

ENVIRONMENT ASSESSMENT REPORT

**Import of Russian, Siberian, Beluga and hybrid
between Russian sturgeon and Siberian sturgeon to
Australia**

**Supporting information for application to amend the
List of Specimens Suitable for Live Import into Australia**

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The business idea behind the proposed project is to establish a caviar and sturgeon fish production facility in the territory of South Australia. Sturgeon and caviar represent delicacy food items traditionally consumed by middle and upper social classes. In the past these products used to be obtained from nature, mostly from the waters of the Caspian Sea. The end of the 20th century witnessed sharp decline in natural sturgeon stocks, and the production went drastically down leading to a complete ban on sturgeon fishing in the Caspian basin and other natural sources. Due to this, the international markets today experience shortage of sturgeon and caviar, which cannot be quickly satisfied by aquaculture (fish farming). This fact has established very attractive prices for sturgeon and caviar with luxurious profit margins.

Therefore, establishing an efficient production plant in the warm climate and free economy of Australia based on well developed technology promises to become a successful business venture posing to become a major player in the international caviar market. Today, major producers of caviar in the world are aquaculture facilities located in the USA, France, Italy, China, and some other countries. Total annual production of caviar in the world is 126 tonnes (2011), however, its annual demand is estimated to be from 400 to 1000 tonnes. The shortage of this product on the market results in steady growth of prices on caviar, which is currently USD900-1200 for kg for wholesale deliveries. At the same, the prices for sturgeon meat also grow and today are about USD8-12 for kg.

1 Taxonomy of the species

a) Family name: Acipenseridae.

b) Genus name:

1. *Huso*
2. *Acipenser*

c) Species:

1. *Huso huso* (Linnaeus, 1758)
2. *Acipenser gueldenstaedtii* Brandt et Ratzeburg, 1833
3. *Acipenser baerii* Brandt, 1869
4. Hybrid – *Acipenser gueldenstaedtii* x *Acipenser baerii*

d) Subspecies:

No identified subspecies for beluga and Russian sturgeon.

Sometimes 3-4 subspecies are identified for Siberian sturgeon (*Acipenser baerii baerii*, *Acipenser baerii baicalensis*, *Acipenser baerii chatys*, *Acipenser baerii stenorrhynchus*) (Bogutskaya & Naseka, 2004).

e) Taxonomic Reference:

Beluga: Linnaeus C. 1758. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus 1. Editio decima, reformata. Imp. direct. Holmia [Stockholm]: Laurentii Salvii. iv+824 p.

Russian sturgeon: Brandt J.F., Ratzeburg J.T.C. 1833. Medizinische Zoologie oder getreue Darstellung und Beschreibung der Thiere, die in der Arzneimittellehre in Betracht kommen, in systematischer Folge herausgegeben. Bd.2. Berlin: Trowitzsch und Sohn. iv+364 S., pls. 1–3.

Siberian sturgeon: Brandt J.F. 1869a. Einige Worte über die europäisch-asiatischen Storarten (Sturionides) // Bull. Acad. St. Pétersb. T.14 [1870]. P.171–176.

f) Common Names:

1. Beluga
2. Russian (Diamond) sturgeon
3. Siberian sturgeon
4. Hybrid between Russian sturgeon and Siberian sturgeon

g) Is the species a genetically-modified organism (GMO)?

All mentioned species are not Genetically Modified Organisms. The hybrid between Russian and Siberian sturgeons is also not a Genetically Modified Organism. For the first time, a hybrid between Russian (Azov population) and Siberian (Lena population) sturgeons was obtained in 1979 by scientists of the All-Union Research Institute of Fisheries and Oceanography (Burtsev et al., 1985; Fillipova, 1985).

2. Status of the species under CITES

All mentioned species are listed on Appendix II under CITES

We have a unique possibility to save such species of fish as sturgeon that are safeguarded by CITES. Production of important species such as beluga and Russian sturgeon in Australia will help to maintain existence of these species. It's quite obvious they are likely to disappear in their natural habitat in a few years because of the destructive influence of humans.

- the implications of illegal trade

Sturgeon eggs in form of caviar are objects of illegal trade. Poaching and smuggling are closely related and have been intensively reported in the media of range States and importing countries (CITES, 2012). However, a great deal of illegally caught sturgeon is destined for the domestic market, particularly meat (Anon., 1998).

- popularity of the species in trade e.g. pet industry

Sturgeon eggs (caviar) are an important object of trade.

- status of species in its natural range e.g. threatened, endangered, protected etc.

According to the IUCN Red List Status, beluga and Russian sturgeon are critically endangered, Siberian sturgeon is endangered (FishBase, 2012).

- why is this species threatened?

At this moment, main factors, which threaten sturgeons, are construction of hydropower stations on rivers, which limit migrations of migratory species such as beluga and Russian sturgeon to spawning ground, development of oil rigs in the Caspian Sea and poaching. There are also high levels of pollution in most rivers within the range of sturgeons (Barannikova et

al., 1995; CITES, 2012). Other factors include pollution and eutrophication of coastal waters (Levin, 1997; CITES, 2012), over-harvesting of fish for caviar and meat (Ruban, 1997; Billard and Lecointre, 2001). Naturally slow growth rate and the fact that sturgeons does not spawn every year also are limiting factors.

According to CITES regulations, sturgeons are listed in the Appendix-II. Appendix-II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

For the species listed in Appendix-II, the following regulations apply:

1. An export permit or re-export certificate issued by the Management Authority of the State of export or re-export is required.

An export permit may be issued only if the specimen was legally obtained and if the export will not be detrimental to the survival of the species.

A re-export certificate may be issued only if the specimen was imported in accordance with the Convention.

2. In the case of a live animal or plant, it must be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment.
3. No import permit is needed unless required by national law.

In the case of specimens introduced from the sea, a certificate has to be issued by the Management Authority of the State into which the specimens are being brought, for species listed in Appendix I or II.

3. Ecology of the species

a) Longevity:

Beluga is a long-lived species, its maximum reported age is 118 years (Pirogovskii et al., 1989).

The maximum reported age of Russian sturgeon is 46 years (Chugunova, 1959).

The maximum reported age of Siberian sturgeon is 60 years (Kozhin, 1964).

Hybrid between Russian and Siberian – there is no information about maximum age of this hybrid because in aquaculture facilities these fish are usually slaughtered early (4-6 years).

b) What is the maximum length and weight that the species attains?

The maximum documented length of unsexed beluga is 8 m with a weight of 3200 kg (Kottelat & Freyhof, 2007).

The maximum reported length of Russian sturgeon is 236 cm (Kottelat & Freyhof, 2007), while the maximum published weight is 115.0 kg. Its common length is 145 cm (Birstein, 1993).

The maximum reported length of Siberian sturgeon is 200 cm (Keith & Allardi, 2001), the maximum weight is 210.0 kg (Sokolov & Vasilev, 1989).

Hybrid between Russian and Siberian – there is no information about maximum size of this hybrid because in aquaculture facilities these fish are usually slaughtered before attaining the maximum size.

c) Discuss the identification of the individuals in this species, including if the sexes of the species are readily distinguishable, and if the species is difficult to distinguish from other species.

The Acipenseridae species possess very distinctive features and are easily distinguished from other fishes inhabiting Australia. However, different species and hybrids of sturgeons are very similar in general appearance and are difficult to identify for a non-specialist (Kottelat & Freyhof, 2007). As for the Russian sturgeon, Siberian sturgeon, beluga and hybrid (Russian x Siberian sturgeon), they can be readily distinguished from each other. Beluga is distinguished from all other sturgeons by very large crescent-shaped mouth and gill membranes free from isthmus. Russian and Siberian sturgeons as well as their hybrid have comparatively small and straight mouth and gill membranes are attached to isthmus. Siberian sturgeon is distinguished from Russian sturgeon by 20-49 fan-shaped gill rakers terminated by several tubercles while the latter has 15-35 rod-shaped gill rakers (Kottelat & Freyhof, 2007). It is difficult to distinguish the sex of sturgeons by external features, however ultrasonic scanning or biopsy is used in aquaculture.

1) Beluga.



Juvenile (Photo supplied by Anatoly Tarasov)



Female (Photo supplied by Anatoly Tarasov)



Male (Photo supplied by Anatoly Tarasov)

2) Russian sturgeon.



Juvenile (Photo supplied by Terry White)



Female (Photo supplied by Yuri Kitashin)

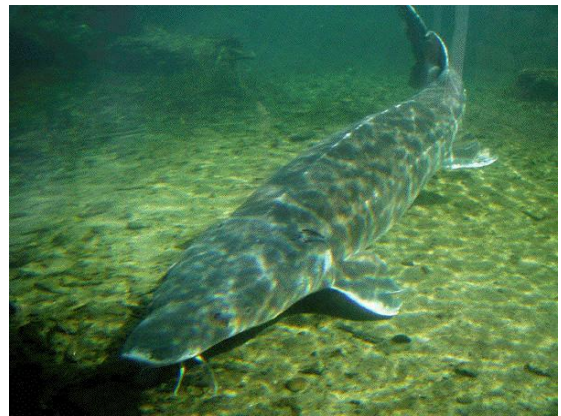


Male (Photo supplied by Yuri Kitashin)

3) Siberian sturgeon.



Juvenile (Photo supplied by Terry White)

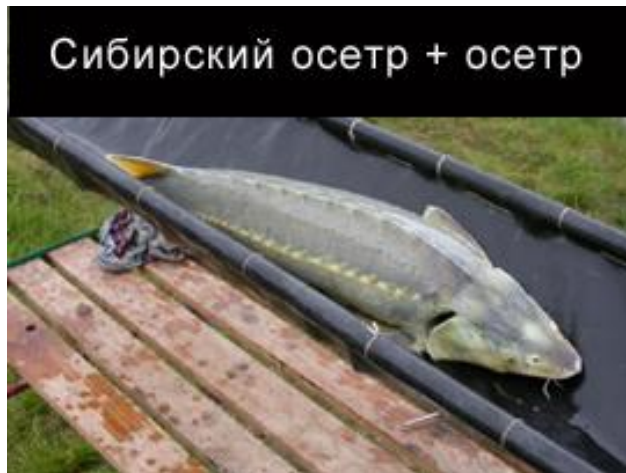


Female (Photo supplied by Mirosław Schepkowski) Male (Photo supplied by Yuri Kitashin)

4) Hybrid between Russian sturgeon and Siberian sturgeon.



Juvenile (Photo supplied by Yuri Kitashin)



Female (Photo supplied by Mirosław Schepkowski) Male (Photo supplied by Yuriy Kitashin)

d) Natural geographic range.

Beluga: Natural geographic range of this species includes Black Sea, Sea of Azov and Caspian Sea. It also enters all main rivers (Don, Kuban, Danube, Dnieper, Dniester) that empty into these seas (Sokolov & Berdicheskii, 1989). Its distribution covers following countries: Azerbaijan, Bulgaria, Czech republic, Slovakia, Georgia, Hungary, Iran, Italy, Kazakhstan, Moldova, Romania, Russian Federation, Turkey, Turkmenistan, Ukraine and former Yugoslavia (CITES, 2012). At this moment, main limiting factors are hydropower stations on rivers, which limit migrations of belugas to spawning ground, development of oil rigs in the Caspian Sea and poaching. There are also high levels of pollution in most rivers within the range of beluga (CITES, 2012).

Russian sturgeon: Caspian, Black and Azov Seas and the rivers that empty into them (Vlasenko et al., 1989). Current distribution of *A. gueldenstaedtii* includes Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan (CITES, 2012). Some data suggest that this species has occurred or occurs naturally in Bulgaria, Georgia, Romania, Turkey and Ukraine (CITES, 2012). Main limiting factors are construction of hydroelectric power stations and dams on the rivers entering the seas that reduced the available spawning grounds (Barannikova et al., 1995). Other factors include pollution and eutrophication of coastal waters (Levin, 1997).

Siberian sturgeon: Natural geographic range of this species covers main Siberian rivers from the Ob to Kolyma, in Lake Baikal, and rarely in the Pechora (Reshetnikov et al., 1997). Countries of its distribution include China, Kazakhstan and the Russian Federation (CITES, 2012).

e) Is the species migratory?

Beluga: The species is anadromous and enters rivers flowing into the Black, Caspian and Azov Seas to spawn. There are two forms: one of which spawns in winter and one in spring. The spring form migration peaks in summer and ends in late autumn. Fish migrating in winter are the largest of the two forms. They stay in the river and reproduce the following year whereas the spring form migrates and reproduces during the same year (Levin, 1997).

Russian sturgeon: The species is anadromous. Migration to riverine spawning grounds occurs during two periods: from early spring to late autumn, peaking in summer; and during the winter, when fish stay in the rivers and reproduce the following year. Juveniles migrate downstream to feeding grounds. In the Caspian Sea the main feeding area is in the north, but a winter migration to the central and southern areas of the Caspian has been observed (Barannikova et al., 1995). Only freshwater populations also exist (Kottelat & Freyhof, 2007).

Siberian sturgeon: There are two forms of this species in the Siberian River basins: one semi-migratory that remains in estuaries or river deltas for feeding, and the other form, more or less resident in one locality and considerably less numerous than the migrating one (FAO 2012).

f) Does the species have the ability to hibernate in winter or aestivate (go into stasis or torpor) in the summer months)?

None of the mentioned species hibernate or aestivate.

g) Does the species have the ability to breathe atmospheric air i.e. has accessory breathing organs?

None of the mentioned species has the ability to breathe atmospheric air.

h) Habitat Requirements.

Outline the habitat requirements for all life stages of the species:

Beluga: The species naturally inhabits temperate waters with a temperature of 10°C - 20°C (Baensch & Riehl, 1991). Beluga is adapted to a wide range of temperatures (an eurythermic species). It occurs in seawater of temperatures typically between 2.0 - 24.8°C (2.0 - 4.0°C in the Northern Hemisphere winter, 6.0 - 8.0°C (March-April) in spring, 14.0 - 22.0°C (June-July) in summer, 12.3 - 12.8°C (October-November) in autumn (CEP 2008). The peak of spawning run in the river is observed at a maximum temperature of 22 – 27°C (CEP 2008). According to Bernis and Kynard (1997), the absence of Acipenseridae from tropical rivers is probably related to thermal requirements for maturation and early development, which generally need temperatures below 20°C.

Beluga are adapted to a wide range of salinities, and occurs in both fresh and typical Caspian, Black, and Azov seawaters (5.43 - 14.34 ‰) (CEP 2012). Critical oxygen concentrations (the point below which metabolism, growth, swimming and consumption is constrained) for Eurasian sturgeons (*A. gueldenstaedtii*, *A. baeri*, *A. stellatus* and the hybrid *H. huso* x *A. ruthenus*) ranges between 25 - 60 % saturation, increasing with temperature (Secor and Niklitschek, 2001).

Beluga does not use nests. It can live, shelter, and feed in estuaries, lakes, rivers. Usually it inhabits sea waters, but migrates into rivers, where spawning occurs (Kottelat & Freyhof, 2007). For spawning, the species requires stony, pebble ground with good water flow.

Russian sturgeon: This species has the same habitat requirements as beluga.

Siberian sturgeon: This species has the same habitat requirements as beluga. However, it inhabits rivers and partially estuaries and do not go into sea waters (Kottelat & Freyhof, 2007).

i) Social behaviour or groupings.

All described species are usually solitary but occasionally form schools (Svetovidov, 1979).

j) Is this species ever territorial or does it exhibit aggressive behaviour?

All described species are not territorial and do not show aggressive behaviour. However, cannibalism can be observed only during their developmental stage.

k) Characteristics that may cause harm to humans or any other species.

There are no characteristics that may cause harm to humans from these species.

4. Reproductive biology of the species

a) At what age does this species reach sexual maturity (males and females)?

Beluga: Sexual maturity is reached at 10-16 years for males and 14-20 years for females (Hochleithner and Gessner, 1999). Most males of the Volga population mature at 14-16 years; most females reach this stage at 19-22 years (FAO, 2012).

Russian sturgeon: The great majority of the males begin to reproduce at an age of 11 to 13 years, while the equivalent age for the females is 12 to 16 years (Berg, 1948).

Siberian sturgeon: The Lena River population reaches sexual maturity at 9-10 years for males and 10-12 years for females; all other populations reach sexual maturity at 18-24 years for males and 24-28 years for females (Hochleithner and Gessner, 1999).

Hybrid between Russian and Siberian sturgeons: In aquaculture facilities, the age of sexual maturity is 3-4 for males and 4-5 for females.

b) Discuss the species' ability to reproduce; triggers for breeding; breeding site requirements.

Beluga: Spawning period usually coincides with a high-water period in spring and begins at a water temperature of 6° to 7° C, and it ceased when the temperature reaches 21° C. The spawning sites are usually in the river bed, at a depth of 4 to 15 m, with a hard, stony or gravelly bottom (FAO, 2012). There are two races of beluga inhabiting the Caspian Sea: vernal and hiemal. The first race spawns at temperatures of 10-15°C, while the second one at temperatures of 7-11°C. Mean absolute fecundity is 680,000-800,000 eggs (<http://www.caspianenvironment.org>)

Russian sturgeon: The spawning sites are gravel or stony beds at depths from 4 to 25 m in large and deep rivers with strong current, 1-1.5 m/s (Sokolov & Vasilev, 1989). Spawning at water temperatures between 8.9° C and 12° C (FAO, 2012). Mean absolute fecundity of Russian sturgeon varies from 196,000 to 366,800 eggs depending on fish size and river (<http://www.caspianenvironment.org>).

Siberian sturgeon: Spawns in main river channel over stone-gravel or gravel-sand bottom and with strong current (Kottelat & Freyhof, 2007). The spawning period ranges from the end of May to mid-June at a water temperature from 9 to 18° C. Spawn occurs in the main channel of rivers over stony-gravel or gravelly-sand bottoms. The spawning of the resident form of this species are not far from the depressions in which they wintering (Sokolov & Vasilev, 1989). Absolute fecundity of Siberian sturgeon varies from 79,000 to 1,459,000 eggs depending on fish size and river (Iliashenko and Iliashenko, 2000).

c) How frequently does breeding occur?

Beluga: Mature fish spawn every 3-4 years (Chebanov et al. 2011). .

Russian sturgeon: In the Volga River, the males reproduce every 2-3 years while females breed every 4-6 years (Chebanov et al. 2011, FAO, 2012).

Siberian sturgeon: Mature fish spawn every 3-5 years (females) and 2-3 years (males) (Sokolov & Vasilev, 1989, IUCN 2013).

e) Can individuals of the species change sex?

All mentioned species cannot change sex.

f) Ability of the species to hybridise.

Sturgeons have an high rate of interspecific hybridization (Billard and Lecointre, 2001). The most known hybrid is “bester”, which a hybrid of female *Huso huso* and male sterlet *Acipenser ruthenus* and is sterile (Frimodt, 1995). Other hybrid is a hybrid between *Acipenser gueldenstaedtii* and *Acipenser baerii*. The hybrid *A. gueldenstaedtii* x *A. baerii* have fertile offspring (Ludwig, 2006).

g) Could the species hybridise with any Australian native species?

None of the mentioned species can hybridise with any Australian native species because there are no native fishes belonging or closely related to Acipenseridae family in Australia.

h) Are individuals single sexed? (i.e. either male or female) or hermaphroditic (i.e. have both male and female reproductive organs)

All mentioned species are single sexed.

5. Feral populations

a) Has this species ever established a breeding population outside of its native range? Identify any areas where this species has established a breeding population outside of its natural range.

There is information about escapes of some individuals of the mentioned species from aquaculture facilities into the wild in some countries outside of their native ranges (e.g., in Germany, France, Italy) but no breeding populations were documented (CITES, 2012).

b) Is the species considered a pest anywhere in its natural or introduced range?

None of the mentioned species is considered a pest anywhere in its natural or introduced range.

c) Has the species been introduced to other countries, even if it has not established feral populations?

The mentioned species have been introduced to other countries in aquaculture (France, Italy, Germany, Canada, USA, Saudi Arabia, UAE, Argentina, Uruguay, Japan, Korea, China, Vietnam) but there is no information about establishing feral populations (CITES, 2012). According to FishBase, of 10 attempts of introduction of Russian sturgeon, one was successful (Sweden) and 3 are considered to be probably successful (Latvia, Lithuanian, and China). As for Siberian sturgeon, of 15 attempts, 1 is considered successful (Uzbekistan) and 3 are considered to be probably successful (Sweden, Lithuania, and Spain). However, according to the report “Identification of non-native freshwater fishes established in Europe and assessment of their potential threats to the biological diversity” of the Council of Europe (T-PVS (2001) 6), the status of Russian sturgeon and Siberian sturgeon for the indicated European countries is cited as probably not established. No information is available for Uzbekistan. As for China, according to Ma et al. (2003), Russian sturgeon in Chinese inland waters is maintained by extensive stocking.

6. Environmental risk assessments of the species

A Risk Assessment on the Import of Russian Sturgeon (*Acipenser gueldenstaedtii*) has been carried out by Ecos Environmental Consulting in 2008.

Based on the information gathered for this report, it is considered that the likelihood of *A. gueldenstaedtii* establishing a self-sustaining population in Australian waterways is very low and therefore if imported, the risk to the Australian environment is low. This is based on evidence that shows that it is extremely difficult to establish self-sustaining populations of sturgeons outside of their native ranges.

7. Assess the likelihood that the species could establish a breeding population in Australia

a) Ability to find food sources. Is the species a generalist feeder or does it have specific food needs? What is the likelihood of it finding food in Australia if it was released or escaped? Describe the feeding characteristics of the species, including whether it has a similar diet to any Australian native species.

All sturgeons are generalist bottom feeders.

Beluga is piscivorous and begins to prey upon other fish in an early life stage (Levin, 1997). Feeds mostly on sea fishes (Black Sea whiting, anchovies, flatfishes, gobies, fry of bottom-living fishes), also crustaceans, mollusks, mysids and amphipods (FishBase, 2012). Preferent prey items are *Alosa* spp., *Engraulis encrasicolus*, cyprinids (*Cyprinus*, *Leuciscus*, *Scardinius*, and *Aspius*). Marine fishes, such as *Scomber scombrus*, *Trachurus mediterraneus* and *Sprattus sprattus* are important in its diet, when the beluga are congregating near the coast prior to entering rivers; during the autumn and winter they descend into deep regions of the sea and feeds mainly on *Mullus barbatus*, *Merlangius merlangus*, *Platichthys flesus* and *Engraulis encrasicolus* (FAO, 2012).

Russian sturgeon is a bottom-dwelling mollusc-feeder (*Corbulomya*, *Abra*, *Cardium*, *Nassa*). They also readily consume crustaceans (shrimps and crabs) fishes (*Engraulis encrasicolus*, *Sprattus sprattus* and gobiids) and polychaetes. The main food items of juveniles are crustaceans, including mysids and corophiids, and polychaetes (FAO, 2012).

Siberian sturgeon feeds mainly on benthic organisms, predominantly chironomid larvae, amphipods, isopods and polychaetes; large quantities of detritus and sediment that sometimes constitute more than 90 % of the stomach contents, are also ingested (FAO, 2012).

So, these species will be able to find food if they escape into the wild and their diet is similar to a number of Australian native species.

b) Ability to survive and adapt to climatic conditions. Describe the characteristics or behaviour that would enhance its ability to survive extreme climatic conditions (e.g. drought) and its ability to adapt to different environments.

All sturgeons naturally inhabit temperate zones. The favorable temperature range is 10-20°C (Baensch & Riehl, 1991). Water temperature during spawning ranges from 9 to 18° C (FAO, 2012). The absence of sturgeons from tropical rivers is probably related to thermal requirements for maturation and early development, which generally need temperatures below 20°C (Bemis and Kynard, 1997). These species cannot survive extreme climatic conditions, which can be found in Australia (e.g., high temperatures and droughts).

c) Ability to find shelter. Can the species live in modified habitats? Identify if this species can live in habitats that have been modified by humans, either directly or indirectly, e.g. example plantation forests; gardens; orchards; vineyards; crops; cities or towns; buildings; improved pastures; dams, channels or drains; other (please specify).

Sturgeons are very exigent to habitat conditions and cannot live in modified habitats (except specially designed aquacultural facilities).

d) Reproduction. Could factors such as longevity, birth rates and numbers of offspring increase the likelihood of the species to establish?

For being able to reproduce the species would need to have a suitable spawning ground – places with pebble ground with clean flowing water and increasing temperature from 3-7 degrees to 12-15 degrees. These types of environments are unlikely to be available in Australia, therefore likelihood of breeding naturally is low. In addition, these species commence breeding very late (in the wild, sexual maturity is usually after 10 years) and they do not spawn every year. Relatively high number of eggs laid during spawning (see Section 4 b) can increase the likelihood of these fishes to establish.

e) Are there any limiting influences on the species' natural range? Predator / prey relationships, competition, availability of resources etc. Assess what similar population constraints might exist in Australia.

Taking into account that these species did not create confirmed established populations outside their native range despite their intentional introductions, the main limiting factors seem to be their specific habitats. As these species are migratory, they require availability of both sea (for growth and development) and fresh waters (for spawning). As for seas, they need low salinity waters (5.43 - 14.34 ‰), which can be found in desalinated seas such as Caspian, Black, and Azov Seas. Other limiting factors are temperature (usually from 6° to 12°C) and substrate (stony, pebble ground with good water flow) required for spawning. Therefore, it is unlikely the sturgeons can find suitable spawning grounds in Australia given their narrow breeding requirements.

f) Address the issue of increased potential for feral population establishment if more individuals of the species were present in Australia.

Taking into account that purposeful introductions of sturgeons in different areas of the world (even in countries with environmental conditions similar to sturgeon natural range) were little successful, probably due to narrow habitat requirements (low salinity water for growth and development and cold fresh waters for reproduction), the probability of establishment of feral populations of these species in tropical climate of Australia are minimal.

8. Provide a comprehensive assessment of the potential impact of the species should it become established in Australia

a) Does the species have similar niche/living requirements to native species?

Generally yes. All mentioned species can compete with some native Australian fishes for resources.

The affected resources can be food, habitats and shelters. First of all it concerns Australian benthic-feeders.

b) Probable prey/ food sources

The mentioned species can attack their prey, which include small fish and invertebrates (see Section 7a).

- Does the species attack or prey on domestic or commercial animals or plants?

The mentioned species do not attack or prey on domestic or commercial animals or plants.

c) Impacts on habitat and local environments.

- Could the species reduce the ground vegetation cover to an extent where it could cause or increase soil erosion

Taking into account that all mentioned species are fish, they do not reduce the ground vegetation cover.

- Does the species construct burrows or dig near or around waterways? Identify if the species does/can burrow or otherwise disturb the substrate (soil or sand) around waterways.

The mentioned species do not construct burrows or dig near or around waterways.

- Has the species ever been recorded causing damage to: native animals' habitats; natural communities; native plants; forestry; agriculture?

The mentioned species do not cause damage to native animals' habitats; natural communities; native plants; forestry; agriculture.

- Could the species inhibit tree seedling regeneration in forests and woodland?

The mentioned species do not inhibit tree seedling regeneration in forests and woodland.

d) Behaviours that cause environmental degradation

- Behavioural characteristics. Describe any behaviours of the species which cause physical disturbance to the environment e.g. hooves, digging etc.

Due to their benthic feeding behaviour, sturgeons can destabilise sediment and increase the suspension of sediments into the water column of water bodies, where they live. However, their densities are unlikely to be high enough that they could have such impacts.

- Does the species eat or disturb wetlands/ wetland vegetation?

The mentioned species do not eat or disturb wetlands/ wetland vegetation.

- Could the species cause pollution of water bodies?

The mentioned species do not cause pollution of water bodies.

e) Impacts on primary industries

- Has the species ever been recorded causing damage to: livestock, poultry, agriculture?

There are no records on causing damage to livestock, poultry, and agriculture by these species.

- Could a wild population of the species eat or damage any of the following: plant parts or products; flowers or buds; nuts; root vegetables; leaf vegetables; sugarcane; fodder crops; cotton; nursery / garden plants; timber forests or plantation trees; fruit orchards; stored grain or seeds; legumes; cereal grain in field; oilseeds or coarse grains in field; other (specify).

Wild populations of sturgeons do not eat plant food.

- Could wild populations of the species use any resources that might cause it to compete with livestock?

Wild populations of sturgeons do not use resources that might cause it to compete with livestock.

- Has the species ever inflicted damage to trees, shrubs or their seedlings that has caused tree death or affected their value as timber?

The mentioned species do not inflict damage to trees, shrubs or their seedlings.

f) Damage to property

- Could the species deface or physically damage buildings?

The mentioned species cannot deface or physically damage buildings.

- Could the species damage fences? Identify if the species has the capacity to damage fences.

The mentioned species cannot damage fences.

Could the species damage equipment?

The mentioned species cannot damage equipment.

g) Is the species a social nuisance or danger?

The mentioned species are not a social nuisance or danger.

h) Describe any potentially harmful characteristics of the species.

- Any potential threat to humans, any available mitigation measures (such as anti-venom), and methods for appropriate handling.

The mentioned species do not pose threat to humans.

- Has the species ever injured people? Identify whether there are any recorded instances of this species causing harm to people.

There are no records on injuring people by the mentioned species.

- Is the species susceptible to, or could it transmit any pests or diseases?

The mentioned species can potentially transmit diseases or parasites to other fishes. Therefore, the risk of introducing any diseases and parasites that are not already present in Australia should be minimised through standard quarantine practise that is applied to the import of any other live organisms entering Australia. Taking into account that only fish eggs are planned to be imported to Australia, this risk is minimal.

9. Conditions or restrictions that could be applied to reduce any potential negative impacts of the species

Compliance with Commonwealth and state regulations: These will be identified through this assessment process and also if approved for import, through the South Australian Licence Assessment Process that will be required to add the species to the list of approved species for the aquaculture site. This includes state requirements for the translocation and ongoing holding of sturgeon on the aquaculture farm.

All aquaculture activities undertaken in South Australia will require adherence to state regulations including regulation 4 (Documentation for tracing aquaculture stock) and regulation 6 (Introduction of aquaculture stock hatchery reared or taken outside the State) of the *Livestock (Restrictions on Entry of Aquaculture Stock) Notice 2008*.

In addition, the *Aquaculture Regulations 2005* must be adhered to. Relevant regulations include regulation 10 (Use of chemicals), 11 (Notification of unusually high mortality rate and duty to isolate unaffected organisms), 12 (Aquatic organisms affected with disease), 13 (Stock register), 19 (Strategies relating to escape of stock) and 21 (Notification of escape of stock or damage that may lead to escape of stock) among others.

In addition, there will be a requirement to adhere to PIRSA Fisheries and Aquaculture guidelines in relation to aquatic animal health biosecurity measures, including quarantine and on-going activities to ensure the facility is biosecure in relation to escape and disease management.

Minimise Escape of Stock: The South Australian Government requires an Escape of Stock Strategy to be developed for all species produced on a licensed aquaculture site that is approved by the Minister. This will be further developed to include Sturgeon species, should these be approved for import to Australia.

Conditions that could be applied to reduce risks:

- All fish should be kept in either shed tanks or external earthen ponds.
- A screen system to prevent escape to other farm areas.
- Surrounding area is unsuitable for survival of sturgeon, for example dry land, sufficiently distant from natural waterways to prevent escape of stock. Security to remove the threat of theft of stock.
- Overseas studies have shown that sturgeon are unable to live, breed and thrive outside of their native range.

Control/eradication programs:

Biosecurity South Australia currently has an emergency response plan for freshwater fish incursions. Once an incursion has occurred, Biosecurity South Australia response arrangements are implemented to facilitate coordination, cooperative and timely response actions to provide the best opportunity for containment and eradication. Dependent on the species some control programs may include:

- Surveillance of the spread, through the South Australian Research and Development Institute (Aquatic Sciences) and the community (to understand movement)
- Removal through commercial fisheries – nets, electro fishing and traps
- Using chemicals such as rotenone to eradicate
- Using attractants and repellents
- Implementation of exclusion screens
- Draining and drying of smaller water bodies

Which option(s) is suitable for a particular situation depends on a range of factors, such as the type of waterway where they are found, whether it is privately owned or publicly managed, and the resources available for control work.

10. Summary of proposed activity

- The rationale for choosing to import this species into Australia.

The main goal for importing sturgeons in Australia is to establish domestic sturgeon aquaculture and become a strong producer of caviar and leading producer of sturgeon meat in the region. This enterprise will conduct its activity both on domestic and international markets. Main consumers of caviar will be leading distributors of these products in Asia (Japan, China, Singapore, Malaysia), Russia, USA, and EU. Fresh fish and caviar will be sold for domestic market. It is necessary to note that creation of a sturgeon aquaculture facility will offers good employment opportunities and employ up to 10 people. Taking into account current demand and prices for sturgeon products, creation of large industrial sturgeon aquaculture facility in Australia is very opportune and will allow attaining high profitability of vested capital.

- Clearly state the numbers of animals you want to import.

First year: 20 000 eggs of the hybrid (Russian sturgeon x Siberian sturgeon), 20 000 eggs of Russian sturgeon; second year: 20 000 eggs of the hybrid (Russian sturgeon x Siberian

sturgeon), 20 000 eggs of Russian sturgeon and 20 000 eggs of Beluga, but the number of eggs can be changed. It will be necessary to buy fish eggs during first 8-10 years.

Sturgeon males are not aggressive and therefore there is no need to segregate them.

Sturgeons can be also used in zoos and public aquaria.

The animals will be obtained from European sturgeon farms (Germany or Italy), that can secure a veterinary-health certificate and CITES certificate.

11. Guidelines on how species should be kept

As appropriate discuss the following issues:

- What are the standards for transporting animals? Will the animals be transported according to International Air Transport Association (IATA) regulations?

The FAO Technical Guidelines on Health Management for Responsible Movement of Live Aquatic Animals (FAO, 2007) have been developed to support sections of the Aquatic Animal Health Code 2010 as well as the ICES Code of Practice on the Introduction and Transfer of Marine Organisms (ICES, 2004). These guidelines will be followed in transporting sturgeon species into Australia.

Gessner et al. (2009) investigated the impacts of air travel on Atlantic sturgeon in order to facilitate air transport of live sturgeon broodstock. This work provides valuable methodology for transporting this species.

After being fertilized and incubated for a short period, eggs are packed in a polyethylene packet half filled with water. 20 000 eggs are packed into one 20 litre packet. Then oxygen is blown into the packet. The packet is placed into a foam plastic box packed with helium ice to maintain a cold temperature. Time of transportation should not be over 36 hours.

- How does enclosure size relate to territory requirements?

All described species are not territorial and do not show aggressive behaviour therefore the size of the enclosure is not relevant to territorial behaviour.

- Discuss the containment and management standards for Australia e.g. the proportion of males to females and the maximum number that should be kept in enclosures/ aquaria. Also if single sex populations would be contained within enclosures to limit breeding etc.

At present, there are no Australian containment and management standards for these species. However, guidelines developed overseas by Chebanov et al. (2011) and Chebanov and Galich (2013) can inform the husbandry practices that apply in Australia. While these guidelines focus on hatchery techniques for the purpose of eventually releasing stock, the guidelines include information on hatchery design and location; collection and transportation of wild broodstock; selection and maintenance of broodstock; tagging of sturgeon; water quality and supply; feeding and feed quality as well as practices around breeding and rearing of juveniles. The sex ratio and number of individuals for breeding should be composed of not less than 30% females and 10% males (Chebanov and Galich 2013).

- What standards are used for the enclosures/ aquaria in which this species would be kept? What are the best practice standards? Who applies these standards? Will enclosures/ aquaria be sufficiently large enough for the humane containment of the animals? For example providing sufficient depth and length?

A number of standards/guidelines have been developed overseas regarding hatchery techniques for sturgeon species (Chebanov et al. 2011, Chebanov and Galich 2013). The former provides a framework for hatching and rearing fish primarily for the purpose of release, but also provides best practice standards for farming sturgeon. The Sturgeon Hatchery Manual (Chebanov and Galich 2013) provides a practical handbook of modern sturgeon hatchery practices and management, including enclosure design and water quality requirements. According to Chebanov and Galich (2013), the dimensions of the enclosures can vary but long-term holding units are substantial in size (30-50 m² and 2 m deep).

The stocking density of broodstock for wintering is species dependent and recommended stocking densities according to Chebanov and Galich (2013) are:

- Russian sturgeon: 20–25 kg/m³
- beluga sturgeon: 25–30 kg/m³

- Address welfare issues in housing captive specimens.

South Australia currently does not consider teleosts fish under the state animal ethics guidelines. However, given that we require fish to be of highest quality, fish health will be our highest priority.

12. State/ Territory controls

All three species of sturgeon have been the subject of an assessment by the Ornamental Fish Management Implementation Group and were listed as noxious nationally. As a result Queensland and NSW have listed the species as noxious under their respective legislation, prohibiting sale and possession. South Australia and Victoria have listed the species as noxious although the species could potentially be kept in some circumstances with the appropriate risk assessment and permit.

Section 78 of the South Australian *Fisheries Management Act 2007* declares the specific sturgeon species being applied for as prohibited (noxious) species in South Australia and they are currently not a permitted species for aquaculture. However, exemption permits, considered on a case-by-case basis, can be issued by PIRSA Fisheries and Aquaculture for the possession of noxious species.

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