Scientific Principles and Citizen Science Advanced

The process of unpaid staff collecting scientifically accurate data for a specific end.

Wright, Richard, Environmental Science Third Edition, New Jersey, 2008.

Outline

Reason for Presentation

The Scientific Method

Evaluating Scientific Claims

Citizen Monitoring Common Errors

Types of Monitoring – Where do we fit?

Developing a Research Question Activity

Elements of Successful Programs

Presentation Goal

- We are all reminded of citizen science extraordinaire skills AND a better understanding of how to evaluate scientific claims.

The Scientific Method

- What is science?
- The Scientific Method Simplified:

  Observation, Hypothesis, Test (Experiment) and Theory…Refine and Repeat.
- Differentiating Data, Theories and Shaping Principles

A Few Definitions

- Objective – “Achieved when all data and observations are considered and not just those which conform to the current model”
- Rational –Clear, logical connections between data and theory.

Reasons for Controversies

Scientists never reach a place of absolute truth

- New Information Creates a Flurry of Theories
- Complexity – not easy to measure some things or with many factors involved
- Bias – vested interests wanting to maintain or promote disagreement
- Subjective Values – what do we do or not do with a topic's current state of knowledge

Evaluating Science

How to judge validity of viewpoints

- What are the observations underlying a theory? Can they be confirmed?
- Do explanations and theories follow logically from data?
- Do explanations account for all observations?
- Are there reasons that a particular theory is favored? Who profits?
- Is conclusion supported by community of scientists with greatest competence to judge?

From Science Daily

Global warming controversy

- The global warming controversy is an ongoing dispute about the effects of humans on global climate and about what policies should be implemented to avoid possible undesirable effects of climate change.
- The current scientific consensus on climate change is that recent warming indicates a fairly stable long-term trend, that the trend is largely human-caused, and that serious damage may result at some future date if steps are not taken to halt the trend.
- Mainstream scientific organizations worldwide (Royal Society, American Geophysical Union, Joint Science Academies, Intergovernmental Panel on Climate Change, American Meteorological Society, and American Association for the Advancement of Science) concur with the assessment that most of the observed warming over the last 50 years is likely to have been due to the human-caused increase in greenhouse gas concentrations.
- However, there is also a small but vocal number of scientists in climate and climate-related fields that disagree with the consensus view.
- ***Note**: This article excerpts material from the Wikipedia article "Global warming controversy", which is released under the GNU Free Documentation License.*

Citizen Science Errors

Non-professionals can collect credible / useable data.

Truth

Some Errors/Problems found in our data:

- Not completing data forms
- Putting wrong information in wrong fields on data form
- Data entered in spreadsheet doesn't match forms
- Ignoring methods
- Not handing in or finding all data forms

Few Basic Definitions - You tell me!

- Citizen Monitoring

- Accuracy
- Precision
- Comparability
- Completeness
- Representativeness

Types of Monitoring: Where do our programs fit?

Trend Monitoring

Measurements made to determine the long-term trend in a particular parameter.

Characteristics: Long duration, low frequency, low-moderate intensity.

Intertidal Beach Characterization (ITBC), Dead Bird COASST Surveys

Baseline Monitoring

- Create a snapshot of conditions at the current time, often as a basis for future comparison.
- Characteristics: Low frequency, short or medium duration, low to moderate intensity.
- Note: Baseline monitoring can eventually become trend monitoring.

Port Susan Shoreline Surveys, Forage Fish Spawning Surveys , Sea star Wasting Surveys, Creosote Log Surveys, Juvenile Dungeness Crab settlement studies

Implementation Monitoring

- Determining whether certain activities were carried out.
- Characteristics: Duration of project. Variable characteristics otherwise. Very easy to data analyze.

Effectiveness Monitoring

- Determine if a specific activity had the desired result.
- Characteristics: Short – medium duration, occurs soon after ‘activity’ is concluded or as activity is instituted, data analysis can be more intense.

Forage fish

Project Monitoring

- Assesses the impact of a particular activity or project, such as timber sale, construction, etc.

Characteristics: Location of monitoring normally ‘brackets’ or is within the activity location (upstream and downstream for example). Often occurs during activity.

Compliance Monitoring

- Are specific legal requirements being met.
- Characteristics: Normally tied to some legally binding permit.

BEACH

Developing Research Questions

What are attributes of a good research question?

- Clear
- Measurable
- Relevant

Developing a Good Question

Is there good forage fish habitat at Picnic Point?

Is there good sand lance habitat at Picnic Point?

Is there sand lance spawning at Picnic Point?

Now, pick a topic and talk among yourselves to create a good research question. Share after 5 minutes

Intertidal biota trends, Marine mammal strandings

Substrate Distribution on Beaches, Pet waste entering puget sound, Algal coverage on beaches, crab gear loss, impact of beach watcher youth education, other?

Elements of a Successful Program

Realistic Goals and Objectives

Determine what data are needed BEFORE beginning.

Review available resources

Make use of ‘expert’ volunteers.

Consider safety issues.

Review & Refine, Review & Refine, Review &…

Elements of a Successful Program

Build Support

- Create a Technical Advisory Committee.
- Be sure DATA USERS are involved in planning.
- Work in partnership with appropriate entities.
- Develop local leadership.

Elements of a Successful Program

Collect High Quality Data!

Develop effective training program.

Select participants.

Provide on-site assistance.

Prepare and use quality assurance / quality control plan (outlines guidelines for collecting and managing data).

Review data on timely basis.

Citizen Monitor Extraordinaire!

- Always document observed conditions.
- Fill in all forms completely.
- Heed your limitations – knowledge, physical, time, etc.
- Hold Program Sponsors accountable for using data.
- Learn how to interpret your data in a credible manner.

All Monitoring Programs Fail If:

The data are never used!

Thank you for your time.