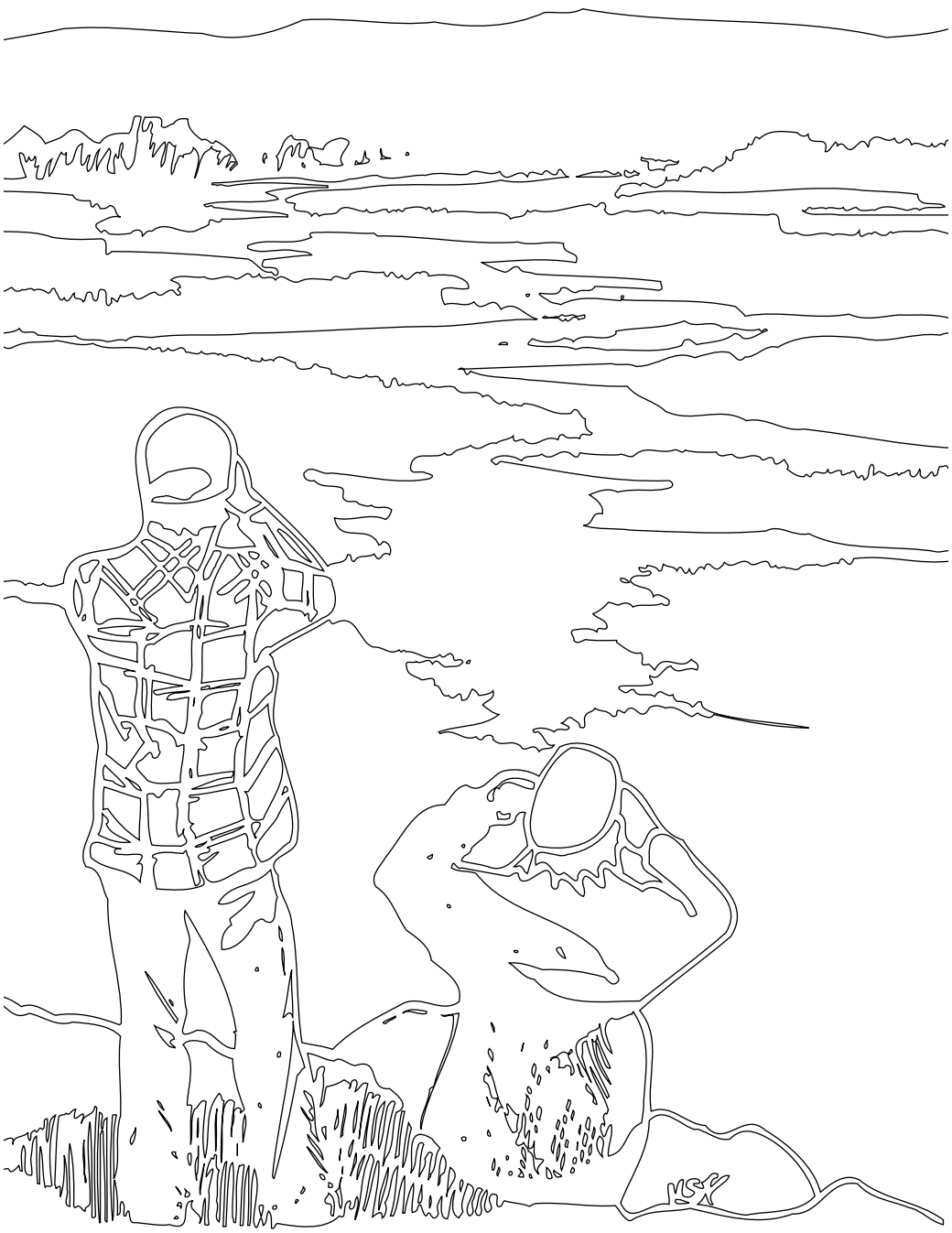
*The **Stewardship** Series*

The Wetlandkeepers Handbook

A practical guide to wetland care



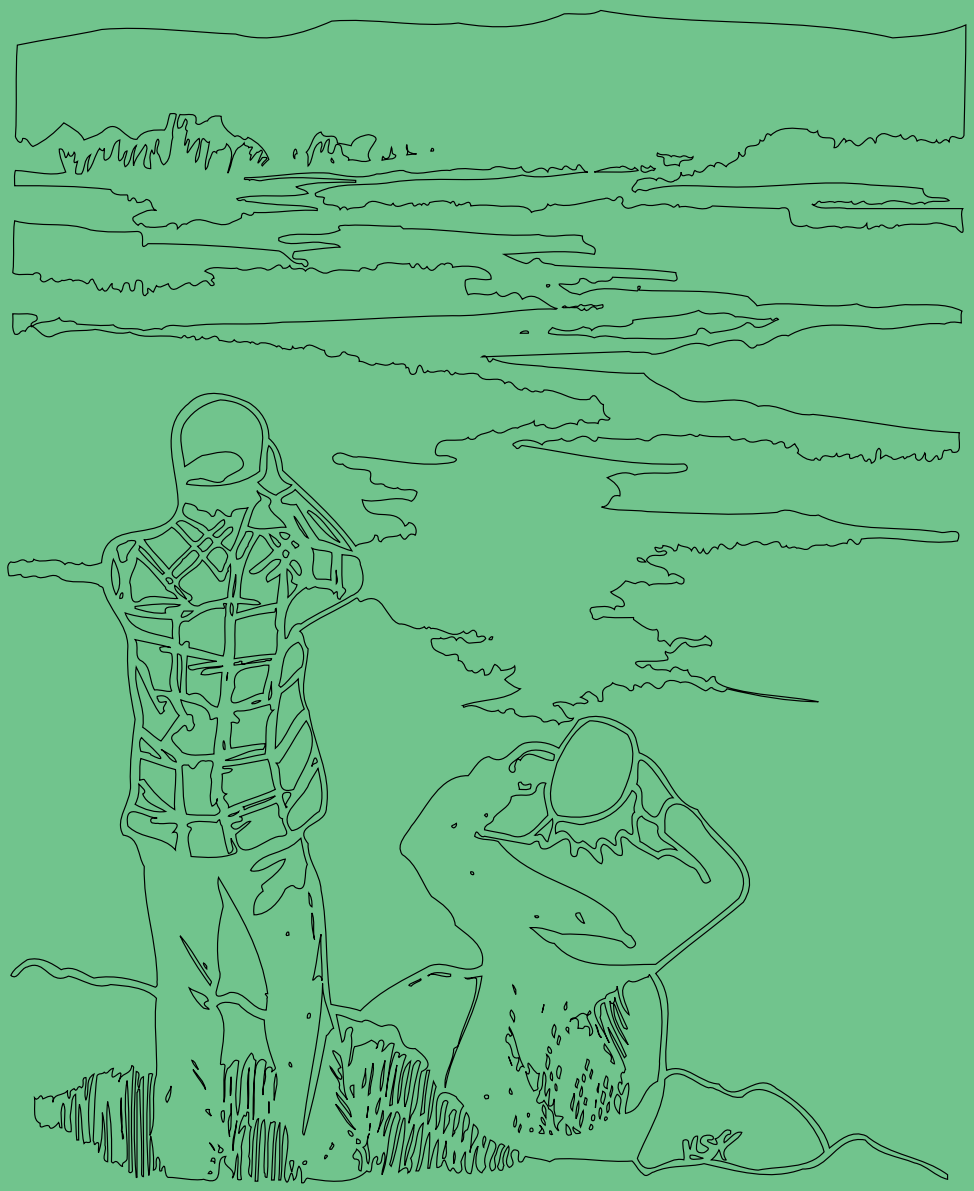
Canada

BCWF
B.C. Wildlife Federation

British Columbia

The Wetlandkeepers Handbook

A practical guide to wetland care



Environment Canada, Canadian Wildlife Service
Fisheries and Oceans Canada, Habitat and Enhancement Branch
Province of B.C., Ministry of Environment, Lands and Parks
B.C. Wildlife Federation

CANADIAN CATALOGUING IN PUBLICATION DATA:

Main entry under title :

The wetlandkeepers handbook : a practical guide to wetland care

Co-published by: Fisheries and Oceans Canada, Habitat and Enhancement Branch, Province of B.C., Ministry of Environment, Lands and Parks, B.C. Wildlife Federation.

ISBN 0-660-16650-X
Cat. No. CW66-151/1996E

1. Wetland ecology -- British Columbia.
2. Wetland conservation -- Law and legislation -- British Columbia.
I. Southam, T. (Theresa)
II. Curran, E.A. (E. Anne), 1949-
III. Canadian Wildlife Service.
IV. Canada. Dept. of Fisheries and Oceans. Habitat and Enhancement Branch.
V. B.C. Wildlife Federation.
VI. British Columbia. Ministry of Environment Lands and Parks.
VII. Title: A practical guide to wetland care.

QH77.C3W47 1996 574′.526325 C96-980388-5

ACKNOWLEDGEMENTS

Funding for the handbook was provided by Environment Canada. Many people helped prepare this first edition of Wetlandkeepers.

Original Steering Committee
Rick McKelvey, Canadian Wildlife Service
Gary Taccogna, Department of Fisheries and Oceans
Rod Silver, Ministry of Environment, Lands and Parks

Project Coordinator
Theresa Southam

Editor and Writer
Anne Curran

Graphic Design & Production
Eric Ansley & Associates Ltd.

Module Authors
Will Mackenzie, Ministry of Forests
Kathleen Fry, Ducks Unlimited Canada
Carolyn and Andrew MacDonald, Many Rivers Enterprises
Emma Child, Federation of British Columbia Naturalists
Linda Nowlan, West Coast Environmental Law
Michel Drouin and Mae Burrows, T. Buck Suzuki Foundation

Reviewers
Stan Orchard, Amphibian Specialist
Tom Sterling, Retired Biologist
Colin Levings, Department of Fisheries and Oceans
Theresa Duynstee, Stewardship Pledge Program
Martin Keeley, Friends of Boundary Bay

Course Development
Abby Schwarz, Langara College

Groups Surveyed
Land for Nature, South Okanagan Branch
T. Buck Suzuki Foundation, Vancouver
East Kootenay Environmental Society
Project Watershed, Courtenay
Sierra Club of B.C., Victoria
Save Georgia Strait Alliance, Nanaimo
Squamish Estuary Conservation Society
Illesillewaet Green Belt Society, Revelstoke
Friends of Boundary Bay
Sargeant Bay Society, Sechelt
Central Valley Naturalists, Mt. Lehman
Heartlands Conservancy, Gabriola Island
Boundary Bay Conservation Committee
Wild Bird Trust, Maplewood Flats, North Vancouver
Chilliwack Field Naturalists
Baines Sound Stewardship, Courtenay

TABLE OF CONTENTS

SECTION FOUR

LAWS AND RIGHTS REGARDING WETLANDS IN B.C.

SECTION FIVE

ACTIVITY MODULES

1.3 Developing and Implementing a Public Education Program

2.1 Initial Wetland Assessment

2.2 Conducting a Survey of Wetland Plants

2.3 Conducting a Wetland Bird Survey

3.1 Wetland Cleanup

FOREWORD

Wetlands play an essential and complex role in the wellbeing of our environment. They clean our freshwater supply, reduce the impact of floods, and support wildlife, including fish and millions of migratory birds. Wetlands occupy an estimated 1,270,000 km or 14 percent of Canada's total land mass and include the world's second largest peatlands resource base (after that of the former Soviet Union). As such, they serve as one of the principal reservoirs for freshwater storage in the northern hemisphere.

Yet over the years wetlands have been treated as wastelands. Hectare after hectare of these biologically diverse areas has been drained and filled, leading to the eradication of literally thousands of hectares of wetland in British Columbia alone.

Growing awareness of the value of wetlands led in the 1970s to the establishment of Canada's National Wetlands Working Group (NWWG), with a mandate to undertake the systematic study and classification of our country's extensive wetland systems. By 1988, with the publication of its volume *Wetlands of Canada*, the NWWG had influenced government policy makers to incorporate wetlands as a major component of the country's conservation strategy and established a framework for their further study. Today that study continues both in Canada and abroad, as wetlands worldwide continue to disappear daily.

These training modules have been developed to encourage broad interest in wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, *Wetlandkeepers* provides background information on wetland ecology and laws related to wetlands, as well as step-by-step instruction on wetland activities. In this first edition the focus is on 'getting to know' your wetland. Later editions will include activities on planning for wetland restoration and protection.

ORGANIZATION OF THIS HANDBOOK

This handbook is organized into the following sections:

Section One: Introducing Wetlandkeepers

Section Two: Getting started

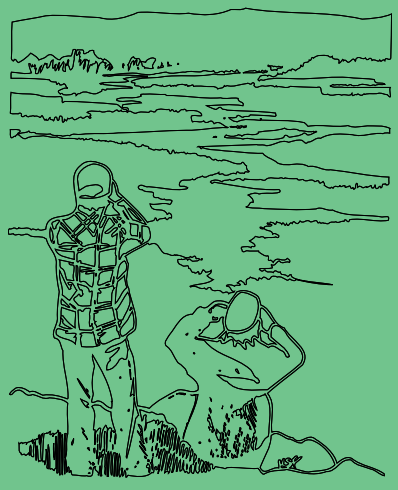
Section Three: Wetland ecology

Section Four: Laws and rights relating to wetlands in B.C.

Section Five: Activity modules

The Wetlandkeepers Program

Section One



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

WHY CONSERVE WETLANDS?

While wetlands have long been valued for their peat — used for many centuries as a source of energy and, more recently, as a growing medium in the horticulture industry — they are now being recognized increasingly for their onsite values as freshwater purifiers and reservoirs, flood control mechanisms, and carbon sinks (holding sites). Many of us are also beginning to appreciate their aesthetic features and to champion the right of their diverse *biota* (plant and animal species) to exist — without our interference — as an expression of the teeming richness and vitality of life on earth.

The only problem is that most wetlands occur along rivers and on valley bottoms where humans also tend to take up residence. The Fraser River is a good example – when settlers first arrived in British Columbia, they quickly recognized the value of the Fraser River delta as fertile farmland and set about to drain, dyke and fill its vast wetlands. Today some 500 kms of dykes extend through the delta, protecting the commercial agricultural operations, industrial concerns, and urban settlements that have grown up behind them. Lower Mainland residents – not to mention large populations of migratory birds and other wildlife – have paid a large price for these developments. Much of the area's wetlands have been permanently lost – while industrial and urban growth continues largely unchecked.

We can't return our landscape to untouched wilderness, especially in areas like the Lower Mainland. But we can conserve the wetlands that remain through community-based initiatives like Wetlandkeepers.

THE PROGRAM

Wetlandkeepers is a program for individuals and community groups interested in stewarding a wetland. Its primary purpose is to raise public awareness of wetland values, but it also has a larger goal – to foster a land ethic among the public at large. By caring for the land, we begin to care about it and to assume responsibility for its protection. As recently as a decade ago, conservation policies and practices were left largely in the hands of government. But government budgets have since shrunk and public attitudes are changing as we become increasingly concerned about the implications of habitat loss. Today many private citizens play a key role in conservation initiatives both as advocates and as volunteer workers – and the need for more public participation is growing.

The Wetlandkeepers program will formally begin in September 1996. Initially, it will consist of this Handbook and five activity modules (plans for more modules are under way). In early 1997 a workshop to support the program will become available from Langara College, the first post-secondary institution in the province to offer courses in wetland ecology. Preliminary work is also being done on other possible resources, including a network of experts in communities around the province and a web-site.

YOUR ROLE

As a Wetlandkeeper you will have a chance to become involved in conserving our endangered wetland resources – and in spreading the word about wetlands to your community. Most of the modules require little in the form of equipment or formal training, and can be started once you've read them carefully, reviewed this introductory section, and established a plan that clarifies your goals and proposed activities. This last step, covered in the next section under the title "The visioning process," is a crucial one and shouldn't be skipped.

The modules, completed in chronological order, should give you a well-rounded picture of the health of your wetland. You can use the data you've collected to track gradual changes in the wetland's functions and make plans for additional monitoring and restoration activities. It will also be useful in any discussions you have with government and non-government agencies concerning protection of the wetland, or funding for further wetland work. In fact, yours may be the only site data available since government offices simply don't have the staff to assess all wetland areas in the province. All data can also be forwarded to the Conservation Data Centre (CDC) in Victoria where it will be reviewed and banked for use by a wide range of conservation groups.

As a result of your work, you may decide to start a public education program to promote wetlands to others in your neighbourhood. This can range in complexity from a simple photo display in the local mall to a fully serviced visitors centre with permanent exhibitry, professional interpreters, and extensive public programming. Educational programs truly bring Wetlandkeepers full circle, accomplishing the primary aim of the program – to increase public awareness.

ACTIVITY MODULES

The modules describe activities that range from simple to complex. Each begins with a background on the monitoring activity it features, and all except one are divided into a series of steps. Where a step is more complicated, it's labelled "advanced" and may be avoided without affecting the overall outcome of the activity. Several of the modules can be completed in a few days or a week, by as few as two people. Two extend over a period of weeks or months and require considerable organization and effort.

The table on page 4 provides details on the training, time, and number of volunteers required for each activity. The five modules include:

DEVELOPING AND IMPLEMENTING A PUBLIC EDUCATION PROGRAM (MODULE 1.3)

Public education programs at a wetland site play an important role in garnering public support for wetland conservation. Being organized, with a solid program and trained volunteers in place, is one of the keys to program success. This module provides information on how to develop and mount a successful program, beginning with the formation of a community-based steering committee. Also discussed are program design, including a section on knowing your audience; promoting your program once it's under way; maintaining a motivated volunteer force; and site preparation.

INITIAL WETLAND ASSESSMENT (MODULE 2.1)

Conducting an initial assessment of your wetland's features is an important first step in understanding its nature. In this module, you start by examining aerial photos and topographical maps of the wetland and surrounding area. Then you make an on-site assessment of vegetation and soils to determine the wetland's class (type). This exercise gives you a better understanding of how the wetland functions and the kind of life it supports. Based on your findings, you can then develop a detailed map of the area for documentation and reference as you proceed with additional survey and monitoring activities.

CONDUCTING A SURVEY OF WETLAND PLANTS (MODULE 2.2)

This module provides details on how to conduct a plant survey by identifying the plant species found in a wetland and estimating the proportion of wetland area each species occupies. With this information, you can monitor changes in the composition and variety of the wetland's plant community, reviewing all your wetland observations and data to determine why these changes have occurred. Plant surveying builds on the basic mapping and survey work described in the previous module and provides baseline data for the development of long-term wetland monitoring and restoration activities.

CONDUCTING A WETLAND BIRD SURVEY (MODULE 2.3)

To protect and conserve a wetland, you must first have a good knowledge of its occupants. This module provides information on designing and conducting a successful bird survey, and on assessing your data afterwards. Bird surveys yield useful information about wetland health and are an effective way for you to document a particular wetland's value. The data you collect can be used in public education programs and as an adjunct to government and group funding submissions on behalf of wetlands conservation.

MARSH CLEANUP (MODULE 3.1)

Estuary marshes are a vital habitat for migrating juvenile salmon and for many other species of aquatic and terrestrial life. Yet they continue to be damaged and destroyed by industrial activity and unplanned urban development. Debris left by logging and other industrial operations destroys plantlife. When it's removed, the underlying marsh is exposed and plants can regenerate. This module provides information on how to clean up a marsh, focussing, in particular, on wood debris. Among the topics covered are obtaining licenses and permits, finding funds, budgetting, and motivating volunteers, with a separate section devoted to the problem of debris disposal.

REQUIREMENTS FOR EACH MODULE

Module	1.3	2.1	2.2	2.3	3.1
Training recommended:	yes	yes	yes	yes	no
Annual time commitment (in days):	2	up to 6	up to 52	up to 6 mos.	3
No. of volunteers:	2 min.	2 min.	2 min.	6 min.	6
Time of year:	summer	spring	fall	spring/fall	winter
Approval required: in all cases, this depends on the requirements of site owner, whether the Crown or a private interest					

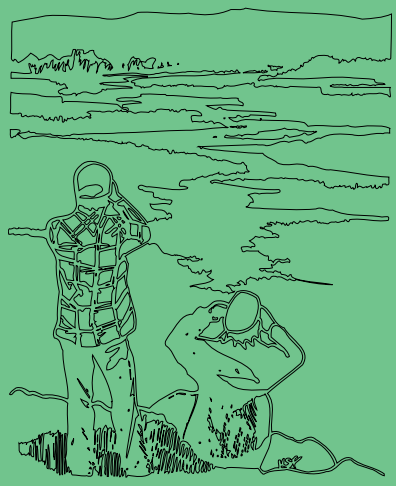
THE STREAMKEEPERS PROGRAM

The model for Wetlandkeepers, the Streamkeepers Program was developed in 1993 in response to the concerns of many volunteers working on stream enhancement projects around the province. Despite volunteer efforts and government regulations, development pressures are continuing to threaten our aquatic habitats. Everyone, from residents to land developers, foresters, and farmers needs to become aware of how important good watershed practices are to the long-term protection of our environment.

The Streamkeepers Handbook describes more than a dozen stream monitoring and restoration activities, ranging from simple to complex. Some take half a day, others several days a year to complete. Interested in getting involved? For more information, contact the closest Fisheries and Oceans Canada community advisor. Where no advisor is available, staff at the nearest Ministry of Environment, Lands and Parks office (Water Management, Fisheries or Habitat Protection) may provide assistance.

Getting Started

Section Two



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

Now that you and your group have joined Wetlandkeepers, how do you begin? This section identifies some basic considerations to bear in mind as you plan your activities.

NETWORK OF ADVISORS

One of your first goals, once you've joined the program, should be to develop a resource list of local wetlands experts. Specialists in this field are usually fascinated with their subject of study and pleased to share their knowledge. Some of them may even decide to join your group. Have a look for this kind of person among instructors in the biological sciences at your local college or university, fisheries and forest workers, staff with the provincial or federal Ministries of Environment and Forests, local anglers and hunters, and members of local naturalist clubs. Your own knowledge base is going to expand as you become more involved in your wetland, but wetland ecosystems are complex and can be difficult to interpret accurately. It's vital to have good resource people on side.

RESEARCHING YOUR WETLAND

Before undertaking any onsite activities, establish that you can legally enter the wetland, then do some preliminary research on its history and values. The nearest branch of the B.C. Land Titles Office can tell you who owns the site (Section Four of this handbook provides detailed information on wetland ownership and the legal protection of both private and public sites). But where do you go next?

In the case of both public and private wetlands, your first contacts should be the Ministry of Environment, Lands and Parks (MoELP), specifically the regional offices of the Fisheries Branch and the Wildlife Branch, and the Victoria-based Conservation Data Centre (CDC). Regional fisheries and wildlife staff may already have inventoried the wetland and be able to provide you with information on its basic characteristics, including dimensions, vegetation, wildlife, and degree of human impact. The CDC, funded by several major conservation agencies (including MoELP), specializes in tracking rare, threatened and endangered species and ecosystems around the province and in compiling this data so that it's accessible and of value to user groups (all queries to the Centre should be in writing and sent by either mail or fax).

MoELP may refer you to the provincial Ministry of Forests for additional information, or to the federal Department of Agriculture, Environment, or Fisheries and Oceans. Regulations regarding the protection of wetlands are contained in the province's Forest Practices Code while fish and wildlife habitat, including wetlands, are protected under both provincial and federal legislation.

Non-government organizations like Ducks Unlimited Canada (DUC) or the Federation of B.C. Naturalists (FBCN) may also be able to help you. DUC has been actively involved in wetlands conservation for more than 50 years and often partners with government and other non-government agencies on major conservation projects. As well, DUC staff respond to hundreds of queries from private landowners with small wetlands on their property and maintain records of these queries. The FBCN represents more than 50 natural history clubs around B.C. and has a membership that includes some of the province's most highly trained and knowledgeable naturalists. Many FBCN clubs are involved in such activities as birding, public education, and local conservation initiatives. Members are familiar with the local landscape and may even have visited your wetland site and conducted bird counts, etc. in the area.

You should also take time to track down informed industry representatives and private citizens who may have researched the wetland as part of their work, or out of personal interest. Amateur historians are a virtual goldmine of information, often providing valuable details on early human impact on the landscape. Longtime anglers are a good source as well, as are hunting and fishing guides, forest industry workers, and many others.

THE VISIONING PROCESS

Once you've completed your background research, you're in a position to clarify and develop plans for your group's wetland stewardship role. Ironically, this is often the moment when many community groups, anxious to get ahead with "hands-on" activities, decide to set aside the planning process – only to lose the purpose and direction of their work as a result. Planning can be frustrating because it takes time. But only by establishing clear goals can you identify and structure activities to accomplish them. In group work, this process is called *visioning*.

Visioning involves three basic steps: identifying key issues related to your wetland site; identifying trends that might affect the wetland over the next 10 to 20 years; and identifying activities that encompass both the short- and long-term goals of your group. The process is not a one-time exercise and should be repeated periodically as you achieve major objectives, or conditions change.

Why has the group decided to steward this wetland? What are your long-term goals (short-term goals as well) and in what order do you want to see them accomplished? Where might your activities eventually lead?

DELINEATING A WETLAND

Many wetlands have a clearly defined edge as revealed by an abrupt topographical change or the sudden absence of hydrophytic (water-tolerant) plants. Sometimes the change is gradual and less obvious.

The margin that exists between a wetland and the surrounding area is called a buffer zone. Sandwiched between the two ecosystems, buffer zones support a diverse array of aquatic and terrestrial life which enhance the diversity of the wetland as a whole. This diversity is commonly referred to as the "edge effect."

Buffer zones reduce the impact of hydrological and other kinds of disturbance beyond the wetland's borders, and can vary in size from a few yards to more than a kilometre. Turn to Section Three of this Handbook for more information on wetland ecology.

Do you want the government to declare the wetland a Wildlife Management Area? Do you want the landowner to register a conservation covenant against the land? Is your long-term goal to establish a permanent interpretive centre?

An effective way to give form and purpose to your group's activities is to take your goals into the public domain. This requires some preliminary research, but can be extremely gratifying. Has your municipality, for example, passed a bylaw that specifically relates to the granting or withholding of development permits on wetlands? Has the provincial government released any wetland policy papers that contain recommendations applicable to your site? Do specific federal or provincial laws have a direct bearing on what you want to accomplish? By entering the public domain you become involved in the official decision-making process, creating opportunities for yourself to actually change how your wetland is treated. It's the difference, to draw a simple analogy, between participating in a model parliament and actually running for a seat.

You usually begin the visioning process by bringing group members, selected wetland specialists, government officials, and others together for a brainstorming session to identify issues. Try to retain a trained facilitator to lead these sessions, if possible. Everyone then has a chance to participate freely and you can take advantage of the facilitator's experience and objectivity to accomplish session goals. Also consider interviewing key community decision makers for their views and conducting surveys with local residents. Strive to involve the community every step of the way.

When you have your list of issues in place, review and analyze each one in turn. Who or what is being affected by it and to what extent? When and where has it occurred? What's causing it? What are the implications over time? What are the current trends and will they even be a factor in another decade? What are the long-term plans, if any, of the municipality or district? Is the wetland in the path of urban development? Is it a source of problems for local residents? What problems? Do migrating waterfowl use it as a stopover? Does it help reduce flooding in the spring? What other ecological functions does it perform?

Now prioritize your list, considering such factors as appeal, urgency, scope of detrimental impact, likelihood of success, and your group's capabilities. How experienced is your group? What kind of expertise do members bring with them? What are the interests of most members? Do you have enough volunteers to conduct weekly bird counts? monthly? Christmas count only? Do you have a land surveyor in the group? a lawyer? What additional strategies are available to you in the public domain?

Does one issue stand out before the others? Make it your primary goal and start identifying the specific tasks the group will have to undertake to accomplish it. How can you stop any further industrial activity on the wetland? How can you persuade government to purchase and protect the site? How and where can an interpretive centre be constructed? Can the wetland support an annual wetland arts festival?

PROTECTING A WETLAND

The most common way to influence use of a public wetland is through the land-use planning process conducted by your local municipal planning office. Several strategies are available to you. You can:

- influence zoning
- make representations to have the wetland designated as an environmentally sensitive area
- attempt to have the wetland included as a protected area
- impose restrictions on a developer's ability to proceed with a project on a wetland if the municipal council permits a subdivision to occur and the developer acquires the land

Turn to Section Four of this Handbook for more details on the legal protection of public and private wetlands.

As simple as it sounds on paper, a process like this can take weeks, even months to complete – but what you have in the end is usually worth the trouble. By sorting through the general issues most of us identify at the beginning of the process – issues like "keep the community green" – we begin to appreciate exactly what's involved in accomplishing them and to look realistically at our interests and capabilities. Only then can we identify the degree of effort, level of detail, and time required to complete the various tasks associated with making our vision a reality.

Visioning also tends to bring group members closer together, providing the focus and momentum so necessary for the successful completion of volunteer projects.

DATA COLLECTION IN THE FIELD

Once you start your onsite assessment and monitoring activities, strive to maintain high standards in collecting and recording data. The Conservation Data Centre (CDC) in Victoria, with its interest in sensitive ecosystems, including wetlands, is prepared to accept data from Wetlandkeeper groups. However, the information must be as accurate as possible since a number of professionals refer to the Centre's data base in setting habitat management policies. Each of the modules in the Wetlandkeepers program contains data recording sheets and instructions on how to fill them out. These should be completed with care, then forwarded by fax or mail to:

The British Columbia Conservation Data Centre
Wildlife Branch
B.C. Ministry of Environment, Lands and Parks
780 Blanshard Street
Victoria, B.C. V8V 1X4

FAX: (604)387-2733

HEALTH AND SAFETY

For all their beauty and value, wetlands can be hazardous to your health. When you're on site, never drink from the wetland or local streams. By definition, wetland waters contain pollutants, both natural and human made, and may carry viruses and water-borne diseases like giardiasis ("beaver fever"). Many small wildlife species are also carriers of diseases that can be transmitted to humans – we're susceptible to some bird diseases, for example. Try to avoid handling wildlife or their droppings altogether, if possible – and use extreme care if you come across a sick animal.

Unstable physical features (beaver dams, log jams, etc.) and potentially hazardous contaminants can also pose a risk to the visitor. Before organizing volunteer monitoring activities, be sure you're familiar with

COLLECT ACCURATE DATA

When you collect data in the field, keep in mind the following general rules of thumb to ensure accuracy:

- in your survey work, always use the same methods from survey to survey
- try to conduct surveys at the same time each week, month, year, etc.
- record every detail of what you do and where, making small illustrations and maps, if necessary, to serve as reminders
- keep strict records of any specimens you take
- use the correct scientific name for all plant and animal species
- always record your actions, observations and other remarks as you make them, not at the end of your survey
- whenever possible, conduct a test twice to confirm results
- ensure that your equipment is clean and in good working order

your site's features and inform participants of them. Depending on the age of volunteers, you might even decide to flag or cordon off certain areas of the site beforehand.

One of the risks of working in damp, cold conditions for any length of time – while you're conducting a bird count, for example – is hypothermia. Hypothermia is a fall in the body temperature to below 35C, causing drowsiness and lowered breathing and heart rates. In extreme cases, it can result in death. The best way to protect yourself against this condition is to dress warmly and wear waterproof outer clothing and boots. Monitoring activities should also be designed so that they allow volunteers some movement and don't leave them in exposed areas for too long.

SAFETY GUIDELINES FOR WETLAND WORK

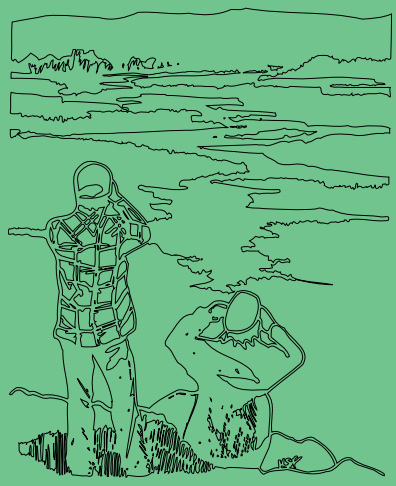
All wetlandkeepers should follow these general guidelines for personal safety:

- verify ahead of time that no one is likely to be hunting in the vicinity of the site
- check hunting regulations
- carry emergency equipment if your wetland is isolated
- ensure that everyone on site is trained in the safe use of all hand- and machine-operated tools
- if you're using a boat or canoe, follow all boat safety rules
- work in pairs or small groups where the activity allows
- dress for the weather and site conditions
- familiarize yourself with site hazards before entering the wetland
- organize a plan that you can institute quickly if an emergency occurs
- if the site is isolated, establish a call-in program to ensure that everyone has returned from the field

The Wetlandkeepers Handbook

Wetland Ecology

Section Three



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

WETLANDS DEFINED

In its volume *Wetlands of Canada*, the National Wetlands Working Group (NWWG) defined wetlands as "land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic (water-tolerant) vegetation, and various kinds of biological activity which are adapted to a wet environment." All wetlands, in other words, have at least three basic characteristics in common – water, water-saturated soils, and water-tolerant plants.

A wetland's hydrology – how water flows into and out of it, the water's depth and flow patterns, and the extent and duration of flooding – all affect the nature of the wetland's soils and also influence the kind of plant and animal life it attracts. We call the seasonal variations in a wetland's water level its *hydroperiod*. Together, the wetland's hydroperiod and the types of soils and plants it contains, are used to identify a wetland's class. Soils and plants used in this way are often called wetland indicators.

SOILS

Wetland soils are anaerobic or deficient in oxygen. Oxygen diffuses slowly through wet soil, slowing the decomposition of wetland plants as they die and accumulate on the soil's surface. Where plants decompose more slowly than they accumulate, *peat* (organic matter) forms. The layered accumulation of a wetland's organic matter is called its *peat record*. A peat record can tell us much about the history of a wetland, including the climatic and hydrological changes that influenced it to evolve into its present state.

While peat consists of organic matter, wetland mineral soils are composed mainly of sand, silt and clays. Wet mineral soils show the effects of water in two ways – through gleying and mottling. Gleying refers to the chemical transformation of iron and manganese in soil that's flooded for some days or weeks. Gleyed soil is a uniform bluish-grey in colour. Mottling refers to the reddish brown splotches found in soil with a fluctuating water table. Actual rust marks, the splotches result when iron in the soil is oxidized and can often be seen along a plant's root system.

Wetland specialists commonly use soil analysis, in conjunction with a survey of plant species, to establish a wetland's border.

WHERE DO WETLANDS COME FROM?

Wetlands occur in areas where the water table is high and often begin life as a depression occupied by a pond or lake. As the depression gradually fills with decaying lakeside vegetation, vegetation typical of fens and bogs invades and peat formation begins.

Peat deposits may expand to cover previously dry land (this process is called *paludification*) as the water table rises during peat buildup. Peat is still accumulating in many areas today.

Wetlands began to form sometime after the last deglaciation about 13,000 years ago. Around 6,000 years ago the last traces of ice disappeared, but it was still hundreds, even thousands, of years before peat formation took place in many areas. The wetlands that now predominate in south and central Manitoba and northwestern Ontario, for example, didn't actually begin forming until 4,000 years ago. Researchers don't fully understand why this lag occurred – it could have been that the climate was unsuitable for wetland formation, or that plant migration into wetland sites was slow.

PLANTS

Only plants that are tolerant of water grow in wetland areas. A small and specialized group within the plant world, they are referred to as *hydrophytes*.

Hydrophytes contain systems or mechanisms that enable them to capture and deliver oxygen to their roots. Some have small openings on the upper surface of their leaves. Others have numbers of air spaces in their leaves and stems, or multiple trunks. Still others have no roots at all. Different species of hydrophytes flourish in different wetland environments, forming species groupings or *plant communities* where they occur together in a particular environment. Plant communities as well as individual plant species are used as indicators of various wetland classes.

BOG BODIES

Because of their acidic content and lack of oxygen, bogs tend to preserve intact the plant and animal life that falls into them. Many European cultures in the past attached a religious or mystical significance to bogs, sometimes making human sacrifices at their edge. Today they are the source of astounding archeological finds, yielding up entire human bodies, skin tissue, clothing and other artifacts still intact. No similar finds have yet been found in Canada.

WETLAND CLASSIFICATION

Canada's wetland classification system (Zoltai et a. 1975; Tarnocai 1980) was published in 1980, at about the same time as the American government published its *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). While they have similarities and share some of the same terminology, the two systems are essentially different and cannot be used interchangeably.

Under the system established by the NWWG, wetlands are divided into five general wetland classes — bogs, fens, marshes, swamps, and shallow water. These, in turn, are subdivided into 70 different wetland forms. The five classes can be described as follows:

Bogs are peatlands with the water table at or near the surface. They consist primarily of decomposing sphagnum moss and are highly acidic and low in nutrients. They may be raised or level with the surrounding area, treed or untreed, and are usually covered with sphagnum moss and heath shrubs. Typical bog plant species include: Labrador tea, bog cranberry, bog laurel, bog rosemary, creeping snowberry, shore pine, black spruce, sundew, and cloudberry.

Fens are peatlands with the water table at or just above the surface. They are wetter than bogs and consist mainly of decomposed sedge and brown-moss peat, making them more nutrient rich and less acidic. Fen flora commonly include sedges, grasses, reeds, and brown mosses with some shrubs and the occasional tree. Among the plant species you can expect to find there: water sedge, marsh cinquefoil, willows, sweet gale, hardhack, golden fuzzy, and fen moss.

Marshes are peatlands or wetlands that are periodically flooded by slow moving or standing water. Marsh waters are rich in nutrients and may vary from fresh to highly saline. Water level usually fluctuates seasonally. Marshes are often characterized by zonal or mosaic surface patterns composed of pools or channels spelled by clumps of sedges, grasses, rushes and reeds. Grassy meadows and narrow bands of trees and shrubs usually edge the marsh area. Where there is open water,

aquatic plants flourish. Freshwater marshes are characterized by emergent vegetation (roots in water, stems and leaves above the water surface), including: cattails, bulrushes, grasses, and horsetail. Salt marshes in coastal estuaries or saline ponds, contain salt-tolerant emergents such as: sedges, glasswort, saltgrass, and seaside bulrush.

Swamps are wetlands or peatlands with standing water or water moving slowly through pools or channels. Internal water movement is pronounced, and the waters are rich in nutrients drawn from the swamp margin and other mineral sources. Where peat is present, it consists mainly of decomposed wood. Swamp vegetation is characterized by a thick cover of deciduous or coniferous trees and shrubs, herbs, and mosses. Typical plant species found in swamps include: mountain alder, willows, skunk cabbage, lady fern, western red cedar, spruce, high bush cranberry, and horsetail.

Shallow-water wetlands are defined as open waters that cover at least 75 percent of a total wetland area in summer and have a midsummer depth of less than 2 m. They are commonly referred to as ponds, pools, shallow lakes, oxbows, reaches, channels, or impoundments, and are usually edged by water-eroded shorelines or by the landward margin of mudflats, floating vegetation mats, or shrubs. Not infrequently, this type of wetland is found within other wetland types. Typical shallow-water plants include: milfoils, pondweeds, pond-lilies, and watershield.

WETLANDS IN B.C.

About three percent of British Columbia is wetland while the province's share of Canada's total wetlands area is just over one percent. Most of B.C.'s wetlands are located in the northeast quadrant of the province where they extend over as much as 75% of the terrain. Major wetland complexes also occur in several other areas – along the Pacific coast from just below the northern tip of Vancouver Island to the Alaskan border; on the northern tip of Vancouver Island; along the Fraser Delta; in the central Okanagan; and in the north central interior.

This is not to say that wetlands do not occur anywhere else. Indeed, most of us, no matter where we live in B.C., can probably identify at least one or two wetland sites in our immediate area. They may not be as extensive as the coastal salt marshes or the bogs north of Fort Nelson, but they perform many of the same functions and deserve the same attention and consideration in local planning initiatives.

NATURE'S KIDNEYS

Perhaps the most amazing of the many functions wetlands perform is that of freshwater filtration and purification. As much as 80 to 90 percent of matter is removed from water as it flows through a wetland.

Wetland soils and vegetation filter out sediment and chemicals, including silt, nutrients, pollutants and toxic materials (pesticide residues from farm runoff and heavy metals from industrial processing). The pollutants and toxins then bind with the sediment and settle on the bottom of the wetland where they become trapped and are gradually absorbed by wetland plants. Through this process they're often converted into non-toxic materials.

Wetland scientists believe that wetland annuals (plants that live and die in one season) absorb most of the pollutants, particularly in spring at the peak of their growth — this is also the time when filtration is of most value to delicate ecosystems downstream. As the plants die off in the fall, they release some of the toxins they've absorbed — when these can do little harm to downstream aquatic life. At the same time, bacteria and fungi eat the decaying plant matter and, in the process, release nitrogen into the air.

FLOOD CONTROL

Wetlands *attenuate* or reduce the impact of floods by slowing and storing flood water. Much like a giant sponge, wetlands absorb water, then release it gradually over a period of weeks or months as the surrounding area dries out. Wetland vegetation also acts as a brake on water flow, slowing its speed and preventing river- and lake-edge erosion. The plants actually bind bank soil, holding it in place against the impact of wave and current motion. More than downstream human settlements benefit as a result. Valuable spawning beds, streamside habitat, and other ecologically sensitive habitats are also protected from washout, erosion and siltation.

Several factors affect a wetland's "attenuation effectiveness." Obviously, the larger a wetland and the more dense its vegetation, the more efficient it will be in slowing and storing water. Hydrology also plays a role – where water flows easily into a wetland area, but cannot escape, it's more likely to be absorbed and stored.

WETLAND WILDLIFE

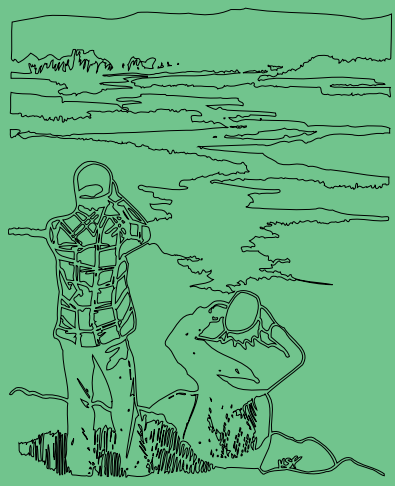
Because of the transitional zone they occupy between aquatic and upland habitats, many wetlands support a wide range of plant and animal life from both habitats.

Vast numbers of migrating waterfowl travel along North America's four major flyways each year, stopping in wetlands to feed, stage, breed, and nest. On the west coast, the Fraser River delta is considered one of the most important migratory way stations of the Pacific Flyway, attracting birds from as far away as Asia, the Canadian arctic and South America.

Wetlands also play a central role in supporting raptors, shorebirds and songbirds, and are the main habitat in British Columbia of such threatened or endangered species as the Townsend's vole, the Vancouver Island water shrew, the shorthead sculpin, and the northern Pacific giant salamander. They are a primary food source for many species, and a source of cover and nesting materials for many others. They serve as spawning beds and nurseries for freshwater fish and, at least in the case of wetland estuaries, are essential habitat for the spawning, feeding and cover of many shellfish, finfish and crustaceans.

Laws & Rights Regarding Wetlands in British Columbia

Section Four



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

This section is divided into two parts. The first part deals with wetland ownership and legal protection for privately owned wetland sites. The second part provides a general summary of federal, provincial and municipal legislation relating to wetlands protection and also includes a definition of conservation covenants and other legal tools for protecting privately owned lands. The information for this section was compiled by Linda Nowlan of West Coast Environmental Law in Vancouver.

It's important to have a general understanding of this legislation, particularly when you first research your wetland and begin to identify your goals. But legal action should itself be regarded as a "last resort" in most conservation disputes. This advice applies particularly to privately owned wetlands where public groups have few, if any, rights. In such instances, your first step should be to establish at what point the landowner is prepared to become involved in the conservation process. By starting at this point, you can then work closely with the owner to satisfy mutual needs and interests. Many private landowners themselves instigate conservation measures, joining with an experienced non-profit organization to coordinate stewardship activities.

PART ONE: WETLAND OWNERSHIP

Your first step in seeking legal protection for a wetland is to determine if it's privately or publicly owned. Depending on ownership, you may be subject to certain restrictions. In the case of a privately owned wetland, your options are largely determined by the owner - the more interested and cooperative the owner is, the more options you're likely to have. Protection of a public wetland, on the other hand, is dependent on several factors, including:

- municipal zoning of the wetland and the opportunity to change that zoning
- whether the wetland contains fish habitat
- presence of absence of wildlife on the wetland
- whether human activities are threatening the wetland by altering water levels, introducing pollution, or logging

Most of British Columbia's wetlands are publicly owned. In a 1994 survey of the Fraser Lowland conducted by the Canadian Wildlife Service, researchers found that 86.7% of the total area of wetlands surveyed is owned by various levels of government, including the federal crown (2.6%), the provincial crown (76.9%) and municipal or regional districts (4.6%). The pattern for the rest of the province is likely similar.

The local office of the provincial Land Title Office can tell you if a wetland is publicly or privately owned. The Land Title Office is the centralized daily registry of title changes to individual properties across B.C. By searching the title of a particular property, you can determine its owner and what restrictions, if any, are registered on it. Restrictions can take the form of an easement, a restrictive covenant, a lease, etc. If you don't want to conduct a search yourself, you might retain one of the firms that do title searches for lawyers, notary publics, and other professionals involved in property transactions (the names of these companies are listed under "title service" in your local yellow pages). To begin your search, you need a legal description of the land, as provided on the tax notice for the land, or through a title search company.

Some land owned by the Crown may not be recorded on a title record in the Land Title Office. In such an instance, you should contact the Crown Land Office, a branch of the B.C. Ministry of Environment, Lands and Parks (MoELP). The municipal or district office in your area can also provide useful information about land ownership and zoning restrictions.

You may find that MoELP and municipal staff refer you to other government ministries for additional information – several provincial ministries (Municipal Affairs, Transportation and Highways, Agriculture, Education, and Health) and federal departments (Fisheries and Oceans Canada, Environment Canada and the Canadian Wildlife Service) are also involved in wetland education and/or protection.

WETLANDS ON PRIVATE LAND

If the wetland you want to steward is on private property, you must first have the permission of the landowner before visiting it or doing anything else to the site.

A member of the public has few rights in relation to a privately owned wetland. The most important restriction is that no one can trespass on private property. Trespass refers to unauthorized entry onto someone else's land. Under B.C.'s Trespass Act, where land is fenced or posted with signs that prohibit trespassing at access points to the property, a person who comes onto the land is regarded as a trespasser – unless they have the consent of the owner, lessee or occupier.

COMPLIANCE WITH THE LAW

What if a landowner is not obeying the law? Some legal options may be available to you, even if the landowner refuses you entry onto his or her property.

Private landowners cannot do whatever they want with their property. They must follow the laws that apply to them. The federal Fisheries Act, for example, prevents the destruction or damage of fish habitat. If you are aware that damage to fish habitat is occurring on a private wetland, you can contact the local office of the Department of Fisheries and Oceans and ask them to investigate. Other, similar laws apply in the same way to private property.

NEIGHBOURS' RIGHTS

If you own property next to a privately owned wetland, you may have more legal options. Landowners cannot use their land in ways that are detrimental to their neighbours' land. If they do, they are subject to litigation under nuisance law. If your neighbour pollutes your property, for example, you may be able to sue for nuisance. Nuisance law covers a wide range of activities, including noise, vibrations, noxious odours, and interference with riparian rights. But it's not as easy as it sounds to mount a suit. First you have to determine if what you consider a nuisance is actually defined as such under the law. And then you have to demonstrate that you've suffered considerable harm. If you're thinking of a nuisance action, consult a lawyer before making any final decision, or contact the West Coast Environmental Law Foundation in Vancouver for advice.

WETLANDS ON PUBLIC LAND

If your wetland is publicly owned, you can freely visit the site, subject to any restrictions imposed by government agencies. Where the wetland is located in a park, for example, you may be restricted to specific hours for entry and exit.

Your rights are more substantial in the case of a publicly owned wetland. You can try to affect the uses of the site through changes in zoning, by participating in the official community plan, or by lobbying for legislation that limits what the land can be used for. You also have options if you think government activities on the site are damaging it. Under several provincial and federal statues, a member of the public can intervene to ensure that the government is obeying the law.

PART TWO
LEGISLATION RELATING TO WETLANDS PROTECTION

Many laws can be applied to the protection of wetlands. Land development and pollution emissions are both controlled by law. Many laws also restrict the use of land or water – by designating land, for example, under the Park Act, or allocating water under the Water Act.

All three levels of government – municipal, provincial and federal – have the power to make laws affecting wetlands. Each has jurisdiction over different aspects of the environment.

The government of Canada, for example, has the constitutional power to enact laws regarding fisheries. The federal Fisheries Act was passed by Parliament in 1985 and, as you will see over the next few pages, is an important tool for protecting wetlands. The federal government also has the authority to pass environmental laws respecting – land reserved for first nations peoples; peace, order and good government; criminal law; and federal undertakings and public land. Today the government plays a central role in wetlands protection through its policy on wetland conservation for federally owned lands. It also produces public information materials on wetlands, in concert with the North American Wetlands Conservation Council, and is active in intergovernmental programs to acquire wetlands, such as the Pacific Coast Joint Venture.

The government of British Columbia has the constitutional power to pass environmental laws respecting the control of natural resources; property in the province; the sale and management of public lands; and "all matters of a local nature." Most environmental laws are provincial.

Municipal and other forms of local or regional government have no direct constitutional powers. Their powers are delegated to them by either the provincial or federal government. Under these delegated powers, however, they have the ability to pass laws that affect the environment, including wetlands.

THE COMMON LAW AND STATUTE LAW

Two kinds of law are referred to over the next several pages – the common law and statute law. Both may be applied in legal actions regarding wetlands protection.

The common law is a body of law derived from Court decisions. Common law courts existed before the establishment of Parliament in England. Judges started to apply similar principles to cases with similar facts, developing precedents to be used in future cases. The law was to be common to everyone. Since our legal system is based on the laws of England, the common law still applies in British Columbia, as amended by statute. The law of nuisance, for example, which restricts your ability to carry on activities which harm your neighbour, is based on the common law.

Statutes also create law. Statutes are acts of the legislature which may be changed by the legislature. Both federal and provincial statutes must conform to the Charter of Rights and Freedoms. In addition, each level of government may only legislate in relation to subjects over which it has jurisdiction. The Canadian Constitution does not give either level of government exclusive jurisdiction over the environment. In fact, the word "environment" is not mentioned at all in the Constitution.

Generally, common law is concerned with private rights between citizens, while statutory law deals with the relationship of the individual to the community. A complete description of the common law is beyond the scope of this module. Most of the following discussion relates to the major statutes used to protect wetlands in B.C.

OPTIONS FOR PROTECTING PUBLIC WETLANDS: FEDERAL LEGISLATION

The *Federal Policy on Wetlands Conservation* represents the federal government's position on wetlands. Issued in 1991, this policy recognizes that wetlands are among Canada's most threatened ecosystems and commits the government to "no net loss" of wetlands. Since this is a policy, not law, it is not legally enforceable. However, it can still be used as evidence in a court or administrative tribunal case. In a case in Ontario, for example, the Ontario Municipal Board refused to allow a landowner to sever a piece of his land for development because it would harm a wetland. The federal government's wetlands policy was cited at the Board hearing as proof of the government's concern over protecting wetlands.

Fisheries Act

Only those wetlands that support saltwater fish and anadromous (ocean-going) fish fall under federal jurisdiction and are therefore subject to the federal Fisheries Act. The Act contains several provisions to protect fish habitat, including habitat that commonly occurs in wetland areas. In the case of wetlands protection, the most important sections to note are:

- Section 35(1) which prohibits the harmful alteration, disruption, or destruction of fish habitat
- Section 36(3) which prohibits the deposit of a deleterious substance in any water frequented by fish (generally, deleterious has been interpreted to mean harmful or toxic)
- Section 37 which gives the Department of Fisheries and Oceans the power to require plans and specifications of projects that have the potential to interfere with fish or fish habitat. Where a plan and/or specification is unsatisfactory, the Minister is empowered to require modifications, or to restrict or close down the work or undertaking.

Using the courts to enforce the Fisheries Act

Where a violation of the Act has occurred or has the potential to occur, causing irreparable harm to fish habitat, a Court injunction may be requested by the Attorney General of Canada under Section 41(4) to halt

the project. This valuable procedure can be used to prevent imminent damage to or destruction of a wetland.

Where damage has already occurred, a prosecution for violating the Act may be started. In such an instance, the Department of Fisheries and Oceans provides technical information to the Department of Justice which is responsible for the prosecution. Those convicted under the Act are subject to penalties ranging from fines to imprisonment, or orders for restorative action. The largest fine every levied against a Canadian company for breach of an environmental statute resulted from a Fisheries Act prosecution. In 1993, Tioxide Co. pled guilty to dumping harmful substances into water frequented by fish. A judge of the Cour de Québec ordered the company to pay $4 million – $1 million in fines and $3 million in the form of projects to protect fish and fish habitat.

Private citizens can also initiate prosecutions under the Act, and will receive half of any fine imposed, where a conviction is obtained. In the case of private prosecutions in B.C., the provincial Crown intervenes to either take over the prosecution or stay (end) the case.

Canadian Environmental Assessment Act

This law provides for projects to be assessed in terms of their potential environmental impact before being approved. Environmental assessment laws are in force at both the provincial and federal levels. The federal law applies when a federal department or agency proposes a project, provides funding or land for a project, or exercises a regulatory duty (such as issuing a license, permit or approval) that allows a project to go ahead.

Specific reference is made to wetlands in the Act's regulations. A wetland is defined as "a swamp, marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year." Several references are also made to projects or activities that could have an impact on "water bodies" (including wetlands) and might therefore require a federal environmental assessment. If, for example, a Fisheries Act authorization is required for a project or activity that will harm fish habitat by draining or altering the water levels of a "water body," then a federal environmental assessment may be conducted.

Where the Act applies, the responsible government department or agency proceeds with an assessment of the likely environmental effects of the project. Different projects require different types of assessments:

- screening: the least detailed form of assessment, a screening entails "a systematic approach to documenting the environmental effects of a project and determining the need to eliminate or minimize or mitigate the effects, to modify the project plan or to recommend further assessment through mediation or a panel review."
- class screening: applies to an entire class of activities, such as dredging, and is designed to avoid duplication of assessments for routine activities.
- comprehensive study involves more detail and is done when a

project is likely to have a major impact on the environment, as in the case of a large energy project, a new pulp mill, or a project in a national park.

- mediation/panel review: the most intensive type of assessment, reviews are conducted independently of government. Only the Minister of Environment is empowered to order a panel review.

You can become involved in the assessment process when a proposed project – such as the construction of a major dam involving federal authorizations – has the potential to harm wetlands. Under the Act, all information and documents relating to an assessment must be made public through a Public Registry available in libraries or the local office of an environmental assessment panel, or from the headquarters for the Canadian Environmental Assessment Agency (CEAA) in Ottawa. This information is also available in electronic form and can be accessed through the West Coast Environmental Law Association's Environmental Legal Information Base (ELIB). To learn more about federal environmental assessments, pick up a copy of A Citizen's Guide to the Canadian Environmental Assessment Process, published in 1994 by the CEAA.

Other federal laws

Wetlands are home to many forms of wildlife, including birds. Some federal laws are designed to protect wildlife and therefore apply to the wetlands where certain species live. The Canadian Wildlife Act, for example, gives the federal government the power to create and administer National Wildlife Areas such as the Alaksen NWA in the Fraser Estuary. These areas are established for the research, conservation and interpretation of migrating birds and wildlife. Similarly, the Migratory Birds Convention Act permits the government to establish Migratory Bird Sanctuaries. Today there are seven Migratory Bird Sanctuaries and five National Wildlife Areas in B.C. Together they occupy .005% of the province's land base.

Along the same lines, the proposed new Oceans Act calls for the development of a national strategy for "management of estuarine coastal and marine systems in waters that form part of Canada" – including tidal wetlands – and for the preparation of integrated management plans for these areas.

OPTIONS FOR PROTECTING PUBLIC WETLANDS: PROVINCIAL LEGISLATION

The province has no specific wetlands law and, unlike the federal government, does not have a formal written wetlands policy. The legal protection that does exist is found in different laws. The provincial Water Act requires permits for activities such as filling which may alter a water course, and regulates changes made around streams. The Forest Practices Code of B.C. Act contains limitations on logging for different classes of wetlands. Residential and industrial development pose the biggest threat to urban

wetlands, yet those activities are still regulated by provincial guidelines which have no legal force.

Water Act

The Water Act is the most important of the province's laws concerning wetlands. It regulates activities likely to affect water as it flows into or out of a wetland. All freshwater in the province is owned by the provincial Crown, subject to licenses, permits, or approvals issued by the Ministry of Environment, Lands and Parks (MoELP).

The Water Act sets up a system of water rights acquired through the issuing of licenses. Rights are allocated on a "first come, first served" basis, except where water has been reserved or is subject to the existence of other rights – aboriginal water rights, for example. Where a license was first obtained under one right, this right prevails over all others.

This model of water rights legislation had advantages when it was first passed in 1909 (it has since been amended). But it's badly out of step with our current understanding of conservation requirements. First, allocation under the Act is a problem – once all water rights have been distributed to licensees, no rights remain for new users. Second, the Act does not deal adequately with the need to maintain instream flows for conservation purposes. Third, neither the Act nor its regulations deals with the problem of low-flow periods, when not enough water is entering the stream or river to satisfy all users, let alone conservation requirements. While the Act does make provision for the cancellation of water licenses, in fact cancellation is rare.

Licenses, permits and approvals

A water license allows a holder – to divert and use a specified quantity of water for a specified time; to store water; to construct works for the diversion of water; to alter or improve a stream or channel; and to construct fences, screens, or guards across streams for the purpose of conserving fish or wildlife. Licenses are issued by the Comptroller of Water Rights or the Regional Waste Manager and may be obtained by specified individuals or organizations, including landowners and municipalities.

Today one of MoELP's priorities, as the provincial water licensing authority, is the protection of fish and habitat. Under the Act, it can either refuse to issue a license or attach conditions to its issuance – by including a "fish clause" in the license, for example, that outlines protection requirements.

A permit is required for flooding Crown land, or for the construction, maintenance or operation of works on Crown land, as authorized by a license or approval.

An approval instead of a license may be issued under some circumstances. An approval is normally given for the short-term use of water (under 12 months) in activities like placer mining and work camps. Approvals are also issued for "changes in and about a stream," as cited in Section 7 of the Act:

". ..includes any modification to the nature of the stream, including the land, vegetation, natural environment, or flow of water within a stream or any activity or construction within the stream channel that has or may have an impact on the stream."

The Comptroller of Water Rights or Regional Water Manager (or an engineer, in the case of changes to streams) can place conditions on an approval to ensure that the impact on water quality, downstream flooding, downstream licensees, and local habitat and ecosystems is kept to a minimum.

Recent regulations for the Act further define the standards for protection of water quality and habitat regarding changes in and about a stream. Since it is an offence not to comply with any term or condition of a license, approval, or the regulations, these additional standards should ensure greater protection for wetlands. Penalties for committing an offence under the Act include fines up to a maximum of $200,000 for each day the violation continues, or imprisonment for up to 12 months.

If you suspect that an activity in or about a stream has the potential to harm a wetland, try to find out if the Water Act applies. Has a license or permit been issued? If so, what are the terms? Have the terms of the license or approval been breached? Make your findings and concerns known to the MoELP Water Management Branch or a MoELP habitat officer in your region.

Rights of appeal under the Act

If you disagree with a decision made by the Water Management Branch, you may be able to appeal it. In some circumstances, appeals are taken to B.C.'s Environmental Appeal Board (EAB).

Only certain narrow classes of people have the right to appeal under Section 38 of the Act. Riparian owners, licensees and applicants for a license are allowed to object to applications for licenses. The Act does not specify who may appeal, but refers only to a "person" (in contrast to the provisions of several other acts, including the Pesticide Control Act, which allow "any interested person" to appeal an Order).

It is also possible for you to pursue legal action through the courts. However, the courts in B.C. have not been too sympathetic to wetlands protection to date. Deficiencies in current legal protection for wetlands are evident in such cases as RE British Columbia Wildlife Federation and Nu-West Development Corp. In 1976, the Wildlife Federation brought judicial review of the Water Comptroller's decision to fill in a natural slough. The Court held that the Comptroller's decision was a purely administrative function involving no natural justice duties and that the Applicant Wildlife Federation had no affected license or property, and therefore no right to intervene in the decision.

Environmental Management Act

Under this Act, the Minister of Environment, Lands and Parks has broad powers, including the power to prepare environmental management plans for specific areas of the province. Section 2 states that management plans may incorporate measures concerning:

- flood control
- drainage
- soil conservation
- water resource management
- fisheries and aquatic life management
- wildlife management
- waste management
- air management

Management plans made under Section 2 have legal force only when the Lieutenant Governor in Council, at the request of the Minister, has requested the plan be made and has then accepted or modified it.

The Cowichan Estuary Plan is a good example of how an environmental management plan can be used to protect wetlands. The Plan was approved by Order in Council. Consequently, no license, permit or power can now be issued or exercised in the Estuary without the written approval of the Minister of Environment, Lands and Parks and unless the issuance or exercise "will have no detrimental environmental impact . . . and is in conformity with the plan."

Environmental Assessment Act (B.C.)

The Environmental Assessment Act (B.C.) came into force in 1995. This new legislation consolidates the fragmented approach to environmental impact assessment which previously existed in the province.

The Act applies to assessments of major project proposals in industrial mining, waste, transportation, energy, water, fin-fish aquaculture/food processing, and tourism. It also allows for meaningful public participation at several stages in the assessment and review process. One of its innovative features is a Project Registry that provides notice and information to the public throughout the review process. Still to be established, the Registry will contain a wealth of important information, including a list of all projects currently under review, an index of records filed at the Registry for each reviewable project, and all important documents and decisions produced during the assessment process.

The Act offers a fair and orderly transition to the new environmental assessment process for projects now being reviewed under existing review procedures. Each project will be placed in the new process at a point that gives credit for progress already achieved in the assessment. Section 3 of the Act allows regulations to be made prescribing what constitutes a reviewable project. Section 4 allows the Minister of Environment, Lands

PUBLIC INPUT

The new Environmental Assessment Act provides for public input at a number of key stages in the environmental assessment and review process:

- when an application is received by the environmental assessment office
- when draft project report specifications are being prepared
- when the project report is filed at the environmental assessment office
- when the draft terms of reference for a public hearing are being prepared
- during a public hearing, if one is held

and Parks, by Order, to designate a project as reviewable when it doesn't already fall within the regulations.

Although neither biodiversity nor wetland protection is explicitly mentioned in the Act, reference will be made to it, of necessity, in the course of examining the environmental impacts of a proposed project on a particular area. The list of reviewable projects as set by regulation is extensive, and this new Act should lead to greater protection of wetlands in British Columbia. A proposal to build a new mine, for example, will now be subject to assessment under the Act, and may result in relocation of the development if the assessment reveals adverse environmental effects.

Wildlife Act

This Act offers some legal protection for wildlife species that may reside in a wetland. Under the Act, the Minister of Environment, Lands and Parks has the power to acquire and manage land for the purpose of accessing, protecting and managing wildlife. The Minister can also designate land managed by the Ministry as a Wildlife Management Area (WMA). A WMA is not a park or recreation area, and any rights to the land granted before the creation of the WMA are not affected by its designation. Currently, B.C. has 12 WMAs, representing 0.012% of the province's total area.

These powers have been used to protect wildlife residing in wetlands, primarily migratory birds. The South Arm Marshes WMA, for example, protects several small islands at the mouth of the Fraser Estuary which serve as valuable habitat for the vast numbers of migratory birds that stop here each spring and fall.

Wildlife management areas are protected from any use that contravenes the Wildlife Act. Permits may be obtained for projects compatible with the values being protected in a management plan. Where no plan exists, a permit must still be compatible with the land values of the protected area. MoELP has an integrated-use philosophy with respect to WMAs. Permits for such activities as forestry and mining are issued where the activity does not affect wildlife species being maintained by the Ministry.

Section 3 of the Act gives the Ministry the powers to:

(a) acquire and administer land, improvements on land and timber, timber rights and other rights on private land, and

(b) enter into and carry out an agreement with a person, association or other body

(c) for the purposes of management or protection of wildlife."

The Ministry buys land under this section, often joining with other major agencies like Ducks Unlimited Canada, the Canadian Wildlife Service and even a municipality to make the purchase. This is what happened in 1993 when the province contributed over $1.6 million towards the purchase of critical wildlife and fish habitat along a 17 km stretch of ocean foreshore on the east coast of Vancouver Island. The Parksville-Qualicum Beach

Wildlife Management Area was purchased by the multi-agency Pacific Estuary Conservation program, made up of MoELP's Habitat Conservation Fund, The Nature Trust of B.C., Wildlife Habitat Canada, Ducks Unlimited Canada, the Department of Fisheries and Oceans, and the Canadian Wildlife Service.

Wetlands are also acquired by the province through the Habitat Conservation Fund (HCF). The HCF is funded primarily through surcharges on angling, hunting, trapping and guiding licenses and through donations and bequests. Over 1200 projects across B.C. have been funded by the HCF since 1981 at a cost of approximately $21 million. HCF funds also go to wetlands enhancement projects – as in the case of the Delkatla Wildlife Sanctuary in Masset, Haida Gwaii. The Sanctuary provides important migratory habitat for sandhill cranes, dusky Canada geese, white-fronted geese, and Tundra swans as well as wintering habitat for trumpeter swans, American wigeons, mallards and northern pintails. HCF funds were used to restore tidal flows to Delkatla Inlet with replacement of a 33 m. section of causeway by a bridge that allowed the natural tide flow to return to the mud flats. The causeway had blocked the tidal flow, and the marsh was becoming freshwater. This project, which cost approximately $1 million, was funded by the federal and provincial governments, the village of Masset, the community, and the non-profit organization Ducks Unlimited Canada.

Non-profit organizations often contribute to fund-raising efforts to preserve wetlands. Another example involving HCF and a non-profit organization is the acquisition of a critical salt marsh on Pender Island. The Pender Island Conservancy Association raised $250,000 to purchase the Medicine Beach wetlands which contain many rare and unusual plants, and have long been used by the Coast Salish people.

Section 5 of the Act provides for the establishment of critical wildlife areas to protect endangered species. A "critical wildlife area" designation provides almost complete protection for an area. This means that the area can tolerate almost no disturbance, and land use is generally restricted to activities centering on preservation of the species threatened. Currently, Green Mountain on Vancouver Island is the only critical wildlife area in B.C., established to protect the Vancouver Island marmot.

Waste Management Act

The Waste Management Act is the central anti-pollution law in the province. It becomes important for wetlands protection when pollution enters a wetland site, either with or without an authorization under the Act. By familiarizing yourself with the Act's requirements, you can determine if the law is being followed.

The Act contains a general prohibition against introducing waste into the environment, subject to a number of exceptions for permitted activities. Section 8, for example, allows discharges to air, water or land under permit. Permits or approvals can be issued by a Manager of the Ministry of Environment, Lands and Parks. These authorizations may also contain

requirements for environmental protection – such as providing security to repair environmental damage, or monitoring to ensure that pollution does not exceed certain limits.

Automatic offences occur when certain kinds of waste are introduced into the environment. Under s.6 of the Act, for example, it's an automatic offence to litter; under s.7, the discharge waste from a recreational vehicle is also considered an automatic offence.

Section 16 sets out when the Environment Minister may require, revise and/or approve a municipal waste management plan. Public consultation regarding the plan's development, amendment and final content is required, as set out in Section 16.2, before a plan can be approved. Once approved, any permits or approvals issued must not conflict with the plan. By contacting the waste management department of the municipality or regional district in which your wetland is located you can obtain a copy of the local waste management plan.

MoELP also has the power to suspend or cancel permits or approvals. Section 23 contains a long list of when this power may be exercised. Section 26 of the Act provides for appeals of MoELP decisions, and s.26, s.27 and s.28 detail the appeal procedures. Finally, s. 34 sets out the offences and penalties for not complying with a permit or approval.

Other parts of the Act may also be relevant to wetlands protection, including requirements to immediately report the spill or escape of polluting substances. The Act gives environmental protection officers wide enforcement powers to enter and investigate projects that are causing, or are capable of causing, pollution or waste, or are being used for the storage, handling, treatment, destruction, or disposal of waste.

Applicants must fulfill many requirements when they make an initial application for a permit or approval, or apply for a significant amendment to either kind of authorization. As specified in the Act's regulations, notice of the application must be given to municipalities, regional districts, chairpersons of waste management committees, residents and owners of adjacent property or others in a wider area (as required by the MoELP Manager), and anyone who may have submitted written notification of their concerns regarding the application. Applicants may also be required to post a notice of application on the site, or publish the notice in the B.C. Gazette or a newspaper.

If you're not satisfied with a MoELP decision regarding a permit, you can file an appeal with the Environmental Appeal Board. Any person affected by a decision has the right to appeal.

Forest Practices Code of B.C. Act

The area logged now in Canada is twice what it was in 1960. While the impact of logging on wetland health can be substantial, wetlands may be protected by the retention of adequate "green strips" around their perimeters. An important legal tool which provides this protection is the new Forest Practices Code of British Columbia Act which includes wetland and riparian setbacks. The area of land along the edge of a wetland or other

SOME IMPORTANT DEFINITIONS

Waste under the Waste Management Act includes air contaminants, litter, effluent, refuse, biomedical waste and special waste (a toxic substance designated by Cabinet). Effluent is broadly defined.

Pollution, defined in Section 1 of the Act, means the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment.

The definition of environment includes water, and "water includes ground water." Thus, the provisions in the Act may apply where waste or pollution is harming a wetland.

defined water body that must be free from logging varies according to the wetland or stream class. The Code establishes Riparian Management Areas (RMAs) which include both a reserve zone and a management zone. Timber harvesting is prohibited in reserve zones except in special circumstances, with the approval of MoELP. The Operational Planning Regulations, Part 10, made pursuant to the Act, contain the water body classifications and setback restrictions for RMAs.

Other restrictions in RMAs:

- road construction is generally prohibited
- wildlife trees must be retained to the greatest possible extent
- an approved Range Use Plan is required for any livestock use in the area

The current setbacks apply only to areas under the jurisdiction of the Code. Some have argued that the Forest Practices Code should also be applied to private forest land and that similar wetland setbacks should be required for all wetlands in B.C. Crucial wetland and other riparian habitat should be protected not only from logging but from residential and industrial and other urban development. The province is currently exploring the possibility of a provincial riparian law that would apply to urban areas, codifying the existing *Land Development Guidelines for the Protection of Aquatic Habitat* prepared by the Department of Fisheries and Oceans.

A series of guidebooks have been produced by the Ministry of Forests for use by the forest industry and MoF regulators in applying the Code and its regulations. The *Riparian Management Area Guidebook* describes how logging should be done in riparian management areas.

Park Act and other protected areas

One way to ensure long-term protection of a wetland is to have it designated as a park. If you're interested in protecting your wetland site, check to establish if it has been recommended for protection as a park, ecological reserve, or other protected area. In recent years, B.C. has embarked on an ambitious protected-areas strategy (PAS) with the goal of doubling the province's protected-areas space to 12% of its total land mass by 2001. Regional protected area teams (RPATS) have been working to identify and investigate candidate protected areas. In the Lower Mainland, for example, a group of government agencies and non-government organizations recently recommended a number of wetlands for protection. For more information on PAS, contact the Parks Branch of MoELP, local conservation groups, or the Land for Nature Initiative of the Federation of B.C. Naturalists.

OBJECTIVES FOR RMAS

According to the *Riparian Management Area Guidebook*, the objectives for riparian management areas are:

1. to minimize or prevent impacts of forest and range uses on stream channel dynamics, aquatic ecosystems, and water quality of all streams, lakes and wetlands
2. to minimize or prevent impacts of forest and range uses on the diversity, productivity of wildlife, and sustainability of wildlife habitat and vegetation adjacent to streams, lakes and wetlands with reserve zones, or where high wildlife values are present

Growth Strategies Act

The Growth Strategies Act became law in 1995 and resulted in the amendment of various other statutes, including the Municipal Act and the Agricultural Land Commission Act.

This Act is an attempt to deal with growth management in the province. It gives regional districts the authority to adopt regional growth strategies and provides mechanisms to ensure coordination between municipalities and regional districts on issues that cross municipal boundaries.

As defined under the Act, the purpose of a regional growth strategy is "to promote settlement that is socially, economically and environmentally healthy and that makes sufficient use of public facilities and services, land and other resources." A strategy should include a number of objectives as set out in the Act, including protection of environmentally sensitive areas and ground and surface water. The provincial Cabinet may designate an area where a regional growth strategy must be developed. But a regional district is otherwise free to decide whether or not it wants to adopt such a strategy.

This statute is considerably weaker than similar legislation in Washington State which has been used extensively by environmental advocates to protect wetlands.

The Washington Growth Management Act of 1990, for example, requires that most counties and cities produce a comprehensive plan addressing land use transportation, public facilities, utilities, housing, and other issues. Under this Act, the first step is to designate critical areas and protect them with a critical areas ordinance. This process is intended to protect Washington's most environmentally sensitive areas. Next, each jurisdiction must adopt a growth policy and a comprehensive plan, then complete development regulations. Critical areas include wetlands, steep slopes, frequently flooded areas, aquifer recharge areas, and fish and wildlife habitat conservation areas. The Act allows local governments to decide how they wish to protect wetlands and other critical areas. Since the specifics of "how to protect" are left up to the local government, each jurisdiction has developed its own ordinances.

Since we face such dramatic urban growth in British Columbia, a strengthened Growth Strategies Act, requiring municipalities to prepare strategies to deal with growth and to identify environmentally sensitive or critical areas to protect, would help to provide stronger protection for wetlands.

CREATING PROTECTED AREAS

Several provincial statutes provide for the creation of protected areas, including:

- Park Act
- Regional Park Act
- Ecological Reserve Act
- Heritage Conservation Act
- Islands Trust Act

OPTIONS FOR PROTECTING PUBLIC WETLANDS: MUNICIPAL LEGISLATION

Municipal Act

Despite some limits on municipalities' authority to enact bylaws specifically for environmental protection, municipal governments have a large role to play in wetlands protection because they control land use and development. Many wetlands protection decisions are now made at the local level. A zoning change can open up a wetland area for development, or declare it an environmentally sensitive area and restrict development.

The Municipal Act provides the province's 179 incorporated municipalities with the ability to protect the environment by – protecting environmentally sensitive areas, regulating tree cutting, flood prevention and soil removal, designating land as parkland, and other planning powers. The Vancouver Charter gives the City of Vancouver powers similar to those set out in the Act as well as other responsibilities, including sewage works and waste removal, parkland designation, and heritage conservation.

Bylaws

Municipalities have the power to make bylaws or introduce policies on many wetlands-related concerns, including:

- zoning
- stream stewardship
- environmental bylaws
- leave area identification and protection
- leave area acquisition and management
- storm water management
- erosion and sediment control
- instream work
- fish passage and culverts
- application reviews and inspections
- monitoring and enforcement training and information needs

In recent years, interest in municipal environmental protection powers has increased. One pioneer municipality is the District of North Vancouver which adopted an Environmental Protection and Preservation Bylaw in 1990. This bylaw includes the Land Development Guidelines discussed below which provide the municipality with a powerful tool to ensure that developers do not damage streams and wetlands during construction.

Land Development Guidelines

The *Land Development Guidelines for Protection of Aquatic Habitat* were jointly developed and published in 1992 by the Habitat Management Division of the Department of Fisheries and Oceans and MoELP's Integrated Management Branch. They focus on development in or beside waters that contain fish or fish habitat.

The Guidelines apply mainly to salmon, trout and char, but are applicable to all fish species affected by development. Out-of-stream habitat features – such as wetlands – are included. The goal of the Guidelines is to "ensure that the quantity and quality of fish habitat are preserved and maintained at the productive level that existed prior to land development activities." Land development projects are therefore subject to the following guideline objectives:

- leave strip protection and provision
- erosion and sediment control and site development practice
- storm water management
- instream work controls
- fish passage and culverts maintenance
- prevention of deleterious substance discharges

While the Guidelines have no legal force (unless they're incorporated directly into a bylaw), they may be of value in prosecutions under the Fisheries Act – in determining if a breach in the standard of care required of developers has occurred. They may also provide information to assist the Minister of Fisheries and Oceans in deciding if development of an area conflicts with the Department's policy of "no net loss" of wetlands.

Some municipalities in the province – North Vancouver, as already mentioned – have incorporated the Guidelines into their bylaws.

Model bylaws

The surge of interest in municipal environmental protection powers has prompted many municipalities to consider adopting more comprehensive bylaws for that purpose. A new publication from the federal and provincial governments illustrates how the land-use regulation powers available to local governments can be used as part of the stewardship implementation strategy. Entitled *A Guide to Stewardship Bylaws*, the document provides sample wording and detailed information for those directly involved in local government bylaw drafting and in the land management process. It also provides sample wording for general clauses enabling legislation, general definitions and references, tree management bylaws, soil removal and deposition bylaws, watercourse protection bylaws, zoning bylaws, development permits, and subdivision and servicing standards bylaws.

Official Community Plans and zoning

An Official Community Plan or OCP is defined in Section 945 of the Municipal Act as a "general statement of the broad objectives and policies of the local government respecting the form and character of existing and proposed land use and service requirements in the area covered by the plan." It sets the broad general policy for development in a community, and all bylaws enacted or works undertaken must be consistent with the OCP.

An Official Community Plan can include goals and policies for protecting local ecosystems such as Density Bonus Zones, Development Permit Areas and Comprehensive Development Areas. OCPs are periodically revised and amended by the local government. Several opportunities exist for public involvement in the preparation and amendment of the plans. Zoning regulates the development of property in a city, town or rural area. The zones are usually set out in both the OCP (if one exists) and a zoning bylaw. Zoning bylaws must be consistent with the OCP.

Environmentally sensitive areas

The Municipal Act allows municipal governments to protect environmentally sensitive areas through their OCPs. Many municipalities have already mapped these areas, or are starting the mapping process. Where a municipality designates an environmentally sensitive area in its official community plan, Section 976 of the Act states that the land cannot be subdivided, buildings cannot be added to, constructed or altered, and land within the area cannot be altered, unless a development permit is first obtained.

Your municipal office can give you full details on ecologically sensitive areas and development permits, and advise you on what actions the municipality has taken, to date, to protect wetlands and other habitat. Depending on your location, you may also want to consult *Protection of Aquatic and Riparian Habitat by Local Governments – An Inventory of Measures Adopted in the Lower Fraser Valley*, published by the Department of Fisheries and Oceans in 1995.

OPTIONS FOR PROTECTING PRIVATELY OWNED WETLANDS

Many wetlands, especially in the rapidly expanding urban areas of the province, are privately owned. Governments are unable to purchase all of these ecologically valuable lands because of rising land prices and limited funds. To secure lasting protection for these areas, another set of legal tools, in addition to the statutes discussed above, may be applicable.

Many different legal tools are available to protect privately owned land, as discussed in detail in a series of recent publications available at cost from the West Coast Environmental Law Research Foundation (*Here Today, Here Tomorrow, Legal Tools for the Voluntary Protection of Private Land in British Columbia* by barbara findlay and Ann Hillyer; *Using Conservation Covenants to Preserve Private Land in British Columbia* by David Loukidelis;

ZONES AND AREAS

"Development Permit Areas may only be designated in an Official Community Plan under the authority of the Municipal Act for special purposes, including the "protection of the natural environment" (s. 945 and s. 976). Development Permits may require actions, e.g. the dedication or preservation of natural watercourses.

Density bonus areas allow the developer to increase density on all or part of the site in exchange for provision of an amenity. Comprehensive Development Areas enable local governments to negotiate complex multi-use sites and to develop customized zoning regulations. These two tools provide incentives for developers to provide amenities, such as protecting watercourses, but action on the incentives by the developer is voluntary.

The three tools – development permit, density bonus and comprehensive development – are part of a menu of tools provided under the Municipal Act. The tools may be used together on the same area, if that meets planning objectives."

from: *Stream Stewardship, A Guide for Planners and Developers*, 1994

and *Leaving a Living Legacy – The Use of Conservation Covenants in B.C.* by William J. Andrews and David Loukidelis).

Some of these tools are well known – for example, one of the most common ways to protect private land is to transfer title to the land from one owner to another party who wants to protect it. Other legal tools are less common, but can also be used in certain situations. Occupation and use of the land, for example, can be transferred to another party, without transferring title, by means of a lease or management agreement.

Once an owner decides what part of the land they want to protect, they can select a legal tool that's suitable for their purposes. In some cases, more than one tool can be used. An owner may decide, for example, that they don't want their land logged, or buildings constructed within a certain distance from a pond. In such a case, one legal solution might be to bind the land with a common law restrictive covenant drawn in favour of a neighbour's property together with a Section 215 covenant under the Land Title Act, drawn in favour of the Crown, both containing the same restrictions on land use.

Because property law was not designed with the conservation of land in mind, legal tools sometimes have serious deficiencies when they're applied in a conservation context, as discussed in the publications mentioned above. One of the best new tools for protecting private land is a conservation covenant.

What is a conservation covenant?

A conservation covenant is an agreement between a landowner and another party – a government body, conservation organization, or adjacent landowner – that's designed to conserve land, or a particular aspect or feature of the land. The agreement is registered against title to the affected land, and the burden of the covenant runs with title to the land and therefore binds all future owners. B.C.'s Land Titles Act has recently been amended to allow such conservation covenants to be granted to qualified conservation organizations and government bodies as a means of protecting private land.

Conservation covenants are voluntary agreements. They are used to protect private land where the owner has willingly granted the covenant on terms that he or she finds acceptable. An owner may be motivated to grant the covenant by concern for preserving the land, by payment for the covenant, and/or by receiving other benefits such as a reduction in real property tax.

As it now stands, s. 215 of the Land Titles Act offers parties great flexibility to fashion a covenant that's suitable for their purposes. A covenant under s. 215 may include any one or more of the following:

- provisions in respect of the use of the land, or the use of a building that exists on the land, or that is to be built on the land
- provisions stipulating that the land is not to be built on at all, or built on only in accordance with the covenant

- provisions regarding subdivision of the land, including a prohibition on subdivision, or provisions regulating the manner of subdivision
- provisions stipulating that parcels of land identified in the covenant, and registered under more than one indefeasible title, are not to be sold or otherwise transferred separately

Under s. 215[1.3], a conservation covenant may also include provisions:

> *"… that land or a specified amenity in relation to it be protected, preserved, conserved, maintained, enhanced, restored or kept in its natural or existing state in accordance with the covenant and to the extent provided in the covenant."*

The word "amenity" is defined in s. 215 as including:

> *". . .any natural, historical, heritage, cultural, scientific, architectural, environmental, wildlife or plantlife value relating to the land that is subject to the covenant."*

Uses of conservation covenants

Conservation covenants held by conservation organizations are useful in a wide variety of situations:

- protecting ecologically valuable features of the land
- providing a buffer zone adjoining a park or other protected area
- requiring that agricultural land be farmed without damage to important waterfowl habitat
- limiting private forest land to ecologically sustainable forestry
- requiring specific management or development practices that protect a variety of values relating to the land, including natural, historical, heritage, cultural, scientific, architectural, environmental, wildlife, or plant values
- providing a buffer zone to protect riparian habitat from logging on private land
- protecting a rails-to-trails or other linear conservation project

Like any law or legal tool, a conservation covenant has limitations. It may be difficult to enforce. It has the potential to add to a landowner's risk of liability if members of a conservation organization or the public are injured while on the land for purposes allowed by the covenant. The proposed covenant holder must invest substantial time and energy to effectively monitor and enforce the covenant. And landowners must obtain legal and tax advice, at personal expense, before entering into a covenant. Nonetheless, conservation covenants are a valuable tool for wetland protection in B.C., and their potential will be more fully realized once landowners and conservation groups have more experience in using them.

A FINAL WORD

No single law or policy exists in the province which will grant lasting protection for a wetland. Instead, as this section demonstrates, there are a variety of laws from all levels of government which may play a role in the protection of a particular wetland. It is important to gather all possible information about the wetland you want to protect before contacting government officials for assistance.

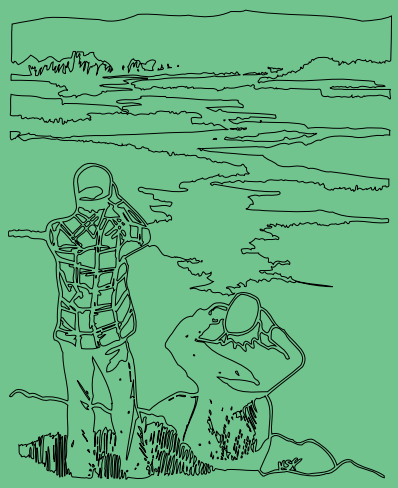
The Wetlandkeeper modules that follow can help you identify the important features of your wetland – its hydrology and other physical features, and the plants and wildlife that depend on it. Convincing government decision makers and other members of the public that the wetland is ecologically valuable will be an important part of your quest to protect the site.

You will also want to establish who owns the land and how it's zoned, if it's in an urban area. This information can help you narrow your search for the laws that may be applicable to your case.

At some point, it may also be in your best interest to consult a lawyer. This is essential if you are trying to protect privately owned land. It may also be desirable for wetlands owned by the Crown. A lawyer can provide assistance with legal arguments, legal research, government policies, and precedents based on other cases involving wetlands. Organizations providing free legal advice on environmental law issues include the West Coast Environmental Law Association and the Sierra Legal Defence Fund, both located in Vancouver.

Section Five
Module 1.3

Developing and Implementing a Public Education Program



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

FORMS REQUIRED FOR THIS ACTIVITY:

program plan*

program outline*

*provided at the back of the module

Welcome to the Wetlandkeepers Program

You are about to embark on a fascinating investigation – wetlands play an essential and complex role in the wellbeing of our environment. These training modules have been developed by Environment Canada to encourage public participation in monitoring wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, each module provides information on a specific wetland monitoring activity. Many volunteer groups, schools and individuals have already become wetlandkeepers and invite you to join in the conservation of our precious wetland resources.

Acknowledgements

The information for this module was compiled by Carolyn and Andrew MacDonald of Many Rivers Enterprises, an environmental education consultancy in Victoria, British Columbia. Illustrations and other visual materials have been provided courtesy of the B.C. Ministry of Environment, Lands and Parks (*Water Stewardship*) and University of Washington Press (*Vascular Plants of the Pacific Northwest* by C.L. Hitchcock, A. Cronquist, M. Ownbey and J.W. Thompson, 1969).

Project activity and purpose

Public education programs at a wetland site play an important role in garnering public support for wetland conservation. Being organized, with a solid program and trained volunteers in place, is one of the keys to program success. This module provides information on how to develop and mount a successful program, beginning with the formation of a community-based steering committee. Also discussed are program design, including a section on knowing your audience, promoting your program once it's under way, maintaining a motivated volunteer force, and site preparation.

BACKGROUND

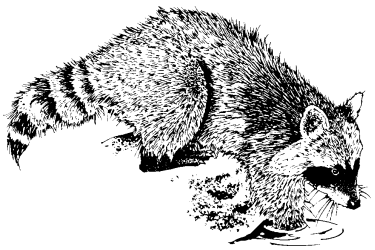
A good wetlands education program provides more than factual information to participants. It also gives them a first-hand introduction to wetland functions and characteristics, allowing them to experience the wetland for themselves. This educational process is called *interpretation* (not to be confused with language interpretation), and those who develop and *facilitate* or deliver the programs are often referred to as *interpreters.*

In Canada, professional interpreters formed their own organization in 1975. Now known as Interpretation Canada, this organization has several regional groups across the country, including one in British Columbia.

Natural history interpretation programs are the key to enhancing public awareness of the need for wetland conservation. Today many wetland sites in B.C. are threatened by pollution, housing and development. Without public interest and intervention, they might well disappear. Interpretive programs draw the public in, introduce them to the critical functions wetlands perform, and encourage them to express their concerns to government planning authorities and politicians. Without this support, your conservation efforts have little chance of success.

Interpretation programs should be as varied and interesting as the people they're trying to attract. School programs, community programs, workshops, slide shows and puppet shows, volunteer restoration projects, special events – all are commonly used by interpreters in education programs. The program plan presented in this module is easy to initiate and will give you a solid base for broadening your program efforts as you gain experience and a better understanding of what works best for your audience.

raccoon
Procyon lotor



Planning and research

The size of your group, your immediate and long-term goals, and the nature of your site are bound to influence the type of program you develop, but so is public reaction. From the beginning, try to get the broader community involved in your efforts. A good first step is to establish a community-based steering committee.

THREE DEFINITIONS OF "INTERPRETATION"

"Interpretation: A communication process designed to reveal meanings and relationships of our cultural and natural heritage to the public through first-hand involvement with the object, artifact and landscape or site."

Bob Peart,
Executive Committee member, 1976
Association of Canadian Interpreters

"An interpretive program gives meaning to land by providing interesting, instructive and enjoyable experiences."

Planning a Nature Centre
National Audubon Society

"Interpretation's primary purpose is provocation, not instruction."

Interpreting our Heritage
Freeman Tilden

STEERING COMMITTEE

A steering committee has many benefits. Members bring specialized knowledge and experience to the group. Some may already be involved in your wetlands site – as a member of the local city council or an employee of the provincial or federal ministry of environment. Others may be active in conservation groups like a natural history club, or represent special interests like the local First Nations community. Still others may work with youth groups interested in volunteering. Outside experts – an instructor in wetland ecology at the local college, for example – are also suitable candidates for membership.

Committees enable work to be shared by a larger number of people and provide in-house expertise during program development. They also increase community support for the project, attract more volunteers – and serve as a source for even more contacts.

Once you've identified and approached steering committee members, structure the committee by naming members to various positions, including chair, vice-chair, secretary, treasurer, and subcommittee chairs for media/promotion, training, program development and site preparation.

At its first meeting, the committee should consider the possibility of forming a non-profit society. This legitimizes your project and opens up funding opportunities. Members should also spend time developing a *mission statement* that clarifies the committee's purposes and goals. Once these basics have been settled, you can review the requirements for developing an educational program. If your wetland is privately owned and the landowner is willing to cooperate, what options do you have for protecting and managing the site? What options do you have if it's publicly owned? Do you need a permit to run an on-site program? Is the site accessible and what facilities does it already have? What facilities does it need? What will development or upgrading cost? (For more information on your legal options, review Section Four in the Handbook on "Laws and Rights Regarding Wetlands in B.C.")

CANDIDATES FOR A STEERING COMMITTEE

- environmental educator or teacher
- natural history interpreter
- government employee with a natural resource ministry (Environment, Forestry, Fisheries and Oceans, etc.)
- member of a conservation organization (Nature Conservancy, Audubon Society, local watershed committee, etc.)
- representative of the local business community
- representative of a local professional group (lawyer, accountant, etc.)
- youth leader (guides, scouts, junior forest wardens, etc.)
- member of local First Nations community
- instructor or professor of wetlands or related courses at local college or university

MAKING A PLAN

Start program planning by listing your goals and objectives. Why do you want to mount this program? How do you plan to get your ideas across?

A goal in this context might be defined as what you want to achieve. Perhaps you have only one or two goals – "to create an awareness and understanding of wetland ecosystems and conservation," or "to involve the local public in the conservation of our wetlands site." Perhaps you have several goals in mind. Whatever the case, always list objectives for each goal you identify.

An objective is how you plan to reach your goal. Objectives should be measurable. That is, you should be able to measure changes in the behaviors, skills and attitudes of your participants once they've completed your program. Take this objective, for example – "By leading public interpretive walks, we will create an awareness of the destruction of habitat caused by free-running dogs and consequently see a reduction in the numbers of these incidents." Or this objective – "Community members who attend our public workshops will know how to get involved in the conservation of our wetland site."

Once your goals and objectives are in place, think about what your program is going to consist of and who you plan to target. You can begin this process by investigating other programs, including school programs, already available in your area. What programs are still needed, and can yours meet some of these needs? Is there a specific "market" for your program – a special interest group, for example, with a particular interest in your site?

Give some thought to who will lead your program and to interpretive opportunities on the wetland. How many interpreters will you require? Do you already have people in place? If not, how do you plan to find them, and what arrangements can you make for training? Are there any restrictions on public access to the site currently? What size group would best be accommodated in view of site size and conditions? Will increased public access have an impact on ecologically sensitive areas and trails? Is signage already in place?

All of this information will affect the size of your program and how quickly you institute it. So will your budget. Do you have any money at the present time? Where did it come from and can you rely on the same sources in future? Perhaps you should consider fundraising – fundraising events give you a chance both to make dollars and to promote public awareness and interest in your site. Other funding opportunities also exist through government, financial institutions, private companies, and many foundations and societies.

MISSION STATEMENT

John Veverka, in his book *Interpretive Master Planning,* suggests that your mission statement for a steering committee include:

- who you are
- what you do
- why you do it

Now think about when you can initiate your program and start setting realistic deadlines. How much of your research is already done and when can you expect it to be completed? How quickly can your subcommittee on program development put a program – or program series – together? How long will it take to prepare the site? When should site promotion begin? Obviously, your answers are going to be influenced by the size and experience of your volunteer workforce – and by such other factors as seasonal access to your site. Late spring, summer and early fall are usually the best times to visit a wetland.

PRINCIPLES OF INTERPRETATION

(i) Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile.

(ii) Information, as such, is not interpretation. Interpretation is revelation based upon information. But they are entirely different things. However, all interpretation includes information.

(iii) Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical, or architectural. Any art is in some degree teachable.

(iv) The chief aim of interpretation is not instruction, but provocation.

(v) Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase.

(vi) Interpretation addressed to children (say, up to the age of twelve) should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best, it requires a separate program.

Interpreting our Heritage
Freeman Tilden

Indian plum/osoberry
Osmaronia cerasiformis

Program design

By now you have an inventory of your wetland and have collected some resources. You may even have spoken to a few wetlands experts. Your next step – the first in the design process – is to choose a general wetlands topic and do some preliminary research, then examine the themes that emerge from your work. Themes are specific topics. They're easier to deal with when you have limited time and space, and are addressing a variety of people.

CHOOSING A THEME

Let's say, for the sake of discussion, that you research wetland insects and decide on the theme "wetland mating." Just imagine the props you could make – and the opportunities to inject humour into your presentation! This theme also allows you to deliver a clear message – that it's important to conserve a wetland for insects to mate in because they serve as food for other wetland wildlife.

Strong themes are essential to your program. They allow you to send a clear message to your audience – and, if the message is clear, your audience will clearly receive it. They also serve as a guide, helping you decide what information to include and how to present it. Before deciding on a theme, be sure that your audience can relate to it. And ask yourself if you're personally interested in the subject matter – you're not going to give your best effort otherwise.

Now write your themes in a sentence or short paragraph and use these descriptions to put together a program plan, following the format of our sample Program Plan and Outline Forms. Keep your themes simple – too many messages will only confuse participants. Include the program goals and objectives you've already developed and the audience(s) you plan to address. Also describe how you plan to present the program, including brief mention of the educational techniques you intend to incorporate, the location and handouts. These documents can be a useful training aid for new interpreters, particularly if you amend them regularly to reflect program changes.

INTERPRETIVE PROGRAMS AND TECHNIQUES

- slideshows
- demonstrations
- workshops
- guided walks
- exhibits
- special field trips (school programs)
- site projects
- special events
- prop talks
- campfire programs
- dramatic skits
- site roving
- characterization
- storytelling
- puppetry
- humour
- games
- films/ video
- role playing
- touch tables
- art
- guided imagery
- live animals
- teachable moments

These are just a few examples of effective educational techniques. We all have our own ways of learning. By using a variety of techniques you reach a broader audience.

Program Plan

Interpreter: Site:

Location(s) on site: Time of day:

Season:

Program title:

Theme of program:

Anticipated Audience (#, age, interests...):

Goals / objectives of program:

Materials needed:

AUDIENCE

Know the audience you intend to address in your program. The audience has to be able to relate to the program if you're going to get your message across. Ideally, you should be aware of audience age, interests, knowledge, experience, abilities, and cultural background. This information is easy enough to obtain if your program is for school groups, a special workshop, or a particular organization. But if you're running an open program for the general public, you might consider specifying audience in promotional materials – e.g. "children's program," "for families," "advanced birding skills," etc. – to ensure that it attracts your target group.

PROGRAM OUTLINE

The outline is your program "storyline." Like a story, your program should have a theme and certain basic elements, including an introduction, a body, and a conclusion. These elements give your program structure and allow you to work out presentation details. Develop your outline in writing, in a format like our sample Program Outline Form.

(i) Introduction – As its title suggests, the introduction gives you a chance to introduce yourself, your organization, and the wetland. It also allows you to set the tone for the rest of the program. Here are some suggestions for what you might include:

- warm-up activity – a physical or focussing exercise to awaken the audience's senses and make them more aware of their surroundings or, literally, to warm them up if they've been waiting in the cold
- dramatic or entertaining beginning with storytelling, puppetry, music, or simple humour – to capture audience interest and enthusiasm and build a sense of anticipation
- your message – the purpose of the program, loud and clear
- an exercise that encourages audience involvement – to let your audience know that their participation is wanted and appreciated, that you're interested in hearing from them

(ii) Body – This is the main portion of your program. All the information and activities you present should relate back to your theme and underlying goals. Drawing on the techniques you've chosen (noted in your Program Plan), develop your presentation to attract and stimulate your audience, bearing in mind that people retain:
10% of what they hear
30% of what they read
50% of what they see
90% of what they do

SHARING THE JOY OF NATURE

Interpreter Joseph Cornell, in his book *Sharing the Joy of Nature,* describes what he calls a "flow learning" technique. This technique can be applied to all ages and in all types of programs. Basically it involves incorporating a natural progression in activities to maximize audience experience. He begins by awakening audience enthusiasm, then focuses their attention, directs their experience and, finally, shares inspiration.

(iii) Conclusion – Your program conclusion is what your audience often remembers longest. A conclusion should reiterate your message and bring your program to a clear end. Leave your audience excited about their experience and with something to think about or do.

ALTERNATE PLANS

It may seem premature, but now is also the time to think about what you'd do if something unexpected happened during your program. What if the weather changed suddenly? What if your group proved to be larger (or smaller) than expected? What if they were younger, or had more experience? What if they had special needs? Try to give some thought beforehand to possible complications, and make provision for them.

Interpretation addressed to children should not be a dilution of the presentation to adults, but should be a fundamentally different approach. To be at its best it will require a separate program.

Interpreting our Heritage
Freeman Tilden

SPECIALTY PROGRAMS

An interpreter needs special skills to handle certain programs. If you've never worked with children, for example, you should get some experience before leading your own children's program. This might involve assisting another interpreter until you feel comfortable, and doing some research on children's developmental stages.

Many other kinds of audiences have special programming needs as well, including those with mobility restrictions, mental disabilities, emotional problems, sensory disabilities (blind or deaf), or limited comprehension of English. Special needs groups may also include the elderly and some religious groups.

CHILDREN'S PROGRAMS

In the case of children's programming, it's especially important to research the needs of the age groups you're planning to work with. Throughout their development, children's needs, interests and abilities are constantly changing and evolving. A three year old, for example, is self-centred, has a limited attention span, is not logical, has small legs, needs to explore and manipulate, and has few experiences. Keeping these characteristics in mind, you should design your program so it's child-centred, activity oriented, exploratory, and requires little walking. Techniques like storytelling, puppets, sensory exploration, hands-on, props, play, drama, role playing and experimentation, etc. would all be suitable.

A resource list with a separate section for children's resources is provided at the back of this module. Our list represents only a few of the many good resources now available for wetland programming for children. Teachers' resource guides and manuals are also an excellent source of programming ideas.

Program Outline

Prepared by: _____ Date: _____

Introduction: _____

Body: _____

Conclusion: _____

Alternate plan (ie bad weather, different audience than expected, etc.): _____

Information sources used: _____

Getting Started

Once you have a program design and an outline in place, your next step is to promote the program and to organize and train your volunteers. Generally, this is a time of trial and error as group members sort out their roles, resolve logistics problems, and familiarize themselves with new information. Expect these growing pains, treat them with a liberal amount of humour, learn and move on.

PROMOTION

A solid promotion plan and campaign are vital to the success of your program. Ideally, one person or subcommittee should take charge of all media-related concerns. Also identify someone to act as your official spokesperson – a group member who presents well, is up-to-date on program developments, and can be available on short notice.

Your final promotion plan will depend largely on your budget and on the type and number of programs you're running. Before you begin your campaign, however, be sure to:

Define your target audience.

Look at local advertising and media coverage examples for other non-profit organizations and ask them for suggestions.

Consult a resource person skilled in promotion – e.g. an instructor in communications at your local college.

Compile a list of local media contacts and speak to them personally.

Research media outlets, agencies and businesses that might provide free air time or ad space, or help with printing costs.

MEDIA OPTIONS

You have at least five media options readily available to you. Again, which one you choose depends largely on your budget.

(i) The *Public Service Announcement* or *PSA* is probably your most cost-effective alternative. Most local radio stations and cable television feature "community calendar" slots in their daytime broadcast schedules and are eager to fill them with information on local events – free of charge. Local magazines and newspapers, particularly community weeklies, also provide space for public announcements.

(ii) Public facilities like your local library or community recreation centre normally have bulletin boards where you can display promotional literature for a set period. Some even have electronic signage to promote local events to passersby. But demand for these services is high and you have to arrange for their use well ahead of time.

(iii) You can also develop your own brochure, particularly if you have the time and skills in house. But remember – the public is already inundated with written advertising. Make sure you include all the basics about your program – the who, what, why where, when and how of it. And provide additional information that will encourage people to hang onto the publication – a calendar of upcoming events, for example, or tips on identifying local flora and fauna.

(iv) You can buy advertising space. An inexpensive ad in a naturalist group's newsletter has a smaller circulation than the local newspaper, but may attract more participants because the group has a special interest in your program.

(v) You can also develop a press release. This is the traditional way to attract the press and broadcasting media. Try to speak with media contacts beforehand to determine what they look for in a release and how much lead time they need to respond. For information on the media in your area, check your local library for a copy of the *B.C. Media Guide* (publication details are listed at the end of this module).

Writing a good press release is something of an art. Keep it to one page, make it factual, and try to appeal to both the media and your intended audience. (A checklist on writing press releases is provided at the back of the module).

When your release prompts a response, ensure that your spokesperson is up-to-date on program developments and has a media package to distribute at interviews. Honesty is always the best policy in any dealings with the media. If you don't know the answer to a question, offer to follow up – it's a much better alternative than "no comment." After any media exposure, send a thank-you letter. It reminds your contacts of your program and gives you an opportunity to inform them of further program developments.

TRAINING AND ORIENTATION

Whether you plan to use volunteer interpreters or have enough funding to hire professionals, it's important to provide background information and training. Before you begin, however, put together an information package for each interpreter that includes:

- program plan for each program
- details on the target audience(s)
- tips on interpretive techniques
- history of the wetland and your group's involvement with it
- field summaries, maps and photos of monitoring activities
- list of group members, including other interpreters
- information on other groups that support your wetland
- copies of all promotional materials prepared by the group
- copies of relevant press clippings
- resource list

For staff training purposes, try to find a few resource people who are familiar with your program subject matter and have interpretation skills (public speaking ability or experience in puppetry, drama, etc.). Interpreters who already conduct wetland workshops or programs would be ideal. If you're unable to locate suitable candidates, contact the provincial government's Project Wild offices, or the community liaison for the federal Department of Fisheries and Oceans in your area. Project Wild provides workshops for educators, based on the Project Wild Manual and other publications developed by the office. The coordinator may be able to arrange a workshop for your staff, or know of good resource people in your area. Federal community liaisons work with community groups around the province and might also be able to suggest a few names (these agencies and others are listed at the back of this module).

Training should include a tour of the wetland and discussions concerning some of the wetland's highlights, where best to mount specific activities, and any site restrictions. A good training package is a nice reward for your interpreters, particularly if they're volunteers. As well as preparing them for their role, it gives them a chance to motivate each other and bond as a team.

VOLUNTEERS

Volunteers are a special group. They are not staff, they do not get paid, and they've chosen to participate in your program. People volunteer for all sorts of reasons – for companionship, for fun and enjoyment, for training and experience, because they like to work with a particular age group or help a cause they believe in. By getting to know them and their motives for becoming involved, you can help them enjoy their work – and keep them coming back.

Volunteer coordination is best administered by one person who has the interest and time to handle volunteer queries, organize schedules, and keep volunteers informed of training opportunities and program changes and developments, etc. Depending on the extent of your program, this can be a full-time job and is only for someone who enjoys the personal contact and exchange. Volunteer responsibilities should be clearly delineated – even written down in the form of a job description, if necessary. Check with volunteer staff on a regular basis, to ensure that they're enjoying themselves and feeling sufficiently challenged. Also create opportunities for them to get together – an informal luncheon on site, a demonstration of interpretive techniques, quarterly meetings with guest speakers, etc. This gives you a chance to see how they're doing and to thank them for their efforts.

Saying thank you is important and can be done in a variety of ways – by organizing an awards ceremony or some other special event, sending occasional thank-you letters, featuring volunteers in your site newsletter and promotional materials, etc. If you have paid staff, ensure that they too understand and respect the volunteers' contributions.

Site preparation

What kind of shape is your site in? As you review site requirements, try to think like a member of the public arriving at the wetland for the first time. Would directional signs or a simple map have helped you find the place more easily? How did you know that you'd finally arrived – is there a sign or perhaps a kiosk at the entranceway? Are there any trails and, if so, are they clearly marked? Would a general map of the wetland and its trail system be of any value? Maybe you could reproduce the map as a hand-out, to make sure that visitors don't get lost.

Do you have the use of a visitor's centre? What hours do you plan to keep and will someone always be available to answer questions when the centre is open? Is it wheelchair accessible? Is there a phone?

The issue of signage can be complicated. If your wetland is on public land, your signs likely have to conform to the signage requirements of the area's management authority. They should also be weather and vandal resistant. Signs are expensive to produce and must be done in a professional manner to minimize their impact on the site. Always check with the relevant authorities before finalizing any signage plans.

If you're intending to attract large numbers of people, one of your main concerns should be the provision of adequate bathroom facilities and drinking water. Visitors will also want to know if they can bring their pets (especially dogs), and may ask for information about general wetland terrain, walking or hiking distances, and the availability of shelters and picnic grounds. This is the kind of information you'll want to include in your promotional materials – especially if the site is undeveloped and therefore unsuitable for some special needs groups.

ORGANIZING A WORKFORCE

Undeveloped sites often require extensive planning and preparation. As in the case of signs, you will want to check with the relevant authorities before going ahead with any construction. Whether your wetland is on private or public property, the issue of liability is an important one and your structures must be built to the required safety standards.

One of the big problems with site development is locating a workforce. Your own group members can probably shoulder some of the work. But if your development plans are extensive, you'll have to look elsewhere for help. One of your best sources is the local college or university, especially if it offers environmental education programming. Youth employment programs (through Human Resources Development Canada) are also a good resource, as are local environmental organizations and youth groups like guides and scouts. You might also try advertising for volunteers in the local paper.

DONATED MATERIALS

If your site budget is limited, consider putting out a request for donations. Individuals and companies are often willing to donate supplies to a good cause. Again, one person in your group should be charged with coordinating donation details, including solicitations and the picking up and storage of donated materials. Don't accept materials you can't use – the donor may be offended if (s)he doesn't see them in place on site.

Consider what you can do for your donors in return. It's important to say thank you – and thank you again. Many companies appreciate being cited as a contributor in your promotional materials and in permanent signage on the wetland. Some also want to cite you in their company literature, as an example of their social conscience. You might feature donors in a special event – opening ceremonies for the site, for example – or present a donor's certificate and commendation. Most of these possibilities also have the advantage of raising your own visibility in the local community (and attracting even more donations).

Post-program evaluation

Programs need to be evaluated on a regular basis. Criticism isn't always easy to accept. But if it's given in the right spirit, it can strengthen your programming and improve site operations as a whole.

Your best source of feedback is your audience. Often all you have to do is watch their reactions to gauge the impact your program is having. Are they asking questions? Are they interacting with you? Are they responding to your enthusiasm about the subject matter? If your group is restless and easily distracted, you may be in trouble. Watch for signs of yawning, people looking at their wristwatches, silence, lack of eye contact, and questions that don't relate to the subject at hand. Of course, this could be indicative of the dull weather …or the time of day. But it's just as likely a sign that your program and presentation need some retuning.

Providing an evaluation form to teachers and other leaders who attend your program is one way to prompt specific comments. Another way is to organize a "sharing circle" at the end of your program and encourage participants to share what they liked best, or least, about it. Installing a suggestion box, with pencils and paper provided, is yet another way.

Don't be afraid to ask fellow interpreters, or your supervisor, to attend your program and give you feedback. And evaluate yourself on a regular basis as well. Look for ways you can improve your performance, without lapsing into self-criticism – and remember to congratulate yourself when a new technique or approach works well.

Giving constructive criticism is difficult for even the most gifted and tactful reviewer. Never allow your private views of a person's character to interfere with your assessment of their professional skills. Strive to be objective and always counterbalance negative with positive – citing a person's qualities as well as their shortcomings. Your purpose is not to alienate colleagues, but to help them improve their performance.

SUPPLEMENT 1.3–A

RECOMMENDED READING

Ashbaugh, Byron L. *Planning a Nature Centre*. New York, N.Y.: Bulletin No. 2, National Audubon Society, 1963.

State of the Parks: 1990 Report. Ottawa, Ontario: Environment Canada Parks Service, 1991.

Hanna, John W. and Pamela Wright. *Interpretive Skills Training Program: Module One, Interpretive Principles and Planning.* Ottawa, Ontario: Interpretation Canada and Parks Canada, 1994.

Hanna, John W. and Gabriel Lacombe. *Interpretive Skills Training Program: Module Two, Interpretive Presentation Skills I.* Ottawa, Ontario: Interpretation Canada and Parks Canada, 1994.

Lothian, W.F. *A History of Canada's National Parks, Volume IV*. Ottawa, Ontario: Parks Canada, 1981.

Peart, Bob. *The Definition of Interpretation.* Interpscan 22:1, 1994.

Program Preparation and Planning. Ottawa, Ontario: Ontario MNR Visitor Service Notes.

Regnier, Gross, Zimmerman. *The Interpreter's Guidebook: Techniques for Programs and Presentations.* Stevens Point, Wisconsin: UW-SP Foundation Press Inc., 1992.

SUPPLEMENT 1.3–B

PRESS RELEASE CHECKLIST

Place your letterhead or logo, with phone and fax, along the top of the page where it's easy to read.

Make your heading clear and concise and set it in large, bolded text.

Make the release "Attention to:" and name a specific person where possible.

Include the date: clearly indicate when the information should be released, or put <u>For Immediate Release</u> near the top.

Identify your contact person and provide their address, phone, fax and e-mail numbers and the times they can be reached.

Double space the body of the text and make it as clear and concise as the title. Some media outlets receive hundreds of releases a week – don't make them work to find the message.

Include an eye-catching illustration – the longer they look at your release, the better chance you'll have of recognition.

Always include your group's mission statement and essential information about your site. Remember that you may not always be dealing with the same people.

Small quotes from group members or local experts, or an amazing fact about wetlands, can help those who are writing articles and copy for news programs. The more opportunities the media has to make the story interesting for its audience, the more likely your message will be heard. Just remember to keep it simple!

SUPPLEMENT 1.3–C

CHECKLIST FOR DEVELOPING AND MOUNTING SCHOOL PROGRAMS

1 Research appropriate program themes/ topics

What grade(s) are you targeting?

Curriculum requirements of the grade level(s)

Age appropriateness of activities and information in the program

Student involvement during the program

Site restrictions/ benefits in relation to your topic

Other programs at different sites (Is this program new or in demand?)

Group size necessary (e.g. Do you need to have a few leaders for the program to divide the students into smaller groups?)

2 Make a program plan

See Program Plan (Appendix 3.3.1 and description under *Making a Plan* in the module)

3 Make connections with local experts

Contact teachers, biologists, interpreters, etc.

Get feedback on your plans before you put them in motion

4 Check if you need any permits before going further

You may want to do this first to save time

5 Organize advertising and promotional materials

6 Set up booking procedures

How, when and where do teachers contact you?

What information must they have ready at that time?

Remember to gather important information about students, including special needs students

7 Develop a pre-program package for the teacher or the school, including:

The exact location, time and length of the program

The program's goals and objectives

What you expect from the students

What you expect from the teachers/ adults (ie. group management)

Information about your site (ie. brochure if possible)

Rules of the site (ie. no dogs, no litter, etc.)

Clothing/ equipment needed (ie. boots, notebook, etc.)

Name tags for the students

Program cost (if applicable) and method of payment

Background information on your program subject - things that the students can work on before their visit (information, resources, vocabulary, etc.)

8 Put your program together

Establish a solid program plan

Gather all props and materials

Review the site well

Practice your activities: games, stories, roleplaying, puppetry, etc.

Try running through the program with a practice group (ie. leaders of the program, or a group of kids you know. . .)

Keep in mind that your program will likely change as you begin to do it with the students; evaluate as you are running the program and change and adjust it, as required

9 Training for program leaders

Bring in local experts on your topic

Bring in presenters on skills needed (ie. puppetry, storytelling, public speaking, leading games, etc.)

Review the program site as a team

Give out resources (ie. group management techniques, further topic information, resource list for their personal use, etc.)

10 Phone the teacher/contact person a few days prior to the program to confirm details and inquire about the knowledge base and abilities of the students.

Can reduce communication problems and help you "fine tune" your program to your audience

11 Arrive early

Check out the site ahead of time, to ensure all is in order

12 Enjoy yourself as you conduct the program!

13 Evaluate the program after completion

Ask the students what they liked best about your program

If other leaders worked with you during the program, take time to talk about what worked or didn't work, and why

SUPPLEMENT 1.3–D

RESOURCE LIST

(a) Interpretation – general information:

B.C. Media Guide.
Victoria, British Columbia: Government of British Columbia Communications Office, June 1995. (Phone: 387-1337)

Fels, Lynn. *Getting Started: Establishing a Volunteer Program.*
Toronto, Ontario: Volunteer Centre of Metropolitan Toronto, 1988.

Lewis, William J. *Interpreting for Park Visitors*.
Colorado: Eastern Acorn Press, 1980.

Lewis, William J. *Reaching for Excellence: The Process of Interpretive Critiquing.*
Colorado: Eastern Acorn Press. (Program Package: 2 hr. video and 22 page workbook)

Post, Kerrie and Andrew & Carolyn MacDonald. *Wildlife Trees of British Columbia.*
Victoria, B.C.: B.C. Ministry of Environment, Lands and Parks & FRDA II, 1996.

Regnier, Kathleen. *The Interpreter's Guidebook: Techniques for Programs and Presentations.*
Interpreter's Handbook Series. Stevens Point, Wisconsin: UW-SP Foundation Press Inc., 1992.

Tilden, Freeman. *Interpreting Our Heritage.*
North Carolina: University of North Carolina Press, 1957.

Van Matre, Steve. *Acclimatizing*.
Indiana: American Camping Association, 1974. (Others available: *Acclimatization*, and many more.)

Veverka, John A. *Interpretive Master Planning*.
Montana: Falcon Press Publishing, 1994.

Wilson, Marlene. *Effective Management of Volunteer Programs.*
Volunteer Management Associates, 1981.

(b) Interpretation – children:

Canadian Wildlife Federation. 1991. *Project WILD*.
(Supplementary Conservation and Environmental Education Activity Guide) Western Regional Environmental Education Council. (In B.C. contact the Ministry of Forests, Victoria.)

Cornell, Joseph. *Sharing Nature with Children*.
Nevada City, California: Ananda Publications, 1979.

Cornell, Joseph. *Sharing the Joy of Nature*.
Nevada City, California: Dawn Publications, 1989.

Hichman, Pamela M. *Hands-On Nature.*
Ontario: Pembroke Publishers Ltd.

Ground Truth Studies Teacher Handbook: British Columbia Edition.
Victoria, B.C.: B.C. Ministry of Environment, Lands and Parks, 1994.

Western Education Development Group (WEDGE). *The Estuary Book*. Vancouver, B.C.: B.C. Ministry of Environment and University of British Columbia, 1981. (Other books available: *The Pond Book, The Lake Book* and *The Ocean Book)*

Program Plan

Interpreter: Site:

Location(s) on site: Time of day:

Season:

Program title:

Theme of program:

Anticipated Audience (#, age, interests...):

Goals / objectives of program:

Materials needed:

Program Outline

Prepared by: Date:

Introduction:

Body:

Conclusion:

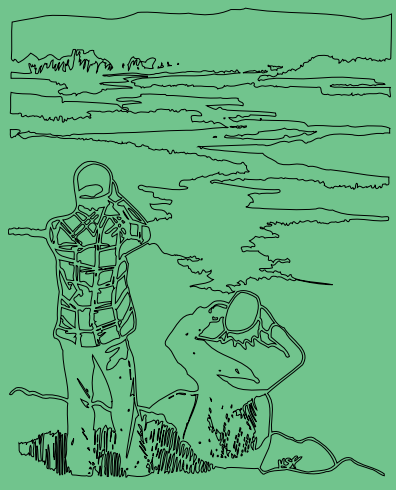
Alternate plan (ie bad weather, different audience than expected, etc.):

Information sources used:

Section Five

The Initial Wetland Assessment

Module 2.1



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

MATERIALS AND EQUIPMENT REQUIRED FOR THIS ACTIVITY:

1. Off-site assessment/mapping:
   air photos
   topographical maps, TRIM or NTS (1:50,000 or 1:20,000)
   tracing paper
   tape
   pencils, Omnichrome pencils, Pigma pens
   protractor
2. On-site assessment:
   rubber boots (waders are even better)
   extended length (50 m) tape measure
   shovel
   pH paper
   air photos
   topographical maps
   notebook (waterproof paper)
   data and map forms
   binoculars
   compass
   plane table
   ridged ruler
   camera
   field guides
   wetland map form*
   wetland reconnaissance form*

*provided at the back of the module

Welcome to the Wetlandkeepers Program

You are about to embark on a fascinating investigation – wetlands play an essential and complex role in the wellbeing of our environment. These training modules have been developed by Environment Canada to encourage public participation in monitoring wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, each module provides information on a specific wetland monitoring activity. Many volunteer groups, schools and individuals have already become wetlandkeepers and invite you to join in the conservation of our precious wetland resources.

Acknowledgements

The information for this module was compiled by Will MacKenzie, a wetlands biologist with the British Columbia Ministry of Forests Research Program. Illustrations and other visual materials have been provided, courtesy of the B.C. Ministry of Environment, Lands and Parks; Canada Map Office, Department of Energy, Mines and Resources, Ottawa; Washington State Dept. of Ecology (*Hydric Soils Guidebook*); University of Washington Press (*Vascular Plants of the Pacific Northwest* by C.L. Hitchcock, A. Cronquist, M. Ownbey and J.W. Thompson, 1969); Ducks Unlimited Canada (*Marsh World, the Green Wing Program*); and Environmental Concern Inc., Maryland and The Watercourse/Project Wet (*WOW! The Wonders of Wetlands)* 1995, Montana, U.S.A.

Project activity and purpose

Conducting an initial assessment of your wetland's features is an important first step in understanding its nature. Aerial photos and topographical maps give you a general picture of its dimensions and characteristics. An on-site assessment of vegetation and soils allows you to determine wetland type. In combination, this information gives you a better understanding of how the wetland functions and the kind of life it supports. Based on your findings, you can then develop a detailed map of the area for documentation and reference as you proceed with additional survey and monitoring activities.

BACKGROUND

Wetlands are truly unique *ecosystems*. Complete and fully functional in their own right, they form an integral part of the broader landscape, regulating the flow of water and playing an essential role in filtration and cleansing. They occur along lake margins and stream sides, in catchments and estuaries, serving as the link between aquatic and upland habitats. Wetlands have a high *water table* and often remain saturated year round – even when they appear dry at the surface.

Five wetland classes are recognized by wetland specialists in Canada today. Each class has its own set of unique characteristics, as set out in the table below, and is further broken down into several forms and types, as already discussed in Section Three of the Handbook on "Wetland Ecology." But they all share the same basic features:

- prolonged presence of surface or sub-surface water
- *anaerobic* (deficient in oxygen) soils
- *hydrophytic* (water-tolerant) plant species

To establish a wetland's boundaries and determine its class(es) – as we plan to discuss in this module – we must first investigate these three features.

WETLAND HYDROLOGY

Wetlands are controlled by *hydrology* or water flow. The amount and quality of water that flows into and out of a wetland determines what plants and animals live there. Many wetlands are highly productive, supporting huge populations of migratory waterfowl and *passerines* or songbirds, as well as insects and small mammals. Others are less lush but contain unique communities of plants and insects found nowhere else.

When a wetland's hydrology is changed, the effect on plant and animal life is often immediate and profound. Wetlands are not naturally static entities. They change gradually in response to natural processes – such as changes in climate or *plant succession* (changes in plant communities). Animals have an impact too. Beavers build dams, creating wetlands where none previously existed, or altering the wetlands already there. These structures often remain in place for years after the animals themselves have disappeared.

A wetland can be characterized according to the kind of hydrological system it occurs in and the nature of the system's water flow. Four such systems, listed below, are commonly referred to in wetlands literature.

WETLAND SOILS

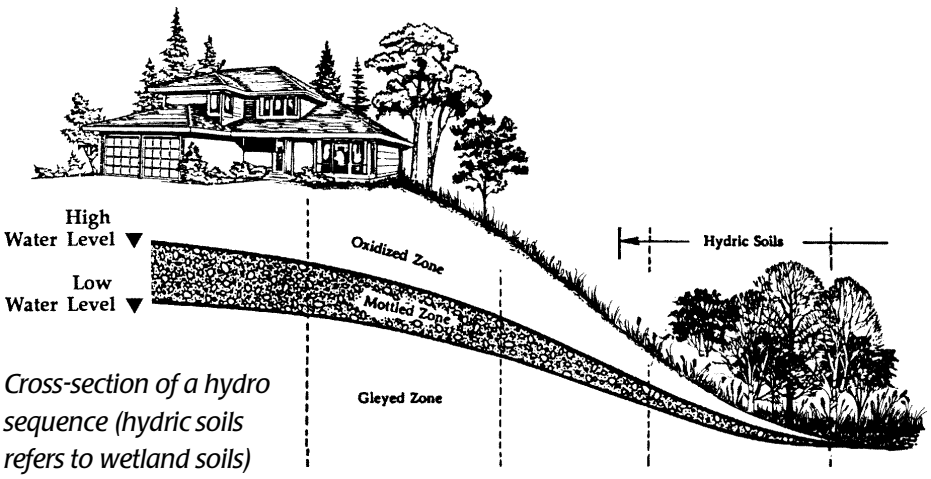
Characteristic wetland soils are anaerobic and consist of either accumulations of *peat* (organic matter) or poorly drained mineral soils.

On sites that are permanently saturated with oxygen-poor water, decomposition occurs very slowly. As a result, dead plants decompose at a rate slower than their accumulation, resulting in the formation of peat. In wetlands that experience lowering water levels during the year or are flooded with well oxygenated water, decomposition is fast enough that each year's accumulation of dead plants decomposes at the same rate as it accumulates and very little peat (less than 40 cm) forms.

Wetlands often progress through a series of stages, from shallow water to marsh to fen to bog. This evolution usually takes place over thousands of years and can be traced by examining the wetland's *peat record* – the layered accumulation of its organic material. In general, peatlands have fewer nutrients available for plant growth than mineral wetlands.

You can determine a wetland's nutrient status and productivity by examining the degree of decomposition of its peat. In undecomposed or partially decomposed peat, plant structures are distinct and you can actually identify different plant species. Wetland biologists use such measures as the Von Post Scale to describe decomposition (turn to the back of this module for a look at the scale).

Two characteristics are common to waterlogged wetland mineral soils – *gleying* and *mottling*. Gleying refers to the chemical transformation of iron and manganese in the soil when it's saturated for lengthy periods. Gleyed soil is a uniform bluish gray in colour. Soils that are saturated year round are usually gleyed to the surface. But, where they are subject to fluctuating water levels, they contain yellow to reddish brown splotches. These splotches, referred to as mottling, are often found along root channels and are actually rust spots where iron has been oxidized (just like that old jalopy in the front yard!). Mottles vary in colour and intensity, depending on the length of time the soil has been saturated.



Cross-section of a hydro sequence (hydric soils refers to wetland soils)

FOUR HYDROLOGICAL SYSTEMS*

Palustrine system – consists of receiving basins with water flowing in from slow creeks, groundwater or precipitation; wetland classes are typically marshes in dry climates and fens and bogs elsewhere. Palustrine systems can be *isolated*; serve as the *headwater* source in a series of receiving basins; serve as the *terminal* or final source in a series of receiving basins; or be a *link* in a chain of receiving basins

Lacustrine system (lake systems) – consists of wetlands bordering deepwater habitats with lots of flowing water, affected by wave action; wetland classes are typically marshes and swamps

Fluvial system – consists of wetlands bordering streams and rivers, affected by spring floods and flowing water; wetland classes are typically marshes and swamps

Estuarine system – consists of wetlands in tidal areas, affected by tides and saltwater; wetland classes are typically salt marshes.

* These system definitions are adapted from L.M. Cowardin et al., *Classification of Wetlands and Deepwater Habitats of the United States,* published by the American government in 1979.

CANADA'S FIVE WETLAND CLASSES

Class	*Features/location*	*Hydrology*	*Typical plants*
Bogs	peatlands	no seasonal flooding	sphagnum mosses
	occur in depressions	no incoming water flow	Laborador tea
	nutrient poor		bog cranberry
	highly acidic		bog laurel
	common in low-lying areas		creeping snowberry
			sundew
Fens	peatlands	inflowing water	sedges and shrubs
	slightly acidic	wetter than bogs	water sedge
	some nutrients	water seeps downslope into basins	marsh cinquefoil
	common in mountainous areas		willows
Marshes	mineral wetlands	open water	emergent vegetation
	nutrient rich	incl. ponds, lakes, slow rivers and estuaries	cattails
	attract waterfowl		bulrushes
	common in dry climates		grasses
			horsetail
Swamps	mineral wetlands	periodically covered by standing	mountain alder
	occur along streams,	or slow moving water	willows
	in sewage areas		skunk cabbage
	attract waterfowl		lady fern
			western red cedar
Shallow	common near marshes	stagnant or slow moving water,	aquatic plants
	rich in insect life	less than 2 m deep	milfoils
			pondweeds
			pond-lilies
			watershield

WETLAND PLANTS

The presence of a particular plant species or *plant community* (group of plants with the same habitat preferences) tells us much about the hydrology and soil conditions of the habitat. Wetlands, as already discussed in the handbook, only support hydrophytes – plants that tolerate or actually require wet growing conditions. These water-loving species indicate wetland conditions.

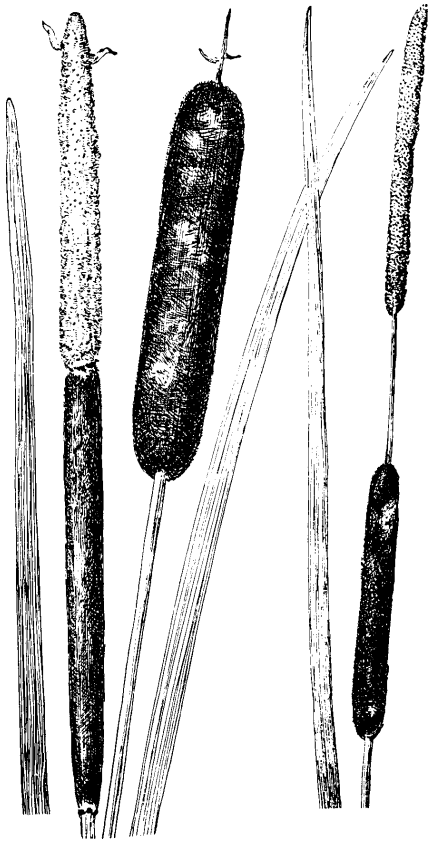
The main challenge facing any wetland plant is how to get oxygen to its root system. Some hydrophytes rely on their leaves and stems to perform this function. Some have no roots at all and simply float on the water or spread over the surface of wetland soils. Others have shallow, spreading roots, or roots growing out of their trunk above ground. Still others have multiple or buttressed trunks at their base.

Both anaerobic soils and hydrophytes are reliable wetland indicators – regardless of the season, or how dry the surface of an area may appear. But because plants are easier to identify than soils, plants are more frequently used as indicators to establish wetland boundaries. Take a moment now to examine the table of Canada's five wetland classes on page 6, and note the plant communities that characterize each.

More than one wetland class can appear in a wetland. The plants and soils in an area that's flooded for several weeks each spring are going to be very different from those in the transitional area between wetland and upland, closer to the wetland's border. Also, not all plant species characteristic of a particular wetland class always appear together.

The best time to complete a wetland assessment is in the summer when the area is dry enough for easy access. The assessment techniques described in the following pages are easy to do, require a minimum of inexpensive equipment, and will give you sufficient information to identify future planning activities for your group. They are divided into three sections, depending on where the work is being done:

- before you go to the field (pre-assessment research)
- in the field (identifying and mapping boundaries, visiting plant communities, identifying wildlife and human features)
- back from the field (data collation and analysis, conclusions)



common cattail Typha latifolia *(left)*
narrow-leaved cattail Typha augustifolia *(right)*

BEFORE YOU GO TO THE FIELD

OFF-SITE DELINEATION

OF A WETLAND

Step 1 Obtain relevant data

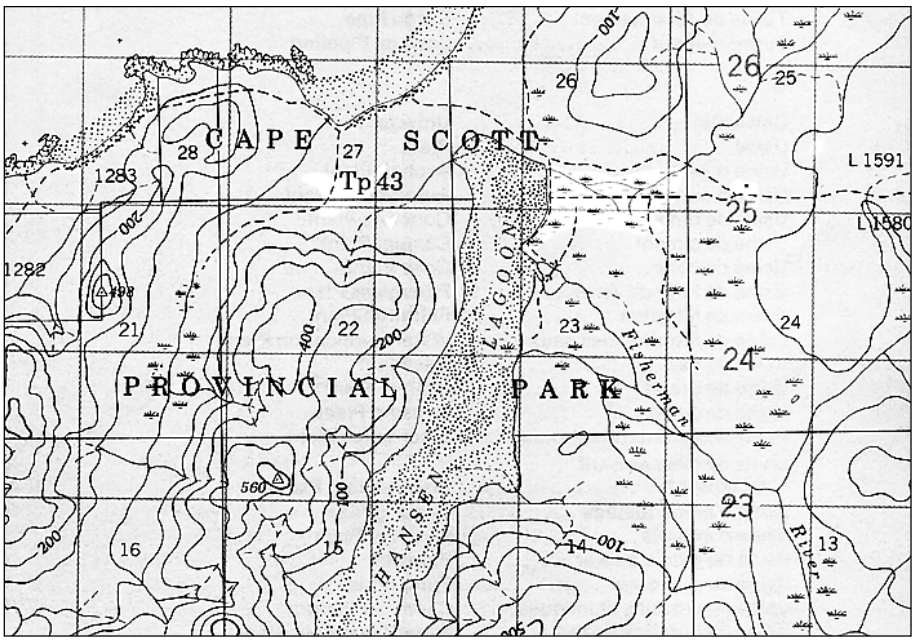
Information on your wetland may already be available. Contact Ducks Unlimited Canada, The Nature Trust of British Columbia and other conservation agencies to determine if wetland studies or inventories have already been conducted. Check also with provincial and federal government authorities, including the regional offices of Environment, Forestry and Agriculture at both government levels. These authorities often cooperate with each other in their field activities and produce joint reports. If the information you obtain does not bear directly on your wetland, it should still give you a better understanding of its functions in relation to other wetlands in the region. All information is important at this early stage. (A list of the main agencies to contact and their addresses and/or phone numbers is provided at the back of this module).

Step 2
Obtain maps and aerial photos

A detailed reading of topographical maps and aerial photos can help you identify many wetland features. Use a large-scale topographic map such as a 1:20,000 scale Terrain Resource Information Management (TRIM) map (turn to the back of the module for information on ordering the right TRIM map for your wetland). If you are working in a large wetland, order all the TRIM maps that apply to the area. Also, order a 1:50,000 National Topographic Series (NTS) map to give you a broader perspective of the land encompassing the wetland. Order two copies of all maps – one for use in the field, the second as your good copy.

Aerial photos are taken at a variety of altitudes, ranging from low (<1:11,000 scale) to high (<1:90,000 scale). You can order a set of them when you're ordering your TRIM maps. If your wetland is located on Crown land, you might consider borrowing photos from the B.C. Ministry of Forests and having them colour photocopied. The photocopies are less expensive, if somewhat poorer in quality, than the photos.

Excerpt from a topographical map of northern Vancouver Island



Step 3
Develop a preliminary wetland map

Identify the basic features of your wetland by examining the maps and photos carefully. Topographical maps show inflow streams, roads and buildings, and the general lay of the land. Aerial photos complement the maps, providing more detail on human and natural features. Try to think in terms of what each feature implies for the functioning of the wetland:

roads	runoff, possible garbage dumping, access for survey
houses	sewage input
farms	nutrient-loaded runoff, land being grazed, irrigation
inflow streams	water source
culverts	water diversion into or out of the wetland
beaver dams	control of water levels
open water	habitat for a variety of wildlife
plant communities	diversity of plant and animal life, depending on size and number of communities

Remember that the scale of the aerial photos is approximate because of flight-line requirements (and photocopying, if you opt to use colour photocopies). One way to check their accuracy is to measure and compare the straight-line differences between two features evident in both the photos and the maps. Aerial photos are otherwise an easy and efficient way to begin the mapping process. Patterns you might miss during an on-site survey are often obvious from the air. Specific plant communities, habitats and human features are identifiable by their colour, texture and location. Obvious changes in vegetation help you delineate wetland borders.

As you identify features, use the Wetland Map form to start developing your own preliminary wetland map. Make sure you establish scale and orientation. Then, using a fine pen (Pigma markers or Omnichrome pencils are good for this purpose), outline the boundary of the wetland. Don't worry about getting it right the first time – both the marker and the pencil lines can be erased. Also outline (in different colours or weights) all obvious plant communities, open water, water inflow and outflow locations, and human features, etc. Then trace these lines onto plain paper to produce a preliminary wetland map you can take into the field.

Wetland Map

Name of Observers and Contact: W. MacKenzie, S. Thomson

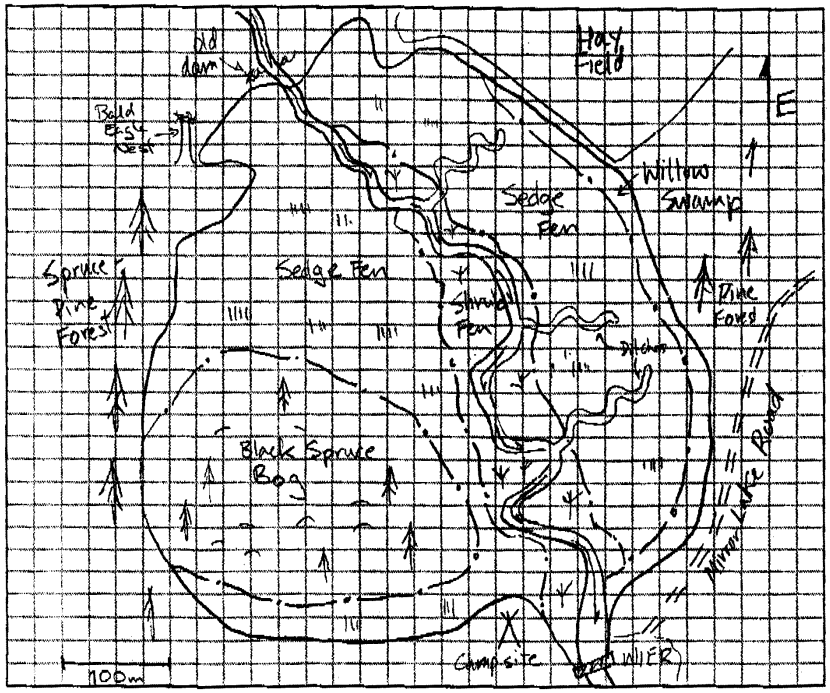
Wetland Locations:

General Locations: Mirror Lake wetlands

Lat/Long: 55° 15' 27' 30'

Driving Directions: Follow Mirror Lake Rd from Quint on Highway to Campground turn off at Km 35.

Wetland Map:
Include: Scale and Dimensions, Orientation, Open water, Different plant communities, Inflow and outflow locations, Wetland and adjacent landuse activities.



Observations: Outlet creek has Ducks unlimited wier established 1990. Also 2 ditches dug to increase open water. Some old beaver activity where the creek flows into the wetland. Eagle nest in snag near inflow creek. Hayfield adjacent to NE segment of wetland

4 Step Identify and map wetland boundaries

IN THE FIELD

ON-SITE ASSESSMENT

OF A WETLAND

Before finalizing field preparations, review Section Two of the Handbook on "Getting Started." Then consult the list at the front of this module for details on the equipment you'll need. Don't forget to include your TRIM or NTS maps, aerial photos, and the preliminary map you've just prepared. List all the features you want to check on a separate sheet and photocopy the table of wetland classes and the Von Post scale to use as field references. You will also need a data sheet like the Wetland Site Reconnaissance form to record your findings.

Full-sized copies of the forms are reproduced at the back of this module. Both are faithful replicas of the forms used by provincial wetland biologists and ecologists in the field. Instructions on how to complete them are provided on the reverse side of each form.

This Step incorporates two activities necessary for the accurate delineation and mapping of a wetland. They are not difficult to complete. However, if the dimensions of your wetland site are already documented or you don't require precise dimensions, you should skip this section and turn directly to Step 5.

IDENTIFYING BOUNDARIES

You can determine a wetland edge by conducting soil analyses at various points along two or more *transects.* A transect is a straight line that extends across your wetland's border from within the site to a point in the buffer zone beyond the wetland's perceived boundary.

To perform this procedure you need a spade or shovel, stakes, flagging tape, paper and pencils, a good field guide to wetland plants, and a camera.

Begin by choosing a point within the wetland where hydrophytic plants and other wetland indicators are present. Other indicators might include – standing surface water or a wet soil surface; water-stained leaves in shallow depressions; water-stained vegetation; and water-borne debris caught up in plant bases and stems.

Now identify a point well beyond the wetland's perceived edge and walk in a straight line (a transect) in that direction, checking for changes in topography and vegetation as you proceed. Often a wetland's boundary is sharply defined – by an abrupt topographical change or the sudden absence of hydrophytic plants. Sometimes the change is gradual, resulting in a broad transitional zone of mixed vegetation over a relatively flat surface. Under these conditions, a soil analysis is the most accurate way to determine the wetland's precise boundary.

As you move closer to the edge of the site, begin examining the soil along the transect. Dig a soil pit to a depth of at least 50 cm and look for evidence of anaerobic wetland soils:

- a peat layer
- gleying (blue-gray colouring) within 30cm of the surface

- mottling (yellow or reddish brown mottles on a gray background) within 30cm of the surface

Continue digging pits along the transect until these characteristics disappear from the soil. At this point you are probably beyond the wetland. Confirm your findings by carefully checking the vegetation and searching for clues to reveal the area's hydrology. Take photos of the soil pit, the vegetation, and any other evidence of upland terrain, and make detailed notes of your actions and findings. Identify the spot by flagging a nearby tree or shrub, or driving a stake into the ground.

Now choose another location in the wetland and perform the same procedure again.

You may have to dig three or four soil pits along each transect before you can determine the wetland's boundary. The number of transects you complete is relative to the size and complexity of the site. Do at least two transects – more if the wetland has been disturbed or degraded. Once you have completed your transects, join the flagged points or stakes to determine the boundary.

Even with soil analysis it can be difficult to identify a wetland's borders. Riparian areas with sandy soils and hydrophytic plants are notoriously difficult to delineate. If you cannot establish the boundary, consult an expert for advice, drawing on your notes and photos for reference. An expert might include a biologist with the federal or provincial ministry of environment, forests or agriculture, a college instructor in wetland ecology or a related field, a knowledgeable member of the local natural history club, etc.

MAPPING

Perhaps the easiest and most accurate way to map your wetland is to persuade a surveyor to join your group and conduct a survey for you, using professional survey equipment. You can also perform an accurate survey yourself if you have access to a Global Positioning System, a handheld device that receives and interprets signals from satellites (a single unit costs about $5000). Alternatively, you can use a simple technique called plane table mapping. While this technique will produce a fairly accurate map of your wetland, it is certainly more makeshift than the technologies described above and less useful in wetlands where visibility is limited.

A plane table consists of a drawing board or other flat surface, about 60 cm by 45 cm in size. Ideally, the table should be mounted on a tripod with adjustable legs. But a sturdy, four-legged table of similar dimensions (a retired end table, perhaps) can serve the same purpose. You also require a straight edge with a simple sighting device (a ruler with a ridge down the middle of it), an extended-length tape measure, and a brightly painted pole to sight against. Two people are required for this activity.

Set up your table on a level spot inside the wetland. Fasten a piece of plain paper on the table surface, then mark your location on the paper with a round-headed pin. Identify several points along the wetland's

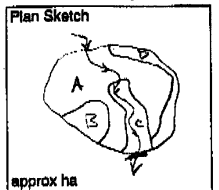
boundary (determined by soil analyses, as discussed in the previous section) and label them A,B,C,D, etc. Now ask your partner to take the painted pole and walk out to A, measuring the distance between the two of you with an extended tape measure. Record the distance, then have her stand the pole on the ground at a point clearly visible to you. Holding the ruler against the pin on the table surface, sight the pole along the ruler's centre ridge and mark this directional point. Repeat this procedure with all the points you've identified. The more points, the more detailed your map will be.

Take the distances you've recorded for the various points and establish a suitable scale – for example, one centimetre for every metre measured. Now measure out from the pinhole the appropriate distance to each directional mark. Join the points to get a simple map. Compare this map to the preliminary map you developed before coming to the field. Is it the same? If not, in what ways is it different?

Wetland Site Reconnaissance Form Card 1 of 1

Location Mirror Lake
Date July 10, 1992
Biogeoclimatic Unit SBSdk Ecosection Nechako Plateau
Surveyor WMJ ST
System Palustrine Subsystem Linked Element
Site# Bulkley # 1
NTS Map 93M/3 Lat 55°15' Long 127°30' Elev. 650

Plan Sketch



approx ha

Profile Sketch

Photos Roll D 1-6.

Unit (%)	A	B	C	D
Position	Central	Island	Streamside	Peripheral
Surface Pattern	Flat	Domed, hummocked	Flat	Mounded
Water table (cm)	0cm	-10cm	0cm	-20cm
Soil Classif.	Organic	Organic	Organic	Mineral
Texture/Von Post	mod. strongly	v. weakly	mod.	strongly
Depth of Organic	50+	50+	50+	20
SMR/SNR				
pH	5.8	4.0	6.0	6.1
Flood/Saturation	seasonal/permanent	Never/Permanent	Seasonal/Perm	seasonal/semi-perm.

History and Modification Notes Weir est. in 1990 to elevated water levels, survey altering to increase open water area

Unit Description

	A	B	C	D
Class	Fen	Bog	Fen	Swamp
Site Association	Beaked Sedge	Black Spruce – Labrador tea Sphagnum	Willow-Sedge	willow high bush cranberry
%Cover Tree Shrub Herb Moss	0 5 80 2	10 15 5 90	0 20 80 0	2 90 40 5
Species (%)	Beaked Sedge 80	Black spruce 10	willow 15	willow 30
	Marsh Cinquefoil 5	Bog birch 5	Bog birch 5	H.B. cranberry 10
	Bog willow 5	Labrador tea 5	Beaked sedge 60	Bluejoint 5
		Bog Laurel 5	water sedge 20	Twisted Stalk 5
		Sphagnum 90		Horsetails 20
		Clover berry 2		
Notable Features		some moose beds	Tall willow > 2m Pond lilies in stream Duck broods on stream	

Step 5
Visit wetland plant communities

Once you've identified and mapped your wetland's boundaries, you can examine the features you noted on your preliminary wetland map. In particular, investigate features that represent different wetland classes – such as distinctive plant communities, open water, and areas of higher elevation. Identify the water sources at each location and confirm them against your preliminary map. Also examine the soils to determine their composition and nutrient status.

IDENTIFY WETLAND CLASSES

Aerial photos usually reveal plant communities, but don't provide enough detail for you to establish their species or the wetland class they represent. Have a look at the plant communities you identified in your preliminary map and record any others not visible in your aerial photos and topographical maps. Look carefully at the various plant species in each and try to establish the wetland class they indicate. Refer to your photocopy of the five wetland classes and to the field guides you've brought with you for clarification. Remember – not all the species common to a particular class always appear in a plant community.

IDENTIFY AND VERIFY WATER SOURCES

Review your preliminary map once again and check the water sources you noted against your on-site findings. Are these sources natural or of human construction? Are they seasonal, permanent, or the result of occasional storms? Have any sources been diverted? What is the direction of their flow? Look for any human structures and activity, including all weirs (small dams), culverts, and modified stream and drainage paths. What kind of sewage system is being used for local homes? What kind of farming is being done? Try to determine if overland flow from fertilized fields and/or livestock is entering the wetland. Record all details in your field notebook or on your Wetland Map form and take photos, particularly if you have questions concerning specific hydrologic features.

Where you encounter open water, use your pH strips to measure its alkalinity/acidity (more information on what the pH measure tells you is provided at the back of the module). Dip a single pH strip in the water and check its colour. Record the reading and also note on your Wetland Map form approximately where it was taken.

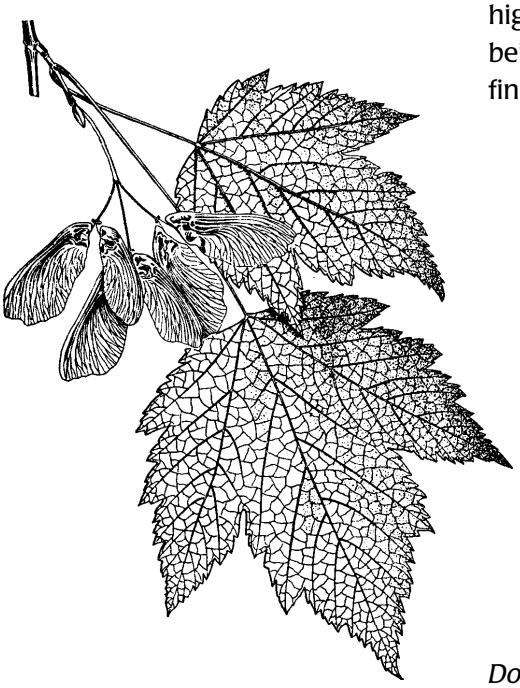
EXAMINE WETLAND SOIL

Examine the soil of each plant community by digging a soil pit or taking a peat core, much as you did when you determined the wetland's boundaries in Step 4. Dig your pit or core to a depth of at least 50 cm (this may be difficult if the water table is high) and check for evidence of anaerobic wetland soils:

- a peat layer
- evidence of gleying (blue-gray colouring)
- evidence of mottling (yellow or reddish brown splotches on a gray background)

Determine the extent of peat decomposition by taking a handful of peat and squeezing as much moisture as you can from it. Examine the plant structures that remain. Describe and assign a number to your findings, using the Von Post Scale at the back of the module. The higher the number on the scale, the greater the decomposition and, generally, the higher the wetland's nutrient status. Record your findings.

Finally, use your pH strips to determine the alkalinity/acidity of the water in the soil pit or peat core. Dip a pH strip into the water at the bottom of the pit, or squeeze water from the peat core into a container. Check the colour of the strip to determine the pH level. Low pH (less than 4.0, high acidity) means lower nutrient availability for plants. Moderate to high pH (more than 7.0, high alkalinity) may indicate that the wetland is being nutrient loaded from external sources (e.g. sewage). Record your findings.



Douglas maple Acer glabrum

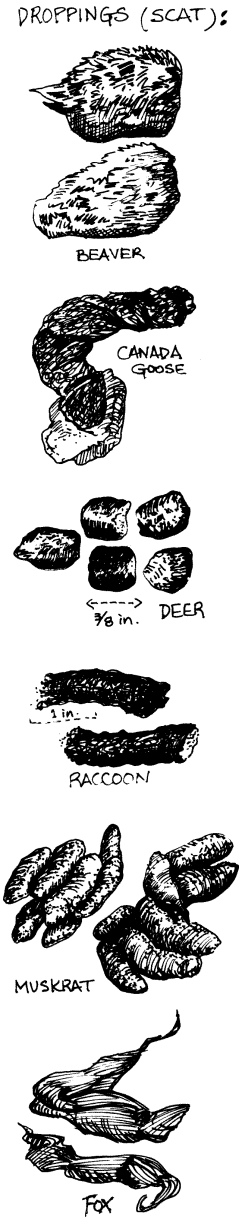
Step 6 Identify wildlife and human features

WILDLIFE HABITAT FEATURES

The extent and variety of wildlife in a wetland are a good indicator of its habitat value. Your primary interest here should be to record signs of wetland terrestrial life. Look first for long-lived habitat features – beaver lodges, beaver dams and runs, muskrat houses, wildlife trees with burrows made by cavity nesters, and raptor nests and perches. Then search for the more telltale signs of wildlife habitation – owl pellets, waterside grass runways built by voles, animal tracks, and scat. Record your findings in your notebook, noting their location, and take photos.

HUMAN FEATURES

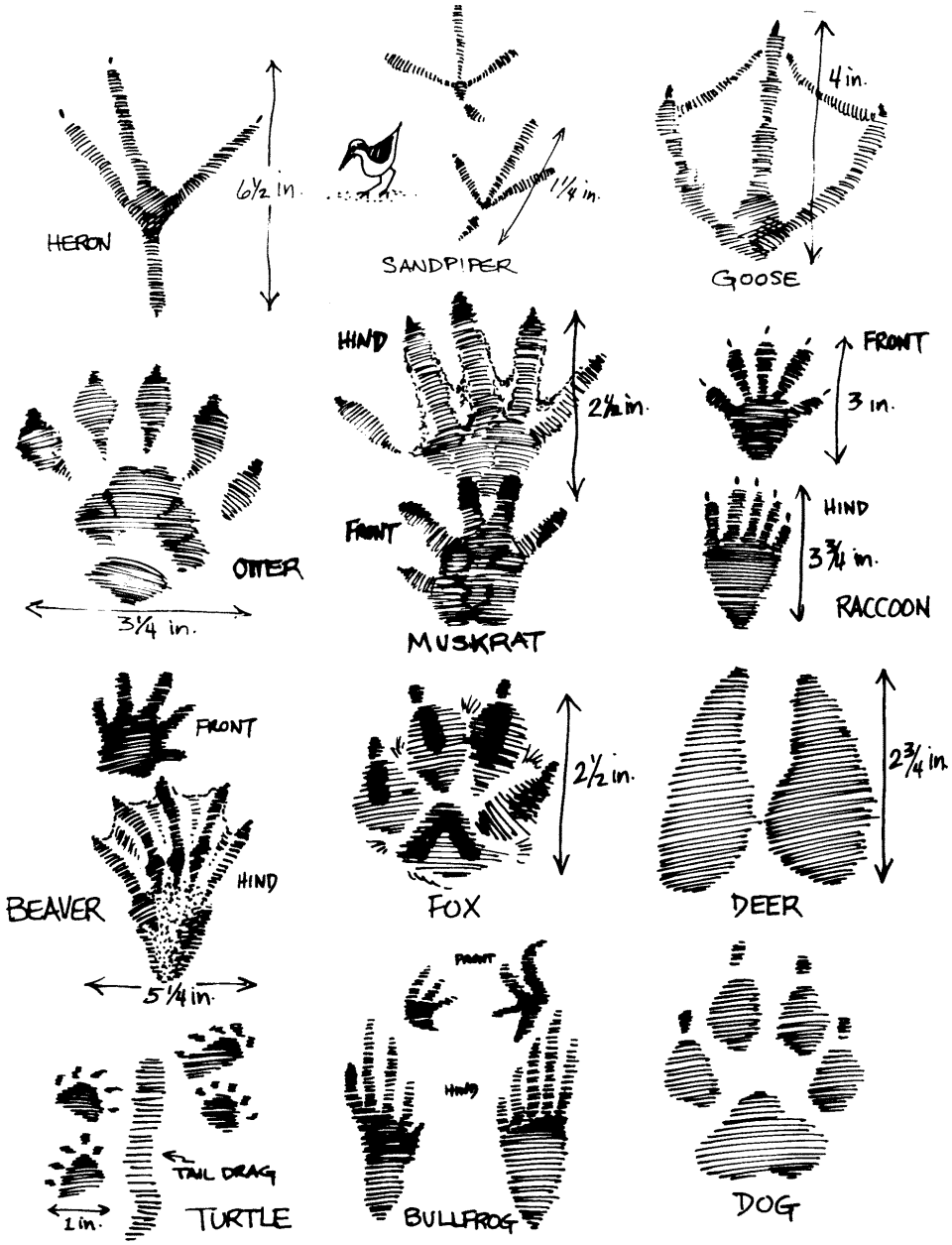
Human features, including disturbed areas, have a considerable impact on the plant and animal life of a wetland. Features that affect hydrology have already been discussed under "water sources" in Step 5. But you should also check for power and telephone poles, roads, and farm development, including fields, stockyards, and buildings, etc. Have nestboxes or loafing platforms been installed in or near the wetland? How many are there? Can you identify their type? Are they being used? Has there been any peat extraction in the wetland? Can you tell to what depth and extent it has been extracted? Do farm animals graze on or near the wetland? Make notes and take photos of the areas affected by these activities. Note on your Wetland Map form where all human structures are located.



BACK FROM THE FIELD

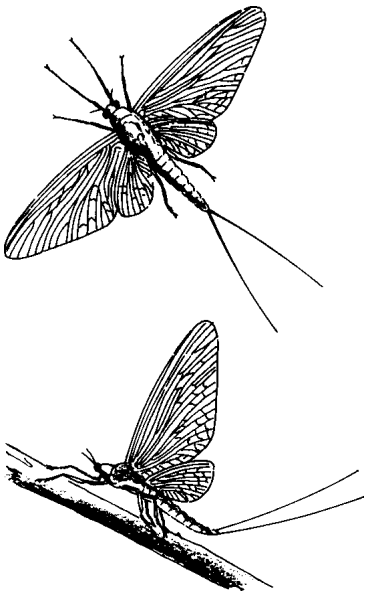
COLLATE AND ANALYZE DATA

Before drawing any conclusions from your on-site inspection, review your findings, as noted on your forms and in any additional field notes you made during your on-site visit. Then make a clean copy of both forms for your own reference and for any future submissions you're asked to make regarding the wetland.



Footprints (tracks):

CONCLUSIONS



mayfly *O. ephemeroptera*

Your initial wetland assessment has provided you with some basic information about the nature of your wetland. Review your Wetland Site Reconnaissance form and revised map carefully. Did your investigations uncover:

- impacted areas
- recent development activities
- areas of exceptional habitat value
- a number of distinct plant communities

Also, did you encounter any indications of *eutrophication* or nutrient loading? Did any of the water you tested, for example, indicate a high pH? And did you notice any mix of marsh and bog plant species? Odd combinations of species often indicate that a wetland is undergoing rapid change from a nutrient-poor to a nutrient-rich environment.

An initial wetland assessment doesn't usually answer all your questions concerning a wetland's health and values. Rather, it serves as the basis for mounting more detailed surveys of the area's plant, wildlife and amphibian populations – surveys that should give you a few more answers.

As a means of documenting your findings for later reference, establish an information binder that contains your revised Wetlands Map form, your Wetland Site Reconnaissance form, your field notes with photos to highlight your findings, and additional descriptive notes, as required (you may, for example, want to include a log detailing the events of the day the assessment was conducted). In a separate section provide summary notes of your findings, including your speculations about habitat values, information on human and wildlife impacts, potential problem areas, and opportunities for wetland restoration and/or enhancement activities.

As well as serving as a record, this information can be incorporated in presentations you make to agencies with a special interest in wetlands and should be included in any funding submissions for further monitoring activities. It can also be used in public information and educational materials and programs.

SUPPLEMENT 2.1–A

RECOMMENDED READING

Guard, B. Jennifer.
Wetland Plants of Oregon and Washington.
Vancouver, B.C.: Lone Pine Publishing, 1995.

Lyon, John Grimson.
Practical Handbook for Wetland Identification and Delineation.
Boca Raton, Florida: Lewish Publishers, 1993.

Meidinger, D. and J. Pojar.
Ecosystems of British Columbia, Special Report #6.
Victoria, B.C.: B.C. Ministry of Forests, 1991.

National Wetlands Working Group.
Wetlands of Canada.
Ottawa, Ontario and Montreal, Québec: Polyscience Publications Inc. in cooperation with Environment Canada and the Canadian Government Publishing Centre, Supply and Services Canada, 1988.

van Ryswyk, A.L., K. Broersma, and J.W. Hall.
Agricultural Use and Extent of British Columbia Wetlands., Technical Bulletin 1992-3E.
Kamloops, British Columbia: Agriculture Canada, Research Branch, Kamloops Research Station, 1992.

Yates, Steve.
Adopting a Wetland: A Northwest Handbook.
Snohomish County, Washington: Snohomish County Planning and Community Development, 1989. (distributed by The Adopt-A-Stream Foundation)

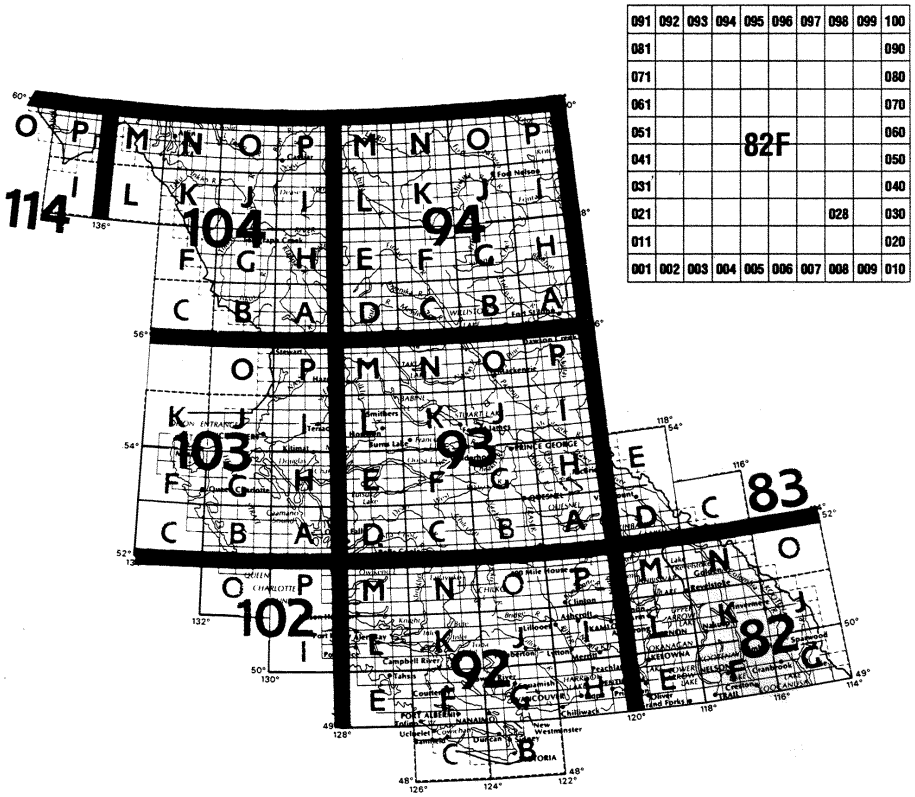
SUPPLEMENT 2.1–B

OBTAINING TRIM MAPS AND AERIAL PHOTOS

The map below is an index of the TRIM maps (1:20,000 scale) available from Maps BC, the centre for government map publication in Victoria. Find the index number and letter corresponding to the region that contains your wetland. Each lettered box is subdivided into 100 smaller boxes representing the 100 TRIM maps available for each region – see the example from area 82F in southeastern British Columbia. If you cannot identify the box in which your wetland is located, order an index map of the letter block area. Index maps provide much more detail about the terrain contained in each area. When you place your order, you can then order aerial photos for the same small box.

National Topographical Series (NTS) maps (1:50,000 scale) are indexed according to the same system. The lettered boxes, however, are each subdivided into 15 smaller boxes. Again, you must identify the small box that contains your wetland.

Maps BC does not accept orders over the counter. You can contact them in writing (1802 Douglas Street, Victoria, B.C. V8V 1X4) or by telephone (387-1441), or through your local government agent. Prepayment is required (by cheque or money order). Orders take about two weeks to process.



SUPPLEMENT 2.1–C

VON POST SCALE* FOR DESCRIBING PEAT DECOMPOSITION

Take a handful of peat and squeeze it tightly. Observe the colour of the water, the amount of peat that escapes between your fingers, and the content and texture of the residue to determine its decomposition class.

"Fibric" peat, found in bogs or poor fens; nutrient-poor

01

undecomposed:

plant structures unaltered

yields clear water, colourless or light yellow brown

02

almost undecomposed:

plant structure distinct

yields almost clear water, light yellow brown

03

very weakly decomposed:

plant structure distinct

yields distinctly turbid brown water

no peat substance escapes between fingers, residue not mushy

"Mesic" peat, found in fens; nutrient medium to medium-rich

04

weakly decomposed:

plant structure distinct

yields strongly turbid brown water

no peat substance escapes between fingers

residue very mushy

05

moderately decomposed:

plant structures clear but becoming indistinct

yields much turbid brown water

some peat escapes from between fingers

residue very mushy

06

moderately strongly decomposed:

plant structures somewhat indistinct but clearer in squeezed residue than in undisturbed peat

about 1/3 peat escapes between fingers

residue strongly mushy

"Humic" peat, found in swamps and marshes; nutrient medium-rich to rich

07

strongly decomposed:

plant structures indistinct but recognizable

about 1/2 peat escapes between fingers

08

very strongly decomposed:

plant structures very indistinct

about 2/3 peat escapes between fingers

residue almost entirely resistant

remnants such as root fibres and wood

09

almost completely decomposed:

plant structures almost unrecognizable

nearly all peat escapes between fingers

10

completely decomposed:

plant structures unrecognizable

all peat escapes between fingers

* *This scale was developed by Swedish scientist Lennart Von Post in 1922.*

SUPPLEMENT 2.1–D

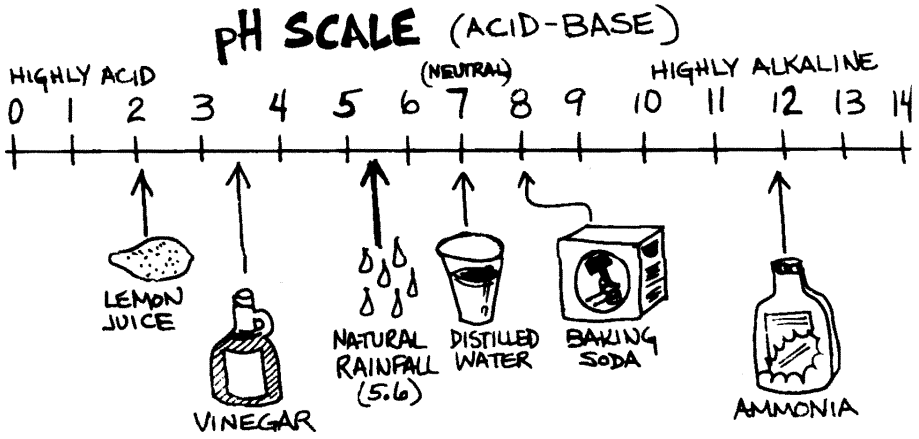
MEASURING pH

pH is the measure of hydrogen ions (H+) in a solution. The more hydrogen ions a solution contains, the more acidic it is. The opposite of acidic is alkaline. Acidity and alkalinity are measured on a scale ranging from 0 to 14, with 0 representing extremely acidic and 14, extremely alkaline.

Most natural systems have a pH of between 6.0 and 8.0 – the range most favorable to plant and animal life. When this level fluctuates to any extent – with the inflow of sewage into a wetland, for example – plants and animals are affected.

Several factors contribute to the acidity of water. Vegetation and underlying strata (rocks and soil) all have an impact. So do human activities, particularly chemical emissions from cars and industrial operations – the source of acid rain problems in southern Ontario's industrial belt. Other factors, such as the lime in runoff from household and agricultural products, have the effect of increasing alkalinity. Highly acidic solutions indicate a nutrient-poor environment; highly alkaline solutions, a nutrient-rich environment conducive to excessive plant growth.

Some wetland environments are highly acidic – peat bogs, for example – as a result of the naturally occurring organic acids in sphagnum moss and some species of wetland trees.



SUPPLEMENT 2.1–E

WETLAND SITE RECONNAISSANCE FORM

The Wetland Site Reconnaissance Form is a faithful replica of the form used by provincial wetland biologists and ecologists in the field. The categories it contains have already been described in the "Background" section of this module and in Section Three of the Handbook on "Wetlands Ecology." If you have difficulty understanding a particular category, turn to these references for more information.

Location: name of wetland and other general references to location, such as "off Hwy 99, two miles down Hackett Road"

Biogeoclimatic unit and ecosection: regional classification developed by the provincial government (turn to p. _ of Introductory Module 1 for more information on biogeoclimatic units and ecosections)

System: landscape classification according to the hydrology of the site (palustrine, lacustrine, fluvial, estuarine)

Subsystem: landscape classification according to the hydrologic connections (within the palustrine system only – headwater, terminal, linked, isolated)

Map sheet: map number of the TRIM/NTS maps that contain the wetland; also, the latitude and longitude of the wetland (if the wetland is very large, use its geographic centre as your reference)

Elevation: as indicated on the NTS (topographical) map of the wetland

Plan sketch: general outline of the entire wetland , showing only major features and wetland classes. Label each of the different sites you investigated for soil type, plant species and other features as A,B,C, D, etc. to correspond to the descriptions you are providing in the Unit Description section of the form.

Profile sketch: a side view of the wetland, identifying the plant communities as you progress from the edge to the centre of the wetland

Unit (%): site references, as labelled A,B,C,D, etc. over each of the four columns provided (use another sheet if you investigated more than four sites)

Position: general location of each site reference you've investigated in the wetland, using terms like peripheral, central, island, outflow stream, etc.

Surface pattern: general shape or pattern of the wetland, according to how it originally formed, using such terms as flat, hummocked, domed, ribbed, channelled, and floating, etc. (turn to p. _ of Introductory Module 1 for more information on wetland surface patterns)

Depth to water table: distance from the soil surface to the seepage water at the bottom of a soil pit. Once you have dug your pit or removed the core, wait for several minutes until the water table settles at its natural level before taking your measurement.

Soil classification: type of soil you find when you dig a soil pit or take a peat core – class it as Organic if it contains more than 40 cm peat and Mineral if it contains less than 40 cm peat.

Texture/Von Post: degree of peat decomposition according to the Von Post Scale in Table 1C

Depth of organic: depth of peat from the surface to mineral soil

SMR/SNR: these acronyms refer to the "soil moisture regime" and the "soil nutrient regime". This category is completed by the government to indicate site potential and need not be filled out.

pH: pH (alkaline/acidity) readings of the water from each soil pit and/or peat core you dig during your mapping

Flood/saturation: frequency of flooding at each site reference on your mapping of the wetland (permanent, seasonal, occasional) and period of saturation (permanent, semi-permanent, seasonal)

History and modification notes: any comments regarding human impact on hydrology, impact of animal activity (particularly beaver); impending problems due to human or animal activity in adjacent areas

Class: the particular wetland class represented by each of the different site references you investigated

Site association: dominant vegetation in the immediate area of each site reference

Percent cover of tree, shrub, herb and moss species: rough estimate of the percentage vegetation represented by each of these wetland plant types

Species: the most common plant species on the reference site and a "ballpark" estimate of its percentage representation

Notable features: plant or animal features that draw your attention as you conduct your investigation

Wetland Site Reconnaissance

Location				
Biogeoclimatic Unit		Ecosection		
System	Subsystem		Element	
NTS Map	Lat	Long	Elev	
Unit (%)				
Position				
Surface Pattern				
Water Table (cm)				
Soil Classification				
Texture/Von Post				
Depth of Organic				
SMR/SNR				
pH				
Flood/Saturation				
History and Modification Notes				

Card of	
Date	
Surveyor	
Site #	
Plan Sketch approx ha.	
Profile Sketch	
Photos	

Unit Description

Class				
Site Association				
% Cover TREE SHRUB HERB MOSS				
Species (%)				
Notable Features				

SUPPLEMENT 2.1–F

WETLAND MAP FORM

The Wetland Map Form is a faithful replica of the form used by provincial wetland biologists and ecologists in the field. The categories it contains have already been described in the "Background" section of this module and in Section Three of the Handbook on "Wetlands Ecology." If you have difficulty understanding a particular category, turn to these references for more information.

General locations: the name of the wetland, if it has one, and its location in relation to other local landscape features

Lat/long: as indicated on the NTS (topographical) map of the wetland

Driving directions: the easiest and most convenient way to get to the wetland via car

Map: establish a scale for the graph and specify orientation. Use a ruler and protractor and consult your mapping notes to plot the wetland. Join points, adjusting the shape slightly to accommodate for minor variations in the wetland perimeter. Note open water, plant communities, inflow and outflow water courses, land-use activities within and near the wetland, evidence of wildlife.

Observations: general description of important features in or beside the wetland. Note human and animal activities that may impinge on wetland's hydrology and water quality. These features affect its overall productivity.

Wetland Map

Name of Observers and Contact

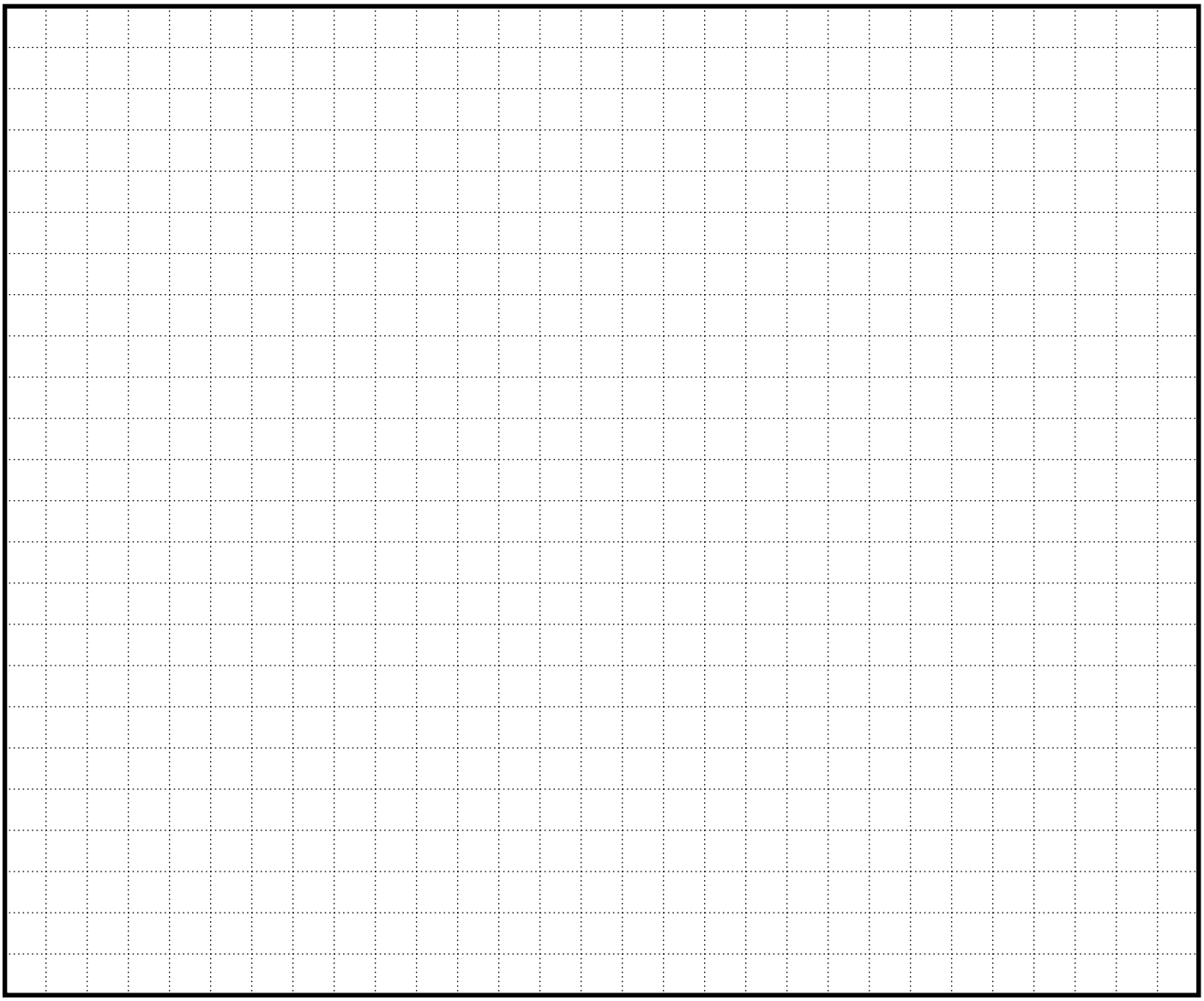
Wetland Locations:

General Locations

Lat/Long

Driving Directions

Wetland Map
Include: Scale and Dimensions, Orientation, Open water, Different plant communities, Inflow and outflow locations, Wetland and adjacent land-use activities.

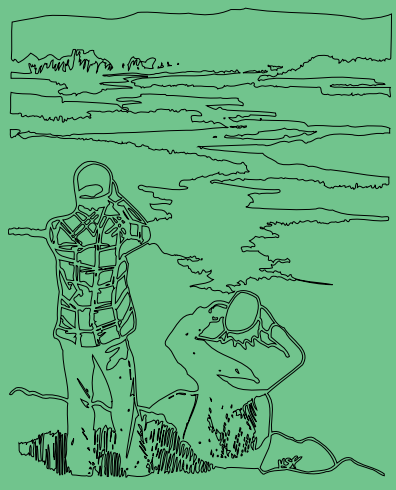


Observations:

Section Five

Conducting a Survey of Wetland Plants

Module 2.2



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

MATERIALS AND EQUIPMENT REQUIRED FOR THIS ACTIVITY:

rubber boots (waders are useful also)
notebook (waterproof paper)
lead pencils
extended length tape measure (waterproof cloth)
4 – 1 m sticks screwed together at the corners (quadrat)
1 m stick measure
string
flagging tape
wooden or metal stakes (with prepainted heads for visibility)
binoculars
camera and film
wetland map
field guides
field data sheet*
*provided at the back of the module

Welcome to the Wetlandkeepers Program

You are about to embark on a fascinating investigation – wetlands play an essential and complex role in the wellbeing of our environment. These training modules have been developed by Environment Canada to encourage public participation in monitoring wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, each module provides information on a specific wetland monitoring activity. Many volunteer groups, schools and individuals have already become wetlandkeepers and invite you to join in the conservation of our precious wetland resources.

Acknowledgements

The information for this module was compiled by Emma Child of the Land for Nature initiative, Federation of B.C. Naturalists, with the assistance of Cynthia Durance of Precision Identification Biological Consultants, Vancouver. Illustrations and other visual materials have been provided courtesy of University of Washington Press (*Vascular Plants of the Pacific Northwest* by C.L. Hitchcock, A. Cronquist, M. Ownbey and J.W. Thompson, 1969); Washington State Department of Ecology (*At Home with Wetlands, A Landowner's Guide by J.P. Michaud, illustrations by S. Noel*); and the Land for Nature initiative.

Project activity and purpose

This module provides details on how to conduct a plant survey by identifying the plant species found in a wetland and estimating the proportion of wetland area each species occupies. With this information, you can monitor changes in the composition and variety of the wetland's plant community, reviewing all your wetland observations and data to determine why these changes have occurred. Plant surveying builds on the basic mapping and survey work described in Module 2.1 and provides baseline data for the development of long-term wetland monitoring and restoration activities.

BACKGROUND

Vegetation is a very distinctive characteristic of wetlands. Only plant species adapted to growing in saturated, *anaerobic* or oxygen-deficient soils can survive in this ecosystem. Called *hydrophytes*, these species are reliable indicators of the presence of a wetland and are usually referred to as *indicators* or *indicator species.*

Vegetation is also an important measure of *biodiversity*. Biodiversity is the term we use to describe the variety of plant and animal species in a particular ecosystem. We say that an ecosystem has low biodiversity when it supports relatively few species and high biodiversity when it supports a wide variety of plant and animal life. The higher its diversity, generally the healthier an ecosystem is.

How is biodiversity maintained in a wetland? Wetland *plant communities* (groups of plants with the same habitat preferences) create a variety of "niches" – small, specialized ecosystems – within the context of the larger wetland ecosystem. Each niche supports a number of plant and animal species specifically adapted to it. The greater the variety of niches, the larger the number of plant and animal species – and the greater the wetland's biodiversity. Most animals have very specific and limited vegetation preferences. A variety of plant species can therefore support an even broader variety of wildlife species.

Red Alder Alnus rubra *is a good example of a hydrophyte that occurs in both wetland and non-wetland areas.*

Plants are the primary producers in the food chain and support all other life. They derive their energy from the sun through *photosynthesis* and pass it to other animals when they are consumed. The *primary productivit*y of an ecosystem – the number and variety of plant species it supports – is a good indicator of its overall biological productivity. The more energy an ecosystem possesses in the form of vegetation, the more wildlife species it can support.

But wetland plants provide much more than food. They also serve as cover against predators, supply nesting materials, ensure isolation during the breeding season, and contain places to roost and loaf. They give shade to wetland streams, preventing evaporation, and are also reliable indicators of change in water quality and flow. The appearance of algae blooms, for example, often signals increased *nutrient loading* from adjacent land (e.g. sewage). The invasion of plant species typical of a dry ecosystem usually indicates a drop in the wetland's water levels.

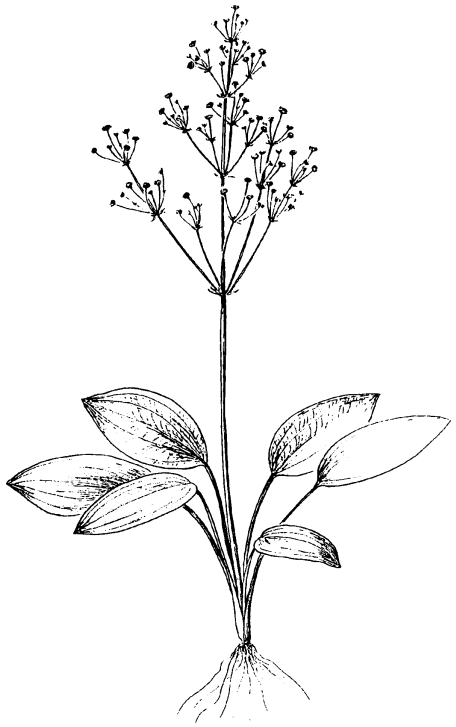
Among the most important functions performed by wetlands vegetation is the filtering and chemical reduction of pollution. Many wetland plants absorb human pollutants (e.g. phosphorous, nitrates, ammonia) and actually transform them into less toxic substances before releasing them again into the environment. They also slow water flow, allowing solid materials to settle out and accumulate on the soil surface. Because of

these valuable qualities, wetlands are sometimes used as sites for secondary sewage and stormwater treatment.

The vegetation surrounding a wetland – called a *buffer zone* – plays a key role in wetland conservation. Buffers can extend for up to 1.5 km beyond a wetland's perimeters and represent a transitional zone between wetland and drier upland habitat. Often they possess the characteristics of both habitats and support a diverse array of aquatic and terrestrial life. This diversity, commonly referred to as the *edge effect*, enhances the biodiversity of the wetland as a whole. Buffer zones protect wetlands against disturbance and provide habitat for amphibians and other wildlife that require wetlands for part of their life cycle.

Regular plant surveys are an excellent way to monitor a wetland's health. The survey techniques described in the following pages are simple, require little equipment, and can easily be adjusted to increase survey accuracy, depending on the volunteer capability and interests of your group.

Water Plantain Alisma plantago-aquatica *is commonly found in freshwater marshes around British Columbia.*



BEFORE YOU GO TO THE FIELD

OFF-SITE PREPARATION

Step 1
Review other wetland research and assessments

Study any previous assessments completed on the wetland, including the mapping activity described in Module 2.1. Note the number of plant communities and their composition. Contact the Conservation Data Centre housed in the B.C. Ministry of Environment, Lands and Parks in Victoria and ask the Centre to provide you with information on non-native (also called exotic), rare and endangered wetland plants in your area (a list of the main agencies to contact and their addresses and/or phone numbers is provided at the back of the module). CDC asks that all information requests be addressed to the Centre in writing.

Familiarize yourself with the plant species cited and others you might expect to find in your wetland. Review your reference materials carefully – it's essential to be able to recognize the plants once you're on site. Choose a good field guide, one that covers the area where the wetland is located. Field guides cite both the scientific and common names of species and provide information on where they can be found, their form and structure, their life cycles, and usually a photo or illustration to aid in identification. Familiarize yourself with your guide before taking it into the field so you can easily look up references while you're collecting data. Appendix 2B provides a list of recommended field guides, based on where you live in the province.

To conduct your survey successfully, you should be aware of two basic concepts respecting vegetation assessment – *plant type* and *vegetation stratum*.

PLANT TYPE

Wetland vegetation is generally divided into 16 plant types, as listed in the box at the right. This typology is based on the *physiognomy* or physical characteristics of plants and is not species specific. Several plant types can appear in a single plant community.

In wetlands, plant types vary according to the wetland class. Aquatic and emergent plants (water milfoil, water lilies, duckweed, bullrushes, cattails) appear primarily in freshwater marshes. Mainly woody vegetation (shrubs and trees like the Sitka spruce, red alder, willow and spiraea) grows in swamps. Mosses (mainly sphagnum) are common to bogs.

As discussed in Section Three of the Handbook on "Wetlands Ecology," a single wetland usually contains more than one wetland class. Changes in plant type and plant community are evident in the transitional zones between the classes as elevation increases and the water table drops. These zones are important to identify and record in the course of conducting your plant survey.

16 PLANT TYPES

The 16 plant types commonly found in wetlands (turn to the back of the module for a list of typical wetland plant types and species):

- treed (coniferous, hardwood, including dead)
- shrub (tall, low, mixed)
- forb (i.e. non-grassy herbs)
- grass (family Gramineae)
- rushes (tall, low)
- sedges
- moss
- lichen
- aquatic (emergent, submerged)
- non-vegetated (>5% vegetative cover)
- introduced

VEGETATION STRATUM

Vegetation varies in height and type within a particular plant community. A vegetation stratum represents a single, horizontal layer of vegetation within the community. When we speak of a "tree layer," for example, we are referring to vegetation that is more than 7 m high. A "tall shrub layer," by comparison, is between 1.5 and 7 m high. And a "low shrub layer" is less than 1.5 m in height. The box at the right lists the vegetative strata commonly cited in plant surveys.

Your choice of survey method depends on the size and apparent diversity of your wetland. In general, if the wetland is larger than 2 hectares or seems to have a diverse vegetation cover, you should opt for a more comprehensive approach. The method described below can be adapted to your needs – expanded for a very thorough survey, or reduced for a quick "snapshot" of wetland plant values.

VEGETATIVE STRATA

The horizontal vegetation layers of a wetland plant community (turn to the back of the module for a list of typical wetland plant types and species):

- tree < 7 m
- tall shrub 1.5 – 7 m
- low shrub >1.5 m
- herbaceous grass and forb
- rush and sedge
- moss and lichen
- emergent
- submerged aquatic

IN THE FIELD

SETTING UP FOR YOUR SURVEY

Before finalizing your survey preparations, review Section Two of the Handbook on "Getting Started." Then consult the list at the front of this module for details on the equipment you'll need. Don't forget to include relevant map(s) as well as your list of plants commonly found in the area, one or more field guides, and a few copies of a data sheet like the sample Field Data Sheet. Complete the top portion of the sheet ahead of time, if possible, to reduce confusion when you analyze your findings later.

Field Data Sheet Vegetation Survey

Summary Data

Name(s):

Date:

Approx. location of class along transect metres to metres.

transect i.d.#

quadrat i.d.#

quadrat location:

(take location measurements from transect's outer end point)

Data sheet of

Site name

Site location:

Class

Class Description

❑ tree ❑ herbaceous ❑ rush/sedge

❑ shrub ❑ moss/lichen ❑ aquatic

Plant Type	*Tot % Cover*	*Species scientific/common name*	*Species % Cover*	*Notes*
coniferous tree				
deciduous tree				
tall shrub				
low shrub				
forb				
grass				
rush				
sedge				
moss				
lichen				
aquatic emergent				
aquatic submergent				
non-vegetated				
introduced				

Voucher specimens with id# (continue on back):

Step 2
Obtain approvals

If the wetland is on private land, contact the landowner to obtain permission to conduct the survey.

Most publicly owned lands afford free access to local residents. However, if your wetland is in a public park or wilderness area, you may be required to submit an outline of your study to the parks or area manager. The Greater Vancouver Regional District, for example, requests that community groups inform them of any surveys they're conducting in GVRD-managed parks. Check with the relevant government authority if you're unsure of what approvals are required.

Harvesting of plants on public lands should be kept to a minimum. Your main purpose for being in the area is to conduct a survey. Try to limit your impact on the natural habitat.

Step 3
Walk the wetland

Take a slow walk through your wetland in order to familiarize yourself with the different wetland classes and the plant types in each. Pay particular attention to changes in elevation, as you are likely to find a corresponding change in plant type. Examine the vegetation layers in each class. The marsh class might have only one layer (herbaceous), the forested buffer zone, three (tree, shrub and moss). Sample areas from all of these classes and their vegetation layers should be included in your plant survey.

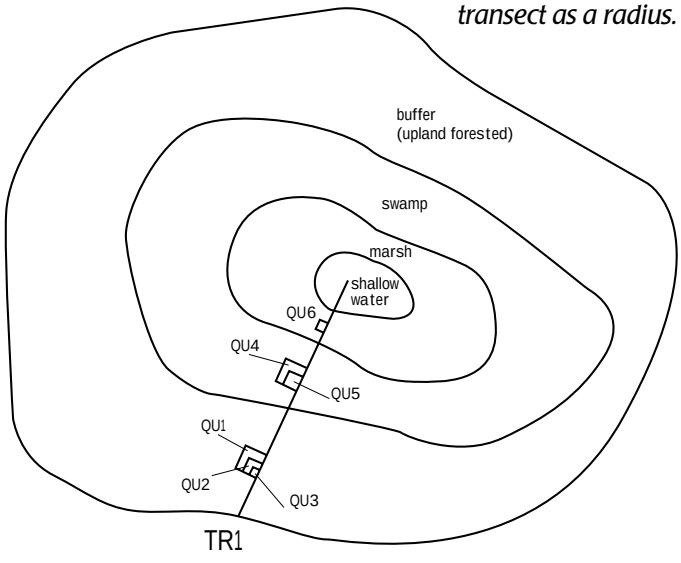
Step 4
Set out a transect

Establish a transect, using a length of rope with each metre marked with flagging tape and a peg at either end. A *transect* is a straight line which extends from the lowest point of a wetland to its outer edge, cutting through all the wetland's classes. The outermost point should be located beyond the wetland boundary (i.e. extend into the buffer zone), as determined in Module 2.1. The easiest way to visualize this line is to think of the wetland as roughly circular in shape and the transect as a radius.

If you cannot establish a rope transect, start at the transect's outer point and, using a compass, move towards its inner point. Once the transect is in place, give it an identification number – e.g. "TR 1" – and record its location in your field notebook. Be as accurate in your description as possible (include a sketch showing its position, if necessary) as you want to be able to set up the same transect in your next survey. Now measure each wetland class along its length, bearing in mind that your measurements will be approximate. The boundaries between classes represent transitional areas and will likely be difficult to distinguish.

The more transects you set out in your wetland, the more complete and accurate your survey is likely to be. Ultimately, the number of transects depends on the time you have available, the size of your volunteer force, and the level of effort you want to put into the activity.

Think of the wetland as roughly circular in shape and your transect as a radius.



Step 5
Mark out quadrats

Start at one end of the transect and establish a quadrat. A *quadrat* is a square area from which samples and measurements are taken. It can be marked on the ground by four pegs and a length of string, or by four collapsible metre sticks screwed together at the corners. One side of the quadrat must lie along the transect. You collect and record all the vegetation information contained in the quadrat. Quadrats are established for every vegetation layer in a particular wetland class. They vary in size according to the vegetation layer being analyzed, as specified below. While small quadrats lie inside larger quadrats, all the quadrats must have one edge on the transect line. Each should also be identified by a number – e.g. "QU 1."

Vegetation Layer	Quadrat Size
herbaceous	1 sq metre
rushes	1 sq metre
sedges	1 sq metre
moss	1 sq metre
lichen	1 sq metre
shrub	5 sq metres
tree	10 sq metres

Sampling with quadrats.

It may be difficult to access the emergent and submerged aquatic layer in the marsh class of your wetland. Also, floating vegetation tends to be patchy. If you decide to go ahead with quadrats, you will need several of them to capture all the vegetation layers. As an alternative, try to "eyeball" the vegetation in the water.

Avoid placing quadrats in the transitional areas between wetland classes as they will not give as accurate a picture of the classes' plant communities. Select a representative area within the class and along the transect. Then record the quadrat's distance along the transect from the transect's outer point.

Step 6
Identify plants

Using the field guide(s) you've selected for the survey, identify the plant species in each quadrat. Plants are classified according to their reproductive mechanisms – their flowers and seeds. Your guide probably contains line and/or colour illustrations of each species and perhaps a photo. Use the guide's identification system and visual references first. If you're still unable to identify a particular plant, have a look at its height and leaf pattern, and take note of its physical surroundings (particularly elevation) and range. Except in the case of trees, avoid basing identification solely on leaf shape. Many plants in British Columbia have similar leaf shapes.

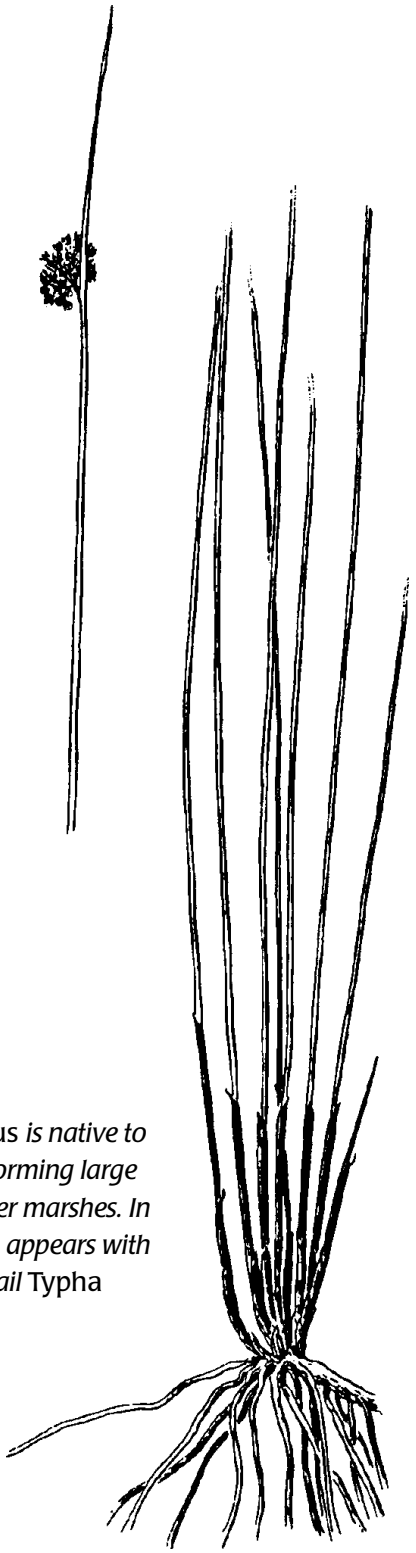
arrowhead *Sagittaria latifolia*

Step 7
Identify exotic species

Exotic is the term applied to plant species that are not native to British Columbia. The most common exotic plants you are likely to encounter in a local wetland are also *invasive*. Invasive species literally invade and overrun a wetland, often choking out native plants in the process. As a result, they reduce the biodiversity of the wetland.

Three species of exotic invasives and one native invasive are commonly found in local wetlands: purple loosestrife *Lythrum salicaria*, Eurasian water milfoil *Myriophyllum specatum*, canary reed grass *Phalaris arundinacea*, and the native species soft rush J*uncus effusus*.

Record the location of all exotic species and the extent of their cover. Do not remove the plants in case they have been incorrectly identified. Take a good photo for identification purposes and report the presence of the species to the Conservation Data Centre (CDC) in Victoria. It is important to monitor exotics on an occasional basis, as they have much to reveal about wetland health.



Soft rush Juncus effusus *is native to the Pacific Northwest, forming large stands in tidal freshwater marshes. In inland marshes, it often appears with stands of common cattail* Typha latifolia.

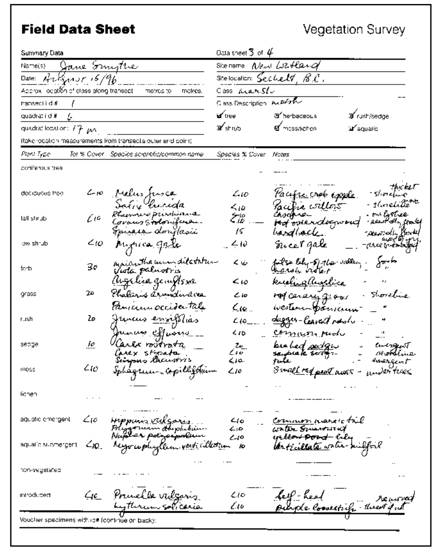
Step 8
Collect information on each vegetation layer

Identify each plant species you see and make a simple list of all the species present. Estimate the percentage cover of each species according to how much space the species occupies within the quadrat. Your estimates should vary from a low of 10% up to 100%. Also estimate the percentage cover of vegetation for the layer as a whole. It takes some practice to estimate cover accurately. Do your estimating with another person to begin with, so you can compare estimates and agree on a figure.

Use a separate Field Data Sheet for each set of quadrats you inventory in a particular zone. Remember – small quadrats lie within larger quadrats. Fill in the top of the sheet first, recording the date, the names of those collecting data, etc. Then record your findings, identifying the plant species and percentage cover for each vegetation layer. Always use the latin name of the species, noting its common name in brackets. In instances where the percentage cover of a species is less than 10%, name the species and record your estimate as “<10%”.

When you cannot identify a particular species, record it as “miscellaneous”. If the plant is common, take a voucher specimen (see Step 9, below) for later identification by an expert. Never take specimens of rare plants. Instead, make a sketch of the plant and describe its structure, colour and approximate dimensions – or bring an expert on your next wetland outing to make the identification for you. Experts can include botanists at local colleges or universities; staff of the provincial ministry of Environment or Forests, or the Royal British Columbia Museum; staff at the federal offices of Environment and Fisheries and Oceans; and members of local natural history clubs and other conservation organizations.

Under “Notes,” make as many observations about each plant species as possible. Describe the soil, exposure to the sun (i.e. exposed, shaded), signs of disease, signs of drying out, and indications of livestock/wildlife browsing or trampling. Review the information contained in your field guide and note where the plant differs from the guide’s description. Sketch the plant to illustrate hard-to-describe characteristics.



Describe each plant species as completely as possible.

Step 9
Collect and preserve specimens

Voucher specimen is the term used to describe plants or plant clippings taken from the field for identification purposes, or to start a plant reference collection. If the plant is herbaceous, take the whole plant, including its roots, as a specimen. If the plant is a shrub, take a small twig with leaves. If the plant is a tree, take only a leaf. Put each specimen in a paper bag, assign a number to the bag, and immediately record the number on your Field Data Sheet under "Voucher Specimens." Be sure the number you assign is unique, to avoid confusion when you examine the bags after your survey.

After you've returned from the field, press all your specimens in weighted newspaper (stacked newspapers weighted with bricks or some other heavy object). Keep the specimens in one piece and avoid bending or folding them. Press them until dry, usually about two weeks. You might then start a plant reference collection by placing all your preserved specimens in a binder with plastic-sheeted pages (such as a photo binder). Reserve a page for each specimen, categorizing and labelling each according to plant type and species, and location in the wetland (TR and QU reference). Plant collections are a useful training device for new volunteers inexperienced in plant identification.

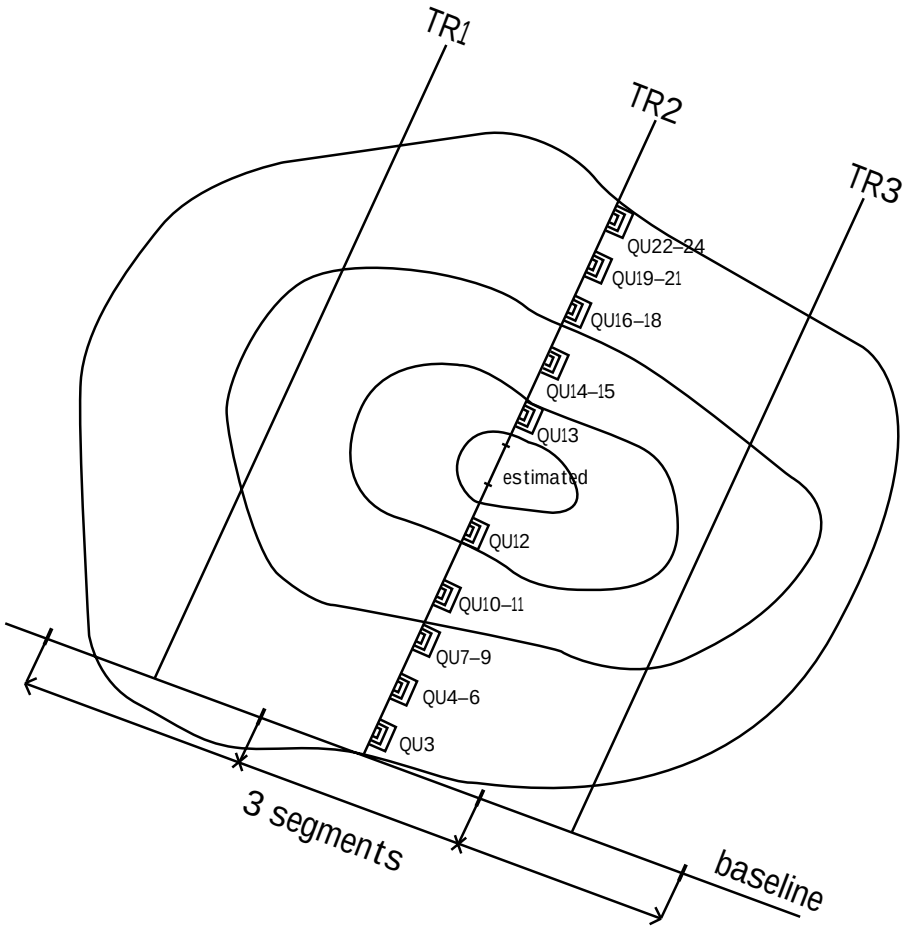
Step 10 (Advanced) Establish a baseline

IN THE FIELD

CONDUCTING A MORE COMPREHENSIVE SURVEY

Steps 10 through 12 are considered advanced. To conduct a more scientifically rigorous survey, set up more transects and place quadrats at equal intervals along all transects. The instructions provided in the next three steps repeat, in part, the instructions contained in Steps 3 and 4. They're included here because they elaborate somewhat on the previous instructions.

Begin by selecting a baseline that runs roughly parallel to one of the wetland's boundaries, or along a conspicuous wetland feature (a road, for example). The baseline must span the entire wetland and lie perpendicular to the wetland's water sources, cutting through the sources. This ensures that the data you collect accurately reflects the impact of water flow on vegetation. As you repeat your survey over time, using the same baseline, you can establish if the wetland is expanding or drying out, and where changes are taking place.



Establish a baseline that runs across the entire wetland and is perpendicular to the wetland's water sources.

Step 11 (Advanced) Set out at least three transects

Divide the baseline into equal segments, depending on the number of transects you plan to set out – three segments, for example, in the case of three transects. Determine the number of transects according to the level of effort you want to put into the survey. You should set out at least three transects, more if you want to conduct a more complete survey.

The midpoint of each segment represents the starting point of the transect. Set out the transect, as described in Step 3, from this point to the opposite edge of the wetland. Identify the wetland classes along the transect and record their approximate location in your field notebook.

Step 12 (Advanced) Mark out quadrats

Set out quadrats at equal intervals along each transect, establishing at least two separate quadrats within each class. This means that the space between quadrats can be no larger than half the length of the smallest class along the transect. The more complete and accurate you want your survey to be, the more quadrats you should set out. But remember – each vegetation layer within each quadrat must be analyzed, making the survey more onerous for volunteers every time you add a quadrat.

BACK FROM THE FIELD

COLLATE AND ANALYZE DATA

When you return from the field, group your data sheets by quadrat. If you've completed more than one quadrat for any class, group them together with the first batch. This gives you a complete set of raw data for each class. Now review your wetland map to ensure that all your transects and quadrats are included and labelled by the number you assigned to each of them in the field. Then examine your data in terms of three critical wetland features – biodiversity, rarity of species, and the wetland buffer zone.

DETERMINING SPECIES ABUNDANCE AND BIODIVERSITY

There's no single, reliable formula for calculating the degree of biodiversity in a wetland. But a good first step in assessing this crucial indicator of wetland health is to tally up the plant species you identified in your survey. Start by tallying the total number of species for the entire survey, then tally the number in each class and, finally, the number in each vegetation layer.

Now have a close look at your figures. Which class or vegetation layer is the most diverse? Which is the least diverse? Are some classes or layers completely made up of a single species? What is happening in other layers in the same quadrat, or in adjacent classes? If you've already conducted previous surveys, how is the present diversity of each class or layer changing over time?

Take a look at the percentage cover figures you've recorded. List the plant species in order of abundance – starting with the most abundant – as they appear in the entire survey and in each class and vegetation layer. Then compare your findings on a class-by-class, layer-by-layer basis with the species tallies you made, above. Which species dominate in the wetland? Which species dominate in the most diverse classes and layers? By comparing percentage cover changes from one inventory to the next, you get an accurate picture of the composition of plant communities over time.

IDENTIFYING RARE SPECIES

Take another look at your percentage cover figures. Which species are present in very limited numbers? What are their defining characteristics? Are they considered rare or endangered according to the information you obtained from the Conservation Data Centre?

By identifying these plants you can keep track of them in later surveys, recording exactly where they are located and even counting the number of individual plants that appear in survey quadrats. You might also want to investigate their presence outside the quadrats from survey to survey, noting their location and also keeping count of their numbers. Be sure, in this last instance, to keep your "outside" figures separate from your formal survey figures.

Some black cottonwood *Populus trichocarpa* communities have been blue listed by the Conservation Data Centre. "Blue listed" plants are considered at risk of becoming threatened. "Red listed" plants are already threatened or worse.

Cottonwood Populus trichocarpa

SIZE OF BUFFER ZONES

Buffer zones are critical to wetland conservation and health. But, like biodiversity, no exact formula has been developed to determine optimum buffer size. Size depends mainly on the class of wetland and the degree of disturbance beyond its edge. Bogs, for example, generally require the largest buffer because they are the most sensitive to disturbance.

A buffer begins where the wetland ends. The line of demarcation is rarely obvious, but may be established by an examination of the area for changes in vegetation and soils. Module 2.1 contains full details of how you can determine a wetland border by means of soil samples. If you haven't already completed this earlier module, you may want to review the material contained in it.

Review the notes you recorded on your wetland's buffer. Then take a closer look at some of the features that may be affecting its functioning:

- Steeply sloped areas with unstable soils should have a wider buffer than gentle slopes with stable soils.
- Highly compactable soils, such as the sandy mineral soils typically found at a wetland's periphery, require a larger buffer to maintain wetland shape and structure.
- By leaving the forest floor intact around a wetland, overland flow and siltation are reduced, and percolation is maintained.

- Above-ground inflow streams to the wetland require a buffer to filter water, maintain water levels, regulate temperature, and provide insects as food for aquatic life.
- What is happening in the upland around the wetland? Is it an urban area? Is it wilderness? Is it being logged? If there are homes or logging operations in the area, the buffer should be wide enough to compensate for pollution run-off and siltation.
- Buffers help prevent the introduction of exotics and invasives to the wetland by providing a physical barrier to seed introduction. This protection is all the more important when development or logging operations are under way in adjacent areas.

Do you think its buffer is adequate for your wetland? For more precise information on buffer requirements, consult the *Forest Practices Code* (under "Operational Planning Requirements") and the *Land Development Guidelines for the Protection of Aquatic Habitat*. While these publications, available through the provincial government (Ministry of Forests and Ministry of Environment, Lands and Parks), are designed primarily for holders of forest and range tenures, and for professional developers, they give you some indication of buffer requirements as determined by the government, based on research and experience. Experts at the regional offices of these ministries may also be able to offer an informed opinion or advice concerning the adequacy of your wetland's buffer.

CONCLUSIONS

If your study has been funded, your funders will be interested in obtaining information on your findings. Government and key non-government agencies will also be interested, particularly if you've detected problems in wetland functions (in hydrology or water quality, for example), or observed rare or endangered plant species in the area. Perhaps you want to apply for additional funds, or develop materials for use in educational programs.

Whatever your reason, it's a good idea to complete a general report of your findings. Reports of this type usually include a description of the wetland, the goals and objectives in conducting the survey, a description of the methodology, findings, interesting comparisons with previous surveys, and a final section on conclusions. If you've used specific sources or reference materials, you should list them as well. Also include a copy of your wetland map indicating the areas you inventoried.

Annual plant surveys are a crucial component of any wetland monitoring program. They enable you to identify problems at an early stage and take action to prevent further damage (even if this only involves informing the appropriate authorities of the need for action). They provide you with "scientific and objective proof" to present to municipal and other government officials in the frequent debate over conservation bylaws, policies and practices. And they encourage public awareness and participation in conservation initiatives.

If they are to be used for these purposes, however, your surveys must be conducted consistently to a high standard. This means using the same methods from survey to survey and recording every detail of what is done on your Survey Data Sheets. Try to conduct your survey every year on the same date (or as close as possible to it) to ensure that your data is comparable from one survey to the next. Keep strict records of voucher specimens. Use latin names when you are recording plant species and put common names in brackets. Always record your actions, observations, and other remarks as you make them, not at the end of the survey.

SUPPLEMENT 2.2–A

RECOMMENDED READING

Bigley, Richard and Sabra Hull.
Recognizing Wetlands and Wetland Indicator Plants on Forest Lands, Contribution No. 300.
Washington State, U.S.A.: Washington State Department of Natural Resources, Forest Management Division, January 1993.

Meidinger, Dale and Jim Pojar.
Ecosystems of British Columbia.
Victoria, B.C.: B.C. Ministry of Forests, February 1991.

Mueller-Dombois, D. and H. Ellenberg.
Aims and Methods of Vegetation Ecology. 1974.

National Wetlands Working Group.
Wetlands of Canada.
Ottawa, Ontario and Montreal, Quebec: Polyscience Publications Inc. in cooperation with Environment Canada and the Canadian Government Publishing Centre, Supply and Services Canada, 1988.

Weinmann, F., M. Boule, K. Brunner, J. Malek and V. Yoshino.
Wetland Plants of the Pacific Northwest.
Seattle, Washington: U.S. Army Corps of Engineers, 1984.

SUPPLEMENT 2.2–B

RECOMMENDED FIELD GUIDES

South coastal British Columbia:

Lewis Clark's field guide to wild flowers of marsh and waterway
Lewis Clark. Sidney, British Columbia: Gray's Publishing Limited, 1974.

Plants of Coastal British Columbia, including Washington, Oregon and Alaska
Jim Pojar and Andy MacKinnon. Vancouver, British Columbia: Lone Pine Publishing, 1994.

Wetland Plants of the Pacific Northwest
F. Weinmann, M. Boule, K. Brunner, J. Malek and V. Yoshino. Seattle, Washington: U.S. Army Corps of Engineers, 1984.

North coastal and interior British Columbia:

Plants of the Western Boreal Forest and Aspen Parkland
Derek Johnson, Linda Kershaw, Jim Pojar and Andy MacKinnon. Vancouver, British Columbia: Lone Pine Publishing, 1995.

Plants of Northern British Columbia
Andy MacKinnon, Jim Pojar and Ray Coupé, eds. Vancouver, British Columbia: Lone Pine Publishing, 1992.

South central interior British Columbia:

Wetland Plants of the Pacific Northwest
F. Weinmann, M. Boule, K. Brunner, J. Malek and V. Yoshino. Seattle, Washington: U.S. Army Corps of Engineers, 1984.

Trees, Shrubs & Flowers to Know in British Columbia and Washington
C. P. Lyons and Bill Merilees. Vancouver, British Columbia: Lone Pine Publishing, 1995.

Plants of Southern Interior British Columbia
Roberta Parish, Ray Coupé and Dennis Lloyd, eds. Vancouver, British Columba: Lone Pine Publishing, 1996.

SUPPLEMENT 2C

COMMON WETLAND PLANTS

Deep freshwater marshes:

Lemna minor
common duckweed

Myriophyllum spicatum
Eurasian watermilfoil

Nuphar polysepalum
spatterdock

Numphaea odorata
white water lily

Scirpus acutus
hardstem bulrush

Alisma plantago-aquatica
water plantain

Swamps:

Alnus rubra
red alder

Athyrium filix-femina
lady fern

Cornus stolonifera
red-osier dogwood

Fraxinus latifolia
Oregon ash

Lysichitum americanun
skunk cabbage

Physocarpus capitatus
Pacific ninebark

Picea sitchensis
Sitka spruce

Pyrus fusca
western crabapple

Salix spp.
willow

Spiraea douglasii
Douglas spiraea

Shallow freshwater marshes

Bidens cernua
beggars–tick

Eleocharis spp.
spike rush

Epilobium angustifolium
fireweed

Epilobium watsonii
marsh willow-herb

Impatiens noli-tangere
touch-me-not

Iris pseudacorus
yellow iris

Lythrum salicaria
purple loosestrife

Oenanthe sarmentosa
water parsley

Phragmites communis
reedgrass, common reed

Polygonum spp.
smartweed, knotweed

Sagittaria spp.
arrowhead, wapato

Scirpus microcarpus
small-fruited bulrush

Sparganium spp.
burreed

Typha latifolia; Typha angustifolia
common cattail; narrow-leaved

Wet meadows:

Juncus effusus
soft rush

Phalaris arundinacea
reed canarygrass

Ranunculus spp.
buttercup

Rumex spp.
dock

Low salt/brackish marshes:

Cotula coronopifolia
brass buttons

Cuscuta salina
saltmarsh dodder

Jaumea carnosa
fleshy jaumea

Lilaeopsis occidentalis
lilaeopsis

Salicornia virginica
pickleweed, glasswort

Scirpus americanus
American threesquare

Spartina alterniflora
smooth cordgrass

Spergularia marina
saltmarsh sandspurry

Triglochin maritimum
seaside arrowgrass

High salt brackish marshes:

Aster subspicatus
Douglas aster

Atriplex patula
saltweed, orache, fat hen

Carex lyngbyei
Lyngby's sedge, slough hedge

Deschampsia caespitosa
tufted hairgrass

Distichlis spicata
saltgrass

Grindelia integrifolia
gumweed

Hordeum brachyantherum
meadow barley

Orthocarpus castillejoides
paintbrush, owl-clover

Plantago maritima
seaside plantain

Potentilla pacifica
Pacific silverweed

Scirpus maritimus
saltmarsh bulrush

Trifolium wormsjoldii
springbank clover

Field Data Sheet

Vegetation Survey

Summary Data

Data sheet of

Name(s):

Site name

Date:

Site location:

Approx. location of class along transect metres to metres.

Class

transect i.d.#

Class Description

quadrat i.d.#

❑ tree ❑ herbaceous ❑ rush/sedge

quadrat location:

❑ shrub ❑ moss/lichen ❑ aquatic

(take location measurements from transect's outer end point)

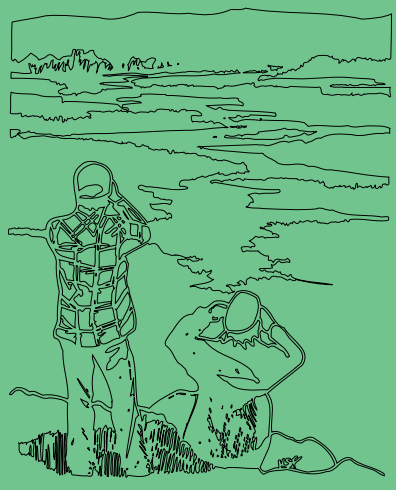
Plant Type	*Tot % Cover*	*Species scientific/common name*	*Species % Cover*	*Notes*
coniferous tree				
deciduous tree				
tall shrub				
low shrub				
forb				
grass				
rush				
sedge				
moss				
lichen				
aquatic emergent				
aquatic submergent				
non-vegetated				
introduced				

Voucher specimens with id# (continue on back):

Section Five

Conducting a Wetland Bird Survey

Module 2.3



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

MATERIALS AND EQUIPMENT REQUIRED FOR THIS ACTIVITY:

wetland map

binoculars (7 x 35 or higher power; 10 x 50 is better but heavy)

spotting telescope (set magnification or zoom)

survey data form

waterproof notebook

small tape recorder

field guide(s)

field data sheet*

*provided at the back of the module

Welcome to the Wetlandkeepers Program

You are about to embark on a fascinating investigation – wetlands play an essential and complex role in the wellbeing of our environment. These training modules have been developed by Environment Canada to encourage public participation in monitoring wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, each module provides information on a specific wetland monitoring activity. Many volunteer groups, schools and individuals have already become wetlandkeepers and invite you to join in the conservation of our precious wetland resources.

Acknowledgements

The information for this module was compiled by Kathleen Fry, Area Biologist for the B.C. Coastal Office of Ducks Unlimited Canada. Illustrations and other visual materials have been provided courtesy of Ducks Unlimited Canada (*Marsh World*, the Green Wing Program); the Comox Valley Waterfowl Management Project (newsletter); and the B.C. Ministry of Environment, Lands and Parks.

Project activity and Purpose

This module provides information on designing and conducting a successful bird survey, and on assessing your data afterwards. Bird surveys yield useful information about wetland health and are an effective way for you to document a particular wetland's value. The data you collect can be used in public awareness programs and as an adjunct to government and group funding submissions on behalf of wetlands conservation.

BACKGROUND

To protect and conserve a wetland, you must first have a good knowledge of its occupants. Basic bird surveys, also called "counts," give you an opportunity both to observe the birds that frequent your wetland and to track changes in the wetland's productivity (ability to support wildlife). When you participate in a count, you are said to be an "observer." Several surveys conducted at specific intervals over a period of time are often referred to as a "study."

Like many other wetland animals, wetland birds require specific marsh habitats, food, and clean water to survive. Birds, however, are much easier to count than other less obvious species, and are therefore used as "indicators" of wetland health. Factors such as land-use changes in the surrounding area, fluctuations in water quality and water level, and a decline in habitat diversity all affect the value of a wetland to wildlife. Through regular surveys you can monitor the impact of these changes and use your findings to promote wetland conservation.

Wetlands across North America have been much affected and, in some cases, lost as a result of land use and development practices in past years. We are now beginning to appreciate the importance of conserving them. But even where many stream and wetland systems are left in their natural state, they are still affected in terms of hydrology, water quality and vegetation by the development going on beyond their perimeter.

Today wetland conservation and management are considered major priorities with federal and provincial governments and several non-government organizations. Canada, the United States, and Mexico have joined under the direction of the North American Wetlands Conservation Council to implement the North American Waterfowl Management Plan (NAWMP). Ducks Unlimited (DU), a non-profit conservation agency, is the major vehicle delivering conservation programs under the NAWMP. DU's record of working with landowners for over 50 years towards wetland conservation makes it well suited to the task.

Regular bird surveys are an important wetland monitoring technique and play a key role in the overall effort to conserve wetlands. The simple survey techniques described in this module are suitable for those new both to birdwatching and to survey. This type of survey is conducted on the ground and requires the basic equipment used by most birdwatchers.

BEFORE YOU GO TO THE FIELD

OFF-SITE PREPARATION

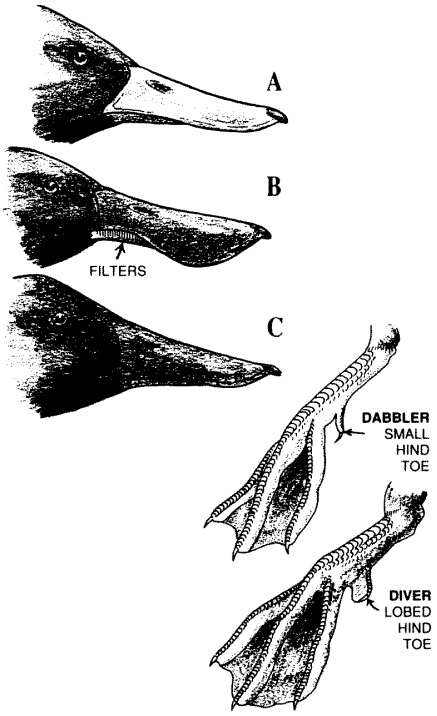
Step 1
Collect and review other wetland assessments and surveys

Bird surveys and other monitoring activities may already have been conducted in your wetland. As you make your initial plans, check with the regional, provincial and federal offices of Environment and such organizations as the Federation of B.C. Naturalists to see what data they've collected. The Canadian Wildlife Service, a branch of Environment Canada, performs surveys on a regular basis in the Fraser estuary and other parts of coastal and interior British Columbia The Victoria-based Conservation Data Centre housed in the B.C. Ministry of Environment, Lands and Parks collects data on rare or endangered wildlife species throughout the province and also monitors sensitive habitats. Members of the Federation of B.C. Naturalists conduct regular bird surveys in several areas around the province and participate in such annual international surveys as the Audubon Christmas bird count (turn to the back of this module for a list of the main agencies to contact and their addresses and/or phone numbers).

As you make your inquiries, be sure to ask government authorities and major non-government agencies about their respective wildlife management concerns in your region. This information will be of value to you in designing your survey and, later, in analyzing your findings.

Also review other kinds of assessments on the wetland. Has the wetland been mapped? Has a plant survey been completed? The maps and data from these activities will increase your understanding of the wetland's productivity and are likely to include references to bird species sighted in the area.

Step 2
Learn to identify common birds



A. mallard – typical of most ducks

B. shoveler – spoon-shaped and equipped with comb-like food filters

C. canvasback – strong and tapered for pulling up tubers and roots

Start making a list of the birds known to visit the wetland and review the groups of birds likely to be present when you make your survey. These groups are listed in the table to the right, according to how they appear in most field guides (more information on each group is provided at the back of this module). A general knowledge of species appearance and characteristics is absolutely essential to the success of your survey.

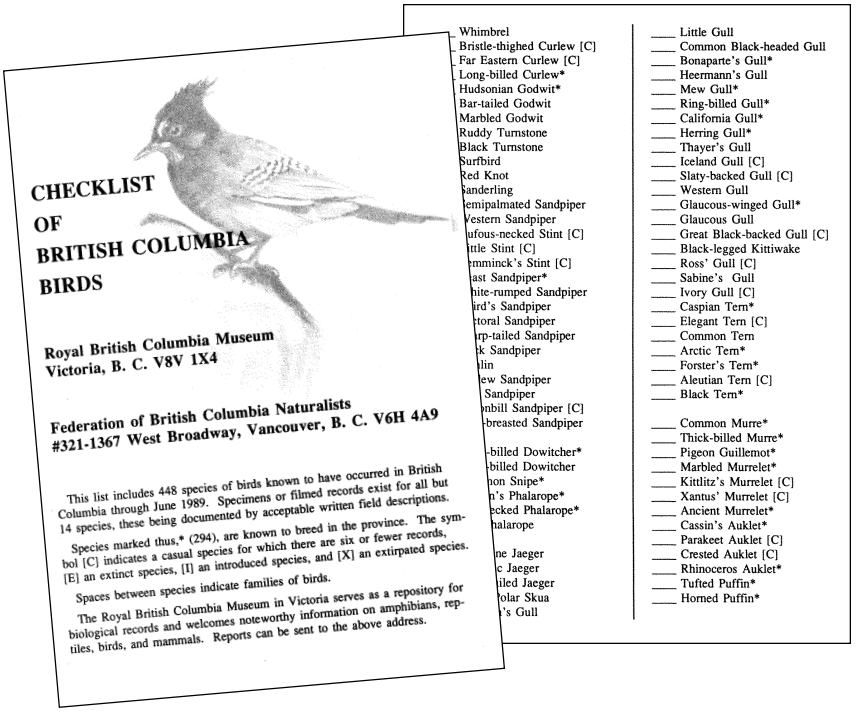
Familiarize yourself with the basic plumages of these groups and with plumage variations due to sex, age, and season. Waterfowl plumages are well documented. Most waterfowl undergo a partial or "eclipse" moult in late summer and are in new "basic" plumage by the fall. Courtship behavior usually starts in winter, and nesting occurs from March onwards in areas where the climate is mild. Shorebirds and warblers undergo similar moulting, breeding and nesting cycles.

Choose a good field guide, one that covers the area where the wetland is located. Field guides cite both the scientific and common names of species and provide information on their size and colouring, preferred habitat, range, habits, voice, and eggs. Familiarize yourself with your guide before taking it into the field so you can easily look up references while you're counting (a list of recommended field guides for birdwatchers is provided at the back of the module).

If you have never been involved in a bird count, autumn is the best time to learn identification and survey techniques. Most waterfowl have moulted into fresh basic plumages and large, diverse flocks of other wetland birds are passing through the province's wetlands. Some birds, particularly warblers, can still be difficult to identify.

COMMON WETLAND BIRD GROUPS

Order Gaviiformes	loons
Order Podicipediformes	grebes
Order Procellariiformes	albatrosses, petrels, storm petrels
Order Pelicaniformes	pelicans, frigate birds, cormorants
Order Falconiformes	vultures, hawks, falcons
Order Ciconiiformes	herons and allies
Order Anseriformes	waterfowl (ducks, geese and swans)
Order Gruiformes	cranes and allies
Order Charadriiformes	shorebirds, gulls, alcids
Order Strigiiformes	owls
Order Caprimulgiformes	nighthawks
Order Apodiformes	swifts
Order Coraciformes	kingfisher
Order Piciformes	woodpeckers
Order Passeriiformes	passerines (songbirds)



CHECKLIST
OF
BRITISH COLUMBIA
BIRDS

Royal British Columbia Museum
Victoria, B. C. V8V 1X4

Federation of British Columbia Naturalists
#321-1367 West Broadway, Vancouver, B. C. V6H 4A9

This list includes 448 species of birds known to have occurred in British Columbia through June 1989. Specimens or filmed records exist for all but 14 species, these being documented by acceptable written field descriptions.

Species marked thus,* (294), are known to breed in the province. The symbol [C] indicates a casual species for which there are six or fewer records, [E] an extinct species, [I] an introduced species, and [X] an extirpated species.

Spaces between species indicate families of birds.

The Royal British Columbia Museum in Victoria serves as a repository for biological records and welcomes noteworthy information on amphibians, reptiles, birds, and mammals. Reports can be sent to the above address.

___ Whimbrel
___ Bristle-thighed Curlew [C]
___ Far Eastern Curlew [C]
___ Long-billed Curlew*
___ Hudsonian Godwit*
___ Bar-tailed Godwit
___ Marbled Godwit
___ Ruddy Turnstone
___ Black Turnstone
___ Surfbird
___ Red Knot
___ Sanderling
___ Semipalmated Sandpiper
___ Western Sandpiper
___ Rufous-necked Stint [C]
___ Little Stint [C]
___ Temminck's Stint [C]
___ Least Sandpiper*
___ White-rumped Sandpiper
___ Baird's Sandpiper
___ Pectoral Sandpiper
___ Sharp-tailed Sandpiper
___ Purple Sandpiper
___ Dunlin
___ Curlew Sandpiper
___ Stilt Sandpiper
___ Buff-breasted Sandpiper
___ Ruff
___ Short-billed Dowitcher*
___ Long-billed Dowitcher
___ Common Snipe*
___ Red Phalarope*
___ Red-necked Phalarope*
___ Wilson's Phalarope

___ Pomarine Jaeger
___ Parasitic Jaeger
___ Long-tailed Jaeger
___ South Polar Skua
___ Mew Gull

___ Little Gull
___ Common Black-headed Gull
___ Bonaparte's Gull*
___ Heermann's Gull
___ Mew Gull*
___ Ring-billed Gull*
___ California Gull*
___ Herring Gull*
___ Thayer's Gull
___ Iceland Gull [C]
___ Slaty-backed Gull [C]
___ Western Gull
___ Glaucous-winged Gull*
___ Glaucous Gull
___ Great Black-backed Gull [C]
___ Black-legged Kittiwake
___ Ross' Gull [C]
___ Sabine's Gull
___ Ivory Gull [C]
___ Caspian Tern*
___ Elegant Tern [C]
___ Common Tern
___ Arctic Tern*
___ Forster's Tern*
___ Aleutian Tern [C]
___ Black Tern*

___ Common Murre*
___ Thick-billed Murre*
___ Pigeon Guillemot*
___ Marbled Murrelet*
___ Kittlitz's Murrelet [C]
___ Xantus' Murrelet [C]
___ Ancient Murrelet*
___ Cassin's Auklet*
___ Parakeet Auklet [C]
___ Crested Auklet [C]
___ Rhinoceros Auklet*
___ Tufted Puffin*
___ Horned Puffin*

Step 3
Design the survey

The design of the survey is dictated by your overall goal for the wetland, and by your objectives based on your goal. If you are planning to establish the wetland as a monitoring station for educational studies, you'll be interested in determining seasonal trends and bird use. If you want to protect the area because it provides habitat for regionally or provincially significant wildlife species, you'll need to document the presence or absence of key bird species, and their numbers. If you're adopting the wetland as a long-range stewardship project, you'll require baseline information for comparison with future bird surveys.

Now review the number of volunteers you have available for the work. Can you accomplish your objective? What about the information you've already researched – some of your work may already have been done for you. Also, consider how much information you need and for what period. Do you want to collect enough data to prepare a species checklist? Are you intending to summarize trends over a particular season? Over a year? Over the long term? Do you want to compare your data with information collected from other wetlands in your region or the province? If your survey work is being funded, your funders may also have specific data needs and should be consulted.

The purpose of a bird survey is to obtain information about the populations of birds that use a particular wetland. Data are usually collected in the form of the number of birds per species seen in the area on a given date. Since it is virtually impossible to see and record all birds at any one time, counts are always considered "relative."

One survey gives you a general idea of which birds use the wetland and to what extent. Several surveys conducted over a season or year provide much more complete information and allow you to calculate "usual" (average) bird use. Weekly or bi-monthly surveys produce adequate data to estimate average seasonal use, maximum use, the timing of peak use, and the chronological order of species passing through the area. However, counts conducted at this frequency should span a one-year period at most, because of the amount of information they generate. If you opt for frequent counts, stop after a year to analyze and interpret your data. Then resume your counts again two or three years later, to determine if general changes have occurred, or to clarify specific aspects of your previous findings.

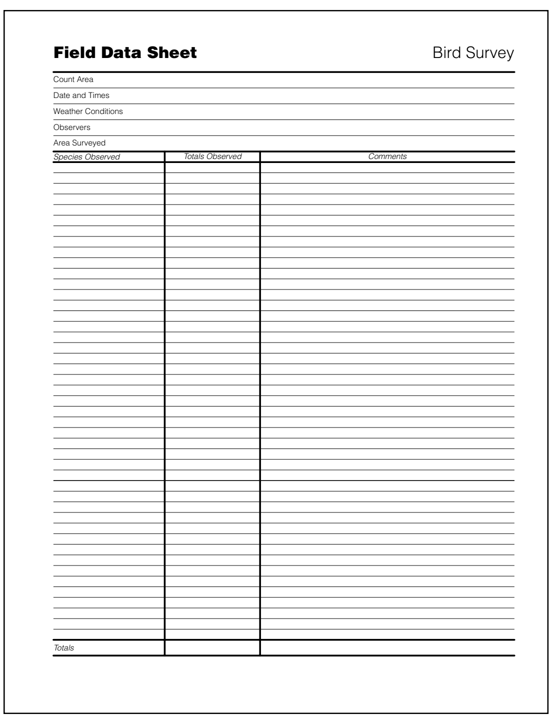
Wildlife agencies sometimes conduct specialized surveys to obtain information about the status of a specific bird species or the use of particular habitats. Some of these surveys are described briefly, for your information, at the back of the module. In all cases, they require government authorization and should not be attempted without additional assistance and training in project design and observation techniques.

Step 4
Obtain approvals

If the wetland is on private land, contact the landowner to obtain permission to conduct the survey.

Most publicly owned lands afford free access to local residents. However, if your wetland is in a public park or wilderness area, and you plan to visit the site on a regular basis, you may be required to submit an outline of your study to the parks or area manager. The Greater Vancouver Regional District, for example, requests that community groups inform them of any surveys they're conducting in GVRD-managed parks. Check with the relevant government authority if you're unsure of what approvals are required.

It is illegal to disturb nesting birds and to collect eggs, nests, or parts of wildlife, except when permitted under certain provincial or federal laws. Your main purpose for being in the area is to conduct a survey, not to collect "souvenirs." Try to minimize your impact on the natural habitat.


Field Data Sheet Bird Survey

Count Area

Date and Times

Weather Conditions

Observers

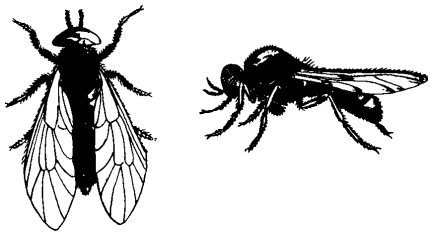
Area Surveyed

Species Observed	*Totals Observed*	*Comments*
Totals		

Step 5
Create a data-recording method

Develop a data sheet, such as the sample Field Data Sheet for recording count information. Each form contains space for a description of the count area, the date and time the count is taken, prevailing weather conditions, the names of the observer(s) conducting the count, and a list of the species commonly observed in the wetland.

Some observers find it easier to record information on a tape recorder, then transcribe it onto sheets when they've completed their count for the day. Other computer-oriented observers have bird-count software packages and record their information on computer-generated data sheets (turn to the back of the module for a brief discussion of three popular packages), or right into the database of their laptop computer. Whatever recording method or format you develop, be sure it's used for all counts throughout your study. Inconsistencies in recording make data analysis more difficult and reduce the accuracy of your findings.



biting blackfly Simuliidae

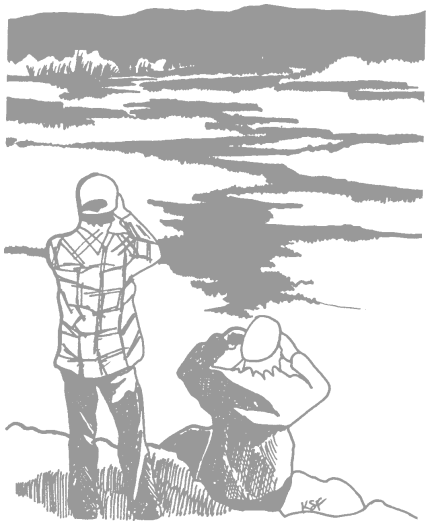
IN THE FIELD

CONDUCT THE SURVEY

Step 6
Identify on-site vantage points

Before finalizing survey preparations, review Section Two of the Handbook on "Getting Started." Then consult the list at the front of this module for details on the equipment you'll need. Don't forget to include relevant map(s) as well as your list of birds commonly sighted in the wetland, one or more field guide(s), and a few copies of the Field Data Sheet or a comparable form. Complete the top portion of the sheet ahead of time to minimize confusion when you analyze your findings later. If you're planning to use a tape recorder or portable computer, check to ensure it's in working order and pack extra batteries and tapes.

Visit the wetland before making your survey to identify a few good vantage points and determine a realistic workload for volunteers, given their level of expertise. Locate your observers where they can get a clear view of most of the wetland, including some water and some edge. Observers should not move between more than one or two vantage points to count birds. The more often the observer moves, the more likely the possibility of duplication and the greater the potential of disturbing the birds.

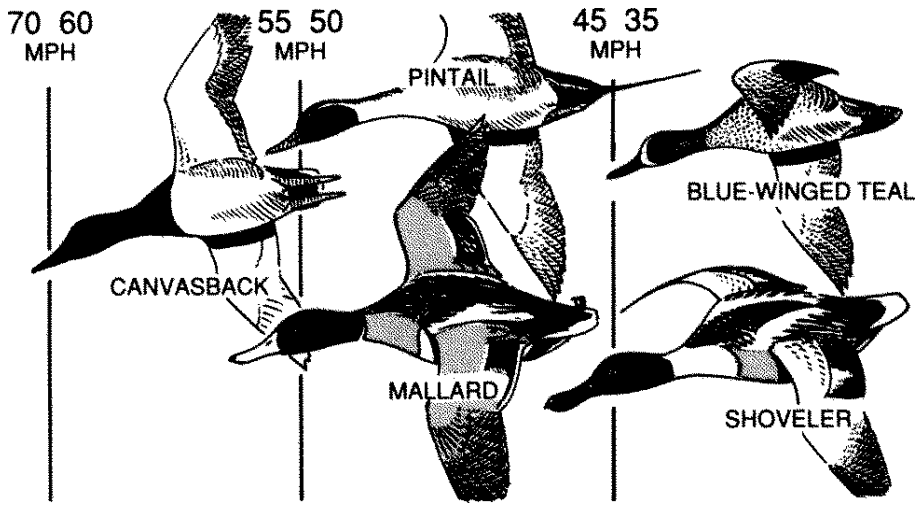


Step 7
Conduct your survey in the early morning

Be prepared to visit the wetland early in the morning when birds are less flighty, but still active and vocal. Bird counts are usually conducted from dawn onwards for two or three hours.

In the case of intertidal areas, time your survey to correspond to the period when the tide is at mid-tide level and rising. In areas with an extensive mudflat, birds are more difficult to identify when they're at the tidal line and often leave once the tide is high. A rising tide brings the birds closer for better species identification. Surveys conducted in tidal areas generally have some bias because the habitat conditions for birds are constantly changing.

Flight speed of ducks



Step 8 Counting

Try not to disturb the birds as you approach and position yourself at your vantage point. Unobtrusive clothing can sometimes be an advantage. Quickly scan the entire viewing area. This gives you an overview of bird groups and numbers, and is particularly valuable if the birds take flight before they've been identified and recorded – a count of unidentified birds is better than no data. Note any peripheral birds first, as they are unlikely to remain in the open for long.

You can count a large flock in several ways, depending on how flighty the birds are. If you choose to scan bird by bird, identifying each bird in the flock, you will need a tape recorder or a second person to keep tally of the numbers of different species. If the flock is disturbed during this tally, your partial sample may be used to give an idea of species composition. Large flocks can usually be broken into estimates of different species groups, such as – 30% wigeon, 50% pintail, 20% unidentified dabblers.

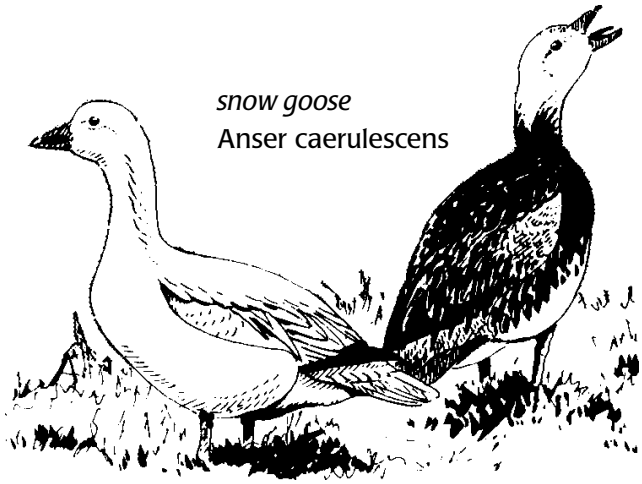
In certain areas, such as tidal foreshores, you are likely to encounter large flocks of waterfowl, gulls and shorebirds in flight. It takes a few years to survey birds accurately under these conditions because of the three-dimensionality of the image you're trying to count. Scientists often train themselves to develop a "search image" for work of this type. Using pictures of flocks of known size, they form a mental image of a specified number of birds in flight. Then they superimpose this image on real-life flocks. Once you have a sense of what 100 birds look like, you can count a flock in multiples of 100. This kind of counting is not easy and requires constant retraining. There's also a good chance of error as different backgrounds can skew your search image.

Step 9
Identify bird species

A sound general knowledge of species appearance and characteristics is essential here. Use your field guide to assist in identifying species at a distance or in flight. Even against a backlit sky, some characteristics show up very well:

- distinctive profile or body shape (pintail)
- white markings and patches (bufflehead)
- audible characteristics (whistling of goldeneye wings, shorebird calls in flight)
- speed of flight, method of takeoff (horizontal lift of mallard)

Birds of prey, secretive species such as rails, and small birds like marsh wrens, swallows, warblers, pipits, and passerines are common throughout most marshes, but less obvious than birds in open water. Most counts only record a sample of the birds close to the observer.



snow goose
Anser caerulescens

BACK FROM THE FIELD

COLLATE AND ANALYZE DATA

Even the most complete survey is still a "snapshot in time" and has built-in biases. Counts conducted every Saturday morning, for example, are still biased by time of day, day of the week, and observer. In view of this bias, it's more accurate to call a survey a "sample" and to think of your study as a group of samples that can be analyzed to determine an "index" of bird use.

If you've done weekly surveys over a one-year period, you have 52 samples with records of perhaps dozens of bird species. Those of you with a computer can probably enter your data through some form of Dbase program and access the information via queries. But the same data can also be transcribed by hand onto a table – it just takes longer. You begin by listing all the bird species along one axis of the table and all the survey dates along the other. Then you fill in each square with the number of species observed on each date. When you're finished, you have a table that looks like the one on the left.

The table can provide you with several kinds of information:

(a) species diversity: you already have a species list serving as one axis of the graph. How many species are represented? Which is the most common? Which is the least common? How do your findings compare with previous surveys conducted in the wetland? In other wetlands in the area?

(b) a bird checklist: look for information to make your species list as complete as possible. Include any rare species that may have been identified in materials provided to you by the Conservation Data Centre when you were planning your study. Also check the list from the Audubon Christmas bird count of the wetland. Have you accumulated enough data to establish that species are migrant, common, resident, or rare? Can you name the months they're present in the wetland? If so, you have the makings of a checklist. Checklists indicate the species you are likely to see at any one time in the wetland and are a valuable tool for wetland education programs. They also document the presence or absence of environmentally sensitive species for use in wildlife management planning.

(c) analysis of the abundance of birds: by tallying species numbers, you obtain information on the wetland's general value for birds. This information is useful to include in reports you produce on your study and on the wetland in general. Different tallies provide you with different insights:

Cluxewe River Estuary Bird Surveys for Autumn 90

Date	21Sep	30Sep	08Oct	14Oct	21Oct	28Oct	04Nov	11Nov	18Nov	25Nov	Total	Max	Min	Mean	SD	%Freq
#LOO	0	2	1	2	4	9	1	7	1	3	32	9	1	3.6	2.9	90.0
LOON	0	0	1	0	0	0	0	0	0	0	1	1	1	1.0	0.0	10.0
GOLD	0	2	0	1	4	9	1	7	1	3	31	9	1	3.9	2.9	80.0
#GRE	0	1	0	1	3	5	0	2	1	2	15	5	1	2.1	1.5	70.0
GREB	0	1	0	1	0	0	0	0	0	2	4	2	1	1.3	0.6	50.0
BRGR	0	0	0	0	0	3	0	0	0	0	3	3	3	3.0	0.0	10.0
WEGR	0	0	0	0	3	1	0	2	1	0	8	3	1	2.0	0.8	40.0
#COR	0	0	0	0	0	0	0	1	0	0	1	1	1	1.0	0.0	10.0
CORM	0	0	0	0	0	0	0	1	0	0	1	1	1	1.0	0.0	10.0
#BRK	3	4	1	1	0	1	0	1	2	0	13	4	1	1.9	1.2	70.0
GBHE	3	4	1	1	0	1	0	1	2	0	13	4	1	1.9	1.2	70.0
#GWA	0	0	0	0	0	0	7	1	7	11	26	11	1	9.0	8.5	40.0
TRUS	0	0	0	0	0	0	7	1	7	11	26	11	1	9.0	8.5	40.0
#GBE	0	0	0	22	0	22	10	8	0	15	77	22	8	15.4	6.5	50.0
GOOS	0	0	0	0	0	17	0	8	0	0	25	17	8	12.5	6.4	10.0
CAGO	0	0	0	22	0	5	10	0	0	15	52	22	5	13.0	7.3	40.0
#DAB	8	26	3	143	10	54	20	59	8	19	348	141	3	34.8	42.9	100.0
DABL	8	0	0	10	3	27	0	5	0	7	52	27	3	10.4	9.6	50.0
GWFE	1	13	0	17	0	8	0	3	8	1	43	17	1	7.2	6.7	60.0
MALL	5	6	0	34	5	5	0	28	0	11	94	34	5	13.4	12.3	70.0
MNPI	2	4	3	16	0	9	20	0	0	0	45	20	2	9.0	8.4	50.0
GADW	0	0	0	0	0	8	0	9	0	0	9	9	9	9.0	0.0	10.0
EWI	0	0	0	30	0	0	0	0	0	0	30	30	30	30.0	0.0	10.0
AMWI	0	3	0	34	3	22	0	14	0	0	75	34	3	15.0	13.5	50.0
#DIV	16	34	33	157	14	97	51	225	81	285	919	225	14	91.9	78.3	100.0
DIVE	0	0	0	0	0	8	0	14	0	0	13	13	11	13.0	0.0	10.0
BADI	0	9	30	26	4	43	26	45	21	49	253	49	4	28.1	15.6	90.0
SCOT	0	0	0	0	0	8	3	0	0	0	3	3	3	3.0	0.0	10.0
SCSC	3	9	0	10	0	18	0	6	0	25	65	25	3	10.8	7.4	60.0
WWSC	13	15	3	41	8	5	0	0	14	0	99	41	3	14.1	12.7	70.0
CASO	0	0	0	0	0	0	0	0	0	4	4	4	4	4.0	0.0	10.0
#SPP	0	0	9	0	0	17	0	151	42	101	312	152	17	78.0	60.6	40.0
MDRS	0	1	0	0	2	1	0	0	0	1	5	2	1	1.3	0.5	40.0
HOME	0	0	9	0	0	0	22	0	4	2	28	22	2	9.3	13.0	30.0
COME	0	0	0	0	0	1	0	0	0	3	4	3	1	2.0	1.4	20.0
BAME	0	0	0	0	0	7	0	0	0	0	7	7	7	7.0	0.0	10.0
BUFF	0	0	9	0	0	0	0	0	0	9	9	9	9	9.0	0.0	10.0
BUCK	0	0	0	80	0	13	0	9	0	11	113	80	9	28.3	34.5	40.0
#RAP	1	1	1	10	0	27	1	18	5	7	71	27	1	7.9	9.2	90.0
RASA	1	1	1	9	0	26	1	17	5	7	68	26	1	7.6	8.7	90.0
NSHA	0	0	0	0	0	0	0	1	0	0	1	1	1	1.0	0.0	10.0
RTHA	0	0	0	1	0	0	0	0	0	0	1	1	1	1.0	0.0	10.0
#ALC	0	0	1	0	0	1	0	0	0	0	2	1	1	1.0	0.0	20.0
BDGR	0	0	1	0	0	0	0	0	0	0	1	1	1	1.0	0.0	10.0

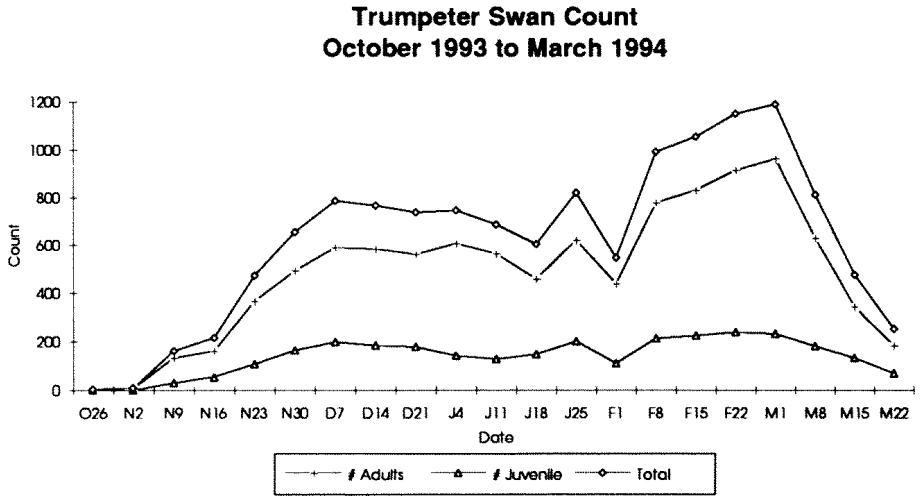
Preliminary data from several surveys taken over the fall season at Cluxewe River estuary, 1990

(i) total the number of birds (all types) seen in each survey for an idea of the wetland's general value. This information is usually presented in the form of a table with subtotals for species groups.

(ii) total the number of birds of a particular species or species group over the study period for information on trends. These findings are usually presented in graph form, a separate graph for each species. With them you can identify the timing of peaks in migration, as demonstrated in the graph below.

(iii) calculate the average use of the wetland in any one season by combining the counts done over that period and dividing by the number of surveys. This kind of information is often used to compare the general use of a study area with general populations of a larger area. If you know, for example, that roughly 5000 waterfowl use a local valley in the fall, and your wetland study area has an average fall use of 3000, then you can assume that your area plays a central role in supporting wetland bird life.

Trumpeter swan count in the Comox Valley, October 1993 to March 1994



CONCLUSIONS

Review your initial research (Step 1) and ask yourself a few questions about the wetland, based on your survey findings:

Does the wetland have high use?

Is the bird use a seasonal phenomenon or is it consistently high?

What are the major species groups using the area?

Are there species of known regional management concern present?

Are there any red, yellow or blue-coded species of provincial concern?

Are there any endangered, threatened or rare species present? (federal concern)

Can you identify key habitats in the wetland used by these species?

How many species use the area?

Is this figure generally representative of the area or does it represent a higher diversity? a lower diversity?

If lower, does the wetland possess some unique characteristic?

Do the patterns of bird use indicate that the wetland is part of a larger complex of habitats which should be considered as a whole?

What general contribution does the wetland make to overall habitat needs in the region?

Does the wetland abut onto an international border?

Are there land use or other known threats to the wetland?

If your study has been funded, your funders will be interested in obtaining information on your findings. Government and key non-government agencies will also be interested, particularly if you've detected problems in wetland functions (in hydrology or water quality, for example) or observed rare or endangered bird species in the area. Perhaps you want to apply for additional funds, or develop materials for use in educational programs.

Whatever your reason, it's a good idea to complete a general report of your findings. Reports of this type usually include a description of the wetland, the goals and objectives in conducting the study, a description of survey methodology, findings, comparisons with previous surveys, and a final section on conclusions. Sources or reference materials, if used, are also listed. Bird study reports are occasionally published by the provincial and federal governments and can be obtained from your local library. While they are more detailed than the report you would expect to complete, they serve as excellent examples of how your own document might be worded and formatted.

SUPPLEMENT 2.3–A

RECOMMENDED READING*

Bellrose, F.C. *Ducks Geese and Swans of North America.* Stackpole Books, 1976. (there have been numerous revisions of this publication)

Campbell, R.W., N.K. Dawe, I McTaggart-Cowan, J.M. Cooper, G.W. Kaiser. *The Birds of British Columbia, Vols. 1 and 2.* Victoria, B.C.: Royal British Columbia Museum, 1990. (*Volume 1: Introduction & Loons through Waterfowl*; *Volume 2: Diurnal Birds of Prey through Woodpeckers*)

Godfrey, W.E. *Birds of Canada (revised edition)*. Ottawa, Ontario: National Museum of Canada, 1986.

Harrison, C. *A Field Guide to the Nests, Eggs and Nestlings of North American Birds.* William Collins Sons & Co Inc, 1978.

Hayman, P., J. Marchant and T. Prater. *Shorebirds: An Identification Guide to the Waders of the World.* Boston, Mass.: Houghton Mifflin Co., 1986.

Jonsgard, P.A. *Ducks Geese and Swans of the World.* Lincoln, Nebraska: University of Nebraska Press, 1978.

Jonsgard, P.A. *A Guide to North American Waterfowl.* Bloomington, Ind. and London: Indiana University Press, 1979.

Jonsgard, P.A. *The Plovers, Sandpipers and Snipes of the World.* Lincoln, Nebraska and London: University of Nebraska Press, 1981.

Madge, S. and H. Burn. *Waterfowl: An Identification Guide to the Ducks, Geese & Swans of the World.* New York, N.Y.: Houghton Mifflin Co., 1988.

* *This list includes general references on B.C. and Canadian birds as well as more specialized references on species groups and other special topics.*

SUPPLEMENT 2.3–B

RECOMMENDED FIELD GUIDES

Field Guide to the Birds of North America, 2nd Edition. Washington, D.C.: National Geographic Society, 1995.

C.S. Robbins, B. Brum & H. Zim. *Birds of North America: A Guide to Field Identification.* New York, N.Y.: Golden Press, 1966.

R.T. Peterson. *A Field Guide to Western Birds,* 3rd Edition. Boston, Mass.: Houghton Mifflin Co., 1990.

M.D.F. Uvardy. *The Audubon Society Field Guide to North American Birds, Western Region.* New York, N.Y.: Alfred A. Knopf, 1995.

SUPPLEMENT 2.3–C

SOPHISTICATED SURVEY TECHNIQUES

Wildlife agencies in the public and private sectors conduct many specialized surveys to obtain information about the status of specific bird species and the use of particular habitats. Most of their survey techniques are well researched and can be used with predictable results in the study and resolution of resource management problems.

Waterfowl have been surveyed in greater detail than other waterbirds. Survey variations include:

surveys of large areas (Vancouver Island, for example) from aircraft, to determine migrant use and composition

aerial photo counts (snow goose counts, for example) where large flocks are photographed and birds painstakingly counted one by one for absolute accuracy

aerial transects through extensive wetland systems in breeding season to determine production based on numbers of pairs and broods observed per hectare

surveys of small, representative areas and extrapolation of results for a larger area with similar characteristics

Qualified observers also conduct ground/canoe counts of waterfowl pairs and broods seen from early spring to fledging. By carefully recording the sex ratios of species and the ages of broods, they can predict the actual nesting populations of species, the success of clutches, and critical dates for the nesting, incubation, hatching and fledging of young birds. In general, assessments of the nesting populations of wetland birds (nesting and brood counts) require some disturbance of the birds and should not be undertaken without clear objectives, the appropriate authorizations, and adequate training and supervision.

SUPPLEMENT 2.3–D

COMMON WETLAND BIRD GROUPS

The following groups of birds are likely to be encountered during wetland surveys. They are listed according to how they would appear in most field guides:

Order Gaviiformes – Loons

large, aquatic diving birds, usually seen resting at the surface or hunting for fish underwater

able to dive underwater for long periods

distinctive calls in the breeding season (the familiar loon "laugh")

different winter and summer plumages

lobed feet set far back on the body

rarely leaves water except to access shoreline nest

species commonly found in British Columbia include common, red-throated and Pacific loons

Order Podicipediformes – Grebes

aquatic diving birds

generally smaller than loons with longer necks and lobed feet

make nests on floating rafts of vegetation; some species (Western grebe) nest in colonies

pied-billed grebe (also called helldiver) small, but noted for loud cackling laugh in breeding season and ability to sink slowly underwater like a submarine

species commonly found in British Columbia include horned and pied-billed grebe

Order Procellariiformes – Albatrosses, petrels, storm-petrels

seabirds, uncommon except on extreme coast where species of storm-petrels nest

Order Pelicaniformes – Pelicans, frigate birds, cormorants

seabirds, common in coastal waters

also nest in some of British Columbia's interior wetlands

cormorants are fish eaters, have elongated body, habit of extending wings to dry, long bill with hooked end to keep grip on slippery prey

Order Falconiiformes – Vultures, hawks, falcons

have talons and hunt live birds, mammals, fish and insects

have heavy hooked bill for tearing apart prey

juvenile plumages of most species are different from adult, differences also according to sex

species commonly seen in and around marshes:

turkey vulture, red-tailed hawk, bald eagle (soaring or perched)

accipters such as Cooper's hawk, sharp-shinned hawk (swift flying in shrubbery and streamside areas)

harriers (hovering, looking for mice)

osprey (hovering, fish eating)

falcons including peregrines, merlins and kestrels (fast pursuit after birds)

Order Ciconiiformes – Herons and allies

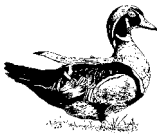
long-legged waders

can be a variety of shapes

many nest in marsh or, in the case of herons, in nearby colonies

wetlands serve as important feeding areas

species commonly found in British Columbia include herons (great blue and green-backed) and American bittern (keeps well camouflaged and blends in with marsh vegetation, distinctive "water pump" calls are loud during nesting season)



Order Anseriformes – Waterfowl

The term "waterfowl" includes ducks, geese and swans found in the Order Anseriformes around the world. The Family Anatidae encompasses most of the waterfowl species of North America, including:

swans (large, white, long-necked, both sexes have identical plumage)

geese (both sexes have identical plumage)

dabbling ducks – members of Anatini and Cairnini tribes

diving ducks – members of the Mergini (mergansers), Aythini (bay ducks), Somateriini (sea ducks) and Oxyrini (ruddy ducks) tribes

Common features of waterfowl:

long flat bill and relatively long neck

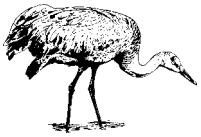
webbed, three-toed feet

a moult of flight feathers

serrations on the bill which help strain food

ability to either up-end (tip) or diver underwater for food

dabbling ducks and diving ducks can be distinguished even at a distance as dabblers remain on the surface and tip up for food while divers dive completely underwater



Order Gruiformes – Cranes and allies

long-legged waders

sandhill cranes nest in bogs

rails – small, skinny birds move silently and usually remain concealed

distinctive clucking, almost chicken-like call

species commonly found in British Columbia include Virginia and sora rails

Order Charadriiformes – Shorebirds, gulls and alcids

mainly white and brown and gray plumages

beaks of varying lengths

long pointed wings

to identify gull species look for markings on bills, wing tips; also, wing colour, leg colour and general size

alcids are seabirds, include auks, auklets, murres and puffins

shorebirds include oystercatchers, avocets and stilts, plovers, sandpipers and phalaropes (lapwings are part of this group, but are only an accidental visitor from Europe

to identify shorebird species look at shape and length of bill, legs and overall proportions

Order Strigiiformes – Owls

nocturnal, some diurnal species

short-necked, ability to rotate head

hunt for rodents and birds (soundless flight)

juveniles often have different plumage from adults

species commonly found in British Columbia marshes include short-eared, saw-whet, barn, barred and screech owls

Order Caprimulgiformes – Nighthawks

forked tailed

grey-brown in colour; male has broad white band at throat

erratic dipping flight, mostly at dusk

large mouth, eats insects

call is a nasal peep

nests on rooftops in urban areas

Order Apodiformes – Swifts

look like swallows

fast, high fliers, usually seen at dusk

wings appear not to bend in flight, swivel as they fly

feed on insects

call is a chip/tick sound

Order Coraciformes – Kingfisher

long, pointed bill

large head and eyes

fish from a perch, diving into the water in pursuit of prey

eat fish, insects and lizards

male has a gray-blue breastband and white collar; female has rusty coloured band on lower chest

nests in cavities in earth or gravel banks

Order Piciformes - Woodpecker

creates cavities looking for insects

cavity nester

also creates cavities for other wildlife species

species commonly found in British Columbia wetlands include flickers, sapsuckers, three-toed, hairy and downy woodpeckers

Order Passeriformes - Passerines (songbirds)

feet adapted for perching

fine singing ability

most eat insects or seeds and migrate with food supply

species commonly found in British Columbia wetlands include song sparrow, yellowthroat, McGillivray's warbler, bushtit, yellow-rumped warbler, waterthrushes, pipits, red-winged blackbird, orange-crowned warblers, Wilson's warbler, marsh wren, savannah sparrow

many other passerines nest in wooded areas adjacent to wetlands

SUPPLEMENT 2.3–E

COMPUTER SOFTWARE PACKAGES FOR BIRDING

BirdBase 3 (IBM software)

Santa Barbara Software Products

One disk with documentation (copy protected)

Cost is approx. $CA 80

Can produce thousands of annual or life lists for every Audubon Bird Annual (ABA) reporting area and region, nation, state, and county, etc. Shows species seen and can also give full details of every sighting. Includes all ABA common and scientific bird names. Requires MS-DOS and 256K with one 3.5 or two 5.5 floppy disks, or a hard drive and any floppy drive.

This product has an expanded version called *World Birdbase 3* which includes a disk with the latest annual update of the Clements' *Birds of the World: A Checklist.* It also runs with *Birdarea,* a bird range program developed by the same company. Cost for *World Birdbase 3* is about $CA 135.

Bird Brain 2.0 (Macintosh software)

Ideaform Inc.

Two disks with documentation

Cost is approx. $CA 180

Includes all AOU (American Ornithologists' Union) checklist area species in North America, Hawaii, Mexico and Central America. Generates automatic life, state, year, state-year lists, seasonal and documentation reports, trip lists, etc. Data entry is automated – you type in the common or scientific name and a menu pops up with species names. Space is provided for number, date, country, state/prov., county, city, place, habitat and brief or extensive notes – plus three additional personal criteria. Is keyed to seven major field guides. Requires MacPlus or larger and hard disk drive. Works with System 6.7 or later.

AviSys 3.5 (IBM software)

Perceptive Systems

One 5.25 " or 3.5" disk with user's manual (not copy protected)

Cost is approximately $CA 150

For serious North American birdwatchers who sometimes take their interest abroad. Has windows, dialog boxes and drop-down menus, and operates by mouse or from the keyboard. Easily updated lists of every length and type; variety of reports, hit lists and census spreadsheets by geographical locale, data range, species, habitat, behavior, and keywords, etc. One-page sighting summaries by state and region. Runs under DOS or Windows, 2MB 386 or better.

Field Data Sheet

Bird Survey

Count Area

Date and Times

Weather Conditions

Observers

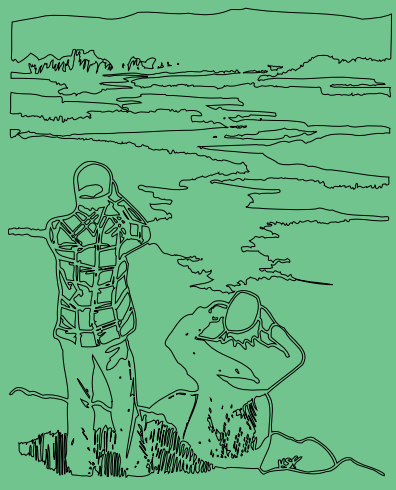
Area Surveyed

Species Observed	*Totals Observed*	*Comments*
Totals		

Section Five

Marsh Cleanup

Module 3.1



B.C. Wildlife Federation
303 – 19292 60th Avenue
Surrey, BC V3S 8E5

1996

MATERIALS AND EQUIPMENT REQUIRED FOR THIS ACTIVITY:

rain gear, including rubber boots

rubberized gloves

hip waders

industrial first aid kit

chain saws and accessories (preferably the STIHL model 036 with 20″ bar)

spare parts for chainsaws (spark plugs, spare chain saw bars, chain saw wrenches, chain sharpeners, gas cans, chain and engine oil, funnels)

peevees (log-rolling device)

pike poles

pickaroons

rafting dogs

dog lines

shovels

rakes

wheelbarrows

pruning shears

If firewood is being cut:

splitting axes

mauls

wedges

data recording sheet*

*provided at the back of the module

Welcome to the Wetlandkeepers Program

You are about to embark on a fascinating investigation – wetlands play an essential and complex role in the wellbeing of our environment. These training modules have been developed by Environment Canada to encourage public participation in monitoring wetlands around British Columbia. Modelled after the *Streamkeepers Handbook* developed by Fisheries and Oceans Canada, each module provides information on a specific wetland monitoring activity. Many volunteer groups, schools and individuals have already become wetlandkeepers and invite you to join in the conservation of our precious wetland resources.

Acknowledgements

The information for this module was compiled by Mae Burrows and Michel Drouin of the T. Buck Suzuki Foundation, Vancouver. Photos and other visual materials have been provided courtesy of the Canadian Wildlife Service; the B.C. Ministry of Environment, Lands and Parks; University of Washington Press (*Vascular Plants of the Pacific Northwest* by C.L. Hitchcock, A. Cronquist, M. Ownbey and J.W. Thompson, 1969); and Paul Kandt, T. Buck Suzuki Foundation.

Project activity and purpose

Estuary marshes are a vital habitat for migrating juvenile salmon and other species of aquatic and terrestrial life. Yet they continue to be damaged and destroyed by industrial activity and unplanned urban development. Debris left by logging and other industrial operations destroys plantlife. When it's removed, the underlying marsh is exposed and plants can regenerate. This module provides information on how to clean up a marsh, focussing, in particular, on estuary marshes. Among the topics covered are obtaining licenses and permits, finding funds, budgeting, and motivating volunteers, with a separate section devoted to the problem of debris disposal.

BACKGROUND

Freshwater and tidal marshes commonly found in major river deltas are among the most productive of all wetlands in the world. They support literally millions of migrating waterfowl each year and also serve as a vital "nursery" for young freshwater and ocean-going fish. Here in British Columbia, the Fraser River alone harbours up to two billion juvenile salmon annually, providing them with cover from their predators as they adapt to saltwater. Some species – the Chinook salmon, for example – spend up to 12 months in the delta. Others, including smelt, eulachons and flounder, use the delta as their spawning ground.

Like all wetlands, tidal and freshwater marshes perform many functions vital to the wellbeing of wildlife and humans. As already discussed in Introductory Module 1, they reduce the impact of flooding by acting as a brake on flood waters and by absorbing and holding excess water. They also filter water, trapping sediment in their root systems and actually removing some toxic substances (for more information on this topic, see Section Three of the Handbook on "Wetland Ecology").

Despite their obvious value, wetlands in many parts of the province have been damaged or destroyed by industrial and urban expansion. In the Fraser River alone, an estimated 70% percent of the estuary's original *riparian* vegetation has been altered by dyking and draining. And more than 50% of its salt marshes, seasonal wet meadows, bogs and brackish marshes are now permanently lost to development.

A major problem on several river systems is the accumulation of wood debris. In the case of the Fraser again, more than 40 wood processing operations currently use the river to transport and store logs. Logs and debris, including bark and wood chips, escape from log booms and float onto marshy areas, smothering their delicate plantlife. As these woody byproducts decompose, the action also removes oxygen from the environment, further impairing its natural productivity.

CONSERVE "DOWNED WOOD"

Not all wood is bad for wetland habitat. In some wetlands, in fact, woody debris plays an essential role as a source of cover, perches, nesting sites and nutrients for wildlife. Debris of this sort is often referred to as *downed wood* because it consists mainly of dead trees that have disintegrated and fallen into the surrounding landscape. By leaving it in place, you conserve wildlife habitat and maintain the ecological balance of the immediate area.

Downed wood also provides habitat for aquatic and streamside life in rivers and streams. Large logs help stabilize stream channels, speed

waterflow and create pools – all to the benefit of young fish. Streamside logs serve as breeding sites for bird species like the harlequin duck and are an important habitat for amphibians. In estuaries, beached logs stabilize sandy shorelines and serve as perches, cover and breeding sites for wetland birds.

Embedded logs and stumps should never be removed from a wetland site. While they might appear "untidy" to the human eye, they are part of the habitat and play a role in conserving its plant and animal life. In removing them, you risk upsetting the ecological balance of the immediate area.

If you have questions or concerns respecting debris removal, contact the nearest office of Environment Canada (Canadian Wildlife Service), the B.C. Ministry of Forests or Environment (Wildlife Tree Committee), or the Centre for Applied Conservation Biology at the University of British Columbia before taking action. By definition, a cleanup is supposed to enhance, not disturb, a wetland – it pays to be cautious!

INCREASE AWARENESS

Wetland cleanups are an effective way to promote community awareness and understanding of wetland functions and values. When different user groups get together on a project of this type (recreational anglers, commercial and aboriginal fishermen, bird watchers, hunters, etc.), they have a chance to increase mutual understanding and further the cause of habitat conservation. Cleanups also make commercial operators such as forest companies, sawmills, tugboat operators, cement plants, and others more sensitive to public scrutiny. Once debris has been removed, many river wetlands and estuaries make visually stunning recreation sites and are suitable locations for school and public education programming.

The cleanup operation described in the following pages is simple to institute, but requires planning, funding, a motivated volunteer force, and some basic equipment, most of it obtainable from an equipment rental outlet. While we focus mainly on the clearing of woody debris from estuary marshes, the steps are the same for all cleanup operations, whatever the nature of the wetland or its location.

EXTRA READING ON THE MANY VALUES OF WOOD DEBRIS:

- *Rotten Luck* (brochure), produced by the Fraser River Action Plan
- *Field Guide to Wildlife Trees and their Users,* produced by the B.C. Ministry of Environment, Lands and Parks (Wildlife Habitat Branch)

BEFORE YOU GO TO THE FIELD

OFF-SITE PREPARATION

Step 1
Choose a site

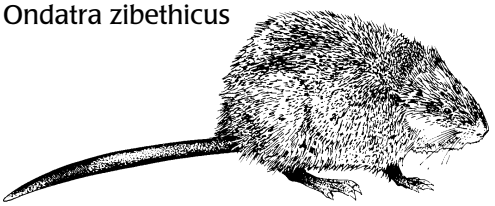
For those of you who are already stewarding a specific wetland, a cleanup operation is often the next step once you've assessed your site (as described in Module 2.1) and surveyed the plants and birds (Modules 2.2 and 2.3). These initial monitoring activities will have given you an idea of the amount and nature of site debris and its impact on wetland functions (particularly hydrology) and wildlife.

If you are not yet stewarding a wetland, contact the regional, provincial and/or federal offices of Environment, and Fisheries and Oceans to identify one that needs to be cleared. These authorities may already have a suitable site in mind (a list of the main agencies to contact and their addresses and/or phone numbers is provided at the back of this module). Federal authorities deal expressly with water systems that empty into the ocean and support salmon and other ocean-going fish. Provincial authorities manage all freshwater systems. Both levels of government cooperate on large-scale conservation programs on major river systems like the Fraser.

It is usually easier to obtain cooperation and funding for cleanups on public land. Restored wetland in public areas is also accessible for everyone's enjoyment. If you want to do your cleanup in an estuary, try to locate a site that has good shoreline access. Cleanups usually generate large amounts of debris, and wetlands accessible only by water are more difficult and costly to work on. Also, look for a site that's considered valuable in terms of habitat potential.

In some areas, wetlands have already been assessed for their habitat value. In 1992, for example, the Fraser River Estuary Management Program (FREMP, administered by several levels of government) produced *Inspection of Red-Coded Wetlands of the Fraser River Estuary,* identifying all the red zones in the estuary. Red-zoned areas have the highest value rating in terms of wildlife habitat, making their restoration a priority. Authorities in other areas may have a similar assessment system for public lands.

muskrat
Ondatra zibethicus



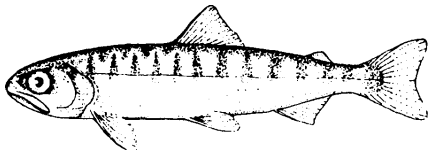
Step 2
Research your site

This step will probably be unnecessary if you've already conducted an assessment of your wetland (Module 2.1).

Obtain a topographical map of the marsh and surrounding area, and spend some time researching its background. Has it been used for any commercial purpose? Are there any human structures on site? What wildlife now use the marsh or the area surrounding it? What plantlife is typical of the area? If the site is located in a tidal area, check tide tables to identify the best times for cleanup activities and speak with government authorities and others (e.g. commercial and recreational anglers and boaters) concerning hazards relating to tidal action.

Visit the wetland to get a better understanding of the size, type and extent of debris. In some wetlands, as already mentioned, wood debris such as dead or dying trees, fallen logs and branches, and accumulations of dead leaves and grasses play a vital role in providing cover, nesting materials, and roosting sites for birds and other animals. Note the functions apparently being served by the debris and be sure to discuss them with an expert on bird and wildlife before finalizing any cleanup plans. An expert might include a wetlands biologist from the local offices of the provincial or federal ministry of Environment or Forests, a representative from the Centre for Applied Conservation Biology at the University of British Columbia, an instructor in wetlands ecology from the local college, an experienced naturalist from the local natural history club, etc.

During your visit, also take time to determine the best point of access. Are there any materials for constructing a temporary boardwalk for the work crew? Where can volunteers park their cars? Will it be necessary to rent a disposal container and, if so, where can it be located? Is there a place where firewood and/or shakes might be cut?



Chinook salmon (fry)
Oncorhynchus tshawytscha

Step 3
Obtain necessary approvals

If your wetland is privately owned, you must have the landowner's permission before accessing it or making any cleanup plans. In many instances, you must also have a permit from public authorities to do the work. Always check with the local government authority and the B.C. Ministry of Environment, Lands and Parks to establish exactly what permissions are required.

A good case in point are privately owned wetlands on the Fraser River estuary. To conduct a cleanup of these areas, you must have both the landowner's permission and a permit from the Fraser River Estuary Management Program (FREMP). FREMP will issue a permit only after it has received the landowner's written approval, a description of the work needed, a description of proposed work methods, maps and diagrams of the area to be cleaned, and a completed application form.

Publicly owned lands afford free access to residents, although you must still have permission and possibly a permit to remove anything from them, depending on the requirements of the managing government authority. Discuss your project with the relevant government office before finalizing any project details, and be prepared to submit a detailed project description in order to get approval.

You may also require other permits and approvals, depending on where your site is located and how you plan to dispose of debris. If you intend to salvage logs, for example, you'll require a Log Salvage Permit from the Ministry of Forests. If you plan to use unmerchantable timber, you'll have to obtain an Unmerchantable Timber Permit from the nearest authorized receiving station. If you hope to sell your debris as firewood, you'll need a Firewood Permit from the Ministry of Forests and will have to pay a royalty on every cubic metre sold. More details on all these requirements are provided later in the module.

Step 4
Identify paid labour force

Depending on the type of wetland and the extent of the cleanup planned, you may decide to hire a small labour force to clear major debris, before involving volunteers.

This approach is essential in the case of tidal marshes and river deltas covered in logs and driftwood stumps. The handling of logs is back-breaking labour and can involve weeks of chain-saw work. Sites are often unstable until large debris has been removed. A "preliminary" cleanup leaves the operation of dangerous or heavy equipment and machinery to trained personnel and makes the wetland safe for volunteers. Experienced workers, drawn from such industries as forestry and fishing, are also more efficient and have less impact on the environment than a volunteer labour force.

Not all wetlands require a preliminary cleanup. If your site is small and debris is limited to plastic, glass and minor scrap metal, volunteers can handle the entire operation themselves.

Step 5
Apply for funding

You pay for your labour force and the costs of renting equipment, etc. through fundraising. In most communities, some funding is usually available through private individuals, local businesses, major forest and lumber companies with operations in the area, other major industry groups, and the local, provincial, or federal government. Non-profit organizations are also a good funding source. Some funders prefer to fund "in kind" – providing an item or service free of charge in exchange for being mentioned in promotional materials relating to the cleanup.

Today, it's common practice for private and public agencies to cooperate or *partner* on a single project, pooling funds to cover the project's costs. This reduces the cost for any one funding agency and allows all the agencies to fund more projects. Partners in a project are often referred to as *stakeholders.* While partnering makes the fundraising process more complicated, "partnered" proposals are more likely to be accepted.

Begin your fundraising by contacting the B.C. Environmental Network (see the list of conservation organizations at the back of the module). The Network produces a calendar listing of potential funders, the types of projects they fund, and submission deadlines, etc.

An essential component of any funding submission is your budget estimate for the project. As you develop this figure, bear in mind that an experienced worker can cut up and remove approximately 10 to 15 cu. yards of debris and logs over an eight-hour period, depending on ease of access and method of disposal. Also, because of the nature of this work, you should expect to pay an industrial-level hourly wage of $12 to $18.

Many funders withhold at least a portion of their funds until all work on a site is complete and a final report submitted. Arrange to have bridge financing in place so you can pay your work force in this interim period.

In general, you can expect your costs to break down as follows:

- on-site wages 50–60%
- tools, equipment and debris removal costs 25–30%
- office administration and accounting 10–25%

CALCULATING WAGES

When you estimate the wages of your labour force, remember to include:

- Workers Compensation Board contributions (approx. 4 percent of wages)
- vacation pay (approx. 4 percent)
- statutory holidays
- employer's share of Unemployment Insurance premiums and Canada Pension Plan contributions

Step 6
Make a public relations plan

A well organized public relations campaign enhances public awareness of the plight of wetlands today, and also helps to raise additional funds and attract volunteers to your project.

Your promotional activities are largely determined by the size of your promotions budget and can be effective even when your budget is small. Take advantage of the public service announcement (PSA) slots – the "community calendars" – provided by local radio and television stations and community newspapers. These outlets generally prefer to carry your announcement only a week or two before it's scheduled to take place – but they're free and reach a large audience. Place project announcements and requests for volunteers on the public bulletin boards at your local recreation centres and libraries. Develop your own brochure. Brochures can be left in community facilities, circulated at community events, and left at retail outlets sympathetic to your cause (for more information on public relations options, turn to Module 3.3 on developing and implementing a public education program).

Your public relations efforts are bound to attract volunteers. Make a list of the organizations that might be interested in participating in your project and send them a request for help. Be clear in your description of the kinds of help needed, suggesting particular groups for specific tasks. Arrange to meet briefly with groups beforehand to explain the nature of the wetland being cleared, on-site safety precautions, equipment or clothing requirements, the necessity of minimizing human impact on the environment, and the specific tasks you've assigned them to. Also, remember to offer them something in return for their hard work – lunch, entertainment, a certificate of commendation and a button, a wetland tour and demonstration, an evening of slides and video taken during the cleanup.

WHERE TO FIND VOLUNTEERS

- other community groups with a conservation focus
- local businesses
- schools, colleges
- youth groups, including guides and scouts
- rod and gun clubs
- natural history clubs
- local youth employment groups

IN THE FIELD

THE CLEANUP OPERATION

Before finalizing cleanup preparations, review Section Two in the Handbook on "Getting Started." Then consult the list at the front of this module for details on the equipment you'll need. Don't forget to include tidal charts, if your site is located in an estuary. Also include a few copies of our sample Marsh Cleanup Summary Sheet or a similar form for use as you conduct your cleanup. Your primary concerns should be the safety of your workers and the protection of the wetland's delicate ecosystem.

Marsh Cleanup Summary Sheet 1

Marsh location: Date:

Name(if applicable) Size:

Municipality/district: NTS #

Organization name/address

Contact person: Phone:

Crew size: volunteers: paid workers:

Upper boundary of cleanup (directions, distance to known landmark):

Lower boundary of cleanup (directions, distance to known landmark):

Map of marsh:

Known/observed site hazards(identify on map):

Downed wood (type, location, wildlife value - identify on map):

Estimated time to complete cleanup:

Step 7 Make your cleanup safe

Ensure that your workers are wearing warm clothes and adequate rain gear, including rubber boots and gloves. Provide an eye-wash station and have a good first-aid kit on hand.

Only experienced personnel should handle power equipment such as chain saws. Check logs for embedded metal before using your saw, to avoid kickback problems. When you're cutting a log into pieces, cut 3/4 of the way through, then rotate the log with a peevee to complete cutting. This stops the log from rolling and protects the saw's chain and blade from the sand. For the good of the environment, never fuel or lubricate machinery on the wetland. Also, use vegetable hydraulic oil for lubrication as it is less damaging to plantlife.

By doing your cleanups in the winter months, from autumn to early spring, you avoid damaging plant growth. But check first to ensure that this isn't a critical period for certain migratory bird species. Start the cleanup by selecting site wood to make temporary walkways. And before actually removing anything, consider the possible impact of your work on the habitat – the most efficient approach isn't always the best. Keep these basic points in mind as well:

Size of debris is not as critical as the surface area it covers; small debris like bark can be just as harmful as large debris, smothering new plant growth and taking decades to decompose

Loose logs are easily moved by tides and/or boat wakes, destroying plants and spawning beds

Use of heavy machinery in the wetland damages plants and compacts the soil

Removal of embedded stumps and logs can cause serious disturbance; left in place they provide cover, nesting and perching sites for wildlife

AN EYE-WASH STATION

A simple eye wash station consists of a few small plastic squeeze bottles with saline solution in them. This kind of bottle is available from most supply stores and has an eye-cup attachment to fit over the eye. It's small enough to be carried by an individual, or may be stored with other first aid supplies.

Prevention is the best cure. Along with other safety equipment such as protective knee pads and safety-toed boots, chain saw operators must wear eye protection. Workers in boggy marshes or near questionable water should also wear goggles or some kind of face protection in addition to rubber boots and waterproof clothing.

Step 8
Remove the debris

Bark and other small debris may blanket a tidal or delta wetland to a depth of between 10 and 15 cm. You can remove most small debris by hand with buckets and wheelbarrows – or by boat, if your site is accessible by water. Boats can vary in size from a rowboat or a small runabout to a barge, depending on the extent of your site and your budget. Once the debris is off the wetland, heavy equipment like a bobcat, front-end loader, dump truck and dumpsters can be used to sort and hold it.

Metal, plastic and glass debris can be recycled at municipal or regional recycling depots. Many depots require that you sort your glass by colour. Some do not accept certain grades of plastic. Most wetlands do not contain sufficient amounts of scrap metal to make metal salvage feasible. Check with your recycling depot to see if they accept metal products. If not, you may have to dispose of metal debris at the municipal landfill site, along with waste wood.

Step 9
Record activities

Using our sample Marsh Cleanup Summary Sheet or a similar form, make a daily record of the volume of material gathered, the locations where debris was collected, and a breakdown of the types of debris and disposal methods. Also keep a log book detailing hours of labour, individual costs, volume of debris removed each day, and area cleared daily. As much as possible, maintain separate records of paid labour and volunteer activities so that you can compare the two at the end of the project

Step 10
Getting rid of wood

Most of the debris you collect will be wood and, depending on the type – logs, stumps, shake blocks, etc. – several disposal options are available to you. Volunteer assistance is particularly useful here.

RETURN LOGS

This solution is more complicated than it sounds. Legislation relating to log recovery favours the forest industry, and logs that bear a forest company stamp can be claimed by the company for the cost of salvage and towing. Any marketable logs salvaged during a cleanup must therefore be returned to the owner, or towed to a licensed receiving station. Direct sales to mills are not permitted under current salvage regulations.

Receiving stations are usually operated by the industry on a cooperative basis. On the Fraser River estuary, for example, the receiving station is the Gulf Log Salvage Cooperative (GLS), located on the Middle Arm near the Vancouver International Airport. Unmarked logs must meet strict standards to be accepted. Even then, a receiving station is likely to pay considerably less than the market value of best-grade logs with no visible markings. Usually the best logs have already been taken by commercial log salvors. See the box at left for more information on GLS standards for salvaged logs.

Several costs are attached to log salvaging. If you intend to tow logs off your site and sell them to a receiving station, you require a Log Salvage Permit. Such a permit is available from the Ministry of Forests at a cost of about $500 ($250 to set up and $250 annually). The receiving station levies a charge for removing tow chains and sorting salvaged logs. Then it charges a further disposal fee if the logs are assessed as unmarketable. Finally, the provincial government levies a stumpage fee on all logs (marketable or otherwise) delivered to the receiving station.

In general, salvaging is not profitable for community groups. Marketable logs form a very small percentage of the total debris collected from wetlands – and most debris has no commercial value. One option is to hire a log salvaging firm. Commercial log salvors are in the business of debris collection and already hold a salvage permit.

STANDARDS FOR SALVAGED LOGS

The Gulf Log Salvage Cooperative on the Fraser River only accepts logs that are floating, are at least 3.5 m long, and have a diameter of at least 15 cm. The Cooperative does not accept:

- logs containing metal
- rotten logs
- roots
- cottonwood
- alder, birch or other hardwood
- logs shorter than 3.5 m regardless of diameter
- logs less than 15 cm in diameter, no matter how long
- Y grade cedar or cypress
- Z grade (culls) of any species
- deadheads or sinkers

GULF LOG SALVAGE PAYMENT SCHEDULE

Gulf Log Salvage Cooperative pays on the following basis:

Percent of market value	Log Grade	Value of Logs
40%	A,B,D,E,F,G	Most valuable
50%	C,H,K	
65%	I,M	
80%	J	
90%	U,X,Y	Least valuable

This schedule is established under the Log Salvage Regulations for the Vancouver Log Salvage District, Forest Act (B.C. Reg. 220/81)

RECYCLE LOGS AND TIMBER

Logs and other wood debris make effective log booms, fences, walkways, benches, signage, etc. on your wetland site. This saves you the cost of new materials and also raises public awareness of how debris can be recycled in useful and pleasing ways. Any cut lumber you salvage can also be used in on-site construction, or sold.

CUT AND SELL LOGS

Wood debris can be cut into firewood or other wood products and sold. However, you must first obtain a firewood permit from the provincial government at a cost of $75, then pay a royalty of $.75 for every cubic metre you sell. In the Fraser River estuary, you are also required to obtain an Unmerchantable Timber Permit from the Gulf Log Salvage Cooperative. Sales may be hampered by the fact that most cleanups are conducted over the winter months and produce firewood in the spring, when it's harder to sell. The majority of customers want hardwood, not the cedar, hemlock and fir often found in wetlands. Also, wood debris is usually wet and takes as long as six months to dry out before it's burnable.

There's better potential for return in shake blocks – large cedar blocks that can be split or cut into shakes (shingles) for roofing. Good quality blocks split into 45 or 60 cm lengths can sell for between $200 and $800 a cord, depending on the grade. This type of debris is common to the marsh wetlands of the Lower Fraser, but forms only a small part of the total debris on them. Most of the good-grade wood has already been collected by log salvors.

GIVE IT AWAY

While it doesn't generate income, giving away wood debris is a good way to promote public awareness of your project – at minimal cost. Advertise in local newspapers, post signs near the wetland itself, and make the wood accessible. If you've already used debris on site, your wetland can serve as a demonstration of how wood by-products might be used.

Wood debris can also be sent to landfill sites, or to a wood recycling depot if there's one in your area. You usually pay a charge for the use of these facilities.

BACK FROM THE FIELD

REVIEW AND ANALYZE CLEANUP

Once the cleanup is completed and the debris removed, review the records you maintained during the operation, including any photos. How long did the project run? Was it longer or shorter than expected? What volume of debris did you collect? What types of debris? Where was it located? What does the debris reveal (if anything) about the site's past history? Based on your knowledge of the area's plantlife, how do you expect the wetland to regenerate?

Did you make any provision (protective log booms, for example) to prevent debris from accumulating again? In the case of estuary marshes, debris returns at an annual rate of about five percent of the total volume removed.

Log booms stop debris carried in by the tide or seasonal high-water flow. But what about the debris introduced by wetland visitors? Have you considered erecting a gate or fence to limit the access of people and vehicles?

Did you use paid labour on your project? If so, what were your labour costs? How many hours did your paid labour force work? What volume of debris did they collect? Was the labour force skilled? Is there any way their efficiency might be improved? How many volunteers participated in the project? What volume of debris did they collect? In what other ways did volunteers contribute?

How did you dispose of the debris? What were your overall disposal costs? Did you generate any income (through the sale of firewood, for example) to offset these costs? Would you consider your efforts successful? In what ways might this part of the operation have been improved?

CONCLUSIONS

Funders usually require a final report that details what was intended, what was accomplished, and how their money was spent. Often the local or regional government requires a report as well, particularly if your site is located on public land. Reports of this type usually include a description of the site, the nature of the cleanup, the workforce and methods used, community participation, problems encountered during the operation, successes achieved, media exposure, and plans for the future. Sources or reference materials, if used, should also be listed.

SUPPLEMENT 3.1–A

RECOMMENDED READING

Marsh Clean-up Manual for the Fraser River Estuary. Vancouver, B.C.: T. Buck Suzuki Foundation, 1995.

Sustainability and Financial Self-sufficiency Marsh Reclamation Project. Vancouver, B.C.: T. Buck Suzuki Foundation, 1995.

Kistritz, Ron U. *Discover your Estuary*. North Vancouver, B.C.: Environment Canada, 1992.

Kistritz, Ron U., G.L. Porter, G. Radcliffe and P.R.B. Ward. *An Ecological Study of Surrey Bend.* New Westminster, British Columbia: Fraser River Estuary Management Program and District of Surrey, 1991.

Kennet, Kristal and Michael W. McPhee. *The Fraser River Estuary*. New Westminster, British Columbia: Fraser River Estuary Management Program, 1988.

Marsh Cleanup Summary Sheet 1

Marsh location: Date:

Name(if applicable) Size:

Municipality/district: NTS #

Organization name/address

Contact person: Phone:

Crew size: volunteers: paid workers:

Upper boundary of cleanup (directions, distance to known landmark):

Lower boundary of cleanup (directions, distance to known landmark):

Map of marsh:

Known/observed site hazards(identify on map):

Downed wood (type, location, wildlife value - identify on map):

Estimated time to complete cleanup:

Marsh Cleanup Summary Sheet 2

Day: (number)

Starting time:

Weather conditions:

Square m cleaned: Volume of debris:

Type of debris:

Disposal:

Wildlife presence (sightings, indicators, etc.):

Finishing time:

Form completed by:

Day: (number)

Starting time:

Weather conditions:

Square m cleaned: Volume of debris:

Type of debris:

Disposal:

Wildlife presence (sightings, indicators, etc.):

Finishing time:

Form completed by:

Day: (number)

Starting time:

Weather conditions:

Square m cleaned: Volume of debris:

Type of debris:

Disposal:

Wildlife presence (sightings, indicators, etc.):

Finishing time:

Form completed by:

Day: (number)

Starting time:

Weather conditions:

Square m cleaned: Volume of debris:

Type of debris:

Disposal:

Wildlife presence (sightings, indicators, etc.):

Finishing time:

Form completed by:

SUPPLEMENT: CONSERVATION ORGANIZATIONS

GOVERNMENT ORGANIZATIONS (B.C. HEADQUARTERS ONLY):

Provincial

For assistance in calling, phone — Enquiry B.C.:
660-2421 (Vancouver)
387-6121 (Victoria)
1-800-663-7867 (elsewhere in B.C. toll free)

B.C. Ministry of Environment, Lands and Parks
810 Blanshard Street
Victoria, B.C. V8V 1X4

B.C. Ministry of Forests
595 Pandora Avenue
Victoria, B.C. V8W 3E7

B.C. Ministry of Agriculture, Fisheries and Food
808 Douglas Street
Victoria, B.C. V8W 2Z7

B.C. Ministry of Municipal Affairs and Housing
800 Johnson Street
Victoria, B.C. V8V 1X4
(604)387-7912

British Columbia Conservation Data Centre
B.C. Ministry of Environment, Lands and Parks
780 Blanshard Street
Victoria, B.C. V8V 1X4
(604)356-0928

Project WILD
B.C. Ministry of Forests
P.O Box 9517
Provincial Government Station
Victoria, B.C. V8W 9C2
(604)356-7111

Wildlife Tree Committee
Habitat Protection Branch
B.C. Ministry of Environment, Lands and Parks
780 Blanshard Street
Victoria, B.C. V8V 1X5

Federal

For assistance in calling, phone — Reference Canada:
1-800-667-3355 (toll free)

Environment Canada/Canadian Wildlife Service
5421 Robertson Road
Westham Island
Delta, B.C. V4K 3N2
(604)946-8546

Fisheries and Oceans Canada
400 - 555 West Hastings Street
Vancouver, B.C. V6B 5G3
(604)666-3545

Agriculture & Agri-Food Canada
202 - 620 Royal Avenue
New Westminster, B.C. V3L 5A8
(604)666-6513

Fraser River Estuary Management Program (FREMP)
301-960 Quayside
New Westminster, B.C.
V3M 6G2
(604)525-1047

OTHER ORGANIZATIONS

Centre for Applied Conservation Biology
University of British Columbia
Room 207, Header House
2336 West Mall
Vancouver, B.C. V6T 1Z4
(604)822-5724

Royal British Columbia Museum
675 Belleville Street
Victoria, B.C. V8V 1X4
387-3701 (Victoria)
1-800-661-5455 (toll free)

NON-GOVERNMENT ORGANIZATIONS:

British Columbia Environmental Network
(umbrella organization for non-profit environment groups)
1672 East 10th Ave.
Vancouver, B.C. V5N 1X5
(604)879-2279

B.C. Wildlife Federation
Suite 102, 6070 - 200 Street
Langley, B.C. V3A 1N4
(604)533-2293

Ducks Unlimited Canada
Coastal office:
W.R.P.S. Box 39530
White Rock, B.C. V4A 9P3
(604)591-1104
Provincial office:
954A Laval Crescent
Kamloops, B.C. V2C 5P5
(604)374-8307

Federation of B.C. Naturalists
321 — 1367 West Broadway
Vancouver, B.C. V6H 4A9
(604)737-3057

Friends of Boundary Bay
P.O. Box 1441, Station A
Delta, B.C. V4M 3Y8
(604)940-9810

Interpretation Canada, B.C. Section
716 Courtney Street
Victoria, B.C. V8W 1C2

The Nature Trust of British Columbia
808 - 100 Park Royal South
West Vancouver, B.C. V7T 1A2
(604)925-1128

Sierra Legal Defence Fund
214 — 131 Water Street
Vancouver, B.C. V6B 4M3
(604)685-5618

West Coast Environmental Law
1001 — 207 West Hastings St.
Vancouver, B.C. V6B 1H7
(604)684-7378