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Plant Phenology, Animal Behaviour and Food-gathering by the Coastal People of the Ryukyu Archipelago

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Abstract

Animal behaviour and plant phenology are directly affected by the weather. Traditionally, human food-gathering activities were also often dependent on the weather. The flying height of a hawk-eagle reveals the coldness of that particular day. The jumping direction of a dugong over the sea is also a good indicator to judge the weather of that day. The flight of a large swarm of a particular dragonfly over the sea indicates that a typhoon is imminent. The extent of bloom of a particular plant species is correlated with the degree of drought in that year. The flowering of some plant species teaches people to cultivate particular kinds of plants in the fields or gardens. Animal behaviour and plant phenology have been shown to be good indicators for planning subsistence activities (gathering, fishing, hunting and farming).

The Ryukyu Archipelago is located in the southernmost, subtropical part of Japan. The weather here is much less seasonally influenced than in mainland Japan, and the Islands frequently suffer much more from the irregular occurrence of droughts and typhoons. Species diversity in the Archipelago is much greater than in mainland Japan. The Ryukyu Islanders are favoured with rich biological resources that help to predict meteorological disasters and anticipate physical changes in the natural environment. Accordingly their food-gathering activities are clearly closely related to behavioural characteristics in accordance with the phenological change of fauna and flora. The ecological-anthropological context of these correlationships is described and examined.

Key words: biological calendar, coastal people of the Ryukyu Archipelago, fishing-gathering subsistence activities, food-gathering, human evolution, phenological change

Introduction

Before today's weather forecasting systems developed, our Japanese ancestors predicted small changes in weather by observing creatures and unsual events. Changes in animal behaviour gave the most familiar and most useful weather forecast. The instinctive behaviours of some creatures serve as meteorological indicators. Some bird species sing in the early morning, indicating the weather of the day. The flying height of *sashiba*, a migratory eagle seen in the Ryukyu Archipelago, reveals how cold the day will become, or the actual temperature is on that particular day. The jumping direction of a dugong over the sea is also a good indicator for the Yaeyama Islanders to judge the weather of that day (Takeda, 1994). The flight of a large swarm of *usubakitombo* dragonflies over the sea indicates that a typhoon is imminent. The extent of bloom of a particular plant species is correlated with the degree of drought in that year. The flowering of *sakura, hikanzakura* and other some plant species teaches people to cultivate particular kinds of plants in the fields or gardens.

Animal behaviour and plant phenology are directly regulated by the weather. Traditionally, human food-gathering activities have also been largely dependent on weather. Animal behaviour and plant phenology have proved to be good in-

Fig. 1. The Ryukyu Archipelago. The Ryukyu Archipelago consists of four major islands: Amami Islands, Okinawa Islands, Miyako Islands, and Yaeyama or Ishigaki Islands from the north to the south.

dicators for planning subsistence activities (gathering, fishing, hunting, and farming). Natural phenomena have been interpreted as signs enabling short-term and long-term weather forecasting – for example the temperature on that day or the following day, and seasonal changes – and this has saved people's lives.

The prediction of weather from observations of fauna and flora is a world-wide human behaviour. In Japan, weather is strongly influenced by the season, and weather forecasting is consequently dependent on seasonal change. The Ryukyu Archipelago is located in the southernmost, subtropical part of Japan (Fig. 1). The weather here shows much less seasonal variation than in mainland Japan, and the Archipelago frequently suffer much more from the irregular occurrence of droughts and typhoons (Takeda, 1993c; Fig. 2 & Table 1). Monthly frequency of typhoons, mean temperature and rainfall (Fig. 3 & Fig. 4) help us understand the environmental background of the Archipelago. Species diversity in the Archipelago is much greater than in mainland Japan. The Ryukyu Islanders were favoured with rich biological resources that helped them to predict

Table 1. Monthly fluctuation of occurrence of meteorologically unusual events (1948 to 1977) (modified from Yamazaki *et al.*, 1989).

Cause	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(%)
Damage by wind or flood														
Typhoon				1	2	7	24	19	26	9	12	1	101	(36)
Depression	1	2	2	2	7	7	3	1	1	1	1	1	31	(11)
Front			1	6	12	21	3	1	1	4			49	(18)
Tornado	3	1	2	1	2	6	4	1	5	5	5	1	36	(13)
Periodic wind		1											1	(0)
Abnormal tide		1		1	2	1							3	(1)
Damage by thunder			1	6	3	7	3	8	3	1			32	(11)
Damage by drought		1	3	4	2	3	4	2	3	3			25	(9)
Damage by cold weather		1											1	(0)
Total	4	7	9	21	29	51	41	34	39	23	18	3	279	

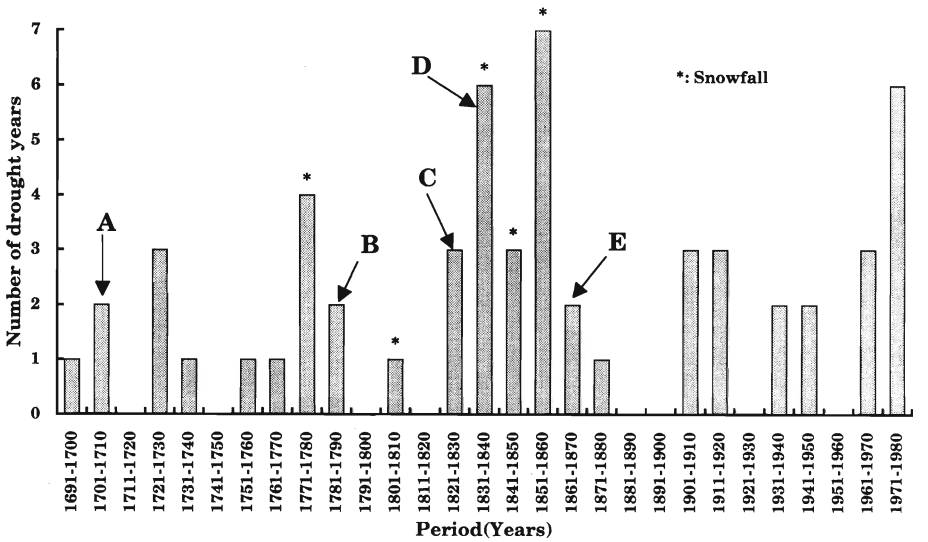

Fig. 2. Frequency of drought in the Ryukyu Archipelago (1700 to 1980) (modified from Takara, 1982) .
Data from 1700 to 1876 are based on "Kyuyou", royal records written in Shuri Emperor times. Other data are collected from Yamazaki *et al.* (1989) and my personal communications.
A: 3199 people died of starvation in 1709.
B: The great Tenmei famine of mainland Japan occurred during this period (1782–1787).
C: 3358 people died of starvation in 1825.
D: 2455 people died of starvation in 1832 in the Ryukyu Archipelago. The great Tenpo famine of mainland Japan also occurred during this period (1833–1839).
E: Mainland Japan experienced the great Keio famine in 1866.
*: Snowfall is very rare, but was recorded in January in 1774, 1805, 1834, 1843 and 1857.
Other unusual events: A great tidal wave (the Meiwa tsunami) struck Yaeyama and Miyako Islands in 1771, causing 9313 and 2548 casualties, respectively. Accidental bird visitors (Eastern common crane, *Grus grus* ; Siberian white crane, *G. leucogeranus* ; White-naped crane, *G. vipio* ; Hooded crane, *G. monacha*, and Demoiselle crane, *Anthropoides virgo*) were recorded in 1726, 1805, 1837, 1838, 1847, 1851, 1865, 1869, 1872, 1873, 1874, 1955, 1968, 1969 and 1992 (Yamazaki *et al.*, 1989; Kugai, pers. comm., 1993).

meteorological disasters and to respond to the physical changes in the natural environment.

The kinds of natural events used by the islanders to construct their local calenders were common throughout the Archipelago. Since phenological dates fluctuate according to the meteorological conditions of each year, geographical location of each island and so on, I have averaged my observations for the periods during which I collected data, from 1980 to 1993.

Examples of major gathering and/or fishing activities are illustrated in relation to animal behaviour and plant phenology in the Archipelago. The traditional understandings of nature among the islanders have been decreasing day by day and year by year. I hope that the present paper will promote interest in the ecological-anthropological foundations of Ryukyuan culture.

Calendar of Animal Behaviour, Plant Phenology (Flowering and Fruiting) and Human Activities in the Ryukyu Archipelago

For this calendar, each month is divided into three parts: **F** = first third, **M** = middle third and **L** = last third. Table 2 is a simplified calendar.

January

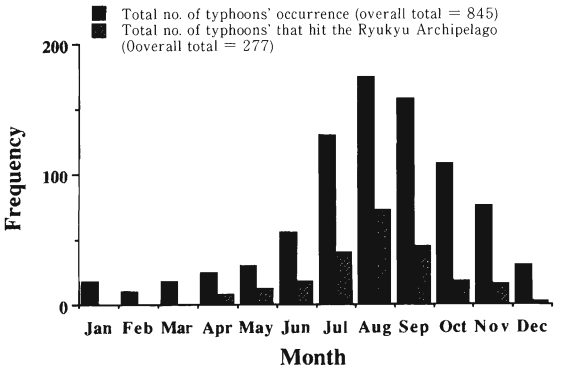

Fig. 3. Monthly frequency of typhoons in the Ryukyu Archipelago (1955 to 1985) (modified from Yamazaki *et al.*, 1989).

F

Ryukyukosumire (violet: *Viola yedoensis*) blooms.

M

Hikanzakura tree (flowering cherry: *Prunus cerasifera*) and *tsuwabuki* herb (Leopard plant: *Farfugium japonicum*) bloom.

L

Momo shrub (peach: *Prunus persica*) and *bara* shrub (rose: *Rosa hybrida*) bloom.

Ookuina bird (banded crake: *Rallina eurizoides*) sings.

Gathering of shellfish or other marine fauna and catching of fish at low tide at night, is most frequent at this time, because this is the time of year with the lowest tides. Also, fish on reef flats are sometimes in a temporary state of numbness, caused by sudden cold, and can be easily caught (Takeda, 1992a, 1994). Shallow-water fish such as filefish (*Balistoides* spp., *Rhinecanthus aculeatus, Stephanolepis cirrhifer,* and *Sufflamen* spp.) and rabbitfish (*Siganus fuscescens*) are easily affected by such cold (Takeda, 1992a, 1994).

Searching for seashells and fish is usually done when work in the fields is completed or when the tide falls during the working hours. Sandals must be worn when gathering on reef flats and reef margins due to the danger of accidentally treading on a type of harmful shell which may lead to serious injury.

Shells are mainly gathered in the daytime because they are very heavy to carry. Shells gathered in the daytime are Chiragra spider conch (*Harpago chiragra*), spider conches (*Lambis lambis* and *L. truncata*), top shell (*Tectus maximus*), mussel (*Septifer bilocularis*), and so on. Species of cone shells (*Lithoconus tessulatus*) or spider conches, however, are avoided because it is laborious work to cut them open and because of the danger from cracking during hammering. In particular, large-sized shells such as the cone shells are so hard that they are not gathered.

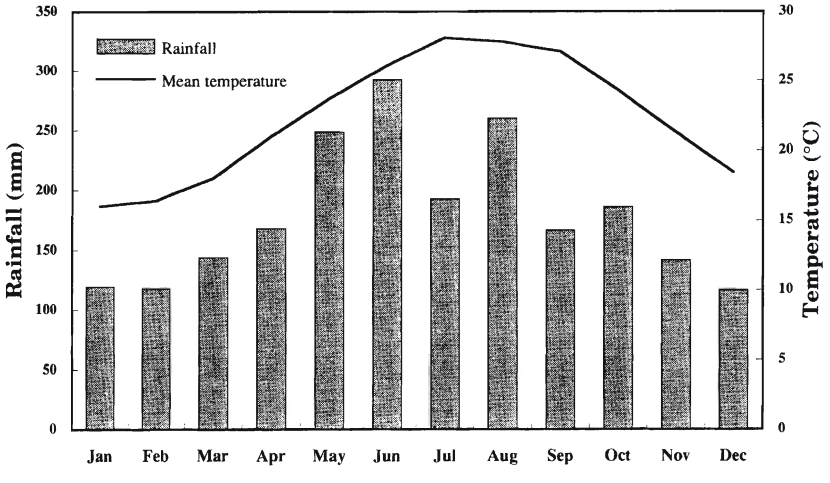

Fig. 4. Mean temperature and rainfall in Naha, Okinawa (1951-1980). Mean monthly temperature and rainfall were averaged for the period 1951-1980. Annual total rainfall was averaged 2128,2 mm for the same period, with annual mean maximum temperature 22.4°C and minimum temperature 20.1°C.

Table 2. Phenological calendar in the Ryukyu Archipelago.

Month		Flora		Fauna	Human activities
		Flowering	Fruiting		
Jan	F	-*Ryukyukosumire*			
	M	-*Tsuwabuki*			-Gathering of asphyxial fish
	L	-Peach -Rose		-Banded crake sings.	-Gathering of marine fauna at low tide at night
Feb	F			-Bush warbler sings.	
	M	-*Hikanzakura* flowering cherry -*Shimaguwa* -*Ryukyu-akamatsu* -*Taiwanyamatsutsuji* -Japanese hawthorn -Chinese fan			
	L	-Sasanqua -*Yamatsubaki* -Japanese snowbell* -*Seishika* shrub	-*Hiramiremon*	-*Himeamagaeru* frog sings.	
Mar	F			-Swallows fly in from the south.	
	M	-China berry*		-Ghost crab migrates.	
	L	-White trumpetlily -*Marubachiyanoki* tree		-Buzzard-eagle heads norhtwards. -*Shiroharakuina* bird arrives. -*Okinawakishinouetokage* lizard emerges.	
Apr	F	-Gladiolus -*Hoshiamaririsu*		-*Iwasakikusazemi* cicada sings.	
	M	-Horsetail tree -Oleander		-*Iwasakimadobotaru* firefly emerges.	-Gathering of seaweed and marine fauna at low tide in the daytime
	L	-Shell flower* -Taiwan acacia -Indian coral-tree	-*Tsurugumi* oleaster -*Urajiroichigo*	-Ruddy kingfisher arrives. -Winged termite swarms. -*Miyakoniinii* cicada sings.	
May	F	-*Fukugi* tree -Lilies -*Satsuki* shrub -Hill gooseberry			
	M	-*Iju* tree*		-Skylark sings. -*Amasagi* flies in. -Dolphins come near shore. -*Minamikibinago* fish come near shore. -*Shoujotombo* dragonfly emerges. -*Tsumagurozemi* cicada sings.	-Fishing with poisons -Gathering of *Minami-kibinago* fish

F, first third of a month; M, middle third; L, last third.
* Plants used for fish-stupefying (see also Table 4).

Table 2. (continued)

Month		Flora		Fauna	Human activities
		Flowering	Fruiting		
Jun	F	-Velvetleaf*	-*Marubachisyanoki*	-Cattle egret arrives.	
	M	-Alexandrian laurel -Crape myrtle -Rose of Sharon		-*Ryukyu-kumazemi* cicada sings. -*Ryukyu-aburazemi* cicada sings. -Land crabs migrate.	-Sailing northwards (in the past) -Gathering of land crabs
	L	-*Ryuzetsuran*		-Jellyfish emerge. -Young rabbitfish come near shore. -Sea snakes come near shore. -*Taiwanhigurashi* cicada sings.	-Gathering and/or fishing of young rabbitfish -Gathering of sea snakes
Jul	F				-Fishing season of lobsters opens.
Aug	F			-*Shigi* and *chidori* birds fly in.	
	M		-*Fukugi* tree -Guava	-Swallows migrate southwards. -Fireflies emerge. -Giant katydid sings.	
	L			-Chinese sparrow hawk arrives.	
Sep	F			-*Ooshiokaratombo* dragonfly emerges.	
	M	-Soybean			
	L			-*Komukudori, kisekirei,* and *isohiyodori* fly in. -*Ooshimamadobotaru* firelfly emerges.	
Oct	F	-Japanese plume grass -*Oogochou* shrub -*Higanbana*	-China laurestine* -*Kuroganemochi*	-Buzzard-eagle arrives. -Mitten-handed crab breeds.	-Hunting of buzzard-eagle -Gathering of crabs -Fishing of octopi
	M	-*Okinawa-karukaya*	-Oranges		-Gathering of flyingsquid
	L	grass			-Hunting of bush boars -Sailing southwards (in the past)
Dec	F		-Oranges	-*Mebosomushikui* birds sing.	-Preparing soybeans for the next harvest
	M	-Camellia			
	L	-Japannese apricot			-Preparing special porridge

* Plants used for fish-stupefying (see also Table 4).

On the other hand, octopi (*Octopus* spp.), crabs and fish are taken at night, along with parrotfish, rabbitfish and tandan catfish, etc. Most fish which sleep at night are easily caught (Takeda, 1994).

February

F

Uguisu bird (bush warbler: *Cettia diphone*) sings.

M

Hikanzakura cherry and *seironbenkei* (never die: *Kalanchoe pinnata*) are in full bloom. *Taiwanyamatsutsuji* (azalea: *Rhododendron simsii*), *takasagosharinbai* shrub (Japanese hawthorn: *Rhaphiolepis* sp.), *Ryukyuakamatsu* tree (Japanese red pine: *Pinus luchuensis*), *Birou* tree (Chinese fan: *Livistona chinesis*) and *shimaguwa* shrub (mulberry: *Morus australis*) are in bloom.

L

Sazanka shrub (sasanqua: *Camellia* spp.), *egonoki* shrub (Japanese snowbell: *Styrax japonicus*), *seishika* shrub (azalea: *Rhododendron latoucheae*), *tsutsuji* shrub (azalea: *Rhododendron* spp.), *hiramiremon* orange (*Citrus* sp.) and others are in full bloom, and *sendan* tree (Japanese bead tree: *Melia azedarach*) and many trees are also in bud.

Himeamagaeru frogs (*Microhyla ornata*) sing in the Yaeyama Islands.

March

F

Deigo (Indian coral-tree: *Erythrina variegata*) blooms. People judge the degree of drought in the forthcoming summer and fall according to the degree of flowering. People will suffer from drought in a year when the *deigo* trees bloom well (see also Fig. 2). On the other hand, if the *deigo* trees leaf abundantly with fewer flowers, typhoons with much rain will hit the Archipelago during the summer season of that year (see also Fig. 3 and Table 1). This local belief has been meteorologically established as almost true, by Yamazaki *et al.* (1989: pp. 22-24).

Tsubame birds (Japanese red-rumped swallow: *Hirundo daurica* and house swallow: *H. rustica*) fly in from the south.

M

Sendan tree (Japanese bead tree: *Melia azedarachi*) blooms. The leaves of this plant, which is not used in forecasting, are useful as fish poison; a good example of use of a seasonally available resource.

Tsunomegani (ghost crab: *Ocypode ceratophthalma*) enters the sea en masse (Takeda & Ohyama, 1989). Its nest holes may be used as a hint in weather forecasting: it is said that if the hole faces the sea, this will be calm the next day, and that if it faces inland, the sea will be stormy. About this time, dangerous small-scale typhoons occur frequently, so it is very important for fishermen to note the direction of the nest holes in order to work on the sea. Strong winds of this season, locally known as *ningachigajimaai*, blow for 7-10 days, so seaweed and small fish are often washed up by the waves and create a stench while putrefying along the beach.

L

Marubachisyanoki tree (*Ehretia dicksonii*) and *soushijyu* tree (Taiwan acacia: *Acacia confusa*) bloom and *teppouyuri* (white trumpet lily: *Lilium longiflorum*) are in full bloom.

Okinawakishinouetokage lizards (*Eumeces kishinouyei*) emerge.

The migratory *shiroharakuina* bird (Chinese white-breasted water-hen: *Amaurornis phoenicurus*) arrives. Flocks of *sashiba*, the migratory gray-faced buzzard-eagle (*Butastur indicus*) head north without any stopover in the Ryukyu Archipelago. The autumn stragglers of *sashiba*, which remained in the islands during the winter, also fly northwards to breed and raise their chicks in the lower mountains and hilly regions of central Honshu, Kyushu and Shikoku, from spring to early fall.

April

F

Gurajiorasu (sword lily: *Gladiolus* spp.) and *hoshiamaririsu* (belladonna lily: *Amaryllis belladonna*) bloom.

Iwasakikusazemi cicada (*Mogannia minuta*), which is the smallest in Japan, sings with the singing peak around the end of April.

It is quite warm about this time, locally called *urizun*, which means the ripening of wheat, but this does not bring about good catches of fish because of a very flat calm on the sea known locally as *fuukaa*.

M

Mokumaou coast she oak tree (*Casuarina stricta*) and *kyouchikutou* oleander (*Nerium oleander*) bloom.

Iwasakimadobotaru firefly (*Pyrocoelia iwasaki*) emerges in the Yaeyama Islands.

This is the time of year marked by the lowest day-time tides. Gathering of seaweed and marine fauna common at low tide, on reef flats and on reef margins (Table 3; see also Takeda, 1993a, 1994). As the water becomes warmer and warmer, people get together in Yonaha and Oura Bays, Miyako Islands for gathering small shrimps, octopi and other fish with hand nets every night. In the daytime *aasa* seaweed and shells are also gathered. These gathering activities can be done until June.

L

Gettou herb (shell flower: *Alpinia speciosa*), *soushijyu* tree (Taiwan acacia: *Acacia confusa*) and *deigo* Indian coral-trees (*Erythrina variegata*) are in full bloom, and *tsurugumi* vine (oleaster: *Elaeagnus glabra*) bears fruit. *Urajiroichigo* (strawberry: *Fragaria* sp.) ripens, too.

Ryukyu-akashobin bird (Ryukyu ruddy kingfisher: *Halcyon coromandar bangsi*) arrives. This bird visits Iriomote or Ishigaki Islands in times of the rainy season called *tsuyu*. Although the rainy season sets in throughout the Archipelago in early May much earlier than mainland Japan, this bird is there called bird of *urizun* season which will lead to the summer season soon.

The winged forms of *shiroari* (termites: *Coptotermes formosanus* and *Reticulitermes speratus*) swarm. It is usually the forerunner of the rainy season to begin. Ryukyu people have no habit of termite consumption whatever, although termites are widely eaten by people of the tropical and sub-tropical world (Bodenheimer, 1951). The Ngandu and the Boyela in Zaire, central Africa, prefer the soldiers of termites (*Macrotermes* spp.) all year round (Takeda, 1990; Takeda and Sato, 1993), but the Tongwe in Tanzania, eastern Africa, seasonally eat the winged reproductives of termites (*Macrotermes* sp.) (Takeda, 1984, 1992c).

May

F

Fukugi tree (*Garcinia spicata*), lilies (*Lilium* spp.), *satsuki (Rhododendron indicum)* and *tenninka* (hill gooseberry: *Rhodomyrtus tomentosa*) bloom.

M

Iju tree (*Schima liukiuensis*), which is used as fish poison, blooms (Table 4). It is believed there are no snakes near, under or in *iju* trees, which seems to be related to some poisonous elements of the trees. The leaves of *toudaigusa* (wartweed: *Euphorbia helioscopia*) have been also used as fish poison. The leaves gathered in summer are still poisonous in other seasons even if dry. The greener the leaves are, the more powerful their effect. Thus, this fishing method is generally used in summer, by individual fishermen. However, when this is done in large tidal pools with netting, three or four persons are needed. Two days are required to carry it out, since preparation takes one day. Preparation involves gathering the leaves and pounding them in a stone mortar. On the following day, when the tide is low, the pounded leaves are scattered by hand in the tidal pools. A net is set around the tidal pool to prevent the stupefied fish from floating away. In the case of this type of fishing, persons who come to the spot are also allowed to steal fish openly (Takeda, 1993a).

The barks of the *iju* tree (*Schima liukiuensis*) are usually used for this purpose on Okinawa,

Table 3. 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 period is concentrated in early spring to summer. In addition to the seaweeds listed in this table, *komenori* (*Carpopeltis prolifera*), *kamogashiranori* (*Dermonema pulvinatum*), *habanori* (*Endarachne binghamiae*), *kobusozo* (*Laurencia ?undulata*), *mozuku* (*Nemacystus decipiens*), and *futomozuku* (*Tinocladia crassa*) are also eaten, but *ana-aosa* seaweed (*Ulva pertusa*) was eaten in the past. *Makusa* or *tengusa* (*Gelidium amansii*), *onikusa* (*Gelidium japonicum*), *shiramo* (*Gracilia bursa-pastoris*) and *obakusa* (*Pterocladia capillacea*) are used as agar-agar, while *hanafunori* (*Gloiopeltis complanata*) and *fukurofunori* (*G. furcata*) as linen-starching. *Makuri, miru* and *motsuremiru* seaweed were drunk as a vermifuge, too. On the other hands, *hondawara* (*Sargassum* spp.) and *fukura* (unidentified) seaweed were used as fertilizer in the fields before the World War II. *Nuuriiaasaa* seaweed was used as bait in a basket-fishing method called locally *teiru* 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 people.

along with the leaves of *sangoju* shrub (China laurestine: *Viburnum odoratissimum), monpanoki* shrub (velvetleaf: *Messerschimidia argentea*) and so on. The meshed leaves of *sangoju* trees were also scattered by hand in the water pools of a small stream, especially in the summer season when rainfall is few. Refer to Takeda (1992a, 1994, in press) for a detailed general list of poisonous Okinawan plants.

Hibari bird (Japanese skylark: *Alauda arvensis*) sings, and *amasagi* bird (Indian cattle egret: *Bubulucus ibis*) fly in from Taiwan to Ishigaki and Miyako Islands.

Shoujoutombo dragonfly (*Crocothemis servilia*) emerges. *Tsumagurozemi* cicada (*Nipponosemia miyakona*) begins to sing in the Miyako Islands.

Minamikibinago fish (blue sprat: *Spratelloides gracilis*) come close to shore for spawning and are caught with baskets (Takeda, 1994).

Akaumigame (loggerhead turtle: *Carreta caretta*), *aoumigame* (green or meat turtle: *Chelonia mydas*) and *taimai* (hawksbill turtle: *Eretmochelis imbricata*) begin landing to make nests. In particular, Yaeyama Islanders who frequently encountered with these three kinds of sea turtles caught them when the turtles nested and swam in the sea (Fig. 5). Catching them is now regulated by the Washington Treaty. Previously, the meat of green turtles was preferred, but all kinds of sea turtles were used by the islanders. The meat was eaten

Table 4. Poisonous plants used for stupefying fish in the Ryukyu Archipelago.

Scientific name	Japanese name	Part utilized
Alpinia specinosa	Gettou	Root
Anagallis arvensis	Rurihakobe***	Grass
Boehmeria nivea	Choma	Root
Cerbera manghas	Okinawakyouchikutou	Leaf
Derris sp.*	Derisu	Root
Diospyros maritima	Ryukyugaki***	Fruit (unripe)
Euphorbia helioscopia	Toudaigusa	Leaf and stem
Glehnia littoralis	Hamaboufuu	Root
Melia azedarach	Sendan	Leaf
Messerschmidia argentea	Monpanoki***	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***	Sanshou	Bark and seed

Note: Beside these posionous plants, toxic ingredients from *nisekuronamako* (sea cucumber: *Holothuria leucospilota*) were used as fish poison in the 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* amd *sanshou* listed in this table.

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

**It is mainly used in the Amami Islands.

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

as food and was also considered a medicine for colds. However, in the past two decades several persons have died from poisoning caused by eating toxic parts of turtles because the turtles have eaten poisonous algae or animals and have become poisonous in some parts of their bodies.

Shortfinned pilot whale (*Globicephala macrorhynchus*), bottle-nosed dolphin (*Tursiops truncatus*), rough toothed dolphin (*Steno bredanensis*) and false killer whale (*Pseudorca crassidens*), and also a very few *kazuhagondou* melon-headed whales (*Peponocephala electra*), come close to shore searching for bigfin reef squid (*Sepioteuthis lessoniana*) and other fish, especially in Nago Bay, Okinawa main island. They are killed with wooden clubs and spears, and the meat was sold or distributed among the local people. See also Takeda (1992a, 1994, in press) for other traditional fishing methods on reef flats and reef margins.

June

F

Marubachisyanoki tree (*Ehretia dicksonii*) ripens. *Monpanoki* shrub (velvetleaf: *Messerschmidia argentea*), which is used for fish poison and sea-goggles, blooms (see also Note 10 and 12 of Takeda, 1994,

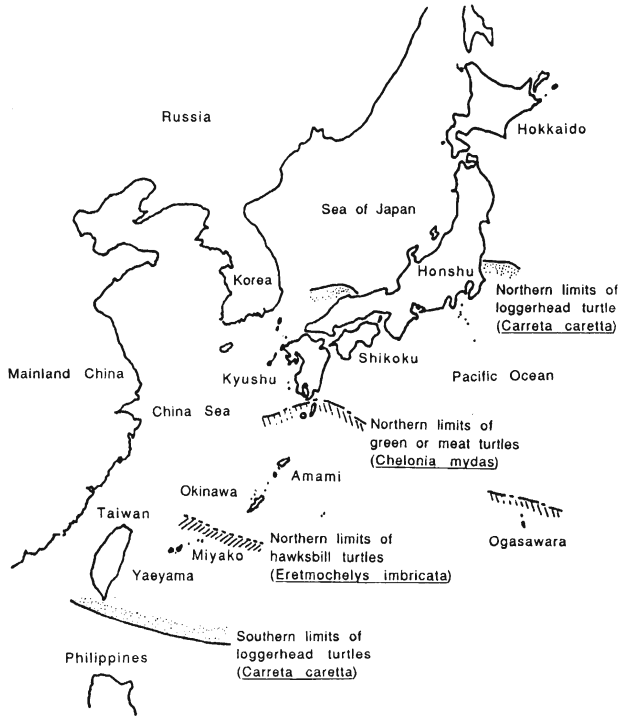

Fig. 5. Geographical distribution of three turtle species in Japan (modified from Kamezaki. 1987).

for the detailed history of devising the sea-goggles made by using this shrub).

M

Terihaboku tree (Alexandrian laurel: *Calophyllum inophyllum*), *Ryukyumukuge* shrub (rose of Sharon: *Hibiscus syriacus*) and *sarusuberi* shrub (crape myrtle: *Lagerstroemia* spp.) bloom.

Ryukyu-kumazemi (blackish cicada: *Cryptotympana facialis*) and *Ryukyu-aburazemi* (large brown cicada: *Graptopsaltria bimaoulata*) sing, althorgh *Ryukyu-kumazemi* cicada begins about the end of April in the Miyako Islands.

Okagani land crabs (*Cardisoma hirtipes* and *C. carnifex*) migrate en masse in the middle of the night, to seaside breeding grounds, and are eagerly sought by the people (see Takeda and Ohyama, 1989 for further details of the relationship between humans and crabs in Yaeyama). The march of red crabs (*Gecarcoidea natalis*), forest-dwelling land crab on Christmas Island, was shown by several photos of extraordinary migration en masse (Hicks, 1987). Land crabs dig out earth from their nest holes and pile it up in front of the holes the day before rain falls. Holes are extended downward while a soil pile is built at the entrance in order to prevent rain from getting into the nest. From this behaviour of the crab, people could predict what the next day's weather.

A seasonal wind called *kaachiibee* blows from the South China Sea immediately after the rainy season ends. Before the mid-19th century, many sailing boats used this wind to travel northwards for trade.

L

Ryuzetsuran (century plant: *Agava americana*) blooms.

Taiwanhigurashi cicada (*Pomponia linearis*) sings.

Kurage jellyfish (*Aurelia aurita* and *Mastigias papua*) emerge. Young rabbitfish (*Siganas fuscescens*), locally called *suku*, move ashore en masse in

search of seaweed on reef flats. They are eagerly sought as food by the coast-dwelling people. The catch of this fish was usually distributed among the people as a gift from the sea-god, *nirai-kanai*. Most of the fish are pickled, for domestic use or selling.

Hiroo-umihebi (sea snake: *Laticauda laticaudata*) and *erabu-umihebi* (semi-annulated sea crait : *L. semifasciata*) move ashore for breeding. These have been caught by hand by the Kudaka Islanders, near Okinawa main island, even though their bite is very poisonous (Araki and Tomihara, 1989). The number of persons permitted to catch them has been limited, but five persons are now allowed to be engaged in this work during the period from May 24 of the old lunar calendar to December 31 in Kudaka Island, which is famous for this capture (Takeda, 1994). Smoked sea snakes are believed to be good for health, and much sought after by the upper class during Shuri Emperor times (see Aragaki, 1985 for further details of snake processing).

In July and August typhoons hit the Ryukyu Archipelago very often during these months (Fig. 3). Some fish are often stranded on beaches and reef flats because of strong winds caused by typhoons, and are taken by local people (Takeda, 1994). Numbers of *usubakitombo* dragonfly (*Pantala flavescens*) are often observed to fly over the sea before a typhoon crosses the Archipelago. These are also the hottest months. Severe heat in summer season sometime kills the fish on reef flats; these dead fish are also easily gathered by people for food (Takeda, 1994, in press).

The fishing season for lobsters (*Panulirus homarus, P. penicillatus, P. ornatus, P. versicolor, P. japonicus* and *P. longipes*), which are caught on reef flats and reef margins, opens on July 1.

August

F

Shigi birds (stints, knots and sandpipers: *Calidris* spp.) and *chidori* birds (plovers: *Charadrius* spp.) fly in.

L

Fukugi tree (*Garcinia spicata*), and guava (*Psidium guajava*), which was recently introduced to Okinawa, bear fruit. There are now many guava varieties from Taiwan, Hawai'i and the Southeast Asia, so some of them bear fruit even in winter. They are usually offered to a family Buddhist altar on the summer Bon festival.

Tsubame birds (Japanese red-rumped swallow and house swallow: *Hirundo* spp.) migrate southwards, although Pacific swallows (*H. tahitica*) are residents in the Ryukyu Archipelago all year round.

Hotaru fireflies (*Curtos okinawana* and *C. costipennis*) emerge.

Taiwan-kutsuwamushi giant katydid (*Mecopoda elongata*) sings.

September

F

Akaharadaka bird (Chinese sparrow hawk: *Accipiter soloensis*), which breeds in the Korean Peninsula and mainland China, migrates to the Ryukyu Archipelago from the North. The bird is known as *hakuro-no-shisya* which means the messenger of the *hakuro's* season (one period of a year based on Chinese traditional lunar calendar).

Ooshiokaratombo dragonfly (*Orthetrum albistynum*) emerges.

M

Daizu (soybean: *Glycine max*) blooms.

The flood tide of this month is the year's highest.

L

Ooshimamadobotaru firefly (*Lychnuris atripennis*) emerges.

Komukudori bird (red-cheeked myna: *Sturnus philippensis), kisekirei* bird (Eastern grey wagtail: *Motacilla cinerea robusta*), and *isohiyodori* bird (Large red-bellied rock-thrush: *Monticola solitarius*) arrive. The *akaharadaka* Chinese sparrow hawk migration ends.

October

F

Susuki (Japanese plume grass: *Miscanthus sinensis), higanbana* herb (*Lycoris radiata*) and *oogochou* tree (*Caesalpinia pulcherrima*) bloom. The *sangojyu* tree (China laurestine: *Viburnum odoratissimum*) and *kuroganemochi* shrub (*Ilex rotunda*) bear fruit.

Sashiba (gray-faced buzzard-eagle: *Butastur indicus*) arrives from the north on the way to Southeast Asia, and stops mostly at the Miyako Islands. Irabu Island in the Miyako Islands is the best known resting place for this long-distance traveller. In earlier times, the bird was hunted for food with *tsugya* traps (see Matsui, 1975 for further details of these traps) and was also sold in Naha markets. In addition, the birds were provided as pets for children. *Sashiba* rice porridge, *takajuushii* was said to be delicious. Their numbers had decreased because of this hunting and the reduction of their high forest habitat, although now the *sashiba* is protected by the international treaty regarding the hunting and capture of migratory birds. The stragglers which remain and overwinter in the island are believed to be a kind of ghost which protects the island so they are not hunted at all. The altitude at which *sashiba* fly is a good indicator for people of the coldness of the day. If they fly lower, it will become cold.

Anadako octopus (*Octopus oliveri*) are caught in shallow reef flats, especially along the eastern coast of central Okinawa main island, although their capture requires skilful fishing techniques (see both the text and Note 11 of Takeda, 1994).

Mokuzugani (river-dwelling Japanese mitten-handed crab: *Eriocheir japonicus*) migrate en masse to seaside breeding grounds. In this season, innumerable crabs whose bodies are full of eggs move down to the sea shore. This is another seasonal indicator. When *sashiba* buzzard-eagles come flying from the north to rest on their way south, it is the season of *kanruu* (one period based on the Chinese calendar, almost equivalent to November by the old lunar calendar), which features a drizzle known locally as *takanoshiibai*, meaning urine of the bird. The crabs are also targeted by the people.

Gazami crabs such as the swimming crabs (*Portunus pelagicus* and *P. sanguinolentus*) and mangrove crab (*Scylla serrata*) are gathered on beaches or near mangroves.

M

Okinawakarukaya grass (*Apluda mutica*) blooms. The fruit of *Citrus* such as the *kaabuchii* and *onsyuu* oranges becomes ripe.

Tobi-ika flyingsquid (*Sthenoteuthis oualaniensis*) are gathered in the early morning near the beach, especially along the western coast of the northern part of Okinawa main island (Takeda, 1994).

The hunting season of *Ryukyu-inoshishi* bush boars (*Sus scrofa*) and birds opens on November 14.

L

In former times the sailing boats, which left in mid-June, returned from the North, using the winds from the north. Local fishermen recognize a slight difference between the wind blowing in the first third of November and that blowing in the last third of the month. The former is so strong and dangerous that it is called *aranishi* or *kanuuyaburi* (*tsugya-yaburi* which means the destruction of *sashiba* eagle traps in Miyako). Therefore, since early times, fishermen and sailors have selected the latter wind for fishing on the sea.

December

F

The fruit of oranges (*Citrus* spp.) such as the *ootoo* and *tankan* ripens.

Mebosomushikui bird (arctic warbler: *Phylloscopus borealis*) sings.

The South winds at this time are very gentle and are locally known as *tanifukibai*. This wind is good for drying out soybeans that have been soaked in water, and when sown these give a good fruit at the next harvest time.

M

Tsubaki shrub (camellia: *Camellia* sp.) blooms.

L

Ume shrub (Japanese apricot: *Prunus mume*) blooms.

In the end of this month, people are confronted every day by strong and severely cold winds from the North, known locally as *tonjiibiisa*. The people make a ritual habit of preparing a special porridge to fight the cold and stay healthy.

Conclusion

The coral ecosystem ensures the food-sufficiency and food-availability of marine resources throughout the year (Takeda, 1992a, 1994, in press). Food-gathering has been very important in the history of the survival of the Ryukyu Islanders, where terrestrial wild food plant availability is rather poor, as most of the islands are geologically derived from coral reefs. Food-gathering has been carried out on a daily basis by women, children and even the aged using non-specialized techniques. Not much diving, spearing or harpooning was required, and nothing very large was taken. Although men will sometimes help out with large-scale gathering expeditions on a commercial basis in some areas, in most of the islands marine fauna and flora gathering is usually small scale, involving only women, children and the aged. There exists no specialized fishing technology and/or commercialized technology such as is found in the Itoman fisherman group or other fishermen of the Ryukyu Archipelago (Takeda, 1992b, 1993a, 1994, in press).

These activities are closely related to the phenological changes of fauna and flora. It is neccessary to reexamine small-scale gathering activities and the detailed ecological relationship between marine species habitat and gathering techniques used by non-specialized coast-dwelling people. The accumulation of these data on coastal communities will give us some means of reconsidering the role of food-gathering activities in the process of human evolution, not only in the coast-dwellers, but also in the foraging societies of the tropic and subtropic regions. Although data are not yet fully prepared, it is hoped that this study will contribute to the ecological-anthropological understanding of phenological changes and food-foraging activities among coast-dwelling people.

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南西海域における海辺社会の動植物の生物季節的変化と沿岸住民の食物採捕

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四季の変化に富む日本では，古来様々な生物の行動や事象から微妙な天候の変化を読みとり，暮らしに役立たせてきた．ジュゴンが海上を跳ぶ向きからその日の天気の具合を読みとり，サシバが飛ぶ空中の高さからその日の寒さを知った．またサクラなどの開花がいくつかの作物の植え付け時期を知る指標になった．このように天候や季節の微妙な変化を読みとる能力に長けた生物は，われわれ人間の生活に深く関わってきたのである．同時に気象情報が現在ほどあふれていなかった時代に先人が築き上げた知恵や，海辺社会に住む人たちの生業維持活動などにも生物気象学的変化に相関しているものが多い．

日本で唯一亜熱帯気候に属する沖縄は本土より明瞭な季節変化に乏しいが，多種多様な動植物相が生息し，生物季節をめぐるさまざまな事象が豊富である．それらの事象とサンゴ礁海域における海辺社会で展開されるヒトの採捕（採集・漁労活動）を月毎に取り上げ，それらの関係を生態人類学的な観点から論述・検討した．

Appendix. Flora and fauna cited in the text.

Scientific name	Common name	Japanese / Local name
(A) FLORA		
(A-1) Trees, shrubs, herbs and flowers		
Acacia confusa Merrill	Taiwan acacia	Soushijyu
Agava americana L.	Century plant	Ryuzetsuran
Alpinia speciosa (Wendl.) K. Schum.	Shell flower	Gettou
Amaryllis belladonna L.	Belladonna lily	Hoshiamaririsu
Anagallis arvensis L.	Scarlet pimpernel	Rurihakobe
Apluda mutica L.		Okinawakarukaya/Nuudaki
Boehmeria nivea (L.) Gaud. var. *tenacissima*	China grass	Choma
Caesalpinia pulcherrima Sw.		Oogochou
Calophyllum inophyllum L.	Alexandrian laurel	Terihaboku
Camellia sp.	Camellia	Tsubaki
C. spp.	Sasanqua	Sazanka
Casuarina stricta Ait.	Coast she oak	Mokumaou
Cerbera manghas (L.)		Okinawakyouchikutou
Citrus sp.	Orange	Hiramiremon
C. sp.	Orange	Kaabuchii
C. sp.	Orange	Onsyuumikan
C. sp.	Orange	Ootoo
C. sp.	Orange	Tankan
Derris sp.	Derris	Derisu
Dioscorea piscatorum Prain et Burkill	Fish-poison yam	Yamu
D. tokoro Makino	Yam	Tokoro
Diospyros kaki L. f.	Japanese persimmon	Kaki
D. maritima Bl.		Ryukyugaki
Ehretia dicksonii Hance		Marubachisyanoki/Keizu
Elaeagnus glabra Thunb.	Oleaster	Tsurugumi
Erythrina variegata L	Indian coral-tree	Deigo
Euphorbia heliscopia L.	Wartweed	Toudaigusa
Farfugium japonicum (l. F.) Kitam.	Leopard plant	Tsuwabuki
Fragaria sp.	Strawberry	Urajiroichigo
Garcinia spicata Hook. f.		Fukugi
Gladiolus spp.	Sword lily	Gurajiorasu
Glehnia littoralis Fr. Schm.		Hamaboufuu
Glycine max (L.) Merrill	Soybean	Daizu
Hibiscus syriacus L.	Rose of Sharon	Ryukyumukuge
Ilex rotunda Thunb.		Kuroganemochi
Juglans sieboldiana Maxim	Siebold walnut	Onigurumi
J. subcordiformis Dode	Walnut	Himegurumi
Kalanchoe pinnata (Lam.) Persoon.	Never die	Seironbenkei
Lagerstroemia spp.	Crape myrtle	Sarusuberi
Lilium longiflorum Thunb.	White trumpet lily	Teppouyuri
L. spp.	Lily	Yuri
Livistona chinesis R. Br.	Chinese fan	Birou/Kuba
Lycoris radiata (L'Herit.) Herb.		Higanbana
Melia azedarach L.	Japanese bead tree	Sendan
Messerschimidia argentea (L. F.) Johnston	Velvetleaf	Monpanoki/Suuki
Miscanthus sinensis Anderss.	Japanese plume grass	Susuki
Morus australis Poir.	Mulberry	Shimaguwa

Scientific name	Common name	Japanese / Local name
Nerium oleande var. *indicum* (Mill.) Degener et Greenwell	Oleander	Kyouchikutou
Nicotiana tabacum L.	Tabacco	Tabako
Pieris japonica D. Don	Japanese Andormeda	Asebi
Pinus luchuensis Mayr	Japanese red pine	Ryukyuakamatsu
Polygonum hydropiper L.	Water pepper	Yanagidade
Prunus cerasifera var. *campanulata* (Maxim.) Koidz.	Flowering cherry	Hikanzakura
P. jamasakura Sieb. ex Koidz.	Hill cherry	Sakura (Yamazakura)
P. mume Sieb. et Zucc.	Japanese apricot	Ume
P. persica (L.) Batsch. var. *percica*	Peach	Momo
P. x *yedoensis* Matsum.	Yoshino cherry	Sakura (Someiyoshino)
Psidium guajava L.	Guava	Guaba/Bansuruu
Rhaphiolepsis sp.	Japanese hawthorn	Takasagosharinbai
Rhododendron indicum (L.) Sweet		Satsuki
R. latoucheae Flanch.	Azalea	Seishika
R. simsii Planch.	Azalea	Taiwanyamatsutsuji
Rhodomyrtus tomentosa (Ait.) Hassk.	Hill gooseberry	Tenninka
Rhus succedanea L.	Wax tree	Hazenoki
Rosa hybrida Hort.	Rose	Bara
Rostellularia procumbens (L.) Nees		Kitsunenomago
Schima liukiuensis Nakai		Iju
Styrax japonicus Sieb. et Zucc.	Japanese snowbell	Egonoki
Ternstroemia gymnanthera (Wight et Arn.) Sprague		Mokkoku
Viburnum odoratissimum Ker-Gawl.	China laurestine	Sangoju
Viola yedoensis Makino var. *pseudo-japonica* (Nakai) Hashimoto	Violet	Ryukyukosumire
Zanthoxylum piperium DC.	Japanese pepper	Sanshou
(A-2) Seaweed		
Carpopeltis prolifera Kawaguchi et Masuda		Komenori
Caulerpa lentillifera J. Agardh		Kubirejita/Umibudou
C. racemosa var. *clavifera* f. *macrophysa* Weber van Bosse	Sea grape	Sennarijita
Cladosiphon okamuranus Tokida		Okinawamozuku/Sunui
Codium fragile Hariot		Miru
C. intricatum Okamura	Sponge seaweed	Motsuremiru
Dermonema pulvinatum Fan		Kamogashiranori
Digenea simplex C. Agardh		Makuri, Kaininsou/Nachoraa
Endarachne binghamiae J. Agardh		Habanori
Enteromorpha intestinalis Link	Green confetti	Bou-aonori
Eucheuma denticulatum Collins et Harvey		Kirinsai
Gelidium amansii Lamouroux		Makusa, Tengusa
G. japonicum Okamura		Onikusa
Gloiopeltis complanata Yamada		Hanafunori
G. furcata J. Agardh		Fukurofunori
Gracilaria verrucosa Papenfuss	Moss Chinese	Ogonori
G. bursa-pastoris Silva		Shiramo
Hizikia fusiformis Okamura		Hijiki
Hypnea charoides Lamouroux	Green tip	Ibaranori
Laurencia ?undulata Yamada		Kobusozo

Scientific name	Common name	Japanese / Local name
Meristotheca papulosa Kylin		Tosakanori
Monostroma nitidum Wittrock		Hitoegusa/aasaa
Nemacystus decipiens Kuckuck		Mozuku
Porphyra suborbiculata Kjellman	Laver, Nori	Maruba-amanori
Pterocladia capillacea Bornet 'et Thuret		Obakusa
Sargassum spp.		Hondawara
Tinocladia crassa Kylin		Futomozuku
Ulva pertusa Kjellman		Ana-aosa
(B) FAUNA		
(B-1) Mammals		
Dugong dugon (Muller)	Dugong	Jugon/Zan, Zannuyuu
Globicephala macrorhynchus (Gray)	Shortfinned pilot whale	Kobiregondou/Hiitou
Peponocephala electra (Gray)	Melon-headed whale	Kazuhagondou/Hiitou
Pseudorca crassidens (Owen)	False killer whale	Okigondou/Hiitou
Steno bredanensis (Lesson)	Rough toothed dolphin	Shiwaha-iruka/Hiitou
Sus scrofa riukiuanus Kuroda	Bush boar	Ryukyu-inoshishi/Yamashishi, Umuza
Tursiops truncatus (Montagu)	Bottle-nosed dolphin	Bandou-iruka/Hiitou
(B-2) Birds		
Accipiter soloensis (Horsfield)	Chinese sparrow hawk	Akaharadaka
Alauda arvensis japonica Temminck & Schlegel	Japanese skylark	Hibari
Amaurornis phoenicurus chinensis (Boddaert)	Chinese white-breasted water-hen	Shiroharakuina
Anthropoides virgo (Linnaes)	Demoiselle crane	Anehazuru
Butastur indicus (Gmelin)	Gray-faced buzzard- eagle	Sashiba/Taka
Bubulucus ibis coromandus (Boddaert)	Indian cattle egret	Amasagi
Calidris spp.	Stints, Knots and Sandpipers	Shigi
Cettia diphone (Kittlitz)	Bush warbler	Uguisu
Charadrius spp.	Plover	Chidori
Grus grus lilfordi Sharpe	Eastern common crane	Kurozuru
G. leucogeranus Pallas	Siberian white crane	Sodegurozuru
G. monacha Temminck	Hooded crane	Nabezuru
G. vipio Pallas	White-naped crane	Manazuru
Halcyon coromandar bangsi	Ryukyu ruddy kingfisher	Ryukyu-akashobin
Hirundo daurica japonica Temminck & Schlegel	Japanese red-rumped swallow	Koshiaka-tsubame
H. rustica gutturalis Scopoli	House swallow	Tsubame
H. tahitica namiyei (Stejneger)	Pacific swallow	Ryukyu-tsubame
Motacilla cinerea robusta (Brehm)	Eastern grey wagtail	Kisekirei
Monticola solitarius philippensis (Muller)	Large red-bellied rock-thrush	Isohiyodori
Phylloscopus borealis (Blasius)	Arctic warbler	Mebosomushikui
Rallina eurizonoidessepiaria (Stejnezer)	Banded crake	Ookuina/Faadori
Sturnus philippensis (Forster)	Red-cheeked myna	Komukudori
(B-3) Fish		
Balistoides spp.	Filefish	Kawahagi/Fukurubi, Kaahajaa
Calotomus japonicus (Valenciennes)	Parrotfish	Budai/Irabuchi, Irabuchaa
Plotosus lineatus (Thunberg)	Tandan catfish	Gonzui
Rhinecanthus aculeatus (Linnaeus)	Filefish	Murasamemongara/Fukurubi, Kaahajaa
Siganus fuscescens (Houttuyn)	Rabbitfish	Aigo/Eiguwaa

Scientific name	Common name	Japanese / Local name
	Young rabbitfish	Aigo/Suku
Spratelloides gracilis (Temminck et Schlegel)	Blue sprat	Minamikibinago/Sururu
Stephanolepis cirrhifer (Temminck et Schlegel)	Filefish	Kawahagi/Fukurubi, Kaahajaa
Sufflamen spp.	Filefish	Kawahagi/Fukurubi, Kaahajaa
(B-4) Other marine species		
Aurelia aurita Lamarck	Jellyfish	Mizukurage
Holothuria leucospilota Brandt	Sea cucumber	Nisekuronamako
Mastigias papua L. Agassiz	Jellyfish	Takokurage
Octopus minor	Octopus	Tenagadako/Shigai
O. oliveri	Octopus	Anadako/Umuzunaa
O. vulgaris	Octopus	Madako/Taku
Sepioteuthis lessoniana	Bigfin reef squid	Aori-ika/Shiruichaa
Sthenoteuthis oualaniensis	Flying squid	Tobi-ika/Tobi-icha
(B-5) Shells		
Harpago chiragra chiragra (Linnaeus)	Chiragra spider conch	Suijigai
Lambis lambis (Lannaeus)	Spider conch	Kumogai
L. truncata sebae (Kiener)	Giant spider conch	Rakudagai
Lithoconus tessulatus (Born)	Cone shell	Harusyagai, Imogai/Buutoo
Septifer bilocularis (Linnaeus)	Mussel	Kujakugai
Tectus maximus (Philippi)	Top shell	Sarasabatei, Takasegai/Soomin
(B-6) Crustaceans		
Ocypode ceratophthalma (Pallas)	Ghost crab	Tsunomegani/Midagaama
Cardisoma carnifex (Herbst)	Land crab	Minami-okagani/Gidaasakan
C. hirtipes Dana	Land crab	Okagani/Takatsumekan
Eriocheir japonicus De Haan	Japanese mitten-handed crab	Mokuzugani/Chinankan
Gecarcoidea natalis	Red crab (Land crab)	
Panulirus homarus (Linnaeus)	Lobster	Kebuka-ise-ebi
P. japonicus (Von Siebold)	Lobster	Ise-ebi
P. longipes (A. Milne-Edwards)	Lobster	Kanoko-ise-ebi
P. ornatus (Fabricius)	Lobster	Nishiki-ebi
P. penicillatus (Olivier)	Lobster	Shima-ise-ebi
P. versicolor (Latreille)	Lobster	Goshiki-ebi
Portunus pelagicus (Linnaeus)	Swimming crab	Taiwan-gazami/Gasamee
P. sanguinolentus (Herbst)	Swimming crab	Janome-gazami
Scylla serrata (Forsskal)	Mangrove crab	Nokogiri-gazami/Gaashiimekan
(B-7) Reptiles and amphibians		
Carreta caretta (Linnaeus)	Loggerhead turtle	Akaumigame/Akagaamii
Chelonia mydas (Linnaeus)	Green or meat turtle	Aoumigame/Mizugaamii, Mijaa
Eretmochelis imbricata (Linnaeus)	Hawksbill turtle	Taimai, Bekkougame/Garasaa, Garasaagaamii
Eumeces kishinouyei (Stejnege)	Lizard	Okinawakishinouetokage
Laticauda laticaudata (Linne)	Sea snake	Hiroo-umihebi/Madaraa
L. semifasciata (Reinwardt)	Semi-annulated sea crait	Erabu-umihebi/Irabuu
Microhyla ornata Dumeril et Bibron	Frog	Himeamagaeru

Scientific name	Common name	Japanese / Local name
(B-8) Insects		
Coptotermes formosanus Shiraki	Termite	Ieshiroari
Crocothemis servilia	Dragonfly	Shoujoutombo
Cryptotympana facialis	Blackish cicada	Ryukyu-kumazemi
Curtos costipennis	Firefly	Kiirosujibotaru
C. okinawana Matsumura	Firefly	Okinawasujibotaru
Graptopsaltria bimaculata	Large brown cicada	Ryukyu-aburazemi
Lychnuris atripennis	Firefly	Ooshimamadobotaru
Macrotermes spp.	Termite	Shiroari
Mecopoda elongata	Giant katydid	Taiwan-kutsuwamushi
Mogannia minuta	Cicada	Iwasakikusazemi
Nipponosemia terminalis (Matsumura)	Cicada	Tsumagurozemi
Orthetrum albistyrum	Dragonfly	Ooshiokaratombo
Pantala flavescens	Dragonfly	Usubakitombo
Platypleura miyakona (Matsumura)	Cicada	Miyakoniinii
Pomponia linearis (Walker)	Cicada	Taiwan-higurashi/Nanatsunkani
Pyrocoelia iwasaki Matsumura	Firefly	Iwasakimadobotaru
Reticulitermes speratus Kolbe	Termite	Yamatoshiroari