Possibility of 20 cm Cube Aquarium

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ABSTRACT: In Aquamarine Inawashiro totally 50 to 100 species (fluctuating depending on the seasons) of aquatic insects, amphibians, and other freshwater creatures have been exhibited one by one in 20 cm cube aquariums which can be exchanged. Each aquarium is fitted freely on rales which are set out a wall. 51 species in two families of diving beetles are confirmed in Fukushima Prefecture. About 40 species of them and 18 species of 19 species in six families of amphibians like frog and salamanders are exhibited. Since each aquarium temperature is not controlled, it rises up to near 30 ºC in summer and fall down to near 0 ºC. Therefore, visitors can observe hibernating frogs during wintertime.

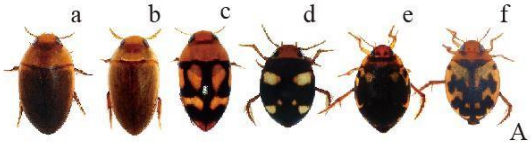
INTRODUCTION

We wondered whether we could install a permanent exhibition on insects, the most diverse species on the earth, and more specifically put a spotlight onto aquatic insects. There are many small species of aquatic insects that range from several millimeters to several centimeters in size and could not be exhibited in a large water tank. There also were no permanent exhibitions like the one that we focused on here up until now. So, we decided to exhibit each species using 20cm x 20cm x 20cm compact cubed water tanks. With removable water tank stands, the water tanks can be installed randomly. The water depth of the aqua terrarium water tanks ranges between 5-15cm (water amount of 2-6ℓ,) and the 70-120 species of insects, including amphibians (fluctuates depending on the season,) are bred in still water at normal temperature without using water supply and drainage or temperature controllers. There are no heating and cooling installation inside the venue to provide an environment as close to nature, with a maximum water temperature of 24.7℃ in the summer and a minimum water temperature of 0.5℃ during the winter to enable visitors to view the living creatures in a state of hibernation.

Dytiscoidea of Fukushima Pref. Japan

There are approximately 146 species of the Noteridae and Dytiscidae family that inhabit Japan. 51 species (Fig.1) have been confirmed in Fukushima Prefecture, and approximately 40 species among them are exhibited year-round.

Fukushima Prefecture faces the Pacific Ocean to the east and is divided into 3 regions (Fig.2, Hama-dori area, naka-dori area, Aizu area) in the Abukuma Highlands and the Ou Mountain Ranges



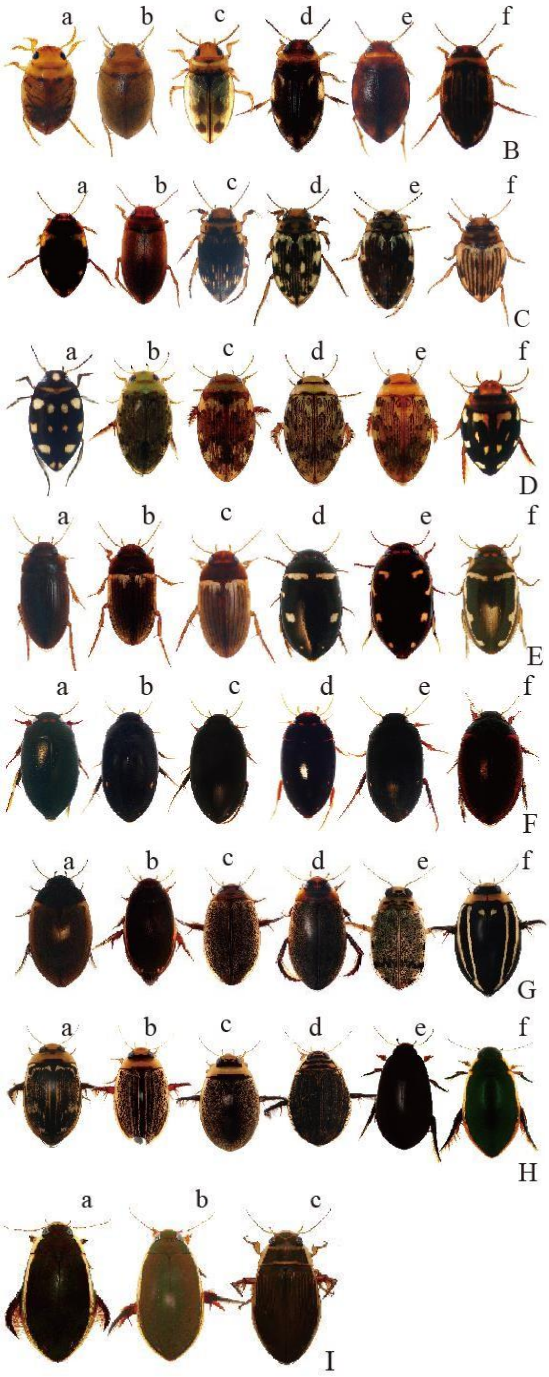


Fig. 1. 51 species of the Noteridae and Dytiscidae family confirmed in Fukushima prefecture.
— A(a, *Noterus japonicas*; b, *Noterus angustulus*; c, *Canthydrus politus*; d, *Allopachria flavomaculata*; e, *Hyphydrus laeviventris laeviventris*; f, Hyphydrus japonicus); B(a, *Hydrovatus subtillis*; b, *Hydrovatus acuminatus*; c, *Allodessus megacephalus*; d, *Hydroglyphus japonicas*; e, *Leiodytes frontalis*; f, *Hygrotus chinensis*); C(a, *Hydroporus tokui*; b, *Hydroporus uenoi*; c, *Nebrioporus ancho ralis*; d, *Nebrioporus nipponicus*; e, *Oreodytes kanoi*; f, *Oreodytes sanmarkii*); D(a, *Oreodytes natrix*; b, Laccophilius difficilic; c, Laccophilius kobensis; d, Laccophilius lewisius; e, Laccophilius lewisioides; f, *Japanolaccophilus niponensis*); E(a, *Copelatus weymarini*; b, *Copelatus teranishii*; c, *Copelatus japonicas*; d, *Platambus pictipennis*; e, *Platambus convexus*; f, *Platambus fimbriatus*); F(a, *Platambus sawadai*, b, *Platambus stygius*; c, *Platambus optatus*; d, *Platambus insolitus*; e, P*latambus ikedai*; f, *Agabus japonicas*); G(a, *Agabus conspicuous*; b, *Ilybius apicalis*; c, *Rhantus suturalis*; d, *Rhantus erraticus*; e, *Eretes griseus*; f, *Hydaticus bowringii*); H(a, *Hydaticus conspersus conspersus*; b, *Hydaticus grammicus*; c, *Graphoderus adamsii*; d, *Acilius japonicas*; e, *Cybister brevis*; f, *Cybister lewisianus*); I(a, *Cybister chinensis*; b, *Cybister tripunctatus lateralis*; c, *Dytiscus marginalis czerskii*)

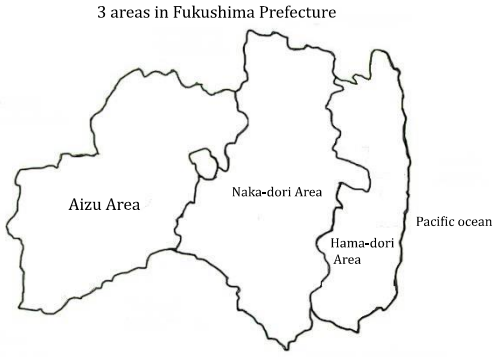


Fig.2. 3Areas in Fukushima Prefecture

that traverse north to south. Hama-dori area where it is mild and has little snowfall. Aizu area where it is much snowfall. Naka-dori areas surrounded by Abukuma Highlands and Ou Mountain Range are intermediate climates of the other two regions.

Natural breeding inside the water tanks

The Dytiscidae live on the land during the pupal stage, so it was made possible for some of the small breeds to breed inside the water tanks at the aqua terrarium exhi- bition. The larvae feed on the Dahniidae or Asellus hilgendorfi that have grown inside the water tanks. 15 species (Fig.3.) breed in aquarium over the 4 years. The Aizu area, which is surrounded by the Iide mountain range and the Echigo mountain range on the west side, is one of Japan's heaviest snowfall areas. Because of these characteristic climate, Fukushima Prefecture is the area where the southern limit of northern species (*Hydroporus tokui*) and the northern limit of southern species (*Canthydrus politus*) live, and the number of types is also the fifth largest area by prefecture.

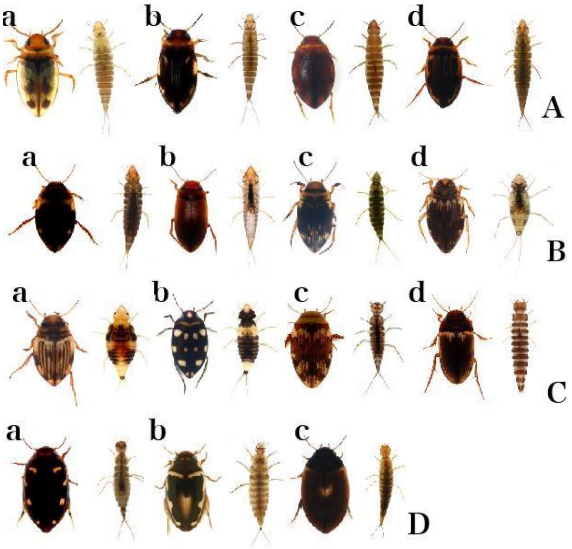


Fig.3. Adults and larvae of 15 species of breeding Dytiscidae family.—A (a, *Allodessus megacephalus*; b, *Hydroglyphus japonicas*; c, *Leiodytes frontalis*; d, *Hygrotus chinensis*); B(a, *Hydroporus tokui*; b, *Hydroporus uenoi;* c, *Nebrioporus ancho ralis*; d, *Oreodytes kanoi*); C(a, *Oreodytes sanmarkii*; b, *Oreodytes natrix*; c, *Laccophilus kobensis*; d, *Copelatus teranishii*); D(a, *Platambus convexus*; b, *Platambus fimbriatus* ; c, *Agabus japonicas*)

Amphibians of Fukushima Prefecture in Japan

There are 80 species of the Caudata and Anura family that inhabit Japan, and 19(Fig.4.) of them have been confirmed in Fukushima Prefecture.

Frog hibernation exhibition

From late October, when the tempe- rature drops below 10 ℃, frogs begin to go underground. From later November, the temperature drops below 5 ℃, and they stop moving inside the water tanks. Frogs dislike bright areas during hibernation, so an openable cover (Fig.4. Fig.5.) is attached to the exhibition surface, and by transferring the hibernating frogs to the exhibition surface side, visitors can view them in their hibernation state (Fig.6.) during the winter.

Fluctuation of annual water temperature/ room temperature/ Outside temperature

Annual temperature in Inawashiro and correlation was found in the variation of room temperature and water temperature of the 20 cm cube aquariums

Fig. 4. 19 species of the Caudata and Anura family family confirmed in Fukushima prefecture.
— A(a, *Hynobius nigrescens*; b, *Hynobius lichenatus*; c, *Hynobius tokyoensis*; d, *Onychodactylus fuscus*); B(a, *Onychodactylus japonicas*; b, *Onychodactylus intermedius*; c, *Cynops pyrrhogaster*; d, *Bufo japonicus formosus*); C(a, *Hyla japonica*; b, *Rana tagoi tagoi*; c, *Rana japonica*; d, *Rana ornativentris*); D(a, *Lithobates catesbeianus*; b, *Glandirana rugose*; c, *Pelophylax porosus porosus*; d, *Pelophylax nigromaculatus*); E(a, *Rhacophorus schlegelii*; b, *Rhacophorus arboreus*; c, *Buergeria buergeri*)

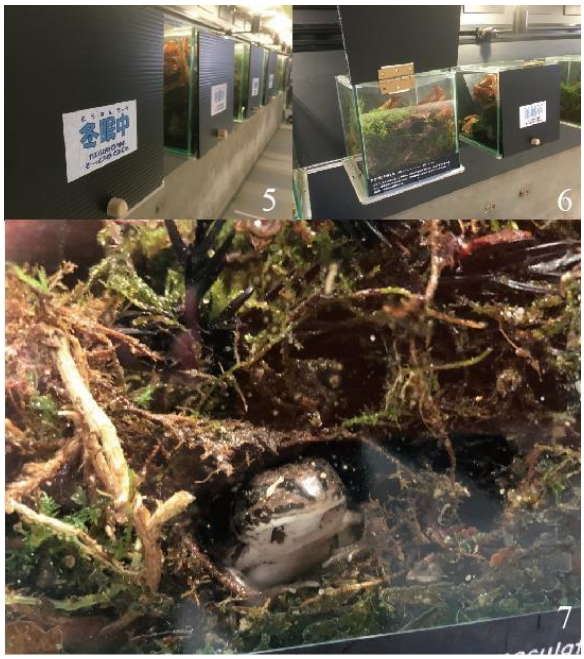


Fig. 5-6. Its rearing compact cubed water tanks(5& 6) and The hibernating Pelophylax nigromaculatus. —5, Frog hibernation exhibition; 6, The hibernating frogs can be viewed when the cover is opened. 7, The hibernating *Pelophylax nigromaculatus*.

corner. The winter season temperature is slightly higher than the outside, and the summer season temperature tends to be somewhat lower than the outside. Although it can say that the exhibition environment is close to the living temperature of these temperature-changing organisms in the natural world and the seasonal change can be felt, the exhibition organism thinks that it is possible to spend the life close to the original environment.

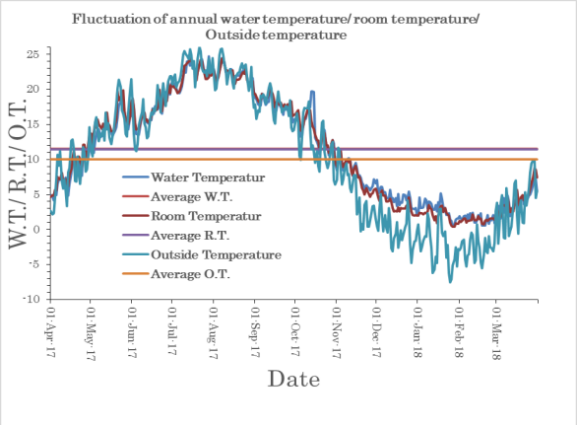


Fig. 8. Water temperature fluctuation in the 20cm cubed water tanks from April 1, 2017 to March 31, 2018.

CHALLENGES

- The aquatic insects that come on shore to pass the winter take up a small area of the land and are affected by the changes of the temperature, and depending on the species some end up dying while underground.
- The year-round breeding of the Hynobius, a genus of the salamander (four breeds,) was possible, but in regard to the Onychodactylus (three breeds,) the high summer temperatures make it difficult for year-round breeding.
- The majority of aquatic insects range between 1mm-5mm, so there are many species that cannot see the diving organisms when moss is laid out on the emer gent plants and at the water's edge.

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