A Checklist of the Parasites of Eels (Anguilla spp.)
(Anguilliformes: Anguillidae) in Japan (1915–2007)

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Abstract Information on the protistan and metazoan parasites of three species of eels, the Japanese eel Anguilla japonica, the giant mottled eel A. marmorata and the European eel A. anguilla, in Japan is summarized in the Parasite-Host List and Host-Parasite lists, based on the literature published for 93 years between 1915 and 2007. Both A. japonica and A. marmorata are native to Japan, whereas A. anguilla is an introduced species from Europe. The parasites, including 44 named species and those not identified to species level, are listed by higher taxon as follows: Sarcomastigophora (no named species), Ciliophora (6), Microspora (1), Myxozoa (6), Trematoda (7), Monogenea (7), Cestoda (3), Nematoda (7), Acanthocephala (4), Hirudinida (2), and Copepoda (1). For each taxon of parasite, the following information is given: its currently recognized scientific name, any original combination, synonym(s), or other previous identification used for the parasite occurring in 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 44 named species of parasites, 43 are from A. japonica, 1 from A. marmorata, and 10 from A. anguilla. Gyrodactylus anguillae (Monogenea) and Raphidascaris acus (Nematoda) are the exotic species that were probably introduced on A. anguilla from Europe, and it has also been suggested that G. nipponensis (Monogenea) was introduced on eels imported from somewhere in the Indo-western Pacific. Of the parasites recorded from A. japonica, eight species are marine and/or brackish-water species, of which two (i.e., Tubulovesicula anguillae, Pseudodactylogyrus kamegaii) are host-specific and occur as adults. This indicates that A. japonica serves as the definitive host for these parasites in marine and/or brackish waters where the host species constantly remains.

Key words: Anguilla anguilla; Anguilla japonica; Anguilla marmorata; checklist; eels; parasites

INTRODUCTION

Eels of the genus Anguilla are commercially important fishes in Japan, where the Japanese eel A. japonica Temminck and Schlegel and the giant mottled eel A. marmorata Quoy and Gaimard occur naturally (Matsui, 1972; Hatooka, 2002). Anguilla japonica is widely distributed in Japan and is one of the most important fishes in freshwater culture and commercial catch. The distribution of A. marmorata in Japan is confined to the southern region and its catch small. On the other hands,
since the late 1960’s, as many as 10 species of eels have been imported to Japan from other countries for culture in ponds or stocking in rivers and lakes (Tabeta et al., 1977). Of these species, some fish of the European eel *A. anguilla* (Linnaeus), the American eel *A. rostrata* (Lesueur) and the shortfin eel *A. australis* Richardson, 1841 have been actually recorded from natural waters in Japan (Tabeta et al., 1976, 1977; Zang et al., 1999; Aoyama et al., 2000; Okamura et al., 2001, 2002; Miyai et al., 2004).

In 1915, Dr. S. Ishii published a paper dealing with myxozoans found on *A. japonica*, which is the first report on the parasites of eels in Japan (Ishii, 1915). Since then, due to the importance of eels in aquaculture and fisheries, numerous studies and investigations have been conducted on the eel parasites in the country. In the present checklist, based on the literature published for 93 years between 1915 and 2007, information on the parasites of eels in Japan is compiled in two lists, Parasite-Host List and Host-Parasite List. In total, 44 named species of parasites are listed along with those not identified to species level. The parasites listed herein are from three species of eels (*A. japonica*, *A. marmorata* and *A. anguilla*). No parasites have been reported from the other eels in Japan.

In the **PARASITE-HOST LIST**, parasites are arranged by higher taxon in the following order: Sarcomastigophora, Ciliophora, Microspora, Myxozoa, Trematoda, Monogenea, Cestoda, Nematoda, Acanthocephala, Hirudinida, and Copepoda. The format is almost the same as in the checklists of Margolis and Arthur (1979) and McDonald and Margolis (1995). Within each higher taxon, genera and species are listed alphabetically. For each taxon 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 identification(s) that have been used in establishing records from eels in Japan. No attempt has been made to evaluate the taxonomic validity of the published reports.
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. For marine or brackish-water species, the name of the prefecture nearest the collection site is given.
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(s) 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.
7) The **References** section includes works directly cited in the Parasite-Host List; the **Supplementary References** are publications dealing with various aspects of parasites of eels in Japan but not containing original parasite records. If only a Japanese title was given by the original author(s), our translation of the title into English is provided in square brackets.

In the **HOST-PARASITE LIST**, hosts are listed alphabetically. In each higher taxon, parasites
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are also listed in alphabetical order, and after the name of each parasite, its geographical distribution is given in parenthesis.

This checklist is the sixth in the following series of published synopses of the parasites of commercially important fishes and shellfishes in Japan: Nagasawa et al. (1987) for the parasites of salmonids; Nagasawa et al. (1989) for the parasites of freshwater fishes in Hokkaido; Nagasawa (1993a) for the parasites of squids and cuttlefishes; Nagasawa (1993b) for the parasites of gadids; and Nagasawa et al. (2007a) for the parasites of ayu (Plecoglossus altivelis altivelis).

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)
              Anguilla japonica (1, 3, 4)
Site of infection: gills
Distribution: Shizuoka
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Remarks: Matsui (1972: 577–578, figs. 27.44, 27.45) reported the occurrence of two ciliates, "Sayphidia or Sayphydia sp." and "Sudonia sp." on the gills of A. japonica, as well as Capriniata piscium (as Trichophrya sp.). His identification of the first two species, 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 (Japanese flounder *Paralichthys olivaceus* and 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 (Japanese seaperch *Lateolabrax japonicus* and red seabream *Chrysophyrys major*) and a brackish-water fish (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

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 *Plistophora* to *Heterosporis* by Lom et al. (1989). Although Awakura (1974) found this parasite in Hokkaido, the infected fish had been transported from Shizuoka. The species is known to infect *A. japonica* in Taiwan (Tsui and Wang, 1988; Tsui 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
Includes: Myxidium sp. of Ishii, 1916; 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 thier size and shape, Hine (1980) regarded both taxa as identical, which was supported by Oka and Egusa (1989). Hine (1980: table 1) listed a record of *M. giardi* found in the gall bladder and musculature of the American eel Anguilla rostrata from Japan, but this record is not herein included 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 myxozoan. Niwa (1979) reported that the spores of *Mixidium* sp. 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* (Ishii, 1915)  
*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, initially 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  
*Host:* *Anguilla japonica*  
*Site of infection:* skin  
*Distribution:* Ibaraki  
*Record:* Fujita 1929 (Lake Ilinuma)  
*Remarks:* The present species was been initially described as *Lentospora anguillae* by Fujita (1929) but it was later 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 it.

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

**Trematoda**

*Azygia gotoi* (Ariake, 1922) Shimazu, 1979  
(FW)

Original combination: *Azygia anguillae* Ozaki, 1924  
Includes: *Azygia gotoi*-like trematodes of Shimazu, 1979  
Host: *Anguilla japonica*  
Site of infection: stomach  
Distribution: Aomori, Ibaraki, Tokyo, Nagano, Shiga  
Remarks: The taxonomy and life history of this trematode was reported in details by Shimazu (1979). Information on the species is available from Shimazu (1999a, 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)

*Genarchopsis goppo* Ozaki, 1925  
(FW)

Synonym: *Genarchopsis anguillae* Yamaguti, 1938  
Host: *Anguilla japonica*  
Site of infection: intestine  
Distribution: Ibaraki, Shiga  
Records: 1. Yamaguti 1938 (Ibaraki: Tsuchiura [as Tutiura]); 2. Shimazu 1995 (Ibaraki: Tsuchiura; Shiga: Lake Biwa)  

Hemiuridae gen. sp.  
(FW?)

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 was in the stomach of *A. japonica*. No description of this trematode is yet available.
**Lasiotocus sp.**
(B or FW)
Host: *Anguilla japonica*
Site of infection: intestine
Distribution: Aomori
Record: Shimazu 2005 (Lake Ogawara)

**Lecithochrium musculus** (Looss, 1907) Nasir and Diaz, 1971
(M)
Synonym: *Sterrhurus musculus* Looss, 1907
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 (1934) needs confirmation (Gibson and Bray, 1986: 83–90).

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

**Phyllodistomum anguilae** Long and Wai, 1958
(FW)
Host: *Anguilla japonica*
Sites of infection: urinary bladder, intestine
Distribution: Aomori, Ibaraki
Record: Shimazu 2005 (Aomori: Lake Ogawara; Ibaraki: Tsuchiura)

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

**Tubulovesicula anguilae** Yamaguti, 1934
(M)
Host: *Anguilla japonica*
Site of infection: stomach
Distribution: Miyagi
Record: Yamaguti 1934a (Matsushima Bay [as Matusima Bay])

**Monogenea**

**Gyrodactylus anguilae** Ergens, 1960
(FW)
Host: *Anguilla anguilla*
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Sites of infection: skin, gills
Distribution: Shizuoka
Record: Ogawa and Egusa 1980 (Maisaka)
Remarks: Ogawa and Egusa (1980) suggested that this species was introduced into Japan from France on A. anguilla. 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 (FW)
Host: Anguilla japonica
Site of infection: skin
Distribution: Shizuoka
Record: Ogawa and Hikoki (Yoshida)

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

Gyrodactylus nipponensis Ogawa and Egusa, 1978 (FW or B)
Host: Anguilla japonica
Site of infection: gills
Distribution: Chiba, Shizuoka, Tokushima, Miyazaki
Remarks: Hayward et al. (2001: 422) suggested that this monogenean was introduced into Japan on eels imported from somewhere in the Indo-western Pacific.

Gyrodactylus sp. (FW)
Host: Anguilla japonica
Site of infection: gills
Distribution: Shizuoka
Record: Ushiyama and Misaki 1977 (Hamamatsu)
Remarks: There is no information on the morphology and taxonomy of this gyroactylid. Identification needs to be confirmed in comparison with the 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, 5, 6)
Anguilla japonica (2)
Anguilla sp. (4)
Site of infection: gills
Distribution: Chiba, Shizuoka, Aichi, Tokushima, Kagoshima

Records:
1. Ogawa and Egusa 1976 (Chiba: -; Shizuoka: -)
2. Ogawa et al. 1985 (Chiba: -; Aichi: -; Tokushima: -)
3. Iwashita et al. 2002 (Shizuoka: Maisaka)
5. Yoshikawa 2005 (Shizuoka: Hamanako Branch of Shizuoka Pref. Fish. Exp. St.)
6. Umeda et al. 2006 (Kagoshima: Ibusuki Branch of Kagoshima Pref. Fish. Center)

Remarks: Ogawa et al. (1985) synonymised P. microrchis as a junior synonym of P. anguillae.

**Pseudodactylogyrus bini** (Kikuchi, 1929) Gusev, 1965

Original combination: *Dactylogyrus bini* Kikuchi, 1929

Hosts: *Anguilla anguilla* (2, 4)

*Anguilla japonica* (1, 5)

*Anguilla sp.* (3)

Site of infection: gills

Distribution: Chiba, Shizuoka, Aichi, Kagoshima

Records:
1. Kikuchi 1929 (−); 2. Ogawa and Egusa 1976 (Chiba: -; Shizuoka: -)
3. Hayward 2004 (Aichi: -; Kagoshima: Yaku Island)
4. Umeda et al. 2006 (Kagoshima: Ibusuki Branch of Kagoshima Pref. Fish. Center)
5. Sato and Tanaka 2007 (Shizuoka: near Lake Hamana)

**Pseudodactylogyrus kamegaii** Iwashita, Hirata and Ogawa, 2002

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Chiba

Record: Iwashita et al. 2002 (Minato River)

Remarks: This species was found on eels collected in brackish waters (Iwashita et al., 2002).

**Pseudodactylogyrus spp.**


*Pseudodactylogyrus bini* or *P. anguillae* of Tanaka and Sato, 2007; Sato and Tanaka, 2007

*“Pseudodactylogyrus* sp. ang. 4” of Hayward, 2004

Hosts: *Anguilla anguilla* (2, 4, 5, 6, 8, 10)

*Anguilla japonica* (1, 3, 7, 8, 11, 12)

*Anguilla sp.* (9)

Site of infection: gills

Distribution: Shizuoka, Kagoshima

Records:
1. Kikuchi 1929 (−); 2. Egusa and Ahmed 1970 (Shizuoka: Yaizu);
3. Egusa 1970 (Shizuoka: Yoshida);
4. Egusa 1971 (−); 5. Oka 1973a (Shizuoka: near Lake Hamana);
6. Hatai and Egusa 1973 (Shizuoka: Yaizu, Yoshida);
7. Ushiyama and Misaki 1977 (Shizuoka: Hamamatsu);
8. Niwa 1979 (−); 9. Hayward 2004 (Kagoshima: Yaku Island);
10. Yoshikawa et al. 2006 (Shizuoka: Hamana Branch of Shizuoka Pref. Fish. Exp. St.);
11. Tanaka and Sato 2007 (Shizuoka: near Lake Hamana);
12. Sato and Tanaka 2007 (Shizuoka: near Lake Hanama)
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Unidentified Monogenea (FW)
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 (FW)
Hosts: *Anguilla japonica* (?)(2)
*Anguilla maromorata* (1, 2)
Site of infection: intestine
Distribution: Shiga, Kagoshima
Records: 1. Luo et al. 2002 (Kagoshima: Yaku Island [as Yako Island]); 2. Scholz et al. 2004 (Shiga: Lake Biwa; Kagoshima: Yaku Island)
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 by the import of *A. anguilla* from overseas (Scholz et al., 2004).

*Bothriocephalus japonicus* Yamaguti, 1934 (FW)
Host: *Anguilla japonica*
Site of infection: intestine
Distribution: Ibaraki, Nagano, Gifu, Shiga
Remarks: Information on this cestode is available from Shimazu (1997). The scientific name was misspelled "japonicum" in Anonymous (2002).

*Bothriocephalus* sp. (FW)
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

Host: *Anguilla japonica*
Site of infection: intestine
Distribution: Shizuoka
Record: Ushiyama and Misaki 1977 (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 globiceps* Yamaguti, 1935 (FW)

Hosts: *Anguilla japonica* (1, 2, 3, 4, 5, 7)
*Anguilla sp.* (A. japonica ?)(6)
Site of infection: swimbladder
Distribution: Aomori, Nagano, Chiba, Shizuoka, Aichi, 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*.

*Anguillicoloides crassus* (Kuwahara, Niimi and Itagaki, 1974) Moravec and Taraschewski, 1988 (FW)

Original combination: *Anguillicola crassa* Kuwahara, Niimi and Itagaki, 1974
Previous identification: *Anguillicola globiceps* of Egusa et al. 1969
Includes: *Anguillicola japonica* of Matsui, 1972
*Anguillicola* sp. of Egusa and Ahmed, 1970; Ushiyama and Misaki, 1977
“Swimbladder nematodes” of Egusa, 1970
Hosts: *Anguilla anguilla* (1, 2, 5, 9, 10)
*Anguilla japonica* (1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17)
Site of infection: swimbladder
Distribution: Chiba, Shizuoka, Gifu, Aichi, Mie, Okayama, Tokushima, Oita, Miyazaki, Okinawa
Checklist of the parasites of eels in Japan


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 reported by 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).

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 conger eels Conger myriaster in Japan (Yamaguti, 1935).

Gnathosoma spinigerum Owen, 1836 (larva) (FW)
Host: Anguilla japonica
Site of infection: musculature
Distribution: unspecified prefecture in Kyushu

Heliconema longissimum (Ortlepp, 1923) (B)
Synonym: Heliconema anguillae Yamaguti, 1935
Host: Anguilla japonica
Site of infection: stomach
Distribution: unknown
Remarks: Matsui (1972: fig. 27.33) showed pictures of the stomach of A. japonica heavily infected by this nematode. Information on the nematode is available from Shimazu (1998). Moravec et al. (2007) recently redescribed the species from Pisodonophis boro (Ophichthidae) in Thailand.

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. longissimum* (as *H. anguillae*) (Suyehiro, 1957).


Original combination: *Filaria anguillae* Ishii, 1916
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 (1935) suggested that the species described by Ishii (1916a) as "*Filaria anguillae*" 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 parasituri*." 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 a parasite of Japanese fishes. It has been suggested that the nematode was introduced into Japan by the import of *A. anguilla* from overseas (Grygier and Urabe, 2003).

**Acanthocephala**

**Acanthocephalus gotoi** Van Cleave, 1925
Host: *Anguilla japonica*
Site of infection: intestine
Distribution: Tokyo, Aichi
Records: 1. Van Cleave 1925 (Tokyo: fish market); 2. Yamaguti 1935a (various localities in Japan); 3. Fukui and Morisita 1936 (Aichi:—)
Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

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

**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) as well. Petrochenko (1956) considered this species as a junior synonym of *Longicollum pagrosomi* but his suggestion has not been supported by Yamaguti (1963), Golvan (1969) and Amin (1985). The species is thus herein treated as a valid species.

**Pseudorhadinorhynchus samegaiensis** Nakajima and Egusa, 1975 (FW)

**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).

**Hirudinida**

**Batracobdella smaragdina** (Oka, 1910) (FW)

**Host:** Anguilla japonica

**Habitat:** Skin

**Distribution:** Aichi, Kagoshima

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

**Hemiclepsis marginata** (O. F. Müller, 1774) (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 caught in brackish waters.

**Copepoda**

**Lernaea cyprinacea** Linnaeus, 1758 (FW)

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

**Previous identification:** Lernaea elegans Leigh-Sharpe, 1925

**Includes:** Lernaea sp. of Niwa, 1979

**Hosts:** Anguilla anguilla (10)

**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). The bibliography of the copepod in Japan was published by Nagasawa et al. (2007b).

### HOST-PARASITE LIST

**Anguilla anguilla** (Linnaeus, 1758) European eel, “yōroppa-unagi” (in Japanese)

<table>
<thead>
<tr>
<th>Sarcomastigophora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryptobia sp. (—)</td>
</tr>
<tr>
<td>Ichthyobodo sp. (—)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ciliophora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apiosoma sp. (Shizuoka)</td>
</tr>
<tr>
<td>Capriniata piscium (Shizuoka)</td>
</tr>
<tr>
<td>Chilodonella sp. (—)</td>
</tr>
<tr>
<td>Ichthyophthirius multifiliis (Shizuoka)</td>
</tr>
<tr>
<td>Trichodina sp. (Shizuoka)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Microspora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterosporis anguillarum (Shizuoka, Aichi, Kagoshima)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Myxozoa</th>
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</thead>
<tbody>
<tr>
<td>Myxidium giardi (—)</td>
</tr>
<tr>
<td>Myxidium sp. (Shizuoka)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monogenea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyrodactylus anguillae (Shizuoka)</td>
</tr>
<tr>
<td>Pseudodactylogyrus anguillae (Chiba, Shizuoka, Aichi, Tokushima)</td>
</tr>
<tr>
<td>Pseudodactylogyrus bini (Chiba, Shizuoka, Tokushima)</td>
</tr>
<tr>
<td>Pseudodactylogyrus spp. (Shizuoka)</td>
</tr>
<tr>
<td>Unidentified Monogenea (Shizuoka)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Nematoda</th>
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</thead>
<tbody>
<tr>
<td>Anguillicoloides crassus (Shizuoka)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Copepoda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lernaea cyprinacea (—)</td>
</tr>
</tbody>
</table>

Remarks: The parasites listed herein are all from cultured *A. anguilla*. There is no record of parasites from this host occurring in natural waters of Japan.

**Anguilla japonica** Temminck and Schlegel, 1847 Japanese eel, “unagi” (in Japanese)

<table>
<thead>
<tr>
<th>Sarcomastigophora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryptobia sp. (—)</td>
</tr>
<tr>
<td>Ichthyobodo sp. (—)</td>
</tr>
<tr>
<td>Trypanosoma sp. (Shizuoka)</td>
</tr>
</tbody>
</table>
Ciliophora

*Ambiphrya* sp. (—)

*Apiosoma* sp. (Shizuoka)

*Capriniata piscium* (Shizuoka)

*Carchesium polypinum* (Tokushima)

*Chilodonella* sp. (—)

*Ichthyophthirius multifiliis* (Shizuoka)

*Trichodina acuta* (Mie)

*Trichodina jadranica* (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)

*Myxidium matsuii* (Kanagawa, Shizuoka, Aichi)

*Myxidium uchiyamae* (Shiga)

*Myxidium* sp. (Shizuoka)

*Myxobolus dermatobius* (Tokyo, Shizuoka)

*Myxobolus fujitai* (Ibaraki)

Unidentified Myxozoa (Shizuoka, Gifu)

Trematoda

*Azygia gotoi* (Aomori, Ibaraki, Tokyo, Nagano, Shiga)

*Centrocestus formosanus* (Kagoshima)

*Genarchopsis goppo* (Ibaraki, Shiga)

Hemiuridae gen. sp. (Tokyo)

*Lasiolocus* sp. (Aomori)

*Lecithochrium musculus* (Mie, unspecified prefecture facing the Seto Inland Sea)

Metagonimus spp. (Shizuoka)

*Phyllodistomum anguilae* (Aomori, Ibaraki)

*Proctotrematoideis pisodontophidis* (Chiba)

*Tubalovesicula anguillae* (Miyagi)

Monogenea

*Gyrodactylus egusai* (Shizuoka)

*Gyrodactylus joi* (Shizuoka)

*Gyrodactylus nipponensis* (Chiba, Shizuoka, Tokushima, Miyazaki)

*Gyrodactylus* sp. (Shizuoka)

*Pseudodactylogyrus anguilae* (Chiba, Aichi, Tokushima)

*Pseudodactylogyrus bini* (Shizuoka)

*Pseudodactylogyrus kamegaii* (Chiba)

*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 globiceps (Aomori, Nagano, Chiba, Shizuoka, Aichi, Okayama)
- Anguillicoloides crassus (Chiba, Shizuoka, Gifu, Aichi, Mie, Okayama, Tokushima, Oita, Miyazaki, Okinawa)
- Cucullanus filiformis (Mie)
- Gnathosoma spinigerum (unspecified prefecture in Kyushu)
- Heliconema longissimum (—)
- Heliconema sp. (Okayama)
- Philometroides anguillae (Tokyo, Aichi)
- Raphidascaris acus (Shiga)

Acanthocephala

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

Hirudinida

- Batracobdella smaragdina (Aichi, Kagoshima)
- Hemiclepsis marginata (Aichi)

Copepoda

- Lernaea cyprinacea (Chiba, Shizuoka, Aichi, Mie, Okayama, Hyogo, Shimane, Miyazaki)

Remarks: The above list shows that 42 named species of parasites have been recorded from A. japonica. Based on their habitat, these species are categorized into two groups: 34 freshwater (FW) parasites, and 8 marine (M) and/or brackish-water (B) parasites (see the Parasite-Host List). The following six species in the latter group occur as adults: Lecithochrium musculus, Proctotrematoides pisodontophidis, Tubulovesicula anguillae, Pseudodactylogyrus kamegaii, Cucullanus filiformis, and Heliconema longissimum. This clearly supports the current knowledge on the ecology of A. japonica (Tsukamoto et al., 1998; Tsukamoto and Arai, 2001; Arai et al., 2003a, 2003b): the species commonly occurs in marine coastal waters as “sea eels” and “estuarine eels” as well as in freshwater waters as “river eels.” Of the six species of parasites of marine and/or brackish-water origin, two species, Tubulovesicula anguillae and Pseudodactylogyrus kamegaii, are host-specific. It is thus apparent that A. japonica serves as the definitive host for the two parasites in marine and/or brackish waters, where the eel constantly remains.

Anguilla marmorata Quoy and Gaimard, 1824 Giant mottled eel, “ō-unagi” (in Japanese)
Anguilla sp.

Monogenea

Pseudodactylogyrus anguillae (Kagoshima)
Pseudodactylogyrus bini (Aichi, Kagoshima)
Pseudodactylogyrus sp. (Kagoshima)

Nematoda

Anguillicola globiceps (–)

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Leigh-Sharpe, W. H., 1925. Lernaea (Lernaecera) elegans n. sp., a parasitic copepod of Anguilla japonica. Parasitology, 17: 245-251.


**SUPPLEMENTARY REFERENCES**


日本産ウナギ類の寄生虫目録（1915～2007年）

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要 旨 1915～2007年の93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（ウナギAnguilla japonica, オオウナギAnguilla marmorata, ヨーロッパウナギAnguilla anguilla）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。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国外からの移入種である。本目録には、44種の寄生虫（繊毛虫類6種, 微胞子虫類1種, ミクソゾア類6種, 吸虫類7種, 単生類7種, 条虫類7種, 絡虫類7種, 匠頭動物4種, ヒル類2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、各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44種のうち、ウナギから43種、オオウナギから1種、ヨーロッパウナギから10種の寄生虫が報告されている。単生類のGyrodactylus anguillaeと線虫類のRaphidascaris acusはヨーロッパウナギとともにヨーロッパから、またGyrodactylus nipponensisもインド・西太平洋地域から持ち込まれたと推察されている。ウナギから報告された寄生虫のうち、8種は海産または汽水産で、2種（Tubulovesicula anguillae, Pseudodactylogyrus kamegaii）の成虫がウナギに特異的に寄生しているため、海洋と汽水域において、ウナギはそれら寄生虫の固有宿主の役割を果たしていると言える。

キーワード：ウナギ；オオウナギ；ヨーロッパウナギ；寄生虫；目録；Anguilla anguilla；Anguilla japonica；Anguilla marmorata