

Parasites of Deep-Sea Sharks from the Andaman Sea with Six New Records of Parasites in Thailand

Watchariya Purivirojkul^{1*}, Phithak Chaidee² and Thanitha Thapanand-Chaidee³

ABSTRACT

Three species of deep-sea sharks, the pelagic thresher (*Alopias pelagicus*), bigeye thresher (*Alopias superciliosus*) and shortspine spurdog (*Squalus mitsukurii*), were collected from the Andaman continental shelf in the Exclusive Economic Zone within Thailand's territorial waters. All samples of the three species were infested with parasites. The 13 species of parasites found in the study were: one species of monogene (*Squalonchocotyle mitsukurii*), one species of trematode (unidentified Hirudinellid), three species of cestodes (*Nybelinia* sp., unidentified Trypanorhyncha, unidentified cestode), one species of Nematode (*Anisakis* sp.), six species of copepods (*Echthrogaleus denticulatus*, *Eudactylina acanthii*, *Lepeophtheirus* sp., *Nogagus ambiguous*, *Pagina tunica*, *Pseudopandarus* sp.) and one species of isopod (unidentified Isopod). Six species of parasites were the first reported in Thailand, namely *Echthrogaleus denticulatus*, *Eudactylina acanthii*, *Nogagus ambiguous*, *Pagina tunica*, *Pseudopandarus* sp. and *Squalonchocotyle mitsukurii* from *A. pelagicus*, *S. mitsukurii*, *A. pelagicus*, *A. superciliosus*, *S. mitsukurii* and *S. mitsukurii*, respectively.

Key words: parasite, deep-sea shark, Andaman sea, Thailand

INTRODUCTION

The Andaman Sea is a non-enclosed sea with deep oceanic waters. It possesses a rich marine ecosystem. The marine fishery resources in the Andaman Sea along the coast of Thailand can be described according to their habitats into two main groups, namely pelagic and demersal. Pelagic resources are generally exploited by purse seines, drift gillnets, liftnets and other surrounding nets. There are 17 species and groups of species of pelagic resources that are considered economically important. The demersal resources

include demersal fish, crustaceans, cephalopods and other mollusks that are mainly caught by trawls, push nets, bottom gillnets, traps, and hooks and lines. Approximately 30 families, comprising more than 300 species, have been recorded (Chullasorn, 1998). Many groups of shark are found in the Andaman Sea, including the big eye thresher, the pelagic thresher and the short spine spurdog.

The big eye thresher (*Alopias superciliosus*) and the pelagic thresher (*Alopias pelagicus*) are large lamniform sharks of the family Alopiidae. They are found in all temperate and

¹ Department of Zoology, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand.

² Deep Sea Fishery Technology Research and Development Institute, Department of Fisheries, Ministry of Agriculture and Cooperatives, Bangkok 10900, Thailand.

³ Department of Fishery Biology, Faculty of Fisheries, Kasetsart University, Bangkok 10900, Thailand.

* Corresponding author, e-mail: fsciwyp@ku.ac.th

tropical oceans of the world at depths down to 500 m. The length of *Alopias superciliosus* is up to 5 m and specimens can weigh up to 360 kg. The average size and weight of *Alopias pelagicus* is 3.7 m and 69 kg, respectively. These two species of thresher shark have been listed recently as vulnerable to extinction by the World Conservation Union (IUCN) (Wikipedia, 2008). The shortspine spurdog, *Squalus mitsukurii*, is a dogfish and a member of the family Squalidae. It is usually found swimming just above the seabed, but also moves throughout the water column on the continental shelf. They have been recorded to depths of 900 m (Compagno, 1984), but are most commonly found at depths from 10-200 m (McEachran and Branstetter, 1984).

Some parasites of these three species of deep-sea shark have been recorded in other countries, but not Thailand. In India, *Echthrogaleus denticulatus* was found in *Alopias pelagicus*. *Bariaka alopiiae*, *Dinemoura discrepans* and *Pagina tunica* were collected from *Alopias superciliosus* (Pillai, 1985). There are many records of parasitic fauna in *Squalus acanthias* in many area of the world, such as Britain (Kabata, 1979), the North Sea (Orłowska, 1979), New Zealand (Wierzbicka and Langowska, 1984), India (Pillai, 1985) and the west coast of Ireland (Henderson *et al.*, 2002). However, only one species of parasite, *Squalonchocotyle mitsukurii*, has been recorded in *Squalus mitsukurii* (Kitamura *et al.*, 2006). In addition, parasites can be used as biological tags, as this may provide data relevant to different types of studies, such as differentiating stocks and determining trophic-reproductive and recruitment migrations, as well as information about the host's diet, feeding habits and the phylogenetics of fish (Williams *et al.*, 1992; Castro-Pampillón *et al.*, 2002).

The current study aimed to gain a better knowledge of the parasites of *Alopias pelagicus*, *Alopias superciliosus* and *Squalus mitsukurii* in Thailand. The results were compared with the

literature on parasite infestation of these deep-sea sharks in other areas. Consequently, they can be applied as selected parasites for use in biological tagging of these three species of deep-sea shark.

MATERIALS AND METHODS

Two species of thresher shark were caught by pelagic longline, whereas shortspine spurdogs were caught by bottom vertical longline and deep sea trapping. The sampling areas were located at a depth of 100 and 450 m in the Exclusive Economic Zone of the Andaman continental shelf in Thai territorial waters (latitude 07° 41.090' N-09° 25.430' N; longitude 097° 27.240' E-097° 57.490' E) in March 2008. Identification of the species was undertaken according to Compagno (1984), Rainboth (1996) and Nelson (2006).

Parasite identification was based on morphological features, according to Yamaguti (1963a); Yamaguti (1963b); Schell (1970); Kabata (1979); Pillai (1985); Campbell and Beveridge (1994) and Kitamura *et al.* (2006). Parasite prevalence and mean intensity of each parasitic species were calculated according to Margolis *et al.* (1982).

RESULTS AND DISCUSSION

Three samples of *Alopias pelagicus*, two samples of *Alopias superciliosus* and five samples of *Squalus mitsukurii* were collected from the Exclusive Economic Zone of the Andaman continental shelf in Thai territorial waters. All samples were infected with parasites. In *Alopias pelagicus*, two species of ectoparasites, *Echthrogaleus denticulatus* and *Nogagus ambiguus*, were found on the body surface and four species of endoparasites, an unidentified Hirudinellid, *Nybelinia* sp. and an unidentified Trypanorhyncha and *Anisakis* sp., were found in the spiral valve. In *Alopias superciliosus*, one

species of ectoparasite, *Pagina tunica* was found on the body surface and two species of endoparasites, an unidentified Hirudinellid and an unidentified cestode, were found in the spiral valve. In *Squalus mitsukurii*, five species of ectoparasites, *Squalonchocotyle mitsukurii*, *Eudactylina acanthii*, *Lepeophtheirus* sp., *Pseudopandarus* sp. were found on gill filaments, with an unidentified isopod found on the body

surface and one species of endoparasite, *Anisakis* sp. was found in the spiral valve (Table 1).

Copepodid parasites were found in the highest number followed by cestodes, with six species and three species, respectively. Other groups of parasites, namely monogenes, trematodes and nematodes were found on only one species (Table 2).

Table 1 Prevalence and mean intensity of parasites from some deep sea sharks in the Andaman sea.

Hosts (number of fish examined)	Parasites	Site of Infection	Prevalence	Mean intensity
<i>Alopias pelagicus</i> (3)	Hirudinellid trematode (t)	spiral valve	100.00	7.67
	<i>Nybelinia</i> sp. (c)	spiral valve	100.00	48.00
	unidentified Trypanorhyncha (c)	spiral valve	100.00	48.00
	<i>Anisakis</i> sp. (n)	spiral valve	33.33	2.00
	<i>Echthrogaleus denticulatus</i> (co)	body surface	100.00	93.66
	<i>Nogagus ambiguus</i> (co)	body surface	33.33	1.00
<i>Alopias superciliosus</i> (2)	Hirudinellid trematode (t)	spiral valve	100.00	10.50
	Unidentified cestode (c)	spiral valve	50.00	2.00
	<i>Pagina tunica</i> (co)	body surface	100.00	6.00
<i>Squalus mitsukurii</i> (5)	<i>Squalonchocotyle mitsukurii</i> (m)	gill filaments	80.00	3.00
	<i>Anisakis</i> sp. (n)	spiral valve	20.00	2.00
	<i>Eudactylina acanthii</i> (co)	gill filaments	100.00	6.60
	<i>Lepeophtheirus</i> sp. (co)	gill filaments	20.00	1.00
	<i>Pseudopandarus</i> sp. (co)	gill filaments	20.00	1.00
	unidentified Isopod (i)	body surface	20.00	1.00

c: cestode, co: copepod, i: isopod, m: monogenean, n: nematode, t: trematode.

Table 2 Number of each group of parasites found in some deep-sea sharks from the Andaman Sea.

Host	Platyhelminthes			Arthropoda		
	Monogenea	Trematoda	Cestoidea	Nematode	Copepoda	Isopoda
<i>Alopias pelagicus</i>	0	1*	2	1*	2	0
<i>Alopias superciliosus</i>	0	1*	1	0	1	0
<i>Squalus mitsukurii</i>	1	0	0	1*	3	1
Total	1	1	3	1	6	1

* same species

Monogenes

Only one species of monogene, *Squalonchocotyle mitsukurii*, was found on *Squalus mitsukurii* in this study. *Squalonchocotyle* (Syn. *Erpocotyle*) belongs to the family Hexabothriidae. This genus usually parasitizes elasmobranches. Many species of *Squalonchocotyle* have been found in *Squalus* spp., with for example, *Erpocotyle acanthi Squalus acanthias* and *Erpocotyle striata* on *Squalus sucklii* and *Erpocotyle tropai* on *Squalus fernandinus* (Yamaguti, 1963a) and *Erpocotyle squali* on *Squalus acanthias* (Orlowska, 1979). In 2006, *Squalonchocotyle mitsukurii* was reported on *Squalus mitsukurii* from Sagami Bay on the Pacific coast of Japan (Kitamura *et al.*, 2006). *Squalonchocotyle mitsukurii* showed host specificity to *Squalus mitsukurii*. The discovery of this monogenoidean is the first such record in Thailand.

Trematodes

An unidentified Hirudinellid was found in *Alopias pelagicus* and *Alopias superciliosus*. This result indicated that this species of trematode was not specific to a host at the species level. This parasite is a very large hemiuroid, usually found in the stomach of large marine teleosts. However, some specimens, such as *Botulus* sp. have been found in piscivorous sharks (Gibson, 2002).

Cestodes

Three species of cestodes, *Nybelinia* spp., an unidentified Trypanorhyncha and an unidentified cestode were found in this study. The *Nybelinia* sp. and the unidentified Trypanorhyncha were classified under the order Trypanorhyncha. They had a true scolex with four tentacles conspicuously armed with hooks. The larval stage of this group of cestodes has been found in marine teleosts and the adult stage in elasmobranches (Campbell and Beveridge, 1994).

Nematodes

Anisakis sp. was found in *Alopias pelagicus* and *Squalus mitsukurii*. In many scientific papers, *Anisakis* sp. was investigated in elasmobranches. For example, *Anisakis simplex* was found in *Squalus acanthias* (Orlowska, 1979; Wierzbicka and Langowska, 1984; Henderson *et al.*, 2002).

Copepods

Six species of copepods, *Echthrogaleus denticulatus*, *Nogagus ambiguus*, *Pagina tunica*, *Eudactylina acanthii*, *Lepeophtheirus* sp. and *Pseudopandarus* sp., were found in this study (Table 1). Three genera of copepods *Pseudopandarus*, *Echthrogaleus* and *Pagina*, found in this study were classified in the family Pandaridae (Pillai, 1985). The thoracic segment of this family has dorsal plates. Pandarids are exclusively parasitic to elasmobranches and their occasional presence on teleosts is purely accidental (Pillai, 1985). Other species, *Eudactylina acanthii* and *Nogagus ambiguus*, also found only in elasmobranches. *Lepeophtheirus* sp. was found in both elasmobranches and teleosts (Yamaguti, 1963b).

Some of these copepodid parasites showed host-specificity comparable with reports in the literature. *Pagina tunica* was found on the body surface of *Alopias superciliosus*; this discovery was in the same record as Pillai (1985), which found these parasites in the same host from Madagascar, in the Indian Ocean. *Echthrogaleus denticulatus* was found in many species of deep-sea shark, including *Alopias pelagicus* and *Alopias vulpinus* (Yamaguti, 1963b; Pillai, 1985).

Eudactylina acanthii and *Anisakis simplex* were found in both *Squalus acanthias* and *Squalus mitsukurii*; these two species of parasite might be specific at the genera level. *Pseudopandarus* has been found previously on the skin of a large dogfish in Ceylon and on the pectoral fin of *Triakis scyllium* in Japan (Yamaguti,

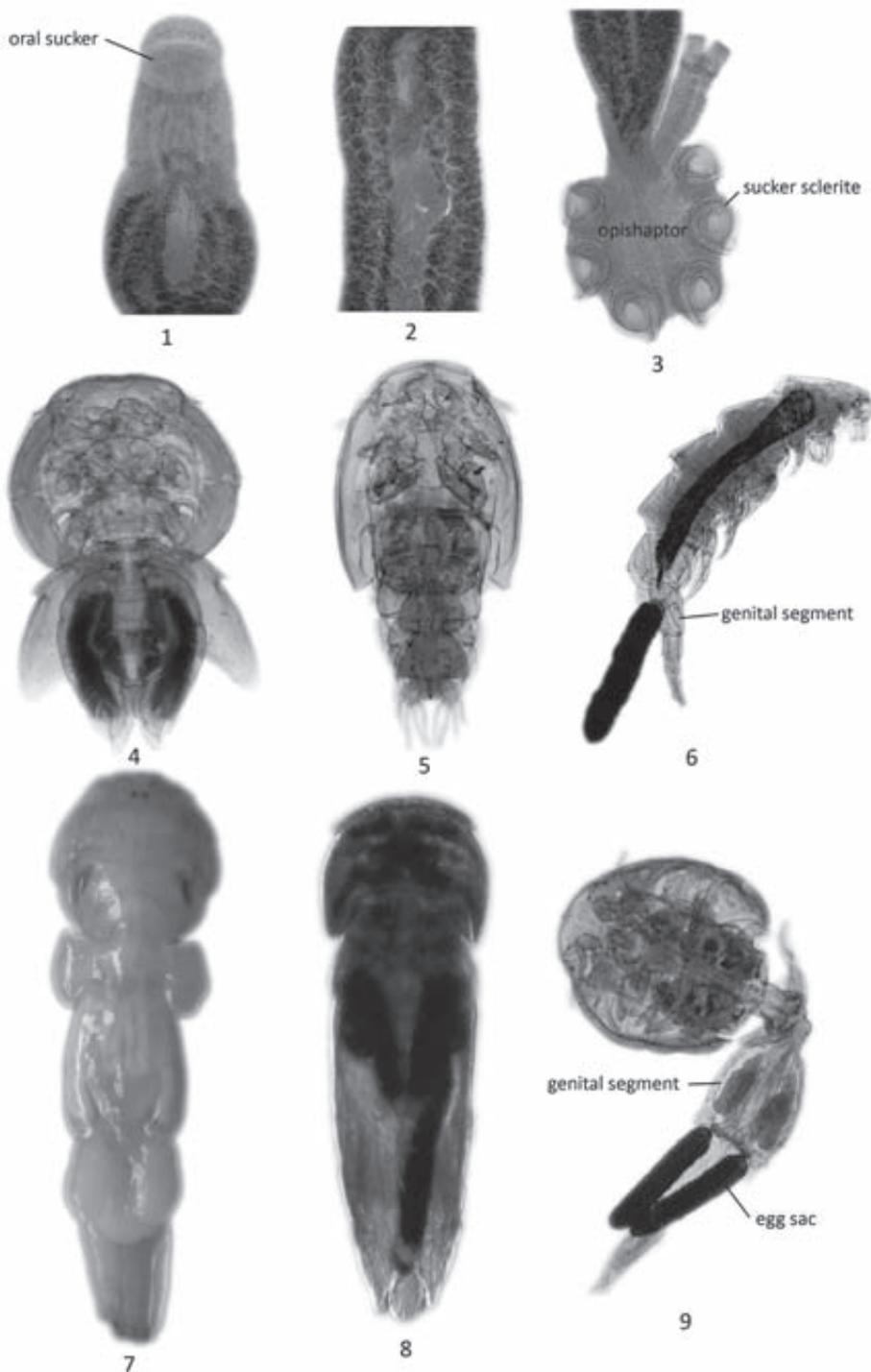


Figure 1 Parasites from deep sea sharks which regarded as new records of Thailand.
 1-3. *Squalonchocotyle mitsukurii* (1. anterior part 2. middle part 3. posterior part)
 4. *Echthrogaleus denticulatus* 5. *Nogagus ambiguus* 6. *Eudactylina acanthii*
 7. *Pagina tunica* 8. *Pseudopandarus* sp. 9. *Lepeophtheirus* sp.

Table 3 List of newly recorded parasites in Thailand.

Parasite	Host
<i>Echthrogaleus denticulatus</i>	<i>Alopias pelagicus</i>
<i>Eudactylina acanthii</i>	<i>Squalus mitsukurii</i>
<i>Nogagus ambiguous</i>	<i>Alopias pelagicus</i>
<i>Pagina tunica</i>	<i>Alopias superciliosus</i>
<i>Pseudopandarus sp.</i>	<i>Squalus mitsukurii</i>
<i>Squalonchocotyle mitsukurii</i>	<i>Squalus mitsukurii</i>

1963b). *Nogagus ambiguous* was found previously on *Squalus acanthias* (Kabata, 1979). Thus, the finding of *Eudactylina acanthii* and *Pseudopandarus sp.* in *Squalus mitsukurii* and *Nogagus ambiguous* in *Alopias pelagicus* represent new host records and their first occurrence in Thailand. In addition, the finding of *Squalonchocotyle mitsukurii*, *Echthrogaleus denticulatus* and *Pagina tunica* were first recordings in Thailand (Table 3).

CONCLUSION

The results from this study indicated that the parasites most common in *Alopius pelagicus*, *Alopias superciliosus* and *Squalus mitsukurii* were *Echthrogaleus denticulatus*, *Pagina tunica* and *Squalonchocotyle mitsukurii*, respectively, when compared with previous literature. *Echthrogaleus denticulatus*, *Eudactylina acanthii*, *Nogagus ambiguous*, *Pagina tunica*, *Pseudopandarus sp.* and *Squalonchocotyle mitsukurii* were recorded for the first time in Thailand.

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