Youth Engagement in STEM: The Potential of Citizen Science

Rick Bonney and Tina Phillips

The Cornell Lab of Ornithology

Program Development and Evaluation

1880: Lighthouse Surveys

1890: National Weather Service Cooperative Observer Program

1900: National Audubon Society Christmas Bird Count

Cornell Nest Record Card Program, 1965

Project FeederWatch, 1987

NORTH AMERICAN NEST-RECORD CARD PROGRAM SEP YEAR 8 1986 Shaded Boxes not to be completed by observer E-1

Species: Eastern Bluebird

Observer (two initials, last name) In squares in space opposite → J S C A S T R A L E

Locality (in relation to nearest town) 3 mi. E of Mitchell

County Lawrence

State or Province Indiana

Elevation (in feet above sea level) 500

Fill in if known Latitude 38 43.4 Longitude 86 24

HABITAT (circle where appropriate)
1. Woods 2. Swamp 3. Marsh 4. Field 5. Grassland 6. Desert 7. Tundra 8. Suburban 9. Urban 0. Other (specify)
01. Coniferous 02. Deciduous 03. Mixed 04. Orchard 05. Cultivated 06. Fallow 07. No Veget. 08. Hedgerow 09. Shrub 10. Salt 11. Brackish 12. Fresh 13. Sandy Beach 14. Gravel Beach 15. Other (specify)
DOMINANT PLANT(S) IN HABITAT (list one or two)
persimmon goldenrod

NEST SITE (circle where appropriate)
01 Bare ground 02 On ground in vegetation 03 Floating 04 Low vegetation 05 Shrub 06 Palm 07 Deciduous tree branch 08 Deciduous tree cavity 09 Conifer branch 10 Conifer cavity 11 Nest box 12 Other structure 13 Cliff or bank 14 Other (specify)
PRINCIPAL PLANT OR STRUCTURE SUPPORTING NEST wood nest box

Height of Eggs Above Ground or Water in Feet (feet and tenths if under five feet) Feet 0 Tenths 4

If parasited by Cowbird check here ☐ and see instructions.

If same pair had other nestings this year, indicate which this is (1, 2, 3) (use separate card for each nesting) 1

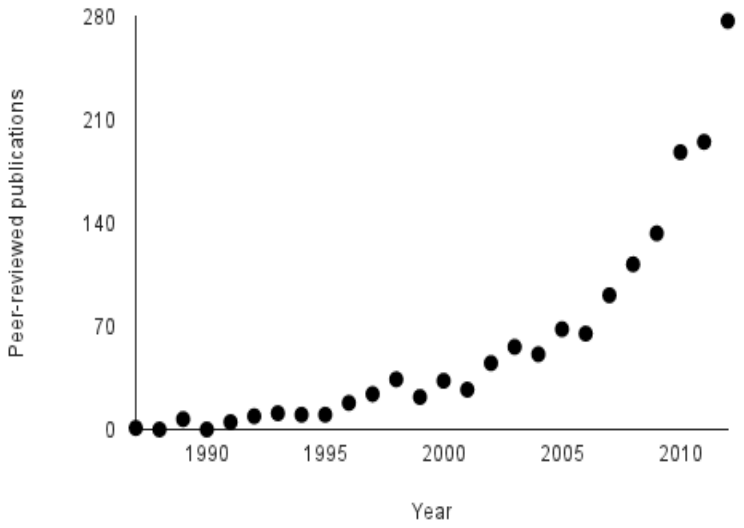
rev. 5-4-71 PLEASE COMPLETE BOTH SIDES OF THE CARD


STARDUST @ HOME
CLEAN BOATS CLEAN WATERS
Clean Annapolis River Project
vital signs
Operation Spider
redmap
REDMAP.ORG.AU
NestWatch
NATIONAL WILDLIFE FEDERATION
WILDLIFE WATCH
Great Swamp Watershed Association
MAINE VOLUNTEER LAKE MONITORING PROGRAM
nature's notebook
eBird
Citizen Weather Observer Program
APRSWXNET
GREAT World Wide STAR COUNT
MINNESO
Frog & Toad Calli
Operation Magpie
COAST
BIRD Sleuth
Project FeederWatch
LUEY
Operation Bluetongue
ADIRONDACK
INVENTORY
ALL-TAXA
BIODIVERSITY
Calflora
House Finch Disease Survey
Golden-winged Warbler Atlas Project
Birds in Forested Landscapes
FBC
Fresno Bird Count
HMAN
The Last Ladybug Project
JAY WATCH
A CITIZEN-SCIENCE PROGRAM
RIS
www.CelebrateUrbanBirds.org
CORNELL LAB of ORNITHOLOGY
H2O CHELSEA
NYC Cricket
GREAT LAKES WORM WATCH
OAKMAPPER
Monitoring Sudden Oak Death
Project BudBurst
www.budburst.org
prbo
JOURNEY NOR

Citizen Science

Members of the public engaging in authentic scientific investigations: Asking questions, collecting or processing data, and/or interpreting results.

Yields Scientific Knowledge



Offers Educational Opportunities for Youth!

- Provides easy access to rich data for discovery
- Offers a range of research experiences in a wide range of settings
- Can yield powerful learning outcomes
- Offers excellent opportunities for examining development of science identity

And it's fun!

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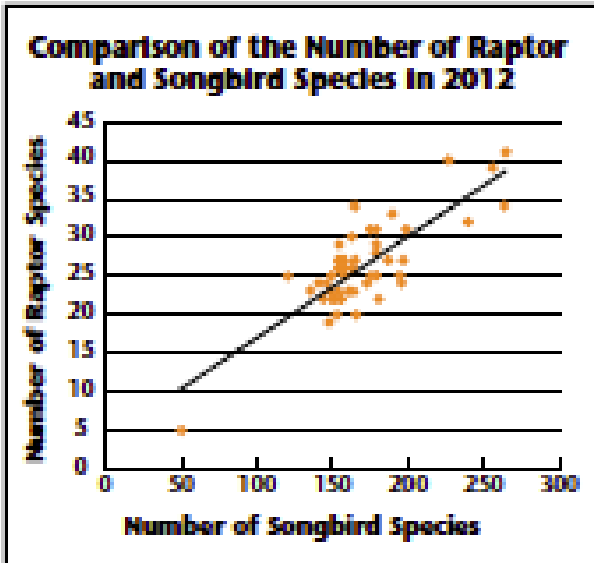
Correlation Between the Number of Raptor Species and Songbird Species in 2012

by Alex, Grade 7
Minnehaha Academy
Minneapolis, MN
Mrs. Humason

Question

Was there a correlation between the number of raptor species and the number of songbird species in 2012?



Conclusion

Based on this data, I can conclude that there is a positive correlation between the number of songbird species and the number of raptor species. It does not support my chosen hypothesis: that there

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Welcome to eBird

Birding in the 21st Century.

News and Features

Pelagic birding in eBird
15 April 2014

Ahoy mateys! Have you ever wondered how to enter your checklists from pelagic trips? Will you be going on a pelagic trip this summer that you plan to enter in eBird? Birding at sea has some challenges that are different from birding on land, but many of the fundamental issues are the same. Birds still have their favorite habitats. Because of this, plotting your location accurately and precisely remains really important. But with the boat constantly moving, this creates some challenges. All of us at Team eBird enjoy pelagic birding more than just about anything, and it remains of of the great frontiers for discovery. To that end, eBird has a new eBird Pelagic Protocol that we hope users will follow on offshore trips. We also have a set of recommendations for how best to log you pelagic birding.

The Cornell Lab of Ornithology

Audubon

Help Support eBird

Donate Now

BirdCast

eBird outputs, April 2014:

- 150,000 plus unique eBirders
- 10.5 million hours in the field
- 150 million observations
- 90 peer-reviewed publications
- Data exploration, visualization, and analysis tools used by 1 million unique visitors annually

eBird

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View and Explore Data

Explore a Location BETA

Recent sightings, checklists, birding activity, best hotspots, and top birders for a county, state, province, or country.

Explore Hotspots BETA

Discover the best places for birding nearby or around the world.

Range and Point Maps

Explore interactive range maps by species or subspecies — zoom in for details

Your Totals

Track your totals and compare with other eBirders.

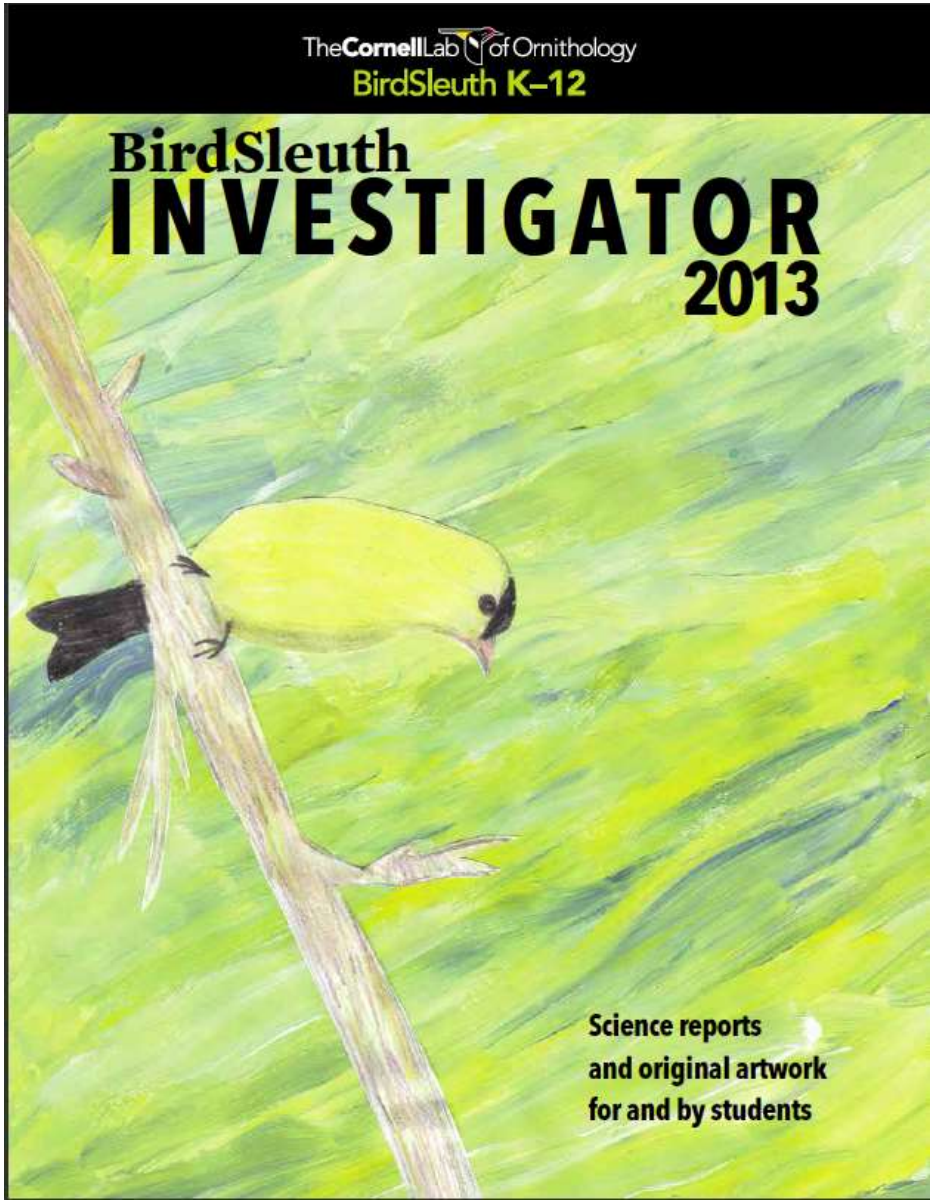
Yard Totals
How many species and checklists have you submitted for your yard?

Patch Totals
How many have you submitted for your favorite birding patches?

Top 100
Compare with the top eBirders in your region.

Procedure

1. In eBird, select the "Explore Data" tab.
2. Select "bar charts."
3. Select the first state, Alabama, and the "entire region" button.
4. Change the date range to all of 2012.
5. Count the number of raptor species (hawks, eagles, owls, falcons, ospreys, condors, kites, and vul-



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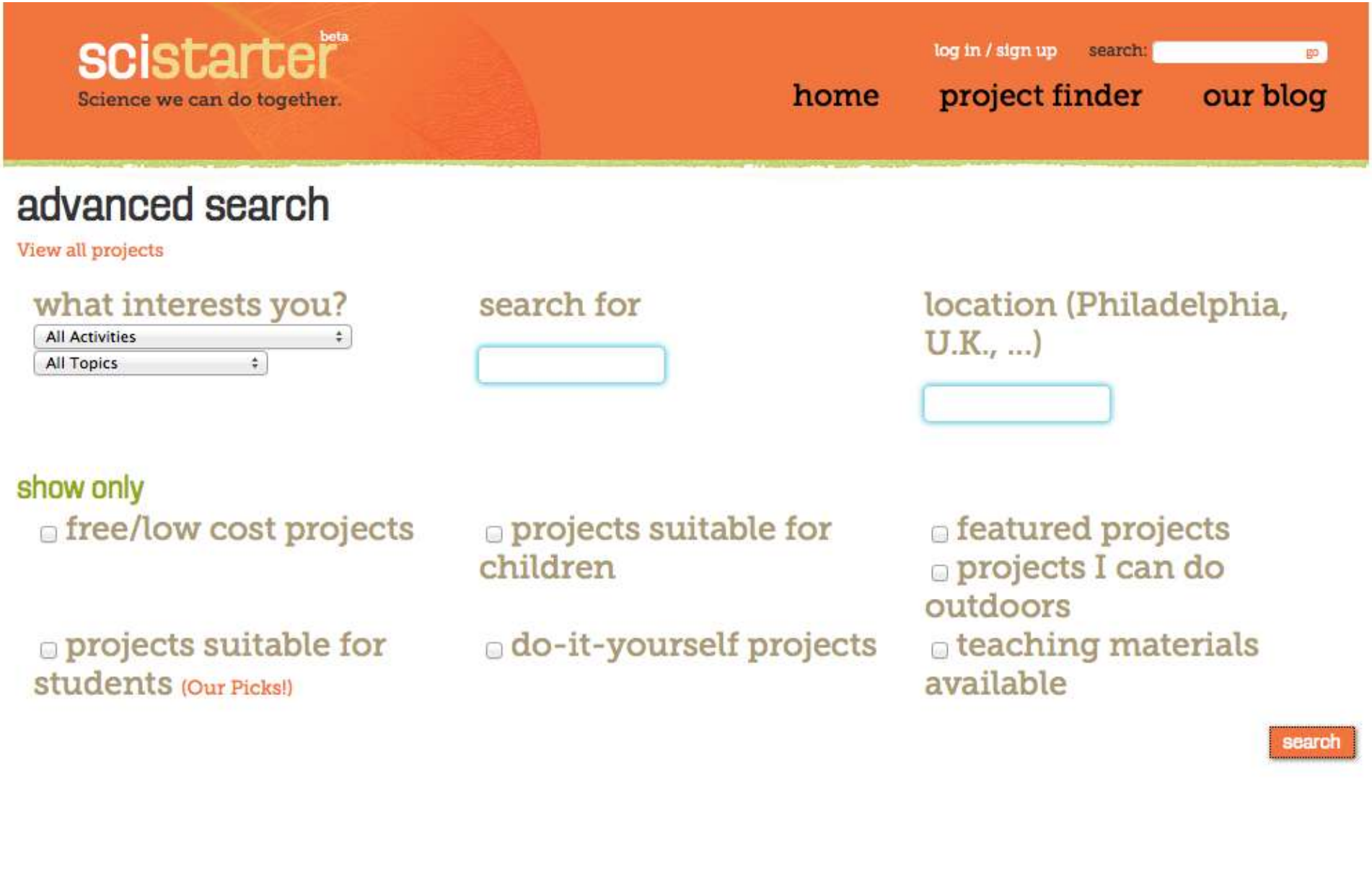
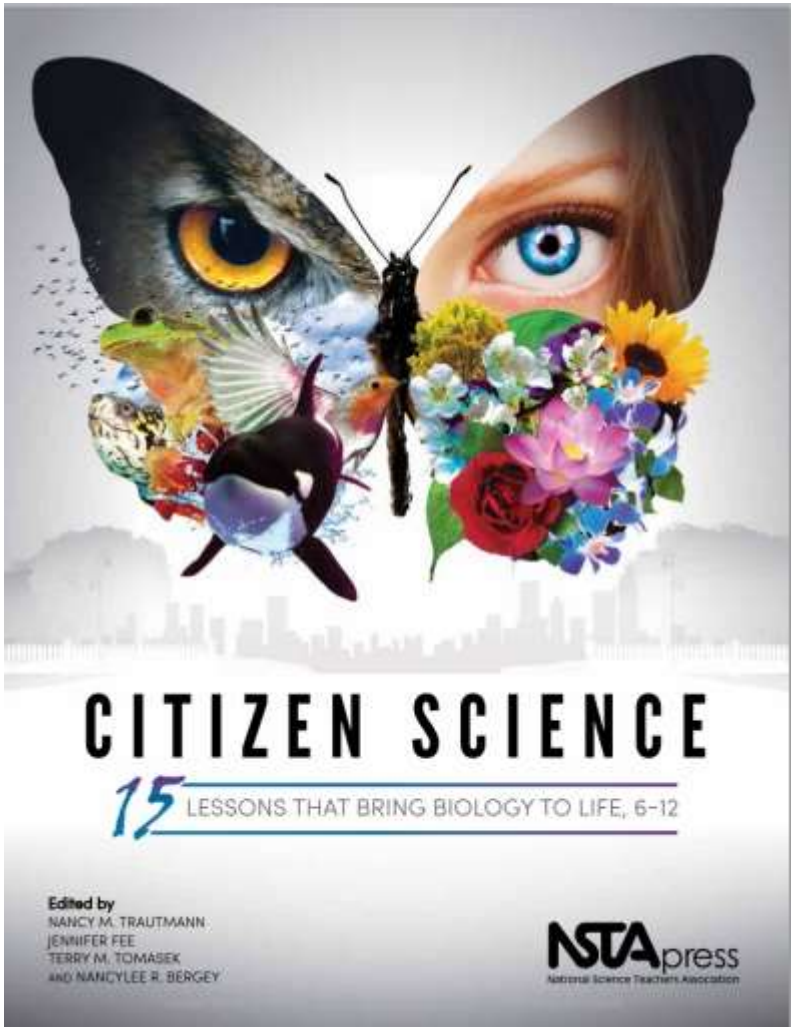
THE DOG
CABIN


scistarter beta
Science we can do together.
log in / sign up
search:
go
home
project finder
our blog
advanced search
View all projects
what interests you?
All Activities
All Topics
search for
location (Philadelphia, U.K., ...)
show only
free/low cost projects
projects suitable for children
featured projects
projects I can do outdoors
projects suitable for students (Our Picks!)
do-it-yourself projects
teaching materials available
search



1. Whale Song Project
2. It's Been a Hard Day's Flight: Flight Distances of Monarchs
3. Terrestrial Invertebrates
4. Signs of Spring: Earthworm Inquiry
5. Animated Maps for Animated Discussions
6. Bird Migration Patterns in My Area
7. Habitat Matters: YardMap Your Schoolyard!
8. Winter Twig Investigation
9. Flight of the Pollinators: Plant Phenology
10. Ozone Biomonitoring Garden Study
11. Turtle Trackers
12. Who's Out There? A Calling Amphibian Survey
13. Wetland Discovery
14. Citizen Science to Study Marine Food Webs
15. Tree Squirrels: Narrators of Nature in Your Neighborhood

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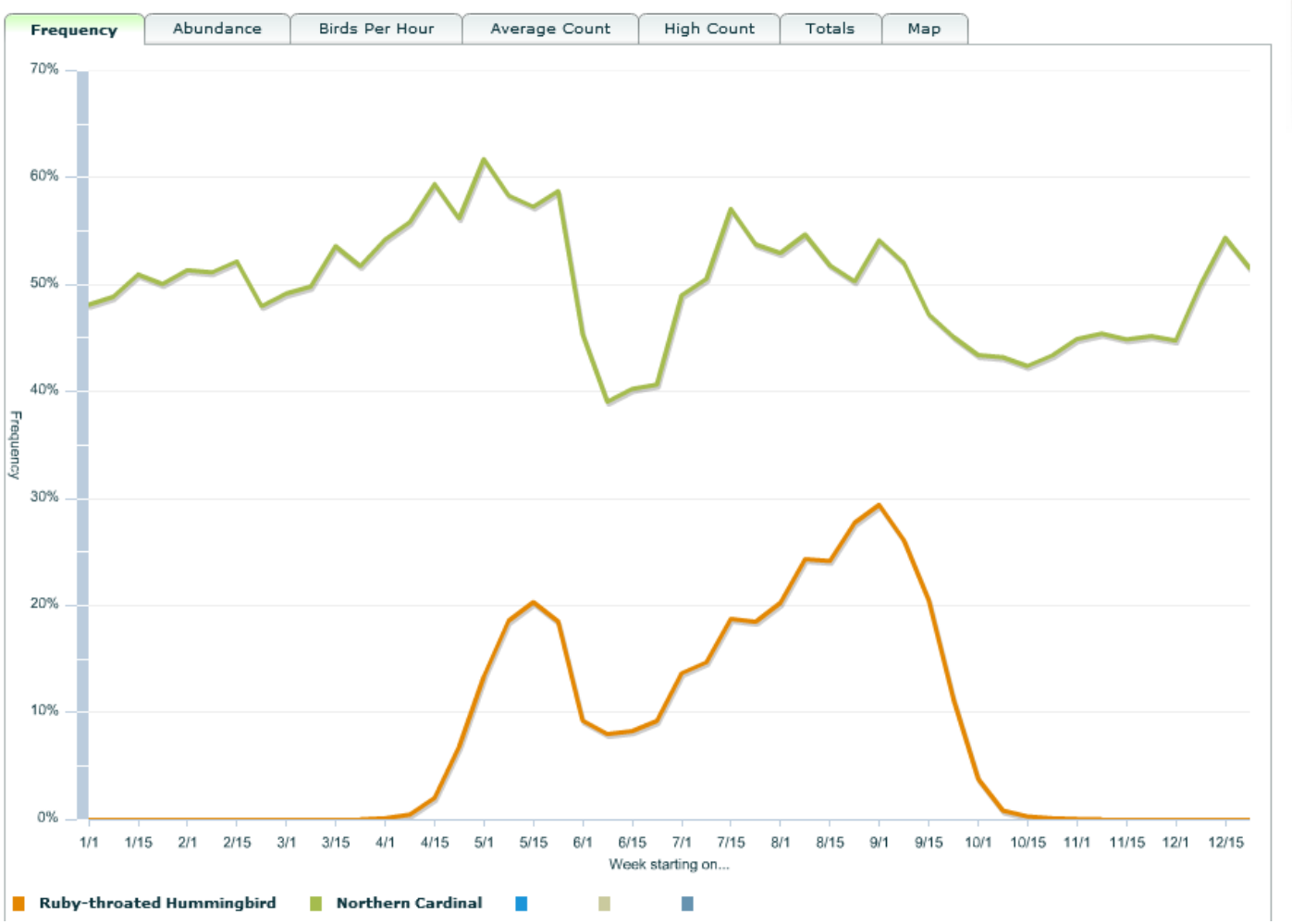
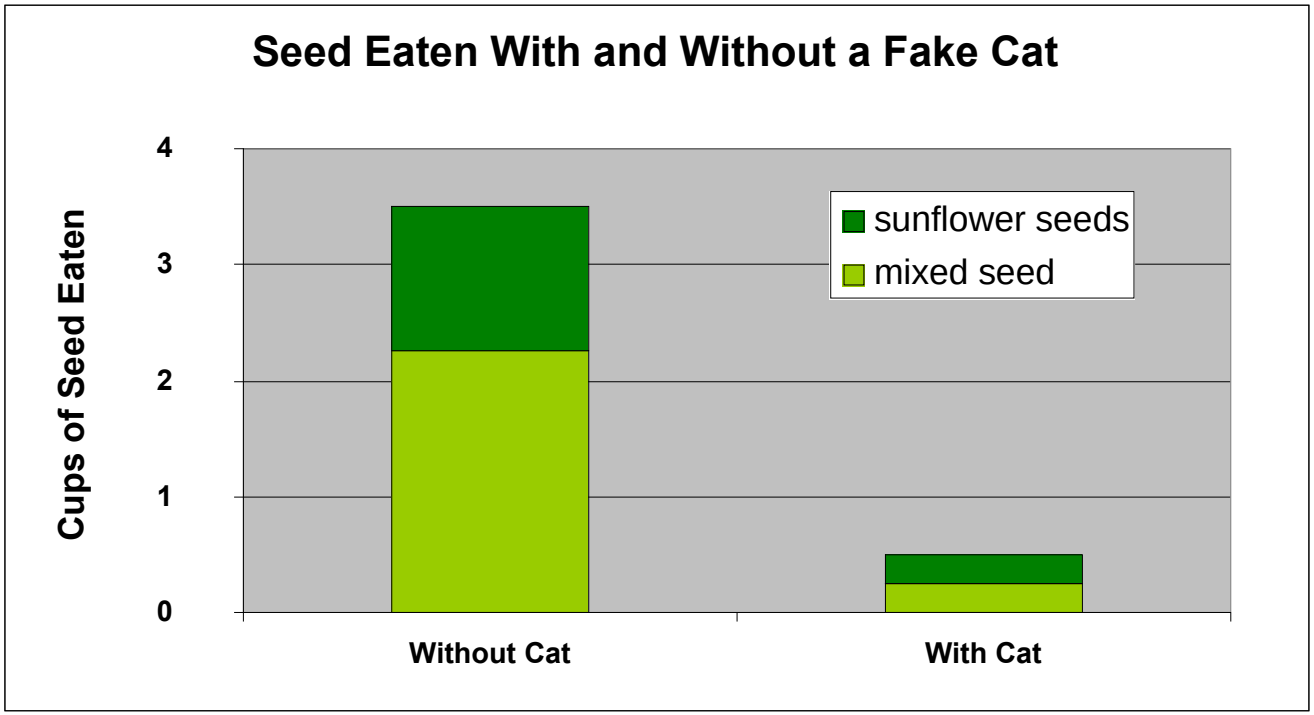
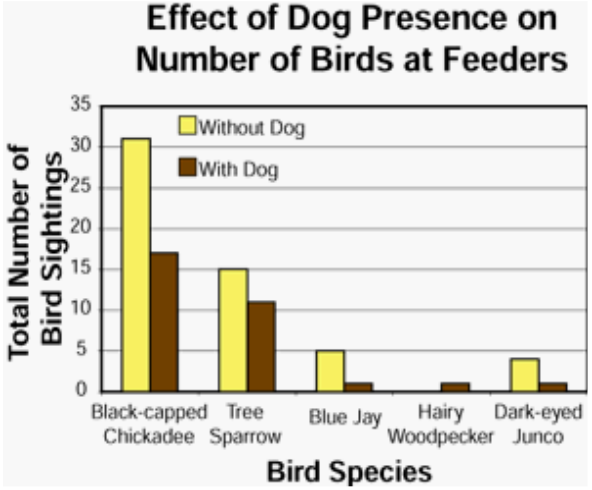
Data-driven inquiry: How often do eBirders in Missouri see Ruby-throated Hummingbirds and Northern Cardinals?

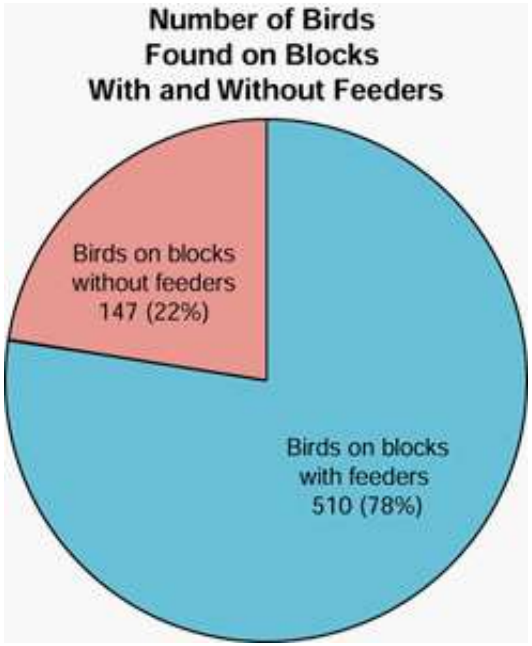


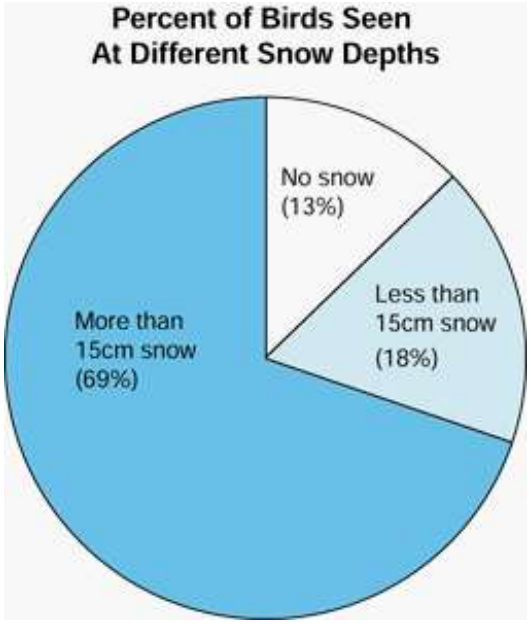
Independent Inquiry: Will a Fake Cat Scare Away Birds?

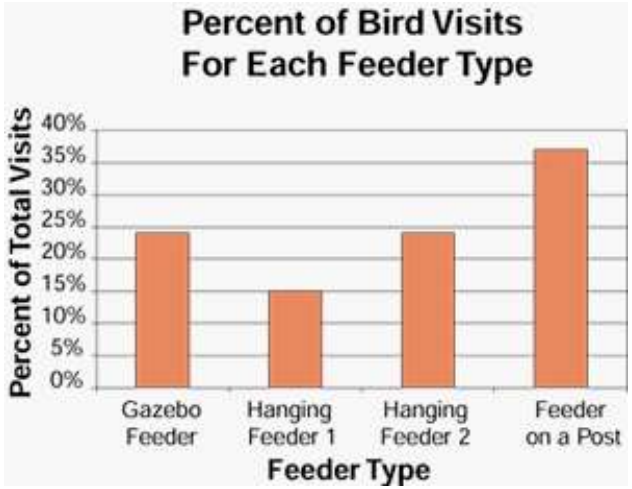
An experiment by Amy




Effect of Dog Presence on Number of Birds at Feeders
Total Number of Bird Sightings
35
30
25
20
15
10
5
0
Without Dog
With Dog
Black-capped Chickadee
Tree Sparrow
Blue Jay
Hairy Woodpecker
Dark-eyed Junco
Bird Species


Number of Birds Found on Blocks With and Without Feeders
Birds on blocks without feeders 147 (22%)
Birds on blocks with feeders 510 (78%)


Percent of Birds Seen At Different Snow Depths
No snow (13%)
Less than 15cm snow (18%)
More than 15cm snow (69%)


Percent of Bird Visits For Each Feeder Type
Percent of Total Visits
40%
35%
30%
25%
20%
15%
10%
5%
0%
Gazebo Feeder
Hanging Feeder 1
Hanging Feeder 2
Feeder on a Post
Feeder Type

“Learning” beyond process and content

In the Monarch Larvae Monitoring Program, youth “bond” over loving science!

(Kountoupes and Oberhauser 2008)

Documented learning outcomes

Engaging in critical thinking
(Trumbull et al. 2000)

Acquiring science skills
(Kountoupes and Oberhauser 2008)

Developing environmental stewardship
(Evans et al. 2005)

Need more examples!

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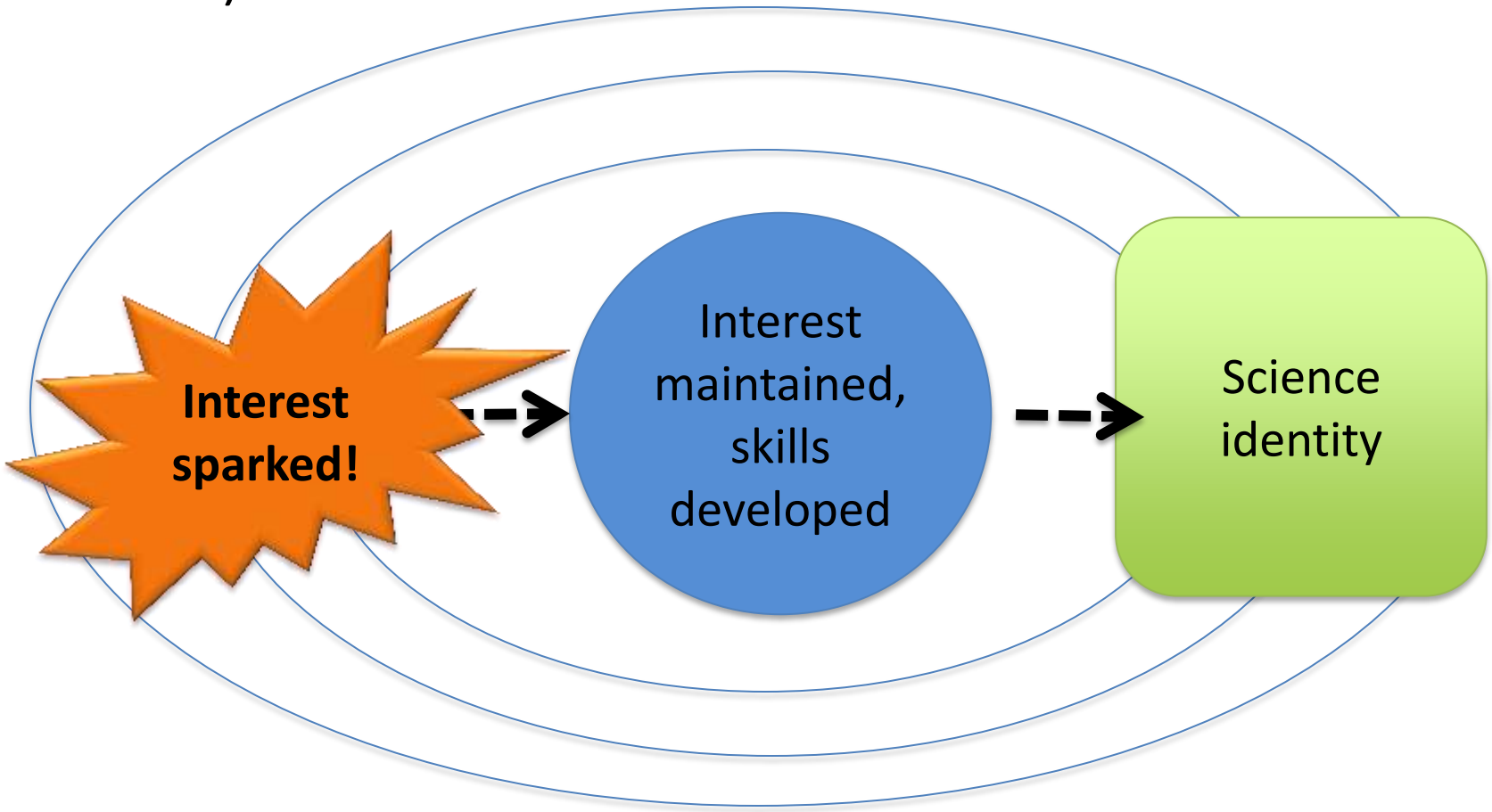
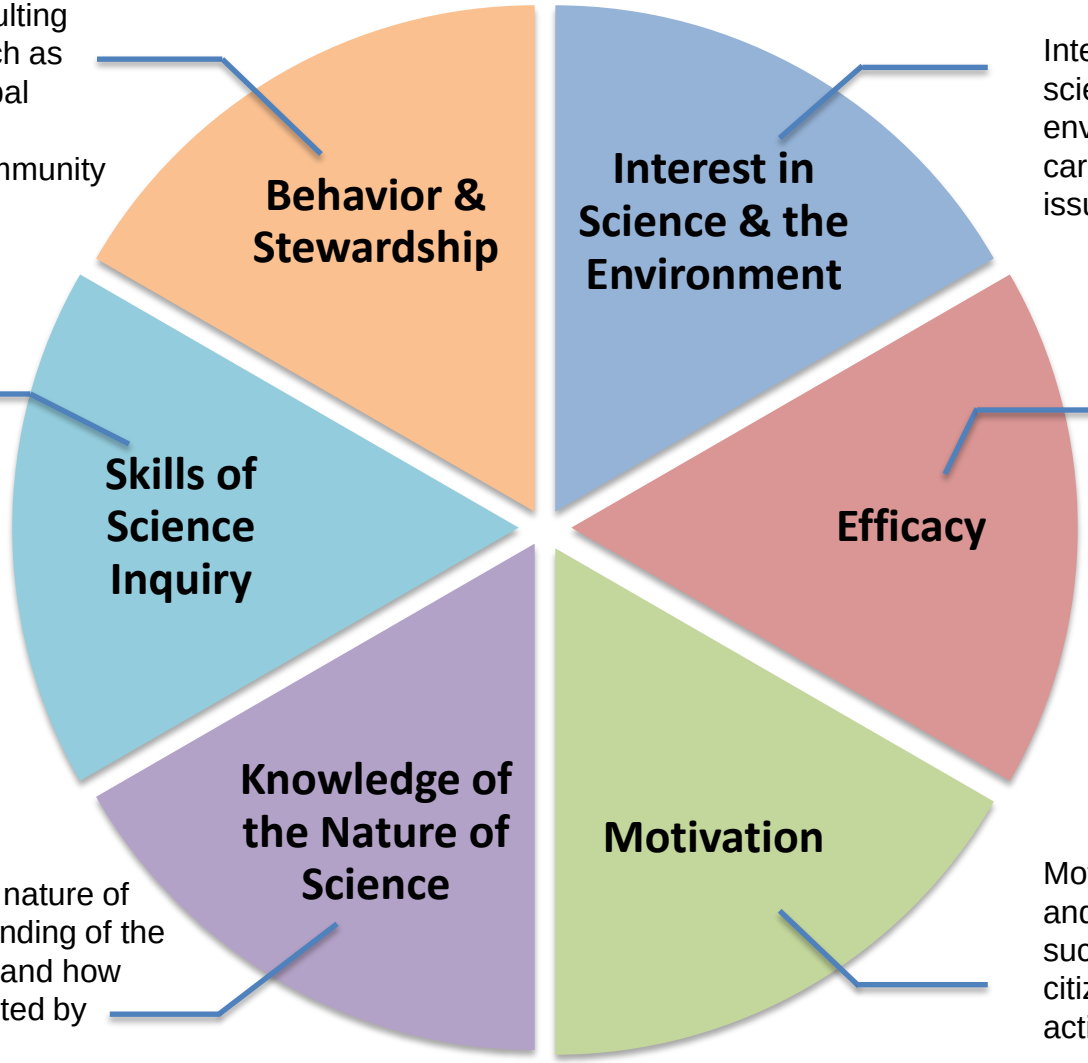
"Learning science depends not only on the accumulation of facts and concepts but also on the development of an *identity as a competent learner of science...*" (National Academy of Sciences)



Developing and Evaluating Learning Outcomes



Behavior change resulting from participation such as place-based and global stewardship, new participation, and community or civic action.

Interest in pursuing science and environmental topics, careers, activities, and issues

Procedural skills such as asking questions, designing studies, collecting, analyzing and interpreting data, experimenting, argumentation, synthesis, technology use, communication, and critical thinking

The extent to which a learner has confidence in his or her ability to participate in science or or to successfully perform stewardship behaviors.

Knowledge of the nature of science; understanding of the scientific process and how science is conducted by researchers

Motivation to pursue science and environmental goals such as STEM careers, and citizen science project activities

DEVISE SCALES FOR YOUTH

Interest in Science and Nature
Self-Efficacy for Science
Self-Efficacy for Environmental Action
Motivation for Science
Motivation for Environmental Action
Perceptions of Science Scale
Skills of Science Self-Report
Data Interpretation Quiz
Behavioral Intention Scale

How can citizen science support development of science identity in youth?

NOYCE FOUNDATION

Citizen Science Salon

« Firefly Watch: Those Blinking Beetles

Exploring a Culture of Health: Disrupting the Doctor's Office with Flip the Clinic

By Carolyn Graybeal | June 3, 2014 4:22 pm

Flip the Clinic, a Robert Wood Johnson Foundation Program

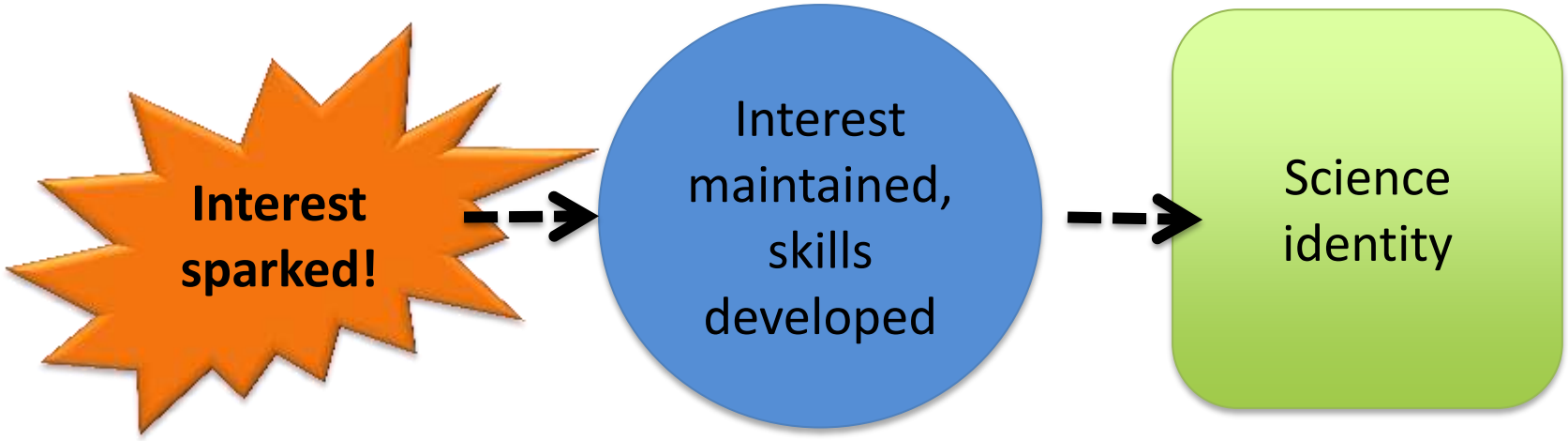
*This post is part of **Exploring a Culture of Health**, a citizen science series brought to you by Discover Magazine, SciStarter and the Robert Wood Johnson Foundation, serving as an ally to help Americans work build a national Culture of Health that enables everyone to lead*

Thank you!

What is needed to support youth engagement in citizen science?

- *Data displays and analysis tools*
- *Leader training and ongoing support*
- *Mentoring or other connection to scientists*
- *Relevance to real world problems/issues*

"4-H Science programs have actively sought to *spark an early youth interest in science education* and related careers by providing exciting and approachable, hands-on learning experiences...." (National 4-H Council)



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BirdSleuth in Action

Curriculum Resources

Fee-based kits & free downloads

Professional Development

Online & in person

CELEBRATION EVENTS

Citizen science, volunteer monitoring, participatory action research... this site supports organizers of all initiatives where public participants are involved in scientific research.

More about this...

Citizen Science at Science Centers (and other Informal Science Institutions)

Cases

Read more...

Videos

Watch more...

Workshops

Learn more...

In partnership with the Association of Science-Technology Centers.

Citizen Science Day Event – Plan Yours!

Promising Practices for Increasing Equity, Diversity, and Inclusion

eBird

Willow Flycatcher annual occurrence

Triggered Situational Interest → **Maintained Situational Interest** → **Emerging Individual Interest** → **Well-developed Individual Interest**

Nature Detectives

Quests

Habitat Connections

Independent participation

Stages of interest development from Hidi and Renninger (2006)