REVIEW

A revised and updated checklist of the parasites of eels (Anguilla spp.) (Anguilliformes: Anguillidae) in Japan (1915-2017)

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Abstract Information on the protistan and metazoan parasites of four species of eels (the Japanese eel Anguilla japonica, the giant mottled eel Anguilla marmorata, the European eel Anguilla anguilla, and the short-finned eel Anguilla australis) in Japan is summarized in the Parasite-Host and Host-Parasite lists, based on the literature published for 103 years between 1915 and 2017. This is a revised and updated version of the checklist published in 2007. Anguilla japonica and A. marmorata are native to Japan, whereas A. anguilla and A. australis are introduced species from Europe and Australia, respectively. The parasites, including 54 nominal species and those not identified to species level, are listed by higher taxa as follows: Sarcomastigophora (no. of nominal species: 0), Ciliophora (6), Microspora (1), Myxozoa (6), Trematoda (12), Monogenea (8), Cestoda (3), Nematoda (7), Acanthocephala (6), Hirudinida (3), Bivalvia (1), and Copepoda (1). For each parasite species listed, the following information is given: its currently recognized scientific name, any original combination, synonym(s), or other previous identification used for the parasite from Japanese eels; habitat (freshwater, brackish, or marine); site(s) of infection within or on the host; known geographical distribution in Japanese waters; and the published source of each locality record. Of the 54 nominal species of parasites listed, 50 are from A. japonica, six from A. marmorata, nine from A. anguilla, and one from A. australis. Five species, viz., Gyrodactylus anguillae, Gyrodactylus nipponensis, Pseudodactylogyrus mundayi (Monogenea), Bothriocephalus claviceps (Cestoda), and Raphidascaris acus (Nematoda), have been regarded as introduced parasites from other countries, and the remaining 49 nominal species are indigenous parasites of Japan. Nine nominal species of marine and/or brackish-water origin, viz., Lechiorthocirrus musculus, Proctotrema taeidoides pisodontophilis, Tubulovesicula anguillae (Trematoda), Gyrodactylus nipponensis, Pseudodactylogyrus kamegaii (Monogenea), Nybelinia anguillicola (Cestoda), Cucullanus filiformis, Helicometra anguillae (Nematoda), and Limnotrachelobdella okae (Hirudinida), have been reported from A. japonica. Individuals of A. japonica known as “sea eels” and “estuarine eels” inhabiting coastal marine and riverine brackish waters are considered to serve as hosts for those marine and/or brackish-water parasites.

Key words: Anguilla anguilla, Anguilla australis, Anguilla japonica, Anguilla marmorata, bibliography, checklist, eels, parasites

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INTRODUCTION

In 2007, *A checklist of the parasites of eels (Anguilla spp.) (Anguilliformes: Anguillidae) in Japan (1915-2007)* was published based on the literature published for 93 years between 1915 and 2007 (Nagasawa et al., 2007). This checklist contained the information on both protistan and metazoan parasites reported from three species of freshwater eels (the Japanese eel *Anguilla japonica* Temminck and Schlegel; the giant mottled eel *Anguilla marmorata* Quoy and Gaimard; and the European eel *Anguilla anguilla* (Linnaeus)) in Japan, and 44 nominal species of parasites were listed by higher taxa as follows: Ciliophora (6), Microspora (1), Myxozoa (6), Trematoda (7), Monogenea (7), Cestoda (3), Nematoda (7), Acanthocephala (4), Hirudinida (2), and Copepoda (1). It also contained the information on unidentified species of Sarcomastigophora, Ciliophora, Microspora, Myxozoa, Trematoda, Monogenea, Cestoda, and Nematoda.

The checklist is revised and updated herein based on three sources of the literature: 1) the papers cited in the 2007 version; 2) those overlooked in the 2007 version (Nagao, 1956; Isobe, 1956, 1962; Irie, 1958; Egusa, 1958; Furukawa and Kobayashi, 1966; Ito, 1968; Horiuchi et al., 1988; Nagasawa, 1991; Rahhou et al., 2005; Shimazu and Araki, 2006; Shimazu, 2007); and 3) those published between the years 2008 and 2017 (Shimazu, 2008; Wielgross et al., 2008; Fang et al., 2008; Tanaka et al., 2009; Shimazu et al., 2011; Katahira et al., 2011, 2012, 2016; Laetsch et al., 2012; Nagasawa et al., 2013; Shimazu, 2014a, 2014b, 2015, 2016a, 2016b; Katahira and Nagasawa, 2014, 2015; Nagasawa and Utsumi, 2015; Ogawa et al., 2015; Kan et al., 2016; Nagasawa and Kan, 2017). In this revised checklist, we deal with the parasites reported from *A. japonica, A. marmorata, A. anguilla,* and the short-finned eel *Anguilla australis* Richardson. *Anguilla japonica* and *A. marmorata* are native to Japan, whereas *A. anguilla* and *A. australis* are introduced species from Europe and Australia, respectively. A total of 54 nominal species of parasites and those not identified to species level are listed herein, and the following 11 nominal species are newly included:

1. *Coitocaecum plagiorchis* Ozaki, 1926 (Trematoda) from *Anguilla japonica* (Shimazu et al., 2011);
2. *Genarchopsis anguillae* Yamaguti, 1938 (Trematoda) from *Anguilla japonica* (Shimazu, 2015);
3. *Genarchopsis chubuensis* Shimazu, 2015 (Trematoda) from *Anguilla japonica* (Shimazu, 2015);
4. *Genarchopsis gigi* Yamaguti, 1938 (Trematoda) from *Anguilla japonica* (Shimazu, 2015);
5. *Isoparorchis eury tremus* (Kobayashi, 1915) (Trematoda) from *Anguilla japonica* (Nagasawa et al., 2013);
6. *Palaeorchis diplorchis* (Yamaguti, 1936) (Trematoda) from *Anguilla japonica* (Shimazu et al., 2011);
7. *Pseudodactylogyrus mundayi* Ogawa, Iwashita, Hayward and Kurashima, 2015 (Monogenea) from *Anguilla australis* (Ogawa et al., 2015);
8. *Acanthocephalus longiacanthus* Katahira and Nagasawa, 2014 (Acanthocephala) from *Anguilla marmorata* (Katahira and Nagasawa, 2014);
9. *Southwellina hispida* (Van Cleave, 1925) (Acanthocephala) from *Anguilla marmorata* (Katahira and Nagasawa, 2014; Nagasawa and Kan, 2017);
10. *Limnotrachelobdella okae* (Moore, 1924) (Hirudinida) from *Anguilla japonica* (Nagasawa and Utsumi, 2015); and
A new scientific name is adopted herein for each of the following species because their scientific name has currently been changed: *Pseudophyllodistomum macrobrachicola* (Yamaguti, 1934) (Trematoda), *Anguillicola crassus* Kuwahara, Niimi and Itagaki, 1974 (Nematoda), and *Heliconema anguillae* Yamaguti, 1935 (Nematoda). These species were reported as *Phyllodistomum anguilae*, *Anguillicoloides crassus*, and *Heliconema longissimum*, respectively, in the 2007 version. Moreover, *Genarchopis goppo* Ozaki, 1925 (Trematoda) listed in the 2007 version has been re-identified and separated by Shimazu (2015) into three species, itself, *Genarchopsis gigi* Yamaguti, 1939, and *Genarchopsis chubuensis* Shimazu, 2015, the latter two species of which are listed herein.

Like in Nagasawa *et al.* (2007), the information on the parasites reported from Japanese *Anguilla* spp. is assembled as Parasite-Host and Host-Parasite lists. In the **PARASITE-HOST LIST**, the parasites are arranged by higher taxa in the following order: Sarcomastigophora, Ciliophora, Microspora, Myxozoa, Trematoda, Monogenea, Cestoda, Nematoda, Acanthocephala, Hirudinida, Bivalvia, and Copepoda. Within each higher taxa, genera and species are listed alphabetically. For each species of parasite, the following information is provided:

1) The current scientific name, including author(s) and date(s), followed by any original combination, recognized synonym(s), or other identifications(s) that have been used in establishing records from *Anguilla* spp. in Japan.

2) The habitat in which the parasite was acquired and normally completes its life cycle is given as FW for fresh waters, B for brackish waters, and M for marine waters.

3) The Site(s) of infection of the parasite in or on its host. If the site was not given in the original record, the likely site was determined from other records and is enclosed in square brackets.

4) The Distribution of the parasite is indicated by prefecture (boundaries shown in Fig. 1), in geographical order from northeast to southwest in Japan.

5) The Record(s). The authors responsible for the records are listed in chronological order. If a parasite has been reported more than once, the references are numbered, but not when there has been only one record of the parasite. Each reference is followed by the locality or localities given in two parts, first the prefecture and then the detailed collection locality or localities from which the parasite was reported. If no locality record was given, the geographical locality is shown by a dash (–). When all records are from the same prefecture, only the detailed collection locality or localities are listed.

6) Under Remarks, explanatory comments are given on systematics, nomenclature, useful references, and notes on specific items such as tentative parasite identifications in the original reports.

In the **HOST-PARASITE LIST**, *Anguilla japonica* is first listed, followed by *A. marmorata*, *A. anguilla*, *A. australis*, and *Anguilla* sp. The scientific and English common names of the four nominal species of *Anguilla* follow Froese and Pauly (2017). After these names, a Japanese name is also provided for each eel species excluding *A. australis*. Based on the Parasite-Host List, all the parasites reported from each of *Anguilla* spp. are listed in alphabetical order in each higher taxa, and after the name of each parasite, its geographical distribution in Japan is given in parentheses. Under Remarks, the parasite fauna of each eel species is summarized.

The **REFERENCES** section includes works directly cited in the Parasite-Host List. If only a Japanese title was given by the original author(s), our translation of the title into English is provided in square brackets.
Fig. 1. Map of Japan showing the prefectural boundaries. The following prefecutural names are arranged in alphabetical order: Aichi-24; Akita-7; Aomori-5; Chiba-15; Ehime-41; Etorofu Island-1; Fukui-26; Fukuoka-43; Fukushima-10; Gifu-23; Gunma-14; Hiroshima-37; Hokkaido-4; Hyogo-33; Ibaraki-12; Ishikawa-25; Iwate-6; Kagawa-39; Kagoshima-49; Kanagawa-18; Kochi-42; Kumamoto-47; Kunashiri Island-3; Kyoto-29; Mie-28; Miyagi-8; Miyazaki-48; Nagano-20; Nagasaki-45; Nara-30; Niigata-11; Okayama-46; Okinawa-50; Osaka-31; Saga-44; Saitama-16; Shiga-27; Shikotan Island-2; Shimane-36; Shizuoka-21; Tochigi-13; Tokushima-40; Tokyo-17; Tottori-34; Toyama-22; Wakayama-32; Yamagata-9; Yamaguchi-38; and Yamanashi-19.

PARASITE-HOST LIST

SARCOMASTIGOPHORA

Cryptobia sp. (FW)

Hosts: Anguilla anguilla
Anguilla japonica

Sites of infection: skin, fins
Distribution: unknown
Record: Niwa 1979 (→)
Ichthyobodo sp. (FW)
Includes: Costia sp. (erroneously as “Chostia”) of Niwa, 1979
Hosts: Anguilla anguilla
Anguilla japonica
Sites of infection: skin, fins
Distribution: unknown
Record: Niwa 1979 (–)

Trypanosoma sp. (FW)
Host: Anguilla japonica
Site of infection: blood
Distribution: Shizuoka
Records: 1. Hoshina and Sano 1957 (Yoshida); 2. Egusa 1967 (Yoshida)

Ciliophora

Ambiphrya sp. (FW)
Host: Anguilla japonica
Sites of infection: gills, skin
Distribution: unknown
Record: Egusa 1978 (–)

Apiosoma sp. (FW)
Includes: Glossatella sp. of Nishio et al., 1970; Egusa, 1970; Hatai and Egusa, 1973; Niwa, 1979
Hosts: Anguilla anguilla (3, 5)
Anguilla japonica (1, 2, 4)
Site of infection: gills
Distribution: Shizuoka

Capriniata piscium (Buetschli, 1889) Jankowski, 1973 (FW)
Previous identification: Trichophrya piscium of Egusa, 1978
Hosts: Anguilla anguilla (1, 2, 4, 5, 6)
Anguilla japonica (1, 3, 4, 6)
Site of infection: gills
Distribution: Shizuoka
Remarks: Matsui (1972: 577-578, figs. 27.44, 27.45) reported, in addition to Capriniata piscium (as Trichophrya sp.), two species of ciliates, “Sayphidia or Sayphydia sp.” and “Sudonia sp.” were
found on the gills of *A. japonica*. His identification of the latter two species, however, is definitely not correct.

**Carchesium polypinum** Linnaeus, 1758 (FW)
- Host: *Anguilla japonica*
- Site of infection: skin
- Distribution: Tokushima
- Record: Naruto Station, Fish. Exp. St. Tokushima Pref. 1966 (–)

**Chilodonella** sp. (FW)
- Hosts: *Anguilla anguilla* (2)  
  *Anguilla japonica* (1, 2)
- Sites of infection: gills, skin
- Distribution: unknown

**Ichthyophthirius multifiliis** Fouquet, 1876 (FW)
- Hosts: *Anguilla anguilla* (1, 3, 4, 5, 6, 7, 8, 9)  
  *Anguilla japonica* (1, 2, 6, 7, 8, 9)
- Sites of infection: skin, fins, gills, buccal cavity
- Distribution: Shizuoka

**Trichodina acuta** Lom, 1961 (FW)
- Host: *Anguilla japonica*
- Site of infection: gills
- Distribution: Mie
- Record: Imai *et al.* 1991 (Tsu)

**Trichodina jadranica** Haider, 1964 (FW)
- Host: *Anguilla japonica*
- Site of infection: gills
- Distribution: Mie
- Record: Imai *et al.* 1991 (Tsu)

Remarks: This trichodinid was reported from the gills of *A. japonica* cultured in freshwater ponds in central Japan (Imai *et al.*, 1991). However, it was later found on marine fishes (the bastard halibut *Paralichthys olivaceus* and the stone flounder *Kareius bicoloratus*) in China (Xu *et al.*, 2001), suggesting that *T. jadranica* is a euryhaline species.

**Trichodina japonica** Imai, Miyazaki and Nomura, 1991 (FW)
- Host: *Anguilla japonica*
Site of infection: gills
Distribution: Mie
Record: Imai et al. 1991 (Tsu)
Remarks: This trichodinid was described from the gills of *A. japonica* cultured in freshwater ponds in central Japan (Imai *et al.*, 1991). However, it also occurs on marine fishes (the Japanese seabass *Lateolabrax japonicus* and the red seabream *Pagrus major* [as *Chrysophyrys major*]) and a brackish-water fish (the barramundi *Lates calcarifer*) in China and India, respectively (Xu *et al.*, 1999, 2001; Mitra and Bandyopadhyay, 2005), indicating that *T. japonica* is a euryhaline species, like *T. jadranica* (see above).

**Trichodina sp.**  
(FW)

Hosts: *Anguilla anguilla* (3, 6, 7, 8)

*Anguilla japonica* (1, 2, 3, 4, 5, 6, 8)

Sites of infection: gills
Distribution: Shizuoka

**Microspora**

**Heterosporis anguillarum** (Hoshina, 1951) Lom, Dyková, Körting and Klinger, 1989  
(FW)

Original combination: *Plistophora anguillarum* Hoshima, 1951

Previous identification: *Plistophora anguillarum* of Hoshina, 1972; Awakura, 1974; Hashimoto and Takinami, 1976; Hashimoto *et al.*, 1976; Niwa, 1979

*Pleistophora anguillarum* of Kano and Fukui, 1982; Kano *et al.*, 1982; Buchmann *et al.*, 1992

Includes: *Plistophora* sp. of Niwa, 1979

Hosts: *Anguilla anguilla* (6)

*Anguilla japonica* (1, 2, 3, 4, 5, 6, 7, 8, 9)

Site of infection: musculature

Distribution: Hokkaido, Kanagawa, Shizuoka, Aichi, Kagoshima


Remarks: The present species was transferred from the genus *Pleistophora* to *Heterosporis* by Lom *et al.* (1989). Although Awakura (1974) found this parasite in Hokkaido, the infected fish had been transported from Shizuoka, central Honshu (see Fig. 1). The species is known to infect *A. japonica* in Taiwan (T’sui and Wang, 1988; T’sui *et al.*, 1988; Tsai *et al.*, 2002) and Korea (Suh and Chun, 1988; Joh *et al.*, 2007) as well. Hoshima (1972) reported the presence of this parasite in young *A. japonica* imported from Taiwan to Japan.
Unidentified Microspora
Host: *Anguilla japonica*
Site of infection: gills
Distribution: Shizuoka
Record: Egusa 1967 (Yoshida)

**MYXOZOA**

*Myxidium giardi* Cépède, 1906
Synonyms: *Myxidium anguillae* Ishii, 1915; *Myxidium enchelypterygii* Hoshina, 1952
Previous identification: *Myxidium anguillae* of Ishii, 1915

*Myxidium enchelypterygii* of Hoshina, 1952
Includes: *Myxidium* sp. of Ishii, 1916b; Iwata, 1972
Hosts: *Anguilla anguilla* (5)
*Anguilla japonica* (1, 2, 3, 4, 6)
Sites of infection: skin, fins, gills
Distribution: Tokyo, Shizuoka, Miyazaki
Remarks: Although Hoshina (1952) reported that the spores of *Myxidium enchelypterygii* were clearly differentiated from those of *M. anguillae* by their size and shape, Hine (1980) regarded both taxa as identical, which was supported by Oka and Egusa (1983). Hine (1980: table 1) listed a record of *M. giardi* from the gall bladder and musculature of the American eel *Anguilla rostrata* from Japan, but this record is not included herein because no references were found to support it.

*Myxidium lentiforme* Fujita, 1929
Synonym: *Myxidium fusiforme* Fujita, 1927
Host: *Anguilla japonica*
Site of infection: kidney
Distribution: Shiga
Record: Fujita 1927 (Lake Biwa)
Remarks: This parasite had been originally described by Fujita (1927) as *M. fusiforme*, but it was later renamed as *Myxidium lentiforme* by Fujita (1929: 249-250) because the former had been preoccupied.

*Myxidium matsuii* Fujita, 1929
Host: *Anguilla japonica*
Site of infection: skin
Distribution: Kanagawa, Shizuoka, Aichi
**Myxidium uchiyamae** Fujita, 1927

- Host: *Anguilla japonica*
- Site of infection: kidney
- Distribution: Shiga
- Record: Fujita 1927 (Lake Biwa)

**Myxidium sp.**

- Hosts: *Anguilla anguilla* (3, 4, 6)
  *Anguilla japonica* (1, 2, 5, 6)
- Sites of infection: gills, kidney, liver
- Distribution: Shizuoka
- Remarks: There is no information on the morphology and identification of this parasite. Niwa (1979) reported that its spores are more commonly found in the kidney of *A. anguilla* than *A. japonica*.

**Myxobolus dermatobius** (Ishii, 1915) Landsberg and Lom, 1991

- Original combination: *Lentospora dermatobia* Ishii, 1915
- Previous identification: *Myxosoma (Lentospora) dermatobia* of Hoshina, 1952
- Host: *Anguilla japonica*
- Site of infection: skin
- Distribution: Tochigi, Shizuoka
- Records: 1. Ishii 1915b (Shizuoka: Numazu); 2. Hoshina 1952 (Tochigi: Lake Chuzenji)
- Remarks: The present species originally described as *Lentospora dermatobia* by Ishii (1915b) was transferred to the genus *Myxobolus* by Landsberg and Lom (1991).

**Myxobolus fujitai** (Fujita, 1929) Eiras, Molnár and Lu, 2005

- Synonym: *Lentospora anguillae* Fujita, 1929
- Previous identification: *Lentospora anguillae* of Fujita, 1929
- Host: *Anguilla japonica*
- Site of infection: skin
- Distribution: Ibaraki
- Record: Fujita 1929 (Lake Hinuma)
- Remarks: The present species originally described as *Lentospora anguillae* by Fujita (1929) was renamed as *Myxobolus anguilli* by Landsberg and Lom (1991). However, because of the preoccupation of the latter name, Eiras et al. (2005) proposed a new name, *Myxobolus fujitai*, for *M. anguilli*.

**Unidentified Myxozoa**

- Host: *Anguilla japonica*
- Site of infection: gills
- Distribution: Shizuoka, Gifu
Anonymous 2002 (Gifu: a tributary of the Kiso River)

Trematoda

_Azygia gotoi_ (Ariake, 1922) Shimazu, 1979

Synonym: _Azygia anguillae_ Ozaki, 1924

Previous identification: _Azygia anguillae_ of Ozaki, 1924; Yamaguti, 1934a; Iwashita _et al._, 2003; Shimazu, 2007

Includes: _Azygia gotoi_-like trematodes of Shimazu, 1979

Host: _Anguilla japonica_

Sites of infection: stomach, esophagus

Distribution: Aomori, Ibaraki, Chiba, Tokyo, Nagano, Shiga


Remarks: The taxonomy and life history of this trematode was reported in details by Shimazu (1979). Although _A. anguillae_ was proposed by Shimazu (2007) as the scientific name of the species, _A. gotoi_ has been currently adopted (see Shimazu _et al._, 2011). Information on the species is available from Shimazu (1999a, 2003).

_Bucephalus_ sp. (M)

Host: _Anguilla japonica_

Site of infection: digestive tract

Distribution: Chiba

Record: Iwashita _et al._ 2003 (mouth of the Minato River)

Remarks: This species has been suggested to be a marine parasite (Iwashita _et al._, 2003).

_Centrocestus formosanus_ (Nishigori, 1924) Price, 1932 (metacercaria) (FW)

Host: _Anguilla japonica_

Habitat: gills

Distribution: Kagoshima

Records: 1. Yanohara and Kagei 1983 (Tanegashima Island); 2. Kagei and Yanohara 1995 (Tanegashima Island)

_COITOCAECUM PLAGIORCHIS_ Ozaki, 1926

Host: _Anguilla japonica_

Habitat: intestine

Distribution: Shiga

Records: 1. Shimazu _et al._ 2011 (Uso River); 2. Shimazu 2016b (Uso River)
**Genarchopsis anguillae** Yamaguti, 1938

- **Host:** *Anguilla japonica*
- **Site of infection:** intestine
- **Distribution:** Ibaraki
- **Records:** 1. Yamaguti 1938 (Tsuchiura [as Tutiura]); 2. Shimazu 1995 (Tsuchiura); 3. Shimazu 2015 (Tuchiura)

**Genarchopsis chubuensis** Shimazu, 2015

- **Previous identification:** *Genarchopsis goppo* of Shimazu, 1995
- **Host:** *Anguilla japonica*
- **Site of infection:** stomach
- **Distribution:** Nagano
- **Records:** 1. Shimazu 1995 (Lake Suwa); 2. Shimazu 2015 (Lake Suwa)

**Genarchopsis gigi** Yamaguti, 1939

- **Previous identification:** *Genarchopsis goppo* of Shimazu, 1995; Shimazu *et al*., 2011
- **Host:** *Anguilla japonica*
- **Site of infection:** intestine
- **Distribution:** Shiga
- **Records:** 1. Shimazu 1995 (Omatsu); 2. Shimazu *et al.* 2011 (Omatsu); 3. Shimazu 2015 (Omatsu)

**Hemiuridae** gen. sp.

- **Host:** *Anguilla japonica*
- **Site of infection:** stomach
- **Distribution:** Tokyo
- **Record:** Ozaki 1924 (–)
- **Remarks:** When *Azygia gotoi* (as *A. anguillae*) was described, Ozaki (1924: 426) reported that another trematode belonging to the family Hemiuridae occurred in the stomach of *A. japonica*. No description of this trematode is yet available.

**Isoparorchis eurytremus** (Kobayashi, 1915) Shimazu, Cribb, Miller, Urabe, Ha, Binnh and Shed’ko, 2014

- **Synonym:** *Isoparorchis hypselobagri* (Billet, 1898)
- **Previous identification:** *Isoparorchis hypselobagri* of Nagasawa *et al*., 2013
- **Host:** *Anguilla japonica*
- **Sites of infection:** stomach wall tissue, mesentery, outer surface of airbaldder wall
- **Distribution:** Shimane, Ehime
- **Record:** Nagasawa *et al.* 2013 (Shimane: Lake Shinji, Lake Nakaumi; Ehime: Sozu River)
- **Remarks:** Information on this species (*as I. hypselobagri*) is available in Nagasawa *et al.* (2013).

**Lasiotocus** sp.

- **Host:** *Anguilla japonica*
- **Site of infection:** intestine (digestive tract)
- **Distribution:** Aomori, Chiba
Records: 1. Iwashita *et al.* 2003 (Chiba: mouth of the Tone River); 2. Shimazu 2005 (Aomori: Lake Ogawara)
Remarks: This species has been suggested to be a marine parasite (Iwashita *et al.*, 2003).

*Lecithochrium musculus* (Looss, 1907) Nasir and Diaz, 1971 (M)
Synonym: *Sterrhurus musculus* Looss, 1907
Previous identification: *Sterrhurus musculus* of Yamaguti, 1934a
Host: *Anguilla japonica*
Site of infection: stomach
Distribution: Mie, unspecified prefecture facing the Seto Inland Sea
Record: Yamaguti 1934a (Mie: Ise Bay; unspecified prefecture: Seto Inland Sea [as Inland Sea])
Remarks: The identification of this trematode by Yamaguti (1934a) needs confirmation (Gibson and Bray, 1986: 83-90).

*Metagonimus* spp. (metacercaria) (FW)
Host: *Anguilla japonica*
Site of infection: fins
Distribution: Shizuoka
Records: 1. Ito and Mochizuki 1968 (Tenryu River); 2. Ito 1968 (Tenryu River)

*Palaeorchis diplorchis* (Yamaguti, 1936) Szidat, 1943 (FW)
Host: *Anguilla japonica*
Site of infection: stomach
Distribution: Shiga
Records: 1. Shimazu *et al.* 2011 (Omatsu); 2. Shimazu 2016a (Omatsu)

*Proctotrematoides pisodontophidis* Yamaguti, 1938 (M)
Host: *Anguilla japonica*
Site of infection: intestine
Distribution: Chiba
Record: Hoshina 1951b (Urayasu)

*Pseudophyllodistomum macrobrachicola* (Yamaguti, 1934) Cribb, 1987 (FW)
Host: *Anguilla japonica*
Sites of infection: urinary bladder, intestine
Distribution: Aomori, Nagano, Ibaraki, Shiga, Tokushima
**Tubulovesicula anguillae** Yamaguti, 1934
- **Host:** *Anguilla japonica*
- **Site of infection:** stomach
- **Distribution:** Miyagi
- **Record:** Yamaguti 1934a (Matsushima Bay [as Matusima Bay])

**Tubulovesicula** sp.
- **Host:** *Anguilla japonica*
- **Site of infection:** stomach
- **Distribution:** Chiba
- **Record:** Iwashita *et al.* 2003 (mouth of the Minato River)
- **Remarks:** This species has been suggested to be a marine parasite (Iwashita *et al.*, 2003).

**Monogenea**

**Gyrodactylus anguillae** Ergens, 1960
- **Host:** *Anguilla anguilla*
- **Sites of infection:** skin, gills
- **Distribution:** Shizuoka
- **Record:** Ogawa and Egusa 1980 (Maisaka)
- **Remarks:** This species was introduced into Japan with *A. anguilla* from France (Ogawa and Egusa, 1980). Hayward *et al.* (2001) showed the current worldwide distribution of the species. Ogawa and Egusa (1978) redescribed it based on the specimens from England.

**Gyrodactylus egusai** Ogawa and Hioki, 1986
- **Host:** *Anguilla japonica*
- **Site of infection:** skin
- **Distribution:** Shizuoka
- **Record:** Ogawa and Hikoki 1986 (Yoshida)

**Gyrodactylus joi** Ogawa and Hioki, 1986
- **Host:** *Anguilla japonica*
- **Site of infection:** skin
- **Distribution:** Shizuoka
- **Record:** Ogawa and Hikoki 1986 (Yoshida)

**Gyrodactylus nipponensis** Ogawa and Egusa, 1978
- **Host:** *Anguilla japonica*
- **Site of infection:** gills
- **Distribution:** Chiba, Shizuoka, Tokushima, Miyazaki
Remarks: This monogenean appears to have been introduced into Japan on eels imported from elsewhere in the Indo-western Pacific region, perhaps originating in Southeast Asia (Hayward et al., 2001: 422). This species prefers brackish waters (Hayward et al., 2001: 422).

**Gyrodactylus** sp. (FW)
Host: *Anguilla japonica*
Site of infection: gills
Distribution: Shizuoka
Record: Ushiyama and Misaki 1977 (suburb of Hamamatsu)
Remarks: There is no information on the morphology and taxonomy of this gyrodactylid. Identification needs to be confirmed in comparison with the above four species of *Gyrodactylus* reported from eels in Japan.

**Pseudodactylogyrus anguillae** (Yin and Sproston, 1948) Gusev, 1965 (FW)
Synonym: *Pseudodactylogyrus microrchis* Ogawa and Egusa, 1976
Hosts: *Anguilla anguilla* (1, 2, 3, 4, 5, 7, 9, 10, 11), *Anguilla japonica* (5, 6, 11, 12, 14), *Anguilla marmorata* (13), *Anguilla sp.* (8)
Site of infection: gills
Distribution: Chiba, Shizuoka, Aichi, Hiroshima, Tokushima, Ehime, Kagoshima
Remarks: Ogawa et al. (1985a) synonymized *P. microrchis* as a junior synonym of *P. anguillae*.

**Pseudodactylogyrus bini** (Kikuchi, 1929) Gusev, 1965 (FW)
Original combination: *Dactylogyrus bini* Kikuchi, 1929
Previous identification: *Dactylogyrus bini* of Kikuchi, 1929
Hosts: *Anguilla anguilla* (2, 4, 6), *Anguilla japonica* (1, 5, 6, 7, 9), *Anguilla marmorata* (8), *Anguilla sp.* (3)
Site of infection: gills
Distribution: Chiba, Shizuoka, Aichi, Ehime, Kagoshima
Pseudodactylogyrus kamegaii Iwashita, Hirata and Ogawa, 2002
Host: Anguilla japonica
Site of infection: gills
Distribution: Chiba, Ehime
Records: 1. Iwashita et al. 2002 (Chiba: Minato River); 2. Katahira et al. 2012 (Ehime: Misho Cove, Renjoji River, Sozu River); 3. Ogawa et al. 2015 (Chiba: Minato River)
Remarks: This species was found on A. japonica collected in brackish waters (Iwashita et al., 2002; Katahira et al., 2012).

Pseudodactylogyrus mundayi Ogawa, Iwashita, Hayward and Kurashima, 2015
Host: Anguilla australis
Site of infection: gills
Distribution: Shizuoka
Record: Ogawa et al. 2015 (Shizuoka: Hamamatsu)
Remarks: This species was recovered from A. australis which had been caught in Tasmania and then shipped alive to Japan (Ogawa et al., 2015).

Pseudodactylogyrus spp. (FW)
  Pseudodactylogyrus bini or P. anguillae of Tanaka and Sato, 2007; Sato and Tanaka, 2007
  Pseudodactylogyrus bini and P. anguillae of Tanaka et al., 2009
  Pseudodactylogyrus sp. of Niwa, 1979
  "Pseudodactylogyrus sp. ang. 4" of Hayward, 2004
Hosts: Anguilla anguilla (2, 4, 5, 6, 8, 10)
  Anguilla japonica (1, 3, 7, 11, 12, 13)
  Anguilla sp. (9)
Site of infection: gills
Distribution: Shizuoka, Kagoshima
Unidentified Monogenea

Includes: *Gyrodactylus* sp. or *Dactylogyrus* sp. of Nishio *et al.*, 1970

“monogenetic trematodes” of Shimazu, 1979

Hosts: *Anguilla anguilla* (1)

*Anguilla japonica* (1, 2)

Site of infection: gills

Distribution: Nagano, Shizuoka


Cestoda

*Bothriocephalus claviceps* (Goeze, 1782) Rudolphi, 1810

Host: *Anguilla japonica* (?)

Site of infection: intestine

Distribution: Shiga

Record: Scholz *et al.* 2004 (Shiga: Lake Biwa)

Remarks: Identification of the eel from Lake Biwa examined by Scholz *et al.* (2004) was uncertain: these authors tentatively identified the fish as *A. japonica* but it may be identified as *A. anguilla*. If the eel was actually the latter species, the cestode may have been introduced into the lake via imported fish from overseas (Scholz *et al.*, 2004).

*Bothriocephalus japonicus* Yamaguti, 1934

Previous identification: *Bothriocephalus claviceps* of Luo *et al.*, 2002

Hosts: *Anguilla japonica* (1, 2, 4)

*Anguilla marmorata* (3, 4)

Site of infection: intestine

Distribution: Ibaraki, Nagano, Gifu, Shiga, Kagoshima


Remarks: The cestode reported as "*Bothriocephalus claviceps*" by Luo *et al.* (2002) was re-identified as *B. japonicus* by Scholz *et al.* (2004). In the 2007 version of this checklist (Nagasawa *et al.*, 2007: 103), "*Bothriocephalus claviceps*" reported by Luo *et al.* (2002) was listed as the species, but it was wrong (Nagasawa, 2015: 98-99). Information on this cestode is available from Shimazu (1997) and Scholz *et al.* (2004). The scientific name was misspelled "*japonicum*" in Anonymous (2002).

*Bothriocephalus* sp.

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Nagano

Record: Shimazu 1979 (Lake Kizaki)
Remarks: There is no morphological and taxonomic information on this cestode (Shimazu, 1979: 230, footnote).

**Nybelinia anguillicola** Yamaguti, 1952 (larva) (M)

Previous identification: *Nybelinia* sp. of Yamaguti, 1934

Host: *Anguilla japonica*

Site of infection: encysted in submucosa of intestine

Distribution: Mie

Records: 1. Yamaguti 1934b (Kuki); 2. Yamaguti 1952 (Kuki)

**Unidentified Cestoda** (FW)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Shizuoka

Record: Ushiyama and Misaki 1977 (suburb of Hamamatsu)

Remarks: There is no information on the morphology and identification of this cestode. It was frequently found from June to September in cultured *A. japonica* (Ushiyama and Misaki, 1977).

**Nematoda**

**Anguillicola crassus** Kuwahara, Niimi and Itagaki, 1974 (FW)

Previous identification: *Anguillicola globiceps* of Egusa *et al.*, 1969

*Anguillicola crassa* of Hirose *et al.*, 1976; Egusa, 1979; Niwa, 1979

*Anguillicola* (*Angullicoloides*) *crassus* of Moravec and Taraschewski, 1988

Includes: *Anguillicola japonica* of Matsui, 1972

*Anguillicola* sp. of Egusa and Ahmed, 1970; Ushiyama and Misaki, 1977

“swimbladder nematode” of Egusa, 1970

Hosts: *Anguilla anguilla* (1, 2, 5, 6, 9, 10, 11)

*Anguilla japonica* (1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21)

Site of infection: swimbladder

Distribution: Chiba, Tokyo, Shizuoka, Gifu, Aichi, Miy, Wakayama, Okayama, Tokushima, Oita, Miyazaki, Okinawa

et al. 2008 (Aichi: Mikawa Bay; Yamaguchi: Fushino); 21. Laetsch et al. 2012 (Wakayama: "natural water system")

Remarks: The biology of this nematode was reviewed by Nagasawa et al. (1994) and Moravec (2006). Information on the species is also available from Shimazu (1998). A brief note on the nematode is also published by Salati (1987). Although Matsui (1972: 571) stated infection of "Anguillicola japonica" in the "gall bladder" of Anguilla japonica, the worm is identifiable as A. crassus, based on a picture (fig. 27.36) shown by him (see Nagasawa et al., 1994: 128). The records (Inui et al., 1998, 1999) were based on the species from A. japonica imported from Taiwan to Japan. Information on the life cycle of the nematode in Japan is available in Hirose et al. (1976) and Moravec et al. (2005). The distribution of the species in Japan is shown by Lefevre et al. (2012).

*Anguillicola globiceps* Yamaguti, 1935

**(FW)**

**Hosts:** Anguilla japonica (1, 2, 3, 4, 5, 7, 8)  
Anguilla sp. (A. japonica ?)(6)

Site of infection: swimbladder

Distribution: Aomori, Nagano, Chiba, Shizuoka, Aichi, Wakayama, Okayama


Remarks: The biology of this nematode was reviewed by Nagasawa et al. (1994) and Shimazu (1998). A brief review on *Anguillicola* is available in Salati (1987). Although Egusa et al. (1969) reported *A. globiceps* from Japanese eels cultured in Shizuoka, Hirose et al. (1976: 27, footnote) reported that Egusa et al.’s worms were not *A. globiceps* but *A. crassus*. The latter authors also mentioned that the morphology of the worms collected at an eel farm in Mishima, Shizuoka was similar to that of *A. globiceps*. The distribution of the species in Japan is shown by Lefevre et al. (2012).

*Cucullanus filiformis* Yamaguti, 1935

**(M)**

**Host:** Anguilla japonica

Site of infection: intestine

Distribution: Mie

Record: Yamaguti 1941 (Hamajima)

Remarks: This nematode was originally reported from the conger eel Conger myriaster in Japan (Yamaguti, 1935b).

*Gnathostoma spinigerum* Owen, 1836 (larva)

**(FW)**

**Host:** Anguilla japonica

Sites of infection: musculature, viscera

Distribution: Kagawa, Fukuoka, Kumamoto


Remarks: This nematode was reviewed by Nagasawa et al. (1994) and Shimazu (1998). A brief review on *Gnathostoma* is available in Salati (1987). Although Egusa et al. (1969) reported *G. spinigerum* from Japanese eels cultured in Shizuoka, Hirose et al. (1976: 27, footnote) reported that Egusa et al.’s worms were not *G. spinigerum* but *G. crassus*. The latter authors also mentioned that the morphology of the worms collected at an eel farm in Mishima, Shizuoka was similar to that of *G. spinigerum*. The distribution of the species in Japan is shown by Lefevre et al. (2012).
Heliconema anguillae Yamaguti, 1935

Previous identification: Heliconema longissimum of Katahira et al., 2011
Host: Anguilla japonica
Site of infection: stomach
Distribution: Ehime, Saga, Kagoshima
Remarks: Matsui (1972: fig. 27.33) showed pictures of the stomach of A. japonica heavily infected with this nematode. Information on the nematode is available from Shimazu (1998). Intertidal crabs serve as the intermediate hosts for the species (Katahira and Nagasawa, 2015; Kan et al., 2016). Its seasonal infection dynamics in A. japonica was clarified by Katahira et al. (2016).

Heliconema sp.

Host: Anguilla japonica
Site of infection: digestive tract
Distribution: Okayama
Record: Suyehiro 1957 (–)
Remarks: The morphology of this nematode is different from that of H. anguillae (Suyehiro, 1957).


Original combination: Filaria anguillae Ishii, 1916
Previous identification: Filaria anguillae of Ishii, 1916; Ishii, 1931
Host: Anguilla japonica
Site of infection: orbit
Distribution: Tokyo, Aichi
Records: 1. Ishii 1916a (Tokyo: Fukagawa-Fuyuki; Aichi: Toyohashi); 2. Ishii 1931 (Tokyo: Fukagawa-Fuyuki; Aichi: Toyohashi)
Remarks: Yamaguti (1935b) suggested that “Filaria anguillae” described by Ishii (1916a) should be placed in the genus Philometra. Later, Rasheed (1963) transferred it to the genus Philometroides. Matsui (1972: 584) mistakenly reported the species as “Philometra parasiluri.” Information on the species is available from Shimazu (1998) and Moravec (2006: 425-427).

Raphidascaris acus (Bloch, 1779) Railliet and Henry, 1915

Host: Anguilla japonica
Site of infection: intestine
Distribution: Shiga
Record: Grygier and Urabe 2003 (Lake Biwa)
Remarks: This nematode is not native to Japan. It has been suggested that the nematode was introduced into Japan by the import of A. anguilla from overseas (Grygier and Urabe, 2003).
Unidentified Nematoda
Host: *Anguilla japonica*
Site of infection: caecum
Distribution: unknown
Record: Shimazu and Araki 2006 (–)

**ACANTHOCEPHALA**

*Acanthocephalus gotoi* Van Cleave, 1925

Hosts: *Anguilla japonica* (1, 2, 3)  
*Anguilla marmorata* (4)
Site of infection: intestine
Distribution: Tokyo, Aichi, Ehime
Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

*Acanthocephalus longiacanthus* Katahira and Nagasawa, 2014

Host: *Anguilla marmorata*
Site of infection: intestine
Distribution: Ehime
Record: Katahira and Nagasawa 2014 (Renjōji River)

*Echinorhynchus cotti* Yamaguti, 1935

Host: *Anguilla japonica*
Site of infection: [intestine]
Distribution: Shiga
Record: Amin *et al.* 2007 (Lake Biwa)
Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

*Longicollum alemniscus* (Harada, 1935) Fuki and Morisita, 1937 (immature worm)

Host: *Anguilla japonica*
Site of infection: [intestine]
Distribution: Aichi
Record: Fukui and Morisita 1937 (–)
Remarks: Information on this species is available in Fukui and Morisita (1938). While Petrochenko (1956) considered this species as a junior synonym of *Longicollum pagrosomi*, his suggestion has not been supported by Yamaguti (1963), Golvan (1969) and Amin (1985). Thus, the species is treated herein as a valid species.

*Pseudorhadinorhynchus samegaiensis* Nakajima and Egusa, 1975

Host: *Anguilla japonica*
Site of infection: [intestine]
Southwellina hispida (Van Cleave, 1925) Witenberg, 1932 (cystacanth) (FW)

Host: Anguilla marmorata

Site of infection: encapsulated in mesentery

Distribution: Ehime, Kagoshima


Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

Hirudinida

Batracobdella smaragdina (Oka, 1910) (FW)

Host: Anguilla japonica

Site of infection: skin

Distribution: Aichi, Kagoshima

Record: Ogawa et al. 1985b (Aichi: Isshiki; Kagoshima:–)

Remarks: While Soós (1967) regarded Glossiphonia smaragdina as a junior synonym of Batracobdella paludosa, Ogawa et al. (1985b) did not follow it.

Hemiclepsis marginata (O. F. Müller, 1774) Vedjovsky, 1884 (FW and B)

Host: Anguilla japonica

Site of infection: skin

Distribution: Aichi

Record: Nagasawa and Miyakawa 2006 (river near Akabane Port)

Remarks: Although this species usually occurs in fresh waters (Burreson, 2006), Nagasawa and Miyakawa (2006) found the specimens on elvers from brackish waters.

Limnotrachelobdella okae (Moore, 1924) Epshtein, 1968 (B)

Host: Anguilla japonica

Site of infection: skin

Distribution: Oita

Record: Nagasawa and Utsumi 2015 (lower reaches of the Katsura River)

Bivalvia

Hyriopsis schlegeli (Martens, 1861) (glochidium) (FW)

Host: Anguilla japonica

Sites of infection: gills, fins

Distribution: Shiga

Record: Furukawa and Kobayashi 1966 (experimental infection)
COPEPODA

*Lernaea cyprinacea* Linnaeus, 1758

(FW)

Original combination: *Lernaea (Lernaeocera) elegans* Leigh-Sharpe, 1925

Previous identification: *Lernaea elegans* of Matsui and Kumada, 1928; Nakai and Kokai, 1931

Includes: *Lernaea* sp. of Egusa, 1958; Niwa, 1979

Hosts: *Anguilla anguilla* (11)

*Anguilla japonica* (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

Sites of infection: buccal cavity, nostril, orbit, fins

Distribution: Chiba, Shizuoka, Aichi, Mie, Okayama, Hyogo, Shimane, Miyazaki


Remarks: Information on this copepod as a parasite of *A. japonica* is available from Matsui (1972).

HOST-PARASITE LIST

*Anguilla japonica* Temminck and Schlegel, 1847

Japanese eel, "nihon-unagi"

Sarcomastigophora

*Cryptobia* sp. (--)

*Ichthyobodo* sp. (--)

*Trypanosoma* sp. (Shizuoka)

Ciliophora

*Ambiphrya* sp. (--)

*Apiosoma* sp. (Shizuoka)

*Caprinia piscium* (Shizuoka)

*Carchesium polypinum* (Tokushima)

*Chilodonella* sp. (--)

*Ichthyophthirius multifiliis* (Shizuoka)

*Trichodina acuta* (Mie)

*Trichodina jadranci* (Mie)

*Trichodina japonica* (Mie)

*Trichodina* sp. (Shizuoka)

Microspora

*Heterosporis anguillarum* (Hokkaido, Kanagawa, Shizuoka, Aichi, Kagoshima)

Unidentified Microspora (Shizuoka)

Myxozoa

*Myxidium giardi* (Tokyo, Shizuoka, Miyazaki)

*Myxidium lentiforme* (Shiga)
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Myxidium matsuii (Kanagawa, Shizuoka, Aichi)
Myxidium uchiyamae (Shiga)
Myxidium sp. (Shizuoka)
Myxobolus dermatobius (Tochigi, Shizuoka)
Myxobolus fujitai (Ibaraki)
Unidentified Myxozoa (Shizuoka, Gifu)

Trematoda
Azygia gotoi (Aomori, Ibaraki, Tokyo, Nagano, Shiga)
Bucephalus sp. (Chiba)
Centrocestus formosanus (Kagoshima)
Coitocaecum plagiorchis (Shiga)
Genarchopsis anguillae (Ibaraki)
Genarchopsis chubunsis (Nagano)
Genarchopsis gigi (Shiga)
Hemiuridae gen. sp. (Tokyo)
Isoparorchis eurytremus (Shimane, Ehime)
Lasiotocus sp. (Aomori)
Lecithochrium musculus (Shiga, unspecified prefecture facing the Seto Inland Sea)
Metagonimus spp. (Shizuoka)
Palaeorchis diplorchis (Shiga)
Proctotrematoidea pisodontophidis (Chiba)
Pseudophyllodistomum macrobrachicola (Aomori, Nagano, Ibaraki, Shiga, Tokusima)
Tubulovesicula anguillae (Miyagi)
Tubulovesicula sp. (Chiba)

Monogenea
Gyrodactylus egusai (Shizuoka)
Gyrodactylus joi (Shizuoka)
Gyrodactylus nipponensis (Chiba, Shizuoka, Tokushima, Miyazaki)
Gyrodactylus sp. (Shizuoka)
Pseudodactylogyrus anguillae (Chiba, Shizuoka, Aichi, Tokushima, Ehime)
Pseudodactylogyrus bini (Shizuoka, Ehime)
Pseudodactylogyrus kamegaii (Chiba, Ehime)
Pseudodactylogyrus spp. (Shizuoka)
Unidentified Monogenea (Shizuoka, Nagano)

Cestoda
Bothriocephalus claviceps (Shiga)
Bothriocephalus japonicus (Ibaraki, Nagano, Gifu, Shiga)
Bothriocephalus sp. (Nagano)
Nybelinia anguillicola (Mie)
Unidentified Cestoda (Shizuoka)

Nematoda
Anguillicola crassus (Chiba, Shizuoka, Gifu, Aichi, Mie, Wakayama, Okayama, Tokushima, Oita, Miyazaki, Okinawa)
Anguillicola globiceps (Aomori, Nagano, Chiba, Shizuoka, Aichi, Wakayama, Okayama)
Cucullanus filiformis (Mie)
Gnathostoma spinigerum (Kagawa, Fukuoka, Kumamoto)
Heliconema anguillae (Ehime, Saga, Kagoshima)
Heliconema sp. (Okayama)
Philometroides anguillae (Tokyo, Achi)
Raphidascaris acus (Shiga)
Unidentified Nematoda (–)

Acanthocephala
Acanthocephalus gotoi (various localities including Tokyo, Aichi, and Ehime)
Echinorhynchus cotti (Shiga)
Longicollum alemniscus (Aichi)
Pseudorhadinorhynchus samegaiensis (Shiga)

Hirudinida
Batracobdella smaragdina (Aichi, Kagoshima)
Hemiclepsis marginata (Aichi)
Limnotrachelobdella okae (Oita)

Bivalvia
Hyriopsis schlegeli (Shiga)

Copepoda
Lernaea cyprinacea (Chiba, Shizuoka, Aichi, Mei, Okayama, Hyogo, Shimane, Miyazaki)

Remarks: This Host-Parasite List shows that 50 nominal species of parasites have so far been reported from *Anguilla japonica*. They are distributed among Ciliophora (6 spp.), Microspora (1 sp.), Myxozoa (6 spp.), Trematoda (12 spp.), Monogenea (6 spp.), Cestoda (3 spp.), Nematoda (7 spp.), Acanthocephala (4 spp.), Hirudinida (3 spp.), Bivalvia (1 sp.), and Copepoda (1 sp.). Of these species, three species, *Gyrodactylus nipponensis* (Monogenea), *Bothriocephalus claviceps* (Cestoda), and *Raphidascaris acus* (Nematoda), were most probably introduced from overseas (Hayward et al., 2001; Grygier and Urabe, 2003; Scholz et al., 2004), and the remaining 47 species are native to Japan.

Based on their habitat, the 47 nominal species are categorized into two groups: 39 species as freshwater (FW) parasites, and eight species as marine (M) and/or brackish-water (B) parasites. Excluding *Nybelinia angullicola* (Cestoda) occurring as a larva, the following seven nominal species in the latter group parasitize *Anguilla japonica* as an adult: *Lecithochrium musculus*, *Proctotrematoideas pisodontophidis*, *Tubulovesicula anguillae* (Trematoda), *Pseudodactylogyrus kamegaii* (Monogenea), *Cucullanus filiformis*, *Heliconema anguillae* (Nematoda), and *Limnotrachelobdella okae* (Hirudinida), and three of them, *T. anguillae*, *P. kamegaii*, and *H. anguillae*, are very likely to be host-specific. The introduced monogenean, *Gyrodactylus nipponensis*, is a brackish-water species. Three unidentified species of Trematoda, viz., *Bucephalus* sp., *Lasiotocus* sp., and *Tubulovesicula* sp., are also likely to be marine parasites. Since the Japanese population of *Anguilla japonica* includes individuals known as “sea eels” and “estuarine eels” inhabiting coastal marine and riverine brackish waters (Tsukamoto et al., 1998; Tsukamoto and Arai, 2001), these eels are considered to serve as hosts for the above (at least nine nominal) species of marine and/or brackish-water parasites.
Anguilla marmorata Quoy and Gaimard, 1824

Giant mottled eel, "ō-unagi"

Monogenea
- Pseudodactylogyrus anguillae (Ehime)
- Pseudodactylogyrus bini (Ehime)

Cestoda
- Bothriocephalus japonicus (Kagoshima)

Acanthocephala
- Acanthocephalus gotoi (Ehime)
- Acanthocephalus longiacanthus (Ehime)
- Southwellina hispida (Ehime, Kagoshima)

Remarks: Only six species of parasites have been reported from Anguilla marmorata in Japan. This is caused by the past insufficient investigation in Japan into the parasites of Anguilla marmorata, on which only two papers are available (Luo et al., 2002; Katahira and Nagasawa, 2014). As Anguilla marmorata is commonly found in the subtropical region of Japan, it is desirable to clarify the parasite fauna of the species from the region.

Acanthocephalus longiacanthus was described from Anguilla marmorata and has been reported only from this eel species (Katahira and Nagasawa, 2014), but, like other echinorhynchid acanthocephalans, A. longiacanthus does not appear to be host-specific. If this is true, no parasites which are specific to Anguilla marmorata have been reported from Japan to date because Southwellina hispida utilizes a variety of freshwater fishes as its paratenic hosts and the remaining four species of parasites also can infect Anguilla japonica.

Anguilla anguilla (Linnaeus, 1758)

European eel, "yōroppa-unagi"

Sarcomastigophora
- Cryptobia sp. (–)
- Ichthyobodo sp. (–)

Ciliophora
- Apiosoma sp. (Shizuoka)
- Capriniata piscium (Shizuoka)
- Chilodonella sp. (–)
- Ichthyophthirius multifiliis (Shizuoka)
- Trichodina sp. (Shizuoka)

Microspora
- Heterosporis anguillarum (Shizuoka, Aichi, Kagoshima)

Myxozoa
- Myxidium giardi (–)
- Myxidium sp. (Shizuoka)

Monogenea
- Gyrodactylus anguillae (Shizuoka)
- Pseudodactylogyrus anguillae (Chiba, Shizuoka, Aichi, Hiroshima, Kagoshima)
- Pseudodactylogyrus bini (Chiba, Shizuoka, Kagoshima)
- Pseudodactylogyrus spp. (Shizuoka)
- Unidentified Monogenea (Shizuoka)
Nematoda

*Anguillicola crassus* (Shizuoka)

Copepoda

*Lernaea cyprinacea* (–)

**Remarks:** Due to a shortage of *Anguilla japonica* elevers for pond culture in Japan, numerous elevers of *Anguilla anguilla* were imported from several European countries (mainly France) to Japan during the late 1960’s and 1970’s (Egusa, 1979; Tanaka, 1979). Currently, the elever import of the species from Europe has been very strictly regulated because it has been registered as a critically endangered species. The nine nominal species of parasites* listed herein were all reported from culured or experimentally reared *Anguilla anguilla* between the years 1969 and 2008 (Egusa *et al*., 1969; Fang *et al*., 2008). There is no recent work on the parasites of *Anguilla anguilla* in Japan. Although some individuals of the species have been reported from Japanese rivers and lakes (Zhang *et al*., 1999; Okamura *et al*., 2001), nothing is known about the parasites of those fish.

*Anguilla australis* Richardson, 1841

Short-finned eel

Monogenea

*Pseudodactylogyrus mundayi* (Shizuoka)

**Remarks:** As a pathway to import non-native eels alive to Japan, smoll-lot commercial tradings from Oceania currently exist (see Ogawa *et al*., 2015). Further attentions are needed to monitor introductions of non-indigenous parasites, accompanied with such international eel transportations, into Japan.

*Anguilla* sp.

Monogenea

*Pseudodactylogyrus anguillae* (Aichi, Kagoshima)

*Pseudodactylogyrus bini* (Aichi, Kagoshima)

*Pseudodactylogyrus* sp. (Kagoshima)

Nematoda

*Anguillicola globiceps* (–)

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A revised and updated checklist of the parasites of eels in Japan


日本産ウナギ類の寄生虫目録：追補改定版（1915-2017年）

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要 旨 1915-2017年の103年間に出版された文献に基づき、日本産ウナギ属魚類3種（ニホンウナギ Anguilla japonica, オオウナギ Anguilla marmorata, ヨーロッパウナギ Anguilla anguilla）と日本に輸入された Anguilla australis の寄生虫に関する情報を2つのリスト（寄生虫－宿主リスト，宿主－寄生虫リスト）に整理して目録を作成した。宿主のニホンウナギとオオウナギは在来種であり、ヨーロッパウナギはシラスウナギとして輸入され養殖された個体 Anguilla australis はオーストラリアから輸入された個体である。本目録は2007年に出版した同名目録の追補改定版である。本目録には、54名義種の寄生虫（綱毛虫類6種、微胞子虫類1種、ミクソゾア類6種、吸虫類12種、単生類8種、条虫類3種，線虫類7種，鉤頭虫類6種，ヒル類3種，二枚貝類1種，カイアシ類1種）に加えて、学名がまだ決定していない寄生虫の情報が含まれる。寄生虫－宿主リストでは、寄生虫は高位分類群ごとに配列され、最新の学名、シノニム、寄生部位、地理的分布および報告者の情報が示されている。上記54名義種のうち、ニホンウナギから50種，オオウナギから6種，ヨーロッパウナギから9種，Anguilla australis から1種の寄生虫が報告されていた。単生類の Gyrodactylus anguillae, Gyrodactylus nipponensis および Pseudodactylogyrus mundavi, 条虫類の Bothriocephalus claviceps, 線虫類の Raphidascaris acus は海外から持ち込まれたと推察されており、残りの49名義種が日本にもとと分布するものである。ニホンウナギから報告された寄生虫のうち、9名義種（Lecithochirium musculus, Proctotrematoïdes pisodontophídis, Tubulovesicula anguillae [吸虫類], Gyrodactylus nipponensis, Pseudodactylogyrus kamegaii [単生類], Nybelinia angulicola [条虫類], Cucullanus filiformis, Helicometra anguillae [線虫類], Limnotrachelobdella okae [ヒル類]）は海産または気水産であり、ウナギや河口ウナギとして知られる個体がそれら寄生虫の宿主になっていると考えられる。

キーワード：オオウナギ，寄生虫，ニホンウナギ，目録，ヨーロッパウナギ，Anguilla australis