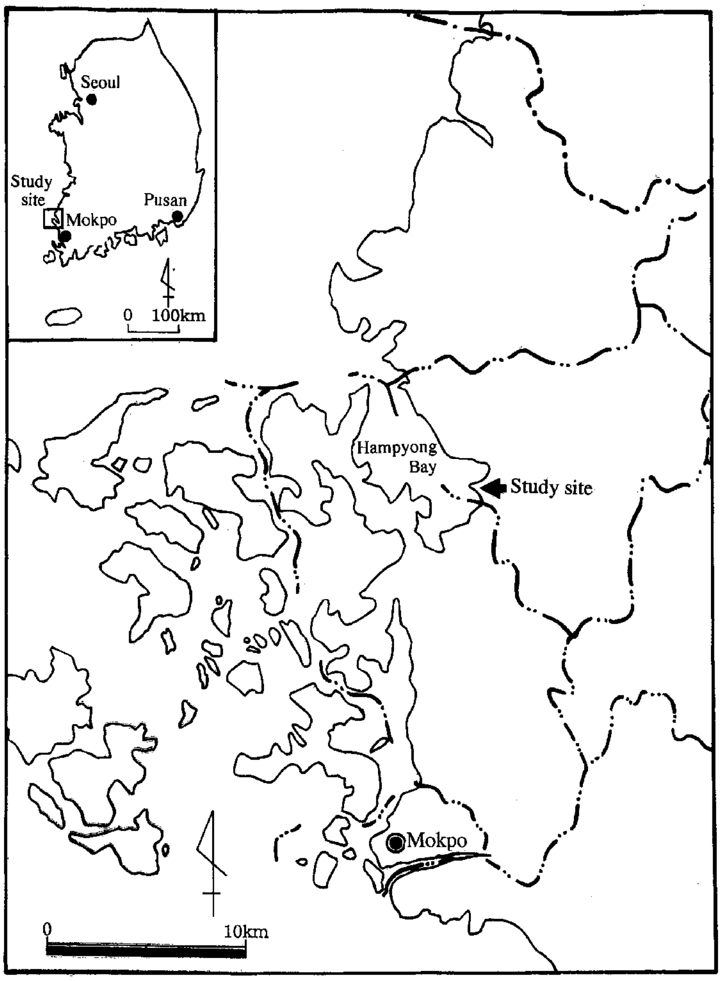
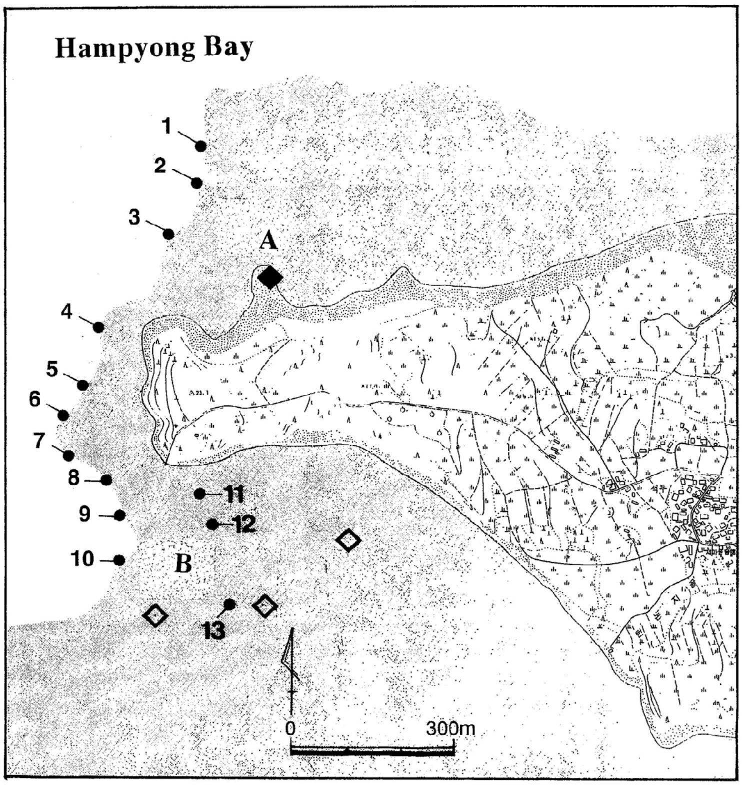


Fig. 2 Hampyong Bay: study site in South Korea

The tidal flat region along the west coast of South Korea is one of the five biggest tidal flat regions in the world. Traditional fishing-gleaning activities are carried out in Hampyong Bay and throughout Chollanamdo, which is a province located in the southern part of South Korea. Among the traditional fishing activities done in this bay there is also the use of fishing nets such as beach seine, hand-line fishing catching for sea bass, etc. Oysters are the most popular catch in Hampyong Bay. Although there are few places to glean oysters in South Korea, Hampyong Bay is one of the places where oyster-gleaning activities frequently occur among the South Korean tidal flats. In this area oysters are collected mainly by women with a gathering tool called a chose (Fig. 4). Gagthering occurs yearly from mid-November to mid-April.

We surveyed a total of 223 women engaged in oyster-gleaning on South Korean tidal flats in March, 1999 (Lee and Takeda 1999; 2000). We examined the relationships between age and career (years engaged in gleaning activities), age and the time spent in gleaning activities, age and the gleaned amount for 30 minutes or 1 hour in weight, other nature-oriented backgrounds, and so on, in order to elucidate the interrelationship among gleaning skills, technologies, the difference in physical powers caused by aging, and efficiencies found in oyster-gleaning activities.



A: The Tekke oyster-gathering grounds
B: The Abuke oyster-gathering grounds
◆: Meeting point (for preparation, measurement, etc.)
◇: Lugworm-gathering grounds
●:1~13 Fishing netting places
ııı: Onion, garlic or rice fields
▭: Houses; ▒: Sandy beach; ░: Tidal flats

Fig. 3 Fishing-gathering grounds in Hampyong

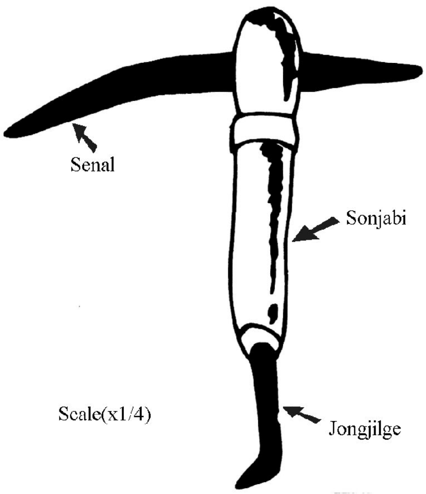


Fig. 4 Oyster-gathering tool called a chose

Table 1 Age and career
(Years engaged in oyster-gathering activities).

Item	Year	Number (%)
	30~49	45 (20.1)
Age	50~59	73 (32.7)
(N=223)	60~69	56 (25.1)
	70~	49 (21.9)
	1~10	43 (20.1)
Career	11~30	48 (23.0)
(N=209)	31~40	56 (26.6)
	41~	62 (29.1)

As for the relationship between age and career, the age limit was broadly between 33-83 years old, with an average of 57.7 years of age. The average career spanned 31.2 years, varying from 2 to 68 years (Table 1). The relationship between age and amount of gleaned oysters in weight throughout a career was not statistically significant. Gathering skills seem not to be determined by age, but further study will be needed. The difference in gathering skills may be caused by engaging in monotonous gleaning work over a long period of time.

The average time spent engaging in gathering activities was 5 hours 4 minutes, with 5 hours 15 minutes being the highest average by the 50-59 age range, and 4 hours 49 minutes being the lowest average by the 30-49 age ranges (Fig. 5).

The total time spent in oyster-gathering activities varies with the date (Fig. 6; Table 2). An average of 4 hours and 32 minutes, 5 hours 12 minutes and 5 hours 4 minutes were spent on March 21st, 22nd and 23rd, respectively. The difference was chiefly caused by the tide fluctuation and weather condition. Moreover, on the day before a market day, laborers make more of an effort to catch oysters.

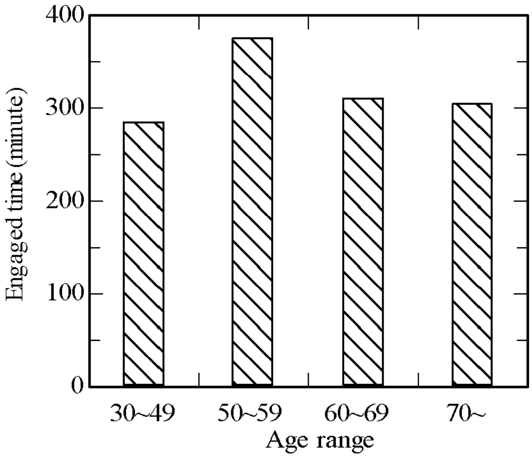


Fig. 5 Age range and time engaged in oyster-gathering activities

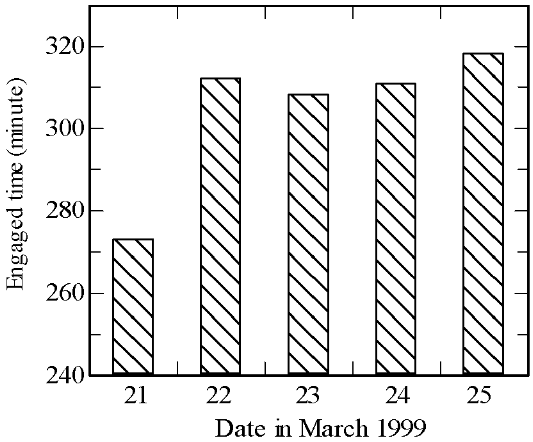


Fig. 6 Working time engaged in oyster-gathering activities

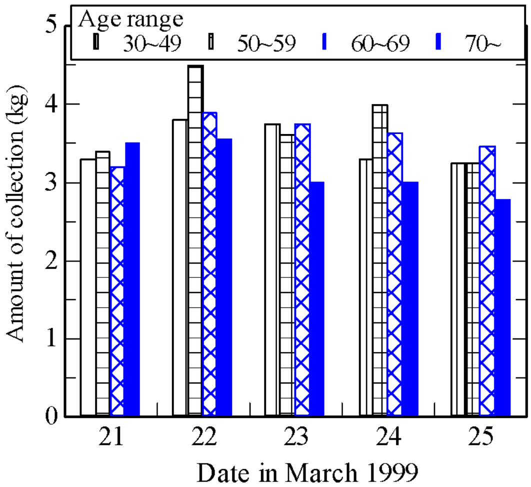


Fig. 7 Age range and amount of collection in weight

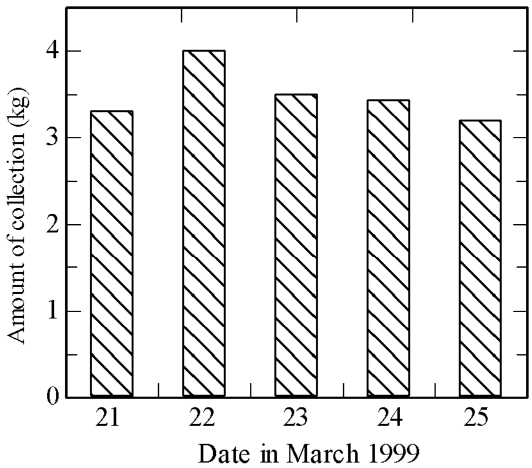


Fig. 8 Amount of collection in weight

Table 2 Time spent in oyster-gathering activities (March 24, 1999)*1

Individual number	Age	Career (year)	Arrival time*2	Time when going*3	Time when getting back*4	Hours engaged*5	Amount of catch (kg)
H1	33	3	10:28	10:31	15:38	5:07	3.5
H2	33	7	10:39	10:41	15:28	4:47	2.5
H3	39	6	10:28	10:31	15:09	4:48	3.4
H4	39	7	10:43	10:48	16:06	5:18	3.2
H5	40	15	11:30	11:35	14:58	3:23	2.5
H6	41	3	10:44	10:48	15:26	4:38	3.5
H7	43	2	9:35	9:40	15:36	5:56	3.0
H8	44	8	10:00	10:04	16:17	6:13	5.0
H9	44	13	10:59	11:06	14:54	3:48	2.8
H10	45	20	11:25	11:26	14:58	3:32	2.7
H11	47	30	11:28	11:35	16:08	4:33	4.0
H12	49	15	10:36	10:49	14:58	4:09	3.0
H13	50	5	11:07	11:08	16:02	4:54	4.5
H14	52	33	9:08	9:10	16:15	7:05	5.7
H15	55	20	10:05	10:15	15:52	5:37	4.3
H16	55	30	10:59	11:06	14:54	3:48	3.0
H17	57	33	9:35	9:37	16:16	6:39	3.7
H18	57	37	9:54	10:02	16:03	6:01	4.5
H19	58	24	9:56	10:03	16:18	6:15	4.3
H20	58	36	10:08	10:10	16:07	5:57	5.0
H21	59	34	9:44	9:48	16:16	6:28	5.0
H22	59	40	10:59	11:05	14:59	3:54	3.5
H23	60	41	11:29	11:35	16:05	4:30	3.0
H24	62	20	10:11	10:19	15:17	4:58	3.2
H25	64	39	9:18	9:28	16:07	6:39	4.0
H26	65	37	9:48	10:17	15:01	4:44	2.4
H27	65	50	11:47	11:54	14:59	3:05	2.5
H28	66	10	9:49	9:55	16:17	6:22	3.5
H29	66	49	9:09	9:24	16:03	6:40	5.0
H30	69	40	11:22	11:24	15:36	4:12	2.6
H31	69	44	9:18	9:29	14:58	5:29	3.3
H32	69	49	10:36	10:47	15:04	4:17	2.0
H33	69	53	9:48	10:04	15:04	5:00	2.5
H34	70	50	9:56	10:03	16:19	6:16	4.5
H35	70	52	9:09	9:24	16:07	6:43	5.5
H36	70	52	9:55	10:04	15:29	5:25	3.0
H37	71	52	11:04	11:05	15:00	3:55	2.5
H38	72	45	9:43	9:46	16:17	6:31	4.0
H39	73	24	9:18	9:29	14:20	4:51	2.0
H40	75	58	10:01	10:04	15:57	5:53	2.5
H41	83	68	10:59	11:02	14:20	3:18	1.3

*1: There is no meteorological agency at Hampyong, but the people know the tide is 40 to 60 minutes later than that of Mokpo. High tides at 07:17 am and 19:23 pm, and low tides at 12:22 pm occurred in Mokpo on March 24, 1999. The sunrise was at 06:31, and the sunset at 18:47.
*2: The time when each oyster-gatherer arrives at the meeting point (see also Fig. 3).
*3: The time when each oyster-gatherer leaves the meeting point for the work at a tidal flats (see also Fig. 3).
*4: The time when each oyster-gatherer gets back to the original meeting point from the tidal flats.
*5: This time includes the time spent walking from the meeting point to the tidal flats, the time spent oyster-gathering and the time spent walking back to the original meeting point after the work in the tidal flats.

Table 3 Amount of oyster gathered in 30 minutes (1999)

Date (Number of persons engaged)	Individual number	Age	Career (year)	Number of oyster gathered	Amount gathered (g)
March 21 (12)	H 8	44	8	166	800
	H 42	45	16	191	850
	H 12	49	15	187	950
	H 43	54	30	182	900
	H 15	55	20	190	800
	H 22	59	40	178	800
	H 25	64	39	159	800
	H 44	65	50	165	700
	H 29	66	49	185	900
	H 35	70	52	180	1000
	H 37	71	52	154	800
	H 39	73	24	115	600
March 22 (10)	H 6	41	3	175	900
	H 8	44	8	160	800
	H 45	51	30	153	850
	H 14	52	33	212	950
	H 18	57	37	133	800
	H 20	58	36	155	800
	H 46	59	39	165	750
	H 47	60	35	112	600
	H 27	65	40	204	900
	H 29	66	49	177	950
March 23 (11)	H 42	45	16	198	700
	H 48	51	2	191	650
	H 49	54	30	176	650
	H 46	59	39	183	650
	H 50	61	40	154	650
	H 51	64	30	153	600
	H 25	64	39	177	650
	H 29	66	49	187	900
	H 31	69	44	183	700
	H 37	71	52	155	600
	H 40	75	58	129	550
March 24 (10)	H 5	40	18	162	850
	H 8	44	8	174	800
	H 9	44	13	139	800
	H 11	47	30	197	950
	H 12	49	15	165	800
	H 25	64	39	180	750
	H 31	69	44	177	750
	H 35	70	52	230	900
	H 36	70	52	135	700
	H 37	71	52	155	800
March 25 (12)	H 1	33	3	182	700
	H 7	43	2	149	550
	H 14	52	33	238	850
	H 52	58	36	174	650
	H 20	58	36	173	650
	H 53	58	38	186	700
	H 46	59	39	186	650
	H 47	60	35	180	600
	H 25	64	39	173	600
	H 31	69	44	187	650
	H 37	71	52	154	600
	H 41	83	68	134	500

*2: Individuals from H 42 to H 53 were excluded from Table 2, but are included on Table 2.

The individuals in the 50-59 age range gleaned 3.76 kg of oysters. This amount is due to the tendency of the individuals in the 50-59 age range to spend a longer time-gleaning compared to other age groups. The 70-79 and up age range gleaned the smallest amount (3.18kg), with an average of 3.5kg in weight (Fig. 7).

As for the relationship between day and amount gathered in weight, the total weight of the amount gathered for each individual woman was 3.3 kg on March 21st, 1999, 4.0 kg on March 22nd (the most abundant amount gathered during the survey period), 3.5 kg on March 23rd, 3.4 kg on March 24th, and 3.2 kg on March 25th. The steady decrease of the amounts gathered is suggested to be closely related with the fluctuation in height of the tide (Fig. 8).

The amount of gleaned oysters in weight for 30-minutes and 1-hour are 725.3 g and 790.9 g, respectively (Figs. 9 and 10; Table 3). Women of 40-49 years of age showed a tendency to display a higher intensity of gleaning effort in comparison to other generations.

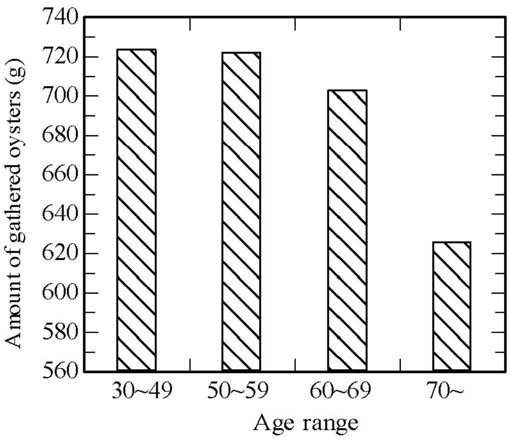


Fig. 9 Age and amount of gathered oysters in weight (per one hour)

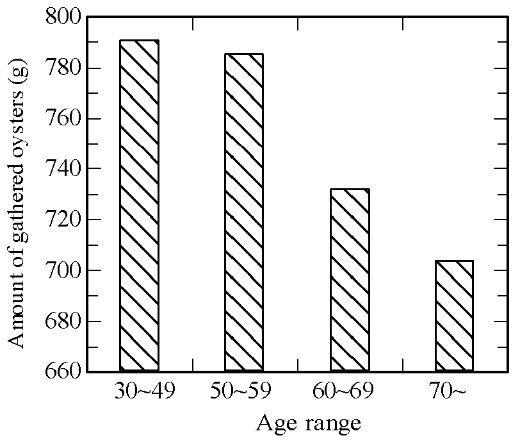
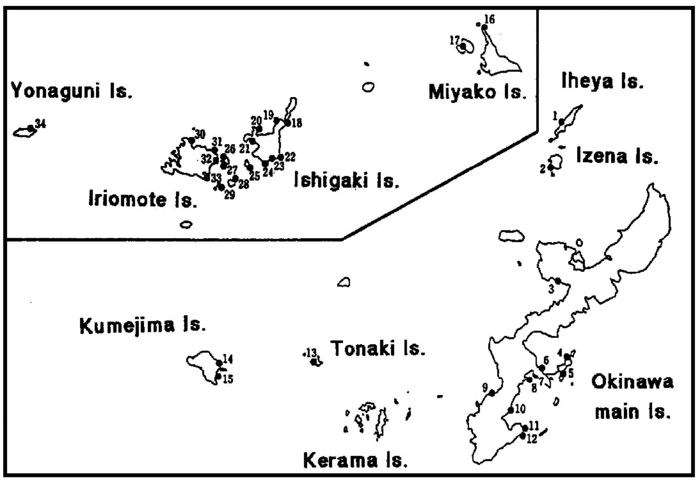


Fig. 10 Age and amount of gathered oysters in weight (per 30 minutes)



Note: 1: Iheya Is., 2: Izena Is., 3: Nago, 4: Ikemi, Miyagi Is., 5: Henza Is., 6: Teruma, Yakena, 7: Awase, 8: Tasukaya, Haebaru, Katsuren 9: Ujidomari, Ginowan, 10: Gaja, Haebaru, 11: Chinzaki, Chinen, 12: Guhsiken, Chinen, 13: Tonaki Is., 14: Maja, Kumejima Is., 15: Shimajiri, Kumejima Is., 16: Karimata, Hirara, Miyako Is., 17: Shimoji, Irabu Is., 18: Ibaruma, Ishigaki Is., 19: Nosoko, Ishigaki Is., 20: Kabira, Ishigaki Is., 21: Sakieda, Ishigaki Is., 22: Shiraho, Ishigaki Is., 23: Oohama, Ishigaki Is., 24: Ishigaki, 25: Taketomi Is., 26: Kohama Is., 27: Kohama Is., 28: Kuroshima Is., 29: Aragusuku Is., 30: Uebaru, Irimote Is., 31: Takana, Iriomote Is., 32: Komi, Iriomote Is., 33: Haemi, Iriomote Is., 34: Sonae, Yonaguni Is.

Fig. 11 Geographical distribution of stone tidal weirs called kachi, kaki or nagaki in Okinawa Prefecture

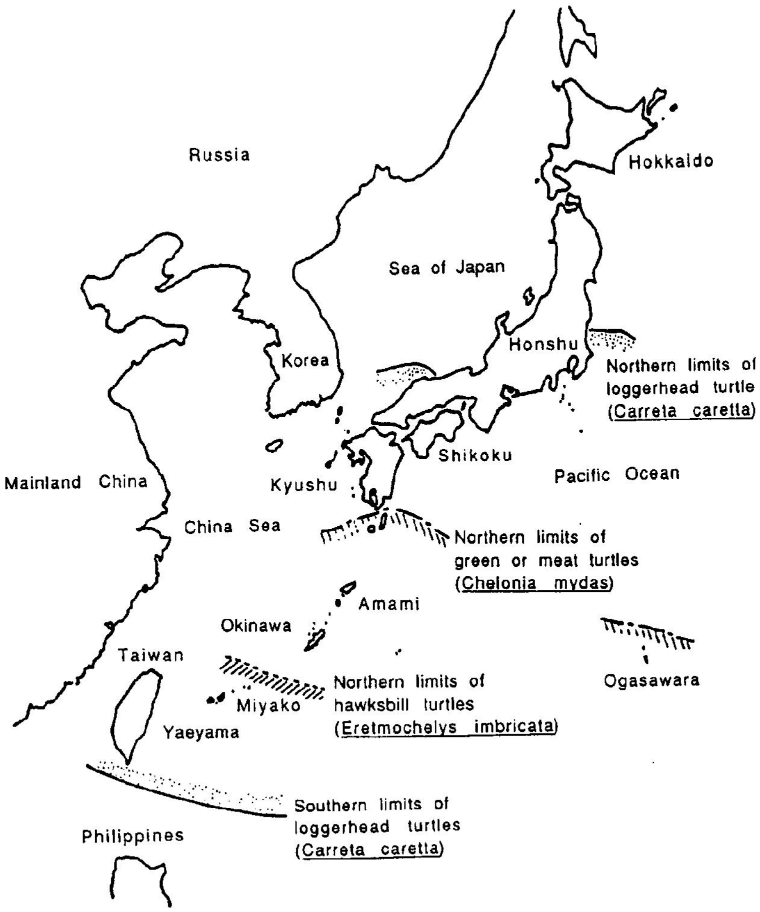


Fig. 12 Geographical distribution of three turtle species in Japan (modified from Kamezaki 1987)

Table 4 Seaweed gathered as food in the Ryukyu Archipelago.

Scientific name / Common name	Japanese name	Season gathered
Caulerpa lentillifera*	Kubirejita	Apr-Oct
C. racemosa / Sea grape	Sennarijita	Apr-Oct
Cladosiphon okamuranus	Mozuku	Mar-Jun
Codium intricatum / Sponge seaweed	Motsuremiru	Mar-Apr
Digenea simplex	Makuri	Mar-Jun
Enteromorpha intestinalis / Green confetti	Bou-aonori	Mar-Jun
Eucheuma denticulatum	Kirinsai	Aug-Sep
Gracilaria verrucosa / Moss Chinese	Ogonori	Mar-Jun
Hizikia fusiformis*	Hijiki	Mar-Apr
Hypnea charoides / Green tip	Ibaranori	Mar-Apr
Laurencia sp.	Sozo	Jul-Aug
Meristotheca papulosa	Tosakanori	Mar-Apr
Monostroma nitidum	Hitoegusa	Jan-Apr
Porphyra suborbiculata / Laver, Nori	Maruba-amanori	Mar-Apr

Note: Seaweed-gathering season is concentrated in early spring to summer. In addition to the variety of seaweeds listed in this table, komenori (Carpopelties prolifera), kamogashiranori (Dermonema pulvinatum), habanori (Endarachne binghamiae), kobusozo (Laurencia? undulata), mozuku (Nemacystus decipiens), and futomozuku (Tinocladia crassa) are also eaten, but ana-aoso seaweed (Ulva pertusa) was eaten in the past. Makusa or tengusa (Gelidium amansii), onikusa (Gelidium japonicum), shiramo (Gracillia bursa-pastoris) and obakusa (Pterocladia capillacea) are used as agar-agar, while hanafunori (Gloiopeltis complanata) and fukurofunori (G. furcata) are used as linen-starching. Makuri, miru and motsuremiru seaweed were drunk as a vermifuge, too. On the other hand, hondawara (Sargassum spp.) and fukura (unidentified) seaweed were used as fertilizer in the fields before

World War II. Nuuriiaasaa seaweed was used as bait in a basket-fishing method called teiru locally in the Yaeyama Islands. Tategusa, akamuu, arana, imizuna, syuna, ogou, nuuri, isomatsu, and fukura seaweed are also available during the summer in the Ryukyu Archipelago, but these species are not scientifically identified.

*Seafarmed in some villages along the coast (Idani 1991), though seaweed which grows naturally on reef flats or reef margins is preferred by the inhabitants.

Table 5 Poisonous plants used for stupefying fish in the Ryukyu Archipelago

Scientific name	Japanese name	Part utilized
Alpinia specinosa	Gettou	Root
Anagallis arvensis	Rurihakobe*3	Grass
Boehmeria nivea	Choma	Root
Cerbera manghas	Okinawakyouchikutou	Leaf
Derris sp.*1	Derisu	Root
Diospyros maritima	Ryukyugaki*3	Fruit (unripe)
Euphorbia heliscopia	Toudaigusa	Leaf & stem
Glehnia littoralis	Hamaboufuu	Root
Melia azedarach	Sendan	Leaf
Messerschmidia argentea	Monpanoki*3	Leaf
Nicotiana tabacum	Tabako	Leaf
Rostellularia procumbens	Kitsunenomago	Leaf
Schima liukiuensis	Iju	Bark
Styrax japonicus	Egonoki	Pericarp
Ternstroemia gymnanthera	Mokkoku	Bark
Viburnum odoratissimum	Sangojyu	Leaf
Zanthoxylum piperium*2	Sanshou	Bark & seed

Note: Besides these poisonous plants, toxic ingredients from nisekuronamako (sea cucumber: Holothuria leucospilota) were used as fish poison in Yaeyama Islands in the past. A fish-poison yam species (Diosocrea piscatorum) is used in the Malay Peninsula (Burkill 1966). In mainland Japan, the leaf and stem of tokoro yam (Dioscorea tokoro), the leaf and bark of yanagidade (water pepper: Polygonum hydropiper), the pericarp of kurumi walnuts (Juglans sieboldiana and J. subcordiformis), the tannin of kaki (Japanese persimmon) (Diospyros kaki), and the leaf of asebi Japanese Andromeda (Pieris japonica) and hazenoki wax tree (Rhus succedanea) were and are used as fish-poisons in some remote areas in addition to egonoki and sanshou listed in this table.

*1 This has one of the most toxic effects among the stupefying plants. One Derris species was first introduced to Iriomote or Ishigaki Island from Taiwan after World War II. It is also cultivated at Kijyoga in the northern part of Okinawa's mainland island. This kind of plant is used as fish poison not only in South-east Asia, but also Polynesia.

*2 It is mainly used in the Amami Islands.

*3 These plants are also used as fish poisoning (ichthyosacrotoxism).

CONCLUSIONS

Tidal flats have been targets to be reclaimed since ancient times because of the vulnerable characteristics of the ecosystem itself (Seon et al. 1999), but a rich variety of marine resources and gleaning methods have been utilized by the coastal people of the Ryukyu Archipelago as shown in Figs. 11 and 12, and Tables 4 and 5 (Takeda 1994a; 1994b). Tidal flat, reef flat and mangrove ecosystems have so far ensured food sufficiency and availability of biologically diverse marine resources throughout the year.

In comparison with fishing practices in the Ariake Sea, Japan, the scale in Hampyong Bay, South Korea is small and women receive little income by gathering oysters. However, traditional fishing-gleaning activities are observed and the people tend to display a stronger self-consciousness than other people of tideland cultures in Japan and Korea. It is also evident that Hampyong Bay women enjoy practical quality of life (QOL) because of warm human bondage among the people and their sustainable resource management of traditional oyster-gathering strategies.

Rapid technological innovations such as the introduction of new fishing methods, fishing devices and aquaculture techniques have, however, occurred throughout Japan. It is evident that these technological factors have estranged traditional cultures and folklores deeply based on local folk traditions. Their conventional monthly fishing-gleaning patterns, and their traditional skills and knowledge necessary for fishing-gleaning at sea and on tidal flats are already now being gradually altered.

Such traditional fishing-gleaning subsistence has been decreasing all over the world. Tidal flat, reef flat and mangrove ecosystems have been reclaimed and altered by human efforts to build rice-fields, factory-lots and so on (Seon et al. 1999 and Lee and Takeda 1999 for Korean case; Takeda et al. 1998 for Japanese case). However, it is crucially important to accumulate data on traditional fishing-gleaning activities in terms of ecological anthropology, so as to make a basic effort to elucidate human adaptabilities in the process of human evolution and survival strategies on tidal flat, reef flat and mangrove ecosystems.

From what we have learned, we intend to proceed to the next step of the accumulation of data on such a tradition of fishing-gleaning strategies through intensive fieldwork. This will provide ecological-anthropological clues to reconstruct human evolution from a nomadic hunting-gathering economy to a settled agriculture economy. However, it requires urgent and intensive fieldwork based on long-term direct observations.

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