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Enrichment course in environmental education for studying coastal wetlands ecology through the visual arts

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ENRICHMENT COURSE IN ENVIRONMENTAL EDUCATION FOR STUDYING COASTAL WETLANDS ECOLOGY THROUGH THE VISUAL ARTS

by
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A THESIS

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ABSTRACT

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For Studying Coastal Wetlands Ecology
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Thesis Advisor: F. Gary Patterson
Environmental Education and Conservation Graduate Program
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The purpose of this project was to develop an environmental education course to be offered to students in grades 4-6 at the Wetlands Institute in Stone Harbor, New Jersey. The course was designed to teach coastal wetlands ecology through the visual arts to supplement and enrich the current environmental education program offered by the Institute. Although the course is designed specifically for use at the Institute, the activities can be adapted to a similar wetland site and used in part by a resourceful teacher to suit the needs of students of any age or level.

The course format consists of a series of six hands-on, interdisciplinary activities focusing on the coastal wetlands and what makes this ecosystem so important. The activities should prove useful to teachers seeking to integrate the visual arts into an environmental education curriculum and are designed to be used individually or as an entire unit. Each activity focuses on a different ecological concept and art

method.

For activity development the author did extensive research on recent environmental education programs utilizing an interdisciplinary approach to teach wetland ecology. For background data in the development of the visual art components of the project, the author consulted with art educators and referred to several books on art techniques and art education.

It is expected that the understanding gained through the implementation of this course will foster a sense of caring and responsibility towards this valuable ecosystem. This will enable the student to be a more informed, responsible, and active citizen in defense of the environment.

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CHAPTER 1

Purpose of the Study

Introduction

Coastal wetlands are demeaned and misunderstood ecosystems which are in danger of being eradicated and polluted by burgeoning human development. Since 1990 the world may have lost half of its coastal wetlands (55% in the United States), primarily through coastal development. Coastal wetlands are being drained, filled, converted to farmland, built upon and "improved" at an alarming rate. It is estimated that almost 1,000 acres of wetlands are lost every day (Wetlands, 1995, p.6).

Our State, and in particular the Southern New Jersey Coastal Area is particularly impacted by these important ecosystems. The salt marshes of Southern New Jersey are vast, flat meadows reaching from the bay side of the Atlantic coastal barrier islands to the mainland. These marshes, or coastal wetlands, fringe our back bays and coves and are intersected by meandering rivers, creeks, channels and thoroughfares. Although one of New Jersey's most important natural resources which play a significant role in the maintenance of water quality, fisheries, wildlife and recreation, the salt marsh is considered by many to be wasteland. New Jersey contains over 245,000 acres of salt marsh with 100,000 acres contained within the three coastal counties of Southern New Jersey, Atlantic, Cape May and Ocean counties (Carlson and Fowler, 1980, p. 1).

The purpose of this project was not to solve the issue of the future of the wetlands, but to develop a series of lessons that will instill a sensitivity and

aesthetic awareness of the importance and beauty of this invaluable, sensitive, and diminishing ecosystem.

Statement of the Problem

There is a recognized need for the development of a course to teach coastal wetlands ecology through the visual arts to supplement and enrich the current environmental educational program offered by the Wetlands Institute in Stone Harbor, New Jersey (Bage, 1995).

Purpose of the Study

The purpose of the study was to develop a course for the teaching of environmental education in the context of a summer program at the Wetlands Institute in Stone Harbor, New Jersey. It was a program developed for students in the 4th to 6th grade range which utilized the visual arts as an enabling mechanism to:

a) Enrich and intensify the degree of scientific education achieved.

b) Establish heightened perceptual awareness of and aesthetic sensitivity to the Wetlands ecosystem by the students who participated in the program .

Significance of the Study

The need for a visual arts driven course for the Wetlands Institute was obvious to the author. The Wetlands Institute is a unique site and philosophic specific institution designed to foster the public's awareness of the existence and need to preserve New Jersey's coastal wetlands. Located in direct proximity to Stone Harbor's back bays, the Wetlands Institute becomes a destination point for summertime visitors to the Jersey Shore.

Programs offered at the Wetland Institute in the summertime should, in pertinent part, be offered to focus on a juvenile target group. This is a particularly excellent opportunity to reach out, and not only touch, but significantly impact upon these young minds. This opportunity to stimulate and educate can be incited by the visual arts. This course was different due to its focus on the emotional and intuitive aspects of the adolescent mind. The author hoped to create an awareness upon which students can build in the future.

In addition to the opportunity to impact upon the visitors to the Jersey Shore, the study can be implemented for local students during the winter months.

Assumptions of the Study

The assumptions which the study will be based are set forth below:

1. The author has adequate knowledge and experience to write lesson outlines and enrichment activities for studying environmental education through the visual arts.

2. There exists a need for this type of project at the Wetlands Institute.

3. The selected activities will be appropriate for students in grades 4-6.

4. That current literature related to Coastal Wetlands Ecology is accurate, valid, and verifiable.

5. The materials chosen by the author for inclusion in the program of study will be meaningful and relevant.

Limitations of the Study

The limitations associated with the study are set forth below:

1. The activities chosen will be limited by funding and availability of resources.

2. Time limitations will restrict the topic to coastal wetlands.

3. The lessons are limited to students in grades 4-6.

4. The teachers that use the enrichment activities will need to possess basic art knowledge and skill to implement the lessons.

5. The lessons are limited to a time frame of six sessions.

Definition of Important Terms

aesthetic education - Refers to a tendency within art education to enlarge the scope of content by adding appreciative, critical, and historical activities to activities involving the making of art. It is also used to encompass more than just the visual arts and to include music, literature, theatre and dance (Efland, 1990, p. 246).

art education - Art education is primarily concerned with visual experiences. It is a systematic program of instruction that focuses on student's natural abilities to perceive, create and appreciate the visual arts (Colbert, 1995, p. vi).

coastal wetlands - Land along a coast line, extending inland from an estuary that is covered with salt water all or part of the year. Examples are marshes, bays, lagoons, tidal flats, and mangrove swamps (Miller, 1995, p. A27).

ecosystems - Community of different species interacting with one another and with the chemical and physical factors making up its nonliving environment (Miller, 1995, p. A29).

environmental education - An approach to teaching and learning that works to help each student develop an awareness of, and a sensitivity to, the environment and its problems (Miller, 1995, p. 11).

interdisciplinary - Combining or involving two or more academic disciplines (Webster, p. 475).

natural resources - Area of the earth's solid surface; nutrients and minerals in the soil and deeper layers of the earth's crust; water; wild and domesticated plants and animals; air; and other resources produced by the earth's natural processes (Miller, 1995, p. A33).

salt marsh - A marshy land area that is wet with salt water or flooded by the sea (Aquatic, 1987, p. 232).

visual arts - The arts, such as painting, sculpture, etc., that are appreciated for their aesthetic excellence through the sense of sight (Webster, 1983, p. 1002).

CHAPTER 2

Review of Related Literature

Introduction

The author's review of related literature focused first upon formulating a general theme for integrating a visual arts curriculum with the goals of environmental education. Thereafter, the focus shifted from the general to specific examples of environmental education programs utilizing an interdisciplinary approach with visual arts components. Finally, the author will seek to correlate the general and specific themes, goals, and instructional guides with the specific objective of this paper: the formulation of an institution and environmental theme specific educational program for students within an appropriate target age group.

The Interrelationship Between the Visual Arts and Environmental Education

> "If humankind adopts the ethics of belonging to the earth, then it will indeed belong. It will fit in; it will be fit; it will survive. If on the other hand it does not adapt this sense of belonging, then not-belonging to will 'come true': humanity will inevitably pollute, breed, or explode itself out of existence. It will have proven maladapted, failed the test for survival."
>
> David Oates (Wisconsin, 1985, p. 11)

"Environmental education must strive to help every student: (1) to develop an awareness of, and a sensitivity to, the environment and its problems; (2) to acquire knowledge and understanding of how the natural systems that comprise our environment work; (3) to foster an environmental

ethic upon which patterns of conduct toward the environment may be founded, developed, and integrated; and (4) to develop the interpersonal skill necessary to effectively discharge the responsibilities of citizenship in improving and protecting the environment at the municipal, county, state, national and global levels. With the development of the awareness, knowledge, ethics, and political skills as aforesaid, a sense of responsiblilty and commitment to the future will hopefully be engendered in every student in order that our environment can be defended and preserved in the future" (Wisconsin, 1985, pp. 11-12).

In formulating a statewide goal, the New Jersey Environmental Education Commission (New Jersey, 1993, p. 1) seeks to develop in all the citizens of our State, children and adults, the knowledge, attitudes, values, skills and behaviors needed to maintain, protect and improve the environment. The Commission's Plan is accompanied by concrete recommendations for implementation that include both the formal education that takes place in schools and colleges and the informal, life long need for continuing education and enlightenment that occurs in places such as nature centers, parks, cultural organizations, civic groups, governmental agencies and businesses. The implementation and future development of this Plan will be accomplished through an open process involving citizens from all areas of the State and all segments of our modern society: government, business and industry, and academia (New Jersey, 1993, p. 1).

On a local level, the ultimate goal of the author's enrichment course is to provide the impetus for developing the necessary awareness, sensitivity and ethic needed for children to continue to develop as environmentally attuned students and adults. Our future depends upon this type of program and the success such programs have in developing concerned citizens working to

maintain and improve the quality of the environment for the preservation of all life on this earth (Aquatic Project Wild, 1987, p. v).

As perceived by the Wisconsin Department of Public Instruction (Wisconsin, 1985, p. 84) art education is primarily concerned with the aesthetic experience - the perception and understanding of beauty. The aesthetic experience involves a heightening of an awareness of all aspects of the senses. The aesthetic experience appeals to almost all children and adults on a very primary and easily perceived level. Environmental education should also consider all aspects of the systems that make an impact upon the environment - natural, man-made, technological, social, economic, political, cultural, aesthetic - and acknowledge their interdependence (Wisconsin, 1985, p. 84). It is on this most human and emotional level that the visual arts can become an effective tool for implementing an environmental awareness.

> "I would suggest that the teacher should not concentrate on teaching the child to paint or print, but to see: to help the development of the child's visual language both in understanding and expression, and to relate that language to the everyday world, and thus promote hopefully, a greater awareness, understanding and concern for the environment."
>
> Eileen Adams (Wisconsin, 1985, p. 85)

The importance of the visual arts as a component of an effective environmental education program is apparent to the author. The visual arts concern for aesthetics and the development of perceptual awareness are closely related (McFee, 1977, p. 144). The Guide to Curriculum Planning in Art Education (Wisconsin, 1994, p. 10) reports that perceptual awareness focuses on helping students develop certain process skills that enable them to perceive and discriminate among stimuli; to process, refine and extend those perceptions; and to concurrently acquire an aesthetic sensitivity to both natural and man-made environments. The manner in which perceptual awareness is

developed through the visual arts is evident in all mediums. In all art processes, the core elements and principles of design are developed. Core design elements include texture, color, line, shape and space. Core design principles are balance, contrast, rhythm, movement and repetition. In order to grasp and understand these elements and principals of design, students must be involved in the kinds of visual activities required for the development of perceptual awareness (Wisconsin, 1994, p. 10). Further research in The Guide to Curriculum Planning in Environmental Education formulated by the Wisconsin Department of Education (Wisconsin, 1985, p. 86) indicates that the potential contribution of art education to the development of observation skills is significant for a number of reasons. Students use their senses of sight and touch in observing colors and textures. In teaching the elements of line, shape, and space, an understanding of spatial relationships should develop. In teaching the principal of contrast, activities on observing similarities and differences develop into an understanding of classification schemes (Wisconsin, 1985, p. 85).

Research findings in a study by the National Art Education Association (Caucutt, 1975, p. 86) indicates that students instinctively relate to nature, but they must be taught to observe, and to see the existence of a natural order in all the components of our environment. Environmental education through the visual arts can provide the observation skills necessary to illuminate the natural order of our environment. A creative teacher through the utilization of the visual arts can open a student's eyes and provide the student with an aesthetic awareness finely tuned enough for the student to see and feel the environment. Through these illuminated senses, intellectual, empirical and scientific understanding will flow (Caucutt, 1975, p. 86).

Art teachers must be concerned with the function and purpose of art in aesthetic expression and communication, and how the arts help children understand themselves and the world around them. The premise of the National Art Education Association (Caucutt, 1975, p. 86) is that today there is a new awareness of our relationships to one another and to our environment. There is a concern for experiencing our surroundings through our senses. The child's relationship to the environment is dynamic and creates patterns of activities that are the basis for insights and judgments, but the child must be educated to focus a perceptive and critical attitude upon his or her surroundings (Caucutt, 1975, p. 86).

It is the focus of the article "Environmental and Aesthetic Education for the Primary Grades" (Sarkas, 1975, p. 85) that ecology and art go hand in hand. Art teachers are in a unique position to assist students in examine the many dimensions of our environment. Through creative art instruction focused on stimulating an environmental awareness, children can begin to establish the perceptions necessary to turn thought into constructive action resulting in the preservation of the environment in the future (Sarkas, 1975, p. 85).

Further research by the National Art Education Association (Caucutt, 1975, p. 87) suggests that time should be provided for children to observe and become familiar with both the environment and art. An opportunity should be provided for children to experiment with materials, man-made and living things, to explore ideas, and to discover the components of the systems that comprise our environment. Some of the objectives of an environmentally sensitive art program may consist of continuous learning experiences that include two and three dimensional art activities related to examining the environment and its component systems (Caucutt, 1975, p. 87).

As indicated by Yasso in his article "Discovering Science in Art, Literature, and Music" (Yasso, 1991, p. 10), it is assumed that the study of science can be enriched when the senses and emotions are brought to the object or phenomenon being studied. Sometimes one or more artistic explorations of the same subject can excite the student's interest and involvement in the study to the point where a rare intuitive leap of creative thought is achieved. Across the broad spectrum of students, such artistic explorations foster the learning process (Yasso, 1991, p. 10). Sometimes artistic representation can provide the intrinsic motivation for the study (Yasso, 1991, p. 10) (Hungerford and Volk, 1990, p. 11). It is Yasso's opinion that various forms of art allow the teacher to have students of all ages explore science in a greatly enriched environment. Along the same vein, the article "Art and Environment: An Integrated Study on the Web of Life" (Larson, 1992, p. 2) espouses the principle that science and art have the ability to become great working partners through environmental studies. The article indicates that art education combined with the sciences can be a leading force in raising the consciousness of students and teachers to the needs of the planet. Although science education has led the way with such programs as Project Wild (Aquatic, 1987, p. vii), the arts can become a partner with science in a new and more holistic way in teaching (Larson, 1992, p. 2). As shown in research previously stated by the author (Caucutt, 1975, p. 86) (Sarkas, 1975, p. 85) (Wisconsin, 1985, p. 10), by including environmental aspects to the visual art curriculum, students's will be taught that one of the similarities shared with the natural world and the arts is the need for beauty. The Earth's beauty is a powerful and mysteriously soothing force (Larson,1992, p. 2). As the mathematician Alfred North Whitehead once stated,

"After you understand all about the sun, and the stars, and the rotation of the earth, you may still miss the radiance of the sunset."

Alfred North Whitehead (Larson, 1992. p. 2)

A holistic world view as emphasized in Larson's research highlights that the parts are only understandable if viewed in dynamic relationship with a functioning whole. Through holistic thinking and teaching, people can view themselves, as only one of many individual but necessary and integrated elements within the Earth's complex and mysterious system (Larson, 1992, p. 2). Through an environmental curriculum and the use of aesthetic creativity in a partnership with scientific thought, perhaps much needed solutions can be found to problems that face the environment (Larson, 1992, p. 2). The sciences traditionally carried the burden of teaching about the environmental and ecological problems that need solutions. Science has searched for technical and theoretical answers, and the arts have focused on the aesthetic elements of the Earth. Larson feels that what seems to have gone unrecognized is that to come to answers through science, there first has to be creative brainstorming and, more often than not, even some drawing (Larson, 1992, p. 3). The following is a curriculum designed by Larson that incorporates art and science with exploration of environmental themes. It is a design for an integrated art and science curriculum.

The curriculum can be divided into three areas of study: goals, problems, and approaches. The goals should include:

1. Enriched outlook on the partnership between art and science.
2. Possible solutions to environmental problems through utilization of creativity and science.
3. Confidence in self-expression from a solid base of scientific and

creative abilities.

4. Enlightening others through the visual product.

The problems can be grouped as: Land, Water, Air and Population.

The approaches include:

1. Looking at the problem
2. Creative Drama/Imagining
3. Brainstorming/Thinking time
4. Creating

In designing this curriculum model, Larson is expressing her belief that holistic thinking is the single most important component to environmental education. She believes that a raised consciousness about the environment allows growth to come about through aesthetics and creative problem-solving. She anticipates that this approach will allow students to come to the realization that there is a unity to all life, symbolized by the web, and that they are a real part of the unity. She paraphrases the following quote by Chief Seattle in her research; "If we touch one part of the web, it affects all other parts of the web as well." Understanding the web of life requires holistic thinking and teaching methods (Larson, 1992, p. 4).

In Leon Winslow's "The Integrated School Art Program" (Efland, 1990, p.209), the integration of art with other studies is recommended. Winslow strongly advocated creative expression, but also maintained that art should be taught for broad cultural purposes, that in this capacity it can function as an important integrating agent in the curriculum. He also believes that aesthetic growth both enlarges childrens' social outlook and enriches their lives (Efland, 1990, p. 209). It is his contention that there should be a balance between

directed and creative activities. Directed activities according to Winslow, are those that involve control, dictation, tracing, copying, criticism, drill, reading, demonstrating, and suggestions from the teacher. Creative activities involve freedom, originality, experiment, imagination, inspiration, emotion, expression, and appreciation (Efland, 1990, p. 209).

Research done by McFee and Degge in their book Art, Culture, and Environment states that everyone influences the quality of the shared environment (McFee, 1977, p. 10). They write that the ways people interact with each other and with nature create the patterns within which they live. As populations increase and resources decrease, the need for humane places to live and work becomes more critical. They also write that because the natural environment and the built environment - buildings, spaces, and transportation networks - affect each other, careful consideration of their interrelationship is essential. They recommend that restoration and recycling of older buildings and streets and new development alike must be planned to harmonize with the life styles of people and the natural environment. The quality of the environment depends on people's ability to use their design sensitivity, their social responsibility, and their ecological concerns together to solve environmental problems. When this is done, art is not an appendage, but an integral part of decision-making (McFee, 1977, p. 10).

To summarize this section, the following list of typical environmental learner outcomes found in The Guide to Curriculum Planning in Environmental Education (Wisconsin, 1985, pp. 86-87) suggests ways in which the visual arts can have a major role to play in the development of a positive environmental ethic in the development of citizen action skills. The role of the visual arts in an appropriate environmental educational program is significant, and may lead,

hopefully, in the future to a resolution of the environmental dangers that threaten our future generations.

Students will:

-recognize the relative quality of their immediate environment and other environments beyond it;

-recognize that human sensitivity to, and appreciation of, environmental quality can be enhanced through the practice of various art forms;

-compare and contrast the humanizing and dehumanizing effects of environments constructed by people;

-develop a sense that they affect, are affected by, and have a responsibility for the environment;

-explain how art contributes directly to aesthetic awareness of, and sensitivity to, natural and built environments;

-make environmental decisions based on aesthetic concepts developed in art;

-recognize that art reflects the artist's experiences, culture, and environments;

-realize their responsibility to positively affect the environment by influencing others to utilize appropriate design;

-evaluate a debate contrasting socio-economic interests with aesthetic considerations; and

-demonstrate skill in using creative expressions as a means of bringing about constructive action to resolve social and environmental issues (Wisconsin, 1985, p. 86, 87).

It is the author's intention to assimilate this breadth of literature and use the preceding concepts to develop an integrated curriculum plan incorporating

the attributes of the visual arts to foster a heightened response to environmental subjects in the target age group.

Review of Environmental Education Programs

This author felt it necessary to review other environmental education programs used to teach coastal wetlands ecology with visual arts components as sources of background for this project.

The extensive educator's guide WOW! The Wonders of Wetlands is designed to meet the need for comprehensive classroom and outdoor wetland activities for grades K-12. The guide is produced by Environmental Concern, Inc. (St. Michaels, MD) and The Watercourse (Bozeman, MT); both recognized leaders in the fields of water education and wetland awareness (Slattery, 1995, p. iii). The guide includes background material for teachers preparing wetland study units. It is divided into six chapters, each starting with a short list of themes and recommended activities to address those themes. It contains material on organizing field trips, making inexpensive sampling equipment, and getting involved in wetland enhancement and stewardship. It is suggested by the authors of the text (Slattery, 1995, p. xiii) that a comprehensive unit should include at least one general wetland introductory activity plus one activity each from the plants and animals, water, soil, and culture/issue sections. In addition, all units on wetlands should culminate in an action project of some kind (Slattery, 1995, pp. 288-316). Teachers are strongly encouraged to incorporate these lessons into disciplines other than science. It is important to tie environmental studies to social studies, art, language arts, mathematics, and other skills (Slattery, 1995, p. xiv).

There is a resource list at the back of the guide that leads to more

sources of wetland information and activities. All activities are labeled with grade level ranges to be used as guidelines . The author finds this work to be an excellent reference for developing a program in coastal wetlands ecology. There are many visuals that can be utilized and when compared to the following programs researched by the author it is the most thorough examination of the wetlands.

The curriculum guide Discover Wetlands was developed to provide educators in Washington State with teaching materials on wetlands. It is a collection of information and activities, compiled from a variety of sources, that focuses on wetlands in Washington State: what and where they are, why they are valuable, and how human actions have affected them. While the target age level is grades 4-8, some of the activities have application to a variety of audiences. The guide includes background information for teachers; 15 activities for exploration, problem-solving and creativity; reproducible graphics and activity sheets; and appendixes that offer educational resources (Lynn, 1995, p.1).

The author found through researching this curriculum guide that teaching about wetlands fits well into curriculum goals for science, social studies, environmental education, English/language arts, and art (Lynn, 1995, p. 4). The curriculum guide specifically points out that given their numerous ecological values, the history of their losses and the fact that they are a current, often controversial environmental issue, wetlands provide an ideal topic for a variety of disciplines - separate or, ideally, integrated into a comprehensive, interdisciplinary unit such as this (Lynn, 1995, p. 1). The author found less examples of creative problem-solving activities with visual arts components in this guide as compared to the programs Aquatic Project Wild and WOW! The

Wonder of Wetlands also reviewed by the author.

Aquatic Project Wild, as defined in the preface of the text (Aquatic, 1987, p.vii), is an aquatic education activity guide designed to explore the worlds of water and the aquatic habitats they support. Related to the earlier Project Wild, this curriculum is an interdisciplinary, supplementary environmental and conservation education program emphasizing coastal and marine concerns (Aquatic, 1987, p.vii). Upon review, the author found the activities easy to comprehend and utilize. When compared to the program WOW! The Wonder of Wetlands , the activities displayed a higher affective learning approach (Iozzi, 1989, p. 3). Aquatic Project Wild had specific sections with information and lessons about wetlands among many other sections dealing with other aspects of aquatic life, whereas WOW! The Wonder of Wetlands was dedicated to wetlands in its entirety. Both guides were excellent resources for the author's project.

The New Jersey Audubon Society's Bridges to the Natural World K-6 environmental education guide featured outdoor activities utilizing many of the state's distinctive habitat types and provides extensive background in an easy to use package. In Section One, fifteen habitats of New Jersey are covered, including coastal dunes and forest, the salt marsh, and the beach. Section Two includes simulation, dramatization, exploration, and discovery activities. The author found the habitat descriptions extremely informative, comprehensive and well illustrated. The activities appeared designed to stimulate children's imaginations while teaching scientific concepts. The lesson plan components, "Putting It All Together" and "Take Another Step" (Kane, 1992, p. 100) espouse teaching to achieve responsible environmental behavior; an approach researched by the author in the article "Changing Learner Behavior Through

Environmental Education" (Hungerford and Volk, 1990, p. 8-17). Upon reviewing the behavior model in this article, the author found this education guide successful in attempting to put knowledge to work through extended activities designed to assure the development of new attitudes and new behavior for the students, making the learning experience a part of life (Kane, 1992, p. 100).

A booklet published by the National Wildlife Federation entitled Ranger Rick's Nature Scope: Wading into Wetlands was reviewed by the author. It was found to be similar to WOW! The Wonder of Wetlands in that it dealt exclusively with wetlands. The author found Sections One, Two, and Four the most helpful in developing an enrichment course on coastal wetlands ecology. The "copycat" pages were also informative and appropriate for the target age level (National, 1989, p.1).

Wetland Wonders, a booklet published by the North Carolina Division of Parks and Recreation for Goose Creek State Park was reviewed. The author found the activities to be site specific and lacking in creativity. Worksheets or study guides were not included.

In this section the author has examined literature related to the teaching of wetlands ecology. A large percentage of this material was useful when the author prepared the enrichment course on teaching coastal wetlands ecology through the visual arts.

The Wetlands Institute

The author's thesis topic an "Enrichment Course in Environmental Education for Studying Coastal Wetlands Ecology Through The Visual Arts" was designed to be implemented into the environmental education program of

The Wetlands Institute of Stone Harbor, New Jersey. For this reason an overview of the philosophy and environmental education programs of The Wetlands Institute are included in the author's literature review.

> "When we go down to the low-tide line, we enter a world that is as old as the earth itself - the primeval meeting place of the elements of earth and water, a place of compromise and conflict and change."
>
> Rachel Carson (Carson, 1955, p. 25)

"The Wetlands Institute, founded in 1969 by conservationist Herbert H. Mills, is a private non-profit organization dedicated to public education and scientific research concerning intertidal salt marshes and other coastal ecosystems. The Institute is supported by private gifts, donations, and membership dues. It is located in New Jersey's Southern Shore region among resort communities famous for beaches, bird watching and fishing" (Wetlands, 1995, p. I).

The environmental programs of The Wetlands Institute aspire to the following three goals:

1. To encourage understanding and appreciation of the unique nature and value of coastal wetlands;
2. To increase understanding, through research, of the natural processes of coastal ecosystems and the effects of man's activities on these processes;
3. To provide opportunities for the public to experience and enjoy the natural aspects of the coastal environment (Wetlands, 1995, p. 1).

As previously described, these goals coordinate with the aims of the New Jersey Environmental Education Commission's "Environmental Education in New Jersey: A Plan of Action" for private, non-profit environmental organizations, whose missions support environmental awareness, education or

protection (New Jersey, 1993, p. 18). These organizations include conservation organizations, environmental education alliances, issue-based organizations, research groups, environmental lobbying groups, interpretive and environmental centers (such as The Wetlands Institute), nature, and organizations that focus on outdoor and recreational pursuits (New Jersey, 1993, p. 18).

The Plan of Action has a number of recommendations directed towards these organizations. The Plan suggests that each organization designate a staff person to act as liaison to either the New Jersey Environmental Education Commission of the Inter-Agency Work Group, as well as communicate regularly through the Environmental Education Network (New Jersey, 1993, p. 19). The Plan also recommended that the Board of Directors and/or staff endorse and adopt the guiding principles into their mission statement and incorporate the knowledge, attitudes, values, skills and behaviors into all appropriate initiatives. These educational organizations should continue to provide members and citizens with a better understanding of the environment through such tools as journals, conferences, workshops, newsletters, events, programs, projects, interpretive walks and displays. Finally, organizations should network with local groups on environmental initiatives (New Jersey, 1995, p. 19).

The Wetlands Institute incorporates these guiding principles into it's many programs and activities. The manner in which these principles are incorporated are through the development of the following educational programs and events:

1. Programs and Field Trips for schools, scouts, groups, families and individuals.
2. Summer Nature Classes for Children - preschool through sixth grade.

3. Preschool Classes throughout the year.
4. Family Adventures such as guided marsh walks and birding expeditions.
5. Lecture Series on coastal issues, wetlands and marine science, and nature.
6. Featured Creature Days for families in summer.
7. Special Events and Dinners on holidays and weekends.
8. Wings 'n Water Festival with national decoy and carving shows, and wildlife art.
9. Student Internships in environmental education and research.
10. Bus Trips to museums, exhibits and natural areas.
11. Films and videotape programs.
12. Workshops for adults such as carving, painting, quilting, and crafts (Wetlands, 1995, p. 3-4).

The Institute's buildings include classrooms, an exhibit and lecture hall, observation tower, research laboratory, library, and a salt marsh and aquaria exhibit. The Institute has also built a salt marsh trail, a marsh boardwalk, and a 100' pier over a tidal creek. The surrounding salt marsh is part of a 6,000 acre publicly-owned tract of coastal wetlands. The marsh and nearby upland and barrier island habitats serve as outdoor classrooms (Wetlands, 1995, p. 2).

The Wetlands Institute has the philosophy and facilities to implement the type of enrichment course the author seeks to develop. In the next chapter the methods used in preparation of the enrichment course will be discussed.

CHAPTER 3

Design of the Project

Introduction

In this chapter the author will explain the methodology employed in creating this enrichment course, sources used to develop the course, the format for the final presentation, and information on the background experience of the author.

The project is entitled an "Enrichment Course in Environmental Education for Studying Coastal Wetlands Ecology Through the Visual Arts" and is designed to integrate a visual arts curriculum with the goals of environmental education for a target age group of grades 4-6. The course format consists of a series of hands-on, interdisciplinary activities focusing on the coastal wetlands and what makes them important. The activities should prove useful to teachers seeking to integrate the visual arts into an environmental education curriculum and are designed to be used individually or as an entire unit.

Methodology

In an effort to design a program to integrate environmental education into a visual arts curriculum, the author chose the topic of coastal wetlands initially because of their local abundance and relevancy to the

student population. In the author's search for a nearby wetland to use as a study site for field study activities, the author contacted the Director of Education for the Wetlands Institute of Stone Harbor, New Jersey. The Director of Education, Karen M. Bage, expressed an interest in the development of a course to teach coastal wetlands ecology through the visual arts to supplement and enrich the current environmental educational program offered by the Institute. She also indicated a need for a summer or winter course specifically designed for grades 4-6 (Bage, 1995). Although the author has developed the course to be taught at the Wetlands Institute to grades 4-6, it is not limited to this facility and age level. The activities can be adapted to a similar wetland site and used in part by a resourceful teacher to suit the needs of students of any age or level.

Besides the educational goals of the Wetlands Institute dictating lesson topic selection, underlying the author's curriculum decisions was belief in the value of the visual arts as an educational learning facilitator for environmental education. The value of scientific research and implementation notwithstanding. The author believes the aesthetic elements of visual arts lesson techniques are particularly valuable in teaching the target-age student. As an example, the chemistry or engineering student may develop the ideological motivation necessary to invent an environmentally friendly machine through an aesthetic awakening provided by the visual arts. The reality of the modern world is such as to magnify the old adage, a picture is worth a thousand words. In politics and business the practical importance of images is astounding. Multi-media techniques can provide the motivational impact and

foundation for teachers and students to build upon.

The author surveyed the natural features of the Wetlands Institute's nature trail to determine the areas most suitable for nature lessons. Accessibility, safety, and the diversity of habitats were considered.

The author reviewed several environmental education programs utilizing an interdisciplinary approach to teach wetland ecology to develop the lesson format utilized in her course. WOW! The Wonder of Wetlands, an educator's guide produced through a partnership between Environmental Concern, Inc. and The Watercourse (Slattery, 1995), was used for background information and several activities developed in the author's course utilized components of the lessons in this guide. The curriculum guide, Discover Wetlands, published by the Washington State Department of Ecology (Lynn, 1995), was examined by the author and the lesson plan format was found to be best suited for the author's project. This format was adapted and used in Chapter Four. The author used the Plant and Animal Cards (Appendix A) from this curriculum guide for field guides in her project.

Both WOW! The Wonders of Wetlands and Discover Wetlands curriculum guides were purchased directly from the publisher by the author using the information in the bibliography of this project (Slattery, 1995) (Lynn, 1995).

Format for Final Presentation

The author's project is organized into six sections. It is designed to be taught either in six consecutive daily sessions or six consecutive Saturday sessions. The activities in each section are formatted in the

following manner:

Title: the name chosen for the activity

Grade Level: suggests appropriate learning levels

Setting: suggested site, such as indoor classroom or outdoor site

Subject Areas: disciplines to which the activity applies

Vocabulary: terms defined in glossary

Objectives: qualities or skills students should possess after the activity

Methods: summary of the activity

Background: relevant information about activity concepts

Materials: supplies needed to conduct the activity

Procedures: step by step directions for the instructor

Extensions: ideas for exploring the activity in greater depth

Evaluation: assessment activities or questions

This format was adapted from a similar design in the curriculum guide Discover Wetlands (Lynn, 1995). It was chosen so the activities can be used individually or as part of an entire unit.

Teaching aids, including work sheets and visuals which supplement the activities, are provided in the Appendix.

Sources of Information

Varied sources were investigated and utilized for this project. In addition to the two aforementioned curriculum guides WOW! The Wonders of Wetlands and Discover Wetlands , the author reviewed Aquatic Project Wild (Aquatic, 1987), Bridges to the Natural World (Kane, 1992), Ranger Rick's Nature Scope (National, 1989), and Project Wild (Project, 1986) for background data in activity development for teaching

students coastal wetland ecology.

For background data for the visual arts components of the author's project the author consulted with art educators and referred to several books on art techniques and art education.

The author used the Rowan College Library, the Cape May County Public Libraries of Upper Township and Cape May Court House, the Education Information and Resource Center (EIRC) in Gloucester County, the Environmental Protection Agency (EPA), the West Deptford Public Library, the Wetlands Institute of Stone Harbor, and the Brigantine Wildlife Refuge for both current and professional literature related to her topic.

Background of the Author

The author is a graduate of Florida International University with a Bachelor of Science degree in Art Education. She has received her teaching certificates from the State of New Jersey in Art Education and Elementary Education. She is presently a matriculated student at Rowan College of New Jersey in the Environmental Education and Conservation Master of Arts program. She has fourteen years of experience as an art instructor in the following capacity:

Grades 7-12 in Melbourne, Victoria in Australia - 3 years

Grades 4-8 in Ocean City, New Jersey - 4 years

Grades K-2 in Marmora, New Jersey - 7 years

She is currently employed by the Upper Township Board of Education in the Upper Township Primary School as an art instructor and teaches kindergarten through second grade students. She is the coordinator of

an "Art Goes To School" program, a member of Upper Township's P.T.A. Environmental Awareness Committee, and the environmental coordinator for the Upper Township Primary School. In this capacity she has implemented a school-wide annual "Earth Day Celebration" and "Earth's Birthday Party".

In addition, the author is a member of the Sierra Club, the New Jersey Teachers Association, Phi Delta Kappa - Rowan Chapter, and the Country Shore Women's Club. She has worked as a professional photographer and traveled extensively throughout Australia, Southeast Asia, India, and Europe.

CHAPTER 4

Enrichment Course in Environmental Education for Studying Coastal Wetlands Ecology Through the Visual Arts

Introduction

This chapter contains the author's project entitled an "Enrichment Course in Environmental Education for Studying Coastal Wetlands Ecology Through the Visual Arts". It is a program developed for students in the 4th to 6th grade range which utilizes the visual arts as an enabling mechanism to:

a) Enrich and intensify the degree of scientific education achieved; and

b) Establish heightened perceptual awareness of and aesthetic sensitivity to the wetlands ecosystem.

Each activity in this course includes the following information:

Title: the name chosen for the activity

Grade Level: suggests appropriate learning levels

Time Range: length of activity

Setting: suggested site, such as indoor classroom or outdoor site

Subject Areas: disciplines to which the activity applies

Vocabulary: terms defined in the activity

Objectives: qualities or skills students should possess after the activity

Methods: summary of the activity

Background: relevant information about activity concepts

Materials: supplies needed to conduct the activity

Procedures: step by step directions for the instructor

Extensions: ideas for exploring the activity in greater depth

Evaluation: assessment activities or questions

The course is designed to be taught either in six consecutive daily sessions or six consecutive Saturday sessions and is constructed into six sections. The activities should prove useful to teachers seeking to integrate the visual arts into an environmental education curriculum on coastal wetland ecology and are designed to be used individually or as an entire unit.

The titles of the activities are as follows:

Activity 1: Wetland Plant Adaptation

Activity 2: Handmade Paper with Inlaid Wetland Plants

Activity 3: Wetland Watercolors

Activity 4: The Story of the Wetland Food Web

Activity 5: Wetland Fish Sculpture

Activity 6: Birds of the Wetlands

Teaching aids, including work sheets and visuals which supplement the activities, are provided in the Appendix.

It is the author's suggestion that the indoor classroom or studio should have space reserved for the display of student art as well as art reproductions or original art by local artists using the wetlands as subject matter. It is the author's opinion that displaying artwork is part of the process of learning about art.

For every activity the author suggests the following general principles

of art instruction:

1. Anticipate the skills needed for an activity. Always try out the steps and procedures the students will use before you introduce a new art technique or material.

2. Remember that in art, unlike many subjects, there often are several equally effective ways to solve a problem, interpret a theme, or answer a question.

3. Encourage development of skills by giving immediate praise to students when they are displaying the appropriate behavior.

4. Remember to emphasize the process of learning about art, not just the final result.

5. Encourage self-evaluation. Ask students to identify facets of their work which are visually effective. Have students consider how they might improve their work through additional practice or effort.

6. Encourage students to consider the function or purpose of their work.

7. Become familiar with the elements and principles of design used in the creation of a work of art. The elements include color, value, line, shape, form, texture and space. The principles are balance, contrast, proportion, pattern, rhythm, emphasis, unity and variety. They are guidelines that aid artists in composing designs (Chapman, 1994).

Activity 1: Wetland Plant Adaptation

Grade Level: Grades 4-6

Time Range: 60 minutes

Setting: Indoor introduction, Outdoor wetland site

Subject Areas: Life Science, Environmental Education, Biology, Art

Vocabulary: Adaptation, hydric soils, evolve, hydrophyte

Objectives

1. Students will be able to identify and describe three features of wetland plants that help them adapt to a wetland environment.
2. Students will collect a variety of wetland plants and press them in a handmade plant press.

Method

Out in the field, students will study plants by using hand lenses and the Wetland Plant Activity Paper (Appendix A). They will collect samples of plants and press them in preparation for Activity 2 of this guide.

Background

Wetland plants are unusual. These "hydrophytes" (water-loving plants) are uniquely adapted for living in their habitat whether that be freshwater marsh, swamp, stream or estuary. They have evolved ways to obtain oxygen in water-logged soils, to reproduce underwater, to rid themselves of excess salt, or to adapt to changing water levels, thus enabling them to survive in habitats where other plants cannot (Lynn,

1995, p. Unit 1-13).

Looking at the form and life cycle of a plant tells us a lot about how it is adapted for survival. Natural selection, or "survival of the fittest," is the theory that those organisms best suited for survival live to reproduce and pass on those genes. Adaptations that enable an organism to survive in its habitat are fascinating to study (Lynn, 1995, p. Unit 1-13).

One of the largest challenges to a wetland plant's survival is its ability to get air. Leaves, stems or any other green, photosynthetic organs need to take in carbon dioxide, and release oxygen gas. When light is unavailable or it is too cold to photosynthesize they must also take in oxygen, since they cannot produce it without light. Roots always need a source of oxygen. Plants that live in well-aerated, upland soils get air directly from the atmosphere and through the soil. Wetland plants must have adaptations to aid in gas exchange, such as air roots, buttress roots, spongy stems, and other air-filled tissues (Lynn, 1995, p. Unit 1-14).

Materials

Part 1 - *for each team of 2-3 students*

Wetland Plant Activity Paper (Appendix A)

clipboard and pencil

chalkboard or easel

magnifying glass or hand lens

field guides (Plant Cards, Appendix A)

optional: knife for collecting samples and for cutting into plant to see internal structures

Part 2

flat pan of water

wax paper

newspaper

several heavy books

Procedure

Part 1 - 40 minutes

Wetland plant identification

Outdoor wetland site

1. Divide the class into teams of 2-3 students. Set a time limit. Pass out Wetland Plant Activity Paper and tools listed under materials (Part 1). Have each team focus on plants in a specific area to work on this activity.

2. Instruct teams to find as many examples of plant adaptations as they can and to carefully collect samples of each. When collecting samples instruct them to take care not to trample the wetland and to collect small sections of a plant and not the whole plant by the roots. Use field guides to identify and label plants.

3. Afterwards, bring the class together to share their observations. Discuss different plant adaptations (Lynn, 1995, p. Unit 1-14).

Sample discussion topics:

Ask students to name the wetland habitats in which they have found plants; list them on the board. (In water, along water's edge, etc.)

Ask students to consider how their house or garden plants would

survive in these environments. Why? (soil is too wet, too saline, or water levels fluctuate.)

Ask them to try to figure out what makes wetland plants able to survive where others cannot (Lynn, 1995, p. Unit 1-14).

Part 2 - 15-20 minutes

Wetland plant press

1. Place the plants in a pan filled with water to clean them.
2. Lift the plants and break them into aesthetically pleasing sections to be used in a work of art.
3. Gently sandwich them between two sheets of wax paper.
4. Place the plants and wax paper between several sheets of newspaper.
5. Place the newspapers, wax paper, and plants on a flat surface and stack heavy books on top (Aquatic, 1989).

Extensions

Press the collected wetland plants and utilize them in the paper-making art lesson in Activity 2 of this guide.

As part of the design, students can use thin permanent markers to label plants on artwork completed in Activity 2.

Cover a bulletin board with a larger-than-life model of a plant, labeling the parts and describing how it is adapted for life in a wetland.

Make sketches of each plant and label accordingly to create a field guide.

Evaluation

Students will identify three environmental factors to which wetland plants are adapted. Describe how plants are adapted for each factor, and give at least one example. Part 1 of this activity has been modified from a similar plant identification activity in the curriculum guide Discover Wetlands (Lynn, 1995).

Activity 2: Handmade Paper with Inlaid Wetland Plants

Grade Level: Grades 4-6

Time Range: 60-90 minutes

Setting: Indoor classroom

Subject Areas: Environmental Education, Art

Vocabulary: Conservation, recycle

Objectives

1. Students will describe two ways in which natural resources can be conserved by recycling paper.
2. Students will demonstrate the process through which paper is recycled by using basic papermaking techniques.
3. Students will recognize the visual characteristics of the design elements (line, color, value, shape, textukre, and space) in forms that are natural and of human origin.

Method

Students will use handmade papermaking techniques and wetland plants to create a work of art.

Background

Paper is fun and simple to make. It can be done with little equipment or expense. Paper is all around us. It abounds at newsstands, supermarkets and in the mailbox, but the paper made by students will be special.

Once the basic techniques are taught there are many different ways the paper can be used. It can be drawn on, printed on and written on. Books and stationary can be made. There are, also, many variations within the paper making process. It can be colored and objects can be embedded in it (Grummer, 1980).

Handmade paper making goes back to 105 A.D. when a Chinese eunuch, T'sai Lun, found a way to make paper from old rags. The Chinese closely guarded their new secret and it wasn't until 500 years later that paper making reached Korea and Japan. It then spread westward to Europe. In the United States, a German colonist set up the first American paper mill near Philadelphia in 1690. Until 150 years ago there was no paper other than that made by hand (Grummer, 1980).

The main ingredient of all paper is cellulose fiber. Since all living plants are made up of this fiber all plants can produce paper. In practice, however, some plants are too weak and others take too much time and energy to clean and break apart for paper making. Cotton is 95% cellulose and it is the most common fiber for hand paper making. Others that are used include abaca (banana plant), sisal, linen, milkweed, iris and okra. Many common weeds and garden plants can also be used (Grummer, 1992).

The process of paper making teaches students about the conservation of natural resources. By purchasing recycled paper or making recycled paper, trees can be saved and the garbage problem lessened.

Materials

a blender

an iron

scraps of old paper torn into small pieces; soft, thick paper is best

water

a plain wooden picture frame, 8 x 10 inches or larger

a piece of window screen material, 12 x 14 inches or larger

a staple gun or some waterproof glue

pressed wetland plants from Activity 1

a large plastic dishpan

some clean rags, at least 15 x 15 inches square

old newspapers

a rolling pin

metal shears or scissors to cut the screen

chlorine bleach, optional

Procedure

1. Put the torn scraps of paper and water in the blender to soak.
2. Meanwhile, stretch the screen over the picture frame and staple it into place.
3. Blend the paper and water until it's smooth pulp. If you're using any colored paper scraps and you want your paper to be white, add 1/4 cup of chlorine bleach to the blender.
4. Pour batches of pulp into the tub, adding a little water if the pulp is too thick, until you have around 5 inches of mushy water in the dishpan.
5. Place the pressed plants in a handy spot near the pan of pulp.
6. Dip the frame under the pulp; then, holding it level, shift it back

and forth until a layer of pulp settles evenly over the surface. This layer should be around 1/2 inch thick.

7. Without tilting the frame, lift frame and pulp layer out of the dishpan. Hold the frame over the pan to let water drain out. If the pulp clumps together or if there are holes, put the frame back under the pulp layer and try again.
8. As soon as you have drained most of the water from the pulp on the frame, press flattened plants onto the layer of pulp in a pleasing arrangement. They need not be completely covered, but must be at least partially covered or they won't stay on the paper when it dries. You can gently push some pulp over the leaves to help bury them.
9. Place a clean rag over the top of the drained pulp layer. Press down gently, squeezing out more water.
10. Lay a few pieces of old newspaper down on a table. Carefully turn the frame, wet paper, and rag upside down onto the newspaper, and lift off the frame. Cover the wet paper with another rag. You now have a sandwich of two rags with a layer of wet paper in the middle.
11. Roll the sandwich with the rolling pin to press out even more water.
12. Carefully peel off the top rag. Turn the wet paper and bottom rag over onto either a smooth counter top or a piece of glass (you can use a window for this), paper side down, and then carefully peel off the remaining rag.
13. Let the paper dry overnight or longer.
14. If you want very smooth paper, spray the dry paper with spray

laundry starch, put a clean smooth rag over the damp paper, and iron it with a slightly warm iron until the paper is dry. The starch will make the paper better for writing on, too.

15. You can use your inlaid paper to make cards, to wrap presents, for a cover for a handmade book, to write notes on, or as a work of art (Diehn, 1992).

Extensions

The inlaid paper can be used to make cards and stationary, to wrap presents or as a cover for a handmade book.

Following is a list of kinds of paper that can be used for recycling:

gift wrapping paper
ticket stubs
postage stamps
calendars
matchbook covers
advertisements
construction paper
magazines
letters
candy bar wrappers
grocery sacks
blotters
newspapers
comic books
crepe paper
envelopes
playing cards
tissues
labels
wasp nests (Grummer, 1980, p. 59)

Evaluation

Teacher observation to evaluate:

1. Use of elements and principles of design; and

2. Level of technical skill observed in paper making process.

Activity 3: Wetland Watercolors

Grade Level: Grades 4-6

Time Range: Two 60 minute sessions

Setting: Outdoor wetland site, Indoor classroom

Subject Areas: Biology, Art, Earth Science, Music

Vocabulary: Wetland, environment, hydric soil, hydrophytic plants, marsh, swamp

Objectives

1. Students will be able to describe at least four general characteristics of a wetland environment.
2. Students will list at least three ways wetlands benefit the environment.
3. Students will use their senses, imagination, and memory to express ideas and feelings in the visual arts.
4. Students will acquire artistic skills to express and communicate responses to experiences in the natural world and will demonstrate that ability in this activity.

Method

After a guided sensory visit to a wetland site, students will create a watercolor painting depicting their interpretation of the experience.

Background

With the help of legends, fictional stories, and the film industry, wetlands have been touted throughout history as mosquito breeding,

malodorous wastelands fit only for monsters and other unsavory creatures. For kids, that translates into "stinky" and "scary". Today, as we gain more knowledge of the beauty and benefits of wetlands, we are drawing the line between make-believe and reality, and the monster images are fading (Slattery, 1995, p. 73).

What is a wetland, anyway? Wetlands are basically *wet lands*. They are often transition zones between dry lands and deep water, but some are more isolated. The most common types of wetlands are swamps, bogs, and marshes. Students may know other types by a variety of names: mire, fen, moor, muskeg, prairie pothole, bottomland, riparian wetland, wet meadow, slough, playa lake, and Delmarva bay. What these have in common is what defines them as wetlands: *water, special soil,* and specialized plants called *hydrophytes* (water loving). The interactions of these three characteristics are what make one kind of wetland distinct from another (Slattery, 1995, p. 71).

Some interesting facts about wetlands:

1. Water is present at or near the ground's surface all or part of the time, even for as few as seven consecutive days.
2. Depth, duration, and frequency of flooding vary from wetland to wetland.
3. Wetlands may be tidal or non tidal (unaffected by oceanic tides) and may contain fresh, salt, or brackish water.
4. Wetlands may be any size or shape, from a low spot in a field that covers a few hundred square feet to an expansive marsh that covers several hundred square miles.

5. Wetlands are found on every continent except Antarctica and in every climate from the tropics to the tundra. They may be in coastal or inland areas, along ponds or rivers, in agricultural fields, or even in cities.
6. Wetlands may be pristine natural areas or may have been "built" by people. Many have been disturbed, to one degree or another, by human activity.
7. Wetlands provide many benefits. Some provide a place to live for endangered plants and animals. The special soils and plants that are found in wetlands can remove pollutants from the water and soak up floodwaters before they reach our houses and businesses. Wetlands provide timber products or can be used for recreational activities such as hunting, fishing, or boating (Slattery, 1995, p. 71-72).

Materials

Part 1

clipboard, paper and pencil

chalkboard or easel

Part 2

watercolor paper, either 9x12" or 12x18"

watercolor brushes, preferably one 1" flat brush and one small detail brush per student

newspaper

containers of water

paper towels

pan watercolor sets

white practice paper, 9x12"

a natural sponge

Plant Visuals (Appendix B)

Plant Cards (Appendix A)

Procedure

Part 1 - 40 minutes

Guided sensory visit to a wetland site

Ask students to describe what they think wetlands are, and what makes them unique. Make a list of wetland characteristics on the board to revise later as students learn more.

Take the class for a walk in the wetland site. Ask them to write down five things they see that they like and five that they dislike. A few minutes will be spent sharing responses. There are no right or wrong answers (Slattery, 1995). Have students find a quiet spot to sit still and observe their surroundings. Weather permitting, encourage them to spend at least 10-15 minutes just observing and listening in the wetland environment. Encourage them to use all their senses.

Upon returning to the classroom begin a discussion in which students will describe their sensory observations. Sample questions to ask:

a) What did you observe?

b) What sounds did you hear? (birds, water, wind)

c) How did you feel? (calm, peaceful)

d) What was the weather like? (warm, cool, sunny, rainy)

Refer back to the list of wetland characteristics on the board and

revise if necessary.

Part 2 - 40 minutes

Introduction to watercolor painting

Explain to students that artists learn to use their paints and brushes in many ways to depict nature. Sometimes they let their colors of paint run together to make fuzzy, watery effects.

Briefly discuss why artists might want to let their paints run together: i.e. the runny, watery effect can be beautiful; or the technique can be used to express a mood or feeling.

Focus on the colors, sights and sounds the students experienced on their wetland visit. Explain that students will use their paints to try to capture this experience after a teacher demonstration to show two basic watercolor techniques.

Nature music can be played while students are painting (Solitude, n.d.).

1. Teacher demonstration to show watercolor techniques.
2. Distribute the materials. Begin with 9x12" practice paper.
3. Ask students to print their names on the back of all papers. Pace the activity so that students can create two practice and one final painting.
4. Explain that you will dampen their paper with a wet sponge. Next, students will use their large, flat brush to paint a watercolor wash over the entire paper. This is called a wet-on-wet watercolor wash technique. Wet-on-wet, as the title implies, means wet paint on a wet surface. After the paper is dampened, the brush with paint is taken across the paper in one stroke. The brush is loaded with paint

again and worked back in the opposite direction, picking up excess water from the previous line. This is continued until the whole area is covered (Whittlesea, 1987). Do not go back to retouch.

4. Put this practice paper aside to dry and proceed with a new practice paper.
5. The next technique is wet-on-dry. This is color applied to dry paper or paint. Load the large brush and draw it across the top of the dry paper, in just the same way as the wet-on-wet technique. Notice the difference. Next use the small brush loaded with paint and practice making grasses and plants (Plant Cards and Plant Visuals can be used as visuals for this exercise). If practice paper #1 is dry, this technique can be practiced over the wet-on-wet background watercolor wash. Put all practice papers aside (Whittlesea, 1987).
6. Using visuals of wetland scenes (preferably photographs of the site) and watercolor paper, have students use the colors of the water to create an overall wet-on-wet background watercolor wash of the wetland.
7. When dry, have students use the wet-on-dry technique with the small brush to paint in the grasses and plants of the wetlands.

Extensions

Invite local watercolor artists to discuss how they work with nature.

Examine artist's sketches, preliminary studies and variations on a theme. Emphasize the idea that a work of art may be the result of many stages of exploration and development.

Emphasize the variety of sources artists use for their work - personal

experience, observation of nature, imagination, etc.

Study the watercolors of nature created by famous artists Andrew Wyeth and Winslow Homer.

Evaluation

Encourage student self-evaluation. Ask students to identify facets of their work which are visually effective. Have them consider how they might improve their work through additional effort or practice.

Use a critique session to focus on each student's achievements.

Activity 4: The Story of the Wetland Food Web

Grade Level: Grades 4-6

Time Range: Three 40 minute sessions

Setting: Indoor classroom, Outdoor wetland site

Subject Areas: Ecology, Biology, Art, Social Studies

Vocabulary: Food web, decomposer, consumer, producer, pictograph, omnivore, detritivore, ecosystem

Objectives

1. Students will investigate the interdependance of living things and their environment by learning about the wetland food web.
2. Students will be able to group organisms according to the functions they serve in a food chain.
3. Students will apply elements and media common to the arts to produce a work of art.
4. Students will demonstrate how art can be used to tell a story or to record an event by creating a work of art that tells a story.
5. Students will be able to describe how and why poisons in the environment accumulate in organisms higher in the food chain.

Method

After learning the complex relationships of a tidal marsh food web, students will create a fabric wall hanging which tells the story of the wetland food web in the manner of a pictograph or folk tale.

Background

An ecosystem is a community of different species interacting with one another and with their nonliving environment of matter and energy. Salt marshes occur in temperate regions and are one of the most productive ecosystems on earth, producing up to two times as much plant food as the most fertile agricultural lands. Salt marshes can be compared with coral reefs in terms of productivity (Aquatic, 1987)(Miller, 1995).

The sequence of who eats or decomposes whom in an ecosystem is called a food chain. It determines how energy moves from one organism to another through the ecosystem. Ecologists assign every organism in an ecosystem to a feeding level, or trophic level, depending on whether it is a producer or a consumer and on what it eats or decomposes. Producers belong to the first trophic level, primary consumers to the second trophic level, secondary consumers to the third trophic level, and so on. Detritivores process detritus from all trophic levels.

Some animals feed at several trophic levels. Thus, the organisms in most ecosystems form a complex network of feeding relationships called a food web (Miller, 1995).

Wetland species literally feed off each other. Plants produce energy from sunlight, water, and nutrients. When plants die they form the detritus that tiny bacteria, fungi, and zooplankton feed on. Worms, snails, small fish, and crustaceans consume these simple organisms, and are prey to larger fish, herons, snakes, turtles, and raccoons. The cycle continues when birds, mammals, large fish, and other wetland consumers die and the products of their bacterial decomposition enrich the soils that feed the

plants.

The constant and inexorable process of birth and death is essential to the continued health of an environment. Humans who "prey" on fish, shellfish, or cranberries are no different than otters eating trout, worms devouring nutrients, or falcons plucking songbirds from shrubbery. In a balanced environment predators and prey evolve a system of checks and balances that maintains species diversity and sustainable population levels. If fish populations aren't culled by birds, mammals, and larger fish, their numbers can grow until their own food resources are threatened. If minks don't prey on muskrats, the rodent population can explode, decimating the marsh vegetation in a few short years (Slattery, 1995).

Living organisms are grouped to reflect their level in the food web. The following are general definitions for these groups:

Producers are green plants able to carry on photosynthesis using the sun's energy to produce sugar and oxygen. The main producer for this ecosystem is salt marsh grass which is always producing new grass as old grass dies.

Primary Consumers use producers for food; therefore they eat only plants. Fiddler crabs, snails, small shrimps, and some fishes like minnows feed on decomposed marsh grasses. Oysters and clams filter detritus and tiny living plants from the water.

Secondary Consumers use primary consumers for food. They do not eat green plants. Crabs, birds, and a variety of fishes including flounder, red drum, and striped bass eat detritus eaters. It is estimated that 70% of the fish that are caught commercially spend at least part of their lifetimes

in the marsh system.

Tertiary Consumers feed only on other carnivores.

Omnivores eat both plants and animals.

Detritivores (decomposers and detritus feeders) live off **detritus**, which is dead and decaying plant or animal matter. Bacteria promote the decay of the salt marsh grass which in turn produces detritus (Aquatic, 1987)(Lynn, 1995)(Miller, 1995).

Materials

Plant and Animal Cards (Appendix A)

Salt Marsh Food Web handout (Appendix A)

Aquatic, Plant, and Bird Visuals (Appendix B)

drawing paper

pencils and erasers

chalkboard or easel

white pencil or permanent marker to draw on felt

8x10" pieces of felt in a variety of colors

12x18" piece of green or blue felt per student

scissors

fabric or white glue

14" wooden dowel per student

thread and needle

string

yarn

Procedure

Part 1 - 40 minutes

Indoor introduction and outdoor wetland site

1. Introduce the basic structure of the wetland food web by listing on the chalkboard a variety of plants and animals (birds, mammals, reptiles, amphibians, fish, insects, and other invertebrates) that live in or use wetlands (Plant and Animal Cards, Appendix A). Arrange them by columns by their position in the food web (Producer, Primary Consumer, Secondary Consumer, Tertiary Consumer, Omnivore, or Detritivore).
2. Take students for a walk in the wetland to identify some of the plants and animals discussed.

Alternative Lesson for Part 1 - Simulation Game - 40 minutes

1. Give each student a copy of The Salt Marsh Food Web handout.
2. Explain the interrelationships to the class and the complexity of the producer and consumer relationship.
3. Explain that energy is lost throughout the chain because upper-level organisms must eat more of lower-level organisms to get enough food energy.
4. Explain that this has important implications for pollution in the environment and for people.
5. Begin the following activity:

The following activity has been adapted from The Living Tidal Marsh, Teacher's Guide - Grades 3-6 (Living, n.d.).

   a. Divide the class into different food level animals - more students at

lower levels than higher levels. For example, with a class of 15:

8 micro-organisms

4 little fish

2 big fish

1 osprey or human

b. Give each of the lower food chain students a slip of paper.

c. Each paper represents one unit of poison that has been released into their wetland environment.

d. Ask the 4 small fish to each "eat" 2 of the micro-organisms and to take a paper from each of the 2.

e. The micro-organisms have ingested the poison into their bodies during feeding. When the small fish eat them, the poisons are passed up the food chain.

f. The 2 large fish "eat" each of the small fish. Each small fish passes its poison card to the big fish.

g. Then the osprey or person eat the 2 large fish and the poison is passed to the highest level consumer.

h. The upper level consumer ends up with all the poison slips.

i. The osprey or person becomes poisoned because the pollutant has been passed up the food chain and magnified from one organism to another.

Part 2 - 40 minutes

Developing Imagery

1. In the classroom explain that students will create a pictograph

(a picture that represents an idea) as a means of recording the story of the wetland food web.

2. Ask students to pretend that they have no written language and the picture they create will record the story for future generations. For example, taken from the book Brown Bag Ideas from Many Cultures: *"Painting on animal hides was one of the most outstanding art forms of the Plains Indians. The works were painted to narrate adventures or to record historical events. These tribal events were portrayed through pictographs, in which a picture represents an idea. Since Native American tribes had no written language, the artwork of these pictographs has recorded the history of the Plains Indians for future generations "(Tejada, 1993, p. 124-125).*
3. To depict the flow of energy through the food chain from the sun to primary producers through tertiary consumers and decomposers, students will choose a plant or animal from each level to sketch.
4. Students should strive for detail and accuracy in portraying each organism. Use the Plant and Animal Cards for visuals. Explain that these sketches need to be big enough to arrange onto a 12x18" background.
5. Students will cut out these sketches and put aside. They will be used as patterns in Part 3.
6. On another piece of drawing paper students will sketch a variety of ideas for their pictograph. They should plan their designs carefully, keeping in mind that the composition should tell a story and include the most important characters.
7. Have students look for unity in their design. Explain that unity is a plan

that makes every part look like it belongs in the artwork. Unity is like everyone working together as a team.

8. Select the most effective sketch to make into a fabric collage.

Part 3 - 40-50 minutes

Fabric Collage

1. Stitch the 12" top edge of the 12x18" piece of felt with the needle and thread big enough for the wooden dowel to fit through. This is the top of the wall hanging.
2. Trace paper patterns (made and put aside in Part 2) onto appropriate colors of felt and cut out. Add details (eyes, textures, etc.) with felt scraps and yarn.
3. When all plants and animals are created with felt they can be arranged onto the wall hanging.
4. Encourage students to experiment with a variety of compositions to to tell the wetland food web story. Refer to original sketch for unity of design.
5. Details can be added with felt, yarn, and stitchery.
6. When satisfied with the design all components are glued in place.
7. To complete the wall hanging a wooden dowel is slipped through the top and a string is tied on each end for hanging.

Extensions

Invite a speaker from a local planning department or a wetlands consultant to talk about wetland productivity.

Trace energy from the sun through the food web by writing a folk tale

using a wetland animal as a main character.

Take a walk in the wetland and make a wetland picture story.

Make a painting or a fabric applique of the pictograph.

Evaluation

Have students summarize what they have learned orally.

Display student artwork and use a critique session to focus on each student's achievements.

Encourage student self-evaluation. Ask students to identify facets of their work which are visually effective. Have them consider how they might improve their work through additional effort or practice.

Activity 5: Wetland Fish Sculpture

Grade Level: Grades 4-6

Time Range: Four 40-minute sessions

Setting: Outdoor wetland site, Indoor or outdoor classroom

Subject Areas: Art, Ecology, Social Studies

Vocabulary: Habitat, pottery, understory, overstory, wrack

Objectives

1. Students will recognize the diversity of plants and animals that depend on a wetland habitat by performing a wetland field study.
2. Students will be able to recognize and describe at least two species of fish that spend part of their life cycle in a wetland habitat.
3. Students will demonstrate ability to model, to construct by joining forms, and to carve by taking away material.
4. Students will create a sculpture with an environmental theme using clay handbuilding techniques.

Method

Students will first do a field study of wetland habitats and the animals that live in them. They will then create a sculpture of a species of fish that reproduces or spends part of it's life cycle in a wetland habitat.

Background

A habitat is the place where an animal finds food, water, shelter, and space, in the arrangement that suits its needs. Different animals often

require different habitats, though many share the same habitat. The habitat for a fish is water; for a bear, the woods; for a porpoise, the ocean; and for an earthworm, the soil. Even within the same class of species habitat requirements can vary. Some fish live in salt water, others in brackish or freshwater; some prefer moving water, others stay where it is still (Lynn, 1995).

All living things in a habitat are interrelated and interdependent. How one animal adapts to change in its habitat affects other organisms in the community. The same principle applies to humans in their environments.

All wetlands, whether coastal or inland, provide special habitats that serve areas far beyond their boundaries. Wetlands are important to plants, animals, humans, and the total environment.

Because of the abundance of food, vegetative cover, and water found there, most wetlands are rich with diverse wildlife species.

Coastal and inland marshes provide breeding, resting and wintering habitats for thousands of migratory birds - including ducks, geese, swans, cranes, and shore birds. Many species of fish that are important for commercial and personal use by humans reproduce or spend part, or all, of their life cycle in fertile wetlands adjacent to larger, more open bodies of water. These fish species include flounder, red snapper, sole, herring, bass, salmon, walleye, perch, and pickerel. A wide variety of reptiles, amphibians, insects, and crustaceans also breed and live in wetlands. Frogs and toads, turtles, salamanders, snakes, dragonflies, water striders, clams, and crayfish flourish in wetland habitats. Many mammals - from muskrats and beaver to whitetail deer and moose - also depend on wetland areas. Wetlands are often referred to as "nurseries" because

they provide critical breeding and rearing habitats for countless numbers and kinds of wildlife (Aquatic, 1987).

Materials

Part 1 - *for each team of 2 students*

4 habitat carts (Appendix A)

clipboard

pencils and erasers

dip nets

hand lens

flat pans with water to hold specimens

Part 2

clay - earth clay or self-hardening (a kiln is needed for earth clay)

glaze or acrylic paint for clay

paint brushes

clay tools

paper, pencils, scissors

Aquatic and Plant Visuals (Appendix B)

rolling pin

unprimed canvas or newspaper to roll clay out on

two 1/2" wooden slats 14" long

small sponges and water containers

plastic bags to store clay in for each student

Procedure

Part 1 - 40 minutes

Field study of wetland habitats

1. Preliminary discussion on types of wetland habitats and animals to look for.
2. Preliminary discussion on wetland field study guidelines.
3. Make or gather equipment for this activity and demonstrate its use.
4. Students will work in teams to do a wetland field study.
5. Instruct each team to observe different animals that live in the wetland and complete a habitat card for at least 4 animals.
6. Have each team make a simple sketch of the area, and mark on the drawing the location of the habitats where animals were found.
7. Encourage students to use dip nets, hand lenses and flat pans for their observations.
8. The habitat cards will be shared with the class at a later time. Sample questions to answer when describing animals:
   - What color is the animal?
   - What is its size and shape?
   - Where, specifically, was it found, and what was it doing?
   - How does it breathe?
   - How does it move?
   - Where are its mouth, eyes, legs, nose, ears?
9. Habitats to describe:
   -swims in the water
   -flies in the air
   -crawls on the pond bottom

-buried in the mud

-lives in a tree

-skims the water's surface

-lives in the reeds

-under a rock

-in the eelgrass beds

-underwater plants

-on the estuary floor

-under the seaweed

Alternative Lesson for Part 1 - Drama Activity - 40 - 60 minutes

The following activity has been adapted from Discover Wetlands: A Curriculum Guide, published by the Washington State Department of Ecology (Lynn, 1995).

1. Create game cards for each of the students in the following format:

Habitat: in the mud
Animal: clam
Behavior: filter feeding

Habitat: underwater plants
Animal: snails
Behavior: feeding

Habitat: in the eelgrass beds
Animal: pipefish
Behavior: hiding from predators

Habitat: in the air
Animal: dragonfly
Behavior: feeding

Habitat: water's edge
Animal: raccoon
Behavior: feeding on crayfish

Habitat: in a tree
Animal: owl
Behavior: sleeping

Habitat:	on the estuary floor	**Habitat:**	under the water
Animal:	stickleback	**Animal:**	salmon
Behavior:	building a nest	**Behavior:**	resting from migration

2. As a class, brainstorm the needs that animals have - air, water, food, a place to sleep, a place to be safe from enemies, a way to protect themselves from bad weather, a protected place to nest and raise their young, etc.

3. Hand out one game card to each student and explain that there are several habitats in a wetland which provide these needs. Those habitats include: the surface of the water

under the water

under the soil or mud

the understory - low-level plants

the overstory - higher shrubs and trees

rocks and piers

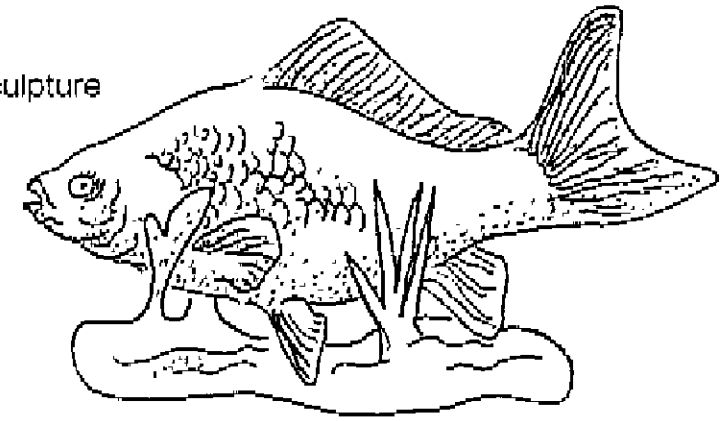
under piles of dead plants washed up by the tides (wrack)

4. Students will take turns acting out the animal behavior described on each card. The rest of the class is only told the habitat and must guess which animal it is and what the animal is doing in the wetland habitat.

5. When everyone has had a turn the students will summarize all the ways animals depend on wetlands to meet their needs.

Part 2 - one 40 minute sketching session and two 40 minute sculpting sessions

Wetland Fish Sculpture



1. After viewing visuals of a wide variety of fish that depend on the wetland for part or all of its life span, students will create and cut out a paper pattern of a fish. This should be no smaller than 6"high by 8"wide.
2. Teacher Demonstration: refer to Slab Hand Building Techniques in Appendix B for directions.
    a. how to form a clay slab and cut out a shape using a pattern
    b. how to join clay pieces
3. First Clay Sculpting Session.

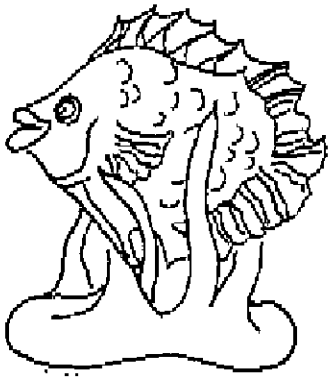
    Students will form a wetland floor and model plants out of clay. They will join the plants to the wetland floor to support the swimming fish. This is achieved by scoring, applying slip and carefully melding the pieces for a secure bond. Remind students to design their plants and wetland floor to support their swimming fish.
4. Cover with air tight plastic bag and sit aside.
5. Second Sculpting Session.

    After teacher demonstration, students will create a slab clay fish and

use a variety of clay tools for textures, details, and finishing work.

6. When fish is complete, sit aside until it is slightly dry - firm, yet pliable.

7. Students will carefully join the clay fish onto the the wetland environment and apply finishing details.



Extensions

See alternative clay lesson in Appendix B.

Create a crayon and watercolor resist scene of an animal in a wetland habitat.

The completed habitat cards from Part 1 can be copied, colored, stapled together, and used as a field guide.

Have students write and act out a play depicting a variety of animals in the wetland.

Research animal behavior strategies and how they help the species survive.

Evaluation

Have students identify some animals that live in and use wetlands.

Have students describe the habitats of these animals.

Critique student artwork.

Activity 6: Birds of the Wetlands

Grade Level: Grades 4-6

Time Range: Two 60 minute sessions

Setting: Outdoor wetland site, Indoor or outdoor classroom

Subject Areas: Art, Ecology, Social Studies

Vocabulary: Migration, stencil

Objectives

1. Students will be able to discuss the migratory habits of birds and recognize that individuals vary within every species.
2. Students will be able to explain how meeting human requirements affects the environment by engaging in a role-playing activity.
3. Students will apply elements and media common to the arts to produce a work of art.
4. Students will demonstrate performance and participation skills by working and creating individually and with others.
5. Students will develop a stencil print utilizing an environmental theme.

Method

Following a student role-playing activity reinforcing the concept of habitat, students will use the theme "Birds of the Wetlands" as motivation for a design to be printed with stencils onto a T-shirt.

Background

Salt marshes are found along the eastern and western coasts of New

Jersey. Salt marshes fringe the coast all the way to Cape May. Wherever they are, these salt marshes contain primarily the same species of animals and plants and their ecology is ruled by their twice-daily flooding by salt water at high tides (Kane, 1992).

The most obvious living creatures of the salt marsh are the birds. If you visited a wetland in fall or spring, you'd see many kinds of migratory birds and waterfowl. Depending on where you were, you'd see hundreds or even thousands of them: ducks and geese, herons and egrets, sandpipers and plovers; eagles and ospreys. These and other birds converge on wetlands en route to their winter or summer homes. Most species spend the winter south of New Jersey but nest north of it, many on the arctic tundra, where long days and abundant food make it possible for the birds to go through their entire breeding cycle in only a few weeks. At the wetland they "refuel" on a rich food supply of insects and berries before continuing on their journeys. Many birds also nest and winter in wetlands, but the bird population of most wetlands increases dramatically during migration (National, 1989)(Kane, 1992).

Although not too many of New Jersey species actually nest in the marsh - some exceptions include osprey, northern harrier, willet, Forster's tern, laughing gull, clapper rail, and seaside and sharp-tailed sparrows - a great many species find food there. Great blue herons, little blue herons, tricolored herons, black-crowned and yellow-crowned night-herons, green-backed herons, American bitterns, snowy egrtets and great egrets are easy to find in season in any large salt marsh. Terns and black skimmers patrol creeks and shallows. Laughing and herring gulls can be seen in New Jersey salt marshes at all seasons. Gulls can

be told from terns by their manner of feeding and flight. Gulls have relatively short wings, slow wingbeats, and feed on the ground or by picking food from the water surface. Terns have long, pointed wings, rapid wingbeats, and usually feed by diving and hitting the water with a splash (Kane, 1992).

Although all shorebirds eat animal food, some species pick it from the surface of the marsh, while others probe into the mud. In this way, different species can feed together in the same area without competing for the same food items. Each bird's beak is specially adapted to help it eat or gather its food (Kane, 1992).

Materials

fabric paint

sponge or bristle brushes

newsprint paper

T-shirts or good paper to print on

newspapers

smocks

scissors

stiff white or stencil paper 6x9", 3 per student

Henri Matisse reproduction "The Parakeet and the Mermaid"70

Procedure

Part 1 - 40 - 60 minutes

The following activity has been adapted from The Living Tital Marsh for grades 3-6 (Living, n.d.).

1. Ask students if they have ever taken care of a pet or sibling. What did they feel their job was? To protect that animal or person from harm?

2. Explain that many creatures need protection and that the creatures in the salt marsh can be harmed when people take away their land to build structures. Tell them there are people in business and government working to protect these creatures.

3. Begin the role-playing activity by putting all students in the same situation by reading the following :

Pretend you live in a state that has a very long coast facing the ocean. It was once a very productive coast full of fish and shellfish and rich in wildlife. But as more people moved into the state, over half of the coast was destroyed. The dumping of garbage or water pollution ruined large areas and the building of houses, factories, and roads destroyed portions of the coast.

This coast is also famous because of the migrating shorebirds that use it as a place to rest and feed.

There is a meeting being held to make a decision on whether or not to protect one part of the coast as a Shorebird Santurary. The Santuary would include a beach and tidal marsh that are very important to the survival of the shorebirds. The santuary must be free from human disturbance to support the birds.

You will help decide whether to protect this coast as a Shorebird Sanctuary.

4. Divide the class into six groups and give each group one of the following positions to represent at the meeting (make up cards):

a. Fisherman who want to fish there.

b. Business people who want to put a factory there to create jobs.

c. Poor people who want the State to build houses for them.

d. Members of a town that that wants to dump their garbage there.

e. Environmentalists, nature-lovers, and scientists who want to protect the area for the birds, fish and wildlife.

f. Builders who want to develop a shopping mall.

5. After discussing the following questions privately in their groups, the students will present their case to the meeting.

a. What are the different uses for the coast?

b. What are the good and bad points of each use?

c. What are ways different uses can go together?

d. How will each idea affect wildlife, including shorebirds, fish, shellfish, and all the animals that live on the coast?

e. How will each idea affect people in the State?

6. Take a vote! Decide by majority vote how you think the State agency should rule on the use of this part of the coast. Recognize the fact that these students may someday be a part of this decision-making process and that these decisions are being made by people every day.

Alternative Lesson for Part 1 - 20-30 minutes

Sensory Wetland Visit

1. Wetland Bird Study (Appendix A), pencil, and clipboard.
2. Take students to a quiet spot in the wetland to observe the birdlife. At

this time explain about migratory wetland birds.

3. After a quiet observation time have students complete the Wetland Bird Study.

Part 2 - 60 minutes

Stencil Printing Activity

1. Introduce. Hold up a stencil. Explain that the paper with a hole in it is called a stencil. Demonstrate how to put a stencil flat on top of another paper to make a print of the stencils shape. The print is made by gently dabbing paint through the hole. The shape of the hole gives a positive shape when printed. The stencil can be used over and over again.

2. Explore and develop. Using a reproduction of Henri Matisse's "The Parakeet and the Mermaid" or a similar example of his simple shape prints, explain that the shapes for the stencils are related, like a family of shapes. The artist printed the stencils in colors that go together. Point out that this artist spent most of his life exploring colors, shapes, and patterns. He loved to see how bright colors look next to each other (Chapman, 1994).

3. Have students gather in small groups of three or four and think of ideas for stencil pictures using the theme of "Birds of the Wetlands".

To set up supplies, place several spoonfuls of paint of different colors in divided trays or small containers for 3 or 4 sutdents to share. Place a sponge brush in each color. Stick tape lengthwise along the edge of the desks. Students can cut or tear off the amount needed to join their stencils.

4. Studio experience. Distribute the materials for making stencils. Guide

students to cut the first stencils, leaving a border about two fingers wide around the shape of the hole. Show them how to tape back the edge. Have students make additional stencils.

5. Distribute the materials for printing. Use the newsprint paper for practice. Stress that a stencil print should look light and soft. Apply the paint with a very gentle, straight up-and-down motion called stippling. The paint should not run under the stencil. Press the sponge on the newspaper several times before stippling inside or around the stencil.

6. Discuss problems and solutions in the practice prints. Make sure the stencil is flat. Hold the stencil so it doesn't move. Use less paint. Wipe away paint that may get on the underside of the stencil.

7. Have everyone make a final stencil print on their T-shirts using light colors first, dark colors last (Chapman, 1994).

Extensions

Create a T-shirt design that illustrates why wetlands are valuable wildlife habitats. Make-up a catchy slogan.

Provide a stencil printing set-up for independant work

Use fabric crayons to transfer a design of an animal in it's habitat onto a T-shirt.

Use a map to locate migratory routes and explain the importance of wetlands for this phenomenon.

Evaluation

Display student artwork .

Discuss student artwork. Ask students to comment on the subject

matter and effects such as repeated shapes and spacing between the stenciled parts.

Discuss ecological concept of habitat.

CHAPTER 5

Summary and Conclusions

Restatement of the Problem

The purpose of this project was to develop an environmental education course to be offered to students in grades 4-6 at the Wetlands Institute in Stone Harbor, New Jersey. The course was designed to teach coastal wetlands ecology through the visual arts to supplement and enrich the current environmental education program offered by the Institute. Upon completion, this course is planned to be offered at the Institute which serves the purpose of the author's thesis.

To meet the needs of the Wetlands Institute, the course was structured to be taught either in six consecutive daily sessions in the summer months or six consecutive Saturday sessions in the winter months. Each section of the course focuses on a different ecological concept and art method that can be used individually or as an entire unit.

The course format consists of a series of hands-on, interdisciplinary activities focusing on the coastal wetlands and what makes them important. Objectives and activities were designed to utilize the visual arts as an enabling mechanism to establish heightened perceptual awareness of and aesthetic sensitivity to the wetlands ecosystem. It is important to note that although the author has developed the course to be taught at the Wetlands Institute to grades 4-6 it is not limited to this facility

and age level. The activities can be adapted to a similar wetland site and used in part by a resourceful teacher to suit the needs of students of any age or level.

Procedures Used For Project Development

For activity development the author did extensive research on recent environmental education programs utilizing an interdisciplinary approach to teach wetland ecology.

The curriculm guide Discover Wetlands, published by the Washington State Department of Ecology (Lynn, 1995), was the most helpful guide in development of lesson plan format, visuals, and background information. Aquatic Project Wild published by the Western Regional Environmental Education Council (Aquatic, 1987), Bridges to The Natural World published by the New Jersey Audubon Society (Kane, 1992), and WOW! The Wonder of Wetlands produced through a partnership between Environmental Concern, Inc. and The Watercourse (Slattery, 1995), were examined by the author and found to be valuable resources for background information and activity development in coastal wetland ecology.

For background data for the the visual arts components of the project, the author consulted with art educators and referred to several books on art techniques and art education.

Principal Findings and Conclusions

As a result of the time structure of the course, the author's project does not include all the ecological concepts that can be dealt with in wetland

ecology. A resourceful teacher can take the art component of each activity and relate it to another ecological concept. In addition, a variety of art media can be utilized in the art component of each activity once the student has created a design.

A teacher without a fine arts background may have difficulty and will need supervision and training when initially teaching the art components of each activity. Each art project will need to be made by the teacher before attempting to instruct the students.

The author is satisfied that the activities chosen for the course will enhance the environmental education program and support the philosophy of the Wetlands Institute in Stone Harbor, New Jersey.

Recommendations for Future Research

As an addendum to a course in wetland ecology, the author recommends inclusion of two teacher guides. The first guide should include instructions in how to make field study equipment with the students. It is the author's opinion that it is interesting for students to construct and then use their own tools in the field. The second guide should include guidelines for proper field behavior and ethics to protect the wetland site. It is important for teachers to know how to instruct students to treat all components of a wetland with respect and the inclusion of a teacher guide will enable the instructor to have the information to relate to students before, during, and after the field study.

The author also recommends the development of an interdisciplinary course to teach coastal wetlands ecology through another area of fine arts, including music, theatre, dance, and visual arts other than the ones

included in the author's course.

Other suggestions for further development are wetland activities that incorporate wetland restoration, creation and enhancement.

BIBLIOGRAPHY

Armstrong, David G. Developing and Documenting the Curriculum. Needham Heights, MA: Allyn and Bacon, 1989.

Aquatic Project Wild. Boulder, Colorado: Western Regional Environmental Education Council, 1987.

Bage, Karen M. Interview with author. September 21, 1995.

Brennan, Billy "B". Romp in the Swamp. (fun songs for kids of all ages), Jensen Publications, 2770 South 171st Street, New Berlin, WI, n.d., cassette.

Brigham, Don L. Focus on Fine Arts: Visual Arts. Washington, D.C.: National Education Association, 1989.

Buckingham, Sandra. Stencil It! Buffalo, NY: Camden House Publishing, 1994.

Carlson, Cathy, and John Fowler. The Salt Marsh of Southern New Jersey. Pomona, NJ: Center for Environmental Research, 1980.

Carson, Rachel. The Edge of The Sea. Boston: Houghton Miflin, 1955.

Caucutt, Allen. "Focus-Elementary Art Education". National Art Education Association. (1975).

Chapman, Laura H. Adventures in Art. Massachusetts: Davis Publications, Inc., 1994.

Colbert, Cynthia and Martha Taunton. Discover Art - Kindergarten. Massachusetts: Davis Publications, Inc., 1995.

Diehn, Gwen and Terry Krautwurst. Nature Crafts for Kids. New York: Sterling Publishing Co., Inc., 1992.

Efland, Arthur D. A History of Art Education - Intellectual and Social Currents in Teaching the Visual Arts. New York: Teachers College Press, 1990.

Grummer, Arnold E. Paper by Kids. New York: Macmillan Publishing Co., 1980.

_____. Tin Can Papermaking. Wisconsin: Greg Markim, Inc., 1992.

Hofsted, Jolyon. Step-by-Step Ceramics. New York: Golden Press, 1967.

Hungerford, Harold R. and Trudi L. Volk. "Changing Learner Behavior Through Environmental Education." Journal of Environmental Education 21, no. 3 (1990): 9-18.

"Interdisciplinary". Webster's Desk Dictionary of the English Language. 1983.

Iozzi, Louis A. "What Research Says to the Educator. Part One: Environmental Education and the Affective Domain." Journal of Environmental Education 20, no. 3 (1989): 3-9.

Kaelin, Eugene Francis. An Aesthetics for Art Educators. New York: Teachers College Press, 1989.

Kane, Patricia F., et al. Bridges to The Natural World. New Jersey Audubon Society, 1992.

Larson, Karen. "Art and Environment: An Integrated Study on the Web of Life". Art, Science & Visual Literacy: Selected Readings from the Annual Conference of the International Visual Literacy Association, (September/October 1992).

Lynn, Brian. Discover Wetlands. A Curriculum Guide. Olympia, WA: Washington State Department of Ecology, 1995.

McFee, June King and Rogena M. Degge. Art, Culture, and Environment. Belmont, CA: Wadsworth Publishing Company, 1977.

Memmott, Harry. The Art of Making Pottery. New York: Crown Publishers, Inc., 1971.

Miller, G. Tyler. Environmental Science Working with the Earth. Belmont, California: Wadsworth Publishing Company, 1995.

National Wildlife Federation. Ranger Rick's Nature Scope: Wading into Wetlands. Washington, DC: National Wildlife Federation, 1989.

Neidermeyer, Fred C. "A Checklist for Reviewing Environmental Education Programs." Journal of Environmental Education 23, no. 2 (1992): 16-22.

New Jersey Environmental Education Commission. Environmental Education in New Jersey: A Plan of Action. 1993.

Niering, William A. Wetlands. New York: National Audubon Society, 1985.

North Carolina State Dept. of Environment, Health, and Natural Resources. Wetland Wonders. Goose Creek State Park: An Environmental Education Learning Experience Designed for Grades 4-6. Raleigh, NC: North Carolina Division of Parks and Recreation, 1994.

Project Wild. Boulder, Colorado: Western Regional Environmental Education Council, 1986.

Sarkas, Albert H. "Environmental and Aesthetic Education for the Primary Grades". National Art Education Association. (1975).

Simmons, Deborah A. "Are We Meeting the Goal of Responsible Environmental Behavior." Journal of Environmental Education 22, no. 3 (1991): 16-21.

Slattery, Britt Eckardt. WOW! The Wonders of Wetlands. St. Michaels, MD: Environmental Concern, Inc., 1995.

Solitudes Series. The Moss Music Group, Inc., 48 West 38th Street, NY, n.d., cassette.

Stehney, Virginia A. "Valuable Wetlands". Science and Children. v19 n8 (1992).

Tejada, Irene. Brown Bag Ideas from Many Cultures. Worcester, MA: Davis Publications, Inc., 1993.

The Living Tital Marsh. Teachers Guide grades 3-6. Princeton: Visual Education Corp. for Public Service Electric and Gas Co., n.d.

"Visual Arts." Webster's Desk Dictionary of the English Language. 1983.

Wetlands Institute. Brochure, 1995.

_____. Wetlands Ecology - Grades 7-12. Stone Harbor, NJ, 1995.

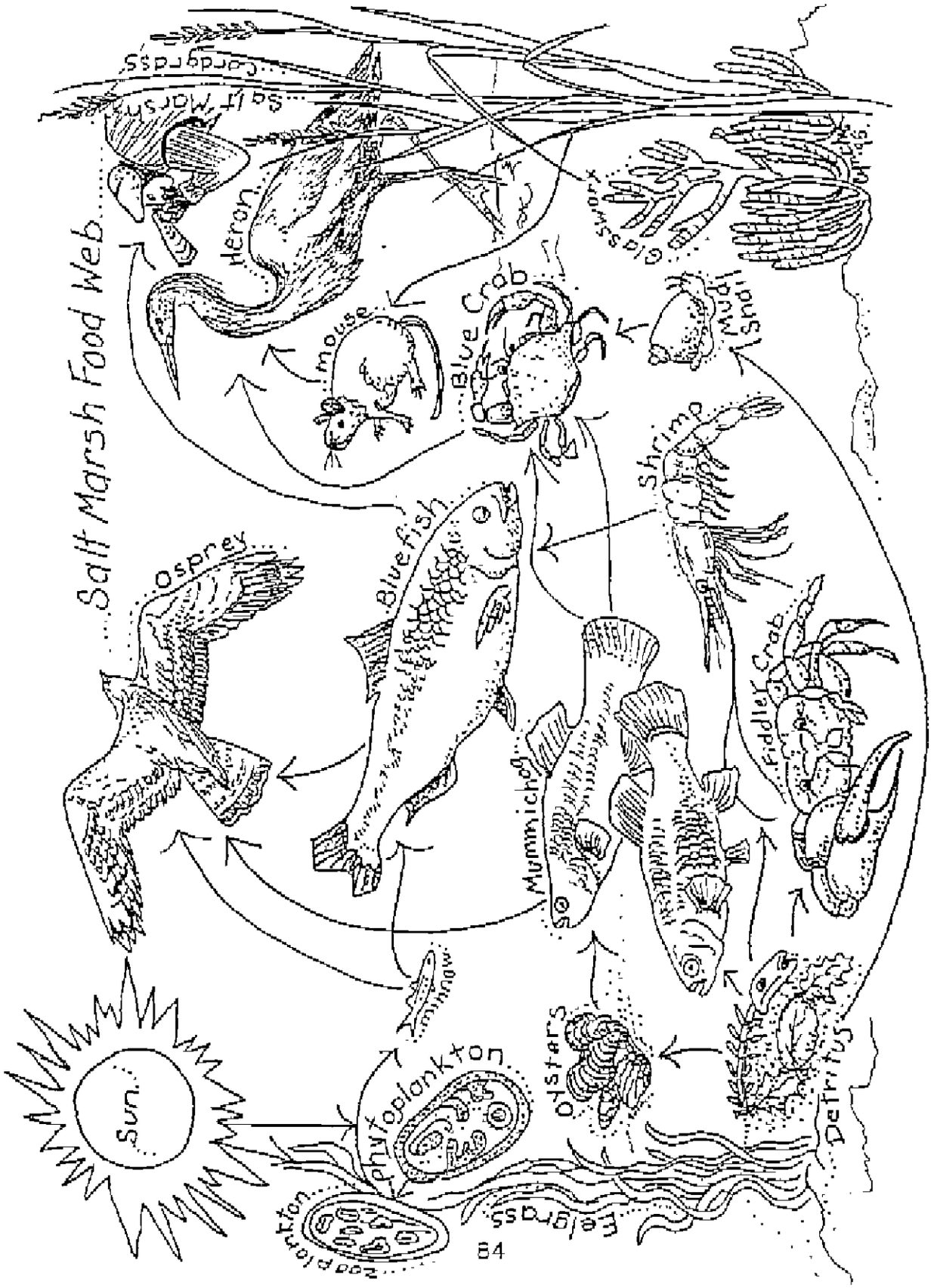
Whittlesea, Michael. The Complete Watercolor Course. New York: Crown Publishers, Inc., 1987.

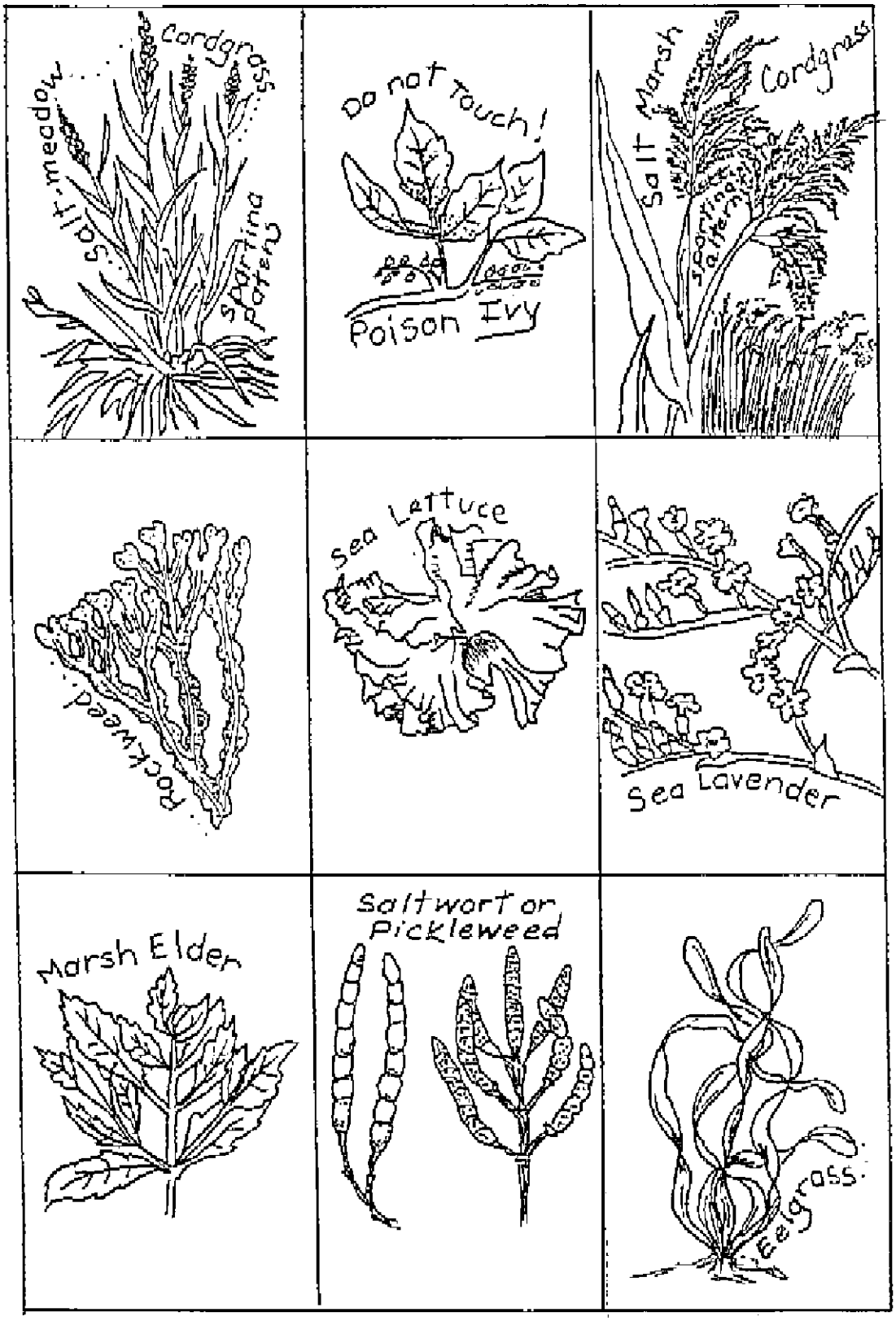
Wisconsin Department of Public Instruction. A Guide to Curriculum Planning in Art Education. Milwaukee, WI, 1994.

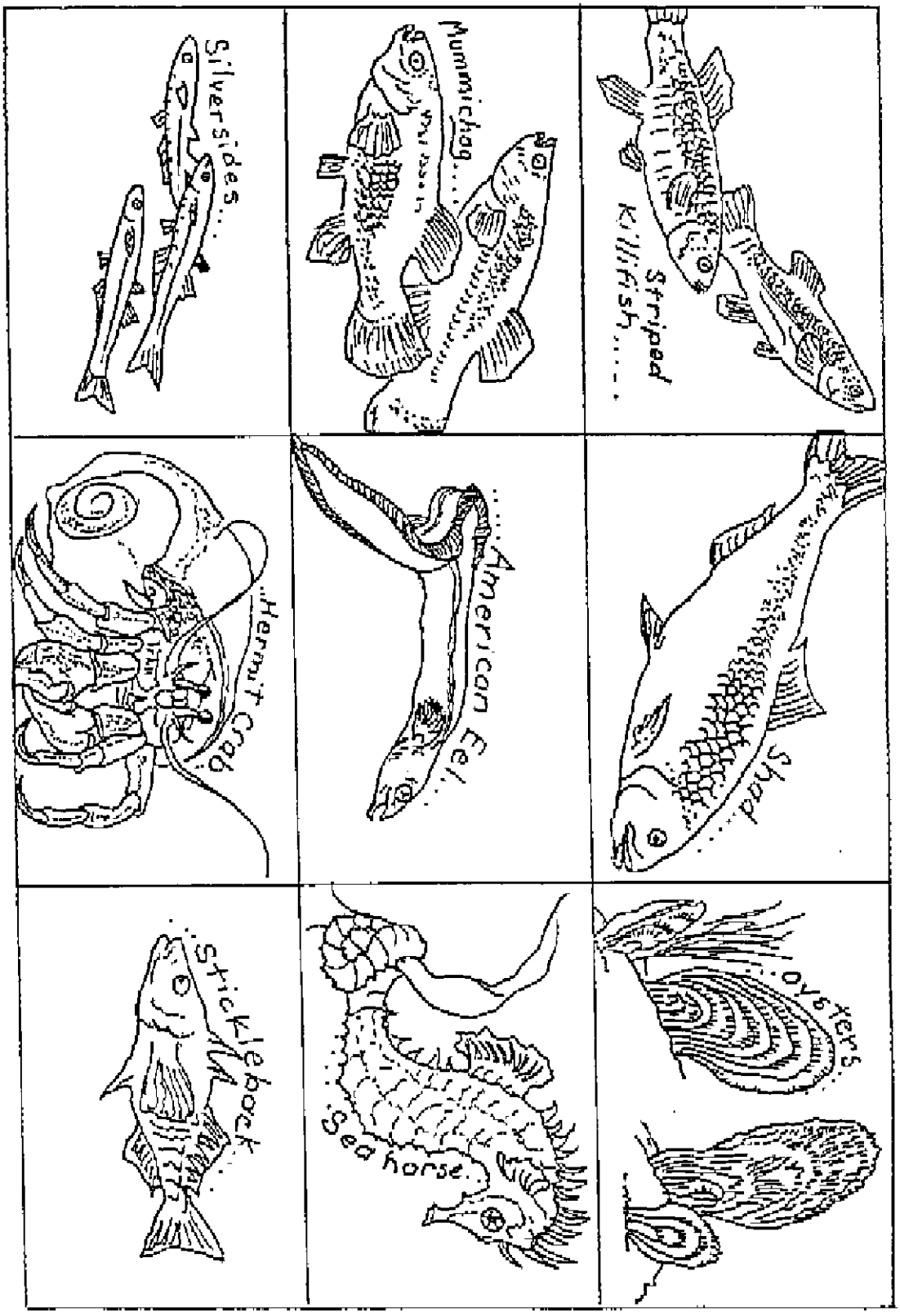
_____. A Guide to Curriculum Planning in Environmental Education. Milwaukee, WI, 1985.

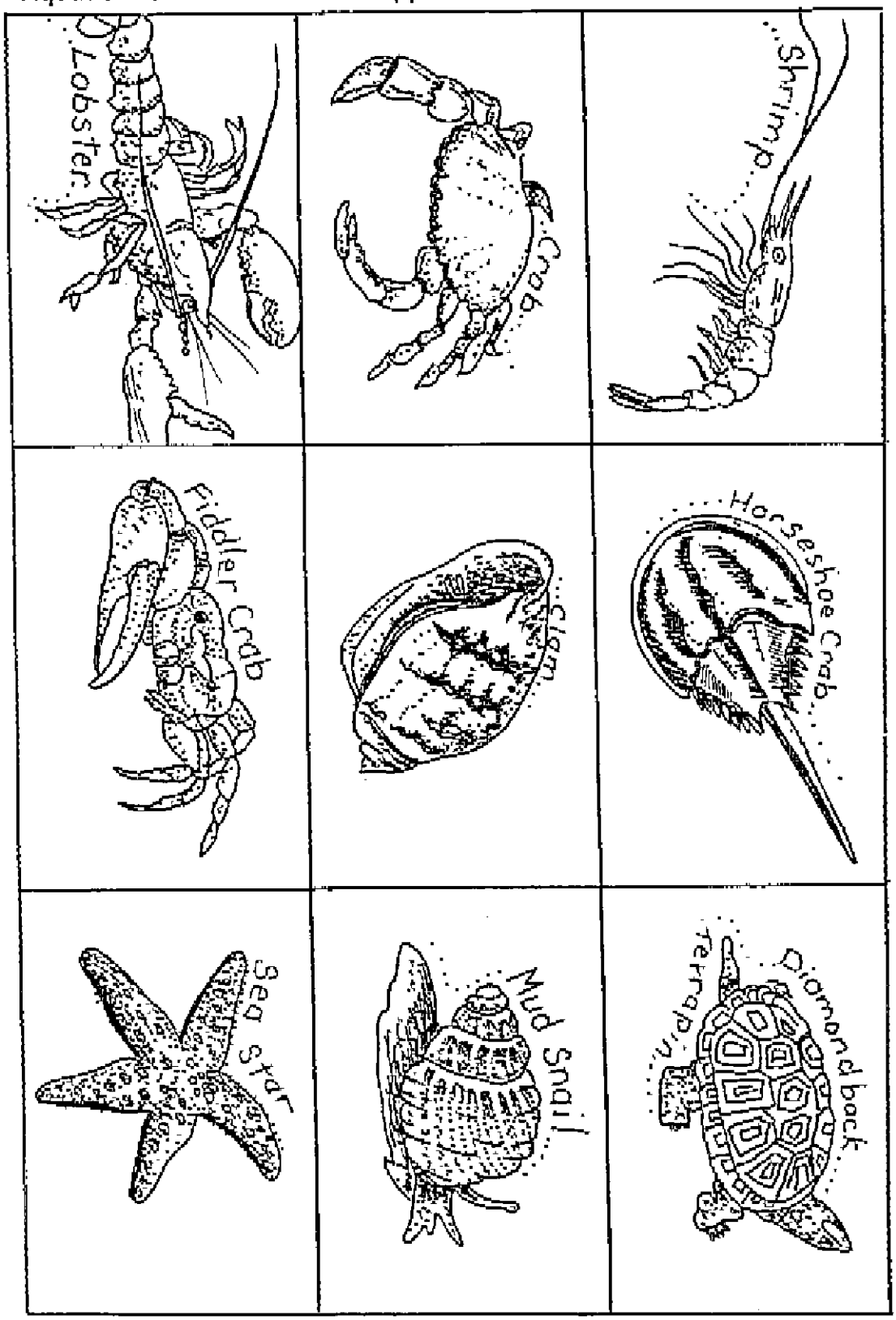
Yasso, Warren E. "Understanding #1: Discovering Science in Art, Literature, and Music". Science Activities. (Spring 1991).

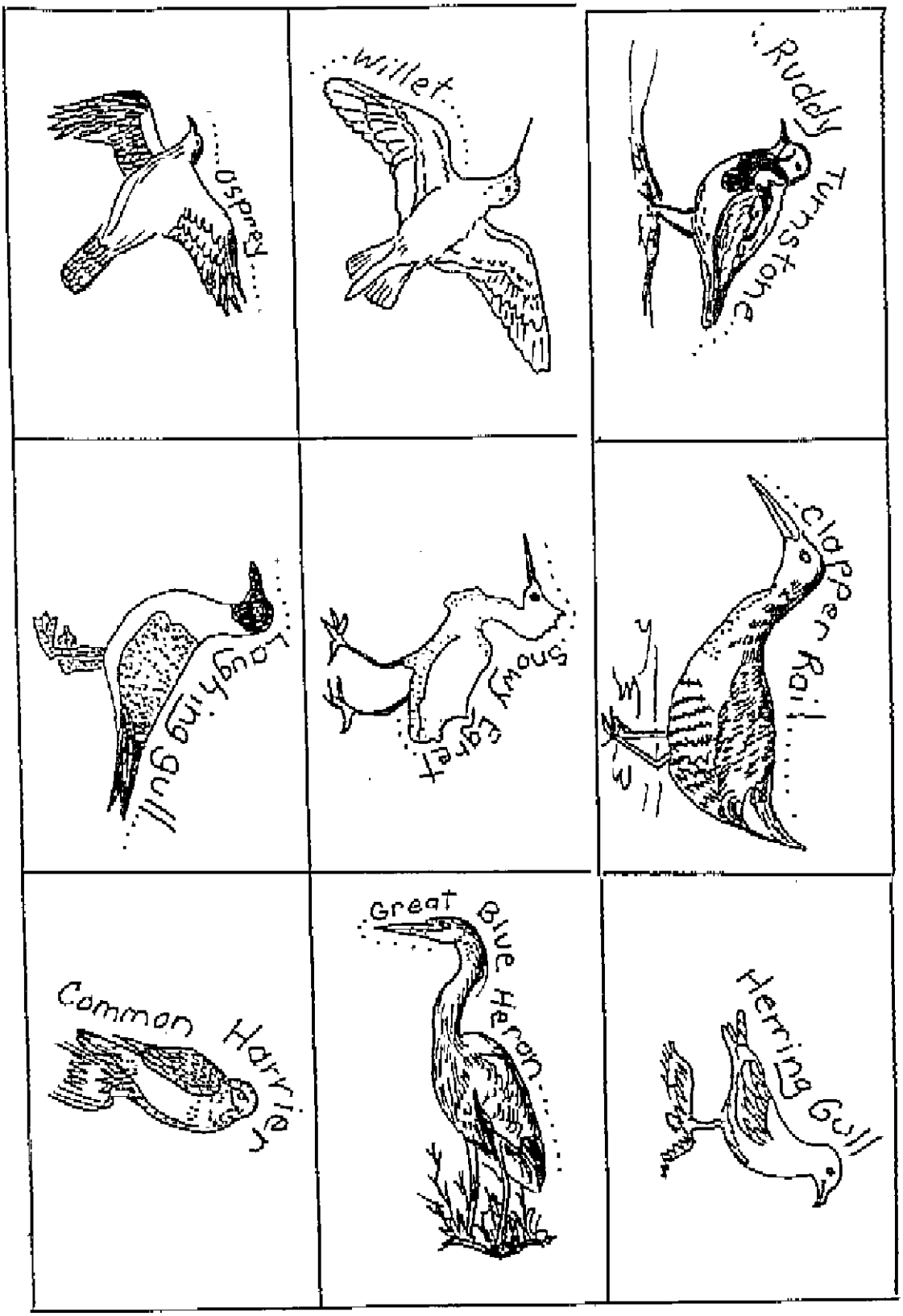
APPENDIX A


Salt Marsh Food Web
Cordgrass
Salt Marsh
Heron
Glasswort
Mouse
Blue Crab
Mud Snail
Shrimp
Osprey
Bluefish
Mummichog
Fiddler Crab
Sun
Phytoplankton
Oysters
Detritus
Zooplankton
Eelgrass


Cordgrass
salt-meadow
spartina patens
Do not touch!
Poison Ivy
Salt Marsh
Cordgrass
spartina alterniflora
Rockweed
Sea Lettuce
Sea Lavender
Marsh Elder
Saltwort or Pickleweed
Eelgrass


Silversides
Mummichog
Striped Killifish
Hermit Crab
American Eel
Shad
Stickleback
Sea horse
Oysters


Lobster
Crab
Shrimp
Fiddler Crab
Clam
Horseshoe Crab
Sea Star
Mud Snail
Diamond back Terrapin


Osprey
Willet
Ruddy Turnstone
Laughing Gull
Snowy Egret
Clapper Rail
Common Harrier
Great Blue Heron
Herring Gull

Appendix A

Wetland Bird Study

Draw a detailed picture of a bird you have observed above

Take a walk around the wetland. How many birds do you see?_____

Sit in a quiet place and observe the bird life of the wetland for about 15 minutes.

Do you hear any sounds?_____
Are any of these bird songs or calls?
Try to see the bird(s) making each sound.

Use binoculars to scan the water and edges of the pond. Then walk quietly along the edge of the wetland.

Look for feathers, tracks, nests, egg shells, and places where birds have probed in the mud.

Try to identify each of the birds you saw with a bird field guide.

How many birds did you see in all?_____

How many different kinds of birds did you see?_____

Did you see more of one kind of bird in one area than another? If so, why might that be?_____
_____

Student or Team Name_____

Wetland Bird Study

Draw a detailed picture of a bird you have observed above

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_____

Student or Team Name_____

Habitat Card

Appendix A

Habitat Card

Draw an animal in it's habitat

Animal name_____

Description using your senses of smell, touch, sight, and hearing_____

_____

What is the name of this habitat?_____

_____

Where found?_____

What might it eat?_____

_____

What evidence of animals do you observe? tracks? droppings?_____

_____

Why would an animal want to live in this habitat?_____

What else might live in this habitat?_____

_____

Can you name or draw the plants in this habitat?_____

_____

Ideas for places to search:
the surface of the water
under the soil or mud
the understory - low-level plants
the overstory - higher shrubs and trees
rocks and piers
under piles of dead plants washed up by the tides

Student or Team Name_____

Draw an animal in it's habitat

Animal name_____

Description using your senses of smell, touch, sight, and hearing_____

_____

What is the name of this habitat?_____

_____

Where found?_____

What might it eat?_____

_____

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_____

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_____

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rocks and piers
under piles of dead plants washed up by the tides

Student or Team Name_____

Appendix A

Student Group _____

Wetland Plant Activity Paper

Wetland plants are unusual. These "hydrophytes" (water-loving plants) are uniquely adapted for living in their habitat whether that is a marsh, swamp, stream or estuary. They have evolved ways to obtain oxygen in water-logged soils, to reproduce underwater, to rid themselves of excess salt, and to adapt to changing water levels, thus enabling them to survive in habitats where other plants cannot.

Use your eyes and hand lenses to observe closely and use the "Plant Cards" or a wetland plant field guide to help you answer these questions.

1. Find a plant living in a wetland. Notice its shape and size. Draw it here.

   How does its shape and size make it able to live in a wetland?

   What habitat is it living in?

2. Find another plant living in a wetland. Feel its texture. Draw it below.

   How do you think its texture helps it to survive in a wetland?

3. Dig up a small plant that is found in abundance in the wetland and look at its roots. Draw below.

   How is this plant adapted for living with salt water?

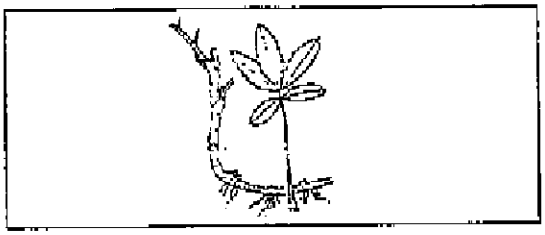
4. Take the stem from the plant in #3 and cut the stem cross wise. Draw what you see. Use your hand lense.

   Can you guess how what you see inside will help the plant obtain oxygen?

5. Carefully collect 2 or 3 small samples of plants that are found in abundance to use in an art activity.

Appendix A

Common Name: PACIFIC SILVERWEED
Scientific Name: *Potentilla pacifica* or *Potentilla anserina*



Wetland Indicator: OBL

Habitat: High salt marshes and adjacent areas.

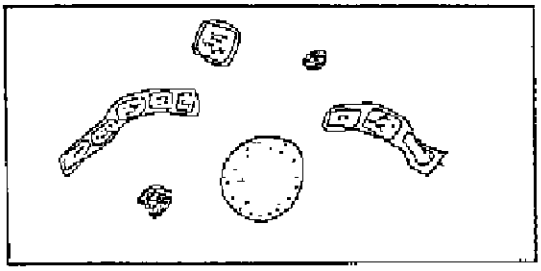
Description: SILVERWEED is named for the undersides of its leaves. The top of the many-toothed compound leaves is dark green and smooth. It spreads by runners and has glossy, yellow flowers that resemble buttercups.

Niche Notes: Rosy finch and snow bunting may eat the seeds of SILVERWEED.

"Gee Whiz:" Native northwesterners ate the roots steamed and dipped in whale oil.

Associates: TUFTED HAIRGRASS, DOUGLAS ASTER, BUTTERCUP, SEDGES, RUSHES

Common Name: PHYTOPLANKTON
Scientific Name: many different species



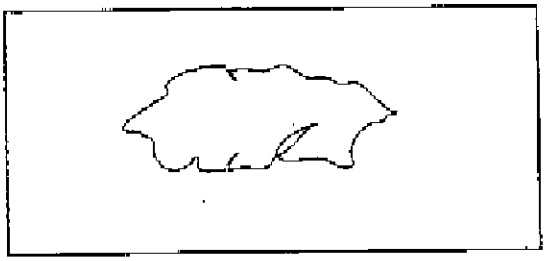
Habitat: May be found floating near the water surface or in the water column. Can be found in fresh and marine waters.

Description: PHYTOPLANKTON come in a wide variety of forms and are fascinating to study. Most PHYTOPLANKTON have a casing made up of silicon.

Niche Notes: PHYTOPLANKTON form the base of most aquatic food webs. They are eaten by ZOOPLANKTON and many small invertebrates.

"Gee Whiz:" Much of the oxygen we breathe is produced by PHYTOPLANKTON. They deserve our attention even if they are small and green!

Common Name: SEA LETTUCE
Scientific Name: *Ulva*



Wetlands Indicator: OBL

Habitat: In marine waters, at or below intertidal areas.

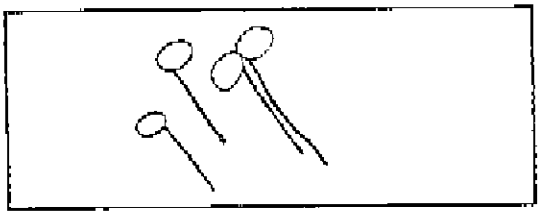
Description: SEA LETTUCE looks like very thin, bright green leaves of lettuce. The blades are translucent and, as in all seaweeds, lack veins. Pieces of SEA LETTUCE that wash up on the shore resemble green cellophane or may be bleached white by the sun.

Niche Notes: SEA LETTUCE may be eaten by various plant-eating marine life.

"Gee Whiz:" SEA LETTUCE is also used in oriental soups and dishes.

Associates: FUCUS or ROCKWEED

Common Name: DUCKWEED
Scientific Name: *Lemna minor*



Wetlands Indicator: OBL

Habitat: Floating on quiet ponds and lakes. It prefers sheltered water, over 5 centimeters deep.

Description: DUCKWEED looks like green confetti scattered on the water. The whole plant is only 2 to 3 millimeters across. It has a single root dangling beneath it, but is attached to nothing. Flowers are rare, since most DUCKWEED is sterile.

Niche Notes: DUCKWEED is excellent food for ducks! When ducks, BEAVERS and muskrats eat it they also ingest the small animal organisms that live in DUCKWEED, and they get a well balanced meal.

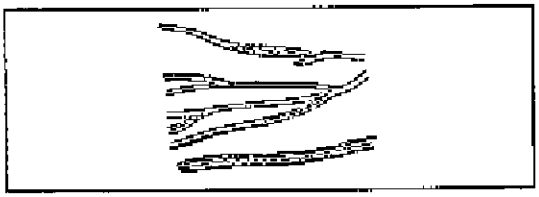
"Gee Whiz:" DUCKWEED produces the smallest flower of all known plants.

Associates: CATTAILS, PONDWEED, LIVERWORT

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: EELGRASS
Scientific Name: *Zostera marina* and *Zostera japonica*



Wetland Indicator: OBL

Habitat: Sandy or muddy intertidal areas.

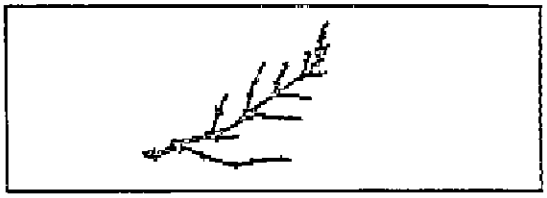
Description: Long, thin, green leaves characterize both species of eelgrass. *Z. marina* has leaves up to three meters (10') in length. *Z. japonica* leaves are finer and don't exceed 15 centimeters. The seeds are contained in translucent packets.

Niche Notes: BRANT geese eat EELGRASS as a staple part of their diet. Ducks and other waterfowl also dine on its seeds and leaves.

"Gee Whiz:" EELGRASS is considered a critical habitat in support of marine fisheries. It is commonly referred to as a nursery for many fish and crustaceans.

Associates: *Smithora naidum* (Red Fringe), a rose-colored seaweed, grows on EELGRASS blades.

Common Name: PICKLEWEED or GRASSWORT
Scientific Name: *Salicornia virginica*



Wetlands Indicator: OBL

Habitat: Low salt marshes.

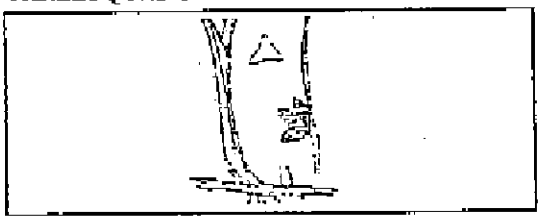
Description: PICKLEWEED is a succulent, lacking true leaves. It has thick, fleshy stems that may be tinged with red on the young, growing tips. Tiny, yellow flowers may occur near the tips of the stems. In winter, most of the fleshy growth is gone, leaving woody stems behind.

Niche Notes: Waterfowl eat the stems and seeds.

"Gee Whiz:" PICKLEWEED survives in its salty habitat by concentrating salt in the outer fleshy tips, which are either eaten or drop off. Try one for a treat; they can also be pickled.

Associates: Salt Grass, Arrowgrass, FLESHY JAUMEA

Common Name: AMERICAN THREESQUARE
Scientific Name: *Scirpus americanus*



Wetlands Indicator: OBL

Habitat: Low salt marshes, extending to higher regions.

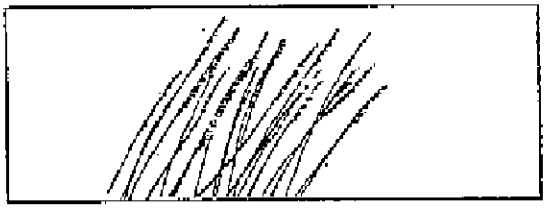
Description: Triangular stems and long, narrow leaves extending from the base identify AMERICAN THREESQUARE. A cluster of brownish flowers protrude from the bottom of its bract, which appears as an extension of the stem.

Niche Notes: A variety of geese, ducks and songbirds dine on this member of the bulrush family. Its seeds are favored, but its rootstalks are also eaten.

"Gee Whiz:" Provides protective cover for many animals, as well as nesting habitat for many waterfowl.

Associates: SMOOTH CORDGRASS, SEASIDE ARROWGRASS, LYNGBY'S SEDGE

Common Name: SMOOTH CORDGRASS
Scientific Name: *Spartina alterniflora*



Wetlands Indicator: OBL

Habitat: Sandy or muddy areas that are inundated twice daily by the tide.

Description: This grass is commonly 1 to 2 meters (3-6') in height. It has large stems about 1 centimeter in diameter. Its long leaves are green in summer and gold in fall. The flower cluster forms a single spike.

Niche Notes: CORDGRASS is an invasive, non-native plant in Washington. It outcompetes other native intertidal plants which are important in supporting a greater diversity of life.

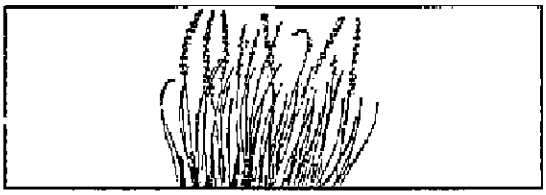
"Gee Whiz:" Provides protective cover for animals that also use it for food.

Associates: AMERICAN THREESQUARE, SEASIDE ARROWGRASS, LYNGBY'S SEDGE

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: SEASIDE ARROWGRASS
Scientific Name: *Triglochin maritimum*



Wetlands Indicator: OBL

Habitat: Saltmarsh areas that are inundated twice daily. It will survive in higher areas, but is unlikely to dominate.

Description: Fleshy, succulent leaves sheathe older, inner leaves. A long flower stalk with green or purple flowers extends above the leaves. Crushed leaves smell like Cilantro.

Niche Notes: Ducks and teal feed on ARROWGRASS.

"Gee Whiz:" This plant has been found in alkaline seeps, east of the Cascades.

Associates: In salt marshes: PICKLEWEED, FLESHY JAUMEA, SALTGRASS;
In brackish marshes: SEDGES, AMERICAN THREE-SQUARE, PACIFIC SILVERWEED

Common Name: SALTGRASS
Scientific Name: *Distichlis spicata*

Wetland Indicator: FACW

Habitat: High or low saltmarshes and is very salt tolerant.

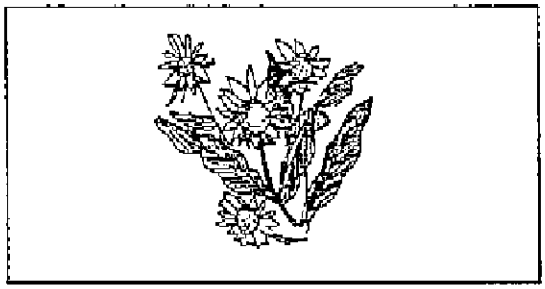
Description: This fairly short grass, less than 30 centimeters (1'), forms dense mats. The leaves are arranged symmetrically in one plane and are sharply angled from the stem. The flower clusters are purple and extend above the stem.

Niche Notes: The rootstalks of SALTGRASS create a dense mat that encourages marsh growth. This provides nesting cover for waterfowl, such as cinnamon teal and shoveller. The seed heads and young plants are food for various ducks and geese.

"Gee Whiz:" Salt crystals may be exuded on the surface of the leaves. This marvelous adaptation gives this grass a grayish appearance and helps one make a definitive identification.

Associates: PICKLEWEED, FLESHY JAUMEA

Common Name: GUMWEED
Scientific Name: *Grindelia integrifolia*



Wetlands Indicator: FACW

Habitat: Prefers high saltmarshes and surrounding areas.

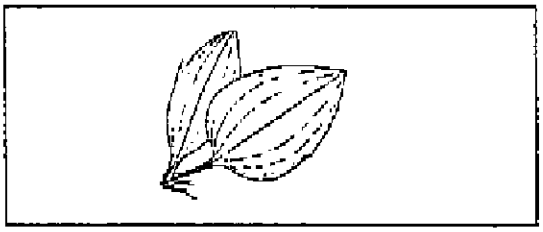
Description: GUMWEED is up to 80 centimeters tall, highly branched, and has lance- or oval-shaped leaves. Its flowers look like small sunflowers and can be seen in spring and summer.

Niche Notes: GUMWEED is of little importance to wildlife.

"Gee Whiz:" Guess where GUMWEED gets its name! The entire plant is sticky to the touch because it exudes a sticky coating.

Associates: SALTGRASS, TUFTED HAIRGRASS

Common Name: SEASIDE PLANTAIN
Scientific Name: *Plantago maritima*



Wetland Indicator: FACW

Habitat: Saltmarshes, but rarely dominates.

Description: This plant resembles SEASIDE ARROWGRASS, but is shorter, only 20 to 30 centimeters (1'). The leaves are more succulent and are often taller than the flower stalks. The plant appears greenish-gray because it is covered with short, woolly hairs.

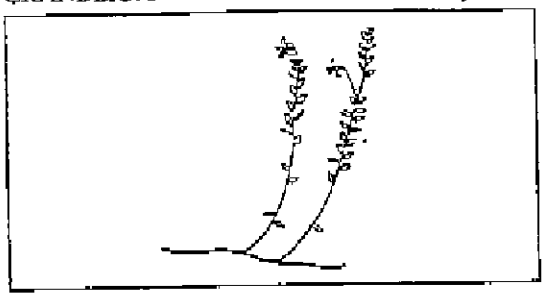
Niche Notes: Plantain seeds may be eaten by birds or rodents, but are not an important part of their diet.

"Gee Whiz:" Can thrive in intense wind and sea spray.

Associates: DOUGLAS ASTER, SEASIDE ARROWGRASS, LYNGBY'S SEDGE, SALTGRASS

(Discover Wetlands, Lynn, 1995)

Common Name: CRANBERRY
Scientific Name: *Vaccinium oxycoccus*



Wetlands Indicator: OBL

Habitat: SPHAGNUM bogs.

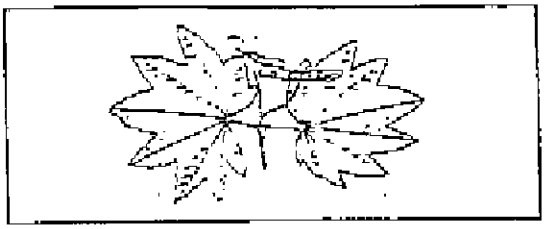
Description: This very small, trailing shrub has leathery, green leaves. Deep pink flowers develop into red, waxy berries.

Niche Notes: CRANBERRIES provide food for birds and small mammals.

"Gee Whiz:" Native Americans collected CRANBERRIES and kept them in boxes until brown. Pioneers to the area prized cranberries and sometimes traded for them.

Associates: LABRADOR TEA, BOG LAUREL, SUNDEW, SPHAGNUM

Common Name: VINE MAPLE
Scientific Name: *Acer circinatum*



Wetlands Indicator: FAC

Habitat: Grow in tangles along stream banks and in damp woods.

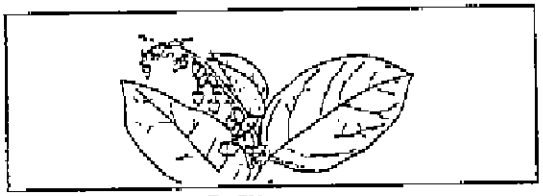
Description: Leafy and wide-spreading, this shrub bears light green leaves that turn bright red in the fall. The leaves are smaller than BIG LEAF MAPLE and have 7 to 9 lobes. It also produces "helicopters," identified by the wide angle between their wings.

Niche Notes: Songbirds and small mammals utilize VINE MAPLE for food, shelter, and nesting.

"Gee Whiz:" VINE MAPLE was an important source of basket making material for Native Americans.

Associates: WESTERN HEMLOCK, WESTERN RED CEDAR, RED ALDER, SKUNK CABBAGE, LADY FERN, WILD LILY-OF-THE-VALLEY

Common Name: SALAL
Scientific Name: *Gaultheria shallon*



Wetlands Indicator: FACU

Habitat: This is not a wetlands species, but may be found in drier areas of forested wetlands.

Description: Dark, leathery leaves and white to pink flowers characterize this very common shrub. It produces abundant, dark, purple, blueberry-shaped fruit.

Niche Notes: Deer browse SALAL. The fruit is popular with song and game birds and small mammals.

"Gee Whiz:" Most agree that SALAL berries are better cooked and sweetened. The foliage is used by commercial florists.

Northwestern Native people ate SALAL berries mashed, dried or dipped in whale or seal oil. The leaves were used to make a number of medicines.

Associates: RED HUCKLEBERRY, DOUGLAS FIR

Common Name: SITKA SPRUCE
Scientific Name: *Picea sitchensis*

Wetlands Indicator: FAC

Habitat: Tolerates full sun or partial shade and ample to moderate water. It does best in foggy, moist atmospheres and tends to be found along the coast from sea level to 2000 feet.

Description: This evergreen tree can reach 60 to 70 meters (180-200') in height. It can be recognized by its thin, greyish-brown scaly bark and droopy branches. The brave may choose to grab the stiff, sharp-needled branches for a painful identification. Individual needles have two white stripes on the upper surface and narrower stripes on the lower. Male cones are red; female cones are reddish- or yellowish-brown and get browner with age.

Niche Notes: Seeds are food for wildlife, the tree provides cover and nesting areas, and needles are eaten by blue and sprice grouse.

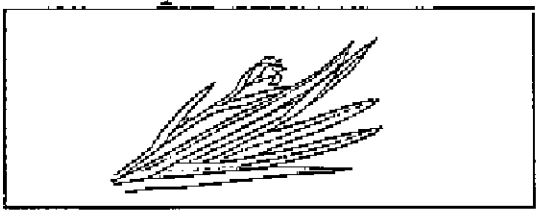
"Gee Whiz:" Northwest Native peoples used the pitch to caulk canoes, as a salve for wounds, as a chest rub for colds, and even as a chewing gum. The roots were used for baskets and the bark boiled into a tea to stop pickles in the throat. The Makah decorated their hair with its leaves before going to sea.

Associates: WESTERN RED CEDAR, WESTERN HEMLOCK, VINE MAPLE, LADY FERN, SKUNK CABBAGE

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: YELLOW FLAG or IRIS
Scientific Name: *Iris pseudacorus*



Wetlands Indicator: OBL

Habitat: Found in inundated areas of open shorelines or meadows.

Description: Found in dense clumps, 1 meter (3') tall clumps. the YELLOW FLAG may be identified by its broad, thick, parallel-veined leaves. It is easily identified by its yellow blooms that are sometimes tinged with purple. If it isn't blooming, it can be identified from a CATTAIL by the way its leaves overlap fan-like at the base of the plant.

Niche Notes: This non-native plant is probably of European origin.

"Gee Whiz": The YELLOW FLAG is poisonous to many animals, including HUMANS. It causes vomiting.

Associates: CATTAIL, RUSHES, SEDGES

Common Name: SKUNK CABBAGE
Scientific Name: *Lysichitum americanum*

Wetlands Indicator: OBL

Habitat: Only grows in standing water or saturated soils.

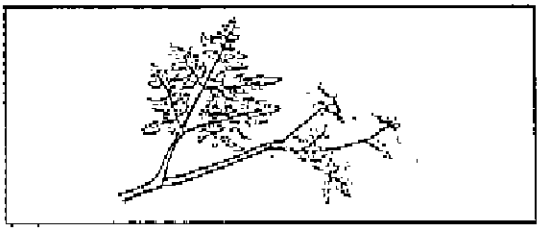
Description: One of the first native flowers to bloom in spring, SKUNK CABBAGE is easily recognized by its whorl of huge, up to 1 meter (3') long, leaves. The tiny flowers are surrounded by a large, yellow spathe. Exudes a stinky smell to attract flies that aid in pollination.

Niche Notes: Grouse, pheasants, bear and elk eat its seeds.

"Gee Whiz": SKUNK CABBAGE roots may be cooked and eaten, but the leaves are poisonous if eaten because they contain oxalyic acid crystals. Native Northwesterners also used the leaves to soothe cuts and swellings, line their canoes, and rolled up as cups for holding liquids, berries, or wrapping salmon when baking over hot coals.

Associates: WESTERN HEMLOCK, WESTERN RED CEDAR, RED ALDER, VINE MAPLE, LADY FERN, WATER PARSLEY

Common Name: WATER PARSLEY
Scientific Name: *Oenanthe sarmentosa*



Wetlands Indicator: OBL

Habitat: Saturated soils or standing water.

Description: The leaves are twice pinnately compound and toothed. Small, white flowers are borne in clusters. The stems have purple ribs.

Niche Notes: WATER PARSLEY is considered an introduced species.

"Gee Whiz:" Be careful. WATER PARSLEY resembles poisonous water hemlock. This species was used by Native Northwestern people. The stalks were eaten or made into whistles, and the roots make a potent laxative.

Associates: CATTAILS, YELLOW IRIS, SKUNK CABBAGE, SEDGES, RUSHES

Common Name: MARSH PEPPER or KNOTWEED or SMARTWEED
Scientific Name: *Polygonum spp.*

Wetlands Indicator: FACU – OBL (depends on species)

Habitat: Shallow water, though some species may be able to tolerate saturated soils.

Description: This plant has reddish-purple stems up to one meter (3') tall and covered with small, indented glands. The leaves are lance-shaped and have a sheath around the stems. The very tiny flowers are borne on lateral or terminal stalks.

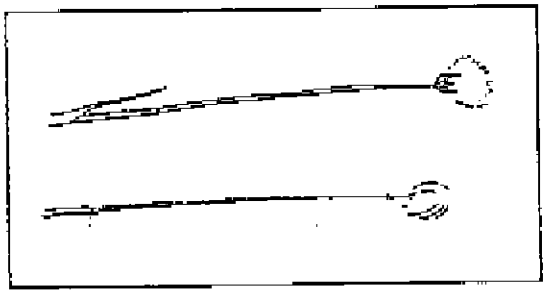
Niche Notes: Stands of SMARTWEED form excellent duck habitat. Their seeds are eaten by waterfowl and they provide superior cover. The seeds are also favored by a variety of birds such as mourning doves, pheasants, snow buntings, finches, juncos, sparrows, and common redpoles. Western chipmunk, muskrats, moose, and some aquatic insects also dine on SMARTWEED.

"Gee Whiz:" SMARTWEED is also called MARSH PEPPER because of its peppery taste.

Associates: DUCKWEED, CATTAIL, RUSHES, SEDGES

(Discover Wetlands, Lynn, 1995)

Common Name: COTTON GRASS
Scientific Name: *Eriophorum chamissonis*



Wetlands Indicator: OBL

Habitat: Younger spongey portions of bogs.

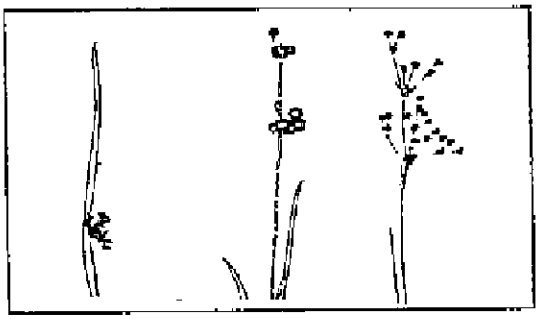
Description: A type of sedge, COTTON GRASS is characterized by a tall, stout stem 30 to 70 centimeters (1-2.5') in height. Leaves, if there are any, are found at the base. The flower cluster, at the end of the stem, develops into a cotton-like tuft.

Niche Notes: Birds use the "cotton" tufts for nest material.

"Gee Whiz:" COTTON GRASS is also called cotton sedge.

Associates: LABRADOR TEA, BOG LAUREL, SUNDEW, SPHAGNUM

Common Name: RUSH
Scientific Name: *Juncus spp.*



Wetlands Indicator: OBL-FACW

Habitat: Saturated soils or even standing water.

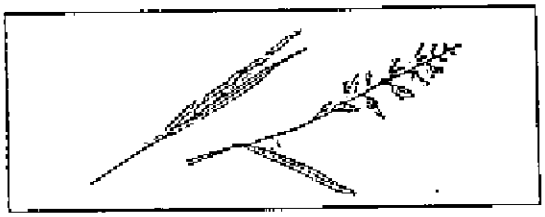
Description: Clumps of RUSHES have cylindrical or flattened stems and leaves that sheathe the stem. Clusters of green or brown flowers help botanists identify various species.

Niche Notes: RUSHES are eaten by few species of wildlife, but they are a good source of cover.

"Gee Whiz:" RUSHES are used in weaving baskets

Associates: CATTAILS, REED CANARY GRASS, SEDGES

Common Name: REED CANARY GRASS
Scientific Name: *Phalaris arundinacea*



Wetlands Indicator: FACW

Habitat: Tolerates a wide range of water conditions.

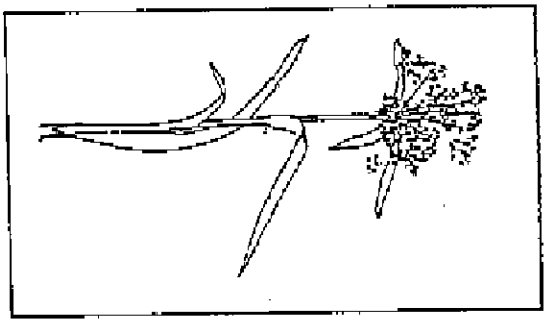
Description: A strong grass that has hollow stems and upper leaves that stand at 45 degree angles from the stem. Little, scaly flowers are held atop the stem.

Niche Notes: A few birds eat the seeds. It was widely planted in agricultural areas because of its ability to grow in saturated conditions. The U.S.F.W.S. now discourages farmers from planting it because of its tendency to out compete native vegetation and its low value as forage for wildlife.

"Gee Whiz:" This introduced species is very invasive and out competes other, more desirable species. It also is an abundant pollen producer, not good for those with allergies.

Associates: CATTAIL, SEDGES, RUSHES

Common Name: SMALL-FRUITED BULRUSH
Scientific Name: *Scirpus microcarpus*



Wetlands Indicator: OBL

Habitat: Low, damp areas

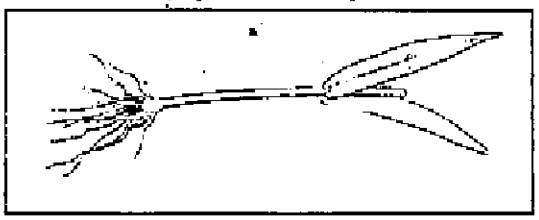
Description: W-shaped, grass-like leaves sheathe a slightly triangular stem that reaches up to 1.5 meters (5') tall. Numerous dark green or brown flowers are held in clusters above the stem.

Niche Notes: The seeds and rootstalk are eaten by all sorts of waterfowl, marsh and shorebirds.

Associates: SEDGES, RUSHES

(Discover Wetlands, Lynn, 1995)

Common Name: PURPLE LOOSESTRIFE
Scientific Name: *Lythrum salicaria*



Wetlands Indicator: FACW+

Habitat: Shallow marshes or saturated soils.

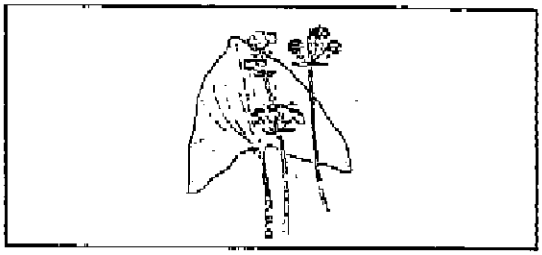
Description: This tall, 1 to 2 meter (3-6') plant has long, slender leaves that are often tinged in pink. It has showy, bright purplish-pink flowers in clusters.

Niche Notes: PURPLE LOOSESTRIFE is not important to wildlife. It is an invasive species introduced from Europe.

"Gee Whiz:" Imported plants can upset the delicate balance in a habitat. PURPLE LOOSESTRIFE out competes other native species and chokes them out. It is considered a noxious weed and the WA Dept. of Ecology is encouraging local jurisdictions to eradicate it.
Native Americans used the leaves to treat chronic diarrhea.

Associates: CATTAIL, WILLOW, HARDHACK

Common Name: WAPATO or BROADLEAF ARROWHEAD
Scientific Name: *Sagittaria latifolia*



Wetlands Indicator: OBL

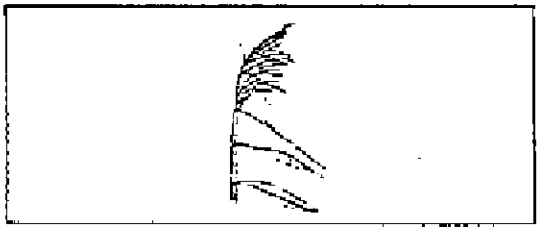
Habitat: Quiet, standing water.

Description: ARROWHEAD earned its name from its distinctly arrowhead-shaped leaves. Small, white flowers are formed on a spike.

Niche Notes: The small seeds and starchy roots are eaten by waterfowl and muskrat.

"Gee Whiz:" Native Americans harvested the roots. Often called duck potatoes.

Common Name: REEDGRASS or COMMON REED
Scientific Name: *Phragmites australis*



Wetlands Indicator: FACW+

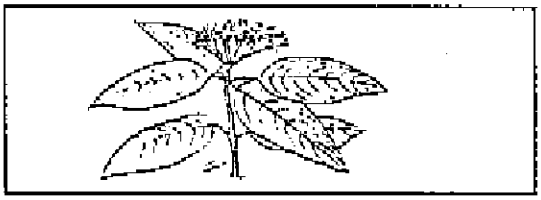
Habitat: Areas where inundation is erratic. It also tolerates brackish conditions.

Description: Very tall, 2 to 3 meter (6-9'), stems and long leaves identify this species. The flower is a rush-like spike that is purplish, but fades to straw color.

Niche Notes: This grass invades areas, driving out other species that are beneficial to wildlife.

"Gee Whiz!" REEDGRASS forms monocultures easily, and is considered a serious pest on the Atlantic Coast. It is only beginning to invade WA wetlands. *(Formerly called Phragmites australis)*

Common Name: RED-OSIER DOGWOOD
Scientific Name: *Cornus sericia*



Wetlands Indicator: FACW

Habitat: Along streams and ponds. It prefers full sun and ample to moderate water.

Description: The many stems of this shrub are bright red to reddish-purple, but turn gray with age. It grows from 2 to 6 meters (6-18') tall. Its leaves have a rounded base and pointed tip and are dark with distinct veins. Flowers occur in flat-topped clusters and the fruits are small and white or pale blue in color.

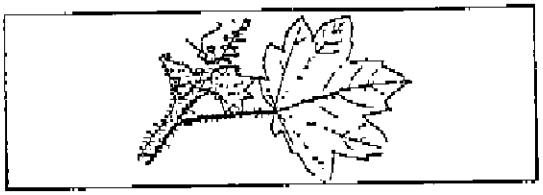
Niche Notes: At least twenty-four species of Northwest birds feed on DOGWOOD. Black-tailed deer and mountain beaver also use it for food. It is valuable for bird cover and nesting.

"Gee Whiz:" DOGWOOD is valuable in habitat reclamation projects and is a beautiful shrub. *(Formerly called C. stolonifera)*

Associates: WILLOW, REED-CANARY GRASS, CATTAILS

(Discover Wetlands, Lynn, 1995)

Common Name: DEVIL'S CLUB
Scientific Name: *Oplopanax horridum*



Wetlands Indicator: FAC

Habitat: Shady, moist woods and near streams.

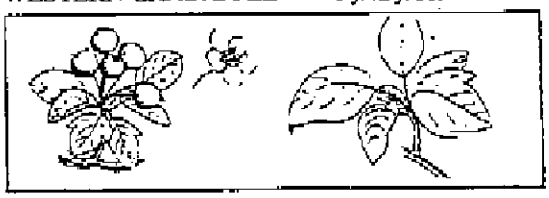
Description: Once encountered, this plant will never be mistaken. It has large, 1 to 3 meter (3-9') stems and huge leaves armed with yellowish spines.

Niche Notes: Most wildlife steer clear of DEVIL'S CLUB. The little, red berries may be eaten by some small birds.

"Gee Whiz:" Even the scientist who named this thought it was horrid (see the Latin name). Northwest Native peoples used the plant, mostly as a source of medicine. The bark can be used to make cold medicine, deodorant, baby talc, or burned and mixed with grease for face paint.

Associates: WESTERN HEMLOCK, RED ALDER, SALMONBERRY, RED ELDERBERRY, LADY FERN, WILD LILY-OF-THE-VALLEY

Common Name: WESTERN CRABAPPLE
Scientific Name: *Pyrus fusca*



Wetlands Indicator: FACW

Habitat: Moist woods, along stream banks, and in bogs.

Description: This shrub has several stems and may be as large as 12 meters (36') tall. It has dark, flaky bark, blunt twigs, and variable shaped leaves. Flowers are white or pink and found in clusters. The small, round fruits are yellow to purplish in color.

Niche Notes: CRABAPPLES are reported to be food for pheasant, grouse, and bears.

"Gee Whiz:" Native Northwesterners ate the fruit of the CRABAPPLE. The lightweight, but tough wood was used for the prongs of seal spears and as a maul. The bark's medicinal properties were used for disorders of the intestines or stomach, eyes, and blood. (*Formerly known as Pyrus fusca.*)

Associates: WESTERN HEMLOCK, HARDBACK, RED ALDER, LABRADOR TEA.

Common Name: SALMONBERRY
Scientific Name: *Rubus spectabilis*

Wetlands Indicator: FAC

Habitat: Moist woods and along stream banks. It prefers full sun or partial shade and at least moderate water.

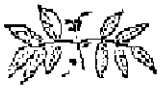
Description: SALMONBERRY's tangle of curving stems, growing up to 4 meters (12') high, are covered in compound leaves. The leaves have three, triangular, hairy leaflets. The flowers are reddish-purple and the berries are orange to bright red.

Niche Notes: The shrub provides shelter for nesting birds and small rodents. The flowers are a favorite of hummingbirds and butterflies. Both birds and mammals eat the fruit.

"Gee Whiz:" The astringent bark, leaves, and sprouts of SALMONBERRY were traditionally used as a remedy for digestive disorders caused by eating too much salmon and to treat burns. The berries are excellent raw or cooked into jam or pie.

Associates: RED ALDER, VINE MAPLE, LADY FERN, FOAM FLOWER

Common Name: RED ELDERBERRY
Scientific Name: *Sambucus racemosa*



Wetlands Indicator: FACU

Habitat: Prefers full sun and at least moderate water.

Description: Each compound leaf has 5 to 7 sharply-toothed leaflets on a long petiole. The soft, pithy, bluish twigs form a large shrub, 2 to 5 meters (6-15'). Small clusters of white flowers are followed by little, crimson berries.

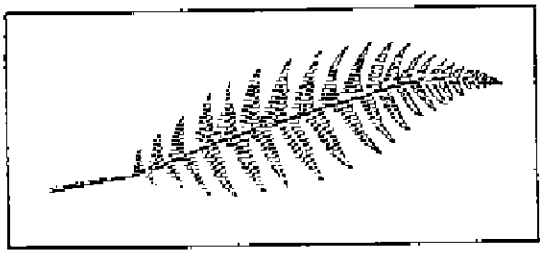
Niche Notes: Though these berries are toxic to humans, 29 species of Northwest birds feed on the berries and deer browse the foliage. Robins and band-tailed pigeons are especially attracted by the fruit.

"Gee Whiz:" The Latin name for ELDERBERRY comes from the word "sambuke" which means "a musical instrument." The wood has been used since ancient times to make flutes and whistles. The flower clusters are delicious if dipped in batter and cooked as fritters. The berries are reported to be poisonous unless cooked. Since they taste unpleasant, even cooked, it is suggested to leave them for the birds.

Associates: WESTERN HEMLOCK, RED ALDER, VINE MAPLE, DEVIL'S CLUB, DEER FERN, FOAM FLOWER

(Discover Wetlands, Lynn, 1995)

Common Name: LADY FERN
Scientific Name: *Athyrium felix-femina*



Wetlands Indicator: FAC

Habitat: Marshy areas, wet forests, and along streams.

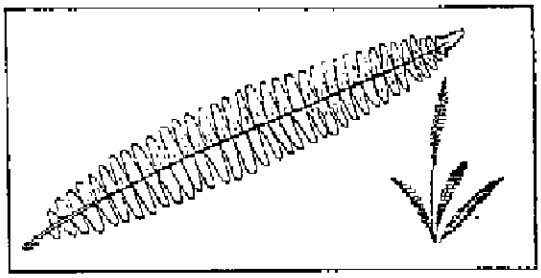
Description: A lacy, delicate, bright green fern, whose fronds are lance-shaped. Its softness will identify it from other ferns. Oval spore clusters may be found on the leaves undersides.

Niche Notes: This fern is of minimal use to wildlife.

"Gee Whiz:" The young, curled fiddle heads of LADY FERN are good either raw or boiled, always wash first for human consumption.

Associates: WESTERN HEMLOCK, WESTERN RED CEDAR, RED ALDER, VINE MAPLE, SKUNK CABBAGE

Common Name: DEER FERN
Scientific Name: *Blechnum spicant*



Wetlands Indicator: FAC+

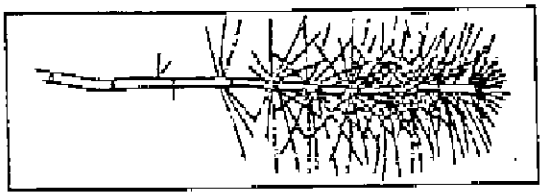
Habitat: Common in shady, moist forests.

Description: DEER FERN have two kinds of fronds. Vegetative fronds are lance-shaped, but the leaflets are not toothed and are attached directly to the stalk. Fertile fronds shoot above the rest of the plant and have spores on the underside of their thin leaflets.

Niche Notes: Elk find DEER FERN a favorite.

Associates: WESTERN HEMLOCK, LADY FERN, SKUNK CABBAGE

Common Name: HORSETAIL
Scientific Name: *Equisetum sp.*



Wetlands Indicator: FAC

Habitat: Flourish in wet, disturbed areas.

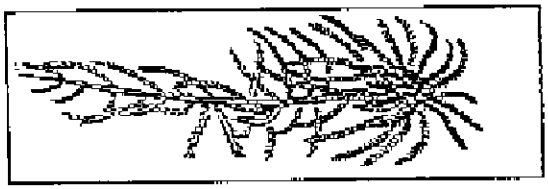
Description: A jointed stem, up to 60 centimeters (24") tall, is surrounded by whorls of wiry branches and small, scaly leaves

Niche Notes: Whistling swans or a hungry BLACK BEAR may eat HORSETAILS, but overall they are of little value to wildlife.

"Gee Whiz:" HORSETAILS are known as "scouring rush" because the silica in their stems make them tough and abrasive enough to scrub pots. Native Americans also used the stems to polish arrows and for an invigorating body scrub. The juice was used as an eyewash. The spore cone was mashed with salmon eggs and eaten. The stem and root was eaten with whale or seal oil, boiled for a hair rinse, or woven into baskets.

Associates: LADY FERN, SKUNK CABBAGE, MONKEY FLOWER, SEDGES, RUSHES

Common Name: PEAT MOSS
Scientific Name: *Sphagum spp.*



Wetland Indicator: OBL

Habitat: Soggy, acid conditions.

Description: Small mossy plants from grayish- to reddish-green mats in soggy areas. The individual plants have bushy heads of leafy structures above a sparser lower section. Spore producing capsules, when present, rise above the leafy heads.

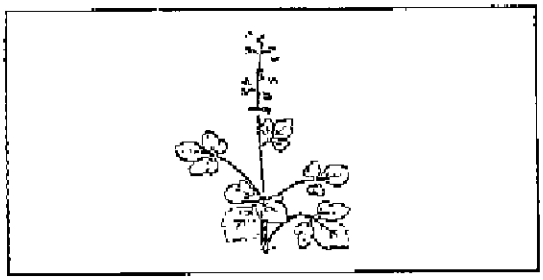
Niche Notes: Not considered a food source for wildlife.

"Gee Whiz:" PEAT MOSS holds many times its weight in water. It is so acidic, it was used during World War I as a sterile dressing for injuries. The mats are often floating and make the soil boggy. It is often used in gardening today. Native Americans used SPHAGNUM moss as the first disposable diapers.

Associates: LABRADOR TEA, BOG LAUREL, CRANBERRY

(Discover Wetlands, Lynn, 1995)

Common Name: THREE-LEAF FOAM FLOWER
Scientific Name: *Tiarella trifoliata*



Wetlands Indicator: FAC

Habitat: Prefers moist woods.

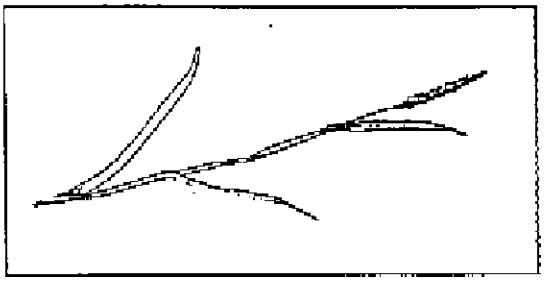
Description: Compound leaves arise from the stem, each consisting of three toothed leaflets. Lacy, white flowers are held high on a stalk.

Niche Notes: Grouse may browse on FOAM FLOWER.

"Gee Whiz:" Native Northwesterners chewed FOAM FLOWER leaves as a cough medicine.

Associates: WESTERN HEMLOCK, RED ALDER, VINE MAPLE, LADY FERN, SKUNK CABBAGE

Common Name: FOXTAIL
Scientific Name: *Alopecurus spp.*



Wetlands Indicator: FACW to OBL

Habitat: Very wet soils.

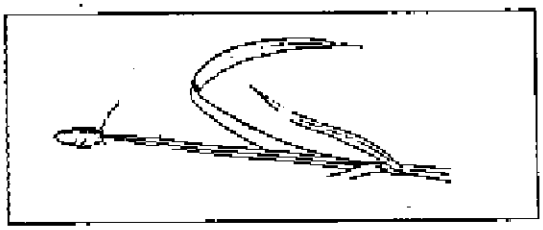
Description: This grass has flat, soft leaves surrounding a hollow 50 centimeter (1' tall) stem. Bristly, little flowers form a cluster resembling a fox tail.

Niche Notes: FOXTAIL is not known to be useful to wildlife.

"Gee Whiz:" FOXTAIL makes excellent forage for wild creatures that don't mind wet places.

Associates: SEDGES, RUSHES

Common Name: SEDGES
Scientific Name: *Carex spp.*



Wetlands Indicator: FACW to OBL

Habitat: SEDGES grow in standing water or saturated soils. Two species, Lyngby's and Slough sedge, are tolerant of brackish water. Lyngby's is more salt-tolerant than Slough sedge.

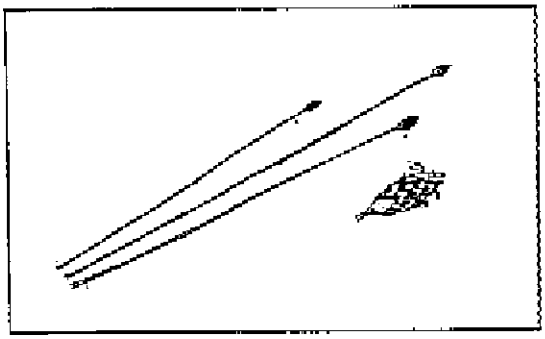
Description: This grass-like plant has triangular stems and fibrous roots. If it has leaves, they are grass-like and shaped like a 'w' when cut across their width.

Niche Notes: The small seeds of SEDGES are eaten by birds such as ducks, rails, grouse, and songbirds. Pika and chipmunks also eat the seeds and leaves. SEDGES provide valuable cover for wildlife.

"Gee Whiz:" Native Northwesterners wove baskets using sedge.

Associates: CATTAILS, REED CANARY GRASS, RUSHES

Common Name: SPIKE-RUSH
Scientific Name: *Eleocharis spp.*



Wetlands Indicator: OBL

Habitat: In clumps in areas with wet soils.

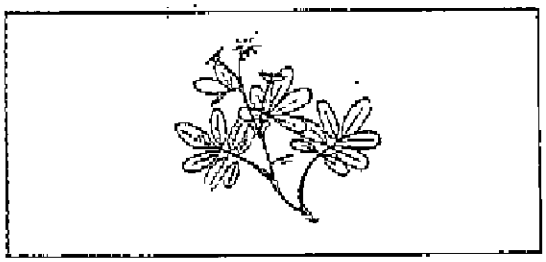
Description: The clumps of rounded or flattened stems are dark green in color. SPIKE-RUSH has no leaves and the flowers form a small brown cluster on the tip of the spikes.

Niche Notes: The seeds and tuberous roots are eaten by waterfowl and marsh birds.

Associates: SEDGES, RUSHES

(Discover Wetlands, Lynn, 1995)

Common Name: MARSH CINQUEFOIL
Scientific Name: *Potentilla palustris*



Wetlands Indicator: OBL

Habitat: Standing water.

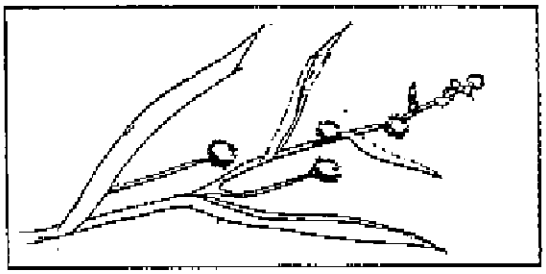
Description: Leaves are compound with 5 to 7 toothed leaflets. Long, reddish stems wind underwater. The flowers are deep red to purple in color and arise from the leaf base.

Niche Notes: MARSH CINQUEFOIL's seeds may be eaten by a few birds, but it otherwise is of little use to wildlife.

"Gee Whiz!" Used by Chippewa Indians as a treatment for dysentery and has been historically known as a powerful cure-all.

Associates: CATTAIL, WATER PARSLEY, RUSHES, SEDGES

Common Name: BURREED
Scientific Name: *Sparganium emersum*



Wetlands Indicator: OBL

Habitat: Marshy areas, peaty soils, or slow-moving streams.

Description: Long, flat, spongy leaves emerge or float on the surface. The flowers and seeds are in clusters that look like burrs. Male flowers are on the upper part of the plant. Female flowers are lower and usually lateral.

Niche Notes: BURREED is eaten by ducks, swans, sandhill cranes, common snipe and muskrat.

"Gee Whiz!" Part of an important group of plants that live half in the water and half out of the water.

Associates: CATTAILS, SEDGES, RUSHES

Common Name: COMMON CATTAIL
Scientific Name: *Typha latifolia*

Wetlands Indicators: OBL

Habitat: Form large stands in quiet, standing water.

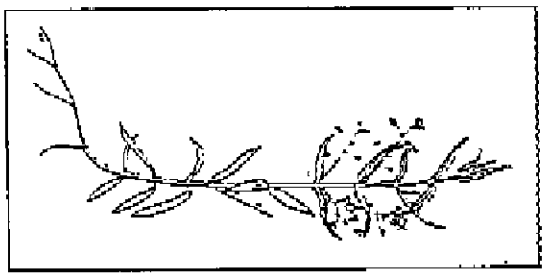
Description: The long, narrow, grayish-green leaves of CATTAIL are almost unmistakable. The tiny, separate male and female flowers make up the "Cat's tail." Leaves have pointed tips and a sheathing base.

Niche Notes: The tiny, hairy seeds are only eaten by some teal. The roots are a favorite for muskrats. It also provides nesting areas for RED-WINGED BLACKBIRDS and MARSH WRENS. While CATTAIL may provide cover for ducks, it usually invades areas that would support other more diverse plant communities used for both food and cover.

"Gee Whiz!" CATTAIL roots were eaten by Native Americans. Its leaves were woven into mats, rainwear, and pack sacks. The young stalks are very tasty in salads. The young "CATTAILS" (male and female flowers) may be boiled and buttered, then eaten like corn on the cob. But, beware if gathering your own CATTAIL for food. The stands growing in roadside ditches may contain high levels of lead and other contaminants from our motor vehicles.

Associates: YELLOW IRIS, SEDGES, RUSHES

Common Name: MARSH SPEEDWELL
Scientific Name: *Veronica scutellata*



Wetlands Indicator: OBL

Habitat: Wet places from waterside to foothills.

Description: The creeping stems of SPEEDWELL have lance-shaped leaves and bluish flowers.

"Gee Whiz!" SPEEDWELL was called "frog leaves" by one Northwest native tribe.

Associates: CATTAIL, WATER PARSLEY, MARSH PEPPER, SEDGES, RUSHES

(Discover Wetlands, Lynn, 1995)

Common Name: WESTERN RED CEDAR
Scientific Name: *Thuja plicata*

Wetlands Indicator: FAC

Habitat: Tolerates full sun or partial shade and ample or moderate water. It flourishes in moist areas along water margins.

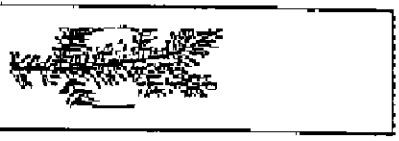
Description: Red bark that peels in long strips and flat, scale-like needles identify this 60 to 70 meter (180-200') tree. Branches are flattened and droopy with tiny, scaly cones near their ends.

Niche Notes: Wildlife eat the seeds in the small cedar cones. The branches also provide winter forage for some wildlife.

"Gee Whiz:" This tree was of significant importance to Northwest Native peoples. Its bark was gathered and shredded into fibers for clothing, diapers, maps, and sails. The wood could be harvested from living trees by cutting a slice and pulling off planks. The wood is very resistant to decay and made excellent houses and canoes. Roots were woven into baskets and limbs were used to scare away ghosts. The buds were chewed to cure sore lungs and toothaches.

Associates: WESTERN HEMLOCK, RED ALDER, VINE MAPLE, SKUNK CABBAGE, LADY FERN, FOAM FLOWER

Common Name: WESTERN HEMLOCK
Scientific Name: *Tsuga heterophylla*



Wetlands Indicator: FACU

Habitat: Prefers partial shade, ample moisture, and little wind. Found in WESTERN RED CEDAR stands that have little undergrowth. It grows rather quickly.

Description: Identified by its droopy branch tips and strongly furrowed, dark bark, this tree grows up to 60 or 70 meters (180-200'). Has soft, flat, round-tipped evergreen needles of varying lengths. Small, oval cones are attached directly to the branches.

Niche Notes: Hemlock provides food for grouse, chickadees, and pine siskin. It is also valuable for cover and nesting.

"Gee Whiz:" Northwest Natives used hemlock pitch for pain and to prevent sun and windburn. The bark releases a reddish-brown dye when boiled. It was used to dye paddles and fishing equipment to make it invisible to salmon. It also makes a yellowish-brown paint when mashed with salmon eggs. The boiled bark was used as a laxative, eyewash, and cure for sore throats. The boughs were suitable for making temporary shelters.

Associates: WESTERN RED CEDAR, RED ALDER, VINE MAPLE, SKUNK CABBAGE LADY FERN, FOAM FLOWER

Common Name: RED ALDER
Scientific Name: *Alnus rubra*

Wetlands Indicator: FAC

Habitat: Thrives in disturbed areas. It requires full sun and ample or moderate amounts of water. Alder tolerates brackish and very poor soil, and is often found on stream sides and in moist woods.

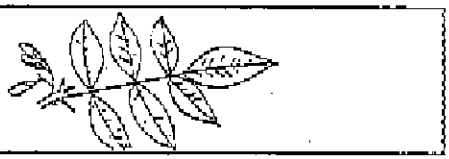
Description: Alder may be found as a crowded shrub or a tree as tall as 20 meters (80'). The bark is thin, smooth, and marked with horizontal lines called lenticels. Leaves are pointed ovals, with toothed, rolled-under edges. The upper surface is smooth and deep green. The under surface is grayish with red hairs on the veins.

Niche Notes: Birds, such as goldfinches, chickadees, and pine siskins, eat the tiny seeds in alder "cones." Elk and deer may also eat the twigs or foliage. BEAVER browse its leaves.

"Gee Whiz:" Alder actually adds nitrogen to the soil. Bacteria, living in nodules on its roots, take nitrogen out of the air and enrich the soil. Alder provides excellent wood for smoking fish and carving. Its bark was boiled for a dye.

Associates: WESTERN HEMLOCK, BLACK COTTONWOOD, WILLOW, SALMONBERRY, LADY FERN, SKUNK CABBAGE

Common Name: OREGON ASH
Scientific Name: *Fraxinus latifolia*



Wetlands Indicator: FACW

Habitat: Deep, moist soils along streams and wetlands. It can tolerate full sun or partial shade.

Description: This leafy tree grows to 20 meters (66'). Its rough, grayish-brown bark is often covered with lichens and mosses. Individual leaflets are light green on top and pale and hairy on the bottom. They are arranged in a pinnately compound leaf. Ash produces a single-winged fruit.

Niche Notes: Ash is of moderate use to wildlife. Grosbeaks eat the seeds of the female tree. Cedar waxwings and purple martins use the tree for food. The seeds and wood provide food for the Douglas chickaree.

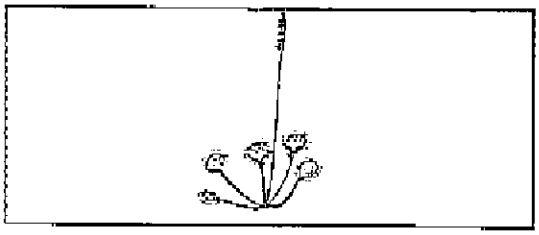
"Gee Whiz:" OREGON ASH is used to make tools and furniture.

Associates: RED ALDER, VINE MAPLE, SKUNK CABBAGE LADY FERN

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: SUNDEW
Scientific Name: *Drosera rotundifolia*



Wetland Indicator: OBL

Habitat: SPHAGNUM bogs.

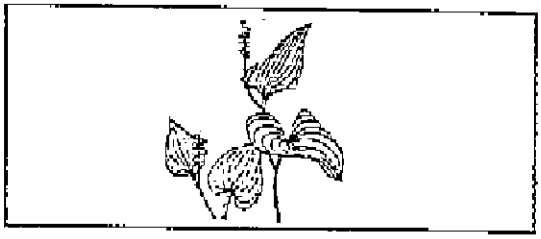
Description: Narrow leaves that extend to rounded ends are covered with long, reddish, sticky hairs. The leaves form a whorl. Flowers arise from a stalk at the base of the leaves.

Niche Notes: It isn't known if anything eats SUNDEW.

"Gee Whiz:" SUNDEW are carnivorous. They trap insects on their sticky hairs and dissolve their bodies for the needed nutrients, mostly nitrogen and phosphorous. This is an adaptation for the nitrogen-poor soils in which they live.

Associates: BOG LAUREL, LABRADOR TEA, COTTON GRASS, SPHAGNUM

Common Name: WILD LILY-OF-THE-VALLEY
Scientific Name: *Maianthemum dilatatum*



Wetlands Indicator: FAC

Habitat: Moist, shaded forests or stream banks.

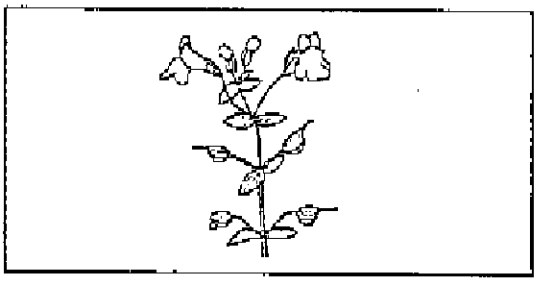
Description: One to three heart-shaped leaves with parallel veins identify this 10 to 30 centimeter (3-12") herb. Flowers are white and stand in a small cluster above the plant.

Niche Notes: The berries are eaten to a limited extent by wildlife.

"Gee Whiz:" The tiny red berries were eaten by Native Americans, but not relished. The Quileute name describes them as tasting kind of sour or like whale oil.

Associates: RED ALDER, WESTERN RED CEDAR, WESTERN HEMLOCK

Common Name: YELLOW MONKEY FLOWER
Scientific Name: *Mimulus guttatus*



Wetland Indicator: OBL

Habitat: Wet meadows.

Description: Fleshy, heart-shaped, toothed leaves are arranged on hollow stems that reach up to 1 meter (3'). Bright, yellow flowers with purple markings appear in pairs at the top. They resemble snap-dragons.

Niche Notes: The tongue of the MONKEY FLOWER'S petal serves as a perfect landing pad for bumble bees.

"Gee Whiz:" The leaves make a tasty salad.

Associates: FOXTAILS, SEDGES, RUSHES

Common Name: CREEPING BUTTERCUP
Scientific Name: *Ranunculus repens*

Wetland Indicator: FACW

Habitat: Common in many moist areas, especially deciduous forests and wet meadows.

Description: Soft, hairy compound leaves have three leaflets and stand on long petioles. Five-petaled, yellow flowers develop into round fruits covered in green spikes.

Niche Notes: Small amounts of BUTTERCUP seeds may be eaten by some wildlife. This species of BUTTERCUP was introduced and has flourished. There are also native Buttercup species.

"Gee Whiz:" The roots of the plant were cooked, dipped in seal or whale oil, and eaten with salmon eggs by Native Americans. The leaves and stems are inedible because they contain the toxin ranunculin, a severe gastrointestinal irritant. The name comes from the Latin "rana", which means frog and probably refers to its watery habitat.

Associates: RED ALDER, WILLOW, SEDGES, RUSHES

(Discover Wetlands, Lynn, 1995)

Common Name: HARDHACK
Scientific Name: *Spiraea douglasii*

Wetlands Indicator: FACW

Habitat: This widespread shrub is found standing in water along stream banks, lakes, bogs, and wet meadows. It tolerates full or partial sun.

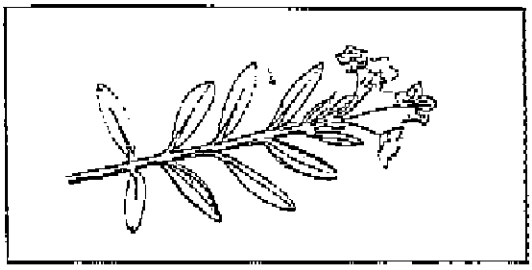
Description: This 1 to 2.5 meter (3-8') shrub has oval leaves with teeth only along the upper half of the margins. Tiny, individual, rosy-pink flowers form conical clusters. The seed clusters quickly turn brown and persist through winter.

Niche Notes: Spiraea, also called HARDHACK, is of limited use to wildlife. It provides cover and white-tailed deer are documented to occasionally feed on it. It is a favorite nesting site for common yellowthroat warblers and Virginia Rails. Unfortunately, Spiraea tends to form a monoculture so dense that nothing grows beneath it.

"Gee Whiz:" Spiraea was of limited use to Native peoples. The seeds were boiled for a tea for diarrhea and the wood could be used for spreading and smoking salmon, since it doesn't burn easily.

Associates: RED ALDER, WILLOW, CRABAPPLE, LABRADOR TEA

Common Name: BOG LAUREL
Scientific Name: *Kalmia occidentalis*



Wetlands Indicator: FACW+

Habitat: SPHAGNUM bogs.

Description: Easily confused with LABRADOR TEA, the BOG LAUREL has darker green leaves with a distinctive white midrib. The flowers are saucer shaped and deep rose in color.

Niche Notes: The plant is poisonous to some animals.

"Gee Whiz:" BOG LAUREL is named after Peter Kalm, a botanist who studied under Carolus Linnaus, the man who started our system of naming and classifying plants.

Associates: LABRADOR TEA, SPHAGNUM, CRANBERRY

Common Name: LABRADOR TEA
Scientific Name: *Rhododendron groenlandicum*

Wetlands Indicator: OBL

Habitat: Bogs.

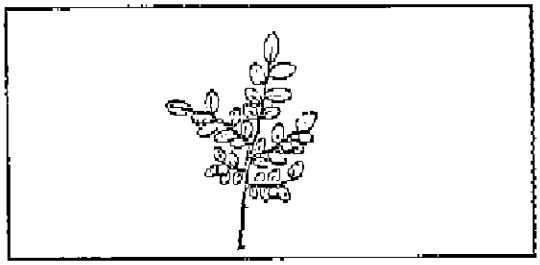
Description: LABRADOR TEA grows as large as 2 meters (6') and is green year-round. Its dark, leathery leaves have rusty colored hairs on their undersides. White flowers are arranged in clusters at the ends of the stems.

Niche Notes: Moose and deer are known to eat this shrub, but it is of limited use to most wildlife.

"Gee Whiz:" LABRADOR TEA can be brewed into a tea, but if it is too strong it is mildly poisonous. *(Formerly called Ledum.)*

Associates: WESTERN HEMLOCK, HARDHACK, BOG LAUREL, CRANBERRY, SPHAGNUM

Common Name: RED HUCKLEBERRY
Scientific Name: *Vaccinium parvifolium*



Wetlands Indicator: FAC-

Habitat: Some forested wetlands growing out of stumps or logs.

Description: Bright green foliage and angled stems make this shrub easy to identify. The oval leaves are widely spaced. Small, urn-shaped flowers are found at the base of the leaves and yield round, red berries.

Niche Notes: The fruit is eaten by many birds including gulls and grouse. Pika, bear, and deer also eat the foliage and fruit.

"Gee Whiz:" The sour edible berries are easier to harvest if "combed" off the stem.

Associates: SALAL, WESTERN RED CEDAR

(Discover Wetlands, Lynn, 1995)

Common Name: BLACK COTTONWOOD
Scientific Name: *Populus balsamifera*

Wetlands Indicator: FACW

Habitat: Stream banks, lake shores, and in forested wetlands. It requires full sun and lots of water.

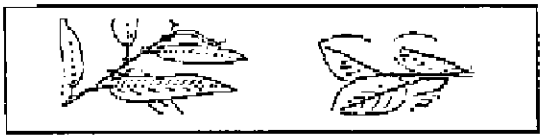
Description: Young cottonwoods have smooth, green bark which develops roughened, gray ridges as the tree matures. The adult trees are very large, 50 to 60 meters (160-200) in height. The buds are sticky in winter. The oval, lance shaped leaves are also resinous. Male and female plants are separate trees. Its cottony fruits are noticeable beneath the tree.

Niche Notes: Cottonwoods offer cover and nesting areas for wildlife. Its buds and catkins are a source of food for the blue grouse. Mountain Beavers eat its foliage, buds and bark. Its seeds are eaten by few species.

"Gee Whiz!" Some Northwest Natives made limited use of the wood. The leaves were bruised and made into antiseptic. The tree's gum was also used for this. Some believed the tree had a life of its own. Because of the leaves' flattened petiole, it shakes with very little wind. Some natives refused to even use it for firewood.

Associates: RED ALDER, WILLOW

Common Name: WILLOW
Scientific Name: *Salix spp.*



Wetlands Indicator: range from OBL to FAC

Habitat: Full sun and lots of water. They are found growing on the banks of ponds and streams, or in wetlands.

Description: WILLOW species range in size from small shrubs to medium trees. The deciduous leaves are long and narrow, and usually pointed. Male and females are separate plants. WILLOWS are excellent for reclaiming riverbanks or wetlands, because of their extensive root systems and ability to take root.

Niche Notes: WILLOWS provide cover and attract insects, but are of limited value to wildlife. Grouse and grosbeak will eat its buds or tender twigs. Pika eat its bark, buds and wood. The dusky-footed wood rat eats its foliage and catkins.

"Gee Whiz!" WILLOW bark contains salicylic acid, the active ingredient in aspirin. Native Americans chewed the bark as a pain reliever.

Associates: RED ALDER, BLACK COTTONWOOD, HARDHACK

Common Name: QUAKING ASPEN
Scientific Name: *Populus tremuloides*

Wetlands Indicator: FAC+

Habitat: Full sun or partial shade and only moderate water. It is often found in groves. It is tolerant of most soil types.

Description: It has smooth, greenish-white bark and reaches 15 meters (50') in height. The leaves have deep green upper surfaces and pale undersides. Male and female flower clusters lack petals and occur separately.

Niche Notes: The resinous buds and catkins are valuable food for grouse in the winter and spring. Its bark and foliage are also enjoyed by browsers, and mountain beavers and porcupine like the wood and bark.

"Gee Whiz!" This tree makes an attractive ornamental, because of its unusual quivering leaves.

Associates: RED ALDER, WILLOW, VINE MAPLE, BLACK COTTONWOOD

Common Name: BIGLEAF MAPLE
Scientific Name: *Acer macrophyllum*

Wetlands Indicator: FACU

Habitat: Transitional areas between wetlands and drier sites.

Description: One large stump may make many stems, so this tree is large, up to 30 meters (90') and spreading. The leaves have the classic look of the Canadian flag and are very large. Small, greenish-white flowers yield little, golden "helicopters."

Niche Notes: A wide variety of wildlife use this tree for food, nesting and cover. Small mammals enjoy eating its seeds.

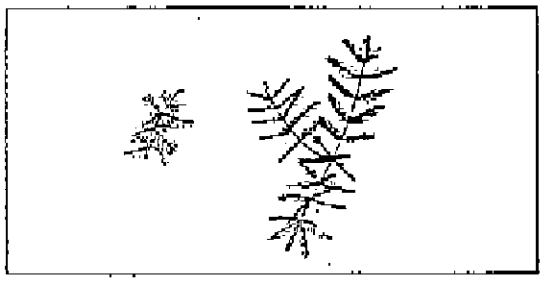
"Gee Whiz!" Northwest Native peoples found MAPLE very useful. Ropes could be made from its bark and the huge leaves were great for covering or laying underneath food. The wood was used by some to smoke salmon, but was more commonly used for carving. It made beautiful dishes, implements, and artwork.

Associates: RED ALDER, VINE MAPLE, SALMONBERRY, LADY FERN

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: WATER MILFOIL
Scientific Name: *Myriophyllum spp.*



Wetland Indicators: OBL

Habitat: Submerged or floating in ponds and lakes.

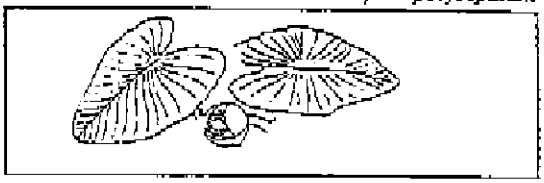
Description: The leaflets of MILFOIL are so small they give it a lacy appearance. Occasionally, the plant is known to bear tiny flowers on separate male and female plants.

Niche Notes: MILFOIL, particularly the introduced European variety, creates a monoculture and chokes ponds and lakes. Muskrats, ducks, and some shorebirds will eat MILFOILS.

"Gee Whiz": Boaters must check their boats and trailers when leaving lakes to prevent the spread of this weed.

Associates: YELLOW POND LILY, BLADDERWORT

Common Name: YELLOW POND LILY
Scientific Name: *Nuphar polysepalum*



Wetlands Indicator: OBL

Habitat: Rooted in lake beds with their leaves and flowers floating on the surface. They do best in areas of still water.

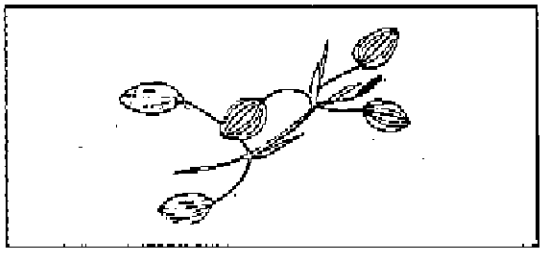
Description: The large, leathery, somewhat arrow-shaped leaf is held on a petiole up to 2 meters (6') long. Large yellow flowers also emerge on the surface of the water, producing edible seeds.

Niche Notes: Water Lilies play an important role in their aquatic habitat. They provide shelter for young fish and are homes to the eggs of aquatic insects and amphibians. Their roots are eaten by muskrats, ducks, and other animals. They are a great place for frogs and baby ducks to rest.

"Gee Whiz": Native Americans have many uses for Water Lilies. The roots may be eaten. The seeds are ground into flour or popped up like popcorn for snacks.

Associates: CATTAIL, WATER MILFOIL, BLADDERWORT, WHITE WATER LILY (*Nymphea* – a non-native lily)

Common Name: PONDWEED
Scientific Name: *Potamogeton spp.*



Wetlands Indicator: OBL

Habitat: Found with its leaves floating on lakes and ponds.

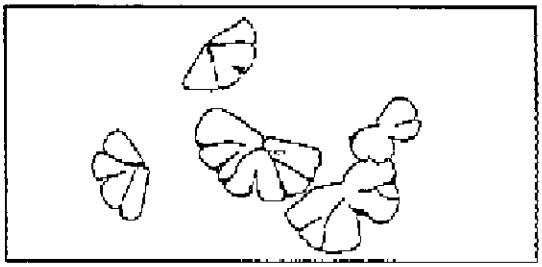
Description: PONDWEED has parallel-veined leaves that are oval, if on the surface, and narrower, if submerged.

Niche Notes: The 40 or so species of PONDWEED in North America provide shelter or food for a variety of species. Insects and fish find shelter in its foliage. SNAILS, muskrats, ducks, and other waterfowl eat it.

"Gee Whiz": The roots of PONDWEED are slightly nutty tasting and can be eaten raw in salads or cooked in stew.

Associates: CATTAILS, YELLOW POND LILY, BLADDERWORT, MILFOIL

Common Name: LIVERWORT
Scientific Name: *Ricciocarpus natans*



Wetlands Indicator: OBL

Habitat: Floating on ponds or streams and washed up on nearby mud.

Description: The LIVERWORT looks like a leathery little leaf with 2 or 4 lobes and its underside has rhizoids, root-like extensions, hanging from its underside.

Niche Notes: It is not known if these plants are eaten by wildlife.

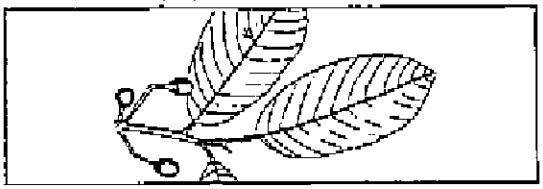
"Gee Whiz": This strange looking little plant is a primitive variety that lacks true leaves, roots, or vascular tissue.

Associates: DUCKWEED, CATTAILS, PONDWEED

(Discover Wetlands, Lynn, 1995)

Common Name: CASCARA BUCKTHORN

Scientific Name: *Rhamnus purshiana*



Wetlands Indicator: FAC-

Habitat: Transitional area between wetlands and uplands.

Description: CASCARA is a small tree with a narrow trunk and smooth, gray bark. Its yellow-green leaves are oval and have distinct parallel veins. Small, green flowers develop into small green to purple-black berries.

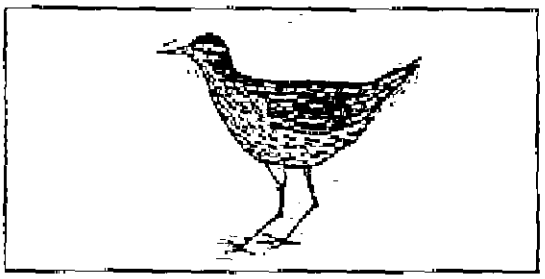
Niche Notes: Quite a few species eat CASCARA'S fruit. Up to one-quarter of a pileated woodpecker's diet may consist of these berries, when available. Band-tailed pigeons, sapsuckers, thrush, RACCOON, Douglas ground squirrels, wood rats, and MULE DEER also feast on the fruit.

"Gee Whiz:" CASCARA bark is collected and made into a laxative. Native Americans also used it for this purpose and, in addition, used it for other medicines and the berries for food.

Associates: RED ALDER, WILLOW

(Discover Wetlands, Lynn, 1995)

Common Name: SPOTTED SANDPIPER
Scientific Name: *Actitis macularia*



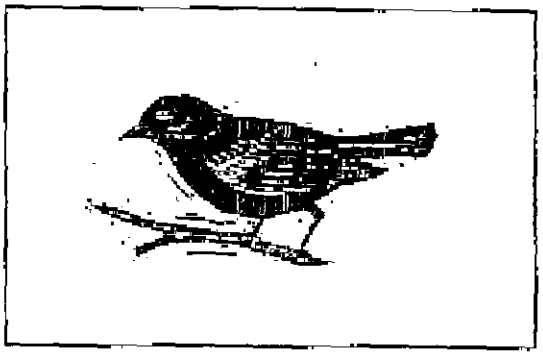
Habitat: Streams, lakes, reservoirs, or almost any body of water surrounded by vegetation or woods. They may be seen on the coast in the winter.

Description: This small sandpiper has peachy or yellowish legs and a white wing stripe. In the spring only, it has large spots on its underparts. It teeters when walking and its wings beat stiffly when flying.

Niche Notes: Sandpipers dine on aquatic insects, crustaceans, and mollusks. They may be eaten by foxes, weasels, and other carnivores.

"Gee Whiz:" Listen for their "peet-weet-weet-weet-weet" or just "peet-weet."

Common Name: RED-WINGED BLACKBIRD
Scientific Name: *Agelaius phoeniceus*



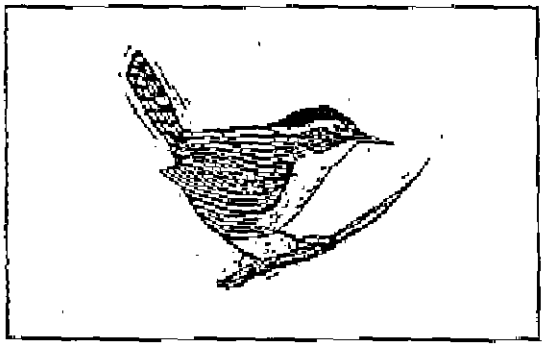
Habitat: Marshes and swamps everywhere are home to this bird. They nest in stands of CATTAIL or other wetland plants.

Description: Male BLACKBIRDS are black with red epaulets bordered in a fine yellow margin. The female is brownish.

Niche Notes: BLACKBIRDS eat the seeds of plants and lots of insects.

"Gee Whiz:" BLACKBIRDS claim territories in the marsh and defend them with loud calls of "check" or "teeyee" or songs of "konk-la-ree."

Common Name: MARSH WREN
Scientific Name: *Cistothorus palustris*



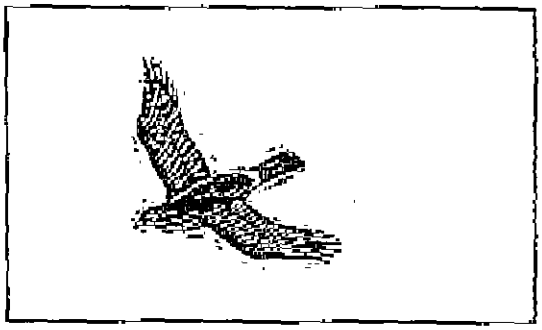
Habitat: Variety of marshy habitats. They nest in CATTAILS.

Description: MARSH WRENS resemble small sparrows, but hang around RUSH, SEDGE, and CATTAIL areas. Their tail is held at a high angle. Listen for their distinctive "machine-gun fire" song in the spring.

Niche Notes: MARSH WRENS feed on MOSQUITO larvae and insects. They are food for HARRIERS.

"Gee Whiz:" Male WRENS have a number of mates, each of whom builds her own nest.

Common Name: NORTHERN HARRIER
Scientific Name: *Circus cyaneus*



Habitat: NORTHERN HARRIERS formerly called marsh hawks, inhabit meadows, farm fields, and coastal dunelands. They nest on the ground.

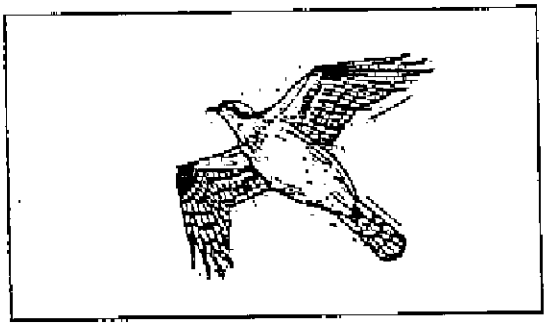
Description: This medium-sized, slim, long-winged hawk is identified by its white rump patch and flying patterns.

Niche Notes: NORTHERN HARRIERS feed mostly on mice and an occasional small bird.

"Gee Whiz:" This HARRIER flies with its wings angled upward when gliding. It also has a habit of flying low over fields in a zig-zag pattern.

(Discover Wetlands, Lynn, 1995)

Common Name: OSPREY
Scientific Name: *Pandion haliaetus*



Habitat: Coasts and inland lakes and rivers on every continent.

Description: This raptor is the size of a large hawk. It is dark brown above and white below. Its head is white with a dark line through the eyes.

Niche Notes: OSPREY eat only fish, which they catch by hovering and then diving, talon first, into the water.

"Gee Whiz:" Because many of the OSPREY's fish are contaminated with toxic chemicals, they have decreased nesting success. Their survival requires active conservation measures.

Common Name: GREAT BLUE HERON
Scientific Name: *Ardea herodias*

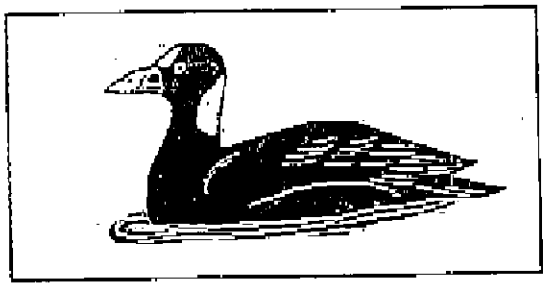
Habitat: Fresh and saltwater marshes, coastal mud flats, sand bars, and shallow bays. They require wetlands with tall trees or rock ledges for their nests.

Description: This huge heron has a gray-blue back and wings. It is about four feet tall and weighs about seven pounds. Its wings span six feet.

Niche Notes: Herons wade through the water eating fish, crustaceans, amphibians, and insects.

"Gee Whiz:" Herons fly with their neck folded back on their shoulders, and their long thin legs out behind their bodies. Listen for their loud "kraaks."

Common Name: SURF SCOTER
Scientific Name: *Melanitta perspicillata*



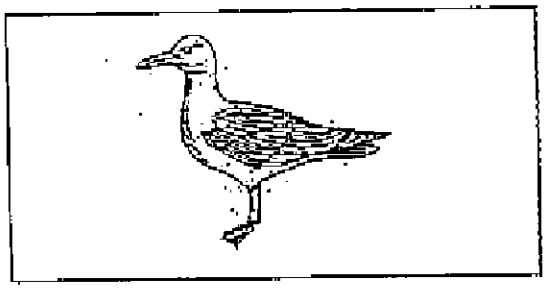
Habitat: Prefer saltwater surf areas. They are abundant on the Pacific Coast and occasionally individuals may visit inland lakes and ponds, but not commonly.

Description: Male SURF SCOTERS are black ducks with prominent white head patches, though these disappear in late summer. His beak is brightly colored with a unique pattern that makes identification relatively easy. The female is dark brown and has less distinct whitish patches on her head.

Niche Note: SURF SCOTERS take much of their food from the breaking surf. They feed on the life found on the ocean bottom.

"Gee Whiz:" When an adult SURF SCOTER takes off or lands, a whistling noise can be heard for quite a distance on quiet days.

Common Name: HERRING GULL
Scientific Name: *Larus argentatus*



Habitat: GULLS prefer coastal areas and inland lakes and rivers.

Description: This GULL is about two feet long with a four-foot wingspan. It has black-tipped wings and a bright yellow bill with a red spot.

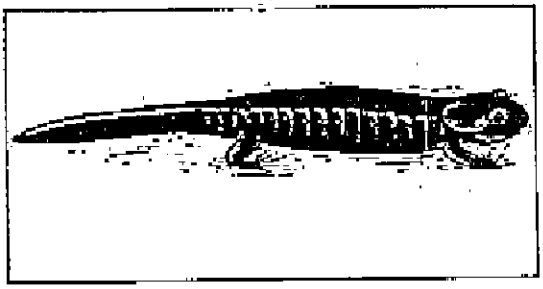
Niche Notes: GULLS eat fish, crustaceans, marine worms, shellfish, sea urchins, insects, other birds, and bird eggs. The young peck at the red spot on the parents bill to be fed, then the adult regurgitates food for them. GULLS may be eaten by foxes, weasels, and other raptors and carnivores.

"Gee Whiz:" GULLS nest on rocky islands and are very protective. They dive on intruders with their sharp bill and have been known to disgorge the food from their stomachs on the trespasser.

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: SALAMANDER
Scientific Name: *Order Urodela*



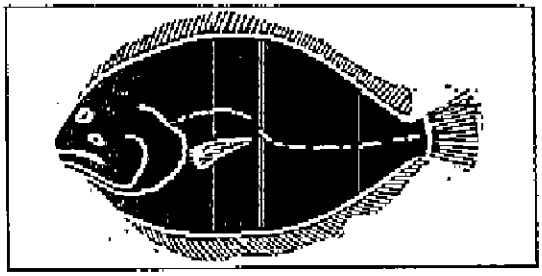
Habitat: Water or areas with water available year-round.

Description: These animals are characterized by their smooth, slimy skin, long body and lack of claws.

Niche Notes: SALAMANDERS eat insects, slugs, worms, and SNAILS. They are eaten by hungry snakes, other SALAMANDERS, frogs, fish and some shrews.

"Gee Whiz:" SALAMANDERS are covered with a distasteful mucus that prevents many animals from eating them. In some, such as the Rough-skinned Newt, the milky mucus is so full of poison that it will kill most vertebrates. Others lose their tails when a predator grabs them.

Common Name: STARRY FLOUNDER
Scientific Name: *Platichthys stellatus*



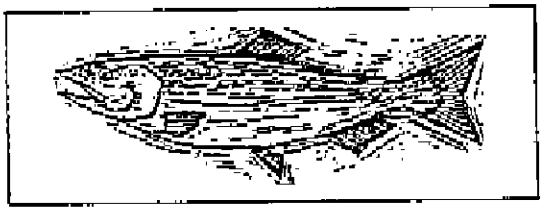
Habitat: Commonly live in marine waters on soft or sandy bottoms. They tolerate freshwater and can be found in estuaries and up coastal streams.

Description: Flounders have a flat, asymmetrical body and blunt snout. They have creamy colored fins with dark stripes. They weigh up to 20 pounds.

Niche Notes: Flounder will eat just about anything smaller than they are, including fish, worms, and shrimp.

"Gee Whiz:" Flounders have two eyes on one side of their head. The cells that become the eye begin development in the normal position, then migrate to the same side of the head.

Common Name: COHO SALMON
Scientific Name: *Oncorhynchus kisutch*



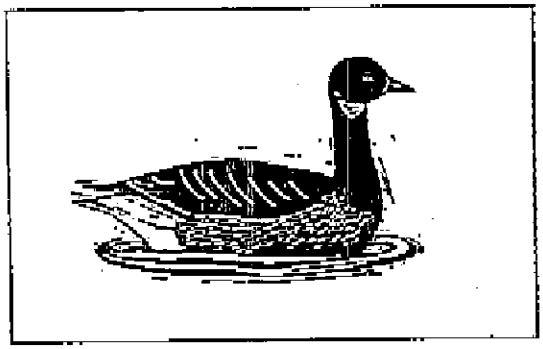
Habitat: Adult salmon live in the sea. They return to spawn in fast-flowing streams with gravel bottoms. The young remain in the stream for one or two years before returning to the sea.

Description: This is a large salmon, reaching up to 90 centimeters (35") and 12 pounds (5.4 kg). They have small black spots on their back and the upper part of their tail fin. They also have gray gums.

Niche Notes: Adult COHO SALMON feed on smaller fish, crustaceans, and invertebrates. The larvae feed on aquatic insect adults and larvae. Young COHO are food for other fish, grebes, and loons. The adults are favored by marine mammals, eagles, bear, and HUMANS.

"Gee Whiz:" COHO must spend a long time in streams. For COHO to survive, the streams they return to must be clean with gravelly bottoms.

Common Name: BRANT GOOSE
Scientific Name: *Branta bernicla*



Habitat: BRANT nest in the tundra and winter in more southern bays and estuaries.

Description: About the size of a mallard duck, the BRANT looks totally black when in the water, except for a white collar. Its blank-and-white pattern is seen when in flight.

Niche Notes: BRANT eat EELGRASS and SEA LETTUCE almost exclusively. They are hunted by HUMANS and eaten by foxes, gull, and ravens.

"Gee Whiz:" Listen for their soft "ruk-ruk" call.

(Discover Wetlands, Lynn, 1995)

Common Name: ZOOPLANKTON
Scientific Name: *Depends on species*

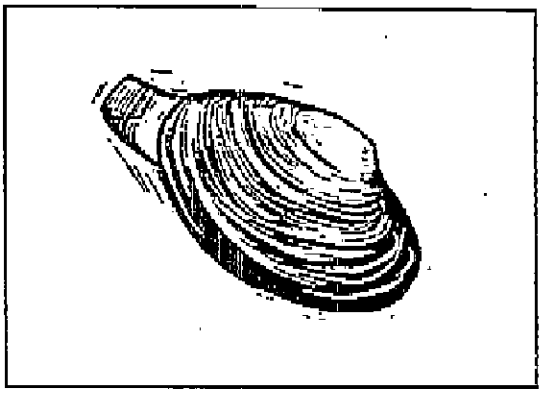
Habitat: ZOOPLANKTON are found drifting in all types of water.

Description: ZOOPLANKTON consist of every small animal-like organism in the water that is subject to floating in the currents. Some spend their entire life as plankton, while others grow to adult forms, such as oysters, barnacles, or starfish.

Niche Notes: All ZOOPLANKTON must eat, but their diet is as varied as they are. Some eat detritus. Others eat PHYTOPLANKTON. Many eat other ZOOPLANKTON.

"Gee Whiz:" These little creatures, being near the bottom of aquatic food webs, are critical to all creatures on the web who depend on them. All animals (including homers) that eat food from the water have plankton to thank.

Common Name: CLAM
Scientific Name: *Order Bivalvia*

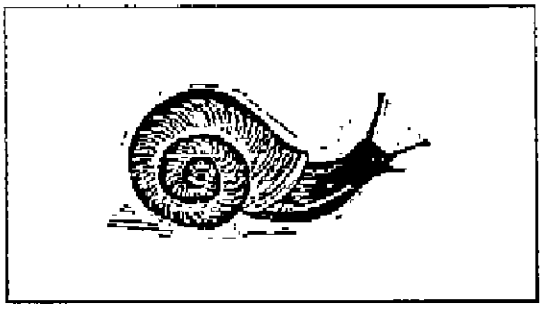


Habitat: Freshwater and marine water.

Description: CLAMS have two shells connected with a hinge.

Niche Notes: CLAMS eat plankton that they collect by filter feeding. CLAMS are food for fish, turtles, RACCOONS, muskrats, birds, and HUMANS.

Common Name: SNAILS
Scientific Name: *Order Gastropoda*



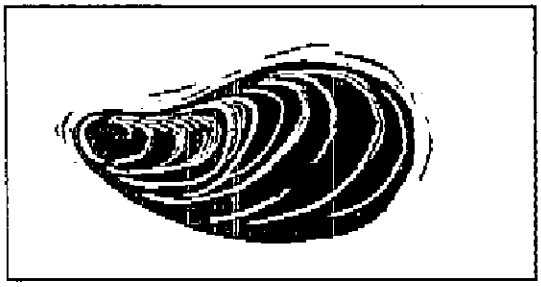
Habitat: Freshwater and marine water. Some SNAILS live in moist terrestrial environments.

Description: SNAILS are easily identified by their spiral shell.

Niche Notes: SNAILS scrape plant and animal matter from surfaces with the help of their file-like tongue called a radula. SNAILS are food for many animals, including fish, SALAMANDERS, turtles, BACKSWIMMERS, WATER STRIDERS, and HUMANS.

"Gee Whiz:" Slugs are a kind of snail without a shell.

Common Name: BLUE MUSSEL
Scientific Name: *Order Filibranchia*



Habitat: Intertidal areas. They often are found attached to pilings and rocks.

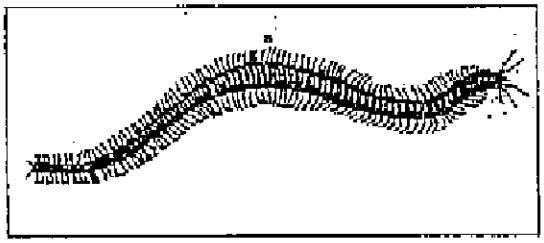
Description: This bivalve is easily identified by its blue color.

Niche Notes: MUSSELS are filter feeders. They strain microorganisms from the water. They are eaten by some birds, sea stars ("starfish"), muskrats, and people.

"Gee Whiz:" MUSSELS attach to surfaces by "byssus" thread, which are exuded from their foot as liquid and harden into extremely strong strands. These strands collect debris and form a habitat for other organisms to live intertwined with the MUSSELS.

(Discover Wetlands, Lynn, 1995)

Common Name: POLYCHAETE WORM
Scientific Name: *Class Polychaeta*



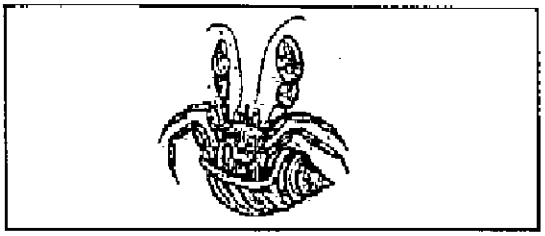
Habitat: These common annelids, marine relatives of earthworms, live either swimming in the ocean or burrowed in the sediments.

Description: These segmented worms have many setae (bristles) that extend from parapodia (fleshy appendages) on their segmented body. Free-swimming POLYCHAETES often have large jaws.

Niche Notes: The free-swimming worms are voracious predators. The burrowing type eat particles from the water and sediments. They are eaten by other worms and a variety of birds.

"Gee Whiz!" Some POLYCHAETES are luminescent (glow in the dark).

Common Name: HERMIT CRAB
Scientific Name: *Family Paguridae*



Habitat: Intertidal areas.

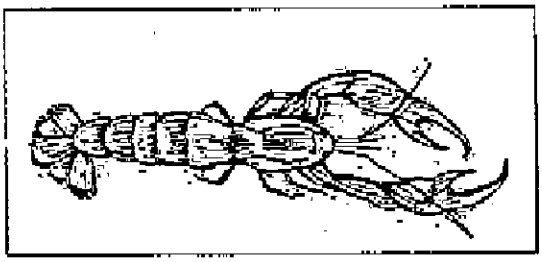
Description: These crustaceans do not have a hard exoskeleton to protect them, instead they use shells from dead gastropods.

They have soft abdomens and strong appendages; they inhabit empty gastropod shells.

Niche Notes: HERMIT CRABS feed primarily on dead organic material and whatever else crosses their path. They are eaten by some shorebirds and other animals.

"Gee Whiz!" HERMIT CRABS will find a new shell when they outgrow the one they are living in.

Common Name: GHOST SHRIMP
Scientific Name: *Astacura*



Habitat: Mud of intertidal areas and estuaries.

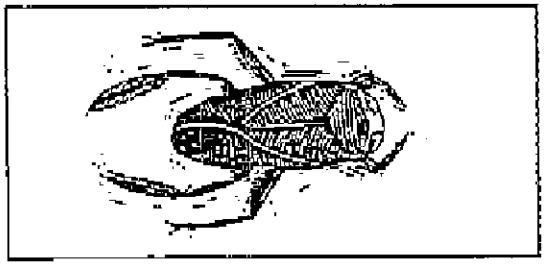
Description: These small white shrimp live buried in the mud.

Niche Notes: SHRIMP feed primarily on detritus and anything smaller they run into. They are a favorite food of shorebirds.

"Gee Whiz!" A good way to find these is to go to the shore with a clam gun. Just take a sample of mud as if you were digging CLAMS. Look through the mud for the SHRIMP.

GHOST SHRIMP are also strained from the mud by the gray whale.

Common Name: WATER BOATMAN
Scientific Name: *Trichocorixia spp. or Sigara spp.*



Habitat: Margins of lakes, ponds, and estuaries.

Description: This aquatic insect is spotted or solid gray with red eyes. Even though it resembles the BACKSWIMMER, it is easily identified because it doesn't bite or swim on its back.

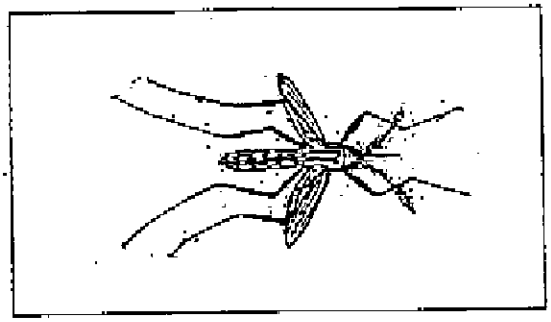
Niche Notes: WATER BOATMAN eat algae, insect or crustacean larvae, or detritus. They are eaten by DIVING BEETLES, frogs, fish, waterfowl, and shorebirds.

"Gee Whiz!" These insects trap a bubble of water underneath their wings to breathe on their dives to the bottom. This is where they find their favorite foods.

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name: MOSQUITO
Scientific Name: *Culicidae family*



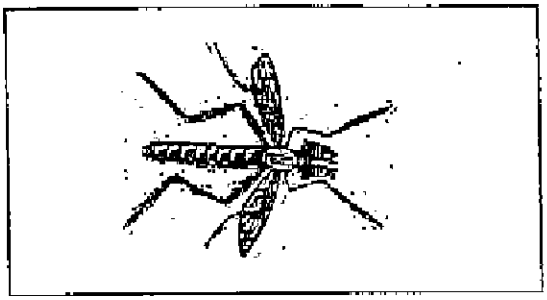
Habitat: Ponds, lakes, and puddles everywhere.

Description: The familiar adult MOSQUITO has a long, tubular proboscis for sucking. The larvae are called wrigglers because they wriggle when they swim.

Niche Notes: Adult MOSQUITOES feed on plants; only the female takes a blood meal before laying eggs. The larvae feed on algae, protozoan, and detritus.

"Gee Whiz:" MOSQUITOES help pollinate some species of flowers.

Common Name: MIDGES or GNATS
Scientific Name: *Chironomidae family*



Habitat: Larvae live in water or wet moss. Adults live in swarms over these habitats.

Description: Adults have a body similar to that of a MOSQUITO. The larvae are red, yellowish-green, or white. The pupae often live in little tubes of cemented silt or debris.

Niche Notes: Adults only live for a few days and often don't eat. The larvae may feed on algae, plant material, and other small organisms. MIDGES are food for fish and aquatic animals, birds, shrews, and ground beetles.

"Gee Whiz:" Adult MIDGES do not bite. The red larvae are known as bloodworms.

Common Name: CADDISFLY
Scientific Name: *Order Trichoptera*

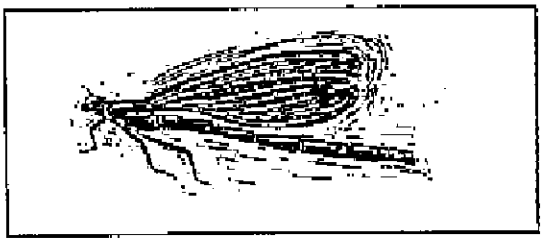
Habitat: CADDISFLIES spend most of their life as larvae in freshwater streams and ponds.

Description: Adult flies, who live less than a month, have long antennae and hold their wings like a roof over themselves when resting. Their wings are covered with fine, silky hairs. The larvae have small hooks at the end of their abdomen and build tiny houses of stick, stones, and leaves with beautiful patterns.

Niche Notes: Larvae crawl upon the bottom eating algae and plant debris. The adults feed on flower nectar. Many fish, like SALMON, depend on the larvae for food.

"Gee Whiz:" CADDISFLY larvae are sensitive to poor water quality conditions. Their name comes from "trichos" meaning hair and "optera" meaning wings.

Common Name: DAMSELFLY
Scientific Name: *Suborder Zygoptera*



Habitat: Larvae live on aquatic plants or on the bottom of streams and ponds. The adults live near water.

Description: The adult DAMSELFLY looks like a slender DRAGONFLY whose wings fold over their backs when resting. The larvae have a trio of gills that look like three tails.

Niche Notes: Larval DAMSELFLY eat MOSQUITO larvae and other small animals. The adults feed on MOSQUITOES and MIDGES.

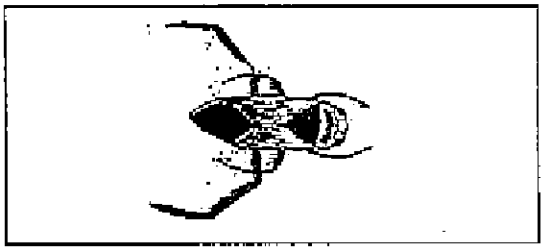
"Gee Whiz:" During the age of dinosaurs, DAMSELFLY ancestors had wingspreads of up to 70 centimeters (27.5").

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Name:
BACKSWIMMER

Scientific Name:
Buenoa spp.
or Notonecta spp.



Habitat: Margins of lakes, ponds, and estuaries.

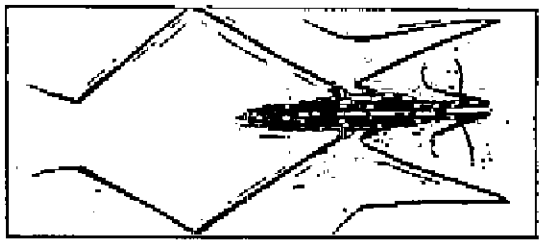
Description: These aquatic insects row themselves through the water on their backs with their long, flattened back legs. Their coloration is the reverse of normal; their backs are light and their bellies are dark.

Niche Notes: BACKSWIMMERS detect their prey with the hairs on their legs, then they inject digestive juices into them. They prefer small insects, SNAILS, or even fish. They are a favorite food of hungry fish.

"Gee Whiz:" Be carefull These guys may bite you.

Common Name:
WATER STRIDER

Scientific Name:
Gerris spp.
or Metrobates spp.



Habitat: Common on the surface of lakes, ponds, and streams.

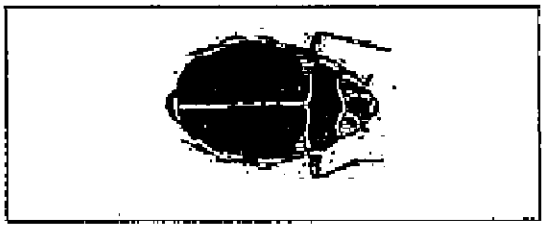
Description: With the help of its long legs and waterproof hairy feet, the WATER STRIDER walks on the surface of the water.

Niche Notes: WATER STRIDERS prefer small living or dead insects for food. They grab their prey, pump in digestive juices, and suck the innards out. Fish dine on WATER STRIDERS.

"Gee Whiz:" If a WATER STRIDER breaks through the surface of the water, it must find something to climb out on or drown.

Common Name:
WHIRLIGIG BEETLES

Scientific Name:
Gyrinidae family



Habitat: In lake, streams, and ponds.

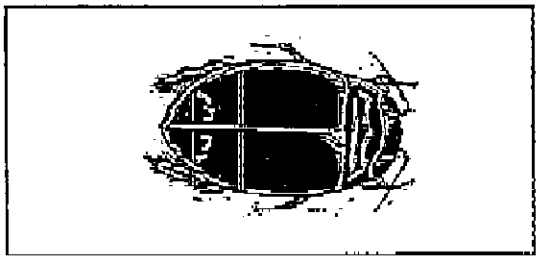
Description: This aquatic insect is blue-black or dark brown in color. Adults are flattened and oval-shaped, and have eyes that are split so they can see both above and below the water at the same time.

Niche Notes: WHIRLIGIG BEETLES are scavengers and eat small insects. They are capable of hunting at night by sensing disturbances of tiny water waves they create by swimming rapidly. They are eaten by fish and waterbirds, but are not tasty to many.

"Gee Whiz:" WHIRLIGIG BEETLES swim in circles upon the surface of the water, often in groups. This obvious behavior helps fish identify them as the bad tasting insects they are.

Common Name:
DIVING BEETLE

Scientific Name:
Dytiscidae family



Habitat: Slow-moving waters of ponds, lakes, streams, and estuaries are home to DIVING BEETLES.

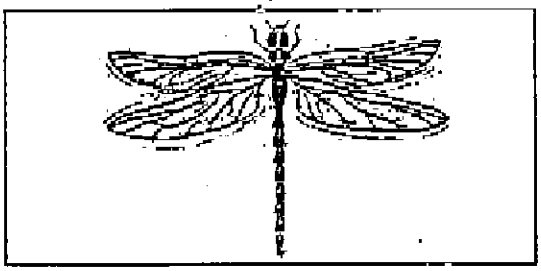
Description: They are black and flattened with hind legs adapted for swimming. The adult is usually suspended from the waters surface, head down. The aggressive larvae crawl on the bottom.

Niche Notes: DIVING BEETLES and their larvae are predators of aquatic insects, fish, and tadpoles. They are food for fish, waterbirds, and water shrews.

"Gee Whiz:" These insects trap a bubble of water underneath their wings to breathe when hunting underwater.

(Discover Wetlands, Lynn, 1995)

Common Name: DRAGONFLY
Scientific Name: *Suborder Anasoptera*



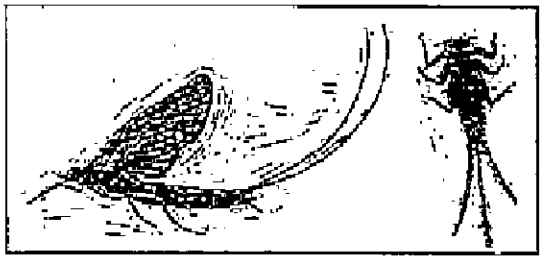
Habitat: Adults live near the water. The larvae live on the bottom of streams and ponds.

Description: These large insects are easily identified by their huge eyes and four wings held at right angles to the body. The larvae have no protruding gills and large jaws.

Niche Notes: Adults are skilled at catching flies and MOSQUITOES on the wing. The larvae prey on all small animals in the water. They'll also bite you.

"Gee Whiz:" Dragonflies can fly 60 miles per hour and see 360 degrees.

Common Name: MAYFLIES
Scientific Name: *Order Ephemeroptera*



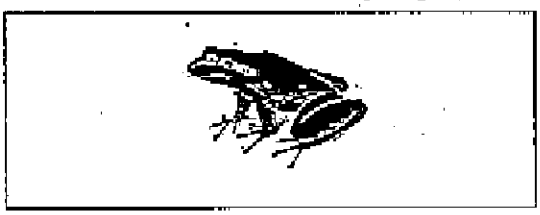
Habitat: Larvae live in clear, fast-flowing streams.

Description: Larval MAYFLIES have two or three fan-like tails and seven pair of gills on their abdomens. Adults have transparent wings and two or three long thread-like tails.

Niche Notes: Larvae feed on the slime covering rocks, consisting of algae and detritus. The adults don't eat. The larvae are eaten by fish.

"Gee Whiz:" Adult MAYFLIES have no mouth parts and only live for about a day.

Common Name: PACIFIC CHORUS or TREEFROG
Scientific Name: *Pseudacris regilla (Hyla regilla)*



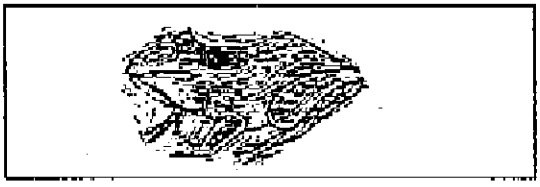
Habitat: Found everywhere in the Northwest, even in urban areas.

Description: Long legs and rounded toe pads help identify this frog. Look for the dark mask reaching from the nostrils to the shoulders.

Niche Notes: Frogs prey on spiders and insects. Their tadpoles eat plant matter. Frogs are food for birds, snakes, and other frogs. Tadpoles are food for insects, fish, SALAMANDERS, and other frogs. Because these frogs can use isolated ponds for breeding, they are able to avoid predation by species that need more permanent sources of water.

"Gee Whiz:" TREE FROGS are well known for their "ker-r-r-ck" noise and are heard almost all year round.

Common Name: BULLFROG
Scientific Name: *Rana catesbeiana*



Habitat: These frogs were introduced to Washington from the eastern United States. They are found in most lowland areas and need permanent water sources.

Description: BULLFROGS are about seven to eight inches long and have green skin covered in spots. They have a fold extending from their eye, over their large tympanum (eardrum), and to their forearm.

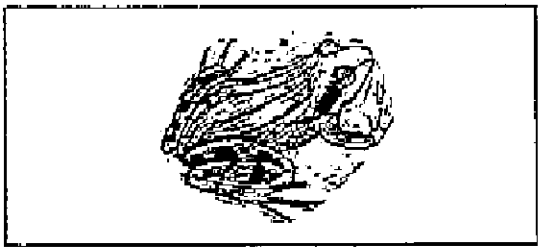
Niche Notes: Adult BULLFROGS eat everything including insects, fish, birds, amphibians, reptiles, and mammals. Their tadpoles eat plant matter and live as a tadpole for two to three years. Frogs are food for birds, snakes, other frogs and even HUMANS. Tadpoles are food for everything from CADDISFLY larvae to other frogs.

"Gee Whiz:" These introduced BULLFROGS have nearly wiped out Northern Leopard Frogs and SPOTTED FROGS in Washington. Waterfowl production is down in BULLFROG infested areas and Western Pond Turtle populations are threatened by BULLFROG predation.

(Discover Wetlands, Lynn, 1995)

Common Name:
RED-LEGGED FROG

Scientific Name:
Rana aurora



Habitat: Found throughout Western Washington.

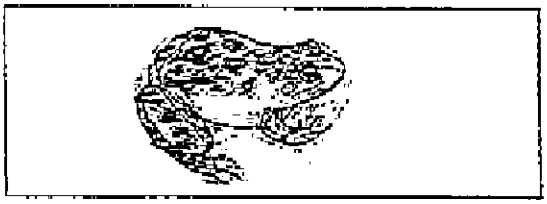
Description: These frogs are reddish-brown with small black flecks on the back and dark bands on the legs. The underside of the back legs are red. The tadpoles are brown with small dark spots on their backs. The lower body of the tadpole is white with silvery or coppery spots.

Niche Notes: RED-LEGGED FROGS hunt for much of their food in vegetation around their water source. Their tadpoles eat plant matter. Frogs are food for birds, snakes, other frogs and even HUMANS. Tadpoles are food for everything from insect larvae to other frogs.

"Gee Whiz:" Male RED-LEGGED FROGS call to their mate from two or three feet underwater.

Common Name:
SPOTTED FROG

Scientific Name:
Rana pretiosa



Habitat: Currently live in the Cascade Mountains, eastern and central Washington. Formerly found in the Puget Sound Lowlands, this species now appears to be almost completely eliminated from that region. It can be found in or near year-round water sources and usually in non-woody wetland.

Description: The spots on this frog have fuzzy edges, light centers and a range of sizes. The underside is orangish-red and looks like it is painted on. Tadpoles don't have spots, but have white bellies.

Niche Notes: Frogs prey on insects. Their tadpoles eat plant matter. Frogs are food for birds, snakes, other frogs and even HUMANS. Tadpoles are food for everything from CADDISFLY larvae to other frogs.

"Gee Whiz:" SPOTTED FROGS make a weak croak and can jump far. Expect their tracks to show this.

Common Name:
TAILED FROG

Scientific Name:
Ascaphus truei

Habitat: Cold, rocky streams of the Olympic, Cascade, and Blue Mountains. It has also been found in streams in the Willapa Hills and Capitol Forest of southwestern Washington.

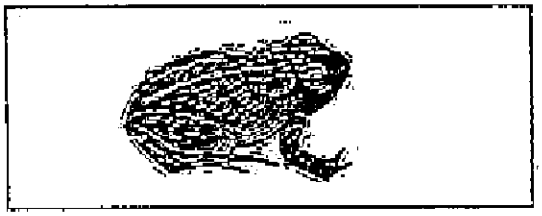
Description: This frog is brown, brownish-red or gray and has a vertical pupil in its eye. Males have a small "tail." The tadpoles are black or brown with a white spot on the tip of their tail and a round, sucker-like mouth for holding on to rocks against the current. TAILED FROGS make no noises and lack most of their ear parts, probably as an adaptation to living in a noisy stream.

Niche Notes: TAILED FROGS prey on insects, but never far from their stream. Their tadpoles eat microscopic algae, mostly diatoms. Frogs are food for birds, snakes, and other frogs.

"Gee Whiz:" Sedimentation from timber harvests and road building in some areas have reduced or eliminated populations of TAILED FROGS. Tadpoles live for a long time in their streams: about two years in lower regions and up to four in mountain areas. By the way, the "tail" isn't a real tail. It is used by males during mating.

Common Name:
WESTERN
or BOREAL TOAD

Scientific Name:
Bufo boreas



Habitat: Found everywhere in Washington except the dry areas of the Columbia Basin. These toads are now rare in the lowlands of western Washington and meadows of the North Cascades.

Description: BOREAL TOADS are about three inches long, have warty brown, green, or gray skin and usually have a white stripe down the middle of their back. They have a chunky build and large, oval parotoid glands behind their eyes. These glands give off a white poison when the toad is threatened. Toads are nocturnal and silent.

Niche Notes: Toads eat insects, spiders, and worms. They are eaten by garter snakes, coyotes, RACCOONS, and crows.

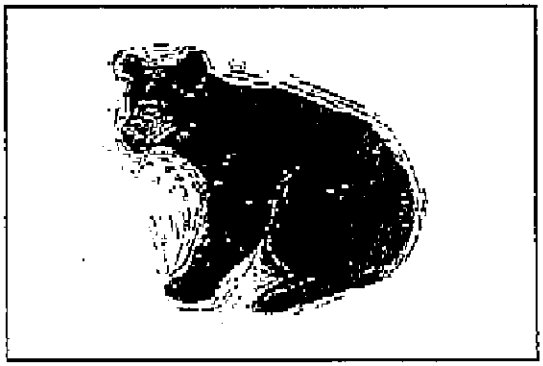
"Gee Whiz:" Don't handle toads, frogs or SALAMANDERS if you have insect repellent on your hands; it can severely damage their skin.

(Discover Wetlands, Lynn, 1995)

Appendix A

Common Names:
BLACK BEARS

Scientific Names:
Ursus americus



Habitat: Forests and all adjoining areas.

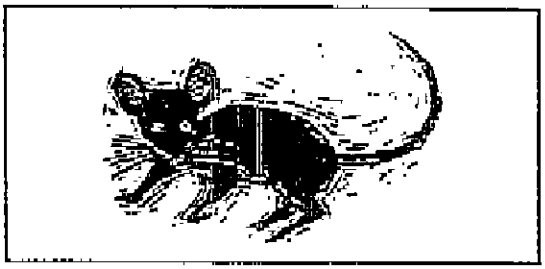
Description: The smallest and most common of bears may grow up to seven feet long and weigh up to 450 pounds.

Niche Notes: Bears are omnivores, eating insects, berries, vegetation, fish, small mammals, and fruits

"Gee Whiz:" Stay away from bears. They are quick and strong, climb trees, and swim well. They are generally shy, but must never be underestimated.

Common Name:
MOUSE

Scientific Name:
Family cricetidae



Habitat: Deer mice prefer woodlands and uninhabitated areas. House mice prefer living with us.

Description: All mice in the Pacific Northwest are around six or seven inches long including tail. The species look similar and are usually only identified by experts or after capture.

Niche Notes: Mice are omnivores. They eat seeds, plants, insects, grubs, and dead stuff. They are food for all sorts of carnivorous mammals and birds.

"Gee Whiz:" You can tell a MOUSE track from a shrew track by looking at the pattern the tail leaves. The shrew's tail drags and leaves a distinct trail. Mice tails only leave erratic marks because they don't drag them on the ground.

Common Name:
HUMAN

Scientific Name:
Homo sapiens

Habitat: HUMANS are found virtually everywhere there is land.

Description: Bipedal mammals. Every individual has a unique appearance.

Niche Notes: HUMANS are omnivorous and quite varied in their diet. They are rarely preyed upon by anything.

"Gee Whiz:" The HUMAN population is increasing by approximately 70 million people per year.

(Discover Wetlands, Lynn, 1995)

APPENDIX B

Appendix B

Basic directions for ways to work with:

Clay

1. Pinch pot
2. Coil
3. Slab

} handbuilding

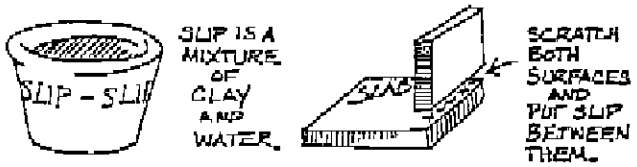
4. Potter's wheel
5. Casting-clay in liquid form

General hints for clay work:

1. Always wedge clay before you use it. Push the clay into the canvas to remove all air bubbles.

2. Always keep your clay moist. Store clay in a sealed plastic bag.

3. When attaching two pieces of clay together always scratch surfaces and put slip between them.



4. Finished clay work should be allowed to dry gradually to prevent cracking. Dry clay work is called greenware. After clay is fired in the kiln it is called bisqueware. It is then ready to paint or glaze.

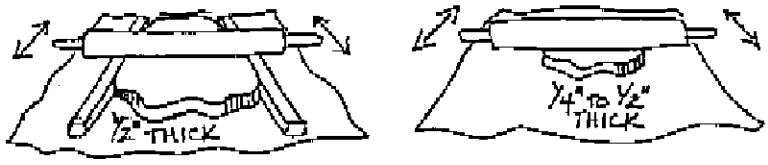
Slab Handbuilding Technique

...clay rolled flat, even in thickness, with edges trimmed.

1. Wedge clay. Use very moist clay.

2. Set clay on canvas cloth to prevent it from sticking to the table

3. For large clay slabs, set two parallel sticks (each 1/2" thick) on each side of the clay. Sticks are not necessary for small clay slabs.



4. Roll out the clay with a rolling pin. If using guide sticks, each end of the rolling pin should rest on them. If making a small slab, roll clay 1/4" to 1/2" thick.

5. After clay has been rolled evenly, trim crooked edges with a ruler and a clay tool.

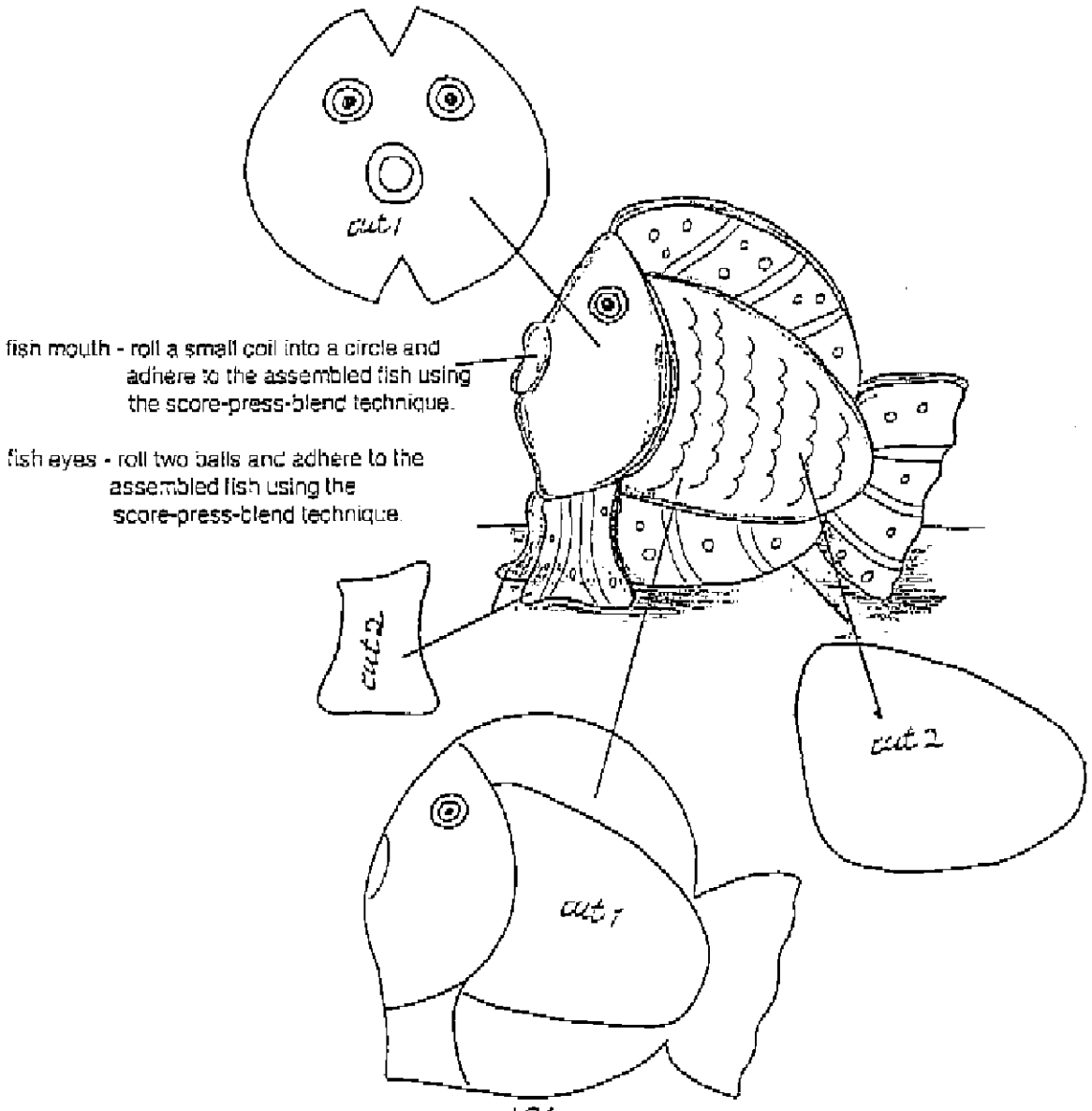
6. Peel the slab off the canvas and let it dry slightly until firm, yet pliable. Now use your slab to create your sculpture.

Appendix B

Ceramic Fish

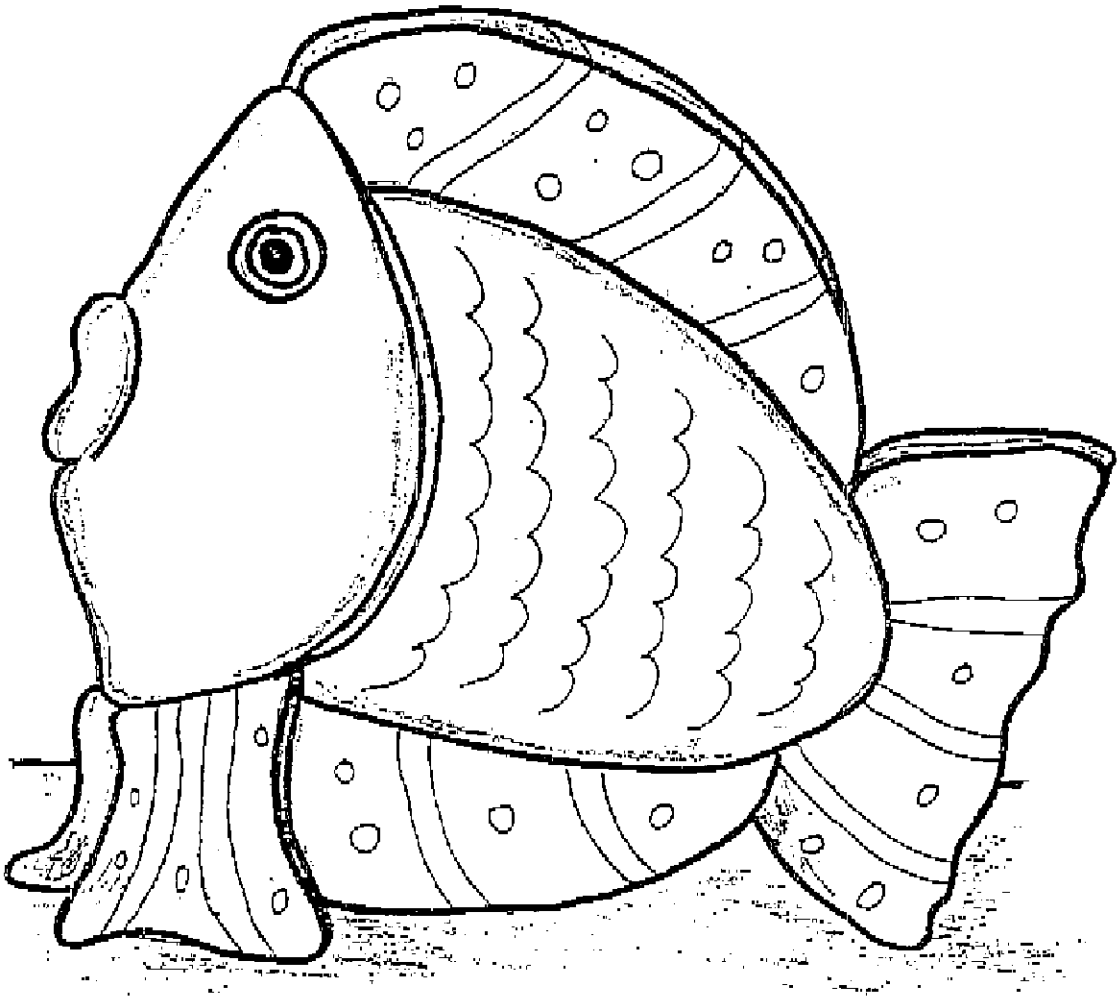
Assembly Instructions

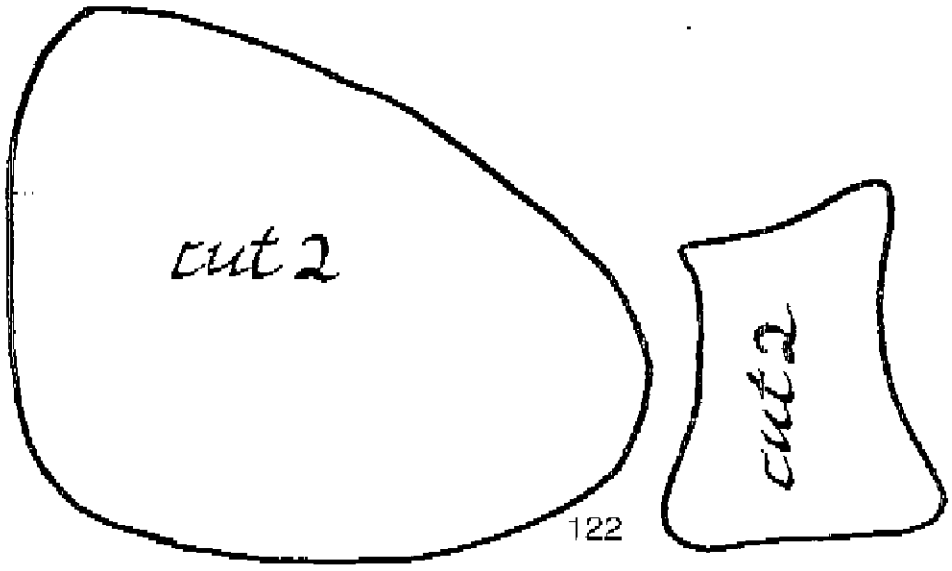
1. Cut out paper patterns.
2. Roll clay using a rolling pin into 1/4" thick slabs.
3. Use paper patterns and cut pieces out of the clay using a knife or similar cutting tool.
4. Use rolling pin to press various textures onto clay pieces before assembly.
5. Assemble all pieces using the score-press-blend technique.
6. Adhere fish mouth and eyes.
7. Using a variety of clay tools complete all texture and finishing work.
8. Let clay air dry.
9. After clay is bisque fired it is ready to glaze or paint.



Appendix B

Ceramic Fish





Appendix B