Turk J Vet Anim Sci
29 (2005) 1279-1284

Research Article

Occurrence and Intensity of some Parasitic Worms in *Acipenser gueldenstaedti, A. nudiventris* and *Huso huso* (Chondrostei: Acipenseridae) from the Southwest of the Caspian Sea

Masoud SATTARI
Department of Fisheries, Faculty of Natural Resources, The University of Guilan, Sowmeh-Sara, P.O. Box: 1144, IRAN
E-mail: msattari647@yahoo.com

Baba MOKHAYER
Department of Fish Health and Diseases, Faculty of Veterinary Medicine, University of Tehran, IRAN

Received: 22.10.2004

Abstract: Sturgeons are the most important fish in the Caspian Sea, but there are only a few reports about their parasite communities in the southern part of this sea. In this study, 102 samples of 3 sturgeon species, namely *Acipenser gueldenstaedti* (n = 78), *A. nudiventris* (n = 18) and *Huso huso* (n = 6), were caught from 3 geographical locations in the southwest of the Caspian Sea (Guilan Province, Iran) from April 1999 to February 2001.

Eight worm species including 3 nematodes [*Cucullanus sphaerocephalus, Eustrongylides excisus* (L.) and Anisakis sp. (L.)], 1 cestode (*Eubothrium acipenserinum*), 2 acanthocephalans (*Leptorhynchoides plagicephalus* and *Corynosoma strumosum*), 1 digenean trematode (*Skrjabinopsolus semiarmatus*) and 1 monogenean trematode (*Diclybothrium armatum*) were found in *A. gueldenstaedti, A. nudiventris* and *H. huso*.

Key Words: Fish, sturgeon, parasite, Caspian Sea

Introduction

Sturgeons (Chondrostei: Acipenseridae) are evolutionary relicts with a wide distribution in the northern hemisphere. Their status as basal actinopterygian fish, their unique benthic specializations, and variation in their basic diadromous life history make sturgeons interesting biological and biogeographical subjects. Extensive studies on Eurasian sturgeons indicate that they are also unique among fishes in possessing a markedly diverse assemblage of host–specific parasites.

The parasites of sturgeons have been studied by several authors (1-5). However, there are only a few reports about their parasites in the southern part of the Caspian Sea. Mokhayer (6) studied the parasites of 3 sturgeon species, namely *A. stellatus* (n = 72), *A. gueldenstaedti* (n = 95) and *H. huso* (n = 4), and reported 17 parasite species (*Trichodina reticulata, Polypodium hydriforme, Skrjabinopsolus skrjabini, S. acipenseris, Amphilina foliacea, Bothrimonus fallax, Eubothrium acipenserinum, Ascarophis ovotrichuria, Cyclozone acipenserina, Cucullanus sphaerocephalus, Contracaecum squalii, Anisakis schupakowi, Eustrongylides excisus (*L.*), Leptorhynchoides plagicephalus, Pomphorhynchus laevis, Corynosoma caspicum* and *Pseudotracheliastes stellatus*). Gorogi (7) studied the parasites of *A. persicus* (n = 604) and reported 3 parasite species (*C. sphaerocephalus, S. semiarmatus* and *L. plagicephalus*). In another study, Gorogi (8) reported 5 parasite species from *H. huso* (*C. sphaerocephalus, Anisakis schupakovi, S. semiarmatus, Corynosoma strumosum* and *E. acipenserinum*). Therefore, in the present study, attempts were made to determine the parasite fauna of 3 sturgeon species in the southwest of the Caspian Sea and the status of their parasite communities (prevalence, mean intensity, abundance and dominance).

Materials and Methods

A total of 102 samples of 3 sturgeon species, namely *Acipenser gueldenstaedti* Brandt, 1833 (n = 78), *Acipenser nudiventris* Lovetsky, 1828 (n = 18) and *Huso huso* Linnaeus, 1758 (n = 6) were collected from April 1999 to February 2001. The samples included sturgeons caught in fisheries sections 1 (location 1) and

2 (location 2) along a shore line of more than 200 km long and also the brood stocks of a hatchery adjacent to the Sefid-Rud River (location 3)(Figure).

As the sampling in this study was restricted by the governmental fishing program (induced spawning of brood stocks and then exporting their flesh), the aging of the sturgeons (by removing the pectoral fin ray) was impossible. After recording biometric characteristics (Table 1), common necropsy and parasitology methods (9) were used. Live trematodes and acanthocephalans were relaxed in distilled water at 4 ºC for 1 h and fixed in 10% hot buffered formalin. Live nematodes were fixed in hot 70% ethanol and cleared in hot lactophenol. Frozen specimens were thawed in water, and then fixed with 10% formalin (trematodes and acanthocephalans) or 70% ethanol (nematodes). All specimens fixed in 10% formalin were stained with aqueous acetocarmine, dehydrated and mounted in Permount. The worms were identified using parasite identification keys (10,11).

Standard statistical computations (mean intensity, standard deviation, prevalence, abundance and dominance) were carried out using Microsoft Excel (Office 2000). The dominance of a parasite species was calculated as N/N sum (where N = abundance of a parasite species and N sum = sum of the abundance of all parasite species found) and expressed as a percentage. Mean intensity was determined by dividing the total number of recovered parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of recovered parasites by the number of (infected and uninfected) fish samples. Prevalence was also calculated by dividing the number of infected fish samples by the total number of examined ones and was expressed as a percentage.

Results

In this study, a total of 1564 worms of 8 species, including 3 nematodes [*Cucullanus sphaerocephalus* Rudolphi, 1809, *Eustrongylides excisus* (L.) Jagerskiold, 1909 and Anisakis sp. (L.) Mozgovoi, 1951], 1 cestode (*Eubothrium acipenserinum* Kholodkovski, 1918), 2 acanthocephalans (*Leptorhynchoides plagicephalus* Westrumb, 1821 and *Corynosoma strumosum* Rudolphi, 1802), 1 digenean trematode (*Skrjabinopsolus semiarmatus* Molin, 1858), and 1 monogenean trematode (*Diclybothrium armatum* Leuckart, 1835), were found in *A. gueldenstaedti, A. nudiventris* and *H. huso*. The prevalence, mean intensity, range, abundance and dominance of the parasites are presented in Tables 2-4.

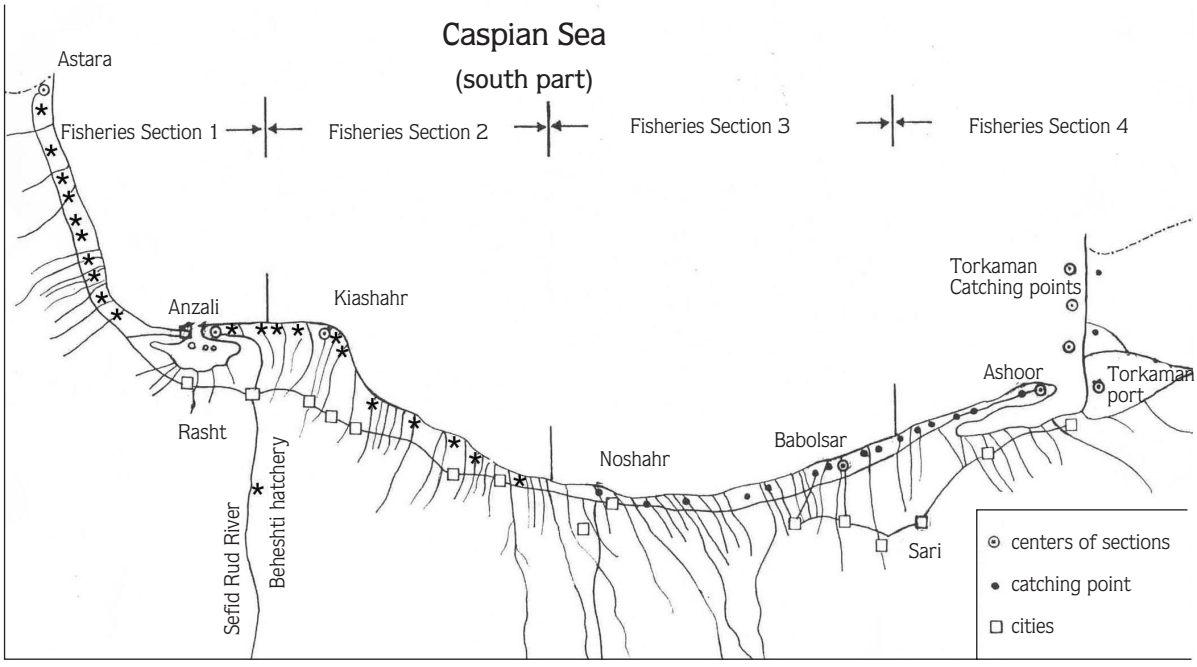

Figure. Fisheries sections and catching points in southern part of Caspian Sea (sampling points indicated by asterisks).

Table 1. Biometric characteristics (weight, fork length, total length, weight of caviar) of *A. gueldenstaedti*, *A. nudiventris* and *H. huso* caught in the southwest of the Caspian Sea.

Characteristics / Fish	Weight (kg) range Mean ± SD	Fork length (cm) range Mean ± SD	Total length (cm) range Mean ± SD	Weight of caviar (kg) range Mean ± SD
A. gueldenstaedti N = 78	7-38 18.510 ± 6.860	105-165 130.36 ± 13.35	120-179 147.98 ± 14.30	0.600-7.600 3.413 ± 1.565
A. nudiventris N = 18	13.5- 46 29.81 ± 11.64	123-180 154.18 ± 18.45	137-191 168.87 ± 17.80	3.600-7.700 4.950 ± 1.870
H. huso N = 6	33-126 61.67 ± 34.55	155-233 179.33 ± 30.32	174-275 201.66 ± 30.38	4.170-8.250 6.240 ± 2.041

Table 2. The prevalence, mean intensity, abundance and dominance of some parasites in *A. gueldenstaedti*.

Parasites	Infested fish number	Prevalence (%)	Mean intensity ± SD	Range	Abundance ± SD	Dominance (%)
C. sphaerocephalus N = 274	48	61.11	5.98 ± 6.84	1-32	3.65 ± 6.08	59.18
E. excisus (L.) N = 47	12	15.28	2.91 ± 2.51	1-8	0.44 ± 1.41	10.15
S. semiarmatus N = 36	12	15.28	2.82 ± 2.56	1-9	0.43 ± 1.40	7.78
C. strumosum N = 72	8	9.72	9.57 ± 16.02	1-45	0.93 ± 5.46	15.55
L. plagicephalus N = 23	5	6.94	4.4 ± 6.5	1-16	0.31 ± 1.91	4.97
Anisakis sp. (L.) N = 6	4	5.56	1.5 ± 0.58	1-2	0.08 ± 0.37	1.30

Table 3. The prevalence, mean intensity, abundance and dominance of some parasites in *A. nudiventris*.

Parasites	Infested fish number	Prevalence (%)	Mean intensity ± SD	Range	Abundance ± SD	Dominance (%)
C. sphaerocephalus N = 105	14	75	8.75 ± 7.09	1-32	6.56 ± 7.22	14.31
S. semiarmatus N = 527	13	68.75	47.9 ± 56.5	1-177	32.9 ± 51.5	71.79
E. excisus N = 59	6	31.25	9.6 ± 10.43	1-21	3.00 ± 7.08	8.03
E. acipenserinum N = 15	6	31.25	2.8 ± 2.49	1-6	0.88 ± 1.86	2.04
D. armatum N = 25	2	12.5	8.9 ± 5.51	5-12	1.1 ± 3.35	3.41
L. plagicephalus N = 3	1	6.25	3	3	0.19 ± 0.75	0.04

Table 4. The prevalence, mean intensity, abundance and dominance of some parasites in *H. huso*.

Parasites	Infested fish number	Prevalence (%)	Mean intensity ± SD	Range	Abundance ± SD	Dominance (%)
C. sphaerocephalus N = 25	4	66.67	6.25 ± 6.7	2-16	4.17 ± 6.08	6.72
E. excisus (L.) N = 328	3	50	109.3 ± 153.9	20-287	54.67 ± 114.26	88.17
C. strumosum N = 11	2	33.33	5.5 ± 0.71	5-6	1.83 ± 2.86	2.96
E. acipenserinum N = 2	2	33.33	1	1	0.33 ± 0.52	0.54
Anisakis sp.(L.) N = 5	1	16.67	5	5	0.83 ± 2.04	1.34
S. semiarmatus N = 1	1	16.67	1	1	0.17 ± 0.41	0.27

As shown in Table 2, a total of 458 worms of 6 species were found in the samples of *A. gueldenstaedti*; 23.61% of the fish had no parasites and 47.22% were infected with 1 parasite species, 22.22% with 2 species and 6.94% with 3 species. Fewer than 10 worms were found in 58.33% and 18.06% had 10 to 30 worms. According to Table 2, *C. sphaerocephalus* had the highest prevalence (61.11%) and dominance (59.18%). The prevalences of *E. excisus* (L.) (15.28%) and *S. semiarmatus* (15.28%) were also high. In addition, mean intensities of *C. strumosum* (9.75) and *C. sphaerocephalus* (5.98) were higher than those of the other parasites.

According to Table 3, 734 worms of 6 species were found in the samples of *A. nudiventris*. All of the fish had parasites; of these, 25% were infected with 1 parasite species, 43.75% with 2 species, 12.5% with 3 species and 18.75% with 4 species. Fish harboring fewer than 10 worms made up 31.25%; 31.25% had 10 to 30 worms and 37.5% harbored more than 30 worms. As shown in Table 3, *C. sphaerocephalus* had the highest prevalence (75%). The prevalence of *S. semiarmatus* (68.75%) was also high. In addition, the mean intensity and dominance of *S. semiarmatus* (47.91 and 74.33%, respectively) were higher than those of the others.

In this study, 372 worms of 6 parasite species were found in *H. huso* (Table 4). As shown in Table 4, *C. sphaerocephalus* had the highest prevalence (66.67%) in *H. huso*. *E. excisus* (L.) had the highest mean intensity (109.33) in the fish. The mean intensities of *C. sphaerocephalus* (6.25) and *C. strumosum* (5.5) were second and third. Interestingly, more than 278 specimens of *E. excisus* (L.) were found in the stomach of a large *H. huso* specimen. They were embedded in the muscles of stomach as granulomatous cysts.

Discussion

There are only a few reports about the parasites of sturgeons in Iran. Mokhayer (6) studied the parasites of 3 sturgeon species, namely *A. stellatus* (n = 72), *A. gueldenstaedti* (n = 95) and *H. huso* (n = 4), and reported 17 parasite species. However, in the present study, *Trichodina reticulata, Polypodium hydriforme, Ascarophis ovotrichuria, Cyclozone acipenserina, Contracaecum squalii* and *Pomphorhynchus laevis* were not recovered from the samples. Gorogi (7,8) also studied the parasites of 2 sturgeons, namely *A. persicus* (n = 604) and *H. huso* (n = 99), and reported 3 and 5 parasite species from these species, respectively. In the present study, one more parasite species [*E. excisus* (L.)] was recovered from *H. huso.*

Of all acipenserid species, the Russian sturgeon has the best known parasite fauna. The complete list of parasites found in *A. gueldenstaedti* includes 46 species; of these, parasitic worms are the largest group and, at the present time, there are records of 36 helminth parasite species (11). Skryabina (5) believes that by considering the composition of species, the parasite fauna of *A. gueldenstaedti* is very similar to that of *A. stellatus*, while in this study and also in other studies on the parasites of sturgeons in the southwest of the Caspian Sea (12), it was found that the parasite fauna of *A. gueldenstaedti* is more similar to that of *A. nudiventris* and *H. huso* than it is to that of *A. stellatus.*

The list of main parasites that have been found in ship sturgeons (*A. nudiventris*) includes 32 parasites. Most of them are parasites specific to acipenserids (1,3,5). Shulman (3) thinks that adult ship sturgeons are infested primarily in the sea by helminths such as *S. semiarmatus, E. acipenserinum* and *C. sphaerocephalus.* In juveniles, on the other hand, the predominant parasites are freshwater species such as *Trypanoplasma acipenseri*, *Amphilina foliacea*, *Hysterothylacium bidentatum, Piscicapillaria tuberculata, Chilodonella cyprini, Trichodina domerguei* and *Argulus foliaceus*. Along the Iranian shore of the Caspian Sea, however, the catching of juvenile sturgeons is forbidden by governmental organizations. Therefore, there is no report about their parasite fauna in the southern part of the sea, although some investigators have found Anisakis sp. (L.) and *Cystoopsis acipenseris* from dead juvenile sturgeons (A. Hajimoradloo, personal communications).

The parasite fauna of the great sturgeon (*H. huso*) has been thoroughly studied by many authors (1,3-5,13) and 33 parasite species have been recorded (14). With great probability, the individual local populations of the great sturgeon are infested by different aggregations of parasitic worms (1). These authors stated that there are findings indicating that the stocks inhabiting the northern Caspian region are infested by parasitic worms more typical of freshwater than those parasitizing the stocks in the southern part of the region. Similarly, in the present study and previous studies (8,6) the worms more typical of the sea, such as *E. acipenserinum,* Anisakis sp. (L.), *E. excisus* (L.), *C. strumosum* and *C. sphaerocephalus*, were found in the great sturgeon, while no freshwater worms such as *D. armatum, A. foliacea* and *L. plagicephalus* were observed.

The sample number of the sturgeons in the present study, particularly *A. nudiventris* and *H. huso*, was small (due to decreasing numbers of these species in catching yields). However, with respect to the results published by Gorogi (7,8) and Sattari (12), it seems that the helminthofauna expected to be found in the sturgeons of the southern part of the Caspian Sea does not exceed 13-15 species.

C. sphaerocephalus and *S. semiarmatus* were the most prevalent worms in the sturgeons and the mean intensity, abundance and dominance of these 2 parasites were also greater than the others. In this study, *E. excisus* (L.), Anisakis sp. (L.) and *C. strumosum* were mostly found in more carnivorous sturgeons such as *H. huso*, *A. gueldenstaedti* and *A. nudiventris.* This is likely because *E. excisus* (L.) needs some benthophagous fishes (e.g., *Rutilus rutilus caspius* and Neogobius spp.) as obligatory second intermediate hosts and *C. strumosum* needs some fishes (e.g., Clupeonella spp. and some gobiids) as reservoir hosts. This is also true for Anisakis sp. (L.); sturgeons are unusual hosts of this parasite and harbor it by feeding on some carnivorous cyprinids.

In the present study, *Amphilina foliacea* (a freshwater parasite) was not found in the sturgeons. It was also true for other freshwater worms such as *L. plagicephalus* and *D. armatum*, which had low prevalence and low mean intensity in the sturgeons (12). This is likely because the spawning migrations of the sturgeons into freshwater have decreased, which may be the result of unfavorable conditions of freshwater ecosystems caused by pollution, dam construction etc.

According to the results of this study and the results reported by Mokhayer (6) and Gorogi (7,8), the diversity of parasites of the sturgeons in the southern part of the Caspian Sea is lower than that in the northern part. It should be noted that the maximum depth of the Caspian Sea in the northern part is about 12 m, while in the southern part it is about 980 m. The salinity of water in the northern part is about 5 ppt (parts per thousand), while in the southern part it is about 13 ppt and may reach 20 ppt in the southeast. In addition, the productivity and carbonate ions between the 2 parts differ from each other. All of these factors may have some impact on the parasite communities of the sturgeons.

It also seems that the diversity of parasites (including freshwater ones) in the southern part of the sea have decreased since the time of the first study (6). This may also be related to unfavorable conditions in freshwater ecosystems, such as pollution and dam construction. In these conditions, it is impossible for the sturgeons to ascend into the rivers for spawning.

Acknowledgments

We would like to thank Dr. Pour Kazemi for helping in the laboratory program, and the International Research Institute of Sturgeons in Iran and the University of Tehran for their supporting funds.

References

1. Dogiel, V.A., Bykhovskiy, B.E.: Parasity ryb Kaspiiskogo morya. Trudy po kompleksnomu izucheniyu Kaspiiskogo morya 7. Izd. Akad. Nauk SSSR, Moskva-Leningrad, 1939; 172-173, (in Russian).
2. Dubinin, V.B.: Parazitofauna molodi osetrovikh ryb Nizhnei Volgi. Uchen. Zapiski Leningradsk, Gos. Univ., 141, seryia Biologich. Nauk, 1952; 28:238-251, (in Russian).
3. Shulman, S.S.: Obzor fauny parasitov osetrovikh ryb SSSR. Trudy Leningradskogo obshchestva estetstvoispttatelei, 1954; 72: 190-254, (in Russian).
4. Nechaeva, N.L.: Parazitofauna molodi osetrovykh ryb Kaspiisko–Kurinskogo rajona. Trudy VNIRO, 1964; 54: 223-238, (In Russian).
5. Skryabina , E.S.: Gel'minty osetrovikh ryb. Izd. Nauka, Moskva, 1974, (in Russian with English abstract).
6. Mokhayer, B.: Recherches sur le parasitisme des esturgoens de La Mer Caspienne Meridionale, PhD Dissertation, Universite de Paris, France, 1972, (in French).
7. Gorogi, A.: Identification of blood and intestinal parasites of *A. persicus* in southern part of Caspian Sea, Iranian J. of Fisheries Sci., 1996; 1: 35-39, (in Persian with English abstract).
8. Gorogi, A.: Identification of blood and intestinal parasites of *H. huso* in southern part of Caspian Sea, Iranian J. of Fisheries Sci., 1996; 4: 43-47, (in Persian).
9. Stoskopf, M.K.: Fish Medicine, W.B. Saunders Co. , Philadelphia, 1993; 52-63.
10. Bykhovskaya-Pavlovskaya, I.E., Gusev, A.V., Dubinina, M.N., Izyumova, N.A., Smirnova, T.S., Sokolovskaya, A.L., Schtein, G.A., Shulman, S.S., Epshtein, V.M.: Key to parasites of freshwater fishes of the USSR, Acad. of Sci. of the USSR , Zool. Inc., 1962; 396-397, 403-404, 434, 438-442, 475-476.
11. Moravec, F.: Parasitic nematodes of freshwater fishes of Europe, Kluwer Acad. Publ., 1994; 172-173, 195-198, 377-380, 396-399.
12. Sattari, M.: Parasites of sturgeons (Chondrostei: Acipenseridae) from south-west of Caspian Sea, PhD Dissertation, The University of Tehran, Iran, 1999; (in Persian).
13. Bauer, O.N., Musselius, V.A., Nikolaeva, V.M., Strelkov, Yu.A.: Ikhtiopatologiya, Pishchepromizdat, Moskva, 1977; (in Russian).
14. Holcik, J., The freshwater fishes of Europe, Vol. 1 , Part 2, AULA-Verlag, Weisbaden, 1989; 395-433, 345-363, 206-223.