

How can the Santa Ana sucker be saved?

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Introduction

According to Kolbert 2015, we are in the midst of a dramatic extinction event that is rivaling major catastrophic extinctions in the past. The difference with the current situation is the cause: The dominance of human beings over the Earth's surface led to the extirpation of thousands of species, and counting.

It's easy to second guess various scientific and policy questions with respect to endangered species, but when we begin to evaluate what is actually being done on the ground for various species, we quickly learn that we are not just in an ecological web, but our policy and regulatory processes are embedded in a complex context of land use history and economic agendas.



Figure 1: Santa Ana sucker, *Catostomus santaanae*

Driving Question

This project will attempt to answer the following question, "How can we save the Santa Ana sucker?" As we have seen, this type of generic question needs to be constrained, defined, and subject to what we already know or will learn about the topic. In addition, we need to define the terms used in the question, such as who is "we"? What do we mean by "save"? And finally, when we ask "how", what are the options available that might fit into the "how"?

Learning Goals

In the broadest sense, we will learn how to conduct a scientific study to meet policy and regulatory goals – in this case for the Endan-

gered Species Act. By selecting the Santa Ana sucker, we have “constrained” the methodological options available, largely to aquatic sciences, such as hydrology, geomorphology, biogeochemistry, ecology, and animal behavior.

- Evaluate sucker habitat using the following tools:
 - Define Water Quality Goals
 - Characterize Hydrology and Geomorphology
 - Analyze Community Profile of Periphyton
- Propose and evaluate options to improve Santa Ana sucker habitat.
- Prepare sets of practical and effective measures that might protect (or increase) the extant populations of the Santa Ana sucker.

Why these learning goals?

Scientific methods vary dramatically accross and within disciplines and subdisciplines, so no course can cover even a fraction of scientific methods available. We have picked the methods above because they might provide the tools to consider how to protect and restore Santa Ana sucker populations.

Project Stages

- Session 1: Define ‘Public Product’ & Team Contract
- Session 2: Revise ‘Driving Question’ and list resources needed
- Session 3: Read, clarify, or develop appropriate SOPs
- Session 4: Field Work
- Session 5: Data Analysis
- Session 7: Development of Public Products
- Session 6: Presentation of Public Products

Defining the Public Product

The stakeholder group has defined the following products for their work:

Annotated Bibliography Thus, we will be collating, organize, and summarize scientific resources that can be digested by a range of stakeholders to help “answer” the driving question.

Analysis of how invasive red algae affect fish behavior

Research Briefs These briefs will describe the knowledge base, information gaps, and research needs for a range of topics. Each student will contribute one science brief that describes the knowledge available to "restore and protect" the Santa Ana Sucker. Each research brief, will address a different scientific issues associated with the Santa Ana sucker—where each issue addresses a specific driving question with respect to the sucker. EA 30 Research Briefs are short (3-4 pages) descriptions of recently EA30 project results. These “briefs” highlights also include one image, a caption (50 words), and several publication citations. Each student will develop one to several briefs that will be made available to the public.

Each brief will include 5 sections:

- Problem definition
- Evidence of problem
- Scientific knowledge to address the problem
- Information gaps
- Next Steps (which could be translated by stakeholders as potential research needs)

Presentation to HPC on findings And as the topics develop, we will bundle briefs to produce 3-5 reports that will be made public as part of a presentation to the HPC group.

Project Partners and Evaluation Criteria of Public Product

Although the audience is the public at large, we will use several collaborators to help us define, refine, and evaluate our public products.

Our collaborators include:

- USFWS
- RCD of SB?
- ??

west fork...Edison... consulting report?

Justin...

baskin...(old Alzheimer..)

annotate bibl. documents.

recovery permit...

coordinator 10A1A permit...

6-25

980? in Carlsbad...

As the develop of individual topics forms, we will form into teams to facilitate field work, literature reviews, and evaluation of current or unpublished data. Note: each student is responsible for an individual contribution.

Once we create topical themes, we will create teams to arrange and order of individual briefs based on the quality and potential interests for each of the sections.

Working with stakeholders is a key component doing environmental science, which might be contrasted with regular scientific research. Although some make the distinction between applied and pure science, I don't find the divide all that useful.

Better that getting into the morass of these definitions, let's move on to figure out what skills we need to apply while working with stakeholders. As it turns out, few stakeholders can really define their project until after it is complete – much to the surprise of the both the stakeholder and the group doing the work.

There is no secret to get around this problem and even if you identify and try to work through it, you might still find that the project doesn't meet the "expectations" of the stakeholder – which were either unrealistic or poorly defined or both.

Active Listening Careful listening and echoing what stakeholders say is an extremely important to develop a successful partnership with stakeholders. Asking for clarity and follow up questions will help you define what the goals of the project in collaboration.

Defining Success As a key component of collaboration is ensuring that all parties agree on what success look like. For example, this would include examples of "models" to emulate or avoid. In addition, going through the project will help articulate clear expectations about the public product and the workload to get there.

Outlining a Process The process can also be called, "project management"

Professionalism and Completion

During the summer, our research partners describe various interests they had with our class. Below are some of the opinions expressed:

Kai Pelenscar – US Fish and Wildlife Service Based on the current data set we have on sucker biology and habitat preference, I would like to identify data gaps where student work would contribute to species' conservation as well as contribute to research or other types of projects. In order to prioritize a list of data gaps, I need to know where we stand on the ongoing research projects relating to sucker.



Figure 2: The Santa Ana sucker *Catostomus santaanae*.

Also, instead of tying the change in habitat to a shutdown, potentially a high velocity flushing flow from RIX [Water treatment facility] would provide data for a measure proposed by Heather's group.

Heather Dyer – San Bernardino Municipal Water District I think it would be great to have them [EA30 students] focus on the red algae and its effect on sucker behavior.

I wonder if we could do a series of snorkel videos of the sucker behavior in/around the red algae (if they are there and utilizing) and compare?

Carl Demetropoulos–Fish Ecologists, Consultant In discussions with other members of the group, we have come along way over the past year and now just need to put it together in a single report, and consider the next phase of analysis.

Larry Brown–USGS Scott and a colleague have developed a 2-D habitat model of a reach below RIX and Jason works with me on the population estimates and habitat utilization. I am really interested in the dynamics of the red algae below RIX within the modeling reach. This could involve mapping of algae patches and measurements of depth, velocity, and substrate to characterize "algae habitat utilization". This could be compared against sucker habitat utilization to determine if they are "competing" for habitat. Doing this before and several times after a big shutdown would be ideal. This data would be very useful (in my mind anyway) to understanding the sucker population below RIX. I also think this data could contribute to a scientific publication. I was planning on doing this during our fall field work to the extent possible in a week but multiple observations would make for a stronger paper. I think the timing is good since our plan is to do the work in late Sept. The class could overlap or work in Sept-Oct.

XXX – *US Forest Service* forest service... needs some work done too... who is the contact?

??? *Southern Edison*

Retired–Cam Swift

Driving Question

Define and constrain driving question

As one of our first exercise, we will explore the meaning of the driving question. As we work to understand our driving question, we will create groups of students to act as research teams that will address a portion of the driving question.

Understanding the Recovery Plan of the Santa Ana sucker

In the XXX of 20XX, the USFWS release a Draft Recovery Plan for the Santa Ana sucker. Please read the Draft Plan before class and we will use this to help create the driving question and refine the public product.

Resources to answer driving question

Each team will determine what resources are available and/or needed to address the driving question. Working with the instructor is key because these resources need to be made available for the following week.

Determine Required Resources and Methods

Answering the Driving Questions

Below is a list of possible themes, but this list is only one potential list and not meant to constrain how we decide to work as a group:

Issue 1: Habitat Use Where are the Santa Sucker? Do they move from habitat to habitat on a daily basis? Diel movement with a Go Pro... succession changes in algae... Video with experimental manipulation of rocks with and without algae on them. E. fork of San Gabriel behavior is much different. More cover...

Select a pool, six pools...too much! exploratory study.

Issue 2: Food Quality How has the invasive red algae influenced sucker food? Are diatoms on the red algae? I find a rock and work it up... What about lipid content? As it turns out that lipid PHA and ARA imputes egg quality up to 3 generations?

Issue 2b: Food Quality How has the invasive red algae influenced sucker food? Are diatoms on the red algae? I

Issue 2a Epiphytic diatoms – growing on Red Algae. .. find a rock and work it up... What about lipid content? As it turns out that lipid PHA and ARA imputes egg quality up to 3 generations?

Issue 2b: Stomach and Faeces We have fish faeces samples from the fall 2015. We will extract the DNA... Faeces 18s rDNA Diatom 18s rDNA

<http://www.fao.org/docrep/x5744e/x5744eof.htm>

Issue 3: Water Quality Temperature, pH, conductivity, DO, and other chemicals?

Issue 4: Hydrology Water velocity? flow and feeding behavior... RIX facility...40-100 cfs before and after flushing event..., micro-velocity meter fish may be found in 1.8/2.2 m/s

Issue 5: Geomorphology As a comparison, Horse Ranch in Big Tujunga has a 3% gradient good location/habitat.

Data Collection and Analysis

We will go to the field on three times locations??...

- Santa Ana River
- San Gabriel River
- Big Tujunga Wash

?Water Quality

?Velocity

Create Public Product

To create public product, we will develop four/five pdf briefs, using LaTeX and Rstudio.

Selecting a Style

We will rely on the Tufte style that we can access in Rstudio.

Writing and Presenting Results

Evaluation of the Public Product

Our stakeholders will evaluate the public product using the criteria that we develop together that will likely include accuracy, scholarship, and clarity.

Other Resources

Examples

<https://www.fws.gov/Endangered/esa-library/index.html>
<http://blogs.scientificamerican.com/extinction-countdown/>