CITIZEN SCIENCE IN THE GRAND CANYON

ECL 290 // Marisa Coyne // FEB. 7th 2018

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… or an exploration of participatory science prepared for scientists by a non-scientist

big three

- What is citizen science?
- What citizen science is taking place in the Grand Canyon?
- How's it going?

flow

- Citizen Science Defined
- Citizen Science Objectives / Motivations
- Describing Participation
- Big Questions
- The Grand Canyon Context
- Citizen Science: Shaping and Shaped by Policy
- Questions?

USGS defines citizen science as scientific research conducted in whole or in part by amateur or nonprofessional scientists

citizen science defined

citizen science objectives / motivations

- Data Collection
- Public Education

Aceves-Bueno E, Adeleye AS, Bradley D, et al. (2015) Citizen Science as an Approach for Overcoming Insufficient Monitoring and Inadequate Stakeholder Buy-In in Adaptive Management: Criteria and Evidence. Ecosystems 18: 493-506.
Bonney R, Cooper CB, Dickinson J, et al. (2009) Citizen Science: A Developing Tool for Expanding Science Knowledge and Scientific Literacy. BioScience 59: 977-984.
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citizen science objectives / motivations

- Data Collection
- Public Education
- Activism / Advocacy

Citizen Science Isn't Just About Collectin

onscientists should take part in discu
bout research priorities and more.

Jason Lloyd

Science Observed

Essays on science, scientists and science studies

Search ...

AIDS activism – citizens, science and citizen science

December 22, 2013 · by jonturney

I was pondering "co-production" as a research plan aim recently, and it strikes me that the whole idea is often more developed in biomedical research than some of the other areas where it has become fashionable. Patient activism has a lot to do with this, and the early history of the AIDS epidemic is informative there – especially as analysed by Stephen Epstein in the 1980s and early 90s. This is a review of his book from that

Citizens monitor Gulf Coast after oil spill

COURTESY PATRICK MEIER

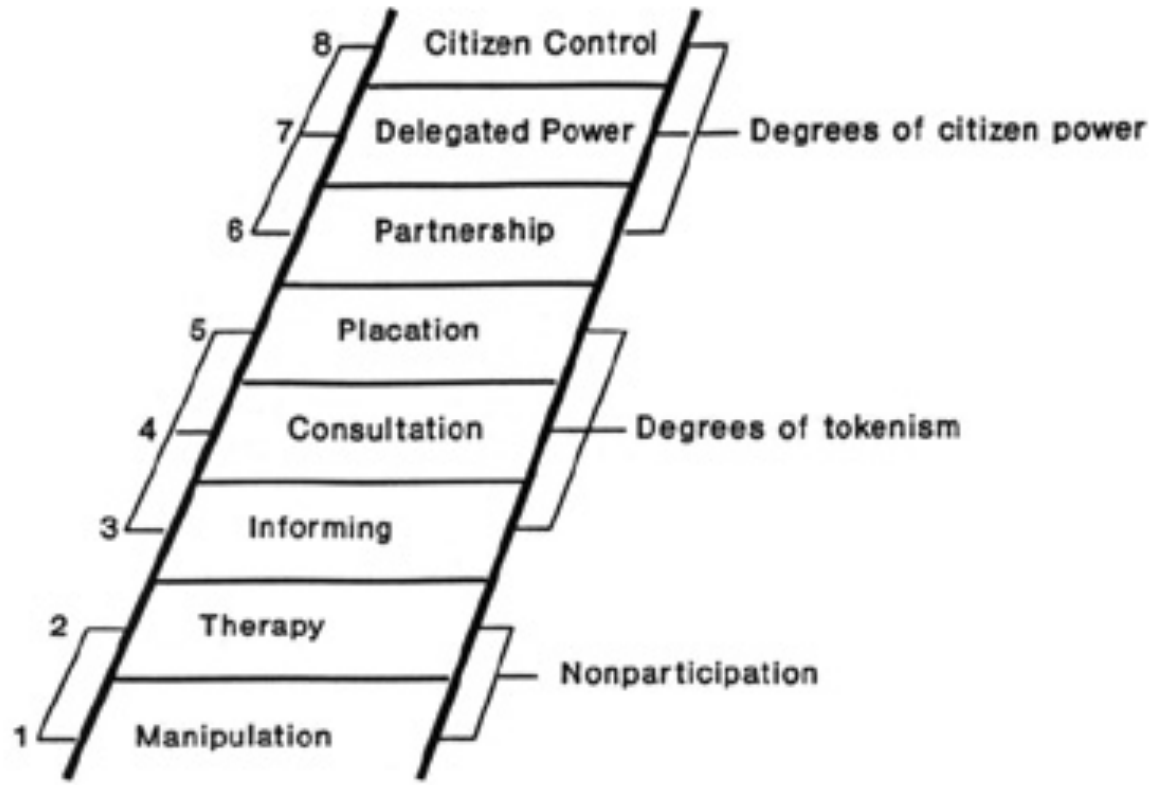
describing participation

- **REMEMBER**: Citizen science is defined by the USGS as scientific research conducted in whole or in part by amateur or nonprofessional scientists

Arnstein's ladder of participation

Figure A-2. The Ladder of Citizen Participation

Figure E-1
The Ladder of Citizen Participation



Source: Arnstien, 1969

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Institute of Planners,35*(4), 216-224. doi:10.1080/01944366908977225

McKenzie's research "cycle"

McKenzie, J. A. (2005). Learning to question - to wonder - to learn. Bellingham, WA: FNO Press.

big questions

- Who gets to participate?
- What kinds of activities qualify as participation?
- What kinds of participation are appropriate?
- How reliable is community collected data?

Bonney R, Shirk JL, Phillips TB, et al. (2014) Next Steps for Citizen Science. Science 343:1436-1437
Burgess HK, DeBey LB, Froehlich HE, et al. (2017) The Science of Citizen Science: Exploring Barriers to Use as a Primary Research Tool. Biological Conservation 208: 113-120.
Freitag A, Meyer R and Whiteman L. (2016) Strategies Employed by Citizen Science Program to Increase the Credibility of Their Data. Citizen Science: Theory and Practice 1.
Thornton T and Leahy J. (2012) Trust in Citizen Science Research: A Case Study of the Groundwater Education Through Water Evaluation & Testing Program. JAWRA Journalof the American Water Resources Association 48: 1032-1040.

***Who**: Grand Canyon Monitoring and Research Center*

***Why**: To understand aquatic insect abundance and distribution throughout the canyon*

Light Trapping in the Grand Canyon

process

- Guides and private trips
- Adult insect collection at night using:
  - Black light
  - Tupperware
  - Ethanol

Personal Communication w/ J. Muehlbauer (2.1.18)

background

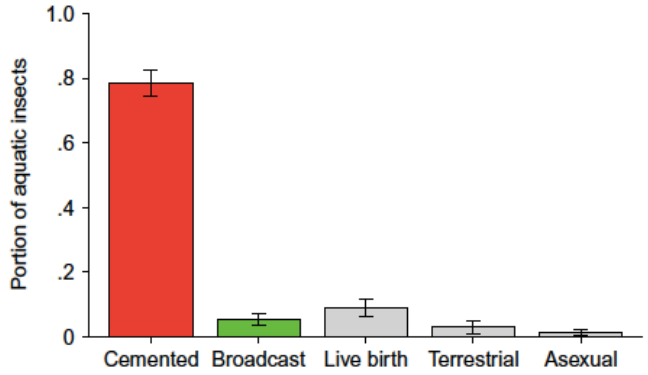


Figure 1. Aquatic insects often cement eggs to substrates along river margins. Represented here are the egg-laying strategies for the most common aquatic invertebrate genera in North America and Europe, representing 96 and 78 taxa, respectively. The error bars represent the standard error of the mean. Adapted with permission from Statzner and Beche 2010.

- Quantity of water released from dam quantity on an hourly basis
- Releases produce tidal effects in freshwater rivers
- Fresh water insects are not adapted to intertidal zone

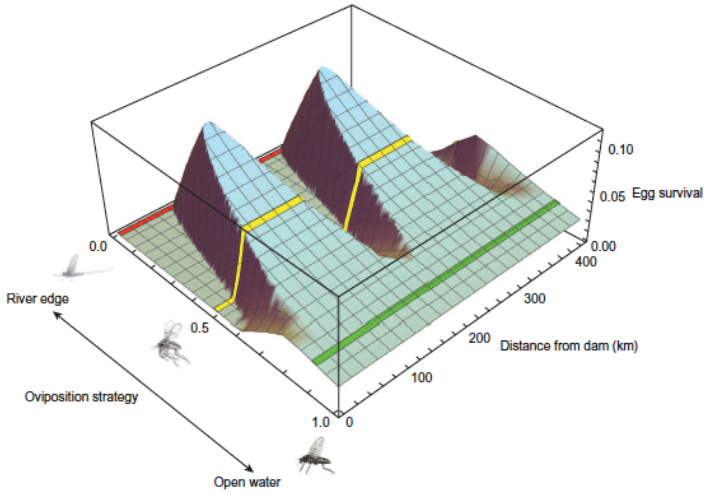
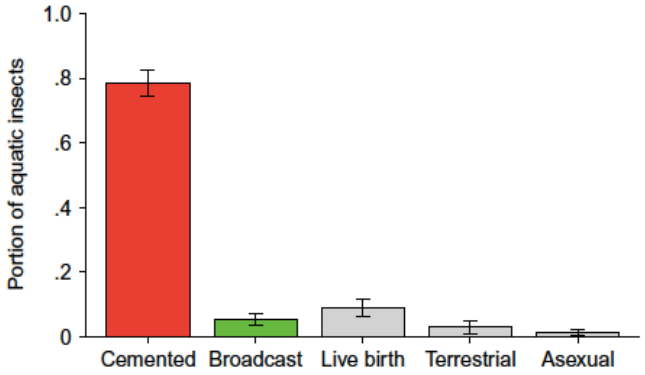


Figure 3. A life history–hydrodynamic model. Output from a life history–hydrodynamic model parameterized for the Colorado River in the Grand Canyon shows that as hydropeaking waves propagate downstream, the locations where daily flow minima occur at dusk are consistently located around river kilometer (km) 100 and 275. River-edge egg layers, such as mayflies (red line), are eliminated from hydropeaking rivers because of desiccation and the mortality of eggs. Open-water egg layers, such as Simulium arcticum *(blackflies; green line) occur at all points along hydropeaking rivers. Intermediate strategists, such as midges (yellow line), exhibit spatial periodicity in abundance, with the highest abundance at locations where the timing of insect egg laying, generally at dusk, is in phase with daily flow minima. This figure illustrates equation 7, assuming $r_2 - r_1 = 0.2$, $c = 2$, and $f = 0.033$ (see the main text for details).*

Kennedy, T. A., Muehlbauer, J. D., Yackulic, C. B., Lytle, D. A., Miller, S. W., Dibble, K. L., . . . Baxter, C. V. (2016). Flow Management for Hydropower Extirpates Aquatic Insects, Undermining River Food Webs. *BioScience*,*66*(7), 561-575. doi:10.1093/biosci/biw05
Statzner B, Beche LA. 2010. Can biological invertebrate traits resolve effects of multiple stressors on running water ecosystems? Freshwater Biology 55: 80–119.

hypotheses

- All the eggs are sad and dry and dead???



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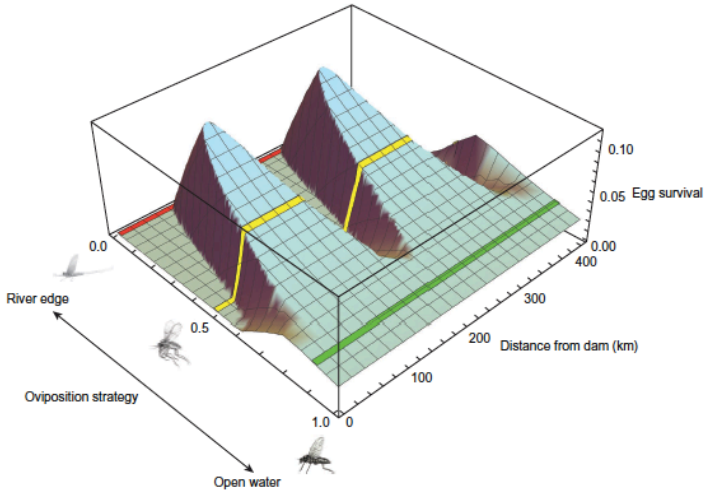

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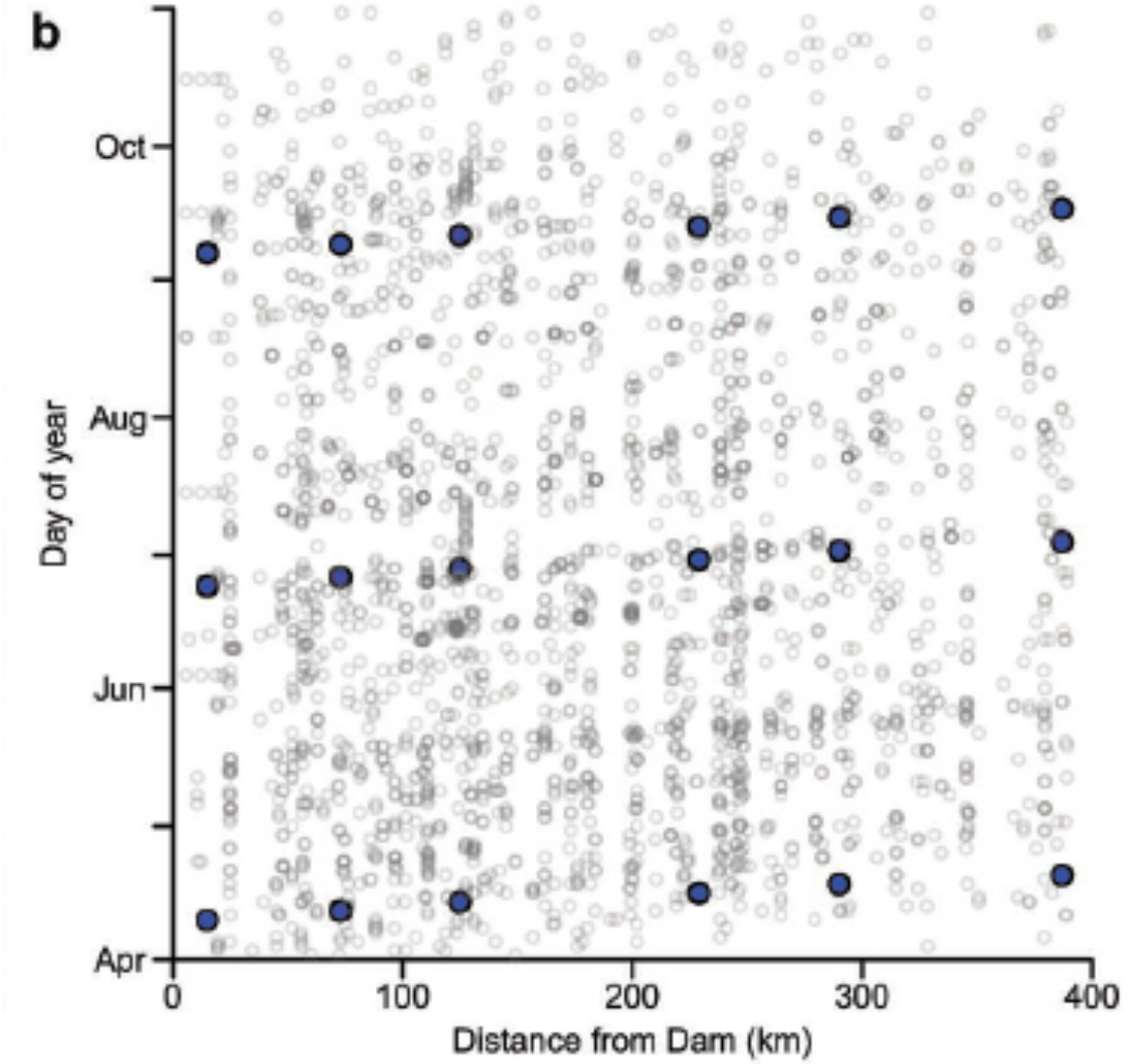
outcomes (people)

- 1000s of samples
- 1,000,000s of insects

(n.d.). Retrieved February 06, 2018, from https://www.usgs.gov/centers/sbsc/science/citizen-science-light-trapping-grand-canyon?qt-science_center_objects=0#qt-science_center_objects



outcomes (people)

- Citizen science brings data volume up
- Citizen science brings research costs down
- Citizen science sure does get the people talking

- Videos
- Papers
- Photos

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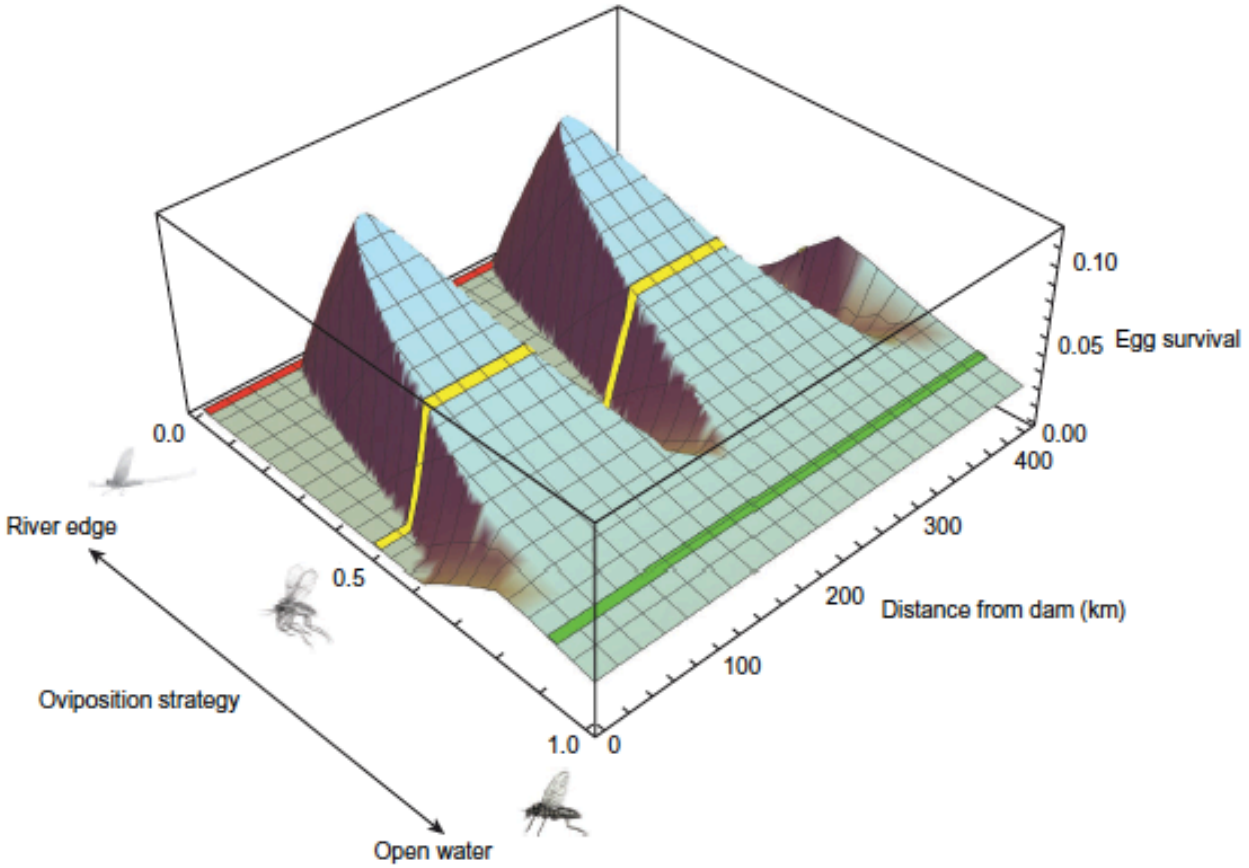
outcomes (insects)

- It's not looking good for edge layers on the Colorado



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policy recommendations

- Reduce variation between hourly discharges during periods of peak aquatic-insect egg laying (dusk?)
- Schedule low flows for weekends when electricity demands are low so that eggs remain wet

Førsund FR. 2015. Hydropower Economics. Springer.
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policy reliance

- Funding for the light trapping project is connected to the **Humpback Chub's** conservation status
- Funding comes from **revenues from operation of the Glen Canyon Dam**
- "If the chub becomes unlisted, our funding becomes uncertain"

Personal Communication w/ J. Muehlbauer (2.1.18)

QUESTIONS?

Gratitude to Jen Metes (CRD Graduate Student and Citizen Science Researcher) and Jeff Muehlbauer (Research Ecologist, Grand Canyon Monitoring and Research Center)

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Metes, J. M. (2017). Dead Birds, Data & Decision-making: Ways The COASST Program & Agencies Interact Through Citizen Science (Unpublished Master's Thesis). University Of California, Davis.

Statzner B, Beche LA. 2010. Can Biological Invertebrate Traits Resolve Effects Of Multiple Stressors On Running Water Ecosystems? *Freshwater Biology* 55: 80–119.

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