

Discovery of *Tanichthys albonubes* Lin 1932 (Cyprinidae) on Hainan Island, and Notes on Its Ecology

CHAN Bosco Pui Lok^{1,*}, CHEN Xiang-lin²

(1. Kadoorie Farm & Botanic Garden, China Programme, Lam Kam Road, Tai Po, New Territories, Hong Kong SAR;

2. School of Life Science, South China Normal University, Guangzhou 510631, China)

Abstract: A wild population of the globally restricted and highly threatened freshwater fish *Tanichthys albonubes* Lin was recently discovered on Hainan Island, China. Prior to the present study, native populations were only known from isolated pockets in Guangdong Province of China and Quang Ninh Province of Vietnam; the Hainan record thus represents the first insular and southernmost distribution of this little-known species. Thus far it is known only from a single site in Hainan, despite repeated surveys of similar habitats throughout the island. The Hainan population occurs in a clean, sluggish coastal stream with abundant hydrophytes, and is sympatric with 20 fish species. Due to the unique geographic distribution of the Hainan population, and the conservation significance of the species, studies of its phylogenetic relationships with conspecific populations elsewhere are underway. The exact locality of the newly discovered Hainan population cannot be revealed, but relevant government authorities have been notified and we are working to protect the site.

Key words: *Tanichthys albonubes*; Freshwater fish; New record; Ecology; Hainan; China

唐鱼野生种群在海南岛的新发现及其生态资料

陈羣乐^{1,*}, 陈湘琳²

(1. 嘉道理农场暨植物园, 香港特别行政区 新界大埔林锦公路;

2. 华南师范大学 生命科学学院, 广州 510631)

摘要: 于2007年在海南岛发现了国家II级重点保护动物唐鱼(*Tanichthys albonubes* Lin)的野生种群, 属种均为海南新记录。该属全球只有两种, 种与种群间都呈间断分布, 对研究鲤科鱼类的系统发育及古地理等均有重要的科研价值。由于早年过度采集作观赏鱼, 加上珠三角地区的急速都市化发展, 唐鱼曾被认为是野外已灭绝种。近年被重新发现后, 迄今只知分布于广东省珠三角地区零散地点和越南广宁省下龙湾附近。海南岛是这个珍稀种首次在亚洲大陆以外被发现的地点, 亦是唐鱼野生种群已知纬度最低的分布点。发现海南唐鱼的地点是一条低地小河, 水质清澈, 水流缓慢, 水生植物茂盛, 与广东省报道的唐鱼生境类似。发现海南种群的小河鱼类丰富, 至今记录有共生鱼类20种, 包括大量掠食性物种, 但唐鱼是该地的优势种之一。在不同月份都可以发现体长10 mm以下的仔鱼, 显示海南岛的唐鱼无明显的繁殖季节。海南岛跟亚洲大陆隔离历史长, 其唐鱼与亚洲大陆种群在形态、分子水平上是否存在明显差异, 不同种群间的系统发育关系如何, 海南唐鱼的保护重要性是否更为突出, 是目前正在研究的课题。

关键词: 唐鱼; 淡水鱼; 新纪录; 生态; 海南; 中国

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The genus *Tanichthys* Lin 1932 is a primitive member of the speciose family Cyprinidae. Only two species, *T. albonubes* Lin 1932 and *T. micagemmae*

Freyhof & Herder 2001, are known. A third, *T. thacbaensis* Nguyen & Ngo 2001, from Yen Bai Province in northeastern Vietnam, was described in a

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*Corresponding author(通讯作者), E-mail: boscokf@kfbg.org

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Vietnamese publication (Eschmeyer & Fricke, 2008), but the validity of this taxon remains to be studied.

Tanichthys albonubes was first discovered on White Cloud Mountain (Latitude ca. 23° N; known as Baiyunshan in Chinese) in Guangzhou City (formerly Canton), Guangdong Province, South China (Lin, 1932), and was thought to be monotypic and endemic to the Pearl River Delta Region (Chen & Chu, 1998). Because of its narrow global range and distinctive taxonomic position, the species is listed as a Class II protected animal in China's State Key Protected Animal List. Since its discovery, this brightly-colored minnow gained global popularity in the aquarium fish trade, and established feral populations have been reported from Colombia (Welcomme, 1988), Madagascar (Stiassny & Raminosoa, 1994) and Australia (Corfield et al, 2008). However, *T. albonubes* has not been recorded in the wild since the 1980s, and the species was feared extinct due to a combination of over-collection by aquarists and, perhaps most important, large-scale urbanisation of the Pearl River Delta Region (Chen, 1936; Yue & Chen, 1998; Wang & Xie, 2004). In recent years, wild populations have been rediscovered, from a coastal stream draining into Halong Bay of Quang Ninh Province in northeastern Vietnam bordering China's Guangxi Province (Kottelat, 2001; Maurice Kottelat, *pers. comm.*, 2009), and subsequently in isolated pockets close to its type locality and coastal Guangdong Province (Yi et al, 2004; information from websites).

1 Methods

At the invitation of Hainan Provincial Forestry Department, the first author and his colleagues have been conducting field surveys in an attempt to inventory biodiversity throughout Hainan Island and identify sites and species of high conservation value. Study sites include both nature reserves and unprotected forests, and special attention was paid to visit little known areas. Fishes were sampled by a combination of bankside observation, snorkeling, hand-netting and electrofishing. Water quality parameters were measured by a Hagen Master Test Kit™, and water temperature was measured by an aquarium thermometer.

2 Results

2.1 The Hainan *Tanichthys albonubes*

On 22 June 2007 we discovered a population of *T.*

albonubes on Hainan Island. The site was far from any villages, and local inhabitants assured us that aquarium fishes were not kept nor had there ever been ornamental fish breeding farms in the vicinity. We therefore believe the population is of wild origin, and this is the first time the genus *Tanichthys* has been recorded outside continental Asia. Hainan Island has a latitude range between ca. 18-20° N. All historic and current records of wild *T. albonubes* in mainland China and Vietnam have a latitude ranges between ca. 21-24° N; the Hainan record therefore represents the southernmost distribution of this species. The global distribution of wild *T. albonubes* is illustrated in Fig. 1.

2.2 Coloration and morphometrics

A few specimens were collected for photography and morphometric measurements. The Hainan *T. albonubes* shows distinctive fin coloration in life; the dorsal, pelvic and anal fins being yellowish-orange in substitute of red as seen in wild fish from Guangdong or aquarium varieties. The dorsal and anal fins, and in some specimens also the pelvic fins have an intense distal orange band; an orange dorsal midline is always present (Figs. 2, 3). Preliminary examination of a limited number of specimens suggests that morphometric characters of the Hainan *T. albonubes* are within or close to the published ranges of Guangdong populations (Tab. 1).

2.3 Ecological notes of Hainan *Tanichthys albonubes*

Hainan *T. albonubes* occurs in a clean, meandering, sluggish coastal stream and its small tributaries. The stream has a sandy/pebble substrate, and fallen leaves sometimes accumulate on the streambed. Between April–August 2007 (i.e. the rainy season), the channel width was between 30-400cm (in the main channel and the tributaries), and water depth was between 20-60cm. Water current ranged between 0.04-0.80 m/s. Water temperature in the open in August 2007 was 29.5°C, and was 27-28°C under partial/complete shade in April 2008. The species forms shoals in backwaters and sluggish sections of the stream, and always stay close to some cover, most frequently among trailing vegetation along the banks. Various water quality parameters were measured at the downstream end of the Hainan *T. albonubes* site in the afternoon of 12 August 2007; the weather was sunny, with a daytime temperature of 35.2 °C and water temperature of 29.5°C in the open. The water tested was slightly acidic, soft, and unpolluted (Tab.2).

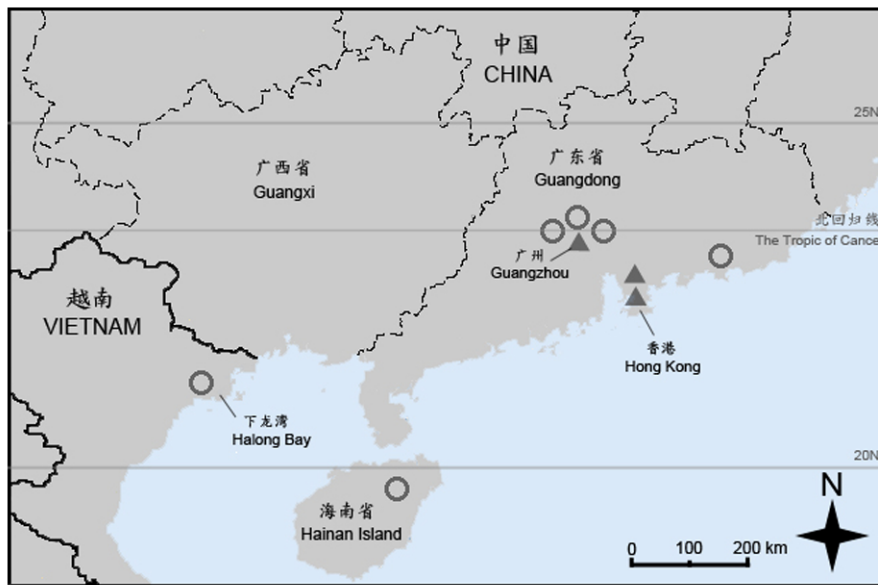


Fig. 1 Global distribution of wild *Tanichthys albonubes*
Circles represent current sites, triangles represent historic sites.

Tab. 1 Morphometric data of wild *Tanichthys albonubes* from different localities

Characters	Hainan Island (n=3)	Guangdong		
		White Cloud Mountain, (n=11)	Conghua (n=40)	Shenzhen (n=3)
Standard length (SL) (mm)	18.63-19.70	21.00 (holotype)	19.50-26.30	26.00-30.00
SL/body height	3.85-4-15	4.2	3.4-4.4	3.7-3.9
SL/head length	3.42-3.59	4.2	4.0- 5.1	4.3-4.5
Dorsal fin ray count	II - 6	II -7	III-6	II - 6
Anal fin ray count	III- 8-9	III- 8	III-7-8	III-8
Predorsal scale count	15-16	“About 14”	--	15
Scale count along lateral midline	32	“About 30”	30-32	30-32
Circum-caudal peduncle scale count	12	14	-	14
Scale count between dorsal fin origin and pelvic fin origin	8	7	-	-
Sources	This study	Lin (1932)	Yi et al (2004)	Ye & Song (1991)

Tab. 2 Water parameters of the Hainan *Tanichthys albonubes* site measured on 12 August 2007

Water parameters	Reading
pH	6.4
Hardness-GH (mg/L)	< 20
Hardness-KH (mg/L)	<10
NH ₃ (mg/L)	0.1
NO ₃ ⁻ (mg/L)	<5
NO ₂ ⁻ (mg/L)	0.1
PO ₄ ³⁻ (mg/L)	0.25

The catchments area is a mosaic of secondary forest, shrubs and abandoned agricultural plots, and some

reaches of the stream with *T. albonubes* have a complete canopy cover. The stream section with *T. albonubes* is approximate 1.5km in length with an altitudinal range between sea-level to 36m asl. No *T. albonubes* can be found upstream with steeper gradient and generally stronger current, and downstream where it flows through open, intensively-cultivated farmland with little bankside woody plants. Bankside trailing plants and hydrophytes are abundant; one characteristic plant along the stream bank is *Pandanus gressittii*, the spiny leaves usually form an overhanging dense mass in which *T. albonubes* take shelter. Tab. 3 is a checklist of hydrophytes recorded from the site.

Tab. 3 Checklist of hydrophytes found in the Hainan *Tanichthys albonubes* site

Family	Species	Growth form
Acanthaceae	<i>Gendarussa vulgaris</i>	Emergent
Araceae	<i>Colocasia antiquorum</i>	Emergent
Commelinaceae	<i>Commelina</i> sp.	Emergent
Commelinaceae	<i>Floscopa</i> sp.	Emergent
Cyperaceae	<i>Cyperus</i> sp.	Emergent
Cyperaceae	<i>Fimbristylis</i> sp.	Emergent
Eriocaulaceae	<i>Eriocaulon</i> sp.	Emergent
Hydrocharitaceae	<i>Blyxa japonica</i>	Submerged
Lythraceae	<i>Rotala rotundifolia</i>	Emergent
Onagraceae	<i>Jussiaea repens</i>	Floating
Onagraceae	<i>Ludwigia prostrata</i>	Emergent
Pandanaceae	<i>Pandanus gressittii</i>	Emergent
Parkeriaceae	<i>Ceratopteris thalictroides</i>	Emergent
Pontederiaceae	<i>Monochoria hastate</i>	Emergent
Pontederiaceae	<i>Monochoria vaginalis</i>	Emergent
Scrophulariaceae	<i>Limnophila</i> sp.	Emergent

A total of 21 freshwater fish species, including *T. albonubes*, were recorded from the site. Other common native species include *Parazacco (spilurus) fasciatus*, *Nicholsicypris normalis*, *Puntius semifasciolatus*, *Misgurnus anguillicaudatus*, *Oryzias curvinotus* and *Macropodus opercularis*. Predatory species recorded were *Anguilla marmorata*, *Clarias fuscus*, *Monopterus albus*, *Eleotris oxycephalus*, *Glossogobius giurus*, *Anabas testudineus*, *Channa gachua* and *Channa maculata*. Invasive *Gambusia affinis* and *Oreochromis* sp. were present also but were scarce in the (mainly) shady stream section where *T. albonubes* is common. Fish life was abundant but *T. albonubes* is a co-dominant species despite being one of the smallest species in the fish community. Other (semi-)aquatic potential predators recorded include the water snakes *Enhydris chinensis* and *Xenochrophis piscator*, as well as the bullfrog *Hoplobatrachus tigrina*.



Fig. 2 Wild *Tanichthys albonubes* from Hainan Island, China (Photo: Bosco Chan)

Individuals less than 10mm in total length could be observed in most months, suggesting the species may be able to breed year round in the warm climate of tropical Hainan Island. However, Hainan *T. albonubes* appears less tolerant to cold temperatures compare to at least aquarium-bred stock. Since September 2007 nine wild Hainan and a dozen of aquarium-bred *T. albonubes* were kept indoor in two unheated tanks side-by-side, but the Hainan *T. albonubes* started to die off during a prolonged cold spell in February 2008, when water temperature of the tank remained $<15^{\circ}\text{C}$ for over two weeks; the

aquarium-bred stock was unaffected. Fish density in the wild appears normal up after the cold spell.

3 Discussion

Chen *et al* (2008) studied the molecular and morphological differentiation of “*Opsariichthys bidens*” complex in China, and the results suggested the Hainan population is genetically and morphologically distinct from mainland China populations. The Hainan-endemic species *O. hainanensis* Nichols & Pope 1927 has been revalidated and is considered a basal member of the

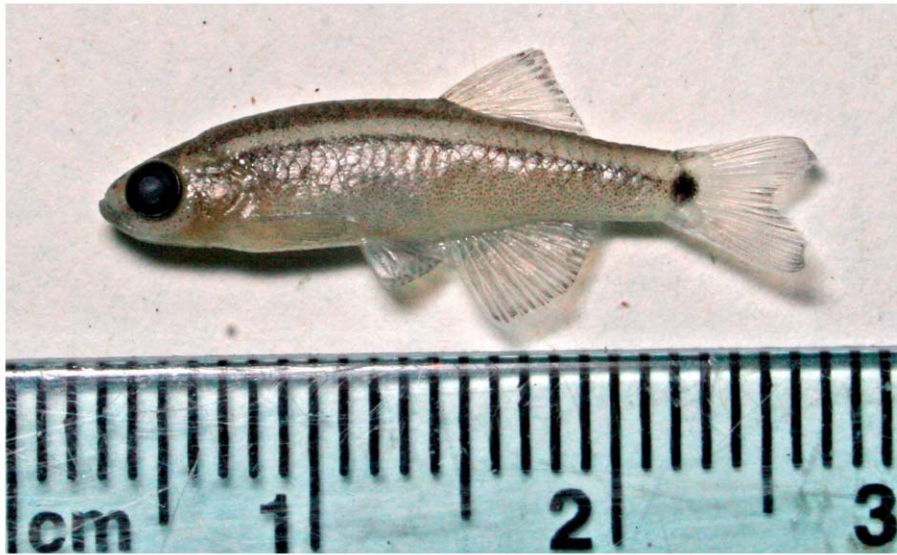


Fig. 3 Specimen freshly-preserved in 10% formalin (Photo: Bosco Chan)

genus. The discovery of Hainan *T. albonubes* therefore has important implications for the studies on mechanism of population differentiation and on the origin of *T. albonubes*. This is the first time the genus *Tanichthys* has been recorded outside continental Asia. Hainan Island has a latitude range between 18-20° N, and is more than 400km south of any known sites where the species has been reported. The same distributional pattern has also been found in a genus of gomphid dragonfly (Zhang & Tong, 2009) and a rare tree *Bretschneidera sinensis* (Zhang *et al*, 2007), both recently discovered on Hainan Island which were thought to have a predominately subtropical distribution.

T. albonubes has a disjunct distribution; the major range is close to the Tropic of Cancer north of Guangzhou City, another population was recently discovered in coastal Guangdong at Shanwei (information from websites), and there was a probably extinct population in nearby Shenzhen and Hong Kong, by the estuary of the Pearl River (Weitzman & Chan, 1966; Ye & Song, 1991). These, as well as the Vietnamese population and the Hainan population, may have been isolated genetically for a significant period of time. Genetic studies of their relationship and their relative conservation significance are needed urgently. Such work has been initiated in collaborations with researchers working on the Guangdong populations.

We tried to locate other *T. albonubes* populations in the neighbouring streams, but so far it can only be found in the site of original discovery, although similar habitats are located in the vicinity. To safeguard the newly discovered Hainan population, the exact locality of this discovery cannot be revealed, as hobbyists are always looking for “new imports” or “new varieties” in the aquarium trade, and a small, single population like the current Hainan *Tanichthys* would be particularly vulnerable to commercial collecting pressure. Nonetheless, relevant government authorities have been and/or will be notified and we are working to protect the site from potential destructive activities.

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