



PROVISIONAL ATLAS:

Cave arachnid biodiversity value in the Ha Long Bay, Vietnam

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Research and Conservation of Cave Arachnids in the Ha Long Bay, Vietnam - A World Natural Heritage Area.

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Introduction

Ha Long Bay and the 9789-1 Project

Ha Long Bay is located in the northeast corner of Vietnam, 165 km from Hanoi. Ha Long Bay covers an area of 1,553 km² with 1,969 islands, of which 90% are limestone islands. To the west and north west, Ha Long Bay stretches from Yen Hung district in Ha Long city to Cam Pha town in Van Don district (Quang Ninh province); to the south-east and in the south, Ha Long Bay borders the western shore of Tonkin Gulf; to the southwest the Bay borders Cat Ba island (Hai Phong province).

In 1962, Ha Long Bay was recognized as a vestige and beauty spot of national significances by Ministry of Culture and Information of Viet Nam and was also recognized as a world national heritage site twice by UNESCO organization. The first time, in 1994 for the exceptional and universal value of the landscape and the second time in 2000 for the special value of geology and geomorphology. On November 11, 2011, the New 7 Wonders Foundation provisionally named Ha Long Bay as one of them.

Ha Long Bay owns a high bio-diversity with the typical ecosystems of the tropical sea. The bio-diversity in Ha Long Bay is shown by the variety of species, and endemic and rare genes. Up to know, there are 2,949 species of fauna and flora of which 1,259 inland species, 1,553 water species, 66 species of reptile and amphibian and 71 bird species. There are 102 specious and rare species at universal and/or regional level, of which 17 plants are endemic to Ha Long Bay. This is a natural area of Vietnam where the most numerous species have been found.

Isolated from the mainland, the Arachnid fauna in Halong Bay caves is certainly characterized by high endemism. This is the first publication of Arachnids in the cave systems in this area. This publication is result of Project “Research and Conservation of Cave Arachnids in the Ha Long Bay, Vietnam - A World Natural Heritage Area” with funding from Rufford Small Grants Foundation

The cave system in Halong Bay

Up to know, more than 20 large and small caves which have been discovered in Ha Long Bay, are seen as living natural museum, a residence for many local invertebrates and carry very special characteristic but have not been studied. The typical caves include: Me Cung cave, Trinh Nu cave, Duc Tien cave, Cap La cave, Co cave, Tien Ong cave, Tien Ong 2 cave, Dong Tien cave, Dua cave, Sung Sot cave, Dau Go cave. Currently, many caves have been exploited for tourism development are Tien Ong cave, Me Cung cave, Sung Sot cave, Dau Go cave,... Bisedes, some natural caves like Dua cave, Dong Tien cave, Trinh Nu cave are less affected by tourism activities.

Caves are divided into several distinct biological zones to aid interpretation. These correspond to the amount of available light and varying environmental conditions. The *Entrance Zone* is the area directly around the cave entrance; it is generally well lit, often supports photosynthetic plants, and undergoes daily temperature and humidity fluctuations. The *Twilight Zone* is just beyond the entrance zone and is often dominated by lichen and algae that require low light conditions. The temperature and humidity are still variable but fluctuations are dampened compared with epigeal variation. Deeper into a cave, light is reduced to zero and the *Dark Zone* is entered, which is subdivided into three zones, the transition, deep cave and stale air zones. The transition zone is perpetually dark, but still fluctuates in temperature and humidity determined by epigeal conditions. The deep cave zone is almost constant in temperature and humidity conditions. The

stale air zone is only found in certain caves and is an area of the deep zone that is constricted, and commonly contains elevated levels of CO₂ and lower levels of O₂.

Introduction to cave biology

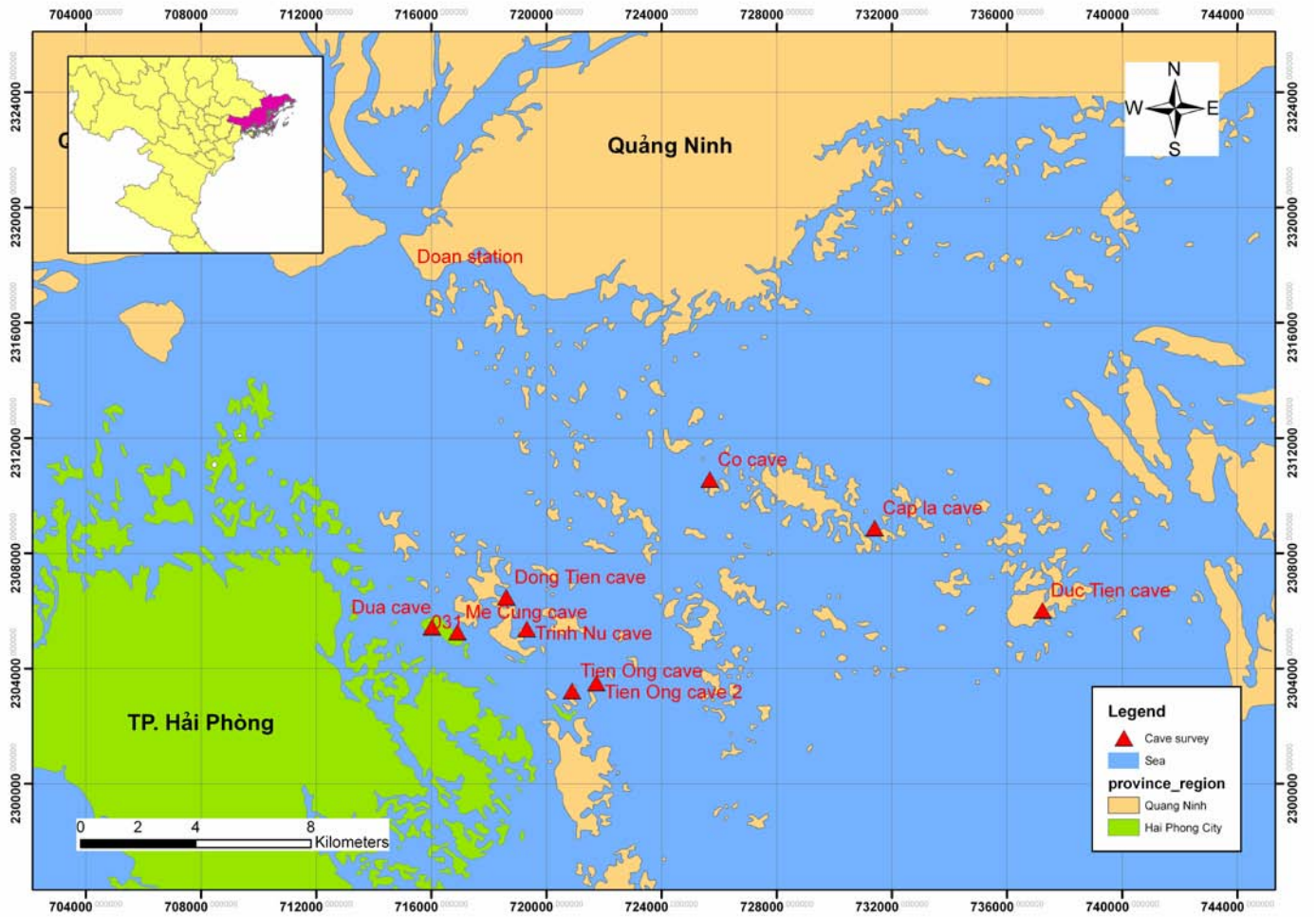
Cave invertebrates are generally classified according to their degree of cave dependence, despite numerous other systems and variations being proposed and adopted by various authors. The level of cave dependence for different ecological groupings is described below:

Troglobites are obligate animals that possess specific adaptations (troglomorphisms) such as loss or reduction of pigmentation and/or eyes, flightlessness, elongate appendages and specific sensory adaptations. These species rely solely on the cave environment for food and reproduction. They are generally restricted to the deep cave zone where conditions are the most stable and are rarely found closer to entrances in the twilight zone.

Troglophiles are animals that can complete their entire lifecycle within a cave but possess no specific adaptations to the cave environment. These species are capable of living outside caves in suitably dark and moist epigeal habitats.

Trogloxenes are animals that regularly use caves for part of their lifecycle or for shelter, but must leave the cave to feed. Common examples of these are bats and cave swiflets.

Accidentals are animals that do not use caves on a regular basis and cannot survive in hypogean environments.



Map of survey caves

Cave arachnids in the Ha Long Bay

Pholcus sp.

Family: Pholcidae

Order: Araneae

Common name: Daddy-long-legs spiders



Distribution: The species is widespread in Vietnam. It occurs in the caves that not far from mainland are Dua cave and Me Cung cave.

Habitat and ecology: This species is found in entrance zone, a troglone species, not troglitic .

Status: Common species

gen.n. sp.nov.

Family: Pholcidae

Order: Araneae

Common name: Daddy-long-legs spiders



Distribution: Known only from the type locality: Dong Tien cave

Habitat and ecology: This species is found in the dark zone. A troglobitic species.

Status: New genus and species. Possibly an endemic species.

sp.nov.

Family: Pholcidae

Order: Araneae

Common name: Daddy-long-legs spiders



Distribution: Known only from the type locality: Dua cave, Trinh Nu cave

Habitat and ecology: This species is found in the twilight zone. Possibly a troglaphiles species.

Status: A new and rare species

sp.nov.

Family: Hersiliidae

Order: Araneae

Common name: Two-tailed spiders



Distribution: Known only from the type locality: Trinh Nu cave

Habitat and ecology: This species is found in the entrance and twilight zones with a big population. A troglophiles species

Status: Possibly a new taxon

Hasarius adansoni

Family: Salticidae

Order: Araneae

Common name: Jumping spiders



Distribution: The species is widespread in the world. It occurs in the caves that not far from mainland are Dua cave, Me Cung cave, Tien Ong cave.

Habitat and ecology: This species is found in entrance zone, not troglitic, accidental species.

Status: Common species

sp.nov.

Family: Theridiidae

Order: Araneae

Common name: Cob-web spiders



Distribution: Known only from the type locality: Dua cave, Me Cung cave, Trinh Nu cave.

Habitat and ecology: The cob-web spider occurs in the entrance and twilight zones with a big population. A troglaphiles species

Status: Possibly a new taxon

sp.nov.

Family: Theridiosomatidae

Order: Araneae

Common name: Ray spiders



Distribution: Known only from the type locality: Dua cave, Tien Ong cave, Tien Ong cave 2.

Habitat and ecology: This species found in the dark and twilight zones. A trogliphiles species

Status: Possibly a new taxon

sp.nov.

Family: Theridiosomatidae

Order: Araneae

Common name: Ray spiders



Distribution: Known only from the type locality: Dua cave, Tien Ong cave, Tien Ong cave 2, Trinh Nu cave.

Habitat and ecology: This species found in the twilight zones. A troglomorphic species.

Status: Possibly a new taxon

sp.nov.

Family: Urobolidae

Order: Araneae

Common name: Hackled-orb web spiders



Distribution: Known only from the type locality: Dua cave

Habitat and ecology: The hackled-orb web spider occurs in the entrance zone with a big population. A troglophile species.

Status: Possibly a new taxon

sp.nov.

Family: Gnaphosidae

Order: Araneae

Common name: Flat-bellied ground spiders



Distribution: Known only from the type locality: Me Cung cave

Habitat and ecology: This species is found in the dark zone with only several individuals. A troglotic species.

Status: A new species. Threatened. The spider' habitat has been narrowed due to tourism activities

Heteropoda robusta

Family: Sparassidae

Order: Araneae

Common name: Huntsman spiders



Distribution: The species is widespread in the Asia. It's occurs in the caves that not far from mainland are Dua cave, Me cung cave, Tien Ong cave, Tien Ong 2 cave.

Habitat and ecology: This species is found in entrance zone, not troglobitic (accidental species).

Status: Common species

sp.nov.

Family: Sparassidae

Order: Araneae

Common name: Huntsman spiders



Distribution: Known only from the type locality: Tien Ong cave, Tien Ong cave 2.

Habitat and ecology: The hackled-orb web spider occurs in the entrance zone with a big population. A troglophile species.

Status: Possibly a new taxon

sp.nov.

Family: Sparassidae

Order: Araneae

Common name: Huntsman spiders



Distribution: Known only from the type locality: Duc Tien cave, Cap La cave.

Habitat and ecology: This species is found in the dark zone with a big population. A troglobitic species.

Status: A new taxon

Gen.nov. sp.nov.

Family: Uropodiidae

Order: Acarina

Common name: Mites



Distribution: Known only from the type locality: Me Cung cave

Habitat and ecology: This species is found in the dark zone with only several individuals. A troglobitic species.

Status: A new taxon. Threatened. The spider' habitat has been narrowed due to tourism activities

sp.nov.

Family: Thelyphonidae

Order: Uropygi

Common name: Whipscorpions



Distribution: Known only from the type locality: Me Cung cave, Cap La cave

Habitat and ecology: The whipscorpions occurs in the dark zone of cave. A troglotic species.

Status: A new taxon. Threatened.

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Dua cave.

Habitat and ecology: This species occurs in the twilight zones. A troglophile species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Dua cave, Dong Tien cave, Trinh Nu cave, Me Cung cave, Tien Ong cave.

Habitat and ecology: This species is found in the entrance and twilight zones with a big population size. A troglophiles species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Duc Tien cave

Habitat and ecology: This species occurs in the twilight zones. A troglophile species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Cap La cave

Habitat and ecology: This species is found in the dark zone with only several individuals. A troglobitic species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Co cave, Cap La cave

Habitat and ecology: This species occurs in the twilight zone with only several individuals. A troglophile species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Dua cave, Dong Tien cave, Me Cung cave, Tien Ong cave 2.

Habitat and ecology: This species is found in the entrance and twilight zones with a big population size. A trogliphiles species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality

Habitat and ecology: This species occurs in the twilight and dark zones with only several individuals. A trogliphiles species.

Status: Possibly a new taxon

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Me Cung cave

Habitat and ecology: This species is found in the dark zone with only several individuals. A troglobitic species.

Status: A new taxon. Threatened. The spider' habitat has been narrowed due to tourism activities

sp.nov.

Family: Epedanidae

Order: Opiliones

Common name: Harvestmen



Distribution: Known only from the type locality: Dua cave, Trinh Nu cave

Habitat and ecology: This species occurs in the dark zone with a big population size. A troglobitic species.

Status: Possibly a new taxon

sp.nov.

Family: Chernetidae

Order: Pseudoscorpiones

Common name: Pseudoscorpions



Distribution: Known only from the type locality: Trinh Nu cave

Habitat and ecology: The pseudoscorpion species occurs in the dark zone of cave with a small population size. A troglobitic species.

Status: A new taxon. Threatened.

Recommendations to preserve cave arachnids

Currently, in Ha Long Bay, several caves have highly biodiversity value have been exploited for tourism development. Tourism development accompanied by cave biodiversity reservation is our great concern today.

Some of the tourists do not respect the rules of the National Park on using food, cigarettes in the caves, which creates a great amount of garbage in caves like water bottles, fruit drink boxes, beer packages, lucky money, clothes, egg shell, peanut shell and so on. These objects generate harmful epidemic to the caves, affecting the living things in caves.

The survey has found rat species in tourism caves. Obviously, they are living in the caves. It is a notable problem. Recycle bins in caves are the food sources for harmful animals which should be moved to the cave outside.

The current lighting system some tourism caves is not conducive to creating a suitable habitat for cave fauna. The constant light is having a detrimental effect on the bat and swiftlet populations in the caves. The current lighting system also creates a fantasy world cave experience that is a potential source of the excitement (exhibited as noise) felt by visitors in the cave. This noise will be of great disturbance to the bat and swiftlet populations within the cave systems.

These problems can be greatly improved by reducing the amount of light being used as well as the type of light used and duration of time that the lights are left on throughout the cave.

Because roads in some tourism caves are not clearly identified, backgrounds of cave are treated on, causing destroy of natural ecosystems. It is urgent for tourists to move on roads separate with cave's backgrounds.

These results lead to several very important recommendation to ensure the caves maintain their biodiversity in the future:

- Immediately make defined pathways in the tourist caves marked by posts and rope to stop the cave floors being destroyed by people walking on them. This destroys habitat for many insects and spiders that live in the cave. Ultimately raised walkways should be installed in all tourist areas to minimise impact to cave floors.

- Clean up the rubbish left throughout the cave. Rubbish attracts rats into the cave that will eat cave invertebrates. Besides, stop people eating and drinking inside the caves as food scraps dropped also encourage rats to live in the caves.

- Reduce noise in the caves as this is disturbing the bat and swiftlet populations which support diverse insect communities in the caves. If the noise continues, the bats and swiftlets may leave the cave permanently, destroying the cave guano insect ecosystem.

- Enforce the “no smoking” ban inside the caves as this is also disturbing the bat and swiftlet populations, and also increases rubbish dropped on floors as butts and empty packets.

- Change the lighting in the caves as it is causing the growth of lampenflora (plants that grow under artificial light in caves). The lampenflora is providing an artificial food source for surface species not usually found in caves, and thus affecting the diversity and abundance of cave invertebrates.

These recommendations to stop the destruction of the caves and formations and ensure World Heritage Values are maintained, but are made here in order to ensure the biodiversity values of the caves are preserved.

Some photographs of caves in Ha Long Bay



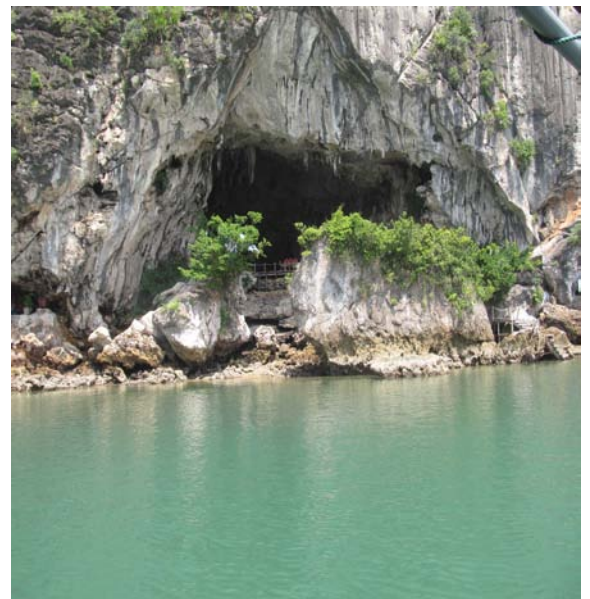
Prepare the arachnid survey



Inside of Dong Tien cave



Entrance of Dong Tien cave



Trinh Nu cave



The way to Tien Ong cave



Inside of Tien Ong cave



Tien Ong cave 2



Inside of Dua cave



The way to Me Cung cave



Inside of Cap La cave



Entrance of Dong Tien cave



Entrance of Duc Tien cave

Photographs were taken by Pham Dinh Sac