

Catch and Catch per unit efforts of *Acipenser persicus* (Borodin, 1897) in southern of the Caspian Sea (Mazandaran waters)

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ABSTRACT: This study has been conducted in the southern coast of Caspian Sea in Mazandaran waters from 2009 to 2012. The sampling was done monthly through two fishing methods; through landing and beach seine nets. After being caught, the samples were delivered to breeding and reproduction center in Sari in order to be artificially propagations for the purpose of protection and restocks. The purpose of this study is to investigate the distribution, abundance, age, fork length, and body, meat and caviar weight, catch condition, catch per unit effort in the beach seine and landing. The results shown that 1283 caught *A. persicus*, 732 had caviars. Totally, the average fork length, body weight, meat and caviar weight were 150.5 ± 17.6 cm, 24.4 ± 9 kg, 18.6 ± 6.4 kg and 4.8 ± 1.7 kg, respectively. The contribution of landing in caviar production was 73.1%. There was a significant difference in the amounts of caviar and meat and the body weight between landing and beach seine nets ($P < 0.05$). The ages of the sturgeons caught in the domain were from 11 to 23 years old. The most frequent age group was 14-15 years which had a frequency of about 44%. The catch per unit effort had decreasing trend from 2009 to 2012 with 0.289 and 0.124 kg/boat per day, respectively. The Persian sturgeon constituted 69% of the whole caviars caught during 2009-2012. The reason was the increase of the release of the juvenile of *A. persicus* in comparison with the other species of sturgeon. As this species is critically endangered, for the purpose of protecting and reviving it in the Caspian Sea, its commercial trade catch projects must be banned and its generators catch projects must be implemented for artificial propagations purposes. Furthermore, because this species is anadromous, the preservation and revival of the rivers must be noticed by the authorities.

Keywords: *A. persicus*, catch per unit effort; Mazandaran, Caspian Sea, Iran.

INTRODUCTION

Persian sturgeon, *A. persicus* was first introduced by as a precious species from Oral River [1, 7, 29]. Based on the studies undertaken by [2], the maximum length of an *A. persicus* in Kura- Caspian is about 228 cm and its weight is about 70 kg. In Volga River the maximum length of this species is 170 cm; the average weight of the adult male sturgeon is about 20 to 30 kg and the average weight of the adult female sturgeon is about 30 to 35 kg [3]. The age structure of *A. persicus* varies in various places. In Oral River, 84.7% of the caught sturgeons were from the age group of 10-21 years old, 76.4% of the female were from the age group of 15-24 years and 54% of the male sturgeons were from the age group of 12-17 years. On the contrary, in Volga River, the caught sturgeons were from the age range of 14-36 years old among which 74.2% were from 20-26 years and the average age of the female and male were 24.4 and 23.4, respectively [3].

A. persicus mostly disperses in Caspian Sea but it feeds and spends the winter in the southern and central sections of the Caspian Sea which the most of sturgeon populations remain mostly near the south and southeast and in the Side Rivers [4]. [5], who reported that some specimens of *A. persicus* have been seen in the northern, western, central and southern parts of the Caspian Sea (Lenkuran coasts). The reproduction time of this species varies in various places and rivers. It is from July to August in Volga River [6], from April to September in Kura River

for which the peak time is on August [7] and from June to July in Oral river [8]. Persian Sturgeon mostly disperses in the depth of 50 meters. It immigrates between Sepidrood, Kura, Gorganrud and Tajan rivers [9]. The amount of *A. persicus* catching in the southern coast of Caspian Sea decreased from 538.3 tons in 1990 to 153.5 tons in 2000 which can be a consequence of constructing Manjil dam on Sepidrood River [10]. The most amount of *A. persicus* catching was recorded to be 1540 tones in Azerbaijan in 1936 but this amount decreased from 630 tones in 1950s to 310 tones in 1960s and on the contrary, the ratio of *A. persicus* catching increased from 350 tones in 1950s to 920 tones in 1960s in parts of the Caspian Sea [8]. Furthermore, the catch of *A. persicus* in Volga and Oral rivers decreased prominently in a way that the amount of immigration for reproduction decreased from 0.4% in 1991 to 0.3% in 2000. From 2000, *A. persicus* catching has been allowed only for artificial propagation purposes in Volga river [7]. *A. persicus* has the most abundant in the southern part of the Caspian Sea. [30]. Regarding the sturgeon catch has been reduced, the program of the ban on commercial fishing of sturgeon in the Caspian Sea has been implemented by neighboring countries from 2008. In addition to the information regarding catching for economic purposes which is too important, there is also quantitative data concerning the dispersion and frequency and the amount of implicit and experimental catching of this species in southern coast of Caspian Sea, especially in Mazandaran waters before and after *A. persicus* catching prohibition. Therefore, the purpose of this study is to investigate the age, catch and catch per unit effort (CPUE), the ratio of caviar to meat, and the distribution and frequency of *A. persicus* in landing and its comparison with beach seines.

MATERIALS AND METHODS

This investigation is part of a four year research project entitled “A biological and statistical survey of sturgeons in the southern coast of Caspian Sea” (Mazandaran Waters) from 2009 to 2010 (Fig.1). The numbers 1 to 12 are related to Babolsar and 12 to 22 are related to the Nowshahr areas.

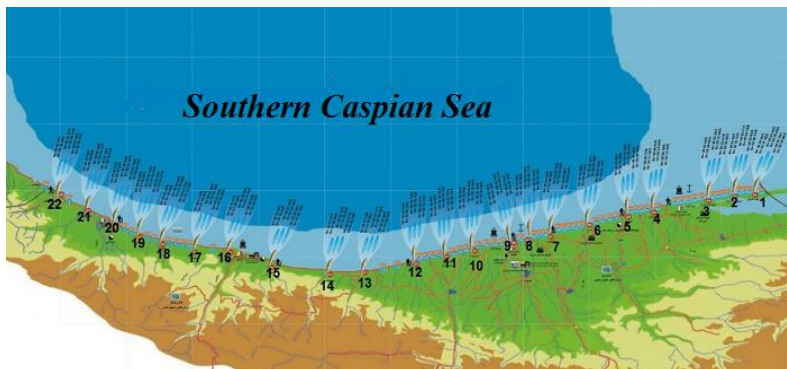


Figure 1. Stations of sturgeons landing in the southern Caspian Sea (Mazandaran waters), Note: The name of landings is comprised 1=Chahar Kome Sharqi, 2= Tazeh abad, 3= Chahar Kome Gharbi, 4=Goharbaran, 5=Khazarabad, 6= Larim, 7= Chapakroud, 8= Miroud, 9= Babolsar, 10= Sorkhrood, 11= Navisi, 12= Eizedeh, 13= Hassanabad, 14= Toskatok, 15= Kheirod, 16= Chalos, 17= Noorsar, 18= 22 Bahman, 19= Nashtaood, 20= Tonekabon, 21= Shirood, 22= Ramsar

In this study, two catching methods have been used for sampling; one has been corporative catching by gill net in the depth of 10 to 30 meters which is basically a long lasting method. In this method, after catching, the fishers delivered the samples to the fishing ground and then, the male and female sturgeons were transferred to Shahid Rajaei caviar breeding and reproduction center in Sari in order to be artificially propagations. The second method has been catching by the beach seines blade net. In this method, the caught sturgeons were first delivered to the fishing ground and then to Shahid Rajaei center. For measuring the body length, a tape meter with 1 centimeter, for weight a bascule with 100 grams, and for the caviar weight a scale with one gram precision were used [11]. The data concerned with catching statistics, boat numbers and catching days was obtained from Mazandaran department of production and utilization. In the landing number of boats, activity days was recorded. The ovary weight has been referred to by caviar weight. The age of the sturgeon has been calculated through determining the first section of the pectoral fin rays with thickness of 0.5 millimeters by a loop in the lab [12]. In this study, the female sturgeon with caviars is referred to as mature female of *A. persicus* and the one without caviars is referred to as immature; the male sturgeon with fully developed testicle organs which vents a milky fluid after transverse cut is referred to as mature male, otherwise, it is called immature male [11]. For calculate fishing effort and catch per unit effort the below formula has been used [13]:

- 1) $Catch = CPUE \times Effort$
- 2) $Effort = BAC \times F \times A$
- 3) $CPUE = \frac{C}{E}$

Which catch stands for the amount of caught sturgeon (kg), CPUE stands for catch per unit effort (kg/boat), BAC (Boat Activity Coefficient) stands for fishing boat activity coefficient, F is frame survey for the number of the gill net stay in the sea and the number of holding beach seine, A (Activity Days Survey) stands for the number of the fishing days and Effort is including BAC, F and A.

For the purpose of calculating the boats activity coefficients (BAC), first multiply the number of the boats by the number of the active fishing days in order to calculate the number of the whole boats. Then, divide the number of the active days to the total number of the whole boats in order to calculate the possibility of fishing per boat. After that, multiply the obtained number by the number of the boats in order to calculate the activity coefficient of each boat. In this study, each fishing boat had 150 gill nets. Therefore, through the use of the second formula, the amount of catch effort has been calculated and for the purpose of calculating the amount of catch per unit effort, the third formula has been used. In the fishing cooperatives, whole of each beach seine is determined as fishing effort standard and catch per unit effort includes the ratio of the caught sturgeon weights divided to the catching effort [11]; [14]. For calculating the ratio of caviar to the meat, the following formula has been used:

$$CM = \frac{Cw}{M} \times 100$$

Which CM is ratio of caviar to meat, Cw is caviar weight (kg) and M is meat weight (kg).

Based on the approved time spots for sturgeon catching by Iranian fishery, the number of the active days through the years 2009, 2010, 2011 and 2012 have respectively been 203, 220, 212 and 220 days out on the sea and the number of the boats have respectively been 96, 94, 79 and 82 ones.

Data analysis

For analyzing the data, Excel and SPSS statistical soft wares have been used after normalizing the data through the Kelmogrof-Smirnof tests. In this test, if the standard P value is less than 5%, null hypothesis about the normal distribution of the data would be rejected. For estimating the significance level of the variables, one way ANOVA and Duncan test with p value less than 0.05 have been used [31].

RESULTS AND DISCUSSION

Results

Length-weight of *A. persicus* through landing and beach seine

Totally, 1283 *A. persicus* were caught with average fork length, body, meat and caviar weights of 150.5±17.6 cm, 24.4±9 kg, 18.6±6.4 kg and 4.8±1.7 kg, respectively. Furthermore, the sum of the body weights, meat and caviar weights have been 31414, 23886 and 3515.6 kg, respectively. The contributions of caviar deliver through landing and beach seine was 71.7% and 28.3%, respectively (Table 1). There has been a significant difference in the amount of caviar, meat and body weight between landing and beach seine (P < 0.05).

Table 1. Compare mean fork length (cm), body weight (kg), meat (kg) and Caviar (kg) of Persian sturgeon (*A. persicus*) between landing and beach seine in the southern Caspian Sea (Mazandaran waters) during 2009-2012

Station	Parameters	Fork length	Body weight	Meat weight	Caviar weight
Landing	Mean±SD	151.2±17.5	25.2±8.7	19.1±6.2	4.7±1.7
	Min-Max	100-210	6-58	5-50	0.95-12.5
	Number	883	883	883	535
	Sum	-	22273	16885	2519.5
beach seine (Pareh)	Mean±SD	149.2±17.8	22.8±9.3	17.5±6.8	5±1.8
	Min-Max	104-215	10-78	7-67	1.7-11
	Number	400	400	400	197
	Sum	-	9194	70001	996.1
Total	Mean±SD	150.5±17.6	24.4±9	18.6±6.4	4.7±1.7
	Min-Max	100-215	6-78	5-67	0.95-12.5
	Number	1283	1283	1283	732
	Sum	-	31414	23886	3515.6

Condition of *A. persicus* in various areas

The average fork length, body weight, meat and caviar weight production of *A. persicus* in Babolsar and Nowshahr have indicated that the sturgeons caught in Babolsar had an average fork length of 148.6±17.9 cm and in Nowshahr was 153.8±16.9 cm. This can be due to concern the time and place of catching and the ecological condition. Furthermore, the total amounts of the acquired meat and caviar in Babolsar have been more than the Nowshahr. In Babolsar, the amount of meat and caviar were 14506 and 1931.5 kg, respectively and in Nowshahr was about 9380 and 1584.2 kg, respectively. This difference can be related to the number of the catching spots in that area (Table 2). There is not a significant difference in the amount of meat and caviar between Babolsar and Nowshahr (p>0.05).

Table 2. Compare mean fork length (cm), body weight (kg), meat (kg) and Caviar (kg) of Persian sturgeon (*A. persicus*) in different zones on the southern Caspian Sea (Mazandaran waters) during 2009-2012

Area	Parameters	Fork length	Body weight	Meat weight	Caviar weight
Babolsar	Mean±SD	148.6±17.9	23.4± 9.2	17.8± 6.5	4.9± 1.85
	Min-Max	100-215	6-78	5-67	1.6-11.4
	Number	809	809	809	396
	Sum	-	18944	14506	1931.5
Nowshahr	Mean±SD	153.9± 16.9	26.3± 8.5	19.8± 6.2	4.7± 1.7
	Min-Max	105-210	10-59	8-50	0.95-12.5
	Number	474	474	474	336
	Sum	-	12470	9380	1584.2

Frequency of *A. persicus* in different age groups

Overall, 262 *A. persicus* were caught from the age range of 11-22 years old. The maximum frequency which was about 44% belonged to the age range of 14-15 years and the minimum was about 0.8% belonged to the age range of 11 years. The results have shown that the average fork length, body and caviar weight increased as the sturgeon age range increased. The average amount of caviar for a 13 year was 2.5 kg and for a 22 year was 5.9 kg (Table 3). The maximum caviar weight which was about 9.2 kg with fork length of 224 cm, body weight of 132 kg and age of 20 years. The minimum caviar weight which was about 1.2 kg with fork length of 120 cm, body weight of 9 kg and age of 14 years.

Table 3. Compare mean fork length (cm), body weight (kg) and Caviar (kg) of Persian sturgeon (*A. persicus*) in different age groups on the southern Caspian Sea (Mazandaran waters) during 2009-2012

Age	Fork length (cm)			Body weight (kg)			Caviar weight (kg)			No.
	Mean± SD	Min.	Max.	Mean± SD	Min.	Max.	Mean± SD	Min.	Max.	
11	108	-	-	7	-	-				1
13	121.4	114	132	12.8	8	28	2.5	1.31	5.15	15
14	134	120	150	16.5	9	30	2.35	1.2	3.7	52
15	146.7	130	158	22.9	14	38	3.38	2.05	5.1	63
16	155.5	134	163	26.4	14	36	4.24	1.73	6.74	42
17	163.2	160	175	30.5	21	40	4.61	2.42	7.6	34
18	156.1	150	173	30.2	20	41	4.56	3.00	6.62	22
19	167.6	150	176	30.3	24	35	4.59	2.9	7.4	14
20	182.2	159	224	43.5	23	132	6.81	3.25	9.2	10
21	182.7	180	191	39	34	46	6.86	4.4	7.2	4
22	187.7	178	200	44.7	40	49	5.89	3.4	8.06	4

Caviar category of *A. persicus*

Totally, 732 *A. persicus* were caught from which 3515.7 kg caviar was acquired. The maximum amount of caviar acquired in 2009 was 1357.9 kg and the minimum in 2012 was about 468.2 kg. The results show that average amount of caviar acquired in 2009 and 2012 has a decreasing trend. The maximum caviar recorded 12.5 kg in 2012 and minimum was 1 kg in 2009 (Table 4). There is a significant difference between the amounts of caviar in the different years (p < 0.05). The acquired amounts of caviar were ranked with grades 1, 2, 3. The highest rank of caviar belonged to grade 1 with 2227.98 kg (63.4 %) and the lowest was grade 3 with 47.65 kg (1.3 %) (Table 5). Furthermore, the ratio of the caviar to the meat in 2009, 2010, 2011 and 2012 have respectively been 11.2, 11.8, 10.8 and 10.5 % of the body weight.

Table 4. Mean caviar weight (kg) of Persian sturgeon (*A. persicus*) in the southern Caspian Sea (Mazandaran waters) during 2009-2012

Year	Mean±SD	Min.- Max.	Sum	No.
2009	4.8±1.8	1-11.4	1357.9	281
2010	4.7±1.8	1.6-11	870.5	186
2011	4.6±1.6	1.6-11	801	173
2012	5.3±1.9	2-12.5	468.2	92
Total	4.8±1.8	1-12.5	3515.7	732

Table 5. Classification caviar of Persian sturgeon (*A. persicus*) in the southern Caspian Sea (Mazandaran waters) during 2009-2012

Caviar classification	Mean±SD (kg)	Min.- Max.(kg)	Sum (kg)	No.
1	5.64±1.72	2.50-11.50	2227.98	395
2	3.92±1.28	1.73-10.20	1092.46	278
3	3.13±1.15	0.95-6.60	147.57	47
pressed	3.97±1.39	1.70-6.10	47.65	12
Total	4.80±1.32	0.95-12.5	3515.7	732

Catch per unit effort of *A. persicus*

Overall, 23886 kg *A. persicus*' meat was acquired where in the maximum of meat production belonged to landing (67.5%) with 16885 kg rather than to beach seine net with a 7001 kg. Catch per unit effort of *A. persicus* for landing varied from 0.124 to 0.289 kg/boat in a day and for beach seine net was variant from 0.052 to 0.150 kg/boat in a day which was related to the amount of catching and effort. The maximum catch per unit effort through landing and beach seine net was 0.289 and 0.150 kg/boat in a day in 2009, respectively (Table 6). Nevertheless, the amount of *A. persicus* catching and catch per unit effort had variations which can be due to the catching method. There is a significant difference between catch per unit effort for landing and beach seine net ($p < 0.05$).

Table 6. Catch and catch per unit effort (CPUE) of Persian sturgeon (*A. persicus*) by landing and beach seine on the southern shores of the Caspian Sea (Mazandaran waters) during 2009-2012

Year	Catch (kg)	Landing			Beach seine		
		Effort (No.)	Catch (kg)	CPUE (kg)	Effort (No.)	Catch (kg)	CPUE (kg)
2009	12146	29232	8464	0.289	24516	3682	0.150
2010	7392	31020	4986	0.160	24168	2406	0.099
2011	7411	25122	5453	0.217	20760	1958	0.094
2012	4465	27060	3370	0.124	21216	1095	0.052

Table 7. Catch per unit effort of *A. persicus* in the southern Caspian Sea during 1990-2003

Year	Previous study Moqim <i>et al.</i> , (2005)										Present study							
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CPUE (kg/boat in day)	2.8	3.0	2.9	2.4	2.4	2.4	2.8	2.8	2.6	2.4	2.3	3.1	2.3	1.9	0.3	0.2	0.2	0.1

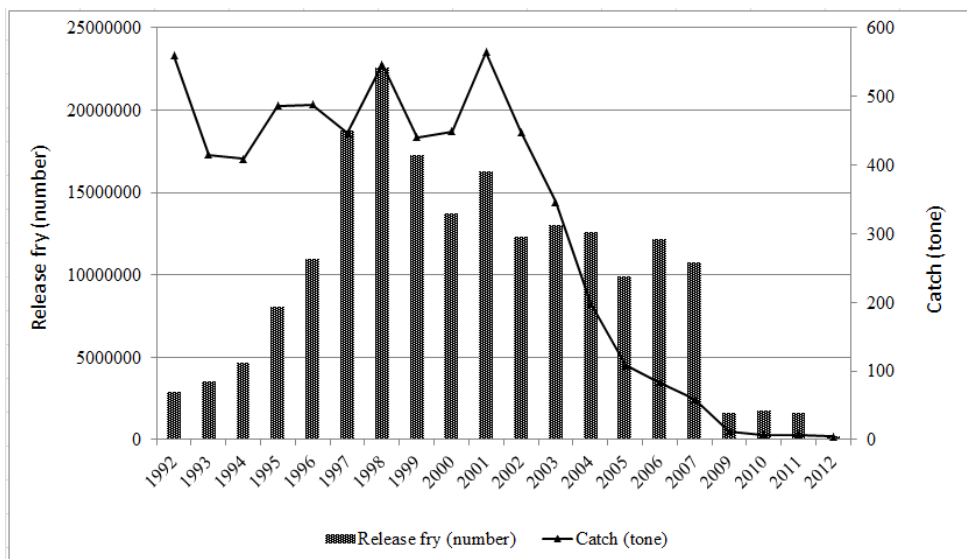


Figure 2. Catch (tone) and release fry of Persian sturgeon (*A. persicus*) at the southern Caspian Sea from 1992 to 2007 [18] and present study (Mazandaran waters) during 2009-2012. Note: The data of catch and release fries of Persian sturgeon from 1992 to 2007 related to whole of the southern Caspian Sea (Guilan, Mazandaran and Golestan) and present study (Mazandaran waters) from 2009 to 2012.

Discussion

Although 80% of the whole sturgeon reserves in Iranian parts of Caspian Sea belong to *A. persicus* [15]), this species is now critically endangered [16]. The amount of catching this species in the southern coast of Caspian Sea decreased from 440 tons in 1960 to 137 tons in 2007 [17]. [18], who reported that the catch of *A. persicus* in the southern Caspian Sea reduced from 559.7 in 1992 to 59.5 tons in 2007. In the present study, the amount of *A. persicus* catching has been about 31.4 tons and its amount of meat and caviar production is 23.9 and 3.5 tons, respectively. The increase of the *A. persicus* catching compared with the other species of sturgeon from 2009 to 2012 can be due to the increase of artificial propagation of this species in Iranian fisheries for the purpose of stocks rehabilitation. Other studies confirm the results of this study by asserting that in 1998, 24.5 million fries of *A. persicus* were released in the Caspian Sea [19]. [20], who noted that the amount of *A. persicus* commercial catch in Golestan and Mazandaran provinces in the whole catch was 79.4% and 35.5%, respectively. [11], who reported that catch per unit effort of *A. persicus* through the landing in southern coast of the Caspian Sea (Guilan, Mazandaran, Golestan) has shown that there is a decreasing trend in the catch amount in a way that the amount of catch per unit effort decreased from 2.823 kg in 1990 to 1.855 kg in 2003 (Table 7).

In the present study, catch per unit effort of *A. persicus* by landing shows a decreasing trend from 0.289 kg in 2009 to 0.124 kg/boat per day in 2012 in which is similar to the findings of the study undertaken by [11]. Furthermore, in this investigation, the amount of catch per unit effort by beach seine net has decreased from 0.150 kg in 2009 to 0.100 in 2010, 0.094 in 2011 and 0.052 kg/beach seine in 2012. The increase of CPUE could be due to the high released fries of *A. persicus* in the southern Caspian Sea [15]. [21], who noted that catch per unit effort of *A. persicus* juveniles in Mazandaran and Golestan coasts was 1.93 kg/gill nets. Comparison of the amounts of catch per unit effort in the present study and the studies undertaken from 1991 to 2001 shows that a steep decreasing trend which can be due to the destruction of the natural habitats by constructing dams on the rivers, overfishing as a consequence of the arrival of the new fishing technologies (use of mono- filament Nylon gill net instead of older Chaperon net), illegal fishing due to the lack of proper and integrate management on Caspian Sea, the collapse of USSR and lack of the mature fish for artificial propagation. [11] announced that the amount of *A. persicus* catch per unit effort in beach seine has decreased from 2.072 kg in 1991 to 1.047 kg in 1993. In the present study, the amount of *A. persicus* catch per unit effort by the beach seine net has decreased from 0.150 in 2009 to 0.054 kg/beach seine in 2012, in which this finding is also similar to the findings of the previous studies. This reduction can be due to the increase of ecological pollution [22], decrease of the number of beach seines from 157 to 131 [14], reduce of mature fish for artificial propagations, and consequently, decrease of the number of the juveniles released in the Sea (Figure 2). [23], who reported that release fries of Persian sturgeon have been released to the Mazandaran rivers within the years 2009 (1660000 numbers), 2010 (1810000No.), 2011 (1610000No.) and 2012 (200000No.), respectively. However, the number of the juveniles of *A. persicus* released to the Caspian Sea has been decreased from 24.5

million in 1998 to 10 million in 2008 [17]. Moreover, a survey of the biological features of *A. persicus* has shown that this species has been manipulated in a way that can be related to the increase of fishing pressure and destruction of the natural habitats [24]. Existence of the juvenile stocks of *A. persicus* in the Caspian Sea and especially in its Iranian coastal has been reported by an investigating searching for the living resources of Caspian Sea in the summer of 2011 [25]. [26] and [27], who asserted that in the investigation of the dispersion of the sturgeons in the depth of 10 meters and less, *A. persicus* had the most frequency (67.7 %) and aggregation among the other species. In addition, [21] reported that in the shallower parts of Mazandaran waters, *A. persicus* was the most frequent species and the other species were *A. gueldenstaedtii*, *A. stellatus* and *A. nudiventris*. The present study has shown that in southern coasts of Caspian Sea, especially in Mazandaran waters *A. persicus*, has had the most abundance and catch per unit effort rather than the other species in which can be due to the increase breeding and release juvenile of *A. persicus* in to the Caspian Sea. This finding is similar to pervious study by [27] and [26].

[28], who stated that the age groups of Persian sturgeon was ranged 9-36 year for female and 9-35 year for male in during 1998-1999, which the female age average has decreased from 16.9 in 1990 to 16.1 in 1999 but for male has increased from 13.7 in 1990 to 14.4 year in 1999, respectively. The present study has shown that the age range of *A. persicus* is variant from 11 to 22 years old and its average age is about 16. The age range of the female has been 13-22 years with an average of 16.8 and 13-16 with an average of 14.6 years for male. These findings was similar to [27] noted. [11], who reported that from 2001 to 2003, the average age of *A. persicus* was 15.9 in the whole population and the average age of female and male were 16.6 and 14.5 years, respectively. The findings show that the age range of *A. persicus* in southern coast of the Caspian Sea has had a normal distribution during the last three decades, that is from 1991s to 2011s, which can be a result of the appropriate ecological conditions for this species as a critical habitat and the standard net size according to fishery fishing management rules and regulations. From 1997 to 1998, the range of caviar weight of *A. persicus* varied from 1 to 14.6 kg and the ratio of caviar to meat decreased from 14.1 kg in 1997 to 13.4 kg in 1998 [27]. In the present study, the range of caviar weight of *A. persicus* has varied from 0.95 kg to 12.5 kg with an average of 4.5 ± 1.8 , and the ratio of the caviar to meat has decreased from 11.2 in 2009 to 10.9 in 2012 which is similar to the study undertaken by [27]. The reduction of the ratio caviar to meat can be due to genetic manipulations (artificial propagation) and ecology destructions. [11], who announced that during the years 2001-2003, the range of caviar weight of *A. persicus* varied from 0.5 to 17.5 kg with average 4.6 (2001), 5.1 (2002) and 5 (2002) kg, respectively.

[28], who noted that more than 70% of the caviar produced of *A. persicus* was grade 1 during 1997-98, in which coincide to increase of age and caviar quality. The ranking got better in a way that a 28- year-old of *A. persicus* with average caviar of 7.480 kg with grade 1 (79.1%) and 11-year old with average caviar of 2.388 kg with grade 1 (56.4%). In present study, Persian sturgeon caviar ranked with grade 1 was the most frequent (54%) among the rankings whereas the frequency of grade 1 caviar in 2009, 2010, 2011 and 2012 has been 51.2%, 45.7%, 58.4% and 70.7%, respectively. The results shown that the highest caviar obtained belong to 20-year-old and 9.2 kg which the caviar had the highest quality. This finding which can be a result of the sturgeon physiological structure, appropriate temperature and food availability for growth and reproduction of the generators in the southern coast of Caspian Sea is similar to the studies undertaken by [27]. [28], who reported that overfishing of sturgeons in the Caspian Sea for caviar was caused the extinction of the natural populations in which this species is critically endangered list now.

CONCLUSION

Consequently, commercial trade catch of *A. persicus* in the Caspian Sea must be prohibited and only mature catch projects implemented for rehabilitation and restocks. Because of, this species is anadromus and migration to the rivers. So some river revival and protection projects must be planned by the authorities to help the natural reproduction of *A. persicus*. Therefore, for acquiring new information about the biological conditions and stocks of this species in the Caspian Sea, investigation projects must be permanently planned and implemented.

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