

The Iranian Caviar and its Substitutes in the World Market

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ABSTRACT World production of caviar from the farmed sturgeon has recently so increased that in addition to compensate reduction of natural resources of sturgeon, it has also increased its share in the world market for caviar and its substitutes. Although Belarus, China and Norway are currently considered as the main exporting countries of caviar and its substitutes but, Iran solely exports caviar from sturgeon species. Having a world reputation in caviar brand, as well as the decreased natural resources, Iran aims to develop sturgeon rearing as well as modern marketing along with global standards to stand its brand and reputation as well as its world market share. The present paper reviewed the caviar and caviar substitutes market with emphasis on sturgeon caviar. During 1991-2013, caviar export from Iran decreased by 21.2 % in quantity and decreased income by about 17.2 %. However, the caviar value increased from 231000 to 680000 USD per ton.

Key words: Caspian Sea, Caviar substitutes, Fishery products, Iran, Marketing

1 INTRODUCTION

“Roe” is a general term for fish eggs (hard roe) or the milt of male fish (soft roe), but “caviar” refers to a valuable and rare food item that is obtained by processing of ova from some fishes, the most valuable of which is from sturgeons (Martin *et al.*, 2000; Keyvan, 2004). Roe is marketed fresh, frozen, in brine, smoked and canned (Monfort, 2002). In the international market, only salted roe of about 20 species among sturgeons (*Acipenser* and *Huso*) and paddlefish (*Polyodon* and *Psephurus*) are sold as caviar (Monfort, 2002). Roes from fishes other than sturgeons are sometimes referred as “caviar substitutes”.

However, the term “roe” and “caviar or kaviar”

are sometimes used synonymously. For instance, salmon roe (red caviar) and lumpfish caviar (Bledsoe *et al.*, 2003). At present, the eggs of more than 38 species other than sturgeon are used to produce substitutes (Bronzi and Rosenthal, 2014).

Having the valuable fatty and amino acids needed for body general metabolism and especially nervous system (Motallebi and Ahari, 2011) as well as being effective in prevention of diseases such as arthritis, gastrointestinal disease and cancer (Behbahani, 2010). Caviar is considered as tonic food that can relieve the effect of anesthesia needed in surgical operation as well as patients with infectious diseases (Motallebi and Ahari, 2011).

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Iran and Russia used to be the main exporter of natural caviar (Bledsoe *et al.*, 2003; Hosseini *et al.*, 2008), but other countries such as Kazakhstan, China and Azerbaijan have also become major exporters of caviar (TRAFFIC, 2009). Several factors such as over-fishing, pollution, hydro-geological alteration such as dams, sand and gravel extraction from the rivers beds and other obstacles have rendered the habitat for sturgeons undesirable by inhibiting their migration and natural spawning grounds. These factors, in turn, have resulted in greatly reduced sturgeons stocks of the Caspian Sea (Adeli, 2002). Additionally, poaching, caviar supply from other countries and counterfeiting this product have also been considered as the contributing factors to the reduced share of the Iranian caviar in the world market (Feyzabadi *et al.*, 2009).

Considerable decrease in caviar export in recent years has been associated with its increasing value. Thus, study on the factors affecting the sustainable caviar export is important, particularly for Iran. Another issue causing decrease in exporting is the lack of a clear international policy in international relationships and, also, lack of an appropriate pricing system (Adeli, 2008). Decrease in stocks and exploitation have increased the price per weight unit of the Iranian caviar. This study aims to investigate the factors affecting Iranian caviar marketing and sale as well as competition in this medium.

2 MATERIALS AND METHODS

Considering the value of caviar in the world market, this study has focused on the latest information about the caviar and its substitutes from different countries, particularly Iran, via library resources and world statistic analyses.

After the investigation of caviar market and the factors affecting it, the information was analyzed, summarized and concluded.

Based on the type of fish, caviar is divided into sturgeon and non-sturgeon categories. The latter includes roes from cod, lumpfish, herring, capelin, salmon and trout, sea-urchin gonads, mullet and tuna (Monfort, 2002). The overall survey on caviar substitutes indicates that more than 38 fish species are currently utilized; these are listed in Table 1.

Although the eggs of these fish are neither recognized nor labeled as caviar according to international labeling standard, they are simply called as caviar by the ordinary people. According to the Codex Alimentarius (CD, 2010), usage of the word 'caviar' can only be for processed eggs derived from fish of the Acipenseridae family, and consists of eggs, follicular or ovulated, treated with food grade salt only.

The world commercial caviars produced from different sturgeon species include: Beluga from *Huso huso*, Osetra from *Acipenser guldenstaedtii*, *A. persicus* and *A. nudiventris*, Sevruga from *A. stellatus* (produced in Iran) and Caviar d' Aquitaine from *A. baerii*, Calvisius (Italy) and Sterling (USA) from *A. transmontanus* (Monfort, 2002). In this study, the production and export of the Iranian caviar has been compared and analyzed with production and world trade of caviar and caviar substitutes.

Table 1 List of fish species to be used as caviar substitutes, indicating the common name in English (and scientific name) as well as the trade name of the product

Substitutes fish	Commercial name
Alaska pollock (<i>Theragra chalcogramma</i>)	Mentaiko
Alewife (<i>Alosa pseudoharengus</i>)	-
Atlantic cod (<i>Gadus morhua</i>)	Taramosalata/Lysekil Caviar/Sm€Orgaskaviar
<u>Atlantic herring</u> (<i>Clupea harengus</i>)	Herring Caviar
Atlantic salmon (<i>Salmo salar</i>)	Salmon Caviar
Biwa trout (<i>Oncorhynchus masou rhodurus</i>)	Bowfin C., Choupique, Cajun C.
Bowfin (<i>Amia calva</i>)	Bowfin C., Choupique, Cajun C.
Bream (<i>Abramis brama</i>)	-
Burbot (<i>Lota lota</i>)	-
<u>Capelin</u> (<i>Mallotus villosus</i>)	Capelin Caviar, Masago C.
Carp (<i>Cyprinus carpio</i>)	Taramosalata, Taramas, Tarama
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Salmon Caviar
Chum salmon (<i>O. keta</i>)	Salmon Caviar
Coho salmon (<i>O. kisutch</i>)	Salmon Caviar
<u>Flying fish</u> (Exocoetidae)	Tobiko, Tobicco, Tobico C.
Gobies (Gobiidae)	-
Grenadiers (Macrouridae)	-
Halibut (<i>Hippoglossus hippoglossus</i>)	-
<u>Lumpfish</u> - Lump sucker (<i>Cyclopterus lumpus</i>)	Lumpfish Caviar
Mackerel (<i>Scomber scombrus</i>)	-
Mulletts (Mugilidae)	Bottarga, Poutargue, Karasumi
Orange roughy (<i>Hoplostethus atlanticus</i>)	-
Pacific cod (<i>Gadus macrocephalus</i>)	-
Ling cod (<i>Molva molva</i>)	-
<u>Pacific herring</u> (<i>Clupea pallasii</i>)	Herring Caviar
Perch (<i>Perca fluviatilis</i>)	-
Pike (<i>Esox lucius</i>)	-
Pike perch (<i>Sander lucioperca</i>)	Galagan
Pink salmon (<i>O. gorbuscha</i>)	Salmon Caviar
Pollack, Pollock (<i>Pollachius pollachius</i>)	Mentaiko
Roach (<i>Leuciscus rutilus</i>)	-
Sockeye salmon (<i>O. nerka</i>)	Salmon Caviar
Trout (<i>Salmo spp. O. mykiss</i>)	Trout Caviar
Tunas (many species)	Bottarga, Poutargue, Karasumi
<u>Whitefish</u> (<i>Coregonus clupeaformis</i>)	Whitefish Caviar. Golden W.C.
Whitefish Cisco (<i>Coregonus artedi</i>)	Cisco, L€Ojrom, Blue Fin Caviar
Vendace (<i>Coregonus albula</i>)	-
Common whitefish (<i>Coregonus lavaretus</i>)	-

In some cases the scientific family name is given because the species are not readily specified
Under line = species most commonly used. Source: Bronzi and Rosenthal (2014)

2.1 Status of sturgeon production and exploitation

Being caught since many years ago, the world catch of sturgeon decreased by 12.2% annually from 2851 tons in 1998 to 884 tons in 2008, during which the catch from the Caspian Sea decreased by 17%, reaching 372 tons. Beluga was the most valuable species with a catch of 46 tons in 2008 (FAO, 2011). All reports suggest that sturgeon populations have had a decreasing trend.

The Iranian sturgeon industry began in 1893, when the government ceded the right of sturgeon catch from the Caspian Sea to Lianozov brothers (Bledsoe *et al.*, 2003). Like the other parts of the world, the sturgeons' catch in the Iranian coast of the Caspian Sea has also declined by 15.4% annually during 1991-2013 (IFO, 2014; Figure 1); FAO reports also indicated an annual decrease of 17.4% in the sturgeon catch over 1999 to 2008 that brought down the catch from 1000 to 178 tones.

Although the sturgeon culture started more than 100 years ago in Europe and North America to support its natural population, its culture and propagation became successful in 1930 in the Soviet (Doroshov and Binkowski, 1985). Sturgeon culture is currently performed in several countries at different stages of development and production (Speer *et al.*, 2000), among which China, Russia and Italy are at the top of the list. The sturgeon species that

have been caught or cultured over the world during 1999-2008 are shown in the Table 1.

A. sturio, *A. guldenstaedtii*, *A. naccarii*, *A. ruthenus*, *A. baerii* and other sturgeon species had, respectively, contributed 0.1%, 0.4%, 0.9%, 0.1%, 0.7%, among which *A. naccarii* was the most cultured sturgeon in 2008 (FAO, 2011). The remaining percentage (97.8%) of the world total production contribution was left unresolved among the species. Considering the drastic decline of sturgeon catch in Iran, farming of these valuable species started and about 312, 251, 363, 456 and 564 tons of sturgeons were reared in 2009 through 2013, respectively (IFO, 2014).

The Iranian caviar has been historically playing a significant role in the world market. Since the convention among the Caspian adjacent countries for stopping the catch and export of sturgeon to protect the natural stocks, the importance of reared caviar has also gained a new dimension in Iran. In fact, considering the halt of fishing and export from the Caspian Sea, the world market demand for caviar and the historical contribution of Iran, there is no solution except for developing reared caviar. During 2009-2013, 1946 tons sturgeon were reared in Iran (IFO, 2012). The main sturgeon species cultured in Iran is *Huso huso*, which its caviar has recently been introduced to the world market by private sector.

Table 2 Common caught and reared sturgeon species in the world

Species	Catch	Culture
<i>Acipenser gueldenstaedtii</i>	*	*
<i>A. ruthenus</i>	*	*
<i>A. stellatus</i>	*	*
<i>A. nudiiventris</i>	*	
<i>A. transmontanus</i>	*	
<i>A. medirostris</i>	*	
<i>Huso huso</i>	*	*
<i>A. Sturio</i>		*
<i>A. Naccarii</i>		*
<i>A. Baerii</i>		*

Source: FAO, annual statistics (2011)

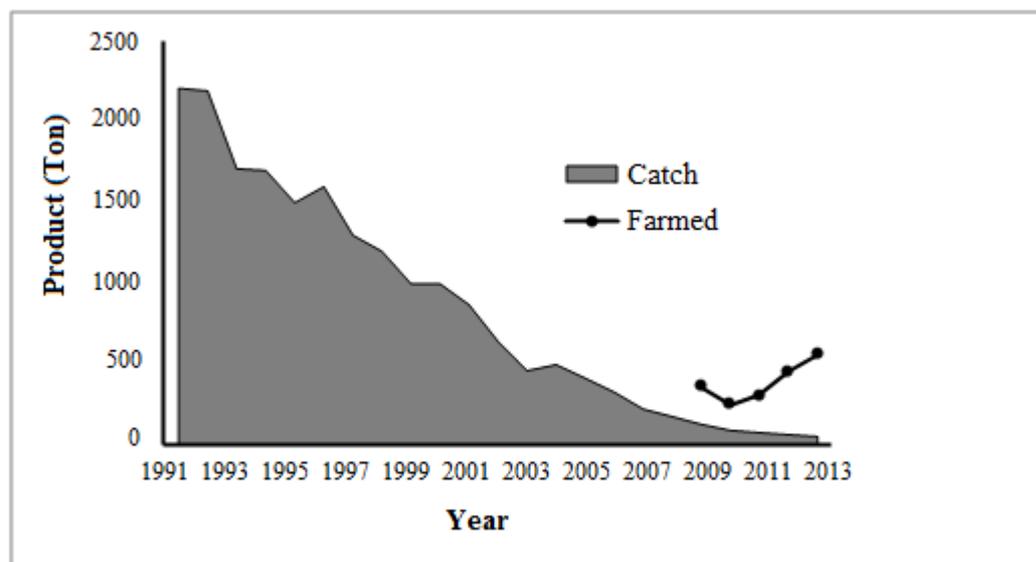


Figure 1 Comparison of the sturgeon catches and farmed in the Iran

2.2 Status of caviar and its substitutes market

Overall, about 45000 tons of various caviars and its substitutes were produced in 2008 (FAO, 2011). Russia, Norway and Korea topped the list of caviar and caviar substitutes, with a production of 37646, 2121 and 1190 tons, respectively.

Some countries such as Oman, Azerbaijan, China and Luxembourg had a little caviar import over 2006-2008. In 2008, for instance, Luxembourg paid 2298 thousand dollars for 8 tons and Oman paid 5956 thousand dollars for 1 ton of caviar. It is notable that despite the little import of caviar and its substitutes to the USA over these years, the sold caviar and its substitutes had higher value compared to the other countries; for example, 14.3 million dollars was paid for 583 tons caviar and its substitutes in 2006. However Denmark paid 4.8 million dollars for 735 tons and Oman paid 4.5 million dollars for 1 ton of caviar and its substitutes in 2006 (FAO, 2011).

Overall, for 46109 tons of caviar and its substitutes import in 2008, 571 million dollars was paid, or almost 12400 dollars per ton. The highest import value belonged to Japan (184 million dollars), followed by Russia and France (53 million dollars each). Over 2007-2008, the amount of the world caviar import decreased by 5%, whereas, its value increased by 2.3% (FAO, 2011).

Twenty nine countries, including Iran, were named by FAO as the caviar exporters over 2006-2008, the highest share of which belonged to Belarus (16.6 thousand tons), followed by China (7.5 thousand tons) and Norway (2.1 thousand tons). Overall, 38749 tons of caviar corresponding to 449 million dollars and 11586 dollars per ton were exported in 2008, the highest share of which belonged to China (103.3 million dollars), followed by Belarus (64.5 million dollars) and Germany (38.5 million dollars). Caviar export quantity and price increased by 1.6 and 3.9% in the world, in 2007 and 2008.

It should be noted that some countries such as Ukraine, Iran, Switzerland, England, Azerbaijan, Israel, Kazakhstan and Finland gained a great income from caviar export, despite the low amount of exportation. For example, Luxembourg gained 2050 thousand dollars by exporting 3 tons of caviar. The most valuable caviar per kg belonged to Azerbaijan (2600 dollars), followed by Iran (1300 dollars). It is notable that Iranian caviar has higher price compared to the other countries and despite its decreased share in the world market, its price per unit has increased. However, China had income per caviar about 14 dollars.

According to the statistical reports by the Iranian Fisheries Organization, caviar production in Iran decreased annually by 17.8% from 283 tons in 1991 to 4.6 tons in 2012 (IFO, 2014). Meanwhile, the caviar export quantity decreased by 21.2% annually over 1991-2013, with a 17.2% annually decreased income from 52 million dollar in 1991 to 816 thousand dollars in 2013. However, its value per ton

increased from 231 thousand to 2 million dollars, suggesting increase in the price of Iranian caviar in the world market due to the natural population diminish and catch decrement. Catch restriction of sturgeon from the Caspian Sea, imposed by CITES, has resulted to increased export of farmed caviar from 0.4 ton in 2012 to 1.2 tons in 2013 (IFO, 2014). However, increasing trend in the export of farmed caviar has brought down the price to 680 thousand dollar per ton. The report from the Trade Promotion Organization of Iran (2007) categorizes the caviar and its substitutes under the same barcode, which makes their differentiation difficult, particularly for the imported items. However, in some countries such as China and South Korea the export value indicate that a higher portion of their caviar export falls under caviar substitutes. For instance, China exported 7500 tons of caviar and its substitutes, corresponding to 103.4 million dollars in 2008, which clearly indicate the role of caviar substitutes.

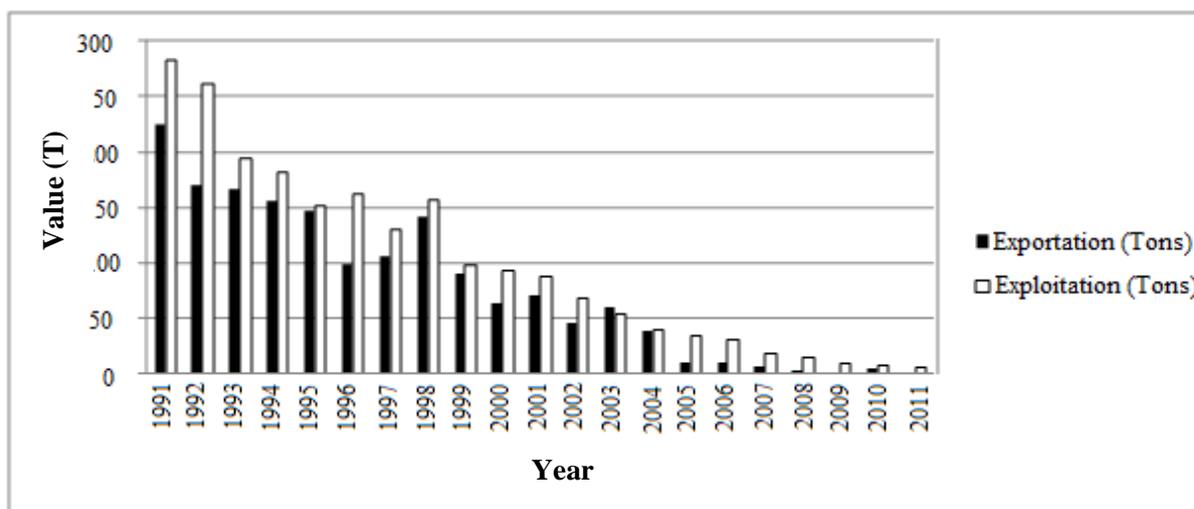


Figure 2 The amount of exploitation and exportation of caviar in Iran

Table 3 Price, export value and amount of the Iranian caviar (2001-2013)

Year	Export amount (t)	Price (Dollar kg ⁻¹)	Export value (×1000 Dollar)
2001	71.0	619.7	4400
2002	46.0	532.8	24510
2003	58.8	608.7	35792
2004	38.4	969.6	37235
2005	9.1	1335.3	13327
2006	9.98	1365.03	13623
2007	6.6	2161.4	14265.7
2008	2.3	3805.3	8752.2
2009	0.4	6175	2470
2010	4.0	1640.2	6561
2011	0.3	2046.6	614
2012	0.4	1427.5	571
2013	1.2	680.0	816

Source: Iranian Fisheries Organization, annual statistics (2014).

2.3 Factors affecting caviar market and marketing

Based on the available literature as well as information from the concerned fisheries and caviar selling authorities in Iran, the factors affecting caviar market values can be divided into two categories, the first being related to fish species and their caviar properties, and the second one includes other general factors that are considered in all aquatic products. Sturgeon species, caviar color, size, variety and taste are considered as the factors related to sturgeons and their caviar properties affecting the caviar price. Beluga caviar is the most valuable caviar among sturgeons (Vaisman and Raymakers, 2001), having the largest grain size that appears light to heavy gray in color (Monfort, 2002). However, in rare cases, such as albino sturgeon, caviar is sold with a very high price as golden caviar. Caviar has different grades in market. Based on the grain size, caviar is graded into 1 to 3, followed by the pressed caviar which has the lowest quality and price (Motallebi and Ahari, 2011). In the USA and west Europe, retail price of pressed caviar is 600 Euro per

100 g (TRAFFIC, 2009). Domestic price for the Iranian caviar is presented in Table 4.

Caviar taste is an effective factor for the consumers' choice and considered as one of the most important qualitative properties affecting its market value (Haj Fathalian *et al.*, 2006; Feyzabadi *et al.*, 2009). For the very same reason, useful works have been conducted on sturgeon reproductive physiology and its effect on the quality and yield of caviar products during the past 20 years (Lu and Rasco, 2013). Implementation of international standards, packing, supply and demand, price, distribution, knowledge on the destination countries, promotion and public relationships are common and non-specific factors of sturgeons could be effective factors in determining caviar price. Implementation of international standards results in the production of a high quality caviar. In addition, species standard code, source code, code of origin, production year, official document registration code of processing plant and type determination are pasted on sturgeons' product using the labeling based on Codex standards.

Table 4 The domestic price of caviar 2013

Caviar type	Price ($\times 10^6$ IR kg^{-1})
Beluga 1	43
Beluga 2	39
Osetra grade 1 a	43
Osetra grade 1 b	41
Osetra grade 2	35
Osetra grade 3	30
Sevruga grade 1	24
Sevruga grade 2	21
Sevruga grade 3	18
Pressed	10

Source: Agricultural Services Specialized Holding Company, Approved by the board of directors (2013)

Packing is an important factor in caviar marketing, which should be considered to produce a valuable and high quality product. Packing determines a merchandise appearance and can attract costumers' attention. Packing is the massage of the seller to the buyer (Adeli, 2008). The processing techniques and storage conditions also have a significant impact on caviar composition and quality (Lu and Rasco, 2013).

Supply and demand is another effective factor in the market price that, in turn, depends on the fish stocks. Diversification in the packaging capacity of caviar based on consumer's purchasing power and good political relations with other countries have increased its export, but farm production by other countries adversely affect the export margin (Zare Zardeini *et al.*, 2013).

Price is an important factor in marketing that, in turn, depends on the total production and distribution costs, competition and the market regulation and tariff. The price of a product reflects its quality in the consumers' mind (Adeli, 2008). The Iranian caviar is

supplied with a higher price in the market because of its value and good history.

Today, the condition of producer and consumer is in such a way that dealers work between them. To determine the structure of distribution system and the strength of its channels, we must identify the rings of marketing management chains, including the type and number of dealers. Aquatic products have unique properties that their fresh supply requires short and fast distribution network, otherwise need processing and different distribution networks (Adeli, 2008). Caviar exploitation in Iran is under the government monopoly, but access to higher sources of income requires shorter and wider distribution and selling channels and, therefore, retailing in the world major markets should be increased. Knowledge on the destination countries, including the culture, consumers' needs and other market-oriented factors are important and should be used to develop production program and promote export.

Caviar marketing needs promotion as a tool to notify and encourage the potential consumers

to consume it. Use of posters, media, banners are some advertisement methods (Adeli, 2008). Participation in international exhibitions, seminars and other activities and use of public relationships to attract minds and sentiment of consumer of the destination countries will be impressive to remind the Iranian caviar brand. After a slight downturn in the market due to fishing stoppage, private investments and governmental supports provided the context for exporting reared caviar to maintain the position of Iranian caviar brand in the market. In the case of Iranian reared caviar, particular systems should be used in advertisements.

3 DISCUSSION AND CONCLUSION

Iran had been one of the top caviar producers in the world for many decades. Today, however, Iran's situation in the caviar market has changed due to decline in sturgeons' population in the Caspian Sea and fishing stoppage. On the other hand, some countries such as China could have gained a remarkable role in caviar by rearing sturgeon and has compensated the caviar shortage from the Caspian Sea that had traditionally supplied about 90% of total world market (DeMeulenaer and Raymakers, 1996). As a result, the role and share of the Iranian caviar has been threatened in the world market. In addition to the major producers as well as countries in the Far East, such countries as Uruguay, the Arabians, Israel, and more recently Argentina and Vietnam also appeared on the scene, producing sturgeons outside the natural range. These new players are not only contributing to the production, but are also having a substantial influence on the structure of the industry as well as the structure and logistics of the markets (Bronzi and Rosenthal, 2014).

Accordingly, Iran should find solution to maintain its role in the world market. Beside the serious effort of Iran to restock sturgeons' population in the Caspian Sea, there is no

solution more important than sturgeon culture, which Iran has recently started. However, the more important issue is to maintain the role and trade mark of the Iranian caviar by investigation of the world market. It is notable that the major factors in the caviar market should be correctly recognized and used to strengthen the role of Iran in the world market.

Understanding the consumers is very important to determine the choice for caviar, including its taste, color and size. Also, knowledge on the competitors, their product price and their role in the market should be considered. Considering the difference in color and grain size of caviar, it is possible to recognize the consumers' desire in the destination countries and to produce and pack their desired products. Evidences show that Americans like large roe and golden caviars. Caviar qualitative properties such as color, taste and texture are important to determine its price. Caviar from different sturgeon species can have different prices because of the difference in organoleptic properties that are species specific. Culturing of top species can create better organoleptic properties of caviar.

Packaging is another important factor in caviar market, which should be considered to increase sell and promote the producers' role. Since the package type is dependent on the consumers' preference, the destination countries and their preferences should be recognized to produce caviar with different packages to increase sell and maintain the role of Iran in the world market. Use of impressive advertisements and providing the culture and processing methods as well as information on the package are important factors in the world caviar market.

The current opportunities, threats, strength and weakness should be considered to maintain the role of Iran in the market. The imbalance between supply and demand, high profit from illegal fishing, and the lack of a strong

supervision on supply in the recent years have led to flourished caviar smuggling and its unreal price (Kateb, 2010). The world illegal caviar market has a turnover of about 800 million USD.

Having a long experience in caviar export, Iran can approach the retailing and selling centers to get back to its traditional role in caviar export. Lack of access to the retail markets and decline in natural sturgeon stocks are the blind spots while the desirable climate and high-grade species availability are the strength of Iran. Relative price of different caviars in the early 1990s imply that great difference in price between the sturgeons caviar and its substitutes will not remain stable in the future. However, difference in the product quality can lead to substantial change in relative price (Ashtarnin and Doreh, 2010). There is a significantly positive correlation between domestic production variables and exchange rate with caviar export rate, while there is a significantly adverse correlation between the world caviar price and caviar export (Feyzabadi *et al.*, 2009). Thus, governmental supports in investment and facilitation of the laws for production increment through sturgeon farming can be regarded as an approach to increase export as well as for protecting wild stocks.

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خاویار ایران در بازار جهانی خاویار و جایگزین‌های آن

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چکیده امروزه با سرعتی که تولید خاویار ماهیان خاویاری پرورشی به خود اختصاص داده است به تدریج کاهش بهره‌برداری خاویار طبیعی جبران شده و سهم بیش‌تری از بازار بین‌المللی خاویار و جایگزین‌های آن را به خود اختصاص می‌دهد. در حال حاضر کشورهایی چون بلاروس، چین و نروژ اصلی‌ترین صادرکنندگان خاویار و جایگزین‌های آن در جهان هستند. اما ایران منحصراً خاویار ماهیان خاویاری را صادر می‌کند. ایران به جهت غنا و اعتبار نام تجاری خاویار تولیدی و کاهش بهره‌برداری آن درصدد توسعه پرورش این ماهیان و بازاریابی نوین، همگام با استانداردهای جهانی و جایگزینی خاویار پرورشی و رونق‌دهی آن در بازار بین‌المللی به اعتبار آوازه خاویار ایرانی است. مقاله حاضر مروری بر بازار خاویار و جایگزین‌های آن با تاکید بر خاویار ماهیات خاویاری است که اعتبار ایرانی آن شهره جهانی دارد. رشد سالیانه مقدار صادرات خاویار ایران در دوره بیست و دو ساله منتهی به سال ۱۳۹۲ به‌میزان ۲۱/۲ درصد و درآمد آن حدود ۱۷/۲ درصد کاهش داشته است. اما ارزش هر تن آن از حدود ۲۳۱ هزار دلار به حدود ۶۸۰ هزار دلار رسیده است.

کلمات کلیدی: ایران، بازاریابی، دریای خزر، جایگزین‌های خاویار، محصولات شیلاتی