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Sturgeon aquaculture in British Columbia: Are we there yet?

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Despite sophisticated land-based systems, industry still in development stages

Aquaculture in British Columbia (B.C.), Canada, has grown substantially in the last 40 years. As the province's No. 1 agricultural export, farmed salmon had a wholesale value of CAD 595 million ($453 million) in 2013, reflecting 91 percent of all B.C. aquaculture production and 42 percent of the province's seafood production.

While salmon will undoubtedly remain the backbone of B.C. seafood production, there continues to be interest in emerging species, including freshwater trout, Arctic char, tilapia and white sturgeon. These species lend themselves well to land-based production using recirculating aquaculture systems. In the case of white sturgeon, the high value for sturgeon meat and caviar is particularly well suited to offset the high costs associated with such production systems.

White sturgeon possess many of the necessary attributes to become a successful aquaculture species. These include tolerance of stress and high rearing densities, good feed conversion and fast growth. More importantly, current culture methodology employs land-based, contained aquaculture facilities that minimize interactions and potential impacts with the environment.

Target Marine Hatcheries is a pioneer in sturgeon aquaculture in British Columbia. It began growing sturgeon commercially in a land-based system in 2000. Photo courtesy of Target Marine Hatcheries.

Sturgeon in British Columbia

Two species of sturgeon are found in B.C. waters: the white sturgeon (*Acipenser transmontanus)* and the green sturgeon (*Acipenser medirostris)*. The green sturgeon, the smaller of the two, is not known to reproduce in British Columbia and is believed to originate further south in Oregon, USA. Little is known about this species, which is not considered a candidate for aquaculture development.

In B.C., white sturgeon are found in the Fraser, Nechako, Columbia and Kootenay rivers. To address concerns over the declining sturgeon numbers, a conservation hatchery program was established on the Upper Kootenay River near Cranbrook, B.C. It has stocked hatchery-reared fish in the Kootenay and Columbia river systems since the mid-1980s. More recently, a second hatchery was established on the Nechako River to support stock recovery efforts.

Early aquaculture development

Still in its early development phases, sturgeon aquaculture in B.C. has focused exclusively on Lower Fraser sturgeon. This work was initiated in the early 1980s by Dr. Dave Lane at Malaspina College — now Vancouver Island University — in Nanaimo. Lane collaborated with researchers at the University of California — Davis on initial work that involved mark and re-capture studies and research on spawning and rearing techniques.

In the late 1980s, several large adult Fraser River fish were donated to the program at Malaspina, and in 1991, Lane and colleagues had the first spawning at a Fisheries and Oceans Canada hatchery. By 2005, sturgeon were being spawned at Malaspina on an annual basis to establish broodstock. Today, some of the fish reared at Vancouver Island University are nearly old enough to reproduce.

Commercial aquaculture

Around 2000, Target Marine Hatcheries began growing sturgeon commercially in a land-based system using fish from the Malaspina breeding program. Over time, Target expanded its facilities and developed its own broodstock. The long-term goal was the production of caviar, but this took longer than expected.

After much research and effort, Target Marine harvested its first caviar in 2011, which is now marketed under the brand name Northern Divine. In addition to developing a premium-brand caviar, Target also produces sturgeon meat and by-products.

There are now five producers licensed to commercially produce sturgeon in B.C. in various stages of planning, production and sales. Based on these ongoing successes, other groups, including First Nations, have expressed interest in developing sturgeon businesses.

In 2012, Vancouver Island University opened the International Centre for Sturgeon Studies (ICSS). The state-of-the-art facility houses broodstock and a range of quarantine, rearing, research, training facilities and labs. Research at the facility on sturgeon biology, conservation and aquaculture provides critical training, genetic and infrastructure support for B.C.'s sturgeon producers. The ICSS also includes an aquaponics facility to investigate land-based multi-trophic aquaculture applications for coldwater species with a focus on sturgeon.

Sturgeon products, markets

Like other aquaculture efforts, sturgeon aquaculture was initially developed as a conservation tool to recover depleted stocks (Figure 1). However, it also attracted the attention of entrepreneurs, given the limited availability of sturgeon caviar and prices ranging CAD 1,000 to 5,000 per kilogram (kg) (USD 761-3,806 per kg), depending on species and quality. The current price for B.C. aquacultured sturgeon caviar is CAD 2,400 per kg ($1,827 per kg). However, time to market can be 11 years, which makes for a long return on investment.

In a paper by Paolo Bronzi and Harald Rosenthal for the proceedings of the 2013 International Symposium on Sturgeons, the global production of true sturgeon caviar is currently estimated at 260 metric tons (MT) from an estimated 32 countries. However, production is expected to more than double over the next 10 years. This production capacity has led to speculation that caviar prices could crash without concerted marketing coordination and support.

It is worth noting, however, that the "caviar" market includes 60,000 MT of caviar and caviar substitutes made from non-sturgeon fish eggs and animal and plant derivatives. This presents a difficult marketing landscape for producers of true sturgeon caviar.

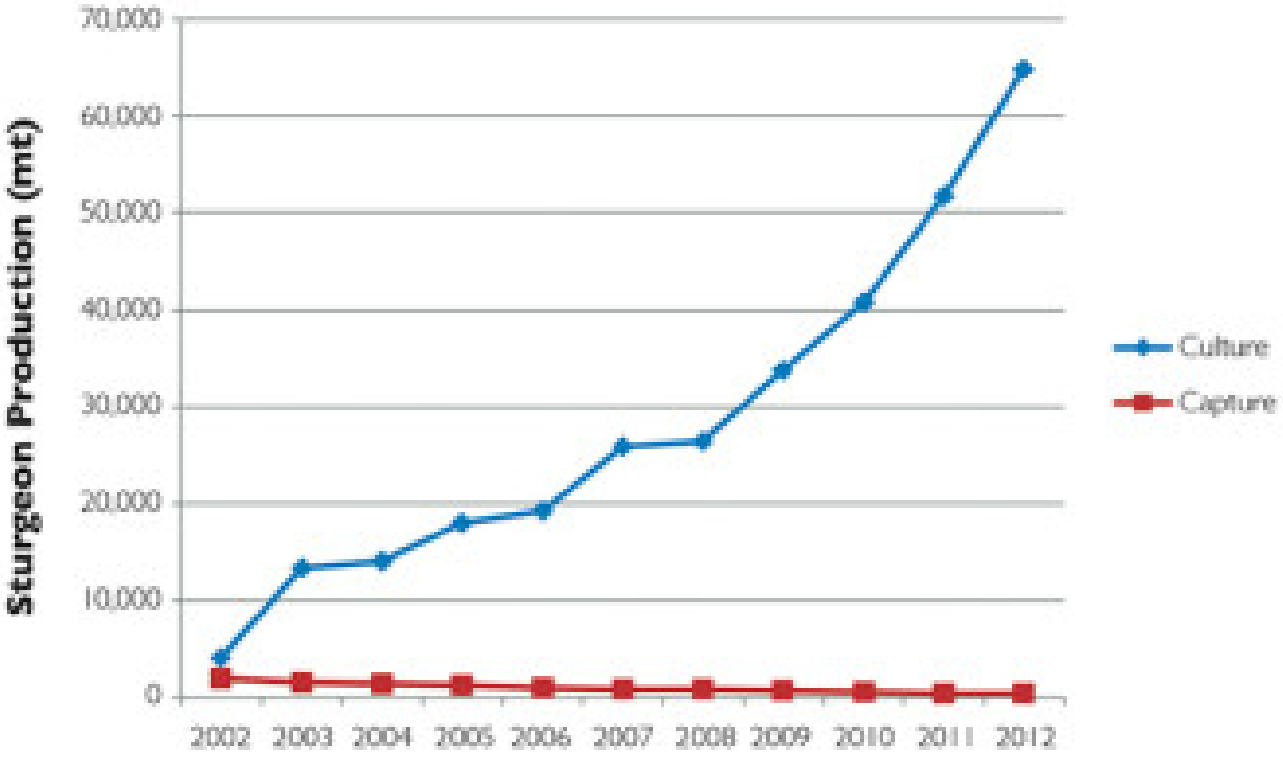

Fig. 1: Global sturgeon production. Source: Food and Agriculture Organization of the United Nations.

Given the

Eggs are collected from sturgeon broodstock at the International Centre for Sturgeon Studies.

production and market challenges of producing caviar, sturgeon growers in B.C. are increasingly looking at developing markets and products based on sturgeon meat. The time to market for white sturgeon meat is three years or less based on harvesting fish at 5 to 8 kg. Current farm gate prices in B.C. range CAD 20 to 35 per kg ($15.37 to 26.90 per kg), depending on the product and destination.

Current sturgeon products include whole gutted fish and head-off, gutted and finned “bullets,” largely from males; and fillets and skin-on portions from females that are held back for caviar production. Fillets and portions from these fish, which can range in size from 30 to 140 kg, incur some additional processing costs and usually weigh 2.3 to 4.5 kg.

Destinations include distributors, restaurants and retail outlets. The bulk of B.C. farmed sturgeon is currently processed as bullets and sold through distributors. This is largely due to the fact that sturgeon is largely unknown as a seafood product in North American retail markets.

There is also a limited market for small, live fish of less than 2 kg, which command a slight price premium. These fish are kept in holding tanks at retail outlets and must be killed before they are handed over to consumers. While a niche market, it is an important one, as fish can be moved to market relatively quickly, although additional transport costs are involved.

Processors are also working on the development of smoked sturgeon products. In addition, producers in B.C. are developing byproducts from sturgeon that utilize the heads, fins, livers and spinal cord marrow of the fish.

Product development and early marketing initiatives have been facilitated by the use of third-party organic and sustainability certification schemes. Given the conservation status of sturgeon in B.C. and worldwide, endorsement of farmed sturgeon as a sustainable seafood product is an important marketing and conservation consideration.

Sturgeon policy in B.C.

In B.C., all producers must be licensed to hatch and/or grow sturgeon by Fisheries and Oceans Canada (DFO), the lead agency for aquaculture licensing. Only sturgeon from the Lower Fraser may be farmed, and the culture must be on land in closed systems with specific measures that prevent escapes. Other conditions of licensing include, but are not limited to, requirements for fish health management plans and reporting.

Sturgeon are large fish. It takes several students to transfer them at Vancouver Island University's International Centre for Sturgeon Studies.

Movement of live fish between facilities and retail outlets is overseen by a federal/provincial Introductions and Transfers Committee. Due to the conservation status of sturgeon, which are listed in B.C. as endangered (Nachako, Upper Fraser, Columbia and Kootenay stocks) and threatened (Lower Fraser stock), permits are required for live fish transfers, and documented chain of custody records must verify that transported fish are of aquaculture origin and have not been obtained illegally.

Permits are also required by retailers and transporters, and are enforced by provincial conservation officers.

Challenges

One of the bottlenecks to the further development of sturgeon aquaculture in B.C. is access to broodstock. While the ICSS and companies like Target Marine have developed broodstock programs, they are based on a limited number of parental fish originally developed by Malaspina. Currently, parental spawners in the ICSS program include four females and three males, from which a second generation will be developed.

The small number of fish represents a genetic bottleneck with a risk of inbreeding depression for future stock development and a physical constraint on the supply of eggs/fry that can be made available to potential growers. Apart from the fish acquired in the early 1990s, no sturgeon broodstock or surplus stock from conservation programs have been made available to develop commercial aquaculture due to conservation concerns.

Several other issues have also been raised, such as the potential for escapes, disease transfer risks and, most importantly, the potential use of cultured sturgeon as a "cover" for fish illegally obtained from poaching and moved through the distribution system. The industry is aware of these issues and is committed to working with regulatory agencies to resolve them through the use of closed-containment systems, fish health management plans, monitoring and reporting, and traceability.

Future sturgeon potential

While caviar will remain the highest-value sturgeon product by weight, there is a significant business case to develop markets for sturgeon meat and value-added products, particularly smoked sturgeon. Smaller whole processed fish, fillets, portions and by-products can also complement caviar production and improve cash flow and timely returns on investment.

Sturgeon aquaculture can represent a very good return on investment, provided growth of the industry is supported by progressive regulatory policies, access to capital and focused marketing to both create demand and ensure prices remain stable.

Based on discussions with producers, the current annual total wholesale value of B.C. cultured sturgeon products is estimated at over CAD 2 million ($1.5 million). Given that a single female can produce CAD 5,000 to 24,000 ($3,806 to $18,270) worth of caviar or, if the eggs are reared and harvested, CAD 6 million ($4.6 million) worth of sturgeon meat, there is potential for the industry to expand several fold once producers reach steady production.

Since one would not want to put a cap on production value, it is impossible to say if “we are there yet,” but it is safe to say that sturgeon aquaculture in B.C. is well on its way.

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