ASIAN PANGASIIDS—AN EMERGING PROBLEM FOR EUROPEAN INLAND WATERS? SYSTEMATIC AND PARASITOLOGICAL ASPECTS

Beata WIĘCASZEK [1*], Sławomir KESZKA [1], Ewa SOBECKA [2], and Walter A. BOEGER [3]

[1] *Division of Fish Systematics*, [2] *Division of Fish Diseases, West Pomeranian University of Technology, Szczecin, Poland*

[3] *Departamento de Zoologia, Universidade Federal de Parana, Brazil*

Więcaszek B., Keszka S., Sobecka E., Boeger W.A. 2009. Asian pangasiids—an emerging problem for European inland waters? Systematic and parasitological aspects. Acta Ichthyol. Piscat. 39 (2): 131–138.

Background. Asian pangasiids (Actinopterygii: Siluriformes: Pangasiidae), commonly referred to as "panga", have recently became an important item on the European fish markets. The fish are currently imported from south-east Asia but the growing consumers' demand is likely to motivate European fish growers to culture the "panga" locally. This in turn could bring about unforeseeable consequences for the aquatic environment. The presently reported study provides the first record of a pangasiid fish (two specimens) from the European natural waters. We attempted to identify the fish through complex morphometric procedures and to study all their parasites, thus determining their potential threat for the environment.
Materials and Methods. Two specimens of pangasiid fish were captured in a pond, in the city of Szczecin, Poland. The fish were examined following procedures commonly accepted in morphological studies yielding detailed measurements. The key structures were described and illustrated (e.g., the shape of dentition on both the vomerine and palatine plates). The measurements were taken with an electronic calliper and a dissecting microscope (Nikon SMZ 1000), coupled with the Lucia Measurement System. Additionally, during necropsy, selected organs were checked for the presence of parasites.
Results. One of the fish specimens hosted the monogenoid parasite, *Thaparocleidus caecus*, that has never been found in Europe. Metric and meristic characters of fish studied, as well as the presence of monogenoid *T. caecus* suggest that the fish found were representatives of *Pangasianodon hypophthalmus,* however, some features, especially those related to the ratio between fins and body or total length, differ markedly from the species description. Comparative analysis suggested that the two specimens collected in Szczecin are hybrids, most likely of *P. hypophthalmus* with other species, of unknown origin, presumably imported from Thailand.
Conclusion. The specific identity of pangasiids imported alive to Europe should be monitored in the future. Additional genetic studies are needed. The monogenoid parasite found on the fish studied poses no threat to the native ichthyofauna (because of its very narrow host-specificity).

Keywords: invasive species, *Pangasianodon hypophthalmus, Pangasius bocourti,* Monogenoidea, hybrids, parasite, *Thaparocleidus caecus,* Poland

INTRODUCTION

Some species of the pangasiid catfishes are economically very important and have a large culture potential. They have been successfully bred and cultured in Thailand and Vietnam (Lerssutthichawal et al. 1999), from where they are exported to the European and American markets, processed mainly into fillets. Those fish, commonly referred to as "panga", have hitherto been unknown to Europe and the USA. The most valuable catfish species are: sutchi catfish, *Pangasianodon hypophthalmus* (Sauvage, 1878), and basa, *Pangasius bocourti* Sauvage, 1880, which can be raised in the river-based cages or earth-constructed ponds. Their hybrids are also of high economical value (Hung et al. 2003). Pangasiids were also experimentally cultured in Puerto Rico during 2003–2004. They were successfully reproduced and cultured with results similar to those achieved in Asian aquaculture (McGee 2005). Moreover, *Pangasius* sp. is regarded as a new species for aquaculture (however not new to market or consumers) in central and eastern Europe (Varadi 2008). It is anticipated that in the next 5 years worldwide aquaculture production of *Pangasius* sp. could be similar to that achieved with tilapia and salmon (McGee 2005).

* Correspondence: Dr Beata Więcaszek, Zakład Systematyki Ryb, Zachodniopomorski Uniwersytet Technologiczny, ul. Kazimierza Królewicza 4, 71-550 Szczecin, Poland, phone: +4891 449 6637, fax: +4891 449 6657, e-mail: *beata.wiecaszek@zut.edu.pl*

Juveniles of *P. hypophthalmus* called sutchi catfish, shark-catfish, iridescent or mystic shark are commercial in aquarium-trade as well (McGee 2005).

Two specimens of pangasiids were captured in a pond, situated in the area of the city of Szczecin. They were probably released there by ornamental fish keepers, because of their large size (over 33 cm). We suspect that many "oversized" pangasiids are released into the wild because very few home fish keepers can cope with fishes attaining sizes up to 130 cm.

The literature on pangasiid catfishes taxonomy is very scarce. Pouyaud et al. (2000) who gave a contribution to the phylogeny of pangasiid catfishes based on allozymes and mitochondrial DNA, concluded that the available morphological and osteological information on Pangasiidae remains very limited. A detailed study, using a large variety of characters, is urgently needed.

The current paper was aimed at presenting an invasive species of catfish with its corresponding parasite new to the natural waters of Poland. This study broadens the knowledge on pangasiids. It verifies also if along with the change of host's habitat, the parasite changed their microhabitat as well. A positive response would leave us to evaluate whether an adaptation to the new conditions of life may influence the morphological changes of the parasite body.

MATERIALS AND METHODS

Two specimens of pangasiids were captured in a small natural pond situated in a park within the city limits of Szczecin (Poland, lat 53º28´N, long 14º16´E), in April 2005. The coloration of these specimens was uniformly grey. The total length (TL) and weight were as following: 42.5 [1] and 33.2 cm [2] and 611.3 and 266.0 g, respectively (specimen numbers are given in square brackets).

In addition 8 sutchi catfish [3] obtained from a pet-shop in Szczecin, imported directly from Thailand (5.88 – 7.91 cm TL; 0.8–4.7 g) were also examined, with intention to compare their parameters with those of the two fish caught in Szczecin. With similar purpose, we studied one specimen of *Pangasianodon hypophthalmus* [4] (as determined by a fish-breeder from the Lower Mekong River drainage, Vietnam), and one specimen of *Pangasius bocourti* [5] (46.0 cm, 1170 g and 44.5 cm, 800 g, respectively). Measurements followed the methods described by Gustiano (2003), markedly modified (Fig. 1).

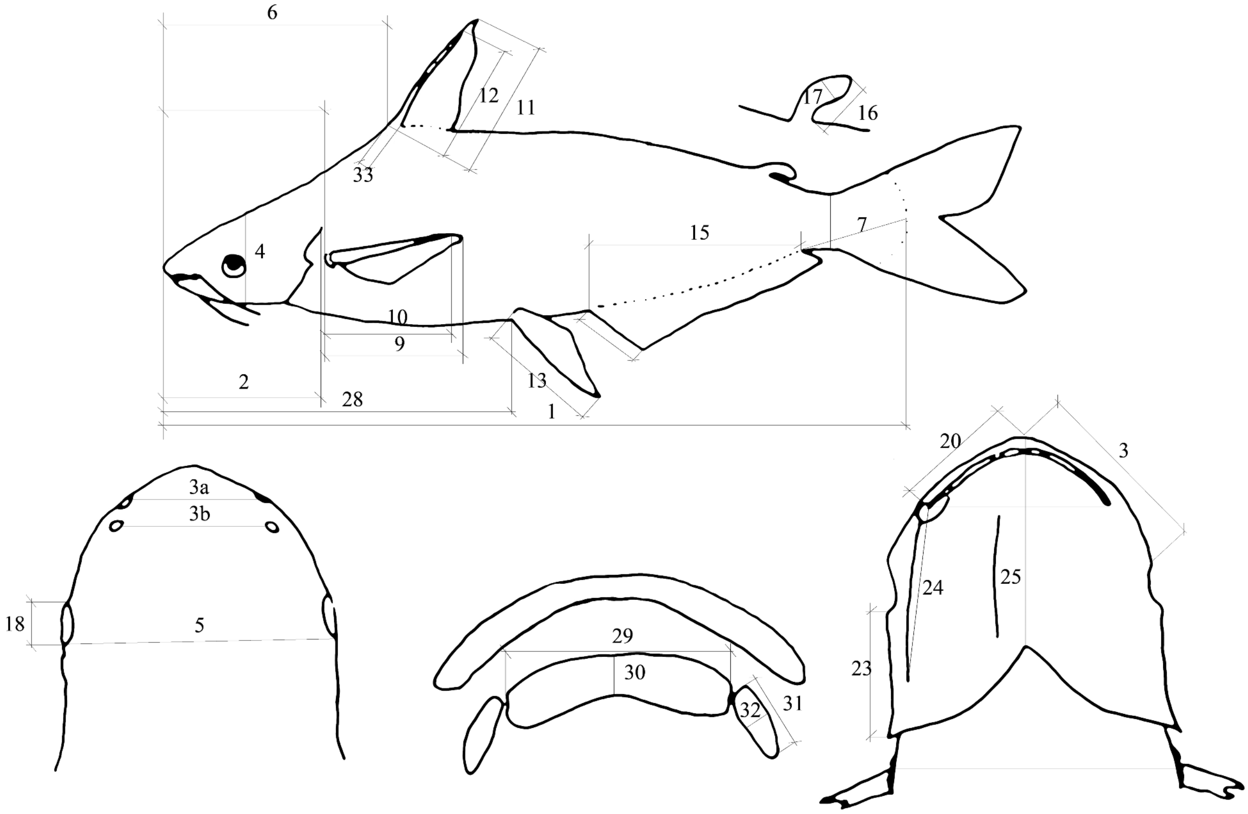

Fig. 1. Measurement design (original, based on Gustiano 2003); 1: Standard length; 2: Head length; 3: Snout length; 3a: Anterior snout width; 3b: Posterior snout length; 4: Head depth; 5: Head width; 6: Predorsal length; 7: Caudal peduncle length; 8: Caudal peduncle depth; 9: Pectoral fin length; 10: Pectoral spine length; 11: Dorsal fin length; 12: Dorsal spine width; 13: Pelvic fin length; 14: Anal fin height; 15: Anal fin length; 16: Adipose fin height; 17: Adipose fin width; 18: Eye diameter; 19: Mouth width; 20: Lower jaw length; 21: Interorbital length; 22: Distance snout to isthmus; 23: Postocular length; 24: Maxillary barbel length; 25: Mandibulary barbel length; 26: Body width; 27: Prepectoral length; 28: Prepelvic length; 29: Vomerine width; 30: Vomerine length; 31: Palatine length; 32: Palatine width; 33: Dorsal spine width

Table 1

Metric characters of the pangasiid catfishes examined, in hundredths of standard length (SL), total length (TL), and head length (HL)

Character and its	[1, 2]			[3]			[4]			[5]		
symbol	%SL	%TL	%HL	%SL	%TL	%HL	%SL	%TL	%HL	%SL	%TL	%HL
Total length (TL)	118.0	100		119.62	100		115	100		117.1	100	
Fork length (FL)	106.4	90.2		106.04	88.66		105	91.3		106.6	91.0	
Standard length (SL)	100	84.7		100	83.64		100	86.9		100	85.4	
Head length (HL)	25.6	21.7	100	24.91	20.84	100	20	17.4	100	22.9	19.6	100
Head depth (hc)	13.9	11.7	54.3	12.45	10.40	50.62	11.9	10.3	59.4	12.6	10.8	55.2
Preorbital distance (prO)	8.2	6.9	32.0	7.12	5.95	28.89	7.5	6.5	37.5	7.4	6.3	32.2
Horizontal diameter of eye (Oh)	4.1	3.5	16.0	7.43	6.22	29.96	2.5	2.2	12.5	3.3	2.8	14.4
Postorbital distance (poO)	15.0	12.7	58.5	12.86	10.76	52.3	10.8	9.4	53.8	13.7	11.7	59.8
Interorbital distance (io)	14.5	12.3	56.7	15.89	13.28	64.86	11.8	10.2	58.8	11.6	9.9	50.6
Anterior snout width (asw)	4.9	2.1	19.0	7.0	5.85	28.42	5.0	4.4	25.0	6.05	5.1	26.4
Posterior snout length (psl)	6.7	2.8	26.1	9.26	7.74	37.75	6.3	5.4	31.0	7.8	6.6	33.9
Snout to isthmus distance (sid)	6.4	2.7	25.0	12.08	10.10	49.1	5.5	4.8	27.5	—	—	—
Vomerine teeth length (vtl)	1.4	1.2	5.3	—	—	—	3.9	3.4	19.3	2.0	1.7	8.9
Vomerine teeth width (vtw)	1.3	1.1	4.9	—	—	—	0.8	0.7	3.8	0.8	0.7	3.5
Palatine teeth length (ptl)	2.4	2.0	9.2	—	—	—	2.4	2.1	12.0	2.1	1.8	9.2
Palatine teeth width (ptw)	0.4	0.3	1.5	—	—	—	0.9	0.8	4.4	0.2	0.2	1.0
Head width (lac)	15.2	12.9	59.6	15.29	12.78	62.44	17.8	15.4	88.8	15.0	12.8	65.5
Width of mouth (lam)	9.3	7.9	36.3	9.68	8.09	39.54	11.3	9.8	56.3	11.0	9.4	48.3
Length of maxillary barbel (lbi)	9.1	7.9	35.5	9.86	8.2	41.09	10.0	8.7	50.0	7.1	6.1	31.0
Length of mandibulary barbel (lbs)	3.4	2.9	13.2	5.9	4.93	24.64	7.0	6.1	35.0	2.9	2.5	12.6
Body width (laco)	11.5	9.7		15.06	12.58		10.0	8.7		10.0	8.5	
Maximum body depth (H)	21.1	17.9		20.49	17.11		27.8	24.1		24.5	20.9	
Minimum body depth (h)	7.3	6.2		7.37	6.16		7.0	6.1		8.4	7.2	
Predorsal distance (pD)	40.3	34.1		39.01	32.63		34.5	30		39.5	33.7	
Preanal distance (pA)	55.2	46.8		55.48	46.4		61.5	53.3		56.1	47.8	
Preventral distance (pV)	43.0	36.4		44.44	37.15		48.1	41.9		42.5	36.3	
Prepectoral distance (pP)	23.9	20.2		23.75	19.86		—	0		0	0	
Ad distance (D)	32.9	27.9		35.43	29.6		33.3	28.9		33.7	28.7	
C distance (ad)	17.2	14.6		11.96	10.04		10.5	9.1		10.1	8.7	
A–C distance	6.4	5.4		5.99	5.03		6.0	5.2		5.3	4.5	
Length of D (lD)	6.5	5.5		7.56	6.32		7.5	6.5		6.7	5.7	
depth of D (hD)	23.3	19.7		17.98	15.0		13.3	11.5		13.7	11.7	
Length of P (lP)	4.8	4.1		4.18	3.5		3.5	3.0		4.1	3.5	
Depth of P (hP)	20.9	17.7		16.95	14.15		15.9	13.8		12.6	10.8	
Length of V (lV)	14.8	12.6		11.13	9.28		10.5	9.1		13.2	11.2	
Length of A (lA)	31.3	26.5		30.08	25.16		23.5	20.4		28.7	24.5	
Depth of A (hA)	13.5	11.4		13.97	11.7		9.0	7.8		9.6	8.2	
Length of ad. (ad)	1.6	1.3		3.72	3.12		2.0	1.7		1.3	1.1	
Depth of ad. (had)	3.7	3.2		6.88	5.77		4.0	3.5		4.0	3.4	

[1, 2] Pangasiidae gen. sp. n = 2 (a pond in Szczecin, Poland); [3] Pangasiidae gen. sp. n = 8 (pet-shop in Szczecin, individuals imported from Thailand); [4] *P. hypophthalmus* × *P. djambal* n = 1; [5] *P. bocourti* × *P. hypophthalmus* n = 1 (from a Vietnamese fish farm, drainage of the lower Mekong River.

Measurements were taken with an aid of electronic caliper and microscope Nikon SMZ 1000, coupled with the Lucia Measurement System, with the accuracy of 1 mm, except for the sample of 8 small specimens, where the accuracy was to 0.1 mm.

The following meristic characters were studied: number of dorsal, anal, pelvic and ventral fins and number of vertebrae. Total vertebral number included the four anteriormost vertebrae, associated with the Weberian apparatus, and the hypural fan centrum. Abdominal and caudal vertebrae were tabulated separately. Gill rakers were counted on the first branchial arch. The shape of dentition was examined both on the vomerine and palatine plates.

Additionally, during necropsy, the following organs were checked for the presence of parasites: skin, vitreous humour and eye lens, buccal cavity, gills, heart, gonad, liver, spleen, gall bladder, alimentary tract, kidney, swimbladder, and the peritoneum. The parasites found were identified from wet mounts and they were fixed and preserved in 75% alcohol, mounted in Hoyer's Medium on microscopic slides and identified. The slides of mucus and parenchymal tissue of the internal organs were exam-

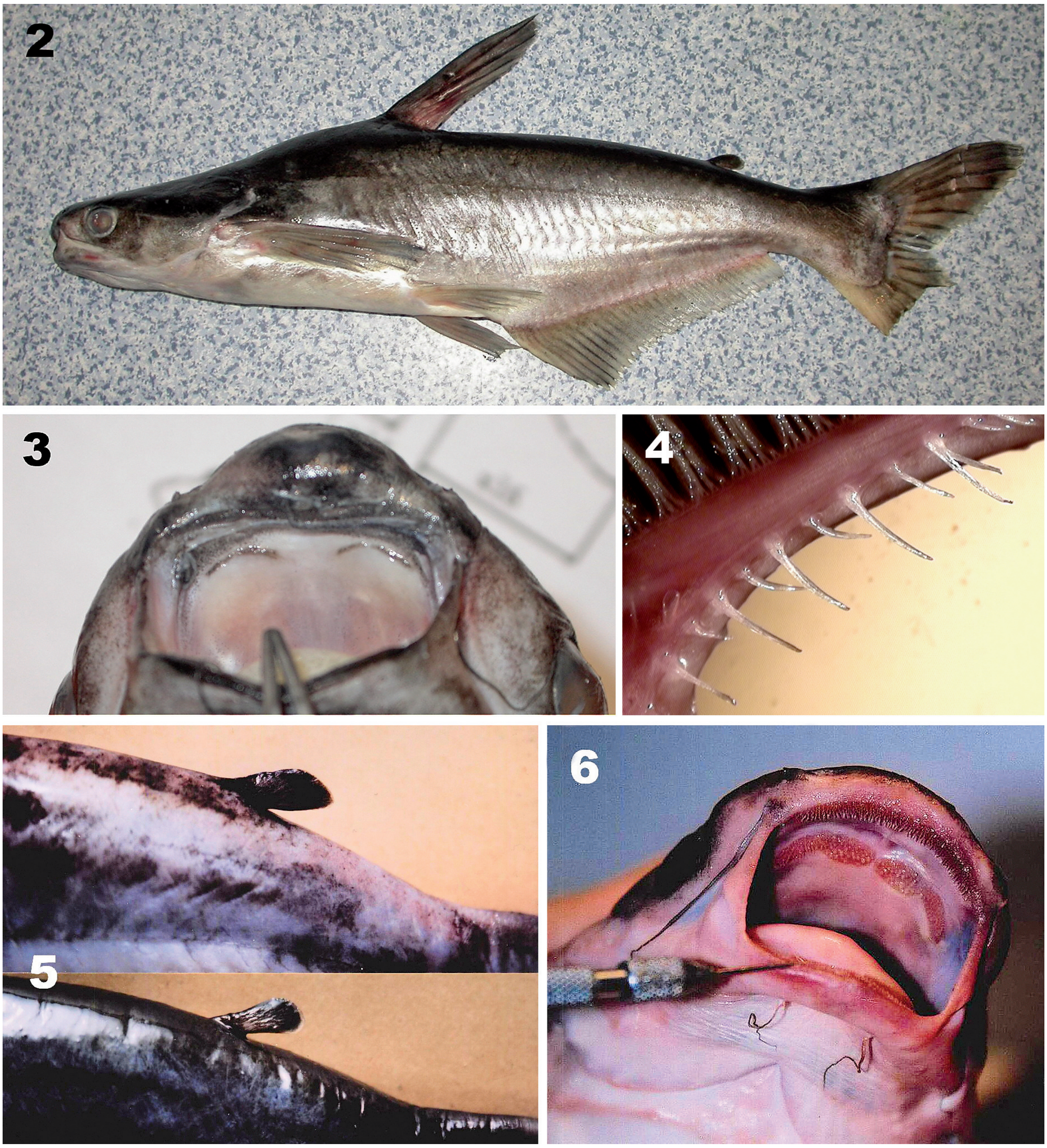

Fig. 2–6. Details of pangasiid morphology; **Fig. 2.** Pangasiid specimen (TL 33.2 cm, W 266.0 g) captured in the pond situated within the city limits of Szczecin, in April 2005 (Photo S. Keszka); Entire fish laterally; **Fig. 3.** The same fish; dentition and palatine; **Fig. 4.** The same fish; arrangement of gill rakers on the first gill arch; **Fig. 5.** A comparative view on the shape of adipose fin; upper the *hypophthalmus*-like, lower the *bocourti*-like; **Fig. 6.** The *djambal*-like dentition of the pangasid hybrid *P. hypophtalmus* × *P. djambal* from a Vietnamese fish farm (Photo S. Keszka)

ined under Olympus BX 50 microscope with differential interference contrast microscopy (DIC) Nomarski. The stomach contents were studied by the decantation method. The parasites were preserved in the Canada balsam and then alum-carmine stained. Measurements of hard elements of the parasite haptor were obtained using a PZO 15 KM measuring eyepiece.

RESULTS

Fish examination. We were not able to promptly identify the two pangasiids captured from the wild in Szczecin, Poland, when they arrived to our laboratory. The first assumption that they represent *P. hypophthalmus*, was rejected after measurements (results are summarized in Table 1). Meristic characters of the pangasiids studied are presented in Table 2. The majority of metric and meristic characters, as well as the presence of the monogenoid *Thaparocleidus caecus* indicate that the animals are members of *Pangasianodon hypophthalmus,* however, some features, especially those pertinent to the ratio between the length of fins to the body- or total length and the ratio of eye diameter to the length of the head, differed markedly from the species description (Roberts and Vidthayanon 1991) (Fig. 2). Pangasiids examined [1, 2] have longer head (25.6% of SL) and larger eye diameter when compared to the specimens *P. hypophthalmus* (21.6 and 30.0 cm long, respectively) demonstrated in the paper of Roberts and Vidthayanon (1991). The dorsal fin of the specimens studied is very high (23.3% of SL), with relatively short base. Pectoral fins are very long (20.9% of SL), overlapping with the origin of anal fin.

When compared to the juveniles studied, specimens captured in the pond in Szczecin have longer pectoral and ventral fins, as well as higher dorsal fin and smaller eye diameter. Meristic measurements in both samples overlap, except for the gill-rakers count. The number of gill-rakers are markedly lower in the sample of juveniles, however it

Table 2

Meristic characters and weight of pangasiid catfishes studied

Character and its symbol	[1, 2]		[3]		[4]	[5]
	range	mean	range	mean	*n* = 1	*n* = 1
Unbranched rays in D (Du)	1–1	1	1–1	1	1	1
Branched rays in D (Db)	6–6	6	6–7	6.5	7	7
Unbranched rays in A (Au)	1–1	1	1–1	1	1	1
Branched rays in A (Ab)	31–32		31–37	33.88	30	34
Unbranched rays in P (Pu)	1–1	1	1–1	1	1	1
Branched rays in P (Pb)	9–9	9	8–10	9.13	14	11
Unbranched rays in V (Vu)	1–1	1	1–1	1	1	1
Branched rays in V (Vb)	7–7	7	6–8	7.13	5	7
Gill rakers on 1st branchial arch (sp. br.)	30–30	30	13–18	16.78	45	36
Vertebral count (vt_t)	38–38	38	38	38	40	38
Abdominal vertebral count (vt_a)	14–14	14	13–14	13.5	15	13
Caudal vertebral count (vt_c)	24–24	24	24–25	24.5	25	25
Weight [g]	266.0–611.3	438.7	0.8–4.7	2.38	1170	800

Table 3

Length (μm) of some skeletal elements of *T. caecus* (*n* = 20) recorded in pangasiid catfish examined

Reference		Marginal hooks length	Dorsal anchor length	Ventral anchor length	Dorsal bar length	Ventral bar length
Mizelle and Kritsky 1969	Mean	12	46	21	32	50
	Range	11–13	45–48	20–22	29–34	44–59
Lim 1990	Mean	11	43	20	44	25
	Range	10–12	40–44	19–21	44–52	22–26
Present study	Mean	12	46	22	45	28
	Range	10–13	44–48	20–23	43–49	25–29

is probably increasing in number with size of the fish, as in *Clarias gariepinus* (Siluriformes: Clariidae) (see: Teugels 1984).

When meristic data of "wild" pangasiids is compared with those available in the literature (Roberts and Vidthayanon 1991, Gustiano 2004), they fit in the ranges of *P. hypophthalmus*, with exception of a slightly lower number (by 1) of abdominal and caudal vertebrae. The palatal tooth bands provide very useful distinctions among species of pangasiids. Two specimens examined [1, 2] have dentition typically *Pangasianodon hypophthalmus* (Fig. 3), i.e., the palatine and vomerine plates of each side are more or less perfectly joined into a single curved toothplate, but the vomerine portions of each side are more or less widely separated at the midline (Roberts and Vidthayanon 1991). Gill rakers were typical for *P. hypophthalmus* (Fig. 4), i.e., smaller rakers alternated with large ones (Roberts and Vidthayanon 1991). In the sample of 8 juvenile specimens from aquarium studied, the oral dentition as well as arrangement and shape of gill rakers on the first gill arch were typical for *P. hypophthalmus,* too.

The shape of adipose fin seems to have significant utility as a diagnostic character. It differs in shape between the *hypophthalmus*-like pangasiids studied and the *bocourti*-like. In the *hypophthalmus*-like pangasiids the adipose fin is broad with a wide base while in *bocourti*-like the base is narrow and clearly round distally (Fig. 5).

Therefore we suggest that the two specimens collected in the natural environs of Poland are hybrids, presumably of *P. hypophthalmus* with another species, of unknown identity and origin, most likely from a pet-shop, also imported from Southeast Asia. This proposal is supported by the presence of an Asian monogenoids.

Two specimens, initially declared as *P. hypophthalmus* [4] and *P. bocourti* [5], used in the comparative study, obtained from Vietnamese aquaculture, appear to be hybrids as well. The morphology of the first specimen [4] is *hypophthalmus*-like, except for the teeth (vomerine and palatine) which is *P. djambal*-like. This result is consistent with Gustiano (2004), who described hybrids of the two species mentioned above, as an effect of artificial hybridization in the Indonesian aquaculture. The morphology of the gill rakers is typical for *P. hypophthalmus*, however their number (45), according to Roberts and Vidthayanon (1991) exceeds both that of *P. hypophthalmus* (29–38) and *P. djambal* (24–35), while according to Gustiano (2004), it fits the upper range. Similarly, the morphology of the second specimen [5] is *bocourti*-like, again, except for the teeth, that is *hypophthalmus*-like, according to the key of Roberts and Vidthayanon (1991). Gill rakers were typical for *P. bocourti*, i.e., rakers of equal size. Their number (36) falls in the lower range reported for this species by Roberts and Vidthayanon (1991) (36–46).

Parasite examination. On the gill filaments of the one pangasiid collected in the natural waters of Poland [2] numerous monogenoids were found. A total of 372 individuals were collected, ranging from 97 on the external arch to 131 on the fourth arch. The monogenoids are 812-µm long, pigmented eye spots, 14 hooks, ventral anchor smaller than dorsal, dorsal and ventral bars v-shaped. Based on detailed morphological examinations of 20 specimens the species was determined as *Thaparocleidus caecus* (Mizelle et Kritsky 1969) Lim 1996 (Monogenoidea: Ancyrocephalidae) (Table 3).

No other parasites were detected in other organs and tissues of the fish examined.

DISCUSSION

The occurrence of exotic or non-native fish species in the natural water environment of Europe can be a really serious problem. Invasion of the non-native fishes, a process with significant social and economic impacts, is one of the main causes of the decline of native freshwater fishes worldwide (Pimentel et al. 2000). Major sources of new fish invasions are: 1) recreational fisheries, increasing markedly in the last few years; 2) introduction of fishes to support fisheries; 3) new species in the aquaculture and their escapes; 4) aquarium trade and live fish markets. Ornamental fishes, which are troublesome in the aquarium culture (e.g., pumpkinseed, *Lepomis gibbosus*) or reach unexpectedly large size (e.g., pirapitinga *Piaractus brachypomus*) (see: Boeger et al. 2002, Więcaszek et al. 2007), are often released to natural bodies of water by ornamental fish keepers. Successful overwintering in Polish waters (except for the warm-water canals of the power plants) would not be possible for the tropical exotic fish species, however it could take place in the warm waters of southern Europe. It is a two-sided problem: firstly these fishes may exert an adverse ecological effect after introduction as potential pests and, secondly, they may disseminate exotic parasites, capable of colonizing native fish species. However according to the so-called "rule of tens" only 10% of introductions end with permanent establishment and only 10% of cases of successful naturalization may be regarded as "pests" or "weeds" (Williamson 1996). Nonetheless, there is a growing concern about a potential impact of the above-mentioned parasites or pathogens on native fish species (Kennedy 1975).

Monogenoids in the Southeast Asia often present specificity a given group of hosts, at subclass, family, genus, as well as species levels. This suggests that, in the majority of cases, the hosts and their monogenoids have co-evolved (Lim 1998). The monogenoid *Thaparocleidus caecus* was described from *Pangasianodon hypophthalmus* (see: Lerssutthichawal et al. 1999). However it was reported also from *P. larnaudii* and *P. conchophilus* (see: Lerssutthichawal et al. 1999). Therefore, it is conceivable that *T. caecus* can be also present in the hybrids of *P. hypophthalmus* with other species.

The first species of Monogenoidea described from *Pangasius* spp. was *Haplocleidus pangasi* Tripathi, 1957 from India. Twenty-one years later, Gusev redescribed the species and transferred it to another genus as *Silurodiscoides pangasi* (Tripathi 1957) Gusev, 1978 (Gusev 1978). *Thaparocleidus caecus* was reported for the first time in USA from the gills of an undetermined aquarium fish species. The authors of the species description, Mizelle and Kritsky (1969) included the parasite in the genus *Ancylodiscoides* Yamaguti, 1937 as *Ancylodiscoides caecus.* A redescription of *Ancylodiscoides caecus* was provided by Lim (1990) from the gills of *P. hypophthalmus* imported from the Thailand and cultured in Malaysia. The new redescription of *Silurodiscoides caecus* (Mizelle and Kritsky 1969) by Gusev (1978), was supplemented by the newly recorded structures of the parasite. The same author (Gusev 1996) stated that *Silurodiscoides* Gusev, 1976 was considered a junior subjective synonym of *Thaparocleidus* Jain, 1952, based on priority (Lim 1996). Hence, the parasite described has changed its specific name to *T. caecus* and under this name, along with *T. siamensis* (Lim 1990) Lim 1996, it is mentioned as a monogenoid from *P. hypophthalmus* of Thailand (Lerssutthichawal et al. 1999). The dimensions of the hard elements of the haptor of the species studied herein are slightly larger than those reported by Mizelle and Kritsky (1969), and Lim (1990) (Table 3). The mean total length of the parasite from this study, however, is slightly smaller. A very high value of mean intensity of infection in the sample investigated herein indicate that the length of the parasites may be strongly influenced both by their large density and a strong food-competition among them. The change of macrohabitat did not affect the presence of living parasites in one specimen. The first fish specimen examined, however, was not parasitized by *T. caecus* nor any other parasites.

Identification and morphological examinations of pangasiid catfishes seems to be very difficult, because in the areas of natural distribution (southeast Asia) escapes from the ponds and cages are common. Refugees are more frequently hybrids from aquaculture and artificially stocked (for anglers) water basins. Similarly, there is no pure species in aquarium trade; therefore fishes imported to Europe simply as "sutchi catfish" and reported in our natural water environment—could be hybrids of unknown parental individuals, not possible to detect precisely without detailed genetic studies (Maurice Kottelat, personal communication).

Taxonomic summary. Formulas the of meristic characters of pangasiids presently studied (Poland; open waters and Thailand; aquarium trade) are as follows:
Specimens from Poland:
Du 1 Db 6, Pu 1 Pb 9,Vu 1 Vb 7, Au 1 Ab 31–32, sp.br. 30, vt_t 38, vt_a 14, vt_c 24;
Specimens from Thailand:
Du 1 Db 6–7, Pu 1 Pb 8–10, Vu 1 Vb 6–8, Au 1 Ab 31–37, sp.br. 13–18, vt_t 41 vt_a 13–14, vt_c 24–25;
P. hypophthalmus × *P. djambal*:
Du 1 Db 7, Pu 1 Pb 14, Vu 1 Vb 5, Au 1 Ab 30, sp.br. 45, vt_t. 40, vt_a. 15, vt_c. 25;
P. bocourti × *P. hypophthalmus*:
Du 1 Db 7, Pu 1 Pb 11, Vu 1 Vb 7, Au 1 Ab 31–32, sp.br. 30, vt_t 38, vt_a 14, vt_c 24.

The parasite of gills, found in the fish examined, is host-specific, and arrived to Polish waters from the Far East along with its fish host. The above-mentioned fish hosted no other parasites—generalists, typical for its new water environment.

Monogenoid *Thaparocleidus caecus* is an autogenic species, for which a fish is a final host and the whole development cycle takes place in the water environment. Hence it is able to colonize new water basins only by the natural migration or the introduction of its host by the humans. The latter method was the most likely the reason of its presence in Europe, where it has never been recorded.

ACKNOWLEDGEMENTS

We thank Mr Tomasz Prus for help in providing two pangasiid catfishes from Vietnamese aquaculture.

REFERENCES

Boeger W., Piasecki W., Sobecka E. 2002. Neotropical Monogenoidea. 44. *Mymarothecium viatorum* sp.n. (Ancyrocephalinae) from the gills of *Piaractus brachypomus* (Serrasalmidae, Teleostei), captured in a warm-water canal of a power plant in Szczecin, Poland. Acta Ichthyologica et Piscatoria **32**: 157–161.

Gusev A.V. 1978. Monogenoidea presnovodnyh ryb. Principy sistematiki, analiz mirovoj fauny i ego evolûcii. [Monogenoidea of freshwater fishes. Principles of systematics, analysis of world fauna and its evolution.] Parasitologičeskij Sbornik **38**: 96–198. [In Russian.]

Gusev A.V. 1996. Issledovaniâ fauny roda *Dactylogyrus* Evrasii. [Studies on the *Dactylogyrus* fauna of Eurasia.] Doklady Akademii Nauk SSSR **167**: 950–952. [In Russian.]

Gustiano R. 2003. Taxonomy and phylogeny of Pangasiidae catfishes from Asia. Ph.D Thesis KU Leuven, Belgium.

Gustiano R. 2004. Biometric analysis of the artificial hybridization between *Pangasius djambal* Bleeker, 1846 and *Pangasianodon hypophthalmus* Sauvage, 1878. Indian Journal of Agricultural Sciences **5**: 70–74.

Hung L.T., Lazard J., Mariojouls C., Moreau Y. 2003. Comparison of starch utilization in fingerlings of two Asian catfishes from the Mekong River (*Pangasius bocourti* Sauvage, 1880, *Pangasius hypophthalmus* Sauvage, 1878). Aquaculture Nutrition **9**: 215–222. DOI: 10.1046/j.1365-2095.2003.00244.x.

Kennedy C.R. 1975. The distribution of some crustaceans fish parasites in Britain in relation to the introduction and movement of freshwater fish. Journal of the Institute of Fisheries Management **6**: 36–41.

Lerssutthichawal T., Lim S.L.H., Chinabut S. 1999. Monogeneans from the pangasiid fishes of Thailand. AAHRI Newsletter **8** (1): 1–5.

Lim S.L.H. 1990. *Silurodiscoides* Gussev, 1961 (Monogenea: Ancyrocephalidae) from *Pangasius sutchi* Fowler, 1931 (Pangasiidae) cultured in peninsular Malaysia. Raffles Bulletin of Zoology **38**: 55–63.

Lim S.L.H. 1996. *Thaparocleidus* Jain, 1952, the senior synonym of *Silurodiscoides* Gussev, 1976 (Monogenea: Ancylodiscoidinae). Systematic Parasitology **35**: 207–215. DOI: 10.1007/BF00009640.

Lim S.L.H. 1998. Diversity of monogeneans in Southeast Asia. International Journal for Parasitology **28**: 1495–1515. DOI: 10.1016/S0020-7519(98)00061-7.

McGee M.V. 2005. Aquaculture of the Asian catfish *Pangasius hypophthalmus* in Puerto Rico. Caribe Fisheries Inc. Lajas, Puerto Rico. http://www.caribefish.com/portal/index.php? (removed by publisher).

Mizelle J.D., Kritsky D.C. 1969. Studies on Monogenetic Trematodes. XXXIX. Exotic species of Monopisthocotylea with the proposal of *Archidiplectanum* gen. n. and *Longihaptor* gen. n. The American Midland Naturalist **81**: 370–386.

Pimentel D., Lach L., Zuniga R., Morrison D. 2000. Environmental and economic costs of nonindigenous species in the United States. BioScience **50**: 53–65. DOI: 10.1641/0006-3568(2000)050[0053:EAECON]2.3.CO;2.

Pouyaud L., Teugels G, Gustiano R., Legendre M. 2000. Contribution to the phylogeny of pangasiid catfishes based on allozymes and mitochondrial DNA. Journal of Fish Biology **56**: 1509–1538. DOI: 10.1111/j.1095--8649.2000.tb02161.x.

Roberts T.R., Vidthayanon C. 1991. Systematic revision of the Asian catfish family Pangasiidae, with biological observations and descriptions of three new species. Proceedings of the Academy of Natural Sciences of Philadelphia **143**: 97–144.

Teugels G. 1984. The nomenclature of African *Clarias* species used in aquaculture. Aquaculture **38**: 373–374. DOI: 10.1016/0044-8486(84)90342-9.

Varadi L. 2008. Species diversification. Upcoming species. Eastern Baltic Aquaculture Conference: "European Fisheries Fund and opportunities for the Development of Eastern Baltic Aquaculture". 6–7 May 2008; Riga, Latvia. www.eurofish.dk/filedownload.php?fileId=315.

Więcaszek B. Keszka S. Antoszek J. 2007. Pirapitinga (*Piaractus brachypomus* Cuvier, 1818)—an alien species in the natural water basins within the Szczecin city area (NW Poland). P. 20. *In*: Book of Abstracts. XII European Congress of Ichthyology, 9–13 September 2007, Dubrovnik, Croatia.

Williamson M.H. 1996. Biological invasions. Populations and community biology series. Vol. 15. Chapman and Hall, London.

Received: 14 January 2009
Accepted: 10 September 2009
Published electronically: 10 December 2009