Parasites of Stellate Sturgeon (Acipenser Stellatus) from South- West of Caspian Sea.

Masoud. Sattari
Department of Fisheries, Faculty of Natural resources,
Guilan University, Iran

Abstract: Sturgeons are the most important fishes of Caspian Sea, but there are few reports about the pathogens of them in southern part of the Sea. In this survey, it has been attempted to indicate the parasite communities of *Acipenser stellatus* and their prevalence as well as their effects on the fish growth.

In this survey 234 *A. stellatus were* caught from three different geographical locations including fisheries sections I, II and a hatchery adjucent to Sephid Rud River (III) in south -west of Caspian Sea (Guilan Province, Iran).Common parasitology procedures were used for necropsy of the fish and recovery of parasites. The parasites were fixed in Buffererd Formalin (10%) and ethyl alcohol (70%), stained by Acetocarmine and then identified. Standard statistical computations (mean, Standard Deviation, range, prevalence and dominance) were calculated for the overall samples and for samples grouped by geographical location. The differences between groups defined by Z test and One Way Anova test ($p<0.05$).

Nine different parasite species were recovered from internal organs of the fish including *Skrjabinopsolus semiarmatus* (prevalence= p = 43.15%), *Leptorhynchoides plagicephalus* (p = 20.18%), *Cucullanus sphaerocephalus (p= 17.26%), Eubothrium acipenserinum (p=9.14%), Bothrimonus fallax* (p = 4.47%), *Eustrongylides excisus* (larvae), *Anisakis sp.* (larvae), *Amphilina foliacea* and *Corynosoma strumosum.*

The prevalence and intensity of parasites in fisheries section of II and III were more than section I. A direct relation was found between some parasites (especially *S .semiarmatus*) and size. The prevalence and intensity of some parasites in females were more than males and also it was found that there is a correlation between some parasites (especially *S. semiarmatus*) and season.

In this survey, again it was found that the internal parasites of *A. stellatus* in this area (south - west) are the same as northern part of Caspian Sea but the diversity of parasites was less than north. Furthermore, the diversity of parasites has been decreased in a period of time (compared with the first survey), though the prevalence and intensity of some (marine) parasites appears to be increased during this period.

Keywords:

Fish, sturgeon, *Acipenser stellatus, parasite,* Caspian Sea

Introduction:

Stellate sturgeon (Acipenser stellatus pallas 1771) is an important and commercial fish in Iran and comprises about 70% of sturgeon caught in Iranian shore of Caspian Sea. The specific name "stellatus" is a Latin word meaning "covered with stars". This name was apparently given to the stellate sturgeon because the plates covering its body have a starlike shape (Holcik 1989). The snout is long, narrow and dorsoventrally compressed, its length varying from 59% to 65% of head length (Chogunov and Chogunova 1964). This character clearly distinguishes the stellate sturgeon from all other members of genus Acipenser (Holcik 1989). The A. stellatus inhabits the Caspian, Azov, Black and Aegian Seas, from which it migrates into the rivers. It is represented only by the migratory form (Holcik 1989). The parasites of A. stellatus have been investigated by several authors (Dogiel and

Bikhovsky 1939; Dubinin 1952; Shulmann 1954; Nechaeva 1964; Skrjabina 1974). However, there is only one report about it in southern part of Caspian Sea (Mokhayer, 1972) which is only about parasitic identification (description) but not about parasites communities and epidemiological information.

So , in the present survey , attempts have been done to determine the fauna of A. stellatus in south - west of Caspian Sea and indicate the feature of parasites communities (Prevalence , Intensity and Dominance) and epidemiological survey related to season , location , sex , and size , and also the effects of parasites on growth rate .

Materials and Methods:

Stellate sturgeons (A. stellatus) were collected during April - February 1997 - 99 and samples included whole fish and viscera. A total of 234 samples were examined. The samples included the broodstock fish of a hatchery located near to Sefid Rud River (Sad-e Sangar) and sturgeons caught in fisheries regions of 1 and 2 along with a shore area of more than 200 kilometers (these fish were processed in 16 different facilities along with the shore). After recording biometric characteristics and removing the viscera, all viscera were examined for parasites; sections of the spleen and liver were squashed and the major ducts in the liver were dissected and examined. Mucus from the first part of intestine was removed and examined between glass plates for protozoans. Live trematodes and acanthocephalans were relaxed in distilled water at 4 C for 1 hour and fixed in 10% hot buffered formalin. Live nematodes were fixed in hot 70% ethanol and cleared in glycerine alcohol or 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 (Fisher Scientific Co, U.S.A.).

Analysis:

Standard statistical computations (mean of intensity, standard deviation and prevalence) were calculated for the all samples and for the samples categoried based on season, geographical location, sex, length and weight. 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 recovered) and expressed as a percentage. The correlation between growth rate and the number of parasites were determined by Pearsons Correlation Coefficient. Computations were performed using Lotus 1-2-3 as a data sheet and sx (Walts - stuff, vertion 4.0) for statistics.

Results:

In the present survey, 9 different parasite species were recovered, which the name ,prevalence (including confidence interval of prevalence with confidence level of 95% or pValue < 0.05), mean intensity and range (minimum and maximum of parasites) are shown in Table 1 .

According to the Table 1, *S. semiarmatus* has been found with highest prevalence (43.5%) in A. stellatus. The *L. plagicephalus* (20.81%) and *C. sphaerocephalus* had lower prevalence respectively. The mean intensity of parasites in *A. stellatus* was similar to prevalence (24.99, 8.41 and 1.66 related to *S. semiarmatus*, *L. plagicephalus* and *C. sphaerocephalus* respectively). The prevalence and mean intensity of other parasite species were low.

According to the Table 2, the dominance of *S. semiarmatus* and *L. plagicephalus* were high (80.34% and 13.48% respectively) and these 2 parasite species comprised more than 93% of parasite communities in *A. stellatus*. The dominances of other parasites were low.

According to the Table 3, prevalence and mean intensity of *S. semiarmatus* in *A. stellatus* in spring and winter were higher than summer and autumn and the differences between these seasons were significant (One Way Anova test, $p<0.05$). So, *S. semiarmatus* had a correlation with season. The prevalence and mean intensity of *L. plagicephalus* in summer were higher than other seasons, but the differences were not significant (One Way Anova test, $p<0.05$).

According to the Table 4, the prevalence and mean intensity of *S. semiarmatus* in fisheries section II and Sad- e Sangar (III) were high but there was found no S. *semiarmatus* in fisheries section I. So, the location had a correlation with *S. semiarmatus*, but not with other parasites.

The prevalence and mean intensity of *L. plagicephalus* in fisheries section II were higher than section I, but the differences were not significant (One Way Anova test, $p<0.05$).

According to the Table 5, the prevalence and mean intensity of *S. semiarmatus* in females were more than males and the differences were significant (Z test, $p<0.05$). So, *S. semiarmatus* had a correlation with sex. According to the Table 6 and 7, the prevalence and mean intensity of some parasites in fish with larger sizes (lengths and weights) were higher than smaller .It is specially concerned to *S.semiarmatus* (which the differences were significant between different sizes) .So, this parasite and to some extent, the other parasites, (except for *L.plagicephalus*) had a correlation (direct relation) with length and weight. The latter had indirect relation with size (length and weight).

Disscution and Conclusion:

In the present survey, nine different species of helminthes were recovered from *A.stellatus*. It is the second survey which has been carried out on parasites of *A. stellatus* in southern part of Caspian Sea (in Iran). In the first survey (Mokhayer, 1972); ten internal parasites were isolated from *A. stellatus*. The present survey has indicated a decrease in diversity of parasite species during a period of about 25 years (from 1972 till now). It may be presumably because the conditions of river ecosystems have deteriorated and the fish can not migrate into the fresh water. So, in the present survey, the freshwater fauna of parasites have been decreased in *A. stellatus*. It is interesting to say that the prevalence and mean intensity of some parasites, especially marine species such as *S. semiarmatus* have been increased during this period.

On the other hand , extensive knowledge of sturgeon parasites in russian shore of the Caspian Sea (Skrjabina ,1974) shows more diversity of parasite species in that regions , while in the present survey and former (Mokhayer 1972) , fewer parasite species have been found in the southern part of Caspian Sea . It may be due to the differences between northern and southern parts of Caspian Sea with respect to physicochemical and biological features of the two parts .For example, the salinity of the Caspian Sea in northern part is 5 ppt, while in southern part is 13 - 14 ppt; the maximum depth of water in northern part is 28 m, while in southern part is 980m. Furthermore, the fertility and carbonate ions of water in southern part are different from (higher than) northern part (Mokhayer 1972).

In the present survey, it has been found that the diversity of parasites in *A. stellatus* is fewer than other sturgeons. It has been also found that the prevalence and mean intensity of *C.sphaerocephalus* in A. *stellatus* were lower than other sturgeons. On the Contrary, the prevalence and mean intensity of *L.plagicephalus* in *A. stellatus* were higher than other sturgeons (Sattari, 1999). The *B.fallax* was only isolated from *A. stellatus* but not from sturgeons. The mean intensity of infection with *E. acipenserinum* in *A. stellatus* was relatively high. The high prevalence and high mean intensity *L. plagicephalus* and *S.semiarmatus* in *A. stellatus* is probably related to the diet of this sturgeon which include some invertebrate specially Gammarids and Oligochaetes (these organisms are known to be the intermediate hosts of *L.plagicephalus* and *S. semiarmatus* respectively .

In the present survey, it was found that the prevalence and mean intensity of *E. excisus*, Anisakis *sp.* and *C. strumosum* in *A. stellatus* were lower than other sturgeons (Sattari 1999). These parasites need some vertebrate intermediate hosts (second obligatory intermediate hosts) which are known to be some benthophage fishes (Gobiidae and Cyprinidae) (Moravec 1994), while *A. stellatus* is used to consume mainly crustaceans and mollusks (Tarverdieva 1967, 1968) and few fish are found in its gut.

In the present survey, it was found that the prevalence and mean intensity of some parasites such as *L. plagicephalus* and *S. semiarmatus* had a relation with season. For example, the prevalence and mean intensity of *S. semiarmatus* were higher in spring and winter than autumn and summer which may be due to spawning migration stress in spring and early winter and suseptibility to infection. The prevalence and mean intensity of *L. plagicephalus* were higher in summer which may be due to high abundance of Gammarids (intermediate hosts) in summer.

In the present survey, it was found that the prevalence and mean intensity of some parasites in fisheries section II and Sad-e

Sangar (III) were higher than fisheries section I. It was presumably due to the role of Sefid Rud River in these Sections (fisheries sections II and III). It is important to note that Sefid Rud is a big river which enters into the Caspian Sea at the sections II and III. It may eutrophicate this area and may allow the intermediate host organisms to grow up. So, the abundance of these organisms in this part is higher than section I. Furthermore, the fry of *A. stellatus* which are hatched in Sad-e Sangar hatchery are released into Sefid Rud River.

In the present survey , it was found that the prevalence and mean intensity of *S.semiarmatus* in females were more than males and the differences were significant .It is presumably because the females which migrated to the rivers for spawning , had bigger sizes than males (as shown in the Tables 6 and 7 , bigger fish had more parasites).

In the present survey , it was found that , the prevalence and mean intensity of some parasites in larger sizes (lengths and weights) were higher than smallers .It is specially concerned to *S.semiarmatus* (which the differences were significant between different sizes) .So , this parasite and to some extent ,the other parasites,(except for *L.plagicephalus*) had a correlation (direct relation)with size (length and weight) . There may be three reasons for this correlation:

1 - The bigger fish have been encountered to parasites for longer period of time than smaller fish.

2 - The stomach contents of bigger fish were more than smaller fish which means they have consumed more food (and more food items) including intermediate hosts of parasites.

3 - The bigger fish consumed larger sizes of food items, including numerous bait fishes which might be intermediate hosts of parasites, while smaller fish could not consume fish but consumed invertebrates (which did not have some certain parasites. for example, *E. excisus* was found mainly in bigger fish and its prevalence in bigger fish (more than 13 Kg) were higher than smallers.

References:

Dogiel, V.A.; Bykhovskiy, B.E. (1939): The parasites of fishes of Caspian Sea; In: Parasitic nematodes of fresh water fishes of Europe; Moravec, F. (1994); Kluwer Academic Publishers 473 pp.

Dubinin, V.B. (1952): Parazitofauna molodi osetrovikh ryb Nizhnei Volgi. In: The fresh water fishes of Europe; HolciK, J. (1989), vol.1, part.2, AULA-Verlag Weisbaden Publication.

Emadi,H;(1996): The situation of catching and the reason of decreasing the sturgeons stock ; Journal of Abzyyan ,vol.1 , p.16-18 ; Iran ; Ie : persian

Gorogi,A;(1995): Identification of blood and internal parasites of A. persicus in southern part of Caspian Sea ; Journal of Fisheries Organization of Iran ; vol.1 ;pp.35 ; IE:persian .

HolciK .J , (1989) , The fresh water fishes of Europe , vol.1 , part.2 , AULA-Verlag Weisbaden Publication , pp. 395-433 , 345-363 , 206-223

Mokhayer, B.; (1972): Recherches sur le parasitisme des Esturgoens de la Mer Caspienne Meridionale, These; Universite de Paris

Moravec, F. (1994): Parasitic Nematodes of fresh watr fishes of Europe, Kluwer Academic publishers, pp. 172-173, 195-198, 377-380, 396 -399 .

Nechaeva, N.L.; (1964): Parazitofauna molodi osetrovikh ryb Kaspiisko – Kurinskogo rajona; In: The fresh water fishes of Europe; HolciK, J. (1989), vol.1, part.2, AULA-Verlag Weisbaden Publication.

Sattari, M. ;(1999) : Parasites of sturgeons (Chondrostei: Acipenseridae) from south -west part of Caspian Sea ; Thesis ; Faculty of veterinary medicine ; The University of Tehran ; Iran ; pp.280 ; IE: persian

Skryabina, E.S. (1974): Helminths of Acipenserid Fishes; In: Parasitic Nematodes of fresh watr fishes of Europe; Moravec, F. (1994); Kluwer Academic publishers 473 pp.

Shulman , S.S.; (1954) :Obzor fauny parasitov osetrovikh ryb SSSR ; In:The fresh water fishes of Europe ; HolciK,J. (1989), vol.1 , part.2 , AULA-Verlag Weisbaden Publication .

Tarverdieva, M.I.; (1967): Sutochnyi khod pitanyia osetra i sevryuga (po materialam iz zapadnogo rajona Severnogo Kaspiya za Leto 1963 g); In: The fresh water fishes of Europe; HolciK, J. (1989), vol.1, part.2, AULA-Verlag Weisbaden Publication.

Tarverdieva, M.I. (1968): Pastbishcha osetra i sevryuga v Kaspiiskom more v 1962 g. i mnogoletnie izmeneniya v pitanii Kaspiiskikh osetrovikh; In: The fresh water fishes of Europe; HolciK, J. (1989), vol.1, part.2, AULA-Verlag Weisbaden Publication.

Terik, M ;(1994): A survey about the diet of sturgeons in southern part of Caspian Sea; Journal of Fisheries Organization of Iran; vol. 1, p.26; Iran; IE: Persian.

Table.1: Distribution of Prevalence, confidence interval of prevalence ($p<0.05$), Mean Intensity and Range (Maximum and Minimum) of parasites in A. stellatus.

				(%)parasite
S.semiarmatus	43.15	36.8-49.5	24.99	1-426
L.plagicephalus	0.81	15.6-26.1	8.41	1-51
C.sphaerocephalus	17.26	12.4-22.1	1.66	1-5
E.acipenserinum	9.14	5.4-12.9	1.94	1-6
B.fallax	4.57	1.9-7.3	2.78	1-20
E.excisus(L)	4.06	1.5-6.6	1.5	1-5
A.foliacea	0..1	-	2	2
Anisakis sp.(L)	0.02	-	1	1
C.strumosum	0.02	-	1	1

Table.2: The number and Dominance (%) of parasites in *A. stellatus*.

Parasite	Number	Dominance (%)
S.semiarmatus	2146	80.34
L.plagicephalus	360	13.48
C.sphaerocephalus	61	2.28
E.acipenserinum	35	1.31
B.fallax	51	1.91
E.excisus(L)	12	0.45
Anisakis sp.(L)	2	0.075
A.foliacea	4	0.15
C.strumosum	1	0.038

Table.3: Distribution of Prevalence, confidence interval of prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in A.stellatus in different seasons

Parasite Prevalence (%) Mean±SD Location	C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	E.acipenserinum Prevalence (%) Mean±SD Range	E.excisus Prevalence (%) Mean±SD Range	B.fallax Prevalence (%) Mean±SD Range
Spring	15.38	55.77	17.31	21.15	0	01.92
N=52	1.75+1.49 (1-5)	27.31+66.5 (1-290)	11.33+16.43 (1-51)	2.27+1.74 (1-6)	0 0	1.0 1
Summer	25	5.56	33.33	0	0	13.89
N=36	2.33+1.22 (1-4)	1.5+0.71 (1-2)	12+13.82 ?	0 0	0 0	1.8+1.75 (1-5)
Autmn	17.65	14.71	14.71	0	0	0
N=34	1.17+0.41 (1-2)	97.2+185.2 (1-426)	6.6+5.3 (1-14)	0 0	0 0	0 0
Winter	14.67	65.33	20	9.33	0	2.67
N=75	1.45+0.69 (1-3)	17.2+26.97 (1-158)	3.87+3.29 (1-12)	1.34+0.79 (1.3)	2.87+2.91 (1-10)	1.0 1

Table.4: Distribution of Prevalence, confidence interval of prevalence (p<0.05), Mean and Range of Intensity (Maximum and Minimum) of parasites in *A.stellatus* in different locations.

Parasite Prevalence (%) Mean±SD Location	C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	E.acipenserinum Prevalence (%) Mean±SD Range	E.excisus Prevalence (%) Mean±SD Range	B.fallax Prevalence (%) Mean±SD Range
st.1	23.09	0	15.38	0	0	0
N= 13	1.67+1.15 (1-3)	0 0	1.5+0.71 (1-2)	0 0	0 0	0 0
St.2	17.22	43.05	22.52	7.95	5.96	4.69
N= 151	1.61+0.94 (1-4)	21.17+56.6 (1-426)	7.32+9.32 (1-45)	2.08+1.62 (1-6)	2.78+2.91 (1-10)	1.57+1.51 (1-5)
St.3	15.15	60.61	15.15	18.18	0	3.03
N= 33	2.2+1.79 (1-5)	37.4+7 (1-290)	17+20.59 (2-51	1.67+1.21 (1-4)	0 0	1.0 1

Table.5: Distribution of Prevalence, confidence interval of prevalence ($p<0.05$), Mean and Range (Maximum and Minimum) of parasites in *A.stellatus* in male and female

Parasite Prevalence (%) Mean±SD Location	C.sphaeroceph alus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean(SD Range	E.acipenserinu m Prevalence (%) Mean(SD Range	E.excisus Prevalence (%) Mean(SD Range	B.fallax Prevalence (%) Mean(SD Range
female	15.83	53.33	20.83	10.83	5	3.33
N=120	1.42+0.77 (1-3)	27.89+69.91 (1-426)	5.88+9.18 (1-45)	2.08+1.55 (1-6)	2.67+3.61 (1-10)	1.0 1
Male	19.48	27.27	20.78	6.49	3.9	5.19
N=77	2.07+1.33 (1-5)	16.14+28.36 (1-126)	11.86+13.4 (1-15)	1.6+1.34 (1-4)	3.0+1.0 (2-4)	2.0+2.0 (1-5)

Table.6: Distribution of Prevalence, confidence interval of prevalence($p<0.05$), Mean and Range (Maximum and Minimum) of parasites in A.stellatus based on fork length

Parasite Prevalence (%) Mean(SD Location	C.sphaerocephalus Prevalence (%) Mean(SD Range	S.semiarmatus Prevalence (%) Mean(SD Range	L.plagicephalus Prevalence (%) Mean(SD Range	E.acipenserinum Prevalence (%) Mean(SD Range	E.excisus Prevalence (%) Mean(SD Range	B.fallax Prevalence (%) Mean(SD Range
100-119	16.92	26.15	18.46	3.08	7.61	3.08
N=65	1.36+0.5 (1-2)	11.18+10.11 (1-35)	12.17+17.25 (1-51)	2.0+1.41 (1-3)	2.4+1.14 (1-4)	1.0 1
120-139	18.63	47.06	22.55	11.79	3.92	4.9
N=102	1.84+1.3 (1-5)	17+31.26 (1-158)	7.13+8.14 (1-27)	1.92+1.75 (1-6)	3.25+4.5 (1-10)	1.8+1.75 (1-5)
14 0<	17.39	73.91	17.39	13.04	0	4.35
N=23	2.0+1.15 (1-3)	64.65+123.6 (1-426	4.25+3.3 (1-5)	1.33+0.58 (1-2)	1.0 0	1

Table.7: Distribution of Prevalence, confidence interval of prevalence ($p<0.05$), Mean and Range (Maximum and Minimum) of parasites in A.stellatus based on weigth

Parasite Prevalence (%) Mean(SD Location	C.sphaeroceph alus Prevalence (%) Mean(SD Range	S.semiarmatus Prevalence (%) Mean(SD Range	L.plagicephalus Prevalence (%) Mean(SD Range	E.acipenserinu m Prevalence (%) Mean±SD Range	E.excisus Prevalence (%) Mean±SD Range	B.fallax Prevalence (%) Mean±SD Range
4-6.999	9.09	22.73	18.18	0	6.81	2.27
N=44	1.25+0.5 (1-2)	9.0+10.62 (1-35)	10.63+16.87 (1-51)	0 0	2.33+0.58 (2-3)	1.0 1
7-9.999	21.62	41.89	20.27	13.51	6.76	4.05
N=74	1.75+1.24 (1-5)	10.03+13.44 (1-54)	9.13+12.63 (1-45)	2.2+1.75 (1-6)	1.6+1.34 (1-4)	1.0 1
10-12.999	20	52.73	18.18	5.45	0	3.64
N=55	1.73+1.1 (1-4)	29.07+51.47 (1-208)	7.2+8.02 (1-23)	2.0+1.73 (1-4)	0 0	3.0+2.83 (1-5)
13-15.999	9.52	71.43	23.81	19.05	4.76	9.52
N=21	2.0+1.41 (1-3)	58.7+125 (1-426	3.8+3.03 (1-8)	1.25+0.5 (1-2)	1.0 1	1.0 1