
Creating Research Opportunities for Biology and Environmental Courses Using Online Data

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The **Cornell** Lab  of Ornithology
Education

Goals of Talk

- Describe biology curriculum and faculty professional development project (CCLI Type 2)
- Update on outreach and usage of previous NSDL projects (Macaulay Library, Science Pipes)
- Seek advice on effective NSDL integration
- Identify partners and collaborators

Online Research in Biology Staff

- PI:
 - Nancy Trautmann
- Co-PIs:
 - Colleen McLinn
 - Mike Webster
 - Irby Lovette
 - David Winkler
- Web Programmer:
 - Heng-Scheng Chuang
- Undergraduate Intern:
 - Ileana Betancourt



The Problem

- Undergraduate research experiences can have a big impact



...but typically only small numbers of students benefit from them

Goals of the Project

- Use rich online databases to engage students in investigating authentic questions
- Through inquiry-based instructional design, bring the teaching of science closer to the practice of science
- Create manageable student research opportunities in large introductory courses, classes with no lab or field component, and online-only courses



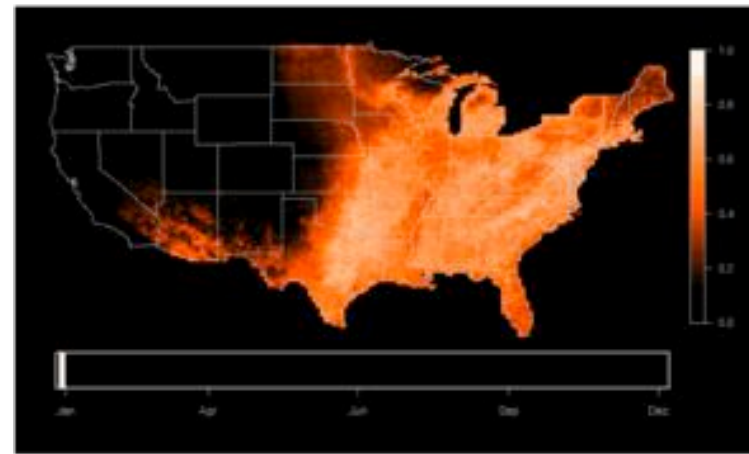
Opportunities of Online Data

- Enhance field studies, by
 - using online datasets to set the scene for student fieldwork
 - viewing field data within broader temporal and geographic trends

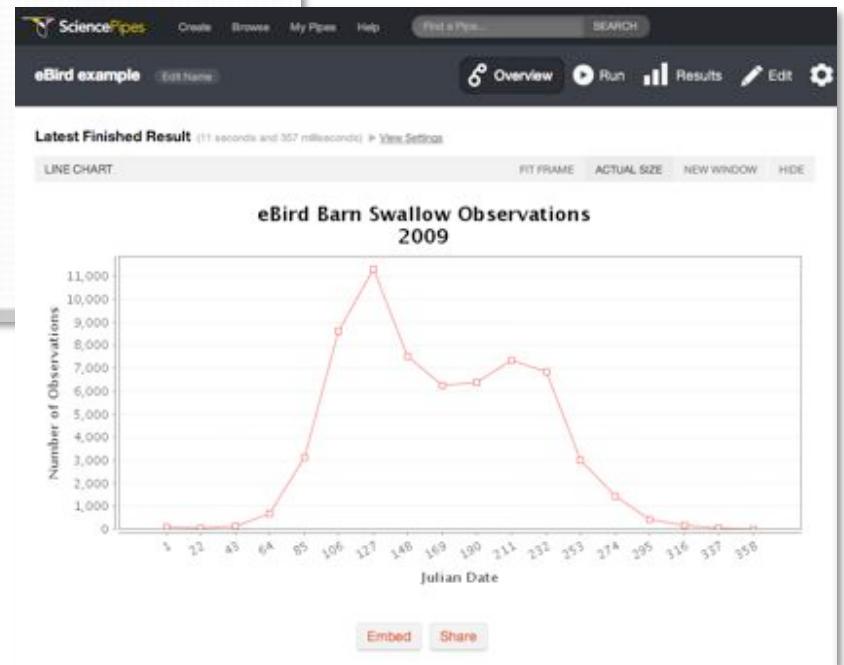
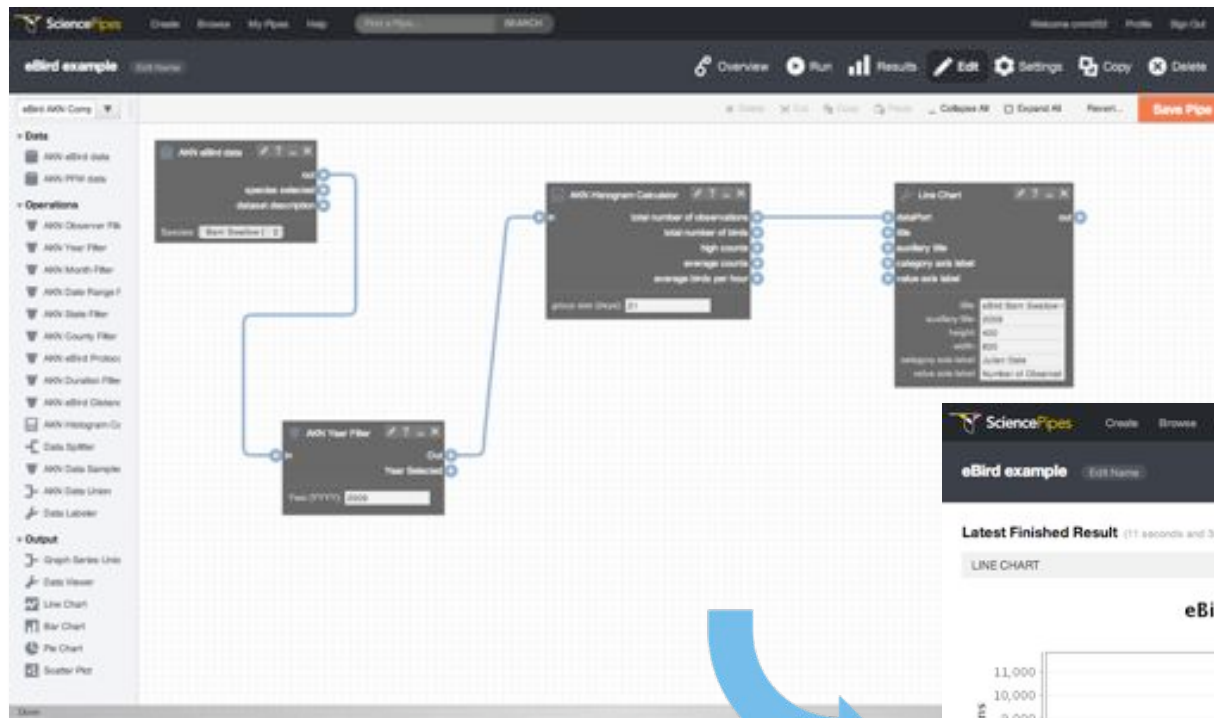


Databases and Tools

- Macaulay Library
 - Online access
 - 100,000 animal sounds
 - 40,000 videos online
 - Sound visualization software
- Citizen science data
 - eBird
 - > 21 million observations
 - Project FeederWatch
 - NestWatch
 - Celebrate Urban Birds



Science Pipes



Educational Uses of Science Pipes

Courtney Wilson,
Nancy Trautmann,
Jim MaKinster,
Barbara Barker

The Science Teacher,
77(7), 34-39
October 2010



Approach

- Gathering information
 - Interview faculty about needs
 - Review AOU survey of ornithology courses
 - Collect syllabi (ESA Syllabus Exchange)
 - Review textbooks for fit
 - Review existing lessons
 - Sit in on lectures/labs
 - Workshop



Workshop: Get Your Students Twittering Social Networking in Ornithology Classes

Margaret Rubega, U Conn

Found Canada geese have different strategies for guarding nests with chicks or eggs that haven't yet hatched. Chicks=silence, eggs=noise. [12:54 PM Apr 27th](#)

Holden Caulfield once asked where the ducks go in the winter and never really got his answer. He should walk by Mirror Lake at Uconn today [2:13 PM Feb 10th](#)

Teaching Observation and Inference Through Online Photo Tagging



Margaret Voss and
Caren Cooper
*American Biology
Teacher, 72(7),
437-443.
September 2010*

Outcomes of Workshop

- List of 60 names
- 4 PowerPoint presentations on web
- Blogged about by postdoc in attendance
- List of books, articles, other resources
- Notice about grant and opportunity to participate

“Congratulations on the very successful workshop on teaching ornithology. I look forward to hearing more about the website. I hope you have plans to publicize both the event and the web resources. There is a lot of innovative teaching in the traditional 'ologies, and it should be celebrated and supported.”

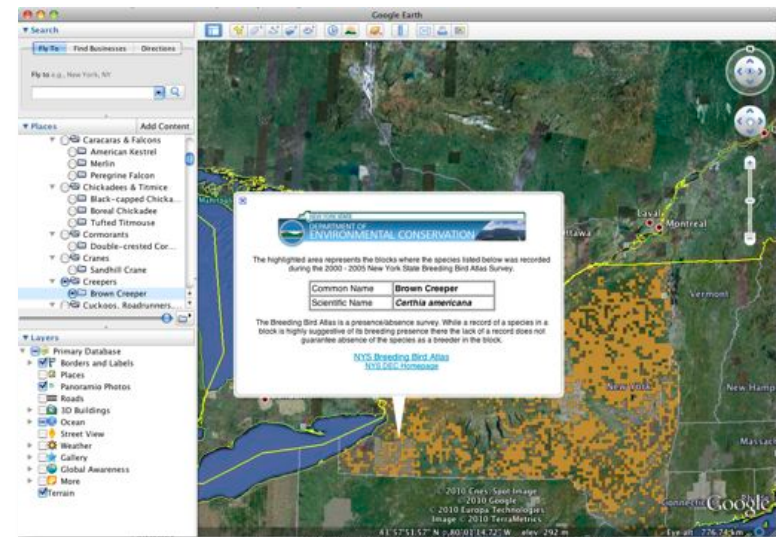
Advisory Board and Pilot Faculty

- Franklin and Marshall
- Loyola Marymount University
- Mercy College
- St. Mary's College of Maryland
- Tompkins Cortland Community College
- University of the South



Topics

- What is a species?
- Why is one sex more elaborately ornamented than the other in some species?
- Have changes in land use altered bird species abundance or distribution?



Curriculum Development Approach

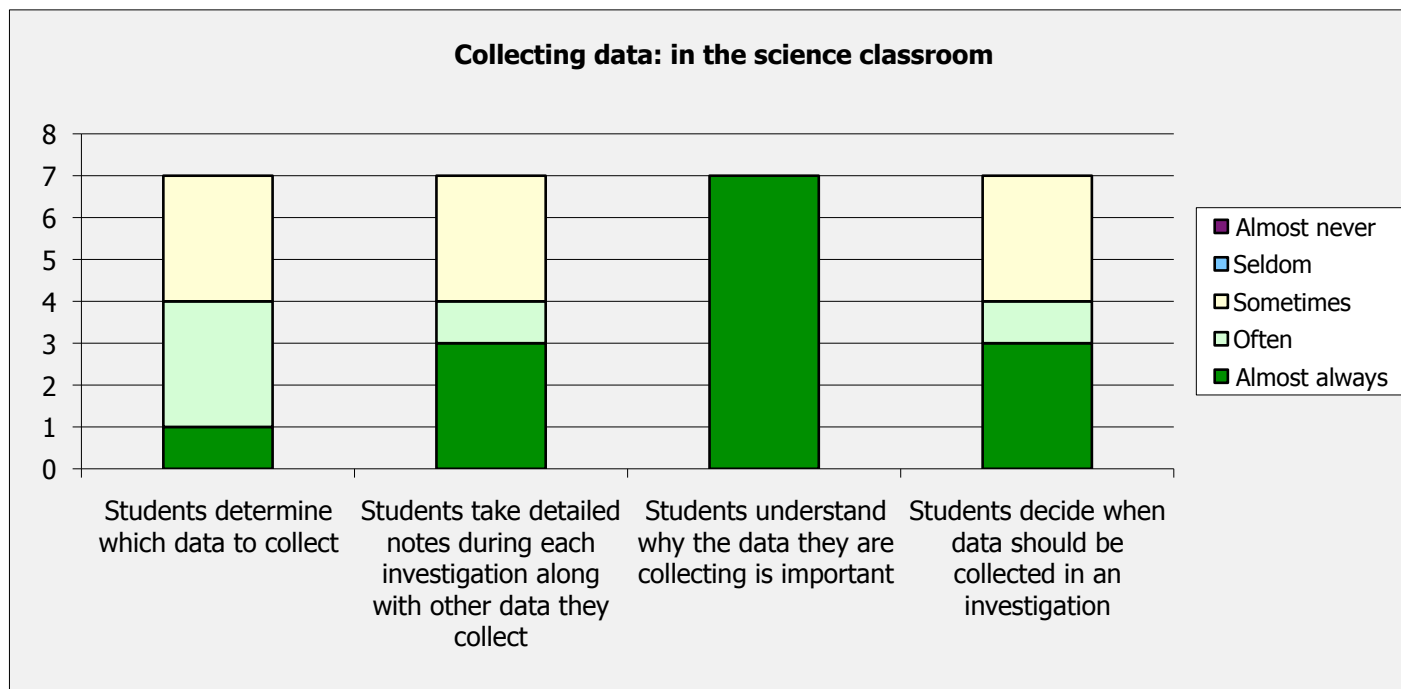
- Consult with subject matter experts and resource providers about possible educational uses
- Consult with faculty advisors about needs
- Collaborations with lecturers
- Graduate seminar on teaching professional development

Graduate Seminar Details

- 1 credit and 1 hour a week
- Guest presenters, short readings
- Presented lighting talks to Community College faculty member
- Presented draft versions to class for peer review
- Final event – invited faculty from Cornell, Ithaca College, Tompkins Cortland Community College
- Refined and edited lessons for website launch

Outcomes of Graduate Seminar

- “I really appreciated the combination of theory (of good teaching) and practice (piloting the lessons). I noticed the participants really used the theory in developing their lessons.”*



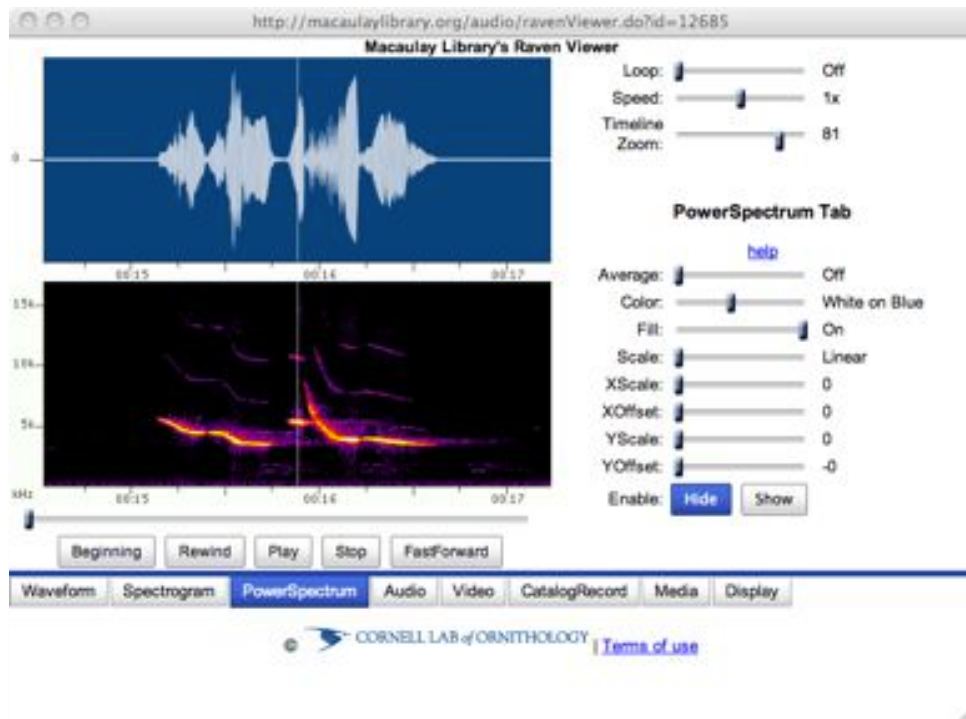
Two Modes of Implementation

- One-time labs as part of curriculum (guided inquiry)
- Longer-term independent or pair investigations (open inquiry)



Guided Inquiry Examples

- Species Concepts



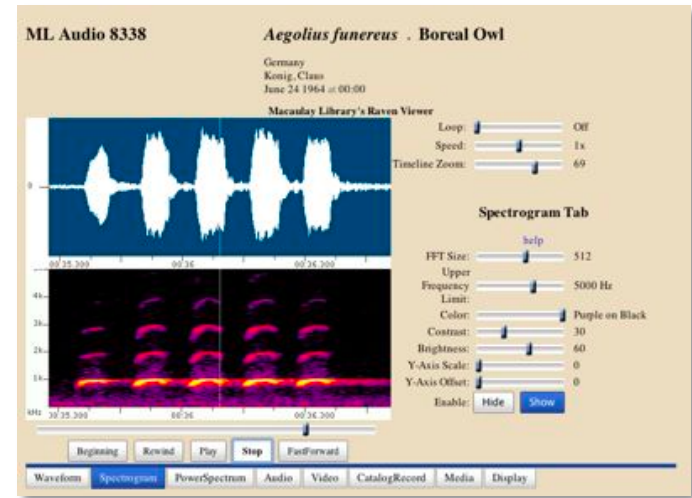
Owls in Trees

Part 1: Learn how to use the Macaulay Library and to interpret a spectrogram view of sound

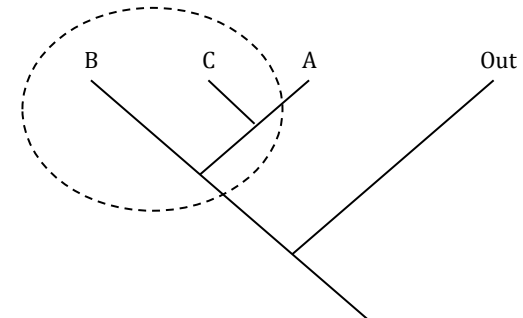
Part 2: Analyze owl calls, identify vocal characters, build a tree based on that data

Part 3: Repeat for owl images/natural history information. Compare trees based on behavioral data to trees based on DNA

Part 4: Develop hypotheses about how other bird vocalizations relate to evolutionary history, and test these via independent research using Macaulay Library

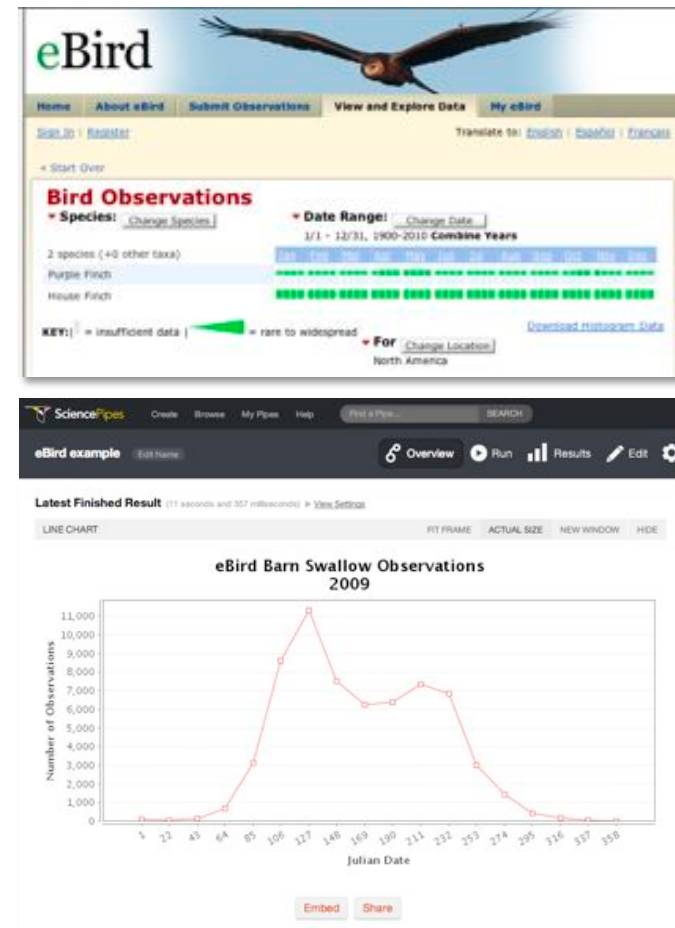


	Character 1	Character 2	Character 3	Character 4	Character 5	Sum
Outgroup	0	0	0	0	0	0
Taxon A	1	1	0	1	0	3
Taxon B	1	0	0	0	0	1
Taxon C	1	1	0	1	1	4



Open Inquiry: Science Pipes

- Tool for easy and user-friendly scientific workflows and graphs
- Access data from Project FeederWatch and eBird
- Filter by species, year
- Make graphs without Excel or data entry!
- Tutorials available



<http://sciencepipes.org>

http://birds.cornell.edu/orb

Investigations | Online Research in Biology

http://www.birds.cornell.edu/orb/investigations

ORR website BOE 7600 Cornell CLO Library EEB MBE Psych CTE Science Pipes CLO Window Strikes COLTS Gmail RSS Inquiry Continuum Clatch Mizes

The Cornell Lab of Ornithology
Online Research in Biology

Resources for teaching with ecology and behavior data

News Investigations Databases About Search

- Login
- Register

Home

Investigations

Birds in Human Landscapes

Submitted by colleen on 08-12-2010 9:34am EDT
Author(s): Yula Kapetanakis, Benjamin Zuckenberg
Summary:
This investigation focuses on examining the impacts that humans may be having on a select group of bird species. The ultimate goal is to evaluate the connections between bird behavior, habitat needs, and factors involved in shifting population trends.

Downloads

Instructor Guide:
Please [login](#) to see these files.

Student Sheets:
Please [login](#) to see these files.

[Login](#) or [register](#) to post comments 304 views

Tags: [introductory courses](#) [distance education](#) [All About Birds](#) [New York Breeding Bird Atlas](#) [Conservation](#) [Ecology](#) [Environmental Issues](#)

Species Concepts in Birds

Submitted by colleen on 06-25-2010 11:43am EDT
Author(s): Emily R. Omer
Summary:
This investigation uses multimedia such as bird songs and their associated visualizations as the raw material to initiate a discussion of traits that can be used to define a species, and the conservation implications of the species definitions we choose.

Downloads

Instructor Guide:

Browse by

Resources Used

- [All About Birds](#)
- [Birds of North America Online](#)
- [Great Backyard Bird Count](#)
- [Macaulay Library](#)
- [New York Breeding Bird Atlas](#)
- [Savon](#)

Subject Area

- [Behavior](#)
- [Conservation](#)
- [Ecology](#)
- [Environmental Issues](#)
- [Evolution](#)
- [Ornithology](#)
- [Physics](#)

Appropriate for

- [distance education](#)
- [introductory courses](#)
- [large lectures](#)
- [upper division courses](#)

Topics Covered

- [evolutionary characters](#)
- [hybridization](#)
- [mating systems](#)
- [phylogeny](#)
- [sexual dimorphism](#)
- [sexual selection](#)
- [song](#)
- [species concepts](#)

Usage Tracking

The screenshot shows a web browser window displaying the 'Reports' page for the Online Research in Biology (ORB) system. The browser's address bar shows the URL <http://www.birds.cornell.edu/orb/admin/reports>. The page header includes the Cornell Lab of Ornithology logo and the text 'Resources for teaching with ecology and behavior data'. Below the header, there are navigation tabs for 'News', 'Investigations', 'Databases', and 'About', along with a search bar. The main content area is titled 'Reports' and lists various tracking options:

- [Home](#)
- [Recent log entries](#)
View events that have recently been logged.
- [Recent hits](#)
View pages that have recently been visited.
- [Top 'access denied' errors](#)
View 'access denied' errors (403s).
- [Top 'page not found' errors](#)
View 'page not found' errors (404s).
- [Top referrers](#)
View top referrers.
- [Top search phrases](#)
View most popular search phrases.
- [Top pages](#)
View pages that have been hit frequently.
- [Top visitors](#)
View visitors that hit many pages.

On the left side, there is a sidebar menu with the following items:

- You are logged in as [collen](#).
- [My account](#)
- [Create New Post](#)
- [Create News](#)
- [Create Investigation](#)
- [Create Static Page](#)
- [Create Upcoming Event](#)
- [Reports](#)
 - [Recent log entries](#)
 - [Recent hits](#)
 - [Top 'access denied' errors](#)
 - [Top 'page not found' errors](#)
 - [Top referrers](#)
 - [Top search phrases](#)
 - [Top pages](#)
 - [Top visitors](#)
- [Download Count](#)
- [My Download Count](#)
- [Downloads By User](#)
- [Download User Spreadsheet](#)
- [Log out](#)
- [Surveyback Queue](#)

At the bottom left, there is a 'Masquerade' section with 'Quick switches' and a link to [TEST results](#).

Why You Used This Investigation

3 / 7

1. What student learning outcomes did you hope to achieve with the "Species Concepts in Birds" assignment?

(Rate how important each student learning outcome was to you, from low to high importance. Then, please list any additional learning outcomes you hoped to achieve).

	Low importance	Medium importance	High importance
Knowledge of specific science concepts that you had identified in advance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge of science content more generally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science process skills such as ability to articulate a research question, develop a valid investigation, and accurately analyze and interpret the data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Awareness of the variety of data sources and media types used in scientific research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Awareness of the growing role of the Internet in scientific collaboration, data sharing, and research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other learning outcomes:

[Previous](#)[Next](#)

Evaluation: In Progress

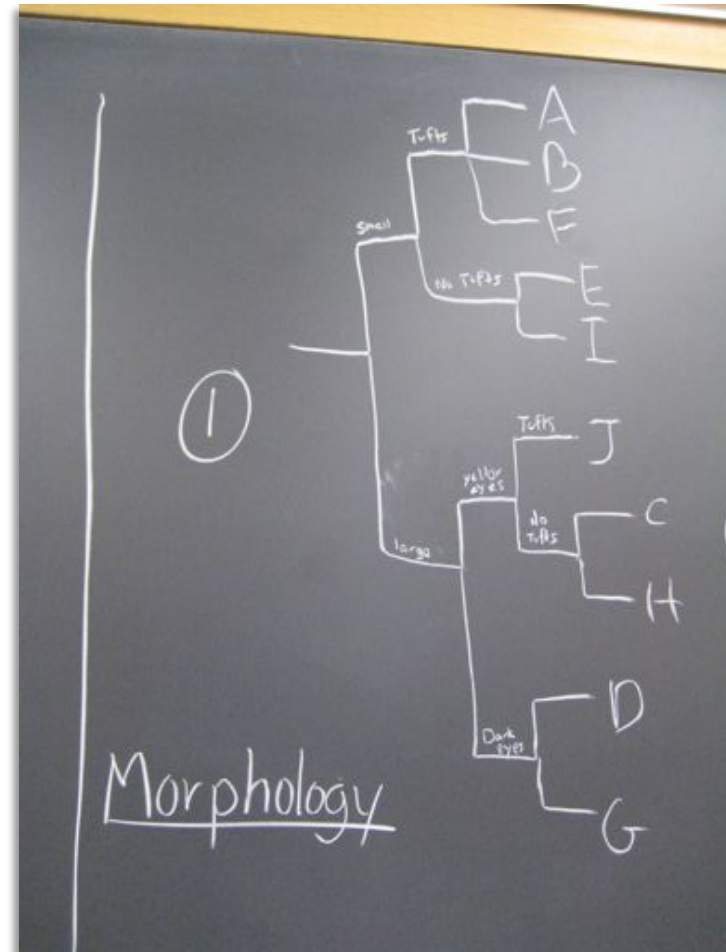
- Faculty Satisfaction:
 - Satisfaction among participating faculty?
 - Extent and depth of use?
 - Surveys, Quantitative Indicators, server logs and web metrics

4. What would you say was the most exciting outcome, if any? [Download](#)

	Response Count
Hide replies	1
1. It opened up the door to talk about the challenge of defining 'species'. The activity led to some great conversation in subsequent classes.	Mon, Oct 25, 2010 9:26 PM Find...
answered question	1
skipped question	0

Evaluation: In Progress

- Student Research:
 - Degree of open-endedness?
 - Evidence of valid, accurate, defensible research?
 - Pre/post student surveys, review of artifacts, develop rubrics for assessment of inquiry by faculty



Evaluation: In Progress

- Program Success
 - Extent of dissemination?
 - Empower broad range of faculty?
 - Successfully facilitated student research projects?
 - Engaging underserved audiences?
 - Program model lessons learned?

Grading Rubric for Assessing Student Inquiry Projects

Scientific Conceptualization	Missing (0 Points)	Beginning (1 Point)	Developing (2 Points)	Proficient (3 Points)	Points
1. Define a scientific problem in biology or environmental conservation	Not defined	Defined improperly	Defined partially accurately	Defined accurately	
2. Formulate a statement of purpose and/or scientific question	Missing	Unclear	Partially clear	Clear	
3. Formulate a testable hypothesis and propose explanation(s)	Missing	Hypothesis present, incoherent explanations	Hypothesis present, partially coherent explanations	Testable hypothesis and coherent explanations	
4. Demonstrate logical connections between scientific concepts guiding question and research design	Not demonstrated	Improper connections	Partial connections	Logical connections	

Online Assessment Tools

The screenshot shows a web browser window titled "Waypoint Outcomes" with the URL "http://waypointoutcomes.com/". The browser's address bar includes a search engine (Google) and a list of search results: "ORB website", "BIOEE 7600", "Cornell", "CLO", "Library", "EEB", "NBB", "Psych", "CTE", "Science Pipes", "CLO Window Strikes", "COLTS", "Gmail", and "RSS". A "Login" button is visible in the top right corner.

The website's main content area features the "WAYPOINT OUTCOMES" logo on the left and contact information on the right: "Sales Inquiries 800.816.8843" and "Support Questions". A dark blue navigation bar contains the following links: "Home", "Fellows Program", "About Us", "Integrations", "News & Events", and "Contact Us".

The central graphic is set against a dark blue background and features a large orange arrow pointing right, surrounded by several orange circles. On the left, a computer monitor displays a bar chart with multiple bars in black, red, and green. To the right of the monitor, three columns of text are separated by vertical lines:

- CREATE**
 - Rubrics
 - Evaluations
 - Surveys
- SHARE**
 - Across courses
 - Among instructors
 - Between programs
- ANALYZE**
 - Align data with outcomes
 - Aggregate and disaggregate
 - Develop longitudinal data

Below these columns is a large orange button with the text "Learn how Waypoint can work for you." At the bottom of the page, there is a "TESTIMONIALS" section with four small thumbnail images of people.

Current Collaborations

- Cyberlearning at Community Colleges (C3)
 - First line of feedback from undergraduates
 - Discuss pedagogical strategies
 - Disseminate online and in person

The screenshot shows the profile page for Sam Donovan on the 'Cyberlearning at Community Colleges' website. The page includes a header with navigation links (Home, My Page, About C3, Members, Discussion, Events, Groups, Blogs, C3 Information) and a search bar. Below the header is a profile picture of Sam Donovan, a man with glasses and a plaid shirt. To the right of the photo is a 'Welcome to Cyberlearning at Community Colleges' message with 'Sign Up or Sign In' buttons. The profile information section includes a bio: 'College Faculty, Researcher, Informal Educator, Technology Specialist'. It also contains several survey questions: 'How would you describe yourself?', 'If you are a college teacher, where do you teach?', 'How much teaching experience do you have?', 'Which of the following areas would you like to help students develop?', and 'Which of the following areas would you personally like to learn more about?'. There are also social media sharing options for Twitter and Facebook, and a link to 'Discussions (12)'.

	Excellent 4	Good 3	Satisfactory 2	Poor 1
Clarity of directions	Directions are very clear and easy to follow	Directions can be followed with minimal difficulty	Directions are possible to follow but could use more clarity	Directions are not easy to follow and clarity is severely lacking
Goal	The lesson has a specific goal it aims to achieve	The lesson implies a goal but could be more direct	The lesson hints at a goal or has multiple confusing goals	The lesson does not have a clear goal
Encourages student collaboration	The lesson encourages maximum student collaboration	The lesson encourages some student collaboration	The lesson implies student collaboration but it is not specified	The lesson does not promote student collaboration
Use of online resources	The lesson uses a specific online resource(s) to demonstrate a specific concept(s)	The lesson uses an online resource(s) but its role in the lesson could be more prominent	The lesson uses an online resource minimally	The lesson does not use an online resource or only uses one supplementally
Allows students to explore a resource	The lesson gives necessary guidance but allows students to explore on their own and do their own research	The lesson gives more guidance but implies that students can also do more exploring on their own	The lesson does not allow much opportunity for students to explore a resource on their own	The lesson minimally uses an online resource or does not allow students to explore on their own
Student thinking	The lesson encourages students to think about a concept in a very non-traditional way	The lesson uses both traditional and non-traditional ways of thinking	The lesson uses both traditional and non-traditional ways of thinking	The lesson allows students to think about a concept in a traditional way

Desired NSDL Collaborations

- Dissemination and Outreach
 - Pedagogic Services, EcoEd DL, others
- Research
 - Undergraduate faculty and student surveys and case studies
- Technical Advice
- Grant partners
 - Drupal small grants – sounds good to me!
- Please contact us!

Future Research Goals

- Faculty surveys and interviews on desired student learning outcomes from working with data
 - Understandings about science content, process
 - Abilities and skills
 - Attitudes
 - Motivation
 - Careers
- Review of existing tools for assessing inquiry
- Develop, validate, disseminate new instruments



**Online Research in Biology site:
<http://birds.cornell.edu/orb>**

Thank you!

