

A Survey of Biological Monitoring Programs  
in the United States that Involve  
K-12 Students as Monitors

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## Chapter 1

### Introduction

#### *Background*

In environmental monitoring programs, individuals observe a specific aspect of an environment on a consistent, long-term basis in order to relate the status of this aspect to the quality of its surrounding environment. While all monitoring programs share these characteristics, existing programs differ greatly. Various entities administer programs that monitor aspects of the environment including government agencies, universities, and non-government organizations. Further, environmental monitoring programs are used to monitor such things as air pollution, water quality, climate, land use, migratory paths of animals, and populations of animals.

Many environmental monitoring programs were developed to create a database of certain characteristics of an ecosystem/environment so that trends and changes in the environment can be identified. Data for monitoring programs can be collected in a variety of ways including field surveys and satellite monitoring. Scientists, resource managers, community volunteers, and students collect data for these programs.

Many environmental monitoring programs utilize volunteers as part of, or for all of, their organization's data collection efforts. Volunteers tend to be interested in the problem being monitored, and most can be easily trained. Volunteers provide inexpensive labor, which is of major significance to programs

with limited funding. Furthermore, when using volunteers to monitoring species, it is often the case that a program can monitor over a larger geographic area than without the volunteers. Monitoring programs that rely on scientists alone for data collection can usually monitor only a limited geographic range and number of species. Volunteers increase the geographic range over which data can be collected from as well as aspects of the environment about which data can be collected (e.g., the number of species).

The involvement of students in monitoring programs is not a new development. Some environmental monitoring programs allow students to participate in their programs as volunteer data collectors, some programs encourage their participation, some programs were designed specifically for them, and some do not allow their participation. *Classroom FeederWatch* has been using students in its bird-monitoring program since 1987 and was developed specifically for students in grades 5-8. Other environmental monitoring programs like the *North American Amphibian Monitoring Program* were not developed specifically for students, but allow their participation.

### *Problem Statement*

Despite the promise and growing use of environmental monitoring programs, notably those involving K-12 students, little is known about the status or effects of such programs. There is no current list or database of all of the available environmental monitoring programs for K-12 students in the United States. In 1998, *Green Teacher* included a list and brief description of environmental monitoring programs that involve students as monitors. However,

that list is now somewhat out of date. As a result, teachers are challenged to find a program that is both appropriate for their students and their geographic location. Furthermore, there has not yet been a more detailed analysis of current student monitoring programs. Finally, little, if any, research or evaluation exists on the effects of student involvement in environmental monitoring on the student, the monitoring program, or the environment.

### *Purpose*

The purpose of this study is to identify and describe environmental monitoring programs that involve K-12 students to monitor plant and animal species in the United States. These will hereafter be referred to as biological monitoring programs.

### *Research Questions*

There are two research questions that follow from this purpose statement.

1. Which biological monitoring programs in the United States involve K-12 students as monitors?
2. What are the characteristics of these biological monitoring programs?

### *Potential Significance*

The answers to the aforementioned questions are needed so that a useful catalog of biological monitoring programs for students could be compiled. As mentioned previously, no such catalog exists. The existence of such a catalog will make it easier for teachers to identify and choose appropriate monitoring programs to integrate into their current curriculum. Additionally, if the search for a biological monitoring program for students becomes easier, it may be more

likely that teachers will utilize existing programs on the basis of their visibility and availability.

On the basis of claims and other anecdotal information presented by program personal, it is apparent that involvement in biological monitoring programs is beneficial for students. Thus, biological monitoring programs that are geared specifically for student participation appear to be valuable pieces of a curriculum. They teach students how to identify and understand environmental problems, enabling them to become part of the solution to those problems. Student volunteers are able to experience learning outside of the classroom in a natural setting, which helps foster an appreciation of and respect for the natural world (affective) in addition to fostering a retention of learning (cognitive). Additionally, many of these programs create “connections between science and other disciplines: language arts, visual arts, social studies, mathematics, and technology” (e.g., Classroom FeederWatch).

Many developers and advocates of biological monitoring programs, myself included, believe that students can make a difference in protecting, preserving, and conserving the natural world. Furthermore, many others, and I believe that it is imperative that we teach children that they are capable of making this difference. Biological monitoring programs appear to be a significant way to educate and empower students. Therefore, it is critical that existing biological monitoring programs become more available to the teachers that may desperately want and need them. This project attempts to begin to fill that need, particularly with respect to biological monitoring programs.

### *Delimitations*

This study will be delimited in the following ways.

- Only programs that include students in grades K-12 will be considered.
- Only programs that monitor the following taxonomic groups will be considered: fish, birds, insects, mammals, reptiles, amphibians and plants.
- Only programs marketed, offered, and/or operated at a statewide level or higher will be included in this survey of programs.

### *Key Terms*

For the purpose of this study, the terms below will be used as defined here.

- Students are defined as any K-12 student in public or private school in the United States.
- Environmental monitoring programs (EMP) refer to programs in which participants monitor environmental factors, gather data on those factors, and make the data available for others to use.
- Biological monitoring programs (BMP) refer to those EMPs in which participants identify a species, gather data on that species, and make the data available for others to use.
- Species monitoring refers to the observation of and data collection on a specific plant or animal.
- Monitoring protocol refers to the pieces of equipment and associated procedures to be used for sampling and data collection. Most federal and

state agencies have developed specific monitoring protocols for what they monitor in the environment.

- Volunteer refers to those participants in monitoring programs that give their time freely and of their own will.

## Chapter 2

### Literature Review

#### *Introduction*

Literature pertaining to environmental monitoring programs that involve students or the quality of student-collected data is so scarce and difficult to find that it is virtually non-existent. However, there are a few noteworthy exceptions. For example, *Green Teacher* produced an issue in 1998 entitled *Environmental Monitoring*. That issue contained several articles relating to student environmental monitoring programs, and the following literature review will discuss some of the contents of this issue. This review will also include articles from the National Oceanic and Atmospheric Administration's *The Volunteer Monitor* and *The Journal of Environmental Education*.

#### *An Overview of Environmental Monitoring Programs*

Mappin (1998) provided an overview of the different types of environmental monitoring programs. He suggested that "there is a need for long-term research to document, describe and predict ecosystem changes at regional and global scales. Environmental monitoring is one response to this need for scientifically sound evidence from long-term studies" (p. 12).

The author indicated that several types of monitoring programs exist. These programs include environmental monitoring, physical monitoring, chemical monitoring, biological monitoring, and biogeochemical monitoring. These programs can be available at a school, community, regional, national, or



international level. These programs are developed, or offered by environmental education groups, advocacy groups, environmental management agencies, and environmental researchers.

### *Student Involvement in Environmental Monitoring Programs*

Students may participate in monitoring programs in two different ways. They may participate in environmental monitoring as part of a school program, or outside of school ( i.e., with their families, friends, youth groups). Furthermore they may participate in programs that allow their participation, encourage their participation or were designed specifically for them. More environmental monitoring programs have become available to students in recent history. Mappin (1998) believes that student environmental monitoring programs are becoming more important because

in times of reduced research budgets, volunteer programs help to maintain basic monitoring, increase coverage, and expand databases... such programs address educators' interest in involving students in authentic science experiences and interdisciplinary activities that link the school with the community.

(p.13)

McClaren (1998) addressed how environmental monitoring programs could be used to enrich educational development. The author identified five principles pertaining to how environmental monitoring relates to education.

1. Data gathering is not an end in itself.

2. The design of data-gathering methods is as much a part of the educational experience as using the tools to gather the data.
3. Monitoring is a cybernetic activity – it is ultimately direction seeking.
4. There is no such thing as value-free information.
5. Monitoring implies action. (p. 7-9)

Perhaps the last principle is the most important to environmental education because collecting data as part of a scientific survey may eventually involve students in action, which is a goal of environmental education. Lastly involving students through direct action provides a superior learning experience because “learning results from the encounter between experience and thought” (p.10).

#### *Reviews of Student Environmental Monitoring Programs*

I found only one study that critically evaluated any existing student environmental monitoring programs. Kathryn Frank (2000) conducted a study of the NatureMapping program for her master’s thesis. Frank’s study was an exception, however, as descriptions and reviews of student environmental monitoring programs are more common in the literature.

LaHart (1998) provided an overview of the Global Learning and Observations to Benefit the Environment (GLOBE) program. The program launched on Earth Day in 1995 and involves K-12 students in collecting/providing data for the scientific community. Students survey an area near their school for land cover and weather. They may also include specific species if they wish. The data are shared via the Internet. Today, classrooms in more than 66 countries utilize the GLOBE curriculum and add data to GLOBE’s database. The

author did not provide a critique of the program; she simply gave a general description of the project and several examples of how she uses it in her classroom in Florida. She does relate the significance of a program such as this, which is that it fulfills the needs of both the education and scientific communities. The program can help scientists observe changes in the environment, which may be indicators of climate change.

Dvornich and Tudor (2001) provide a look at the NatureMapping program, which they co-founded, and describe how it has united resource agencies and environmental education. The NatureMapping program promotes “community-based environmental protection by mapping wildlife sightings and habitat” (p. 8). The authors discuss how “education reformers are demanding measurable results in student learning through authentic experiences” (p. 9). Environmental monitoring is a feasible response to such demands. The authors identify characteristics, which they believe contribute to good environmental education programs. Some examples of these characteristics include providing real opportunities for students to study biology, providing opportunities for stewardship, and developing observation skills. Much of the paper is a description of the NatureMapping program and its various components. They also include examples of how teachers/schools have incorporated the program into their curriculum.

Dvornich and Tudor (2001) discuss how the NatureMapping program has been very valuable to natural resource managers, students, teachers, scientists, and communities alike. For example, “resource agency biologists initially were

skeptical of the value of this type of education outreach both for learners and for their work...biologists now welcome activity that engages the community in positive stewardship roles by helping the participants to understand their natural heritage” (p.13). Scientifically, the author’s show that student participants are producing quality data. “Analysis of 5 years of NatureMapping datasets show information consistent with expert datasets, and has provided new expert-verified information on a few species” (p. 13). This evidence supports a continuing union between the groups and individuals involved in NatureMapping.

Ely (2000) also described the NatureMapping program. The author does not evaluate the program, but rather points out its major successes. Essentially, Ely describes the program, and provides justification for the quality of the data collected: “part of NatureMapping’s philosophy is that a dataset of lower quality but high quantity is just as important as a higher-quality but low-quantity dataset” (p. 1).

For her thesis, Frank (2000) interviewed both students that participated in the NatureMapping program and those that did not to see how the student’s reflected on biodiversity. Students in the NatureMapping program discussed topics relating to biodiversity, observation, and research skills whereas the students who were not involved in the NatureMapping program discussed trash, recreation skills, and hard work. Frank discovered that a community’s improved impression of schools and their students was the most significant outcome of the program.

### *Summary*

There are two key themes apparent in all of the articles reviewed in this section. First, student and volunteer monitors are free and can cover a larger area than one or two scientists. With funding for monitoring programs at a minimum, student and volunteer monitors are a viable solution to this problem. Second, programs need to be developed that provide students with opportunities to do real science via data collection.

The second theme is the most relevant to environmental education. Teachers have indicated that they need help in creating real world experiences for their students. Volunteer monitoring programs are a valuable way for students to do so and to apply the skills they have learned. In addition monitoring programs may help to instill a sense of efficacy in students. Prior theory and research suggests that if students do not believe that they can make a difference, then they will not try. Further, if students do not try to better the environment, I believe that it is less likely that they will make an attempt as adults. Involving students in environmental monitoring programs appears to be defensible on both educational and environmental grounds, and may well foster the development of environmentally responsible citizens in significant ways.

## Chapter 3

### Methods

#### *Introduction*

The primary method of information collection for this project involved email and Internet searches. In addition phone interviews were conducted with members of agencies, non-government organizations, and candidate programs.

Prior to beginning the search for biological monitoring programs (BMP<sub>r</sub>), several criteria were identified that each program needed to meet in order to be included. First, each program needed to be offered, sponsored or marketed at a statewide level or higher. Second, only programs that were designed for the participation of students in grades K-12 as volunteers were considered. Finally, programs had to be designed to collect data on one or more of the following species groups: fish, birds, insects, mammals, reptiles, amphibians, and plants.

There were several phases of this project. The first phase involved gathering information about BMP<sub>r</sub>s. The second phase involved organizing and reporting information about each BMP<sub>r</sub>. The third phase involved reviewing the information obtained about each BMP<sub>r</sub> for accuracy.

#### *Phase I*

##### *Planning Phase I: Identification of Potential Sources for Candidate Programs*

After the criteria were set, my advisor and I discussed possible sources of candidate programs. Among these sources were state departments of natural resources and environmental quality; state environmental education

organizations; government agencies such as the National Oceanic and Atmospheric Administration (NOAA), U.S. Fishery and Wildlife Service (USFWS) and the National Park Service (NPS), non-government agencies; and conservation organizations such as the Sierra Club, Audubon Society, and The Nature Conservancy. In addition, my advisor provided me with contacts at several of the aforementioned agencies and organizations.

*Carrying Out Phase I: Identification of Candidate Programs*

In the initial phase of this research, I conducted an Internet search using *students AND environmental monitoring programs* as search terms in order to get an idea of what type of monitoring programs were out there and where they were located. This helped me to focus and narrow down the parameters I would use for future searching. During this phase, my advisor and I continued to discuss and refine what types of student monitoring programs existed, who they were sponsored by, who they were available to, and what species they included.

I continued the investigatory phase of this project by running an Internet search for all of the state agencies associated with natural resources and environmental quality. I then contacted via email each of the agencies I found. I explained the purpose of my project, and asked if their agency sponsored any projects that fit the criteria I had established. I followed up on any responses I received.

In addition to this, I also used several other search strategies. I contacted all the individuals that my advisor suggested that I contact. In addition, I contacted various conservation and non-government organizations. During this time I continued to search the Internet for pertinent programs. Upon finding a

program that I believed to be relevant, I would contact the Project Coordinator or person of similar description, explain the purpose of my research, and ask them for more detailed information about their program.

## *Phase II*

### *Planning Phase II: Organizing Information*

Once I obtained information on several programs, my advisor, and I discussed what information I needed to obtain and present about each program. We organized this information into three categories:

1. Nature and Scope of the Project;
2. Overview of the Project; and
3. Overview of Project Monitoring and Data.

The first category (1, above) was to include: the project title, source(s) of information about the project, target species, target age group(s), participation level of students, sponsoring agency(s), project age, and geographic scope. The second category (2, above) was to contain information pertaining to: the project description, project Web site, project materials, project publications, and the training required and provided. The final category (3, above) was to contain information on: the nature of monitoring protocols, how the data are entered and stored, who the data are shared with, and how the data are used.

### *Carrying Out Phase II: Description of Environmental Monitoring Programs*

Once I had reviewed a program's information, I created a format or template into which I could enter information for each program. I began this process by drafting five examples. I took five programs for which I already had a significant amount of information, and then entered this information into the



template. My advisor reviewed these drafts three times, and we made revisions to the template after each review. Once the template was finalized, I obtained the additional information necessary for these five programs (See Appendix A). I also continued to search for additional candidate programs during this time.

### *Phase III*

#### *Carrying Out Phase III: Review of Project Profiles*

Once I had completed a draft summary for each qualified BMP, I contacted people knowledgeable about each program, usually the Project Coordinator, to verify the information I had included. This review of program information was done via email. I attempted to contact personnel involved with each program up to three times. If no response was obtained after three attempts, no further attempts were made. If a response was obtained I asked the person to review the information I provide about their project, and that person was listed as the *source* in each program profile, as presented in Chapter Four.

## Chapter Four

### Results

#### *Introduction*

There were several difficulties inherent in identifying and selecting biological monitoring programs to include in this project. An abundance of volunteer monitoring programs exist in the United States and this is increasing. The majority of programs found were water quality monitoring programs. There are also several programs that monitor weather and atmospheric conditions. In addition, most volunteer monitoring programs were developed under the premise that adults would serve as volunteers. Given this, my problem was two-fold: (1) I wanted to find monitoring programs that focused on plants and animals, and (2) I wanted to include programs in which students were involved in monitoring.

I found that there are essentially four types of programs in respect to who does the monitoring:

- programs that do not allow student participation;
- programs that allow children to participate with their parents;
- programs that encourage student participation (i.e. programs that have school curriculums);
- and programs that were designed specifically for students.

To further complicate this, some environmental monitoring programs that do not focus on biological monitoring per se do include some type of biological

monitoring as part of a broader environmental monitoring program. For example, many water quality monitoring programs include macroinvertebrates as part of their survey. However, since these species were not the main focus of that EMP, I decided to not include these programs in this study.

For the purpose of this project, I wanted to take a closer look at programs that were designed specifically for students. Most of these programs include monitoring as part of a curriculum plan. At first I thought that I was going to find an abundance of programs, and would have to narrow my results down to a specific region of the United States to make this a manageable project. However, to my surprise I found that relatively few BMPs designed specifically for students exist in this country. Further, even fewer programs were left once my study was delimited to include only programs that were offered on at least at a statewide level. By limiting programs to a statewide level I essentially eliminated any program that was offered by a school district or that had been created by a teacher for specific use of her/his own students.

#### *Results for Research Question 1*

Research Question 1: Which BMPs in the United States involve K-12 students as monitors?

I found 9 programs that were designed specifically for students. I have also included 2 programs that encourage student participation. A list and description of the programs designed specifically for students and that provide curriculum follow (in alphabetical order).

#### *Biodiversity Monitoring Project*

The Conservation and Research Center of the Smithsonian Institution's National Zoological Park developed the Biodiversity Monitoring Project. The program was developed for middle and high school students. The Biodiversity Monitoring Project is a student inquiry-based program that allows students to design their own monitoring projects and then shares the results with other students. Students are also required to do a structured survey (created by Smithsonian) of a plot that has been assigned to them. The data are then posted on the program's Web site.

#### *Classroom FeederWatch*

Classroom FeederWatch is based at the Cornell Laboratory of Ornithology and is supported by the National Science Foundation. The program was developed for students in grades 5-8. Classroom FeederWatch teaches students how to identify birds and monitor birds using the stages of the scientific method. Data are collected by the students and then entered (by the students) electronically into the Cornell Ornithology Lab's database.

#### *GLOBE*

GLOBE is an international, hands-on, inquiry-based, environmental science and education program. The program is funded by NASA, the National Science Foundation, and the U.S. Department of State. GLOBE is run by the University Corporation for Atmospheric Research (UCAR) and Colorado State University (CSU). The program was designed for primary, middle, and secondary school students. The GLOBE program couples science and education through monitoring. Student monitors in the GLOBE program collect

data on plants, birds, land cover, freshwater macroinvertebrates, soils, hydrology, and atmosphere. Students collect their own data and enter it electronically on GLOBE's Web site. Data are used for student investigations and scientific research.

### *Gulf of Alaska CoastWatch*

The Gulf of Alaska CoastWatch program is sponsored by The Center for Alaskan Coastal Studies (CACS). The program was designed for students in grades 5-12. The CoastWatch program is an inquiry-based program that brings together science and education via monitoring of the intertidal zone. Students collect long-term data and enter it electronically into the CACS database.

### *The International Brant Monitoring Project*

The International Brant Monitoring Project is sponsored by the Padilla Bay National Estuarine Research Reserve. The program was designed for students in grades 6 - 8. Students involved in the program learn about the Brant geese through an interdisciplinary approach. Students collect their own data on the geese as they migrate along the West Coast of the United States each year. The data are entered into an online database and distributed by an automated email list.

### *Journey North*

Journey North was developed for K-12 students. The program is offered nationwide, and allows students to monitor the migration of eight species each spring and fall. In addition, students monitor the changes in plants as indicators of seasonal change.

### LiMPETS

LiMPETS is a joint venture of the California Sea Grant Program, Farallones Marine Sanctuary Association, University of California, Santa Cruz, and the National Oceanographic and Atmospheric Administration's National Marine Sanctuary Program. The program was developed for middle and high school students. LiMPETS uses a hands-on approach to learning through monitoring of the intertidal zone, offshore areas, and sandy beaches. Students' data is shared by way of the Internet.

### Minnesota Worm Watch

The Natural Resource Research Institute of University of Minnesota, Duluth, sponsors Minnesota Worm Watch. The program was designed with a range of participants in mind, including K-12 students. Through Minnesota Worm Watch students are able to study ecosystem processes by monitoring earthworm populations.

### MonarchWatch

MonarchWatch is sponsored by the University of Kansas' Entomology Program. The program was designed specifically for K-12 students. Teachers can incorporate the MonarchWatch curriculum into their existing curriculum. Students in the MonarchWatch program work with teacher, volunteers and researchers to study the fall migration of Monarch butterflies.

### NatureMapping

NatureMapping is sponsored by a variety of agencies across the United States. The program encourages the participation of K-12 students. Teachers use the program to supplement or integrate into existing curriculum. Participants of the NatureMapping program collect biodiversity data that can be shared with students, communities, natural resource managers and scientists.

### OceanGLOBE

OceanGLOBE is sponsored by the UCLA Marine Science Center. The program was developed for upper elementary, middle, and high school students. Teachers can use the project's curriculum materials and guide books to help their students create their own project. Participants in the OceanGLOBE program use a hands-on approach to collecting real, long-term data.

### *Research Question II*

Research Question 2: What are the characteristics of these biological monitoring programs?

I have included 13 programs here; the 11 programs previously described as well as 2 additional programs that allow the participation of student volunteers, but do not provide any curriculum to supplement the monitoring. A list of these programs is provided below.

## 1. Title: Biodiversity Monitoring Project

### Nature and Scope of Project:

**Source:** Kelly Cauthorn

**Target Species:** Teacher and students choose which species they will monitor.

**Target Age Group:** middle and high school students

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** Smithsonian Institute

**Project Age:** since 1998 (pilot year)

**Geographic Scope:** Virginia, Colorado, Oregon, Maryland, and Texas, but looking to expand nation-wide

### Overview of Project:

**Project Description:** The Biodiversity Monitoring Project is a student inquiry-based program that allows students to design their own monitoring projects and then shares the results with other students.

**Project Web site:**

<http://www.nationalzoo.si.edu/Education/ClassroomPartnerships/BioDivMonPro/default.cfm>

**Project Materials:** Teachers attend a week-long training session where they receive the manual for the project. The manual includes methods/techniques, activities, lesson plans, and instructions on how to use remote sensing, GIS, and statistics.

**Project Newsletter/Reports:** Biodiversity Monitoring Project Newsletter

**Training Required and Provided:** Teachers attend a week-long training workshop. Additional taxa-specific training workshops are offered throughout the year to enhance a teacher's training.

### Overview of Project Monitoring and Data:

**Nature of Monitoring Protocols:** The project is student inquiry based, so the projects change from class to class. Each class develops their own monitoring protocol and methods. Protocols used by Smithsonian Scientists are available for teachers and students to use or to provide examples for developing their own protocols.

**Entry and Storage of Monitoring Data:** Initially, students conduct a biodiversity survey of their designated plot and enter the results into Forest Plotter software for a basic analysis. Then, the data are posted on the web site. Other data collected by the student (as a result of their self-guided inquiries) are entered into a Microsoft Excel chart.

**Sharing of Monitoring Data:** Students can download the results of other students' surveys from the project's web page. Also, symposiums are held so students from different participating schools in an area can present their projects to each other.



**Uses of Data:** The data are not currently used for anything beyond this project. As the validity of student-collected data becomes more accepted, perhaps these data will be shared.

## 2. Title: Classroom FeederWatch

### **Nature and Scope of Project:**

**Source:** Jennifer Schaus, Project Leader - Classroom BirdWatch.

**Target Specie(s):** birds

**Target Age Group:** grades 5-8

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** Cornell Laboratory of Ornithology

**Project Age:** Since 1987

**Geographic Scope:** United States

### **Overview of Project:**

**Project Description:** Students learn to identify birds while learning how to implement the stages of the scientific method.

**Project Web site:**

[http://birds.cornell.edu/cfw/teaching\\_with\\_cfw/curric\\_overview.html](http://birds.cornell.edu/cfw/teaching_with_cfw/curric_overview.html)

**Project Materials:** A curriculum guide is available on the website

**Project Newsletter/Reports:** Not available

**Training Required and Provided:** Not available

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Protocols follow Cornell's Lab of Ornithology's eBird protocol.

**Entry and Storage of Monitoring Data:** Data are collected by the students and submitted electronically to the Cornell Lab of Ornithology.

**Sharing of Monitoring Data:** Not available

**Uses of Data:** Not available

**Note:** Over the next two years, Classroom FeederWatch will be phased out to make room for a new curriculum called Classroom BirdWatch.

### 3. Title: Frogwatch

#### **Nature and Scope of Project:**

**Source:** Amy Goodstine, Frogwatch USA Coordinator

**Target Species:** frogs and toads

**Target Age Group:** all K-12 students

**Participation level of students:** encourages/allows student participation

**Sponsoring Agency(s):** National Wildlife Federation, United States Geological Survey

**Project Age:** since 1999

**Geographic Scope:** United States including Puerto Rico

#### **Overview of Project:**

**Project Description:** A long-term program that monitors frog and toad populations and educates the public on issues of amphibian and wetland conservation.

**Project Web site:** [www.nwf.org/frogwatchUSA/](http://www.nwf.org/frogwatchUSA/)

**Project Materials:** Frogwatch USA Monitoring Protocol, Frogwatch USA data collection sheet, Frog and Toad Call CD

**Project Newsletter/Reports:** National Wildlife Magazine, quarterly e-newsletter

**Training Required and Provided:** This program currently requires self-guided training according to directions provided on the web site and through program staff when needed.

#### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Calling survey technique.

**Entry and Storage of Monitoring Data:** Volunteers record information on data sheets and enter it into a database.

**Sharing of Monitoring Data:** Most are publicly accessible, and additional information can be provided upon request.

**Uses of Data:** Long-term monitoring of amphibian populations at individual wetland sites.

#### 4. Title: GLOBE

##### **Nature and Scope of Project:**

**Source:** John McLaughlin, The GLOBE Science Team

**Target Species:** plants, birds, algae, atmosphere, hydrology, soils, land cover/phenology

**Target Age Group:** primary, middle, and secondary school students

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** NASA, National Science Foundation, U.S. Department of State

**Project Age:** since 1994

**Geographic Scope:** International (105 countries)

##### **Overview of Project:**

**Project Description:** The GLOBE program unites science and education through monitoring the natural and physical environment. Students collect valid data on the environment and share it with the public via the Internet.

**Project Web site:** [www.globe.gov](http://www.globe.gov)

**Project Materials:** Teachers Guide, Cloud Chart, MUC Field Guide for Land Cover Classification

**Project Newsletter/Reports:** Not available

**Training Required and Provided:** Teachers are trained at professional development workshops.

##### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** All protocols are scientifically validated by NSF-funded scientists.

**Entry and Storage of Monitoring Data:** Data are reported electronically via the Internet. Students can also create maps and graphs and analyze data on the web site.

**Sharing of Monitoring Data:** All data are available to the public, and can be accessed in a variety of file formats.

**Uses of Data:** Data are used for student investigations and scientific research.

## 5. Title: Gulf of Alaska CoastWatch

### Nature and Scope of Project:

**Source:**

**Target Species:** various intertidal organisms (periwinkles, chitons, mussels, limpets, seastars, sea urchins, barnacles, anemones, algae, snails, nudibranchs, clams, cockles, sea cucumbers, crabs and octopuses)

**Target Age Group:** grades 5-12

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** The Center for Alaskan Coastal Studies (CACS)

**Project Age:** Not available

**Geographic Scope:** Alaska

### Overview of Project:

**Project Description:** CoastWatch integrates science and education through monitoring of the intertidal zone. Through inquiry-based activities students use a hands-on approach to gather data over a large geographic range. Thus, they create a large, long-term database that can be used by scientists and students alike to study how the intertidal zone changes over time.

**Project Web site:** [www.akcoastalstudies.Coastwatch.html](http://www.akcoastalstudies.Coastwatch.html)

**Project Materials:** Gulf of Alaska CoastWatch Activity Guide

**Project Newsletter/Reports:** Not available

**Training Required and Provided:** Not available

### Overview of Project Monitoring Data:

**Nature of Monitoring Protocols:** Project uses GLOBE protocols.

**Entry and Storage of Monitoring Data:** Data are entered into the CACS database.

**Sharing of Monitoring Data:** Students, teachers and scientists can access data from other classes on the Web site.

**Uses of Data:** Not available

## 6. Title: The International Brant Monitoring Project

### **Nature and Scope of Project:**

**Source:** Glen "Alex" Alexander

**Target Species:** Brant geese

**Target Age Group:** grades 6 - 8

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** Padilla Bay National Estuarine Research Reserve

**Project Age:** since 1996

**Geographic Scope:** Alaska, Washington, Oregon, California (British Columbia and Baja, Mexico)

### **Overview of Project:**

**Project Description:** The Brant Monitoring Project engages students in an interdisciplinary approach to species monitoring. Students study the biology, ecology, migration and habitat of the Brant geese. Then they observe the migration of the geese and report their findings to the project's list serve.

**Project Web site:** <http://www.padillabay.gov/brant>

**Project Materials:** A curriculum guide is available at the web site. Participants supply their own spotting scopes.

**Project Newsletter/Reports:** Not available

**Training Required and Provided:** Teachers are supported by the curriculum and web site as well as by on-site coordinators.

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Site specific protocols are established by participants.

**Entry and Storage of Monitoring Data:** Data are entered into the project's online database and list serve.

**Sharing of Monitoring Data:** Upon entry, data are instantly available in the online observation log to the public.

**Uses of Data:** Data are used for the educational purposes of the participants.

## 7. Title: Journey North

### **Nature and Scope of Project:**

**Source:** [www.learner.org](http://www.learner.org)

**Target Species:** bald eagle, caribou, hummingbird, manatee, monarch, robin, whooping crane, gray whale, tulips

**Target Age Group:** all K-12 students

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** Not available

**Project Age:** since 1991

**Geographic Scope:** United States, 7 Canadian Provinces

### **Overview of Project:**

**Project Description:** Students map the migration of species every spring and fall.

**Project Web site:** <http://www.learner.org/jnorth/>

**Project Materials:** Not available

**Project Newsletter/Reports:** Not available

**Training Required and Provided:** Not available

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Not available

**Entry and Storage of Monitoring Data:** Data are reported electronically. Some data is collected directly by the students. In addition, some species are tracked via satellite and students can download the data.

**Sharing of Monitoring Data:** Data are shared between classrooms all over the U.S. and Canada and with scientists.

**Uses of Data:** Not available

## 8. Title: LiMPETS (Long-term Monitoring Program and Experiential Training for Students)

### Nature and Scope of Project:

**Source:** Claire Johnson, LiMPETS Program Manager and Jennifer Saltzman, Farallones Marine Sanctuary Association

**Target Species:** A variety of invertebrate and algae species are monitored in the rocky intertidal. The Pacific mole crab, *Emerita analoga*, is monitored for the sandy beach. A variety of species are monitored for the offshore area (this part of the program is a pilot program).

**Target Age Group:** middle and high school students

**Participation level of students:** encourages student participation

**Sponsoring Agency(s):** California Sea Grant Program, Farallones Marine Sanctuary Association, University of California, Santa Cruz, and the National Oceanographic and Atmospheric Administration's National Marine Sanctuary Program including the Olympic coast, Cordell Bank, Gulf of the Farallones, Monterey Bay and Channel Islands National Marine Sanctuaries.

**Project Age:** Since 2002, however many of the programs were operating before this but now fall under the LiMPETS program.

**Geographic Scope:** The West Coast of the United States, and is looking to expand into the Hawaiian Islands and American Samoa.

### Overview of Project:

**Project Description:** This program provides a unique opportunity for teachers to participate in professional development to gain the necessary skills and confidence to engage their students in monitoring activities in the field. The program provides students with a hands-on approach to monitoring ocean and coastal ecosystems.

**Project Web site:** <http://limpets.noaa.gov>

**Project Materials:** Protocols and species list can be downloaded from the LiMPETS web site. Classroom and field monitoring kits are available in certain regions on a check out basis.

**Project Newsletter/Reports:** LiMPETS Summary Report (available on website)

**Training Required and Provided:** Local and regional workshops are held year round.

### Overview of Project Monitoring and Data:

**Nature of Monitoring Protocols:** Monitoring protocols are outlined on the website.

**Entry and Storage of Monitoring Data:** Rocky intertidal and sandy beach monitoring data can be entered electronically into a database (<http://limpets.noaa.gov>). Here, data can be graphed and compared to data collected from other monitoring sites.



**Sharing of Monitoring Data:** Data are available on the website and are used by students, volunteer groups, the general public and resource monitors.

**Uses of Data:** The data can be used by resource managers as baseline data to assist in making informed decisions about the ocean. The data also provides long-term information on trends that affect rocky intertidal and sandy beach environments.

## 9. Title: Minnesota Worm Watch

### **Nature and Scope of Project:**

**Source:** Cindy Hale

**Target Species:** exotic earthworms

**Target Age Group:** Students of any age can participate, but monitoring activities are more appropriate for middle and high school students.

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** Natural Resource Research Institute, University of Minnesota, Duluth

**Project Age:** since 2000

**Geographic Scope:** Minnesota, but teachers and environmental educators in other states have used the information provided on the web site in their state.

### **Overview of Project:**

**Project Description:** Students explore ecosystems and their functions by monitoring exotic earthworm invasions in hardwood forests.

**Project Web site:** [www.nrri.umn.edu/worms/](http://www.nrri.umn.edu/worms/)

**Project Materials:** Activities, games and resources for the program can be found online.

**Project Newsletter/Reports:** None yet.

**Training Required and Provided:** Training workshops for teachers, environmental educators and natural resource professionals were held in 2001-2003. Each workshop is approximately six hours and includes discussion of the research findings related to the impacts of exotic earthworm invasions in hardwood forest, hands on earthworm sampling and identification, classroom learning activities, how to conduct habitat, soil and earthworm surveys in the field, and a forest ecology game.

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Data sheets and sampling instructions are provided for conducting general or detailed habitat surveys, soil surveys and earthworm surveys including stop by stop instructions for the preservation of earthworm specimens. Several levels of earthworm identification are also provided; a one page handout identifying several common species by their ecological groups and an online key for identifying a wider range of species.

**Entry and Storage of Monitoring Data:** Data from surveys are recorded and mailed to Cindy Hale.

**Sharing of Monitoring Data:** None yet.

**Uses of Data:** None yet.

## 10. Title: MonarchWatch

### **Nature and Scope of Project:**

**Source:** Chip Taylor

**Target Specie(s):** Monarch Butterflies

**Target Age Group:** all K-12 students

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** University of Kansas, Entomology Program, Department of Ecology and Evolutionary Biology.

**Project Age:** since 1992

**Geographic Scope:** 37 states and 4 Canadian Provinces east of the Rocky Mountains, and Mexico

### **Overview of Project:**

**Project Description:** Monarch Watch is a collaborative network of students, teachers, volunteers and researchers dedicated to the study of the Monarch butterfly, *Danaus plexippus*. Specifically, the program focuses on the fall migration during which about 100,000 monarchs are tagged each fall by tens of thousands of volunteers. The data from the tag recoveries are used to assess the size of the population and study the timing and pace of the migration.

**Project Web site:** <http://www.monarchwatch.org>

**Project Materials:** Curriculum for the program is available on the web site.

**Project Newsletter/Reports:** Season Summaries and monthly updates are posted on the web site. Hard copies of the Season Summaries are distributed to members.

**Training Required and Provided:** Directions for tagging, or rearing, are provided through the web site and via written materials.

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** Migratory monarchs are collected and tagged with coded tags in the fall. Data sheets are returned and used to determine the total number of monarchs tagged and to record the data associated with each recovery.

**Entry and Storage of Monitoring Data:** Tag recovery records are posted to the web site and published in the Season Summary.

**Sharing of Monitoring Data:** All data on recoveries is available to the public on the web site and through our publications.

**Uses of Data:** The data are used to inform policy makers, the public, and students on the status of the population, and to prepare scientific papers on the dynamics of the migration and population as revealed by the recaptures.

## 11. Title: NatureMapping

### Nature and Scope of Project:

**Source:** Karen Dvornich, National Director

**Target Species:** all wildlife and the habitats in which they were observed

**Target Age Group:** all K-12 students

**Participation level of students:** encourages student participation

**Sponsoring Agency(s):** Iowa State University, University of Washington, Wisconsin Cooperative Educational Service Agency 10, Virginia

Department of Game And Inland Fisheries, Arkansas Cooperative

Extension Service, Fresno City College Biology Department, Sawtooth

Science Institute, Indiana Biodiversity Initiative (USFW), Wayne National

Forest (in Ohio), South Carolina Department of Natural Resources,

**Project Age:** since 1992

**Geographic Scope:** United States, British Columbia (interest from Australia, Mexico and Norway)

### Overview of Project:

**Project Description:** NatureMapping unites students, community, scientists, and natural resource managers through the collection of biodiversity data.

**Project Web site:** [www.fish.washington.edu/naturemapping/joinhow.html](http://www.fish.washington.edu/naturemapping/joinhow.html)

**Project Materials:** guidelines and protocols, On-line materials for wildlife and water (Washington state only for water)

### Project Newsletter/Reports:

- Dvornich, K.M., Tudor, M. & C.E. Grue. (1995) NatureMapping: Assisting management of natural resources through public education and public participation. *Wildlife Society Bulletin*, 23(4), 609-614.
- Dvornich, K.M., Brooks, K., Garner, J. & M. Tirhi. (2002) Long-term implementation strategies for biodiverse lands. *Gap Analysis Bulletin No. 11*, 51 – 52.
- Frank, K.I. (2000) Connecting with nature: A study of the effects of the NatureMapping program on its grade school participants, their schools and their communities. Eugene, Oregon: Department of Planning, Public Policy and Management Thesis. University of Oregon, 165 pp.
- Tudor, M.T., & K.M. Dvornich. (2001) The NatureMapping Program: Resource agency environmental education reform. *Journal of Environmental Education*, 32(2), 8-14.

**Training Required and Provided:** workshops/teacher training provided

### Overview of Project Monitoring and Data:

**Nature of Monitoring Protocols:** The NatureMapping Program Learning Protocols, 2000.

**Entry and Storage of Monitoring Data:** Data recording sheets can be downloaded and printed off the Internet, data are then entered into the NatureMapping database. Online data entry in some states, Microsoft Excel spreadsheet with multiple worksheets for data analysis, graphing and submission to the NatureMapping database.

**Sharing of Monitoring Data:** Data are shared amongst students, community, natural resource managers, and scientists.

**Uses of Data:** Data can be used by communities and local agencies as a basis for community planning; by state or federal agency site specific projects; assessment of GAP analysis predicted species distribution models.

## 12. Title: OceanGLOBE

### **Nature and Scope of Project:**

**Source:** Bob Perry, UCLA OceanGLOBE, and Instructor, Malibu High School

**Target Specie(s):** birds, mammals, plankton, plant and animal debris and other physical and oceanographic factors

**Target Age Group:** upper elementary, middle and high school students

**Participation level of students:** designed specifically for students

**Sponsoring Agency(s):** UCLA Marine Science Center

**Project Age:** since 1995

**Geographic Scope:** California

### **Overview of Project:**

**Project Description:** OceanGLOBE provides students with a hands-on approach to collecting real data. Long-term data are collected from the marine environment by students so that they can play an active roll in learning about how science is done.

**Project Web site:** <http://www.msc.ucla.edu/oceanglobe/>

**Project Materials:** curriculum materials, research guide books, and research protocols

**Project Newsletter/Reports:** None

**Training Required and Provided:** Not available

### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** standard

**Entry and Storage of Monitoring Data:** Each participating site has their own entry and storage methods.

**Sharing of Monitoring Data:** Informal

**Uses of Data:** class discussion, analysis and illustration of State and National Science Standards

### 13. Title: Minnesota Frog & Toad Calling Survey (MFTCS)

#### **Nature and Scope of Project:**

**Source:** Yvette Anderson

**Target Species:** 14 frog and toad species

**Target Age Group:** all ages (the survey has to be completed in a car, so one of the participants for each route has to have a valid driver's license)

**Participation level of students:** allows student participation

**Sponsoring Agency(s):** Non-game Wildlife Program, Division of Ecological Services, Minnesota Department of Natural Resources.

**Project Age:** since 1996 (pilot began in 1993)

**Geographic Scope:** Minnesota

#### **Overview of Project:**

**Project Description:** The MFTCS consists of 227 routes scattered across the state of Minnesota. Volunteers are assigned to a route(s) and conduct night-time "listening surveys" on three evenings per year between April and July. Each route consists of 10 stops, at least 0.5 miles apart, representing a variety of wetland types. Volunteers drive to each stop, listen for 5 minutes, and record which species they hear.

#### **Project Web site:**

[http://www.dnr.state.mn.us/volunteering/frogtoad\\_survey/index.html](http://www.dnr.state.mn.us/volunteering/frogtoad_survey/index.html)

**Project Materials:** N/A

#### **Project Newsletter/Reports:**

- Anderson, Y.C. & R.J. Baker. (2002) Minnesota frog and toad calling survey 1996 – 2002. St. Paul, MN: Minnesota Department of Natural Resources. .

**Training Required and Provided:** Training materials include audio tape or CD of Minnesota's frog and toad calls, maps, written instructions, as well as the availability of the Volunteer Coordinator can answer any questions via phone or email.

#### **Overview of Project Monitoring and Data:**

**Nature of Monitoring Protocols:** The program follows the protocol of the NAAMP. Protocol is available at

[http://www.dnr.state.mn.us/volunteering/frogtoad\\_survey/index.html](http://www.dnr.state.mn.us/volunteering/frogtoad_survey/index.html)

**Entry and Storage of Monitoring Data:** Data are entered electronically into the North American Amphibian Monitoring Program (NAAMP) database.

**Sharing of Monitoring Data:** Via the NAAMP, MFTCS produces reports of their results for volunteers and the public.

**Uses of Data:** Data are used to monitor Minnesota's frog and toad populations over time.

**Note:** MFTCS varies from NAAMP in that MFTCS allows volunteers to create their own routes.

### *Summary of Results*

The programs I mentioned are diverse in both their locations and the species that they monitor. Five of the programs are offered nationwide (i.e., Classroom FeederWatch, GLOBE, Journey North, MonarchWatch, Frogwatch) and at least two more (i.e., Biodiversity Monitoring Project, NatureMapping) are looking to become nationwide programs in the future (Table 1, p. 40). Four programs are specifically coastal programs (i.e., LiMPETS, Gulf of Alaska Coast Watch, International Brant Monitoring Project, OceanGLOBE), and are located exclusively on the west coast of North America (Table 1). Some of the programs focus on only one species (MonarchWatch) whereas others are more diverse in the number of species that they monitor (Table 1).

I was not able to make a final contact with personnel associated with three of the programs (Journey North, Classroom FeederWatch, Gulf of Alaska Coast Watch) and therefore the project profiles compiled for them are somewhat incomplete.

In addition, there were some very well established monitoring programs that allow student participation that I would like to have included, but for which I did not receive a response from. These programs include: the North American Amphibian Monitoring Program (NAAMP), National Audubon's Christmas and Backyard Bird Counts, and the North American Butterfly Association's (NABA) 4<sup>th</sup> of July Butterfly Count. These programs do not supply curriculum for instructors and require adult supervision, but they are well-respected examples of volunteer monitoring programs in which students are welcome.



*Table 1*

Characteristics of Biological Monitoring Programs

Program	Species Monitored	Target Age Group	Participation Level of Students *	Geographic Scope
Biodiversity Monitoring Project	Varies	Middle and High School	DFS	VA, CO, OR, MD, TX (and still expanding)
Classroom FeederWatch	Birds	Grades 5-8	DFS	Nationwide
Frogwatch	Amphibians	N/A	ASP	U.S. and Puerto Rico
GLOBE	Varies	Primary, Middle and High School	DFS	105 Countries
Gulf of Alaska CoastWatch	Multiple possible (intertidal)	Grades 5-12	DFS	Alaska
The Intl. Brandt Monitoring Project	Brandt Geese	Grades 6-8	DFS	AK, WA, OR, CA, British Columbia and Baja, Mexico
Journey North	Multiple possible	K-12	DFS	Nationwide and 7 Canadian Provinces
LiMPETS	Multiple possible (intertidal)	Middle and High School	ESP	West Coast of U.S.
Minnesota Worm Watch	Earthworms	K-12	DFS	Minnesota
MFTCS	Amphibians	N/A	ASP	Minnesota
Monarch Watch	Monarch Butterflies	K-12	DFS	37 States and 4 Canadian Provinces
NatureMapping	Varies	K-12	ESP	Nationwide and British Columbia
Ocean GLOBE	Multiple possible (coastal/ocean)	Upper Elementary, Middle and High School	DFS	California

\* Note: DSF – Designed Specifically for Students  
 ESP – Encourages Student Participation  
 ASP – Allows Student Participation