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**Instituut voor Taxonomische Zoologie (Zoologisch Museum)
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No. 53

**Ecology and Distribution of Groundwater Crustacea and
Freshwater Ostracoda in SW Honshu
and the Nansei Islands, Japan**

I Groundwater Crustacea & List of Stations

by

Nico W. Broodbakker

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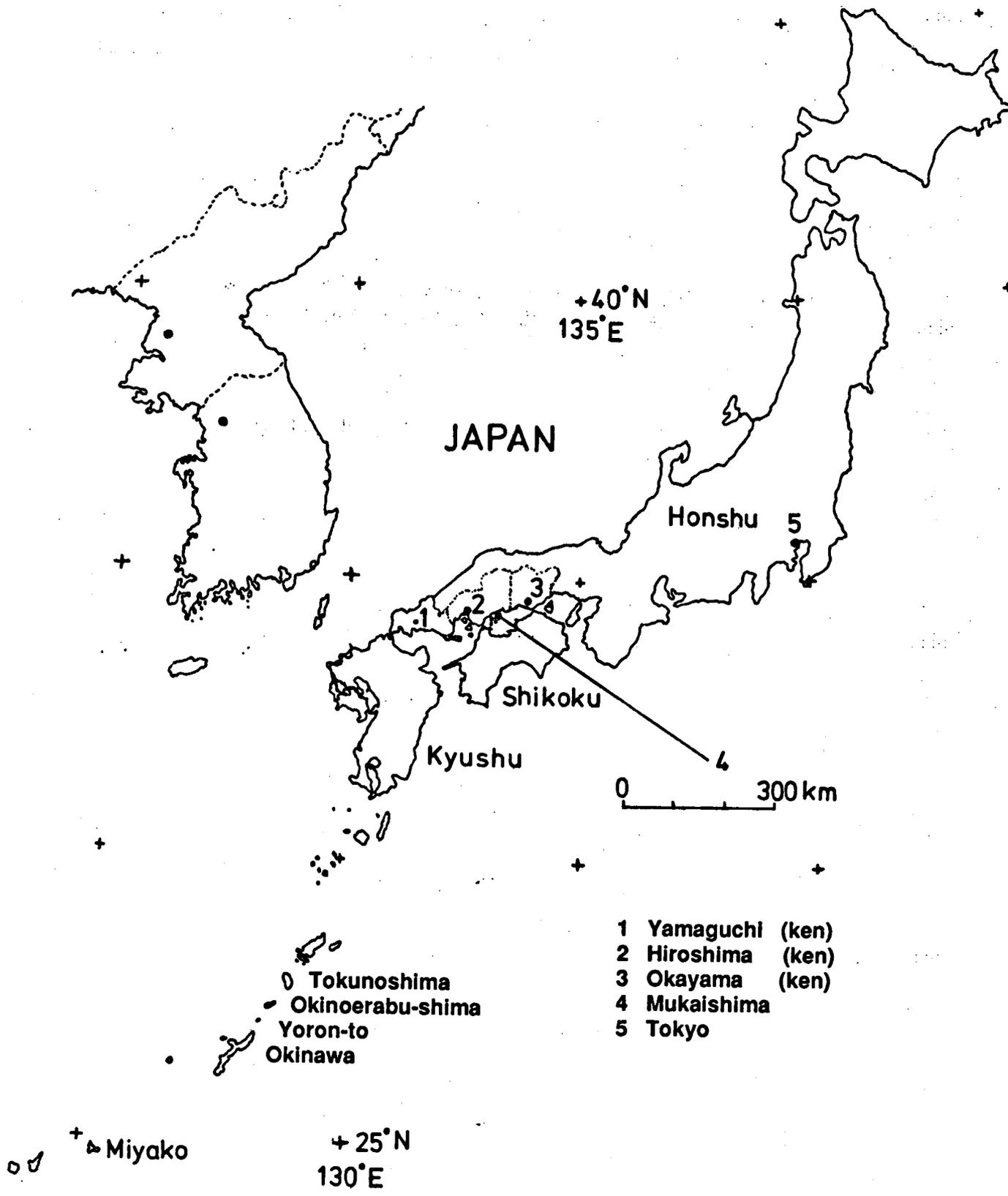


Fig. 1 Map of Japan, with indications of the islands and prefectures (ken) visited.

INTRODUCTION

This project was originally planned to take place in the summer of 1985. Due to unforeseen circumstances it could not in fact be carried out until the autumn of 1986. This meant that some aspects of the project had to be changed because of seasonal influences.

One major drawback was the absence of any flooded rice fields, because the fieldwork was done after the growing and harvesting of the rice. It was therefore impossible to collect any ostracods from ricefields in south west Honshu. Since the rice fields are one of the major ostracod habitats in Japan, this meant a dramatic decrease of the number of possible collecting sites.

Surprisingly no Ostracoda were collected in the larger ponds and pools so commonly found in SW Honshu, which are used to irrigate the land in dry periods. The same phenomenon was noticed in NW Shikoku, where no Ostracoda were found during several days of sampling.

Therefore the decision was made to include groundwater habitats into the project. Since nothing was known about the groundwater Ostracoda fauna of Japan, some interesting results were expected. Expanding the project would also make possible a comparison between the Ostracoda fauna of groundwaters and surface water habitats.

The surface water habitats where Ostracoda were found in SW Honshu, proved to be small or shallow ponds, pools, puddles, concrete ditches and all kinds of containers. Ostracoda were also found in groundwater habitats such as wells, caves and springs. The number of possible habitats and the variation between them was however quite low, probably because of seasonal influences.

In autumn and winter the number of Ostracoda species is known to decrease in northern latitudes. Therefore it was decided to locate the second half of the fieldwork phase on some of Japan's south-western Nansei Islands, namely Okinawa, and the Amami Oshima Islands: Tokunoshima, Okinoerabu-shima, and Yoron-to. Since the temperature on these islands is much higher in the winter months than in the rest of Japan, it was expected that more Ostracoda species would be found.

MATERIALS AND METHODS

The samples were collected during the period from October until December 1986. The collection areas were situated in Hiroshima-ken (prefecture) and Yamaguchi-ken in SW Honshu, and on the islands of Okinawa (Okinawa-ken); Tokunoshima, Okinoerabu-shima and Yoron-to (Kagoshima-ken, Oshima-gun). Further details about locations and environmental data can be found in the list of stations.

Material was collected by using either a dip net (rectangular opening 13 x 18 cm, mesh size 0.03 mm), or a vertical self-closing plankton net (Cvetkov net: diam. 30 cm, mesh size 0.03 mm), depending on the situation. Sometimes both nets were used. The animals were killed with 4% formalin and later transferred to 70% alcohol. In the field, notes were made about the accompanying fauna. The samples were sorted out with the help of a Nikon binocular microscope. Some environmental data on the habitat were collected, viz.:

- conductivity (measured with a TOA CM-1K conductivity meter, lent for the duration of the project by the manufacturer);
- water temperature (measured with an alcohol thermometer, or a TOA Water Quality Checker WCQ-1A);
- pH, oxygen saturation level, and sometimes turbidity (measured with the TOA WCQ-1A);
- the amount of detritus and leaf litter;
- the shape and size of the waterbody;
- water colour, water depth and in case of wells watertable.

A total of 250 stations has been sampled, of which 115 were located in SW Honshu, 50 on Okinawa, 26 on Tokunoshima, 32 on Okinoerabu-shima, and 26 on Yoron-to. Ostracoda were found in 87 stations, and groundwater Amphipoda or Isopoda in 26 stations.

GROUNDWATER CRUSTACEA

Groundwater Amphipoda or Isopoda were found in 18 stations on Honshu, of which 14 were wells and 4, caves. The four caves are all located on the Akiyoshi-dai plateau in Yamaguchi-ken. In Okinawa only one specimen of groundwater Amphipoda was found in the cave Itokazu-abuchira (J 59). On Okinoerabu-shima no groundwater fauna was encountered at all. On Tokunoshima groundwater Amphipoda belonging to the family Bogidiellidae were found in one cave, Ginryu-do (J 101). On Yoron-to Bogidiellidae were collected in six wells, but not in the three sampled caves. This is the second record of Bogidiellidae from Japan. Matsumoto (1976) mentions a *Bogidiella* species from Miyako-shima, another Nansei Island SW of Okinawa.

The Amphipoda found on Honshu probably belong to the genus *Pseudocrangonyx*, of which two species are described from Southern Honshu, *Ps. kyotonis* and *Ps. shikokunis*, by Akatsuka & Komai (1922). All collected Isopoda belong to the family Asellidae. The groundwater species most probably belong to the genera *Phreatoasellus* and *Nipponasellus*.

Only one species of Ostracoda belonging to the subfamily Candoninae was found exclusively in groundwater habitats, namely in wells in SW Honshu. Several surface water species were collected in caves and wells. The most common ostracod species in wells is *Cyprretta* cf. *seurati* Gauthier, 1929. This species was found in nine open wells, two dark caves, a covered well and a semi-dark cave. It is, however, also the most abundant surface water species found during this project. On the Nansei Islands a species of the genus *Physocypria* was found in two dark caves and three covered wells; and a species belonging to the Candoninae was found in two dark caves and two covered wells. Both these species were also found in surface water habitats. *Dolerocypris sinensis* Sars, 1903, a common surface water species, was found in three open wells and two caves. All other surface water ostracod species were never found more than twice in each type of well or cave. The Ostracoda will be discussed in a forthcoming article.

ACKNOWLEDGEMENTS

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Special thanks are due to the late Dr. Takaharu Hoshino, the associate professor of the Station, who recently died at the young age of 40. He and Prof. Ichiro Okubo of Shujitsu Junior College in Okayama, made the arrangements for me to stay and work in Japan.

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In the field we always encountered an enormous amount of cooperation from the people who lived in the villages we visited. Numerous people have helped us to find suitable habitats for Ostracoda and groundwater fauna. My special thanks are due to: Matsuda-san; Yoroizaka-san; Prof. Sato; Prof. Mizuoka; Mr. & Mrs. Kudo; Toshida-san; Fukushima Tsugio & Nagai Hitoshi; Shigeno Yamashita; Naoya Ikeda; Fumi & Haruo Okudo; Kaneshi Takahira; Kazuhiko Sakai, and Prof. Nohara.

Furthermore I would like to thank all the owners and wardens of the caves of Akiyoshi-dai, Gyokusen-do, Suiren-do, Shoryu-do, and Akasaki-do, who provided free entrance and guidance in their caves; the people of the town halls of Wadomari-cho and China-cho on Okinoerabu-shima, and of Yoron-cho on Yoron-to; and the Research staff of Sesoko Marine Science Center on Okinawa, especially Prof. Yamazato & Prof. Kamura, for their hospitality and assistance.

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Domo Arigato Gozaimasta

LITERATURE

AKATSUKA, K. & T. KOMAI, 1922. Pseudocrangonyx a new genus of subterranean amphipods from Japan. *Annot. Zool. Japon*, **10**: 119-126.

MATSUMOTO, K., 1976. An Introduction to the Japanese groundwater animals with reference to their ecology and hygienic significance. *Int. J. Speleol.*, **8** (1/2): 141-155.

LIST OF STATIONS

- No Type of habitat (cov/uncov); location; shape; size; (watertable
+) w.depth; bottom; remarks.
- Hiroshima-ken, Mukaishima-cho, Mukaishima Island
- J 1-3: 7-11-1986; J 4,7,8: 8-11-1986; J 5,6,9,10: 14-10-1986;
J 11,12: 16-10-1986
- J 1 Rectangular, concrete, open container, on NW slope of hill next to road; 500 m S of Tsubuta; 1.5 x 2.5 m; 0 + 1.3 m; Lemna cover 70%; H₂S smell.
Ostracoda: Dolerocypris sinensis (1).
- J 2 Rectangular, concrete, open container, attached to J 1; 1.7 x 0.8 m; w.depth 12-20 cm; Lemna cover 20%; thick layer of detritus and leaf litter.
Ostracoda: Dolerocypris sinensis (> 100); Heterocypris incongruens cf. attenuata 1.
- J 3 Rectangular, open, concrete container, on N slope of hill, adjacent to road; 500 m S of Tsubuta; 2 x 2.6 m; 0.3 + 1.1 m; thick layer of leaf litter (rushes) & detritus; Lemna cover 100%; plastic rubbish; smelly.
Ostracoda: Cypria sp. A (> 1000); carap. Cypretta cf. seurati (> 10).
- J 4 Round, open, concrete container, under orange trees in grove, next to coast road, just N of bridge to Innoshima; diam. 0.5 m (opening 0.75 m); 0.05 m; orange leaves, detritus and dead insects on concrete.
Ostracoda: Heterocypris incongruens cf. attenuata (> 100).
- J 5 Circ. concr. well covered with concr. lid; E side of road, 1.5 km N of Tachibana (direction Kawajiri); diam. 0.9 m; 9 + 1 m; some leaf litter and decaying terrestrial animals.
Fauna: Pseudocrangonyx (50); Colembola.
- J 6 Circ. open, concrete well, W of Eno-oku, right under raised expressway; diam. 1.2 m; 0.6 + 1.5 m.
GW-fauna: Pseudocrangonyx sp. (10)
Ostracoda: Stenocypris major (1 juv.).
- J 7 Circ. concrete well, covered with metal lid, in garden behind shop in Tsubuta, near harbour; diam. 0.9 m; 2.7 + 1.4 m.
Ostracoda: Candoninae sp. A (15).
- J 8 Circ. open concrete well in garden of deserted house under tree in Tsubuta; diam. 0.9 m; 0.8 + 2 m; leaves and bamboo floating on surface.
Ostracoda: Cypretta cf. seurati (21).
- J 9 Circ. open, concrete well; just S of Eno-Oku; diam. 1.2 m; 0.1 + 1 m; surface totally covered with floating small, round algae.
Ostracoda: Cypridopsis cf. vidua (> 25).
- J 10 Just W of Eno-Oku; concrete ditch; long, steep sides; 0.6 m ; 0.3 m; concrete with thin layer of silty mud; colourless; some Cladophora, some Lemna; water slowly streaming.
Ostracoda: Stenocypris major (80); Ilyocypris angulata (65); Cypridopsis cf. vidua (56); Dolerocypris fasciata (25); Dolerocypris sinensis (1); Candoninae sp. B (7).

- J 11 Mar.Biol.Station; upper concrete ditch; $\sqrt{}$; 0.6 m; 0.01-0.02 m at some places; concrete with thin layer of sand, leaf litter and some silt.
Ostracoda: Heterocypris incongruens cf. attenuata (20).
- 11B: Ditch totally dried out on 5-11-1986.
- J 12 Mar.Biol.Station; lower concrete ditch; $\sqrt{}$; 0.6 m; water up to 5 cm deep for a length of about 1.5 m; thin layer of sand and gravel with black silt and some leaf litter; foul, whitish water with oily spots on surface.
Ostracoda: Heterocypris incongruens cf. attenuata (>1000).
- 12B: Same conditions; date: 5-11-1986.
Ostracoda: Heterocypris incongruens cf. attenuata (>500).
- Yamaguchi-ken, Akiyoshi-cho, Akiyoshi-do, 18-10-1986.
- J 13 This sample was collected in the NE branch of the main cave tunnel & stream, not visited by tourists and in total darkness. Width of stream varying from 1 to 5 m; w.depth varying from 0 - 2 m; fast-moving water to practically stagnant pools. Bottom mostly limestone rock, sometimes coarse sand & gravel, in other places boulders and cobbles. The NE tunnel was sampled to to the point where the water totally covered the cave floor.
GW-fauna: Pseudocrangonyx sp. (1); Phreatoasellus akiyoshiensis (Ueno, 1927) (7); Akiyoshia uenoi (40); Talitridae (2).
- J 14 Cave pools, with water flowing in from the side of the tunnel in the direction of the mainstream, one big lamp attached to the wall; semi-darkness. Pools up to 1 m wide and 10-20 cm deep. Between huge limestone boulders on rockbottom with some silt and cobbles.
GW-fauna: Pseudocrangonyx sp. (3); Akiyoshia uenoi (7).
(Rivulogammarus sp. ? (2)).
- J 15 Concrete gutter, with slowly flowing stream, next to road leading to main entrance of Akiyoshi-Do; width 1.5 m; w.depth 5 cm; cemented in flat stones, only thin layer of silt, with some coarse sand & gravel.
Ostracoda: Candoninae sp. C (2 ♂♂ + 1 ♀ + 4 juv.); Candoninae sp. D (3 ♂♂); Candoninae sp. E (1 ♂); Stenocypris major (1); Potamocypris sp. (2 ♀♀ + 1 ♂ carap.); valves of Heterocypris incongruens; 1 carap. of Ilyocypris angulata.
- Yamaguchi-ken, Mito-cho, 19-10-1986 (Map 85 & detailed maps)
- J 16 Taisho-do, "Donai Fuchi" (Abyss), blind branch of main tunnel; width up to 5 m; w.depth 5-40 cm; length 15-20 m; tiny side-tunnel on right side, up to 1 m wide, 6 m length and up to 1.5 m high, w.depth up to 30 cm; Pseudocrangonyx was spotted in this tunnel. Bottom very muddy, semi-darkness in the back of the blind branch, and almost dark in the tiny side-tunnel.
GW-fauna: Pseudocrangonyx sp. (8); Gastropoda.
- J 17 "Lotus pond" in Taisho-do; shallow pool in middle of main cave, formed by water dripping from roof of cave, surrounded by wooden fence with three lights; diam. 4 m; w.depth 5-10 cm; clay with rectangular cobbles, layer of brown algae on the mud.
Fauna: Oligochaeta (3); Gastropoda (10).

- J 18 Kagekiyo-do, side branch of main tunnel, with slowly flowing stream or pools, about 7 m above the ground level of main tunnel; width 0.5 - 1 m; w.depth 5-30 cm; muddy bottom with coarse sand at some spots; about 10 m of the tunnel is accessible. Fauna: *Oligochaeta* (1).
- J 19 Kagekiyo-do, branch of main tunnel about 40 m from the end of the tourist part. Several pools in almost complete darkness; 8 x 2 x , 1 m, 4 x 2 x , 1 m, and smaller; bottom mainly pebbles & cobbles. GW-fauna: *Pseudocrangonyx* sp. (12); *GW-Asellus* sp. (2.5).
- J 20 Concrete pond at entrance of Kagekiyo Cave; irregular shape 7 x 12 m; w.depth up to 20 cm; many flocculent green algae on bottom, some leaf-litter, no silt; pond edged with boulders cemented in place. Ostracoda: *Cypridopsis cf. vidua* (> 1000).

Yamaguchi-ken, Kusunoki-cho, 20-10-1986 (map 87)

- J 21 Circ. open, concrete well, next to road on W border of Ono Lake; 1 km S of Ichihara; diam. 0.5 m; 0.8 + 2.8 m; muddy bottom. Ostracoda: *Candoninae* sp. A (6 ♀♀); *Candoninae* sp. B (1♀ + 1juv.); *Cypria* sp. A (1♂ + 1♀).
- J 23 Square well, made of bricks covered with layer of concrete; well covered with wooden lid; in garden of house next to newly built Shinto shrine in Kamiichi; 0.8 x 0.8 m; 0.3 + 0.7 m; sandy bottom, some detritus. Ostracoda: *Candoninae* (1 juv.?).
- J 24 Circ. well made of pottery, covered with metal lid; behind shed, 10 m E of main road in Kamiichi; diam. 0.6 m; 1.2 + 1.7 m; sandy bottom, very clean. GW-fauna: *Pseudocrangonyx* sp. (4).
- J 25 Circ. well lined with rounded granite boulders, upper part square concr. blocks, covered with corrugated iron; N side of road in Shako; diam. 0.7 m; 5 + 4 m. GW-fauna: *Pseudocrangonyx* sp. (4).
- J 26 Circ. well lined with granite boulders, granite square blocks at opening, covered with wooden boards; somewhat further up the road in farmyard, Shako; diam. 0.7 m; 7 + 2.8 m. No GW-fauna.

Yamaguchi-ken, Shimonoseki-cho, 21-10-1986

- J 27 Circ. open, concr. container, just N of Ozuki and express way, on the edge of a rice-field beside a low dyke; diam. 0.6 m; 0.2 m; some Lemna. Ostracoda: *Dolerocypris sinensis* (80).
- J 28 Circ. open concr. container in the middle of ricefields about 150 m N of J 27; diam. 0.6 m; 0.6 m. Ostracoda: *Dolerocypris sinensis* (12).
- J 29 Concr. ditch along road and rice-fields, Ego; width 2.5 m; 0.1-0.3 m thin layer of mud and coarse sand, some aquatic vegetation along one side near small waterfall from concrete pipe next to a bridge. No vegetation in other places, leaf litter 1. Ostracoda: *Cyprinotus uenoi* (1♂ + 1♀); *Hemicypris* sp. A (4); *Heterocypris incongruens* cf. *attenuata* (1); *Ilyocypris angulata* (7); *Cypretta* cf. *seurati* (2); *Stenocypris major* (5); *Cypria* sp. A (3).

Yamaguchi-ken, Kikugawa-cho, 21-10-1986 (Map 88-89)

- J 30 Circ. well, lined with rounded granite boulders, upper part square made of square granite blocks, covered with wooden and metal lid, in farmyard next to road, Kamitabe; diam. 0.6 m; 4.5 + 1.5 m.
GW-fauna: Bathynellacea (>10); GW-Asellus sp. (3).
Ostracoda: Dolerocypris sinensis (1).
- J 31 Circ. well, J 30-type covered with corrugated iron and wood, in house under construction, opposite Shinto shrine next to road, Nishin; diam. 0.6 m (opening 0.4 m); 2.4 + 1.1 m.
GW-fauna: GW-Asellus (1).
- J 32 Circ. concr. open well, next to derelict house in shrubs next to new house, Uematsu; diam. 0.6 m; 2.1 + 1 m; floating leaves & branches. floating leaves and branches.
Ostracoda: Candoninae sp. A ?(1♂).

Hiroshima-ken, Mukaishima-cho, Mukaishima Isl.: J 33: 7-11, J 34: 10-11-'86

- J 33 Rectangular concrete basin, in orange grove SW of Michigoe; 1.5 x 3 m; 0.1-0.5 m; bottom sand and gravel.
Ostracoda: Stenocypris major (>100).
- J 34 Rectangular concrete container on hillside, next to road just W of MMBS; 2 x 4 m; 1 m; Lemna cover 2 %.
Ostracoda: Cypridopsis cf. vidua (24); Dolerocypris fasciata (3).

Hiroshima-ken, Higashi-Hiroshima-shi, Befu Mitishita, 26-10-1986 (Map 60)

- J 37 Circ. well, lined with stones, with concr. cover, next to Prof. Mizuoka's house; diam. 0.7 m; 1 + 1.5 m; sandy bottom.
GW-fauna: Pseudocrangonyx sp. (2).
- J 38 Shallow circ. concrete well with metal lid, next to road and house on crossroads; diam. 0.7 m; 0.5 + 0.4 m; bottom very silty, a bit smelly
Ostracoda: Stenocypris major (2); Candoninae sp. B ? (1 ♂).
- J 39 Lotus field (pond); >1500 m²; 0.07 m; bottom muddy with some green algae and Lotus leaves.
Ostracoda: Cypridopsis cf. vidua (105); Cypria sp. A (?2); Cypretta cf. seurati (13); Heterocypris incongruens (3 juv.)
- M 3 Mud sample from nearby dry Lotus field. From this mud many specimens of Heterocypris incongruens cf. attenuata could be reared in the laboratory, from November 1986 until January 1987.

Hiroshima-ken, Takehara-shi, Shinjo-cho, 26-10-1986 (Map 52)

- J 40 Circ. concrete well, covered with metal lid, in yard of house next to road, uphill from Nat. Road 432, 1 km S of crossroads with Nat. Road 2; diam. 0.8 m; 2 + 1 m.
GW-fauna: Pseudocrangonyx sp. (5);
GW-Asellus sp. (c.100).
- J 41 Old large, circ. well, lined with large boulders covered with metal lid, about 100 m E of J 40 in yard of house; diam 0.9 m; 5.5 + 1 m.
GW-fauna: GW-Asellus sp. (1).

- J 42 Open circ. well, lined with granite boulders, shelter of granite blocks with roof built over the well; at the end of the road leading uphill; diam. 0.7 m; 0.5 + 0.7 m; ferns growing on the inside walls.
Ostracoda: Cypria sp. A (7).

Hiroshima-ken, Kisa-cho, 28-10-1986 (Map 56)

- J 43 Circ. well, lined with rounded stones, concrete upper part, 95 % covered by wooden boards, square opening; in farmyard just N of Road 28 in Tsuji; diam. 0.5 m; 3 + 2.3 m.
GW-fauna: Pseudocrangonyx sp. (1: dead).
- J 44 Circ. concr. well, covered with concr. lid, behind printers office in Kisa village; diam. 0.8 m; 3.3 + 1 m.
GW-fauna: GW-Asellus sp. (1).
- J 45 Well with pump, opening closed with cement, therefore inaccessible with svetkov net, animals collected by several rounds of pumping in successive days; in farmyard next to railway E of Road 184 (24-27 Nov)
GW-fauna: Pseudocrangonyx sp. (4).

Hiroshima-ken, Innoshima-shi, Innoshima Island: 10-11-1986 (Map 47)

- J 47 Circ. concrete, well, covered with concr. lid, next to road in orange grove, 1 km N of Ohama; diam. 0.9 m; 0.1 + 1 m; some leaf litter.
Ostracoda: Stenocypris major (4 juv.)
- J 48 Circ. concr. well, covered with concr. lid, in orange grove next to road, 1.5 km NE of Shigei; diam. 0.8 m; 1 + 2 m.
Ostracoda: Candoninae sp. A (5).
- J 49 Small, oval puddle in sand and gravel next to dried-out ditches next to J 48 in adjacent potato field; 0.3 x 0.5 m; < 0.07 m.
Ostracoda: Heterocypris incongruens incongr. (> 500: > 95% juv.).
- J 50 Circ. concr. well, 50 % covered by concr. lid, in cabbage field by road; 1 km SE of Shigei; diam. 0.9 m; 0.4 + 1.6 m.
Ostracoda: Cypretta cf. seurati (75: 66% juv.).
- J 51 Concrete ditch running along road by J 50; width 0.4 m; , 0.02 m; slow flowing water, fine layer of silt on sand and gravel.
Ostracoda: Cypridopsis cf. vidua (> 500); Dolerocypris fasciata (> 200); Cypretta cf. seurati (> 10).
- J 52 Circ. concr. totally covered container, along SE coast road, 1 km NE of Muronouchi; diam. 1 m; ? ; large amount of leaf litter (5).
Ostracoda: Cypria sp. A (13).

Hiroshima-ken, Mukaihara-cho: 11-11-1986 (Map 55)

- J 54 Circ. concr. covered well in garden of farmhouse, surrounded by rice-fields. Bamboo overhanging, lower part of well probably lined with stones; 500 m W of main road and railway, 3.5 km N of central town; diam. 0.9 m (opening 0.7 m); 1.5 + 1.5 m.
GW-fauna: Pseudocrangonyx sp. (2).
- J 55 L-shaped pond in garden of farmhouse 500 m S of J 54; one leg 2 x 1 m the main leg 2 x 5 m; < 0.4 m; layer of fine muddy sediment on bottom some leaf litter on surface, some overhanging trees, bordered with boulders, 1 m² of reeds growing in the pond.
Ostracoda: Cypria sp. A (17).

- J 56 Circ. covered well, boulders lining most of well, beside house adjacent to forest, 400 m S of J 54.
GW-fauna: GW-Asellus sp. (18); Pseudocrangonyx sp. (3).
- OKINAWA-ken, Okinawa Island (Maps NG-52-26 & 27)
- Naha-shi, Sueyoshi (NW Naha): 22-11-1986 (Map: 27-7-2)
- J 57 Spring captured in container made of bricks and lined with concr., bottom concr., covered with 3 concr. blocks; Nishinokawa Spring; 0.9 x 1.8 m; 0.7 m; some silt and light brown gravel.
Ostracoda: Stenocypris major (3).
- J 58 Open concrete basin, next to the container (J 57), water dripping in from rock wall; 0.8 x 1.1 m; 4-5 cm; bottom light-brown gravel with some cobbles & mud, at some places totally filled with leaf litter.
Ostracoda: Stenocypris major (> 200) (85%); Dolerocypris fasciata (c.40) (15%).
- Tamagusuku-son, SE Okinawa: J 59-63: 23; J 64-65: 24-11-1986 (Map: 27-4-3)
- J 59 Itokazu "Abuchira" (= cave), long high tunnel-like cave, with side entrance. The left tunnel has cooking pits since the cave was used as shelter during the 2nd World War (see detailed map). One round well (diam. 1.5 m; 0.4 m) and many longish pools, water slowly flowing from pool to pool; width up to 1 m; 0.3 m; total darkness; muddy bottom with limestone cobbles, many pieces of rusted iron, glass bottles & pieces of wood.
GW-fauna: Pseudocrangonyx sp. (1).
Ostracoda: Cypria sp. B (1); carapaces of Cypris subglobosa.
- J 60 Yaaji Cave, entrance by way of a doline, small tunnel leading to the main tunnel with stream in the middle. On the right side a big pool on the left side moderate to fast flowing stream of varying depth, ending in a seemingly stagnant pool. Pool extends further to the right. Sample taken in the pool (see detailed map of cave). Just N of Kakinohana, entrance just W of main road; width up to 5 m; w.depth up to 0.6 m; bottom very muddy with limestone ridges, mud mixed with limestone sand; total darkness.
Ostracoda: Cypria sp. B (80); Stenocypris major (9); Candoninae sp. G (10); Cypretta cf. seurati (1); valve of Cypris sp.
- J 61-63 Gyokusendo Cave, long tunnel-like cave with stalactites. Stream slowly flowing through the middle, made up mostly of practically stagnant pools; entrance 500 m S of Maekawa; width 2-5 m; w.depth up to 0.5 m; bottom mostly muddy with some limestone boulders at one place a bed of cobbles stuck together, with some mud; everywhere semi-darkness, with fluorescent lights on the long wooden bridge leading through the cave (see detailed map of cave).
Ostracoda: Cypria sp. B (1+ valves); valves of Candoninae sp. G & Cypretta cf. seurati.
- J 64 Kuraga Cave, cavity next to road and about 10 m lower, water flowing into a big pool (12 x 8 m; 0.3 m) from under the rock wall. A square concrete open well is built in the pool (1 x 1 m; 0.6 m); just N of Kirabaru; bottom very muddy, semi-darkness.
Ostracoda: Stenocypris major (3 juv.); Cypretta cf. seurati (1).

J 65 Rectangular concr. container partly covered with corrugated iron and wood; water falling in from pipe above, and flowing out through overflow; next to road on path uphill, 200m W of Shikiya; 1.2 x 2 m; 1 m. Ostracoda: Stenocypris major (>35)

Itoman-shi, SW Okinawa: 24-11-1986 (Map: 27-8-1)

J 66 Katashi-"ga" (= spring), spring captured in basin lined with stones; 1-1.5 x 5 m; 0.3-0.5 m; just W of main road in Takamine; open shelter over basin; bottom stones, sand & gravel; Cladophora type algae, water flows over a concrete edge into a large concrete basin of irregular shape (diam. 15-20 m). Ostracoda: Stenocypris major (6).

J 67 Spring next to road in sugar cane field, about 500 m N of Takamine; concrete stairway leading down to small basin lined with stones; water flowing from between stones and out over edge of basin. Some aquatic vegetation; 1.2 x 0.8 m; 0.2 m; soft muddy bottom. Ostracoda: Cyprretta cf. seurati (56); Stenocypris major (12); Cypria sp. B (5); Cypridopsis cf. vidua (1).

Motobu-cho, NW Okinawa: J 68-74: 26-11; J 79-80: 30-12-1986 (Maps: 27-1-1 & 26-4-2.4-4)

J 68 Circ. open well, lined with stones and roofed by a concrete open shelter just W of road 449 in Amasaki, Kenken; diam. 0.9 m; 1.8 + 0.6 m; sandy bottom with some stones. Ostracoda: Dolerocypris sinensis (40); Cypria sp. B (2).

J 69 Small pond in grass field between sugar cane plantations in the hills of Henachi; totally covered with grass, which makes the size difficult to estimate; 1 x 2 m or more; 0.1-0.2 m; peaty water with a large quantity of grass-leaf litter. Ostracoda: Cyprretta cf. seurati (c.100); Dolerocypris sinensis (1).

J 70 Circ. pond in the hills at crossroads in Ufudo; . 500 m²; at edge 0.05-0.2 m; surrounded by trees and shrubs, grass and reeds growing in a large area of the pond; muddy bottom. Ostracoda: Hemicypris sp. B (>100).

J 71 Circ. pond next to road about 250 m W of Ufudo; . 250 m²; 0.4-0.5 m; surrounded by rushes and sugar cane, 10% cover of Water Hyacinth (sample from roots); bottom muddy. Ostracoda: Cyprretta cf. seurati (165); Stenocypris major (85); Cypridopsis cf. vidua (60); Cypria sp. B (40); Hemicypris sp. C (8); Candoninae sp. G (1♀ + 2♂♂).

J 72 Circ. open well, lined with stones, in garden of house in Shoshi; diam. 0.7 m; 5 + 2.1 m; ferns growing on the walls of the well. Ostracoda: Cyprretta cf. seurati (10); Dolerocypris sinensis (1 juv.).

J 73 Spring captured in concrete basin, covered by open concr. shelter on S of road just E of Shoshi in forest patch; 1 x 2 m; 0.3 m; bottom sand, gravel & mud, many small roots of trees in the water. Ostracoda: Cypria sp. B (3); Candoninae sp. G (1♂ + 1♀); Darwinula sp. (1).

J 74 Square container/well, built with stones and concrete; about 500 m SE of Nakasone, in Amesoko area; 4 x 3.5 m; 2 m. Ostracoda: Cyprretta cf. seurati (1).

- J 79 Triangular shaped turtle pond, 500 m W and uphill of Hamamoto; 8 x 9 x 9 m; . 0.4 m; deep hole dug out in clay with steep sides.
Ostracoda: Cypria sp. B (c.150); Stenocypris major (c.75);
Cypridopsis cf. vidua (1).
- J 80 Rectangular pool lined with black plastic sheeting, in sugar cane field by road, in the hills about 750 m NE of Ishikawa (Ocean-EXPO); 7 x 3 m; . 0.4 m; layer of mud, branches and other rubbish on bottom.
Ostracoda: Cypria sp. B (c.75); valves of Heterocypris incon. incon.

Ochimi-son, N Okinawa: 27-11-1986

- J 75 Circ. concr. well, 95% covered with wooden lid; in garden of house just W of road 58 in Nerome; diam. 0.7 m; 2.5 + 0.3 m; bottom sandy mud with stones.
Ostracoda: Cypretta cf. seurati (1); Special species (1♂).
- J 76 Spring captured in concrete container on hillside, about 500 m S of Road 58 in Kijoka; 2 x 1 m; 0.4 m; bottom sandy mud.
Ostracoda: Stenocypris major (19); Dolerocypris fasciata (16).
- J 77 Ikuza field in N Kijoka; 15 x 30 m; 0.03 m; green algae, very muddy. muddy.
Ostracoda: Chrissia vittata (56); Cyprinotus kimberleyensis (12 ♂♂ & ♀♀ + 22 instars); Ilyocypris dentifera (6♂♂ + 1♀)
Candoninae sp. G (1♂ + 1♀); 2 valves of Hemicypris sp. A?
& Heterocypris incongruens cf. attenuata.
- J 78 Field next to Ikuza field (J 78), without vegetation; >500 m²; 0.05 m; muddy bottom, much green algae.
Ostracoda: Chrissia vittata (12); Cypria sp. B (2);
Candoninae sp. G (1♀).
- J 81 Two circ. concrete containers, next to road and cane fields in Untenbaru, NW Yagaji Island, Nago-shi.
A: diam. 0.6 m; 0.4 m. Ostracoda: Cypretta sp. (> 500).
B: diam. 0.75 m; 0.4 m. No Ostracoda.

LIST OF STATIONS : AMAMI OSHIMA ISLANDS

- No Type of habitat (cov/uncov); location; shape; size; (watertable
+) w.depth; bottom; remarks.
- Tokunoshima, Isen-cho, 12-12-1986 (Map NG-52-13-14.19-2.3: 1:50,000)
- J 100 Two ponds, joined by small trickle, amongst boulders, underneath bamboo in the mountains, about 1.5 km NW of Kinen; 1.5 x 1.5 & 2 x 1.5 m; , 0.2 m; bottom clay and silt with cobbles.
Ostracoda: Stenocypris major (50).
- J 101 Ginryu-do (cave), about 0.5 km N of Kami-Kenfuku (or Ginga-do ?; map in book); long tunnel-like cave (height & width 2-5 m) with stream flowing through; width of the stream varying, up to 2 m; 5-50 cm; bottom clay with black pebbles & cobbles, some gravel; big pool at the end of the accessible part. Lightbulbs present, but only commercially exploited in summer season.
GW-fauna: Bogidiellidae sp. (5).
- Tokunoshima, Tokunoshima-cho (Map NG-52-13-14.19-2.3: 1:50,000)
- J 102-103: 12; J 104-105: 13; J 107-108: 14-12-1986
- J 102 Circ. pond in middle of grassy field, in depression between hills, just E of Ohara; diam. 8 m; 0.3 m; bottom hard clay with some pebbles; small patch of waterhyacinth, bullrushes on one side. Same Ostracods under waterhyacinth as in the rest of the pond.
Ostracoda: Cypridopsis cf. vidua (25); valves of Ilyocypris sp.
- J 103 Long rectangular pond, divided across the middle by narrow embankment; next to J 102; 12 x 6 m; 0.1 m; waterhyacinth in patches around edge.
Ostracoda: Stenocypris major (3 juv.).
- J 104 Large pond, surrounded by trees on three sides and rushes on the 4th some rushes in the middle; in newly laid out recreation area just W of Tokuaase; . 1000 m²; . 0.5 m; bottom clay.
Ostracoda: Cypretta sp. (33); Candoninae sp. G (1♂ + 1♀).
- J 105 Small flooded rice field without vegetation, on W side of coast road just S of Shinokushi; 15 x 7 m; 0.05 m; bottom muddy.
Ostracoda: Heterocypris incongr. incongruens (> 500); Stenocypris major (5 juv.); Dolerocypris sinensis (1).
- J 107 Concrete rectangular basin, along coast road 1.5 km N of Kamikedoku; 5 x 2.5 m; 0.5 m; bottom muddy, cane fields on all sides.
Ostracoda: Cypretta sp. (> 500); Heterocypris incongr. incongruens (c.50).
- J 108 More or less rectangular pond, adjacent to N 110 on left side of road in the most N part of San; 1.5 x 4 m; 0.2 m; bottom muddy, 90% cover of waterhyacinth, some Lemna; surrounded by open land, grass and wasteland.
Ostracoda: Candoninae sp. G (only carap. left, no formalin).
- J 109 Stagnant pond in the hills 2.5 km E of Kaneku, Amagi-cho, 15-12-'86; c. 25 m²; up to 0.5 m bottom clay; pond against hillside, very large boulders cover 40% of the area, surrounded by trees and some cane.
Ostracoda: Conform Cypretta sp., but without septa, mostly small, some big ones (> 1000); Dolerocypris sinensis (2).

J 110 Kojima-no-kurago, long tunnel-like cave in limestone rocks on the W coast, entrance in rockwall 300 m W of Kojima, Isen-cho, 15-12-'86; one exit in the cliff wall on the sea shore (map 26 in yellow book); stream running through cave with waterfall from ceiling at 1/3 of the way; width of stream up to 2 m; up to 0.5 m; bottom limestone rock with loose rocks, gravel and sand, many cobbles and small boulders in streambed
No GW-fauna or Ostracoda.

J 111 Spring under sheer rockface, on edge of reclaimed land in Kametsu, Tokunoshima-cho, 15-12-'86; water drips from rock cracks and is caught in a concrete container; 1 x 7 m; 0.5 m; bottom sandy mud & gravel with rubbish and loose concrete blocks; filamentous algae on bottom, ferns and moss on rocks above container.
Ostracoda: Cypretta cf. seurati (. 100).

Okinoerabu-shima (special map 1:25,000 and detailed maps of 1:10,000)

China-cho: 18-12-1986

J 112 Suiren-do, long tunnel-like cave, water running throughout, running water with pools of varying sizes, depth up to 3 m; commercially exploited in summer, but last part not open for tourists; sandy bottom with some gravel and pebbles. Wooden bridges everywhere (Map 2).
No fauna.

J 113 Shoryu-do, long winding cave with evidence of water throughout, but present in several small pools, width up to 1 m, depth 0.2 -0.5 m; limestone with many stalactites, bottom sand & gravel with a fine layer of detritus. Intermittent lighting for visitors in summer.
Ostracoda: Candoninae sp. G (6 ♂♂ + 4 ♀♀); Cypretta cf. seurati (1).

J 114 - J 117 Negative: Togen-do, Sumiyoshi-no-kurago, Masana-no-kurago, Nyatsugo (see maps in grey book).

Wadomari-cho: J 118-124: 19-12; J 125-130: 20-12; J 131-132: 21-12-'86

J 118 Open well on edge of flower field by road, just N of Kibiru; oval shape: 2.5 x 1.7 m; 1 + 0.7 m; recently widened, 3/4 lined with stones, rest mud & clay; bottom red clay.
Ostracoda: Cypretta sp. (85); Heterocypris incongr. incongruens (13); Dolerocypris sinensis (6).

J 119 Open wooden rectangular water container, next to J 118; 1 x 2 m; 0.35 m.
Ostracoda: Cypretta cf. seurati (1).

J 120 Small spring/puddle surrounded by large boulders in wasteland, 500 m NE of Kibiru, by main road; 1 x 0.5 m; 0.05 m; bottom brown clay, some green algae.
Ostracoda: Cypretta cf. seurati (20); Dolerocypris sinensis (10); Candoninae sp. G (4 ♂♂ + 2 ♀♀); Cypridopsis cf. vidua (1).

J 121 Circular well, semi-covered by corrugated iron, NE of Kunigami; diam. 1 m; 13 + 8 m; well in backyard of house, ferns growing on the inside walls; top part concrete blocks.
Ostracoda: Cypretta cf. seurati (1).

- J 122 Large pond, bordered by concrete 3/4 way round, rest grassy slope, in E part of Kunigami, S half of the pond is just reclaimed; >10,000 m²; 0.05-0.1 m on edge; bottom clay.
Ostracoda: Stenocypris major (3); Hemicypris sp. C (6);
Cypretta cf. seurati (1).
- J 123 Originally large pond, practically dry, except for a few small puddles, S part of Kunigami, on N-side of road to Kibiru; diam. <0.5 m; <0.05 m; bottom very muddy.
Ostracoda: Heterocypris incongr. incongruens (>500);
Ilyocypris dentifera (>500); Hemicypris sp. C (>500?);
Stenocypris major (>100); Cypris subglobosa (>10);
Cypretta cf. seurati (>10).
- J 124 Similar to J 123, but somewhat more water left, on S-side of road to Kibiru, 250 m W of J 123; irregular shaped pool, up to 3 m long and 1 m wide; <0.15 m; muddy clay bottom, with some gravel, dead reeds around the edge of the pool.
Ostracoda: Heterocypris incongr. incongruens (>500);
Ilyocypris dentifera (>100); Hemicypris sp. C (>100);
Stenocypris major (>100); Cypris subglobosa (>10);
Cypretta cf. seurati (>10).
- J 125 Circ. well cut out of rock, 40% covered with wood, above ground level concrete; E of main road in Kibiru; diam. 1 m; 15.5 + 1.5 m;
Ostracoda: Cypretta cf. seurati (20).
- J 126 Kibiru-no-kurago, steps leading down to entrance of cavity on W side of road in center of Kibiru; small stream from under rocks flows in semi-natural basin, also small side water source from rocks; water flows away into underground tunnel, but is mixed with sewage; bottom sandy, some clay & silt; side source more rocky; semi-darkness.
Ostracoda: Stenocypris major (28);
Heterocypris incongr. incongruens (4).
- J 127 Oval pond, surrounded by grass and sugar cane, just W of Kibiru; >500 m²; 0.1-1 m at edge; bottom red mud, some large pieces of wood by edge.
Ostracoda: Stenocypris major (c.130); Hemicypris sp. C (50);
Ilyocypris dentifera (25); Cypridopsis cf. vidua (27);
Cypria sp. B (20); Cypretta cf. seurati (6); Cypris subglobosa (3); Heterocypris incongr. incongruens (3).
- J 128 Circ. pond, 200 m NW of Kibiru; >500 m²; 0.2 m at edge; bottom edge stones with mud, gentle slope on two sides with grass growing into the water, steep drop on other two sides. Ostracods could be found in all places, but mostly between the vegetation.
Ostracoda: Cypridopsis cf. vidua (18); Ilyocypris angulata (10);
Cypretta cf. seurati (9); Hemicypris sp. C (1).
- J 129 Large pond, 500 m NW of Kibiru; >5000 m²; . 1 m; bottom red clay with limestone boulders, grass growing down into the water, slope varies (<45°).
Ostracoda: Ilyocypris angulata (10); Cypris subglobosa (8);
Cypretta cf. seurati (4); Stenocypris major (3);
Dolerocypris sinensis (2); Cypridopsis cf. vidua (4).
- J 130 Large pond, 600 m N of Kibiru; >1000 m²; 0.2 m at edge; bottom clay with pebbles, gradual slope of c.10°, grass growing into the water.
Ostracoda: Cypretta cf. seurati (c.200); Cypridopsis cf. vidua (78);
Stenocypris major (40); Hemicypris sp. C (38);
Cypria sp. B (25); Ilyocypris angulata (9).

J 131 Circ. well cut out of rock, lined with stones, concrete wall above ground level, completely covered with concrete slab; in yard of house on N side of main road in Degi; diam. 1.5 m; 28.3 + 2.6 m.
Ostracoda: Cypria sp. B (4).

J 132 Circ. pond, S of main road in Neori; . 500 m²; . 1 m, at edge 0.1 m; bottom muddy clay; edge of pond fringed with bullrushes & grass, both growing into the water; leaf litter from rushes (5).
Ostracoda: Ilyocypris angulata (c.50); Cypridopsis cf. vidua (c.30);
Cypris subglobosa (1); Stenocypris major (1).

Yoron-to, Yoron-cho (Map NG-52-20-10-2: 1:25,000)

J 133-139: 23-12; J 140-142: 24-12; J 143-146: 25-12-1986

J 133 Akasaki-do, long narrow cave with very slow flowing stream; width 0.6 m; 0.25 m; bottom clay & stones and hard limestone rock; passage of cave 2-3 m across and about 2 m high (map in yellow book); lights on intermittently in summer for tourists. Sample mainly from almost stagnant pool at the end of the cave near a second exit: 12 x 0.6 m, probably running water in summer.
Ostracoda: Dolerocypris fasciata (11).

J 134 Shiruka-abu, underground lake at end of very narrow passage about 200 m from N sea coast, NW of Kagino; . 100 m²; . 0.2 m; ceiling up to 2 m high; bottom very muddy, with some pebbles and limestone rocks. Fauna: Atyidae (15).

J 135 Yago, long, narrow tunnel-like cave with moderately fast-flowing stream ending in a pool at the bottom of a stone staircase in Okugawa, about 8 m below groundlevel; a stone gutter feeds the pool from the tunnel; further up in the tunnel there are several semi-stagnant pools up to 0.3 m deep, width up to 0.5 m; bottom limestone rock with pebbles, cobbles and some sandy gravel in some places.
Fauna: Atyidae (1); Asellus sp. (1); Gastropoda (1).

J 136 Circ. well, lined with stones, 50% covered, but under open shelter, 300 m NE of middle section of airstrip, about 200 m from NW coast; diam. 2 m; 10.7 + 1 m; surrounded by grass fields, concr. wall above ground level.
GW-Fauna: Bogidiellidae sp. (5).

J 137 Circ. well, lined with stones, concr. wall above ground level, totally covered & under shelter by farm house on E side of road, 900 m S of Chabana (E of Okusha); diam. 1.5 m; 8 + 0.6 m.
GW-fauna: Bogidiellidae sp. (17).

J 138 Circ. well, lined with stones, small ferns on sides, covered by plastic netting, beside cane field, 100 m from the SW coast, just NW of Tomori; diam. 1 m; 12.5 + 0.6 m.
GW-fauna: Bogidiellidae sp. (1).

J 139 Circ. well lined with stones, 60% covered, ferns around opening, concr. wall above ground level; near house on edge of vegetable patc 200 m from SW coast, just S of Tomori; diam. 1 m; 11.9 + 0.5 m
GW-fauna: Bogidiellidae sp. (17).

J 140 Circ. pond, by road just NE of viaduct under airstrip; diam. 15 m; <1 m; muddy bottom, with large rock in the centre; surrounded by grass which grows into the water; green algae (higher & filamentous) and weeds growing throughout.
Ostracoda: Cypretta cf. seurati (>1000); Stenocypris major (15);
Cypris subglobosa (10).

- J 142 Rectangular shaped pond just N. of Gusuku, by school; 12 x 50 m; >0.2 m bottom clay, concr. on one edge, mud on another, sugar cane on 3d and grass on 4th side; wayterhyacinth growing around the edges. Sample taken from side bordered by mud.
Ostracoda: Cypridopsis cf. vidua (>500); Stenocypris major (5);
1 carap. of Candoninae sp. G.
- J 143 Circ. open well, lined with stones, wall above ground level, in farmyard under trees, about 300 m from N coast in Kagino; diam. 1 m; 15.4 + 0.3 m; shrubs & ferns growing on top rim, sugar cane on one side, hedge on the other.
GW-fauna: Bogidiellidae sp. (15).
Ostracoda: Cypretta cf. seurati (>100).
- J 144 New, open circ. concr. well on edge of sugar cane field and road, opposite house, 150 m from E coast just N of Sena; diam. 1 m; 3.3 + 2.6 m.
GW-fauna: Bogidiellidae sp. (1).
Ostracoda: Cypretta cf. seurati (13).
- J 145 Circ., open concr. well, in sugar cane field next to road 150 m from E coast, SE of Sena; diam. 1.5 m; 3.2 + 1.7 m; oil film on surface.
Ostracoda: Cypretta cf. seurati (1).
- J 146 Circ. pond, E of Masukina; diam. 10 m; , 0.4 m; muddy bottom, covered with a large quantity of filamentous green algae & higher algae; grass all around and growing into water; originally this pond has been much larger, the N part is been cut off by a grass covered bank.
Ostracoda: Cypretta cf. seurati (>500); Stenocypris major (40);
Cypris subglobosa (13); Chrissia vittata (1).

**ENVIRONMENTAL DATA & ACCOMPANYING FAUNA
AT THE STATIONS**

No	Temp C	O2	pH	Turb.	Cond.	Water colour	Det. l.l.	Accompanying fauna
1	14	38%	7.5	10	360	-	3	Chao4
2	14	115%	8.9	30	290	g	5	Chi4
3	15	14%	7.2	30	600	b	5	
4	15	80%	8.2	40	340	g	5	Chi4
5	19	67%	6.2	10	200	--	2	
6	21	57%	7.4	10	300	--	2	Chi3-Nat1
7	18	80%	7.4	10	340	--	3	Cyc4-Oli3-As2
8	18	32%	7.1	20	240	--	2	Cyc2
9	19	43%	6.5	30	330	g	3	Oli3-Chi3
10	21.5	88%	7.8	0	340	--	4	Oli3-Eph3-Odo1-Cyc3-Phy3-Chi3
11	22	86%	7.7	--	400	--	4	As3-Chi3-Cyc2
12a	21	70%	6.4	90	600	w	3	Chi3-Phy2-Psych3
12b	16	33%	7.5	30	560	w	3	Chi3-Phy2-Eris3
13	15.5	86%	7.7	--	220	--	1	Oli1-Orch1-Akiyo3
14	15.5	86%	7.5	0	220	--	1	Oli1-Rivu2-Akiyo2
15	17	86%	7.1	0	210	--	3	Aty1-Rivu3-As3-Semi3-Chi3-Eph3 Tri2-Plan2-Pisi2-Cyc3-Oli3
16	15	79%	7.7	25	280	--	1	Gas3
17	15	86%	7.6	280	170	cl	2	Oli2-Gas2
18	16	76%	7.3	0	180	cl	1	Oli1
19	16	74%	7.3	10	120	cl	1	Cyc3-Ins2-Oli2-Chi2
20	19	88%	8.0	5	65	cl	2	Oli2-Eph4-Tri3-Chi3
21	20	30%	7.1	80	160	g	5	Cul3-Cyc3-Clad1
23	17	60%	6.7	0	100	cl	2	Oli2-Tri3-As3-Cyc2
24	17	67%	6.6	15	92	cl	1	Cyc2-Ger2-Oli1
25	18	48%	6.5	20	120	cl	1	As2-Cyc3
26	18	52%	6.9	40	230	cl	1	As4-Cyc2
27	16	33%	8.1	520	190	gg	5	Eph2-Cyc2-Chi2
28	16	52%	8.6	280	120	gg	5	Chi4-Cole2-Eph3
29	20	81%	7.2	25	170	cl	3	?
30	19	71%	6.7	5	78	cl	2	Cyc2
31	20	71%	6.3	30	140	cl	2	As4-Cyc1-Oli2
32	18	48%	6.9	30	180	y	5	Cyc3-Cul3-Chao3
33	16	130%	9.1	70	470	gb	3	Cul3-Phy3-Chi3-Oli3-As1-Cyc4- Call
34	15	100%	8.7	50	260	dg	2	Cyc2-Chao5-Eph3-Chi3-Odo2-Oli2
37	20	62%	6.6	30	150	cl	2	Dug3-As3-Cyc2-Call
38	19	40%	6.5	50	180	w	3	Dug1-Chi2-Tip1-Cyc2
39	19	76%	6.8	10	92	cl	3	Oli4
40	18	76%	7.1	30	180	--	2	Hala2-As3-Cyc3-Cul2
41	18	71%	7.0	10	145	cl	1	Dug3-As3
42	18	83%	6.6	10	80	cl	3	Oli2-As3-Cyc2-Call
43	17	85%	7.0	20	220	cl	2	As
44	20	62%	6.8	0	120	cl	2	As2-Oli2
45	--	76%	7.0	30	120	cl	1	
47	15	33%	8.1	0	590	b	3	As1-Psych1
48	19.5	76%	7.7	0	---	--	2	Cyc2-Chi2-Oli2
49	16	88%	7.8	50	340	cl	2	Oli3-Chi1
50	18	72%	7.6	30	630	b	1	As1-Cyc3-Phy2-Dug2
51	21	90%	9.3	20	460	cl	3	Cyc1-Tip1-Dug2-Oli4-Phy2-Hiru2
52	17	24%	7.7	20	450	b	4	Cyc3-Chi2-Cul2-Psych1
54	17	70%	7.5	20	50	--	1	As2
55	12	74%	7.1	5	88	cl	3	Cyc3-Clad3-Tri2-Chi3-Eph3-Odo1- Hyd1
56	16	74%	6.5	50	30	--	1	

No	Temp C	O2	pH	Turb.	Cond.	Water colour	Det. l.l.	Accompanying fauna
57	24	83%	8.1	0	620	c1	4	As2-Bra1-Odo1
58	24	85%	8.3	0	560	c1	5	As4-Bra2
59	23	86%	8.4	0	600	c1	1	As-Cyc2
60	23	62%	8.0	0	900	b	1	As4-Cyc3-Dug3-Oli4-Pisi3-Phy3
61-63	23	79%	8.5	0	620	c1	1	Macro2-As2-Psych1
64	24.5	75%	8.2	300	1050	c1	1	Cyc3-Chi3-Eph1-Psyc1-Oli3-Pisi2
65	24	83%	8.3	30	780	b	2	As3-Chi2-Oli2-Pisi2
66	25	83%	8.0	0	500	c1	2	As2-Cyc2-Pisc3
67	25	83%	8.0	0	610	c1	3	Amp3-Cyc2-Eph3-Chi3-Odo3-Gas3
68	21.5	69%	7.5	90	600	c1	1	Cyc3-Hyd1
69	21	52%	7.1	30	220	rb	5 5	Plan3
70	19	62%	7.7	10	260	c1	4 5	--
71	20	76%	7.7	20	260	bg	4 1	Cyc3-Col2-Hem3
72	23	69%	7.9	0	540	--	2 0	Cull1-Oli1
73	22	69%	7.7	0	560	c1	5 0	Macro2-As2-Cyc2-Melita3
74	22.5	71%	7.7	0	410	g	1 1	Amp3-Eph1
75	23	74%	8.1	20	870	c1	2	--
76	22	64%	7.9	30	300	c1	2 5	As4-Nat1-Amp3-Cul3-Eph3-Oli3-Phy3
77	22	95%	8.5	20	320	c1	4	Cyc3-Cla4-Ger3-Eph3-Lym2
78	22	73%	8.1	100	620	g	5	Chi4-Odo1
79	18	88%	7.0	--	250	gb	2	Cyc4-Chi2-Pisc2-Turtles
80	19.5	150%	8.5	--	580	dg	3	Chi3-Hem2-Odo1-Phy1
81 A	22	62%	8.0	--	480	og	5	Chi5-Cul2-Eph2
81 B	22	130%	8.9	--	390	blg	5	Chi4-Stra3
100	20	86%	8.1	0	330	c1	2	Hem4-Eph3-Chi3-Cyc3-Oli2-Gas2-Pisi2-Ger2-Bra1-Tri1
101	22	83%	8.6	0	380	c1	1	Aty1
102	19	90%	8.2	0	340	c1	2	Eph3-Pisc2-Cyc2-Chi2
103	19	86%	8.0	0	250	yb	-	Chi2-Eph2-Odo2-Hem2
104	20	79%	8.1	0	270	gb	3 5	Cla5-Odo2-Hyd2
105	23	83%	8.8	0	230	b	4 1	Plan3-Lym2-Hem2-Coll
106	24	86%	8.2	30	580	gg	3 2	Eph2-Cyc2-Chi2-Ger2-Gas2
107	24	81%	7.7	30	140	bg	2 2	Chi3-Hem3-Cyc3-Eph3-Coll
108	24	81%	7.5	0	360	c1	3 3	Chi3-Odo2-Vel2-Ger2-Plan2
109	19.5	71%	7.8	0	150	drb	3 3	Cla4-Col3-Hem3-Lym2-Hyd2-Chi2
110	21	86%	8.6	0	280	c1	1 0	Oli2-Cyc2-Tri1
111	20	71%	7.7	0	540	c1	1 2	Dug2-Phy2-Lym2
112	--	--	--	--	320	c1	1 0	No fauna
113	21	50%	8.1	--	360	c1	1 0	Cyc3-As3-Oli2-Gas2
114-117	described in N-list							
115	23	69%	8.0	0	420	c1	1 0	No fauna
116	23	76%	8.1	0	1600	c1	1 0	No fauna
117	22	76%	8.3	30	410	c1	1 0	Chi1
118	19	52%	8.0	0	340	gb	0 1	
119	17	90%	9.7	20	320	g	1 0	
120	19	81%	7.6	20	510	c1	2 0	As3
121	23	83%	7.9	0	510	c1	2 1	Dug2-Oli1
122	17	88%	8.3	20	280	gb	3 1	Chi3-Oli3-Pisc2-Odo1
123	16	48%	7.9	230	300	gb	3 0	Cyc5-Chi4-Col3
124	16	88%	8.3	0	280	c1	3 0	Cla4-Col2-Chi2
125	23	73%	8.2	0	550	c1	1 0	
126	23	74%	8.4	0	480	c1	0 0	Sem3-As2
127	16	82%	8.4	30	280	g	3 3	Cyc4-Cla3-Ger3-Odo2-Chi2-Oli2-Eph2-Hem1

No	Temp C	O2	pH	Turb.	Cond.	Water colour	Det. l.l.	Accompanying fauna
128	17	83%	8.5	20	340	g	3 2	Pisc1-Odo2-Chi2-Eph2-Cyc2
129	16	83%	8.3	230	190	br	3 3	Cyc3-Odo2-Plan2-Viv2-Chi2
130	17	86%	8.0	20	280	cl	3 3	Cla5-Noto3-Plan2-Odo2
131	24	--	---	--	---	cl	3 0	Cyc3-As3
132	19	76%	8.3	--	260	gb	5 5	Cyc3-Pisc3-Plan2
133	19	57%	---	0	650	cl	1 0	As3-Aty3-Cyc3
134	22	83%	8.1	0	900	cl	2 0	Aty3
135	19	83%	9.1	0	700	cl	1 0	Aty1-As1-Gas1
136	21.5	71%	8.0	0	420	cl	1 0	Cycl
137	21.5	84%	8.0	0	560	cl	1 0	
138	21	79%	8.5	0	660	cl	3 1	
139	21	69%	8.2	0	790	cl	1 0	Oli1
140	21	95%	9.8	0	340	cl	2 0	Cyc3-Cla2-Eph2-Odo2-Hem2
142	20	170%	10.5	0	360	db	4 0	Cyc3-Odo3-Pisc3-Chi2-Eph2- Plan2-Gas1-Coll
143	21	48%	7.4	0	1000	cl	2 0	Plan3-Cyc3
144	21	48%	7.7	0	1100	cl	1 0	Cyc3-Cull
145	21	48%	7.7	0	1400	cl	1 0	Aty2
146	19.5	157%	9.6	-	250	cl	2 0	Odo3-Plan3-Cyc3-Hem2

LIST OF ABBREVIATIONS

Abbreviations used for watercolour

b	=	brown(ish)	bg	=	brown-green
blg	=	blue-green			
cl	=	clear			
d	=	dark			
g	=	green(ish)	gg	=	green-grey
r	=	red	gb	=	green-brown
w	=	whitish			
y	=	yellow			
--	=	not recorded			

Abbreviations used for species names

Akiyo	=	<u>Akiyoshia</u> sp. (Gastropoda)
Amp	=	Amphibia
As	=	<u>Asellus</u> sp. (Isopoda, Crustacea)
Aty	=	Atyidae (Natantia, Crustacea)
Bra	=	Brachyura (Crustacea)
Cal	=	Calanoidae (Copepoda, Crustacea)
Chao	=	<u>Chaoborus</u> sp. (Culicidae, Diptera)
Chi	=	Chironomidae (Diptera)
Col	=	Coleoptera
Cul	=	Culicidae (mosquito's)
Cyc	=	Cyclopidae (Copepoda, Crustacea)
Dug	=	<u>Dugesia japonica</u> (Tricladida)
Eph	=	Ephemeroptera
Eris	=	<u>Eristalis</u> sp. (Diptera)
Gas	=	Gastropoda
Ger	=	Gerridae (Hemiptera)
Hala	=	Halacaridae (Hydracarina)
Hem	=	Hemiptera (except Gerridae, Velidae & Notonectidae)
Hiru	=	Hirudinae
Hyd	=	Hydracarina
Lym	=	<u>Lymnaea</u> sp. (Radix sp., Gastropoda)
Macro	=	<u>Macrobrachium</u> sp. (Natantia, Crustacea)
Nat	=	Natantia
Noto	=	Notonectidae (Hemiptera)
Odo	=	Odonata
Oli	=	Oligochaeta
Orch	=	<u>Orchestia</u> sp. (Amphipoda, Crustacea)
Phy	=	<u>Physa</u> sp. (Gastropoda)
Pisc	=	Pisces
Pisi	=	<u>Pisidium</u> sp. (Eulamellibranchia)
Plan	=	<u>Planorbis</u> sp. (Gastropoda)
Psych	=	Psychodidae (Diptera)
Stra	=	Stratyomyidae (Diptera)
Tip	=	Tipulidae (Diptera)
Tri	=	Trichoptera
Vel	=	Velidae (Hemiptera)
Viv	=	<u>Viviparus</u> sp. (Gastropoda)

