CALFed Progress Questionnaire
California Sea Grant College Program

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ProjectYear_2A 2nd Year **ProjectNo_2C** U-04-SC-005

TypeQuestionnaire_2B Interim Questionnaire

Preparer Information

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Project Information

ProjectNo_2C U-04-SC-005 **StartDate_3a** January 2007 **EndDate_3b** December 2008
ProjectTitle_4 Temperature and salinity effects on the physiology of sturgeon

CALFed Fellow contact information

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Research Mentor (for additional please see #8)

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Community Mentor (for additional please see #9)

CMTitle_7A **CMLastName_7B** **CMFirstNamt_7C** **CMInit_7D**
CMInstitution_7E

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

Additional Community Mentors_9

Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.

ProjectObjectives_10

This proposal was written to address the CALFED action regarding trends and patterns of populations and systems response to a changing environment; more specifically, it will address the potential effects of climate change and anthropogenic disturbance on white sturgeon from a physiological perspective. The project will have three main goals; 1) to determine the critical thermal maximum for white sturgeon and how those maxima correlate with salinity, 2) to use proteomics in order to identify, isolate, and sequence salinity- and temperature-specific protein bioindicators of physiological stress, and 3) to investigate the use of tissue microarray analysis to screen for bioindicators of temperature and/or salinity stress in both laboratory and field acclimated animals.

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Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

The determination of CTMax and the effect of environmental salinity was carried out last summer and produced interesting results. We showed that sturgeon acclimated to water with similar osmolality to that of their plasma resulted in a higher temperature tolerance. This was and intuitive result, but it had not been previously shown nonetheless. The results of this study have recently been accepted into the Journal of Experimental Zoology (pending some revision).

All experimental acclimations that were proposed have been conducted at this point, including both for proteomic analysis and for tissue microarray construction (in addition to some experiments that were not proposed originally-see next section). A large number of different tissues were collected from these animals, some of which have been, and continue to be, used for analysis.

1) Proteomics: The two-dimensional gel analysis did take some time to optimize for sturgeon tissue, but eventually useful protein maps for the different conditions were constructed and difference between temperature-exposed and control fishes have been detected, as have differences between freshwater and seawater-acclimate fish. As these proteins are sequenced, using the mass spectrometer, a list of candidate proteins for a potential bio-indicator assay is being compiled. This is ongoing at this point, but some preliminary results show the presence of heat shock protein pre-cursors and calcium-sequestering proteins in the stressed fish. 2) TMA Construction: Several sturgeon microarrays have already been constructed. We now have microarrays for temperature and salinity treated sturgeon that can be analyzed as new data is generated by the proteomic analysis. Once we determine top candidates for bio-indicator assays, these microarrays will be stained with appropriate antibodies.

PROJECT MODIFICATIONS: Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

Modifications_12

We have incorporated the use of green sturgeon into this project. Green sturgeon were successfully spawned last spring providing an exciting opportunity to work on a threatened species. My mentors and I thought this would make for a more useful overall project, as our justification for using white sturgeon initially was as a surrogate for the green. The majority of the work we have done so far have been on green sturgeon.

It was one of the bases of this project that the effects of global climate change were going to result in a greater variability of salinity and temperature in the SF Bay-Delta Estuary. Based on the predictions made by Knowles and Cayan (2002, 2004), we set up microcosm experiments to simulate the predicted salinity variation. Two winter scenarios were constructed, where sturgeon acclimated to bay or estuary water were challenged by a rapid influx of freshwater. Conversely, a summer scenario was set up where sturgeon faced a tidal cycle from 3 to 24 ppt salinity for a 24 h period. The data collection is ongoing but has produced some interesting preliminary results. These fish have shown an increased expression of HSP 70, caspase 3/7 (apoptosis) and have compensated for large disturbances in plasma ionic balance; this experiment will be submitted as a multi-variate approach to examining acute salinity stress for sturgeon.

BENEFITS AND APPLICATIONS: Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. CALFED is looking for "management cue" (see http://science.calwater.ca.gov/pdf/soemgmtcues.pdf).

BenefitsApplic_13

1) CTMax: The finding that salinity acclimation and thermal tolerance are linked is valuable. We assume that if fish respond to temperature based on salinity, they will more than likely respond to salinity based on temperature as well. Hot summer months (where salinity may also be more variable in the future) may result in the selection of sub-optimal areas by Delta species, or if they are unable to migrate, these conditions may lead to very high levels of environmentally-derived stress. This should be considered in management decisions.
2) Our bio-indicator is still being developed, but use of biopsy tissues from wild fish will eventually be tested to measure the level of these proteins in wild fish.

PUBLICATIONS: List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and CALFED Science Conference during the duration of the fellowship.

Publications_14

Sardella, B. A., Sanmarti, E., and D. K.ltz. The Critical Thermal Maxima of green sturgeon (Acipenser medirostris) and the effects of environmental salinity. CALFED State of the Estuary Conference, Oakland, CA, October 2007.

Sardella, B. A., E. Sanmatri, and D. K.ltz, 2008. The critical thermal maximum of green sturgeon (Acipenser medirostris) and the effect of acclimation salinity. Journal of Experimental Zoology, (Accepted pending revision)

* I will be giving an oral presentation and presenting a poster related to this sturgeon work at the upcoming International Congress on the Biology of Fishes in Portland, OR this summer. Abstract for this work will be submitted at the end of this month.

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COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

Will Jewell, UC Davis Mass Spectronomy Lab.
Will has been helpful in training me for the se of the MS for protein ID.

AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

Awards_16

none

KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

Temperature/salinity interaction, green sturgeon, proteomics, tissue microarray, global climate change

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PATENTS: List any patents associated with your project.

Patents_18

none

Additions: Additional information can be added here. Please begin the text with the number of the question you are adding to.

Additions_19