



The Future of Sturgeon: Commercial Aquaculture and Conservation Hatcheries

Friday, October 31, 2003

10:30 AM - 12:30 PM

Location: Saanich Room

Chairs: Bill Bennett and John Morgan (Malaspina University-College)

- 10:30 E.D. Lane
The International Centre for Sturgeon Studies:
a proposed centre for sturgeon conservation and aquaculture research
- 10:45 H. Rosenthal
World Sturgeon Conservation Society
- 11:00 R. Ek
Upper Columbia sturgeon conservation hatchery
- 11:15 D. Westlake
Sturgeon culture policy development in BC
- 11:30 J.C. Henry
Commercial white sturgeon culture in BC
- 11:45 R. Withler and J. Supernault*
Genetic variation in cultured and wild white sturgeon
- 12:00 J. P. Van Eenennaam*, J. Linares-Casenave and S. I. Doroshov
Reproduction and culture of green sturgeon (*Acipenser medirostris*)
- 12:15 S. Flynn, M. Reith, M. Matsuoka, D. Martin-Robichaud and T. Benfey*
Sex control in shortnose sturgeon, *Acipenser brevirostrum*, LeSuere

**Denotes presenting author: Underline denotes presenter is a student eligible for Best Student Oral Presentation Award*



The International Centre for Sturgeon Studies: a proposed centre for sturgeon conservation and aquaculture research

E.D. Lane

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Malaspina University-College has been involved in sturgeon conservation and culture research since the 1980s and is the only academic institution in western Canada to have captive white sturgeon broodstock on campus. In 2000 and 2002, Malaspina provided fertilized eggs and fry for the start-up of the first commercial white sturgeon culture operation in BC. This year, Malaspina has submitted a proposal to the Federal and Provincial governments to establish an International Centre for Sturgeon Studies (ICSS) on the Nanaimo campus. The ICSS would be devoted exclusively to sturgeon issues and would carry out research that has application to four main areas: commercial culture, conservation hatcheries, wild stock protection, and policy development. A major goal of the Centre would be to facilitate collaboration in aquaculture and conservation activities at regional, national, and international levels.

World Sturgeon Conservation Society (WSCS): an international forum for scientific discussion on and concerted actions for the effective conservation and management of the highly endangered sturgeon species

H. Rosenthal

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Sturgeon are among the oldest fishes in the world. They are prized for their delicate flesh and world famous caviar. Once abundant in lakes and rivers throughout the Northern Hemisphere, sturgeon stocks

are now highly endangered, mostly due to over-harvesting and severe habitat alterations.

The idea for the World Sturgeon Conservation Society grew out of two international sturgeon symposia held in Piacenza, Italy in 1997 and in Oshkosh, Wisconsin in 2001. A Foundation Committee was formed during the US Symposium that met on March 11, 2003 in Neu Wulmstorf (near Hamburg, Germany) to establish the Society.

The Society intends to act as an international forum of scientific discussion for all persons interested in pertinent issues on sturgeons while at the same time seeking opportunities for close co-operation at an international level.

Upper Columbia sturgeon conservation hatchery

Ron Ek

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The upper Columbia River white sturgeon population now consists of several known or suspected subpopulations that were isolated by dam construction from each other and from historical critical habitats. The Columbia population in British Columbia was assigned to the provincial Red List in 1993 based on a BC Conservation Data Centre status review that described the species as "critically imperiled". As part of the Upper Columbia White Sturgeon recovery initiative, a sturgeon conservation hatchery was established first at the Hill Creek hatchery, near Nakusp and during the spring of 2003 was moved to the Freshwater Fisheries Society of B.C.'s Kootenay Trout Hatchery at Bull River. Maturing adults are captured in the Columbia River below Castlegar and are transported to, held and spawned at the hatchery to produce 12,000 yearling sturgeon from 6 family groups for release back into the Upper Columbia River each year until natural recruitment can be restored.



Sturgeon culture policy development in BC

D. Westlake

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The Ministry of Agriculture, Food and Fisheries and the Ministry of Water, Land and Air Protection are developing a comprehensive policy for commercial sturgeon culture. A consultation draft of the policy framework was released for comment during the summer of 2003. Elements of the policy framework draft include minimum standards of containment, siting requirements, broodstock access and licensing of live sales. A synopsis of the proposed provincial policy and sturgeon aquaculture policies from other jurisdictions is presented.

Commercial white sturgeon culture in BC

J.C. Henry

Target Marine Products Llp, Madeira Park, BC V0N 2H0

Commencing in 1999, commercial White Sturgeon aquaculture is in its infancy in British Columbia, with Target Marine Products currently the sole producer in Canada. The first live market fish were produced in the summer of 2002, and meat fish in the summer of 2003. The production goal is initial marketing of caviar by 2006. The natural and political climates in BC present unique challenges for culturing sturgeon. A recirculation system was built to provide the habitat control required for commercial culture in BC. Production performance (growth rate, feed conversion, and survival) has been comparable to that of other farmed fish. Several R&D projects are being carried out to improve

culture through a better understanding of preferred photoperiod and feeding regimes, gonadal development and various water quality preferences and limitations of White Sturgeon. While most biological issues have been effectively overcome, political hurdles have been met with various degrees of success. The completion of the Provincial sturgeon policy; however, will add stability to the industry.

Genetic variation in cultured and wild white sturgeon

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White sturgeon, *Acipenser transmontanus*, from the Sacramento, Fraser and Columbia river systems were surveyed at 14 microsatellite loci in an examination of population structure within and between major river systems. All loci were duplicated in the polyploid species, with between one and seven alleles scored in individual sturgeon in individual microsatellite PCR amplifications. Alleles were analyzed individually as dominant characters (presence/absence) and used to derive a multilocus estimate of Nei's standard genetic distance among wild sturgeon sampled from six geographic locations and two families of cultured sturgeon putatively developed from Lower Fraser sturgeon parents. Genetic differentiation among the wild samples was low, with genetic distances between samples within the Fraser watershed as large as those detected between the three watersheds. The cultured sturgeon families constituted two genetically homogenous groups, with strong affinities to the Lower Fraser fish from which they were derived.



Reproduction and culture of green sturgeon (*Acipenser medirostris*)

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The anadromous green sturgeon is considered vulnerable in the United States and Canada, with the only known spawning populations in the Klamath, Rogue and Sacramento Rivers. Since reproduction is a critical factor in sturgeon stock management, our objectives have been to characterize the Klamath River broodstock and develop culture techniques for conservation-oriented research. We sampled 128 broodfish, over a four year period (1999-2002), during the spring (April-June) spawning run in the lower Klamath River. Broodfish ranged 14-40 years in age and 145-242 cm in total length, with a bimodal distribution of sexes (older and larger females). The condition factor was lower than in white and Atlantic sturgeons, associated with the long-tapered body shape in green sturgeon. Mean gonadosomatic index averaged 13% in females and 5% in males, and individual fecundity averaged 152,000. Green sturgeon have large eggs (twice by volume and weight compared to white sturgeon), and all females had oocytes in an advanced stage of germinal vesicle migration (polarization index <0.08), indicating spawning readiness. Methods have been established for handling and transport of broodfish, hormonal induction of spawning, in vitro fertilization, embryo incubation, larval and juvenile rearing.

Sex control in shortnose sturgeon, *Acipenser brevirostrum*, LeSuere

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Sturgeons are among the most critically endangered of all fish species because of habitat destruction and overfishing for production of caviar. Their elusive nature and prolonged maturation cycle has made study of their reproductive biology difficult. Aquaculture provides a means to maintain broodstock, produce cultured caviar to alleviate further overfishing and a unique opportunity to study reproduction in these animals.

To better understand the genetic mechanism of sex determination, chromosomal manipulation was used to produce diploid gynogenetic shortnose sturgeon. Such individuals contain only maternal DNA. Sex ratios of approximately 35 % male to 65 % female have been observed in a sample of 205 gynogens indicating that the female is not the homogametic sex in this species.

An additional experiment to directly feminize populations of normal diploid short nose was also conducted in an attempt to identify the period over which sexual differentiation occurs. Treatment groups were given oestrogen in their diets at varying dosages from 10 - 50 mg/kg of food by spraying a quantity of hormone onto commercially prepared feed. Significantly higher proportions of females in the treatment groups will indicate that the hormone was administered before the period of sexual differentiation was complete.