

# 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 correlations is described and examined.

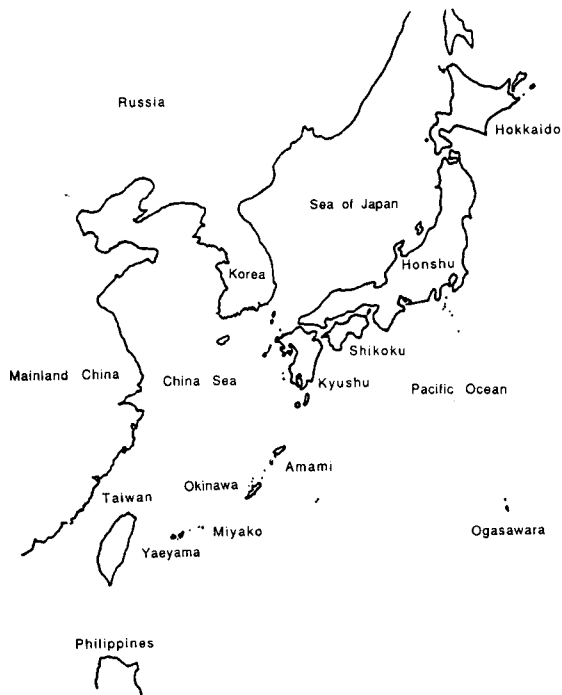
**Key words:** biological calendar, coastal people of the Ryukyu Archipelago, fishing-gathering subsistence activities, food-gathering, human evolution, phenological change

## Introduction

Before today's weather forecasting systems developed, our Japanese ancestors predicted small changes in weather by observing creatures and unusual 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

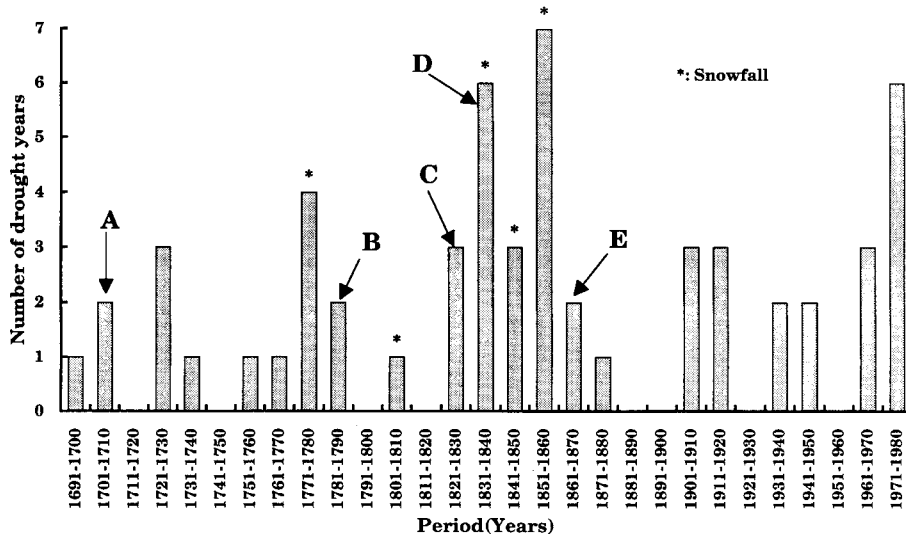


Fig. 2. Frequency of drought in the Ryukyu Archipelago (1700 to 1980) (modified from Takara, 1982).

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 calendars 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

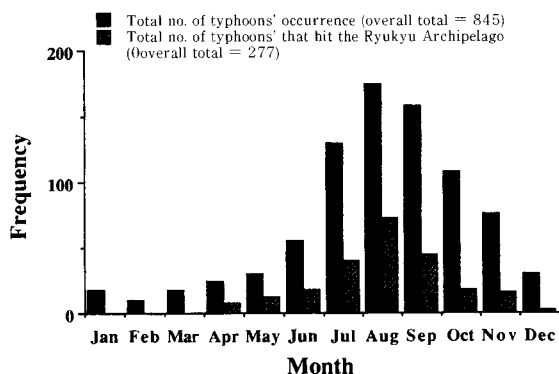


Fig. 3. Monthly frequency of typhoons in the Ryukyu Archipelago (1955 to 1985) (modified from Yamazaki *et al.*, 1989).

## 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 crane: *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.

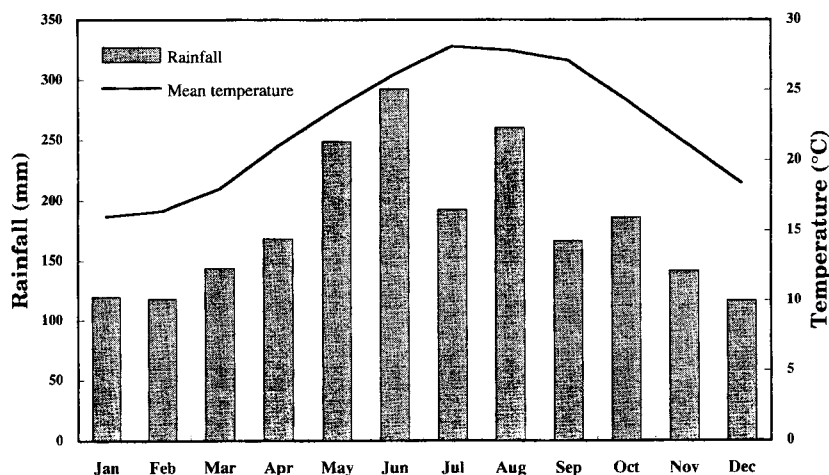


Fig. 4. Mean temperature and rainfall in Naha, Okinawa (1951-1980). Mean monthly temperature and rainfall were averaged for the period 1951-1980. Annual total rainfall was averaged 2128.2 mm for the same period, with annual mean maximum temperature 22.4°C and minimum temperature 20.1°C.

**Table 2.** Phenological calendar in the Ryukyu Archipelago.

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

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*	<i>-Marubachisyanoki</i>	-Cattle egret arrives.	
	M	-Alexandrian laurel -Crape myrtle -Rose of Sharon		- <i>Ryukyu-kumazemi</i> cicada sings. - <i>Ryukyu-aburazemi</i> cicada sings.	-Sailing northwards (in the past)
	L	- <i>Ryuzetsuran</i>		-Land crabs migrate. -Jellyfish emerge. -Young rabbitfish come near shore. -Sea snakes come near shore. - <i>Taiwanhigurashi</i> cicada sings.	-Gathering of land crabs -Gathering and/or fishing of young rabbitfish -Gathering of sea snakes
Jul	F				-Fishing season of lobsters opens.
Aug	F			- <i>Shigi</i> and <i>chidori</i> birds fly in.	
	M		- <i>Fukugi</i> tree -Guava	-Swallows migrate southwards. -Fireflies emerge. -Giant katydid sings.	
	L			-Chinese sparrow hawk arrives.	
Sep	F			- <i>Ooshiokaratombo</i> dragonfly emerges.	
	M	-Soybean			
	L			- <i>Komukudori</i> , <i>kisekirei</i> , and <i>isohiyodori</i> fly in. - <i>Ooshimamadobotaru</i> firefly emerges.	
Oct	F	-Japanese plume grass - <i>Oogochou</i> shrub - <i>Higanbana</i>	-China laurestine* - <i>Kuroganemochi</i>	-Buzzard-eagle arrives. -Mitten-handed crab breeds.	-Hunting of buzzard-eagle -Gathering of crabs -Fishing of octopi
	M	- <i>Okinawa-karukaya</i>	-Oranges		-Gathering of flyingsquid
	L	grass			-Hunting of bush boars -Sailing southwards (in the past)
Dec	F		-Oranges	- <i>Mebosomushikui</i> birds sing.	-Preparing soybeans for the next harvest
	M	-Camellia			
	L	-Japanese 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. *Taiwanyama-tsutsuji* (azalea: *Rhododendron simsii*), *takasagosha-rinbai* shrub (Japanese hawthorn: *Raphiolepis* sp.), *Ryukyuakamatsu* tree (Japanese red pine: *Pinus luchuensis*), *Birou* tree (Chinese fan: *Livistona chinensis*) 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 *hoshiamarinisu* (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 Ooura 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 *tsunugumi* 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: *Copto-*

*termes 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
<i>Caulerpa lentillifera</i> *	Kubirejita	Apr-Oct
<i>C. racemosa</i> /Sea grape	Sennarijita	Apr-Oct
<i>Cladosiphon okamuranus</i> *	Mozuku	Mar-Jun
<i>Codium intricatum</i> /Sponge seaweed	Motsuremiru	Mar-Apr
<i>Digenea simplex</i>	Makuri	Mar-Jun
<i>Enteromorpha intestinalis</i> /Green confetti	Bou-aonori	Mar-Jun
<i>Eucheuma denticulatum</i>	Kirinsai	Aug-Sep
<i>Gracilaria verrucosa</i> /Moss Chinese	Ogonori	Mar-Jun
<i>Hizikia fusiformis</i> *	Hijiki	Mar-Apr
<i>Hypnea charoides</i> /Green tip	Ibaranori	Mar-Apr
<i>Laurencia</i> sp.	Sozo	Jul-Aug
<i>Meristotheca papulosa</i>	Tosakanori	Mar-Apr
<i>Monostroma nitidum</i>	Hitoegusa	Jan-Apr
<i>Porphyra suborbiculata</i> /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 *futomo-zuku* (*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* (*Gracilaria 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: *Messerschmidia 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: *Bubulcus ibis*) fly in from Taiwan to Ishigaki and Miyako Islands.

*Showjoutombo* 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: *Caretta caretta*), *aoumigame* (green or meat turtle: *Chelonia mydas*) and *tamai* (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
<i>Alpinia specinosa</i>	Gettou	Root
<i>Anagallis arvensis</i>	Rurihakobe***	Grass
<i>Boehmeria nivea</i>	Choma	Root
<i>Cerbera manghas</i>	Okinawakyouchikutou	Leaf
<i>Derris</i> sp.*	Derisu	Root
<i>Diospyros maritima</i>	Ryukyugaki***	Fruit (unripe)
<i>Euphorbia helioscopia</i>	Toudaigusa	Leaf and stem
<i>Glehnia littoralis</i>	Hamaboufuu	Root
<i>Melia azedarach</i>	Sendan	Leaf
<i>Messerschmidia argentea</i>	Monpanoki***	Leaf
<i>Nicotiana tabacum</i>	Tabako	Leaf
<i>Rostellularia procumbens</i>	Kitsunenomago	Leaf
<i>Schima liukuensis</i>	Iju	Bark
<i>Styrax japonicus</i>	Egonoki	Pericarp
<i>Temstroemia gymnanthera</i>	Mokkoku	Bark
<i>Viburnum odoratissimum</i>	Sangojyu	Leaf
<i>Zanthoxylum piperium**</i>	Sanshou	Bark and seed

**Note:** Beside these poisonous 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 (*Dioscorea piscatorium*) 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.

\*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 Kijyo 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 (ichthyosarcotoxism).

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,

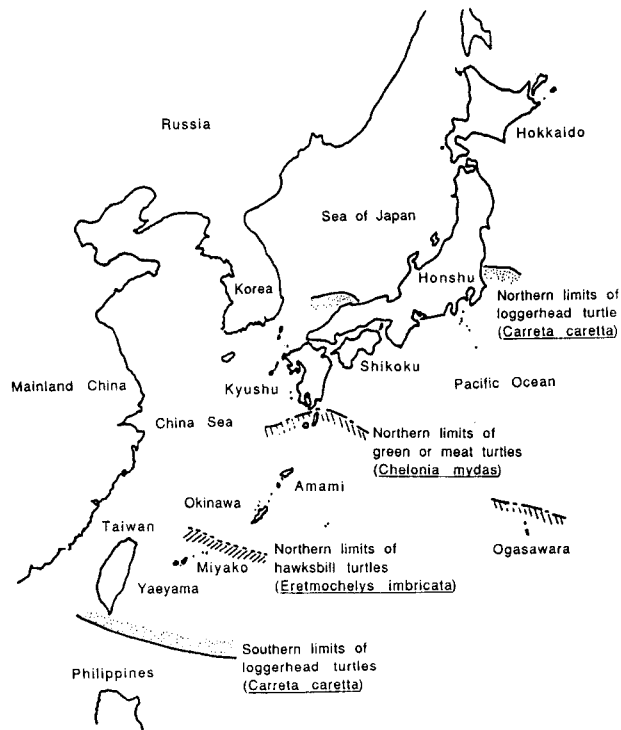


Fig. 5. Geographical distribution of three turtle species in Japan (modified from Kamezaki, 1987).

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, although *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: *Agave americana*) blooms.

*Taiwanhigurashi* cicada (*Pomponia linearis*) sings.

*Kurage* jellyfish (*Aurelia aurita* and *Mastigias papua*) emerge. Young rabbitfish (*Siganus fuscus*), 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 crai: *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 albistylum*) 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: *Stumus 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 South-east 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 driz-

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

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

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

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

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