California Sea Grant College Program
Final Report

R/AQ-131
Parentage in White Sturgeon
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Project Hypothesis
We hypothesize that the addition of six microsatellite loci to an existing panel of eight microsatellite loci will increase the accuracy rate of parentage assignment of farmed white sturgeon to 95%.

Project Goals and Objectives
Objective 1: Increase power in conducting parentage assignment to identify family structure in mixed family cohorts of farmed white sturgeon for the purpose of conducting future heritability studies.

Objective 2: Identify the minimum number of microsatellite markers required to assign parentage with a target accuracy rate of 95% correct assignments within each family.

Briefly describe project methodology
We added six microsatellite loci to an existing dataset of eight microsatellite loci to increase parentage assignment accuracy within 15 half- and full-sibling families of known parentage. Genotype data was collected at the six microsatellite loci for eight broodstock and their one day post-hatch offspring (N=720). Accuracy in assigning each offspring to their correct sire and dam using the full 14 locus data was documented.

Some markers were more informative than others for identifying parentage in farmed white sturgeon. Eight copy microsatellite loci generally had more alleles and therefore more power to exclude incorrect parents than four copy loci (Rodzen and May 2002; Drauch Schreier et al. 2011).

Parentage analysis was conducted with different subsets of the 14 marker panel to determine whether a smaller panel of markers might be used to achieve the target assignment accuracy; this step allowed us to provide accurate parentage assignments for future projects in the least amount of time at the lowest possible cost. We identified a subset of 11 markers from the 14 marker panel that resulted in the assignment accuracy target of 95% both within and among families.

Describe progress and accomplishments toward meeting goals and objectives.
The project is complete. To date, all DNA from the 15 half- and full-sibling families has been extracted and amplified by PCR at the six new microsatellite loci. Parentage assignment was calculated with the full set of 14 markers and was found to be above the 95% target level of accuracy.

Markers were then removed in a step-wise fashion to identify a subset of 11 markers that still resulted in 95% accuracy in parentage assignment.

PROJECT MODIFICATIONS:
N/A

PROJECT OUTCOMES:
We determined that the addition of six microsatellite markers to an existing panel of eight microsatellite markers did increase power in conducting parentage assignment to a target accuracy level of 95% in mixed family cohorts of farmed white sturgeon. Additionally, we identified a subset of 11 markers that still achieve 95% assignment accuracy that can be used in future projects to conduct parentage assignment in the least amount of time and at the lowest possible cost.

IMPACTS OF PROJECT:
The results of this project will be integrated into a larger, multidisciplinary project examining the causes of ovarian adiposity in farm-reared white sturgeon. A multi-institutional collaboration of nutritionists, physiologists, and geneticists has been assembled to examine several variables that might contribute to ovarian adiposity including diet, farm effects, and genetic effects. Accurate parentage analysis is required for estimation of heritability of ovarian adiposity, as family relationships among white sturgeon females harvested for caviar is unknown. Increasing our power in parentage analysis allows us to apply our microsatellite panel to assign parentage and examine ovarian adiposity in California and Idaho white sturgeon farms, as the heritability of traits may differ between populations (Visscher et al. 2008). Ultimately, it is our hope that this project will be used to ascertain causes of ovarian adiposity and to develop guidelines for caviar farms to maximize caviar production and increase product quality.

Advances in sustainable caviar production will ultimately reduce demand for wild harvested caviar, a market this is greatly contributing to the critical endangerment of sturgeon worldwide (Kondorevskaya and Krasikov 1999; Speer et al. 2000; Carey 2005; Pikitch et al. 2005).

BENEFITS, COMMERCIALIZATION, AND APPLICATION OF PROJECT RESULTS:
Parentage analysis has utility in agricultural and aquaculture operations where offspring may be separated from parents and/or visual identification of relatives is impossible (e.g. Petersen et al. 2009). In white sturgeon aquaculture operations, for example, larval white sturgeon from multiple families are pooled in holding tanks soon after hatching. Each tank then contains full-siblings, half-siblings, and unrelated sturgeon. This method presents a challenge for producers who are interested in understanding the ontogeny of ovarian adiposity in female white sturgeon. Females with fatty ovaries yield less caviar per body weight than those with lean ovaries and caviar from fatty ovaries tends to be of lower quality (Webb 2009; Van Eenennmann et al. 2010; Doroshov et al. 2010). The causes of ovarian adiposity are unknown, although diet, environmental effects, and genetic effects likely contribute. An interdisciplinary, multi-regional team has been assembled to evaluate how dietary, environmental, and genetic variables influence ovarian adiposity in white sturgeon (Doroshov et al. 2010). To understand how genotype influences ovarian adiposity, we conduct heritability analyses among half-sibling families of female white sturgeon for which caviar yield and ovarian fattiness have been evaluated.

Parentage analysis will be required to parse harvested females into half-sibling families. By adding six microsatellite loci to an existing dataset of eight microsatellite loci and determining the minimum number of microsatellite markers required to assign parentage with a target accuracy rate of 95%, we increase parentage assignment accuracy in the least amount of time at the lowest possible cost.

ECONOMIC BENEFITS generated by discovery
No response.

Issue-based forecast capabilities
N/A

Tools, technologies and information services developed
No response.

Publications
None listed.

DISSEMINATION OF RESULTS:
This section is pending. We plan to present the results of the parentage validation at a meeting of stakeholders and collaborators in the larger white sturgeon ovarian adiposity project. Results and recommendations from this larger project will be presented at national and international meetings, including the annual Western Region Aquaculture Center (WRAC) meetings and the International Symposium on Sturgeons to be held in Vancouver, British Columbia, in 2013. Additionally, management guidelines on how to reduce the incidence of ovarian adiposity will be provided to sturgeon producers and other stakeholders in the form of podcasts and multimedia presentations made available on the WRAC website (Doroshov et al. 2010).

WORKSHOPS AND PRESENTATIONS:
This section is pending. The results of this study will be presented at workshops and presentations in upcoming months/years (see "Dissemination of Results" section).

COOPERATING ORGANIZATIONS:
Federal
N/A

Regional
N/A

State
N/A

Nongovernment
N/A

International
N/A

Industry
Sterling Caviar, Elverta, CA

Academic
University of California, Davis

Sea Grant
N/A

Other
N/A

INTERNATIONAL IMPLICATIONS:
White sturgeon hatcheries exist in countries other than the United States. The management guidelines on how to reduce the incidence of ovarian adiposity that we provide to sturgeon producers and other stakeholders in the form of podcasts and multimedia presentations available on the WRAC website will be accessible online and may therefore be informative to producers in other countries, particularly Russia.

FOR ALL STUDENTS SUPPORTED BY THIS GRANT, PLEASE LIST:
Volunteer Count 2

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