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Understanding the Drivers and Limiting Factors of Tui Chub in Pyramid Lake, NV as the Most Important Food Source for Recovering Lahontan Cutthroat Trout

Phaedra Budy

Utah State University, phaedra.budy@usu.edu

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CRU Data Management Plan Template

1. Project and Contact Information

Project Title: [Understanding the drivers and limiting factors of Tui chub in Pyramid Lake, NV as the most important food source for recovering Lahontan Cutthroat Trout.] (parenthetically include any identifiers such as RWO number or other Funding ID).

USGS Program: Cooperative Fish and Wildlife Research Units Program, [UTAH]

Summary Description: [Provide a brief (2-3 paragraphs) description of the project specifying purpose (needs and objectives) and geographic location]

The importance of tui chub as the primary food source for recovering Lahontan Cutthroat Trout (LCT) in Pyramid Lake, Nevada has been firmly established. However, there is evidence that over the longer term, Tui Chub abundance has been declining, concordant with declines in lake elevation. The mechanism(s) driving this decline remains unknown and could include changes in food availability with changes in lake biogeochemistry, spawning and recruitment failure due to lack of littoral habitat, or a community food-web change. This uncertainty must be addressed in order to ensure the continued recovery of LCT including new natural recruitment, and to assist in determining stocking levels in order to not exceed carrying capacity.

The project being will explore the factors determining food availability for Tui Chub, changes in littoral habitat as they may affect spawning and recruitment success, and potential changes to fish community dynamics, all with consideration of the potential concordant declines in lake elevation.

1. **OBJECTIVES:** Our goal is to evaluate the potential limiting factors for Tui Chub annual abundance, long terms trends, and persistence in Pyramid Lake.

Specific objectives under these goals are to:

- (1) Understand the relationships (direct and/or indirect) between Tui Chub abundance and distribution and water quality factors associated with declining water levels (e.g., total dissolved solids, TDS). This could include food availability for Tui Chub.
- (2) Determine when and where Tui Chub spawn and rear.
- (3) Understand the relationship (direct and/or indirect) between Tui Chub abundance and distribution and littoral habitat availability associated with declining water levels.
- (4) Determine if there have been other changes to the fish community that may be affecting Tui Chub.
- (5) Determine the most effective time to sample larval Tui Chub as an index of annual abundance.

- (6) Develop a relationship between above (larval index) and annual availability of Tui Chub (as measured each fall).
- (7) Work with PLF and USFWS to make management recommendations regarding the management of Tui Chub and LCT based on #1-5 above.

Starting Date: [“when the contract is signed”]

Ending Date: [September 30, 2024]

Additional Information: [None]

Main CRU Point of Contact: [Phaedra Budy; Utah CFWRU; 435-770-3274]

Alternate USGS or CRU Point of Contact: [NAME; AGENCY; PHONE]

1. **Funding Agency Collaborators (USGS and/or external):** [Lisa Heki – Project Leader, U.S. Fish and Wildlife Service, Lahontan National Fish Hatchery Complex, (775) 861-6354, Email: lisa_g_heki@fws.gov]
2. 2. Plan and Acquire

If you are collecting new data: [Describe your sampling methods, the data to be collected, and indicate whether there are special manipulations, processes or procedures for collecting the data (e.g. licenses, permissions, specialized equipment or software)].

1. Our general approach will be to 1) measure limnological factors potentially associated with declining water levels and Tui Chub health and abundance, 2) measure littoral habitat and rebuild (model) the degree of littoral habitat lost, 3) perform experiments with Tui Chub to assess their response to any limnological factors likely to be limiting, 4) perform experiments with larval Tui Chub to assess the importance of littoral habitat, and 5) attempt to develop relationships between potential limiting factors and Tui Chub abundance and distribution. All research activities are or will be permitted under California SCP-10779.

Study Area: Our study area is Pyramid Lake, Nevada.

Field Methods: A MS-level graduate student will complete a thesis as a key component of this project. We will conduct field work primarily in the spring, early summer, and fall of each year. We will continue our annual fall monitoring (funded separately by USFWS) or midwater trawling, gill netting, and hydroacoustics, which will characterize the fish community annually and be critical to this project. We will perform larval fish tows weekly at a sub set of index sites over the potential time of Tui Chub spawning (likely determined by day length and temperature, May to July).

We will attempt to build relationships between environmental conditions and Tui Chub recruitment success and to build a predictive model accordingly. We will sample the full suite of limnological factors a minimum of every 2 weeks, and some factors will be sampled continuously with sensors. We will explore the use of stable isotopes and hard part microchemistry to determine the effect of TDS in the food web and incorporation into Tui Chub diets and physiology. We will perform a detailed literature review of the effects of TDS on fishes and their associated food web and compare that to the situation in Pyramid Lake. We will measure the bathymetry of Pyramid lake and reconstruct the degree that littoral habitat has been lost by retrospective reconstruction based on lake elevation and GIS, etc. We complete controlled replicated experiments as discussed above where relevant, hopefully at PLF facilities but possibly at the USU Millville Aquatic Research Facility. We will sample and analyze littoral benthic food availability (macroinvertebrate density).

For permitting, we are already covered under USU IACUC protocol 11014: Adaptive management and monitoring of Pyramid Lake, Nevada, and USFWS permit (issued to Reno Fish & Wildlife Office) for handling T & E species (LCT, Cui ui): ESPER0010710 (while we update and amend of our current Recovery permit TE-08832A-1 which will be submitted by December 2021).

Data Analysis: We will analyze field data using mixed effects models and perhaps some multivariate techniques yet to be determined. We will analyze bathymetry and littoral habitat data using GIS and digital elevation models. We will evaluate trends using retrospective and prospective regression-based techniques tailored to the data type.

If you are using existing datasets: [Provide the name, format, a persistent identifier, and source citation (if any)]. *If the existing data come from a federal government agency,* a Memorandum of Understanding (MOU) is recommended and should be referenced here (see USGS MOU). *If the existing data come from other than a federal government agency,* a Data Sharing Agreement should be used to include provisions concerning data access and dissemination (see USGS DSA).

Approximately [XXX MB, GB, TB, or PB] of data will be collected or generated over the course of the project with data being collected and/or updated [FREQUENCY (daily, weekly, monthly)]. The [YOUR UNIT] has the appropriate hardware, software and staff resources necessary to perform the data management activities as laid out in this document.

3. Describe Data/Metadata and Manage Quality

Data

[1] new data set(s) or data product(s) will be created during the course of this project.

[Describe your procedures for]: data will be entered on computer from data sheets once per week; data from remote data loggers will be downloaded onto a computer monthly; we will ensure data will be of the highest quality by thoroughly training staff, using form validation during data entry, and script/coding used to identify and flag anomalous observations, etc. Once all data are collected and proofed, the final data package will be stored in an open data format as comma delimited values.

Metadata

The PI, [Phaedra Budy], will generate FGDC-CSDGM or ISO compliant metadata in XML format using free tools available through the U.S. Geological Survey (USGS) or the U.S. Forest Service (USDA Metavist 1.6). Links to the free metadata tools are available through the USGS data management website at: <https://www2.usgs.gov/datamanagement/describe/metadata.php>.

[Describe the data processing steps or provide the scientific workflow detailing how you went from raw data to data set/product/results, *the data have not been collected yet*]

[Describe the entities and attributes of your dataset (e.g. the columns/fields of your dataset or create a data dictionary for reference, *the data have not been collected yet*)]

4. Backup/Secure and Preserve

During the course of the project, the data will be stored [on a computer backed up to Box (USU Cloud server)]. Data will be backed up [weekly] and backups will be stored on [Box (USU Cloud server)]. No PII information will be stored in this data set (or if so, describe security precautions for the sensitive data). Data and relevant FGDC-CSDGM or ISO compliant metadata will be delivered as a turn-key, digital package to [US FWS]. The data and metadata will be preserved over the long-term by [USFWS] consistent with their agency policies.

5. Publish and Share

A variety of reports including peer reviewed publications, theses, dissertations and final reports will result from the data and will be used to meet contractual reporting requirements. The PI, [Phaedra Budy], will retain rights to use the data to produce reports and publications for [2] years after data collection is complete. PI will also have the right to distribute the data used as part of a manuscript or other report to the publisher when the publisher requires the data be made available.

For non-USGS funded research, add the following:

As the primary funding agency, [AGENCY] will retain ownership of the data throughout the lifespan of the project, be solely responsible for sharing the data throughout the lifespan of the project and be responsible for making the data available to the public after the project is completed (consistent with their agency policies). Consequently, all requests for copies of the data will be directed to [AGENCY].

For USGS funded research, add the following:

The PI, [Phaedra Budy] will provide a complete copy of the fully proofed data (using the QA/QC controls above) and FGDC-CSDGM or ISO compliant metadata to the U.S. Geological Survey's [Utah Cooperative Fish and Wildlife Research Unit]. The [Utah Cooperative Fish and Wildlife Research Unit], as the funding agency, will be responsible for officially reviewing the data and metadata and publishing the data and metadata consistent with USGS Fundamental Science Practices (FSP) policies and procedures for USGS data releases (<https://www2.usgs.gov/usgs-manual/im/IM-OSQI-2015-03.html>). The data will be made available to the public through [ScienceBase Data Release]. A Digital Object Identifier number will be generated by the appropriate party once the final location of the dataset is established.