Research Links
A Forum for Natural, Cultural and Social Studies

Dungeness Crab

In and around Pacific Rim National Park Reserve

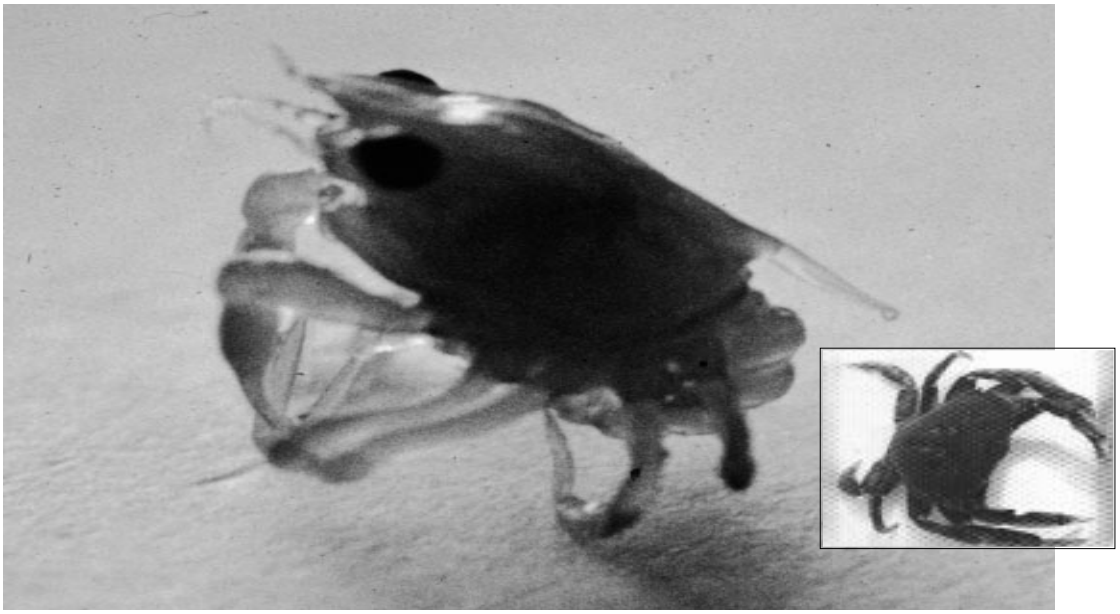

Figure 1. A Dungeness crab megalopa looks somewhat like an adult crab, and is about the size of a small pea.

Glen S. Jamieson

The Dungeness crab is the largest shallow-water crustacean found in southern British Columbia, with a carapace width exceeding 200 mm. Larger king and tanner crabs are also present in BC, but these are either deepwater species or occur only in the northern part of the province. Recent studies have provided information relating Dungeness crab distribution to regional oceanography, and explain why the west coast of Vancouver Island lacks the high crab abundance that characterizes major crab fisheries on the outer coasts of Washington, Oregon and northern California (Jamieson et al. 1989; Jamieson and Phillips 1993).

LIFE HISTORY

The Dungeness crab is somewhat unique in having a relatively long larval period, lasting about 4-5 months depending on water temperature. There are 5 zoeal stages, followed by a megalopal ("big-eyed") stage (Figure 1), which looks somewhat like an adult crab, is about the size of a small pea, and can swim at 10-15 cm per second. The megalopal stage lasts about 30 days, after which the larva settles to the sea bottom and metamorphoses into a first instar juvenile crab, which looks like a miniature adult. Little is known about the depth preferences and spatial distribution of zoeae, but megalopae migrate vertically on a daily basis, with outer-coast crab descending to about 25 m depth during the day and being at the water surface at night. Crab larvae hatch in late winter-early spring, when currents (Figure 2) could carry them thousands of kilometres. Surveys show that megalopae can be transported over 100 km off shore. The currents create a problem for the crab because few newly-settled crab survive in waters deeper than 40 m, so offshore larvae must somehow return inshore and settle in shallow water to survive.

THE ROLE OF OCEAN CURRENTS

Knowing what we do about coastal megalopae movement raises the questions: What determines the Dungeness crab settlement patterns off Pacific Rim National Park Reserve (PRNPR), and what happens to Dungeness crab larvae hatched in the relatively confined waters of the Strait of Georgia, between southern Vancouver Island and the mainland? Are larvae from the fished crab population at the mouth of the Fraser River flushed out of the Strait, or do they somehow remain within the Strait for their entire larval period? If the latter, what prevents them from being swept out of the Strait?

The answers to these questions lie in the oceanography of BC waters. The Subarctic Current crosses the Pacific Ocean from Japan and splits about the latitude of southern BC into the south-flowing California Current and the north-flowing Alaska Current. Within a few tens of kilometers from shore, the winter wind-driven Davidson Current flows north from California to northern BC. When winter storms subside and fairer weather dominates the coast, the Spring Transition occurs as winds shift mostly to the north

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Research Links

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FEATURE ARTICLES

DEPARTMENTS

FRANCOPHONES

Le texte de cette publication est offert en français. Vous pouvez l'obtenir en écrivant a l'adresse dans la p.24

SUBMISSIONS WELCOME FOR THE WINTER ISSUE. THE DEADLINE IS OCTOBER 10, 1997.

EDITORIAL

With every issue, our goal is to provide you with interesting, useful information. Whether it's looking at a recently completed research project, or an idea for the future, we believe that is what makes our publication unique. We also use *Research Links* to keep you, the research community, up to date with practical information that has implications for your work. This is the reason I am introducing some major changes in Parks Canada. (Further information regarding the Ecosystem Secretariat is provided by Doug Hodgins on page 8, and details regarding Western Canada's Field Units are on page 9.)

Parks Canada is undergoing some major reorganization and reductions. To those not directly involved, the changes can be confusing. Several of the articles in this issue of Research Links mention initatives designed to work within the new agency system. The purpose of the information which follows is to help you, the research community, understand what is happening.

AGENCY

Parks Canada is being asked to maintain the current system of parks and sites, continue to create new areas, and to do so at less cost. With this in mind, the Government of Canada announced in the March 1996 Budget that it would strive to provide a program with the authority and flexibility to better carry out its responsibilities by establishing Parks Canada as an Agency. The agency will be established under the Department of Canadian Heritage as a separate service to manage and preserve a system of national parks, national historic sites, canals and related protected areas for the use and enjoyment of Canadians. The agency's expanded ability to enter into new partnership arrangements will be a key benefit. Canada-wide consultations are underway to plan the establishment of a Parks Canada Agency. National and regional stakeholders representing environmental and heritage groups, tourism and business, as well as parks Canada employees are invited to participate. Details regarding Agency establishment and follow up on suggestions and concerns expressed during consultations held in June 1996 are contained in the Parks Canada Agency Progress Report, available upon request.

REORGANIZATION OF PARKS CANADA

Parks Canada is in the process of moving from a three-level organization (Park-Region-Headquarters) to a two-level organization, consisting of a national office with a network of operational field units augmented by a system of service centres. The national office directs the operational programs and provides national policies and standards. There is no middle management structure. Field units consist of groupings of parks and sites which have geographic and program affinities and are totally accountable for program delivery. Each field unit is headed by a superintendent. There are 29 field units, 15 in Western Canada (for more information, see page 9).

Service Centres contain specialized expertise and provide professional and technical services at the request of the field unit superintendent. They promote consistent high quality standards of service, facilitate interdisciplinary teamwork, provide independent advice on mandate and delivery, and take advantage of economies of scale. They also perform storage and curatorial functions for cultural resources. There is one Service Centre for Western Canada, directed by Orysia Luchak, with offices located in Winnipeg, Calgary and Vancouver.

These major reorganizations and reductions are being felt throughout the organization. Research Links is feeling the crunch too, and I want to assure you that there is strong support to continue the publication. The Editorial Board is working to ensure its ongoing production, and always welcomes your comments and ideas. The best measure of our success is your written, faxed or e-mailed feedback.

Patricia Benson
Research and Information Specialist, and Editor of Research Links.

Whirling Disease Task Force Announced in Alberta

Duane S. Radford

Alberta Environmental Protection (AEP), in partnership with Alberta Agriculture, Food and Rural Development, has formed a task force to address the threat of whirling disease to the province's wild and farmed trout. This move follows AEP's announcement in April, 1997, to close Alberta's borders to the import of live trout as of October 1, 1997, until risk assessments of suppliers can be completed. This action will help to prevent the transmission of whirling disease to wild trout waters through the aquaculture industry.

Although whirling disease has not been reported anywhere in Canada, it has been implicated in the significant decline of wild trout populations in Montana, Utah and Colorado. The disease is a concern for park managers because native trout species in Canadian national parks could be adversely affected. A top priority of the new task force (on which sits Charlie Pacas of Banff National Park), is to prepare a contingency plan so officials can act quickly and effectively, should cases of whirling disease be confirmed.

The task force has already established a panel of experts to advise members on scientific matters relating to the parasite's life cycle and procedures for testing trout for the disease. In addition, the task force is formulating a public awareness campaign to inform and educate Albertans about the disease, its transmission and potential impact, and how we can keep the disease out of Alberta.

Whirling disease is caused by a microscopic parasite which attacks the cartilage of young trout and salmon. It is named for the erratic, tail-chasing or "whirling" behaviour displayed by some young fish infected with the parasite. Although the parasite may not kill fish directly, it makes them more vulnerable to disease and environmental distress, both of which can cause death. Infected fish can transfer the disease to new locations. Mud is both the medium for the parasite's host, the tubifex worm, and a vector for the disease, as spores can exist in the mud for up to 30 years. Whirling disease poses no threat to humans.

To reduce the risk of introducing whirling disease to Alberta waters, anglers, fishing guides and boating enthusiasts are asked to take the following precautions:

- Wash mud off all boats, trailers, waders and boots used outside Alberta.
- Do not transfer fish or water from one water body to another—fish dead or alive can contain parasite spores.
- Fish offal, particularly head and bones, should be disposed of in dry garbage destined for collection, and should not enter natural water systems.

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Fishing in Alberta Home Page: http://www.gov.ab.ca/~env/nrs/wmd/fishing.html

FEEDBACK

RESEARCH LINKS RECEIVES AWARD FROM NATIONAL ORGANIZATION!

Patricia Benson, the principle editor of *Research Links*, was presented with a merit award by the Federal-Provincial Parks Council (FPPC) at Cornerbrook, Newfoundland in June, 1997. Patricia was one of six individuals to receive this award, acknowledging their "outstanding work in the parks field." In the award presentation, Mike Porter, Acting Director General of National Parks and 1997 chair of the FPPC said, "Research Links' success is the result of a loyal and enthusiastic team..." The Council was launched in 1961 "to provide a forum for federal, provincial and territorial jurisdictions to foster the enhancement of park resources through the exchange of information and technical expertise." Patricia, with the support of Natural Resource Group Manager, Bernie Lieff, has been the moving force behind *Research Links* since its inception in 1993.

"We in the Saskatchewan Provincial Park System appreciate receiving *Research Links* and reading of progress being made on issues that also affect us. I particularly enjoyed Harvey Locke's recent "Podium." It is good advice to park employees not only in Saskatchewan but in all provincial and territorial jurisdictions."

— John Vandall, Supervisor of Resource Management and Protection, Saskatchewan Environment and Resource Management, Regina, SK

"You sent me the SAMPA III issue of *Research Links*. It seems to be an interesting, useful and practical publication. I'll share it with my son who is in the sustainability movement."

— Peter Bein PhD. PEng, Vancouver, BC

ALBERTA PRAIRIE CONSERVATION ACTION PLAN (1996-2000)

Bill Dolan

The Prairie Conservation Action Plan (PCAP) is an action blueprint for conserving the biological diversity of Alberta's native prairie. It emphasizes applying a conservation ethic to all activities and management decisions on the prairies, with a special focus on initiatives in nearby communities. The plan also recognizes that the prairie's heritage value extends beyond an ecological value alone to include cultural and economic contributions, and that all these aspects are interdependent.

The first five-year PCAP was released by Canada's three prairie provinces and the World Wildlife Fund in 1988. In Alberta, drafting a new plan to take the province into the next millennium was coordinated by the Prairie Conservation Forum (PCF). The Forum is a multi-stakeholder group originally initiated by the Alberta government, and includes approximately 35 different organizations representing diverse interests in prairie conservation. The PCF has enabled different agencies and organizations to develop close working relationships. In many cases, these relationships are particularly important in moving ahead prairie conservation issues, even when an issue involves only one agency. Several initiatives facilitated by the PCF include:

- Agreement in Principle to set aside part of CFB Suffield as a National Wildlife Area
- Development of a "Conservation and Management Strategy for Riparian Forests in Southern Alberta"
- An Occasional Paper Series to promote prairie conservation issues.

Alberta's PCAP is a working-level document linked to a larger strategy with similar documents in preparation for Manitoba and Saskatchewan. It is intended to facilitate the completion of real tasks or actions implemented by one or more member agencies in support of prairie conservation. Alberta's plan emphasizes multi-party partnerships, networking with other conservation initiatives, and cooperative approaches at the community level, to reach consensus on effective, common sense and cooperative strategies.

The plan's four goals are to:

1. Acquire better information about prairie ecosystems.
2. Ensure that all three levels of government have policies in place which favour conservation of prairie ecosystems.
3. Adopt ecosystem land-use practices and protective strategies across the entire landscape, not just at selected sites.
4. Increase public awareness and support for the values and importance of prairie ecosystems.

In addition to actions by specific members or partnerships, the PCF is working on three key initiatives this year:

1. Designing a university course on prairie conservation in cooperation with an Alberta university.
2. Developing a communication strategy including specific products which will promote the understanding and appreciation of our native prairie ecosystems.
3. Compiling prairie inventories over the past five years and analyzing gaps in research/inventories, generally considering work done over the past 30 years.

The PCAP's objective to provide specific protection for significant, representative and sensitive ecosystems has implications for protected areas. This objective has led to several actions, including: protecting sites in the Ross Lake, Dune Point and Prairie Coulee areas by 1997; protecting the Lost River site by 1999; producing management plans and biophysical inventories, and establishing monitoring programs for all protected areas within two years of site designation. Once completed, the Alberta, Manitoba and Saskatchewan plans will be consolidated in a new statement of prairie-wide conservation principles.

For more information about Alberta's Prairie Conservation Forum and its Action Plan, please contact:

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Parks Canada Research Adventures

Putting Natural Curiosity To Work

Donna Cook

Peter Achuff teaches participants about forest diversity and succession in Yoho's blowdown

Yoho National Park launched a program that brings together tourism, environmental education and research activities. Parks Canada Research Adventures are short-term working holidays that involve the public in scientific and educational activities in national parks. The purpose of the program is to provide help in fulfilling parks' responsibilities to conduct long-term environmental monitoring and to educate local students and the public about ecosystem issues in national parks. Clients pay to participate and in doing so, contribute financially as well as personally to the efforts of Parks Canada's research and education programs.

The Yoho Research Adventures program resulted in 144 hours of volunteer work through two working vacation programs conducted during the summer and fall of 1996. Seven participants assisted with Lake O'Hara socio-ecological research, grizzly habitat research and beaver monitoring. Researchers had participants perform different tasks. The most successful and usable results were those gained through simple, easy-to-verify duties. Participants cross-referenced photographs from trail monitoring equipment, compiled a communications inventory, conducted vegetation transects to assess grizzly habitat quality, and documented beaver activity through photography, mapping and field note taking activities.

One of the educational goals of the program is to target Canadian teachers. A teacher who participated in 1996 worked with other participants in support of environmental education in the park. As a result of this work, one group wrote an educational article about the research project. Another group delivered a high quality school interpretive program which the park would not otherwise have the resources to provide. The September program trained participants to lead a student field trip on beaver ecology. The field trip consisted of four short field exercises that were pre-planned with a recipe-like field booklet for leader and students to follow. The beaver habitat theme allowed participants to share the knowledge they gained earlier in the week when they were documenting active beaver sites in park valleys. The students from the local community of Golden were responsive as they listened to and learned from the Research Adventure participants who showed them how to study beavers in the wild. Participants commented that by conducting the school programs, they realized how much they had actually learned from their hands-on research experience.

Most importantly, increased awareness of park issues translated into several concrete examples of support of protected areas, as demonstrated in feedback received weeks after the program. A young teacher from British Columbia wrote to the Friends of Yoho National Park (a non-profit, co-operating society) stating: *"I enjoyed my Research Adventure at Lake O'Hara... so much, that I just had to become a member. So I'm joining both the Friends of Yoho and the Lake O'Hara trails club to contribute to the preservation of and education about a truly unique Rocky Mountain area. In addition to my membership fee, please accept my humble first donation..."*

Many Canadians wonder if the public would pay for the experience of helping a researcher collect data in the outdoors. Yet, for many urban dwellers who are concerned about the state of the earth, this opportunity is one they are keen to pursue. Working holidays or "volunteer vacations" are well established in the United States, Australia and England, where thousands of paying volunteers assist with nature conservation, scientific research and social programs in developing nations.

Parks Canada Research Adventure participants experienced what few members of the public have in a Canadian National Park. Participant evaluations indicated that the program's strength is in providing an constructive, hands-on learning experience. The "first-hand" nature of the experience allows for the best learning opportunity possible, and distinguishes this program from other eco-tourism programs which offer guided tours of research areas or nature trails. Other strengths noted in participant comments were the location, being able to view wildlife, the amenities and the ability to work with researchers, park staff and school children.

Interest has grown for the 1997 season, which features programs in Banff and Yoho National Parks. In Yoho, Research Adventure participants will be immersed in the Rocky Mountain ecosystem with a variety of activities, from tracking rare wolves and measuring forest diversity to monitoring heritage river watersheds and helping students learn about carnivore conservation. In Banff, participants will learn about black bear populations and their travel routes in the Bow Valley and teach park visitors ethical wildlife watching practices.

Although it is too early to judge the full value of this program in a Canadian context, Parks Canada Research Adventures provide participants and Parks Canada with positive results. Through their participation, Research Adventure participants help Parks Canada to

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west and this nearshore current reverses, disappearing into the waters already flowing south in the California Current. The Fall Transition reestablishes the Davidson Current. Thus, crab larvae hatched off California a few months before the Spring Transition may be carried north. However, in the remaining months of their developmental period after this transition, crabs that did not move so far north as to become entrained in the north-flowing Alaska Current are carried south. It is not known how far larvae actually move, as they cannot be followed individually. However, drift cards released off Victoria, BC, have been recovered off the Queen Charlotte Islands in northern BC only a few weeks later, indicating that potential movement is substantial. Larvae hatched from crab populations virtually anywhere south of Alaska may be mixed during this event.

Outflow from the Fraser River provides more insight regarding crab distribution off PRNPR on the coast of Vancouver Island. This freshwater flow, which freshets in late spring, tends to flush the surface waters of the southern Strait of Georgia. Because it is freshwater, it forms a lower salinity layer on the ocean surface. The spin of the earth results in the Coriolis force, which causes this water mass to move to the right, into Juan de Fuca Strait, mostly on the Canadian side. Thus, the Fraser River outflow hugs the west coast of Vancouver Island (Figure 3). The year-round outflow, termed the Vancouver Island Coastal Current, is up to 50 km wide off Barkley Sound and narrows as it moves northwestward. In Juan de Fuca Strait, the outflowing surface water creates an estuarine effect, entraining some salt water and carrying it out. This in turn creates a deeper water current flowing into the Strait to replace the saltwater removed. The surface outflow is mostly on the Canadian side, so the inflow is mostly on the American side of the Strait (Figure 3).

Crab larvae surveys off PRNPR in May and June (after the Spring Transition), showed virtually no crab larvae in nearshore waters in the Vancouver Island Coastal Current, whereas up to hundreds per square metre occupied the surface water at the boundary between this current and the more offshore, south-flowing California Current. Hence, the Coastal Current seemed to act as a barrier to landward movement of the outer-coast crab megalopae, so megalopae accumulate in the boundary area between the opposing currents. As this Coastal Current does not occur off the adjacent southern American States, larvae readily move to the coast there where they can survive after settlement. This difference in current patterns seems to explain why overall landings have been larger and more consistent off the US than off Canada.

Where do crab larvae that form the smaller, but still significant, crab population off PRNPR originate? A big storm during one survey revealed the answer. In that storm and similar events, winds come from the southwest, and push sufficient water against Vancouver Island to create a hydraulic head. For a few days during the storm, this head stopped the outflow from Juan de Fuca Strait, temporarily stopping the Coastal Current. In the

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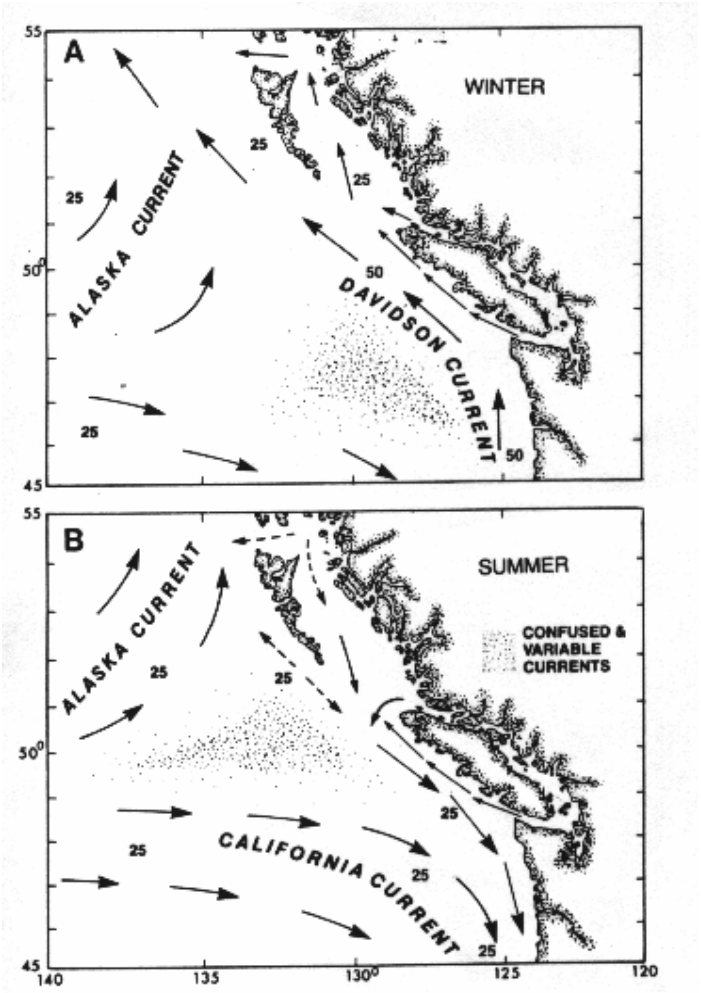

Figure 2. Prevailing surface circulation off the British Columbia-Washington coast in winter and summer. Broken arrows indicate uncertain currents. Numbers indicate current velocities (cm sec-1). (from Thomson 1981)

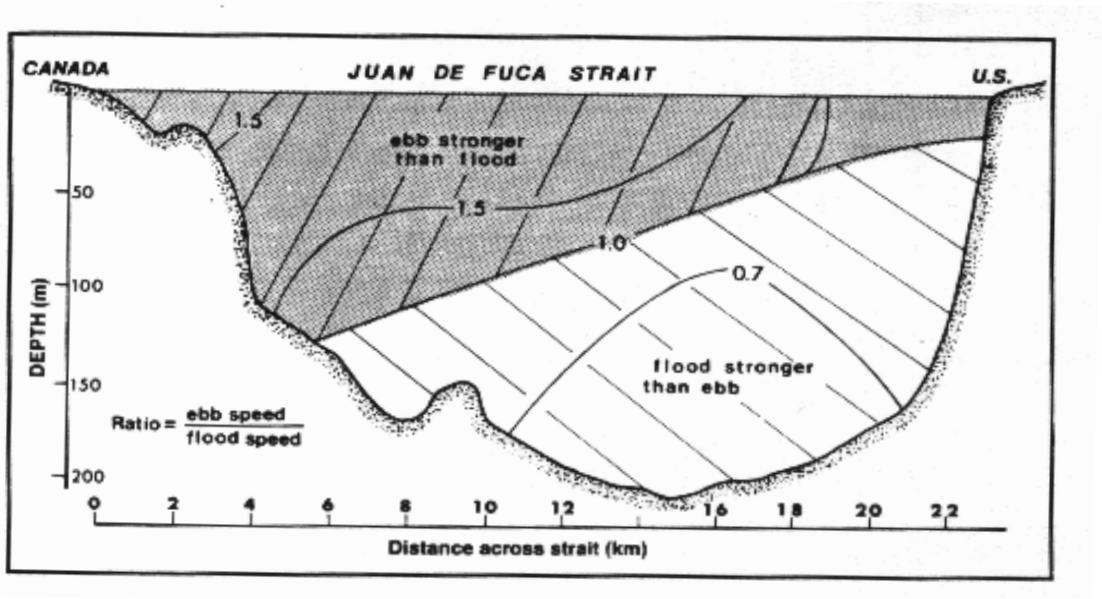

Figure 3. Average ratio of the ebb speed to the flood speed in cross-section frm Pillar Point (USA) to Port Renfrew (PRNPR, Canada). (from Thomson 1981)

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absence of that barrier, outer-coast crab larvae could move to the shore. Possibly they were blown by winds when the crab were at the water surface at night, much as other material at the water surface, such as oil, can be blown by winds. These storm events do not occur with the same intensity every year, and would have to occur just when the crab are ready to settle to result in crab populations off PRNPR. Consequently, major crab settlements off PRNPR are at best periodic events. Landings data suggested they occurred in only 2 years during the 1980s.

STRAIT OF GEORGIA CRABS

Why did the Coastal Current observed during the study not contain crab larvae from the Strait of Georgia, and did this mean that Strait of Georgia crab did not move into outer coast waters? During their daily migrations, megalopae from the Strait of Georgia move to depths of about 140 m, whereas outer-coast larvae move to about 25 m depth during the day. Outer-coast larvae cannot normally enter the Juan de Fuca Strait, because they are always confined to outward flowing surface water. In contrast, Strait of Georgia larvae are at the surface at night only, but because nights are short in late spring (about 6 h), and days are long (18 h), they spend most of their time in the inward flowing, deeper waters. The result is that Strait of Georgia larvae are retained in the Strait of Georgia and virtually never mix with outer coast larvae. This also means that few larvae are in the outward flowing, near surface Coastal Current, which explains why few crab megalopae are found close to shore off Tofino, BC, just north of PRNPR.

IMPLICATIONS OF FINDINGS

These studies show that humans have very little influence on the scale of crab settlement that may occur in any given year. Given the large dispersal range of Dungeness crab, closing a local fishery to increase adult crab abundance will not ensure that future settlements will be any larger. However, PRNPR managers may be able to influence the long-term survival of newly-settled crab larvae, particularly in areas where settlements are often small. In such circumstances, predators are often proportionally more abundant, and most crab survival occurs in shallow water, often intertidal areas where bottom cover (eel grass, shells etc.) is available. This type of environment is found in Clayoquot Sound in Lemmens Inlet, Browning Passage and Grice Bay. Ensuring that potential "crab nursery" habitats are not heavily impacted by humans is an important step in protecting whatever crab settlement naturally occurs.

Following a period of high crab settlement, there is a tendency to assume that similar settlements may be repeated soon, and for fishers to invest in more gear and bigger boats. If subsequent crab settlement is not above average, over-fishing can occur, and future crab year-classes may be heavily impacted. Juveniles are particularly affected as they can enter traps before they are large enough to be retained by the fishery, and are often damaged during release. When crabs can legally be retained, fishing can be intense as too much gear is deployed for the relatively small resource. In this situation, neither the crab nor the fishers benefit, and a better management approach would be to restrict trap numbers and, where possible, to extend harvest of a large year-class over a number of years.

Dungeness crab studies illustrate how complex the relationship between a species and its habitat can be, and how abundance is intimately intertwined with local environmental and socio-economic conditions. As more and more questions arise, the Dungeness crab study shows how trying to answer what appeared at first to be a simple question about a local population can lead to many other questions, and ultimately to a more fundamental understanding of population dynamics.

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Effects of ocean variability on the abundance of Dungeness crab larvae. Can. Spec. Publ. Fish. Aquat. Sci. 108: 305-325.

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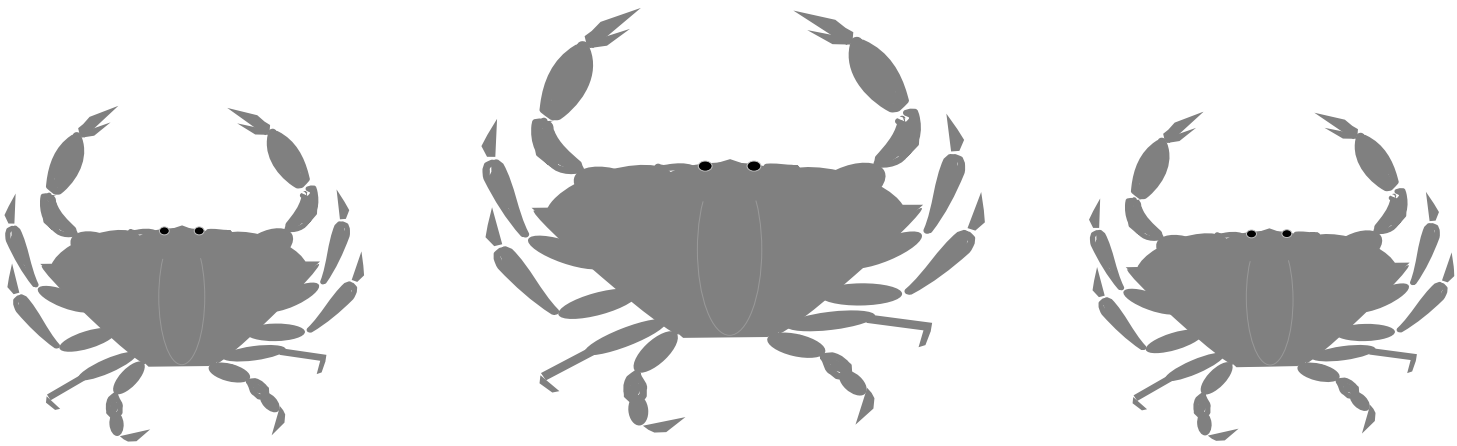


Changes in Parks Canada

What is an Ecosystem Secretariat?

Doug Hodgins

An Ecosystem Secretariat is an organizational unit dedicated to providing greater strategic direction to ecosystem-based management issues and developing long-term sustainability goals for the national park. The Secretariats would promote consistent approaches to ecosystem-based management issues and ensure that the principles that underlie such a management approach are front and centre in decision-making along with relevant priorities and investment considerations. The principle focal points would include:

- ecological and commemorative integrity objectives and their achievement;
- Park Management Planning and other land use planning and management;
- standards and levels of appropriate use consistent with park management objectives;
- integration of Protected Areas into the larger regional landscape;
- establishing long-term research goals, coordinating the preparation of the park's research agenda and issuing research permits;
- coordination of strategic and baseline research including ecological, socio-economic and cultural resource research;
- establishing strategic direction that ensures an appropriate level of understanding of park ecosystems;
- providing strategic advice on how National Parks can demonstrate leadership in environmental stewardship;
- ensuring a high standard and protocols of application of the Canadian Environmental Assessment Act;
- promoting high quality consistent approaches to data management;
- establishing standards for monitoring programs and reporting on progress toward assuring the ecological and commemorative integrity of the park; and
- monitoring progress and reporting such through the State of the Park Report.

Why did Parks Canada feel that such an organization adjustment was necessary? In simple terms, with the pressures of day-to-day operational and management issues, it was difficult to maintain the long term, strategic view of where the park should be heading. Dedicated energy was needed to develop long term solutions to management issues, landscape condition goals, standards and protocols that were needed and the tools to enable park staff to achieve these goals. Such tools may be in the form of detailed research and monitoring protocols, management arrangements with other jurisdictions such as municipalities, provinces or First Nations as well as technical support tools such as Geographic Information Systems.

It is sometimes helpful to describe what an Ecosystem Secretariat does *not* do. While the units may be involved in some aspects of implementation because of staff expertise, they are not directly responsible for:

- the delivery components of ecosystem-based management such as implementation of strategic plans, preparing resource management plans, or undertaking specific resource actions such as prescribed fire, exotic plant control, actioning wildlife/ human conflicts and so on;
- management actions such as enforcement and resource monitoring;
- undertaking specific applied, issue driven research in response to identified management concerns;
- implementing their own plans; or
- preparing environmental screenings.

Larger field units, such as Jasper National Park, will have up to seven professional level positions in the Secretariat including a Land Use Specialist, Conservation Biologist, Environmental Assessment Specialist, Data Management Specialist, Communications Specialist, Library and Collections Technician and the Secretariat Manager. Not all parks have an Ecosystem Secretariat Unit. Smaller organizations will accomplish these goals as part of the Warden Service. However, long-term focus is no less important and smaller field units are still expected to address this need.

The division of responsibilities between the Ecosystem Secretariat and the Warden Service has been a source of some confusion. Figure 1 shows the three building blocks of Parks Canada's business plan. It also demonstrates that generally the Secretariat focuses on longer term strategic matters while the Warden Service has a greater operational focus. Other aspects of park management will have similar divided responsibilities. Having said that, all staff are expected to take the long term view and therefore the division line is very permeable. This collaborative approach among staff is the key to successfully implementing this model.

The Ecosystem Secretariat units are being implemented at different rates throughout the parks of western Canada. Future issues of Research Links will profile the people involved, report on progress being made and discuss some of the lessons learned.

Doug Hodgins is Manager, Ecosystem Secretariat Jasper National Park. Tel: (403)852-6186

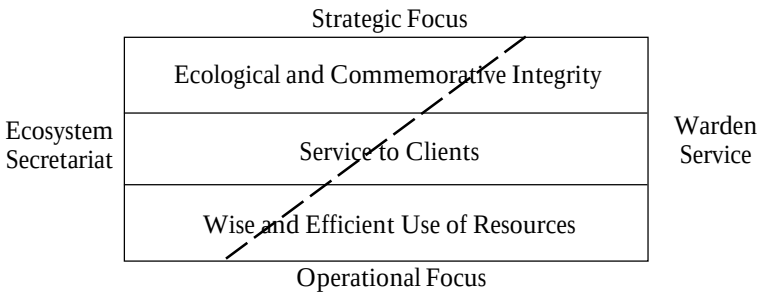
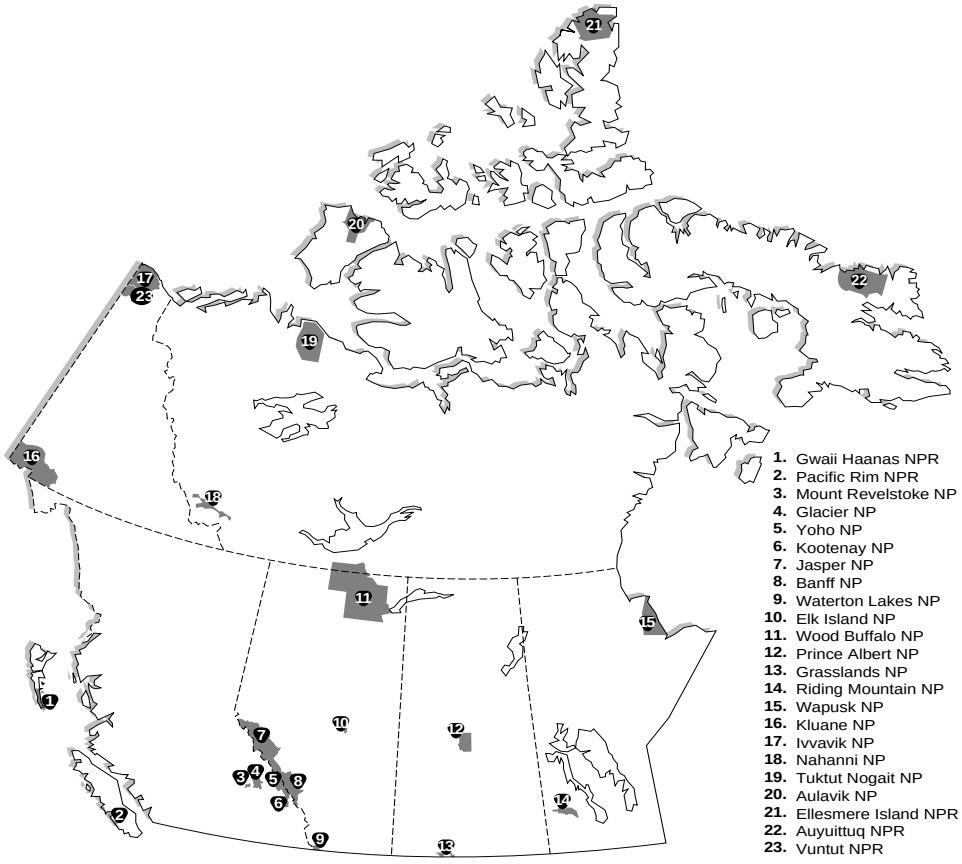


Figure 1. Responsibilities Model for the Ecosystem Secretariat

FIELD UNIT SUPERINTENDENTS IN WESTERN CANADA*



GWAII HAANAS—Steve Langdon in Gwaii Haanas
Includes: Gwaii Haanas (1), Kitwanga Fort and Sgan Gwaii

COASTAL BRITISH COLUMBIA—Jim Barlow in Victoria
Includes: Fort Langley, Fort Rodd Hill, Gulf of Georgia Cannery, Fisgard Lighthouse and Pacific Rim (2), St. Roch

MOUNT REVELSTOKE/GLACIER—Roger Beardmore in Revelstoke/Glacier
Includes: Mount Revelstoke (3), Glacier (4) and Rogers Pass

KOOTENAY/YOHO—Darro Stinson in Kootenay (Darro Stinson is on leave; John Allard acting)
Includes: Kootenay (6), Lake Louise, Yoho (5), Twin Falls Tea House and Kicking Horse Pass

JASPER—Ron Hooper (acting) in Jasper
Includes: Jasper (7), Athabasca Pass, Jasper Park Information Centre, Jasper House, Yellowhead Pass and Fort St. James

BANFF—Charlie Zinkan in Banff (Charlie Zinkan is acting Executive Director; Céline Gaulin acting)
Includes: Banff (8), Cave and Basin, Banff Park Museum, Rocky Mountain House, Abbot Pass Refuge Cabin, Skoki Ski Lodge, Sulphur Mountain Cosmic Ray Station and Howse Pass, Banff Springs Hotel

WATERTON/BAR-U—Josie Weninger in Waterton Lakes
Includes: Waterton Lakes (9), Prince of Wales Hotel, Bar-U Ranch and First Oil Well in Western Canada

NORTHERN PRAIRIES—Peggy Clark in Prince Albert
Includes: Prince Albert (12) and Elk Island (10)

SOUTHWEST NORTHWEST TERRITORIES—Ken East in Yellowknife (Ken East is on assignment; Peter Lamb acting)
Includes: South Slave/Deh Cho, Wood Buffalo (11) and Nahanni (18)

SASKATCHEWAN SOUTH—Jim Masyk in Grasslands
Includes: Grasslands (13), Batoche, Fort Battleford, Motherwell Homestead, Fort Walsh, Frenchman Butte, Battle of Fish Creek, Fort Livingstone, Fort Pelly and Fot Expérance

RIDING MOUNTAIN—Greg Fenton in Riding Mountain (14)

MANITOBA—Mike Fay in The Forks (Mike Fay is on assignment; Greg Thomas acting)
Includes: The Forks, Lower Fort Garry, St. Andrew's Rectory, Riel House, York Factory, Prince of Wales Fort and Wapusk (15)

YUKON—Linda Johnson in Kluane
Includes: Kluane (16), S.S. Klondike, Vuntut (23), Chilkoot Trail, S.S. Keno, Dredge No. 4, Gold Room at Bear Creek and Dawson City Buildings

WESTERN ARCTIC—Bill Fox in Tuktut Nogait
Includes: Tuktut Nogait (19), Aulavik(20), Ivvavik (17) and the MacKenzie Delta Pingos

NUNAVUT —To Be Announced
Includes: Auyuittuq (22), North Baffin and Ellesmere Island (21)

* *Numbers in parentheses refer to national park locations on the map above. The names in upper case are field units, followed by national parks and national historic sites.*

Remembering
Tanya Rintoul
1971 - 1997

On July 22, 1997 Banff National Park lost a valued researcher, Tanya Rintoul, who drowned in a canoeing accident on the Vermilion River. At the time of her accident, Tanya was studying the effects of fire on forest ecology. Tanya's expertise in fire ecology was of great benefit to Parks Canada. Her research in Banff focussed on changes in vegetation that occurred due to combinations of fire, ungulate browsing, and forest succession. She was becoming an expert on habitat conditions necessary to conserve saskatoon, rose, aspen, willow, and other palatable species that are becoming increasingly rare in our ungulate rich, fire poor forests. We looked forward to working with Tanya for some time, and we extend our condolances to her family and friends.

The following was written by close friends and given out at a memorial service held at Muleshoe Overlook on July 26.

Tanya was an energetic and beautiful individual who excelled and believed in every pursuit she undertook. Growing up in Southern Ontario in a loving and supportive family, Tanya first learned the beauty of the natural world at her cottage, "Rocky Perch." Barefoot summers at the cottage, and time spent in the Girl Guides and Junior Rangers, led Tanya to a discovery that impacted her life and directed her future.

After being presented with the Duke of Edinburgh award and completing undergraduate degrees in Outdoor Recreation and Biology at Lakehead University (graduating class 1994), Tanya went on to receive an MSc (Forestry) in 1997. Tanya's love of the environment was not just intellectually grounded, however; she expressed herself through her art and music and lived her life as she believed. Tanya was an avid outdoor enthusiast and naturalist who loved Northern Ontario and Lake Superior. She worked for LACL (Lakehead Association for Community Living – an organization that helps to integrate individuals with developmental disabilities into the community) and ECHO, a group dedicated to raising public awareness and concern for the environment within the community. In 1991, Tanya was chosen to lead a cultural expedition in Baffin Island. Tanya also participated in the Bicentennial Mackenzie Expedition of 1991 (an historic re-enactment of Sir Alexander Mackenzie's 3,500 km canoe voyage from LaChine, Quebec to Lake Winnipeg, Manitoba), an adventure during which she formed many long-lasting and loving friendships.

Although we miss her dearly, we all find comfort in the following:

Tanya embraced life to the fullest, and died doing what she loved.

RESEARCH PURSUITS

QUOTA/RESERVATION SYSTEMS

Mount Robson Provincial Park is implementing a quota and reservation system for the Berg Lake Trail this summer. This action was a result of recommendations from a management plan based on the Limits of Acceptable Change (LAC) model. As a BC Park employee and UNBC student, I am assessing the introduction of the reservation/quota system by monitoring the campers' reactions through a questionnaire, interviewing park managers with similar systems, and reviewing existing literature. If anyone has information pertaining to quota/reservation systems in backcountry environments, or knows of relevent literature, your assistance would be greatly appreciated.

Contact: Eamon O'Donoghue, Mount Robson Provincial Park. Tel: (250)566-4325, fax: (250)566-9777; e-mail: jhegan@vis.bc.ca

SILVA FOREST FOUNDATION

The Silva Forest Foundation (SFF), is a nonprofit charitable organization based in the West Kootenay, BC. The board and staff of the SFF are scientists and activists with decades of experience working with rural communitites to develop diverse forest uses which protect, maintain and restore forests. The SFF develops and teaches the principles of Ecologically Responsible Forest Use, including alternatives to conventional timber management.

The SFF recently completed its fifth year of training sessions in ecologically responsible forest use. Courses included: Ecologically Responsible Timber Management at the Stand Level, Ecoforestry for Professionals, Practical Forest Hydrology, Ecoforestry for the Public, and Forest Diseases and Insects. Each SFF course includes an extensive syllabus, and most sessions involve practical field exercises designed to reinforce the concepts presented in discussions and slide shows.

SFF courses meet the needs of a variety of people, and participants include professional foresters, forest technicians, teachers, tree planters, forest activists, loggers, biologists, hydrologists, staff from the Ministries of Forests and Environment and Parks Canada, Indigenous people and interested people from many other walks of life.

For further information regarding the SFF and course outlines for the 1998 season, contact Shannon Hammond, Workshop Co-ordinator, Silva Forest Foundation, PO Box 9, Slocan Park BC, V0G 2E0. Tel: (250)226-7222; e-mail: sff-research@netidea.com; http://www.silvafor.org

- continued from page 5-

connect students with real science and park protection issues. The participants' personal and financial contributions support research programs and help the organization meet its commitment to monitoring the health of park environments. It is an exciting opportunity for the public to have an in depth learning experience that leaves them inspired to become involved in protection of national parks and other heritage areas.

Participants in the Valley of the Beaver program document a fresh drag trail

ACKNOWLEDGEMENTS

The Research Adventure program began in 1995, as a result of looking at partnerships as a way of providing better and more cost effective school programming. Derek Petersen, Ecosystem Manager at that time, was setting up a variety of research and long-term monitoring projects, many of which were well-suited to both school and volunteer participation. While the concept was initiated in Yoho National Park, Research Adventure program developers are grateful for the huge amount of support received from outside the park. Advice and assistance was gained from Alberta Region's Tourism Secretariat, Ottawa's Natural Resources Sector staff and Cooperative Activities unit and private sector tourism partners. Working with Good Earth Travel Adventures, a local tourism operator, has significantly reduced the amount of time required to organize the program, as they handle the business of packaging and selling, and assist with marketing the program.

Parks Canada Research Adventure participants assemble field notes and photographs after a survey for beaver activity in the Amiskwi Valley

Donna Cook is the Heritage Tourism Officer for Yoho and Kootenay National Parks and Lake Louise area. She initiated the Research Adventure program while working as the Environmental Education and Community Liaison Officer in Yoho in 1995.

Participant Comments

"The environmental education component of the program was very beneficial. It was good that the emphasis wasn't just focused on the topic of study—beavers—but other factors that influence a National Park ecosystem such as biodiversity, fire management and forest ecology which play an important role also. We were able to show the students that natural and human biases have to be balanced and maintained."

"I have learned about the scope, time, dedication and skills required to work in a National Park setting. The skills and knowledge gained will be very useful to me as a teacher and biologist; the outdoor recreation (hiking) was physically and psychologically rewarding, and the contacts and friends I have made will be an on-going part of my life."

"The work was not difficult, but it wasn't boring either. It was interesting to watch and perform, and when the pieces fit together in the study, the work done was even more rewarding"

INFORMATION

Parks Canada Research Adventure programs are currently being developed for Kootenay, Yoho and Waterton Lakes National Parks for the 1998 season.

For more information on these initiatives, contact:

Donna Cook
Parks Canada
Box 213
Lake Louise, AB.
T0L 1E0.
Tel: (403)552-1260
Fax: (403)522-1212

SAMPA III Wrap-Up

Patricia Benson

Conference delegates were enthusiastic in their praise for the third international Science and Management of Protected Areas conference (SAMPA III), held May 12-16, 1997. More than 370 people gathered in Calgary to pursue the theme "Linking Protected Areas with Working Landscapes and Conserving Biodiversity," with 9 keynote speakers, 134 presentations, 24 poster presentations and 10 exhibits.

Attendance surpassed previous SAMPA conferences—we saw 191 in Halifax (1991) and 265 in Acadia (1994). International delegates arrived from Argentina, Australia, Denmark, Finland, Germany, Korean, Lebanon, Mexico, South America, Russia, Taiwan, United Kingdom and Venezuela. Not surprisingly, Canadians (321) and Albertans (180) comprised the largest number of delegates. On the other hand, persons affiliated with universities (114) outnumbered our Parks Canada staff (95).

From all accounts the conference delegates considered the conference a success—enjoyable, effective and educational. We asked conference participants to answer a brief survey about the conference and about their preferences. We invited them to evaluate the conference hosts, what we did right, and more importantly, what we could do better next time. Going through the responses is always very enlightening. In addition to rewarding us with what you liked and what you would prefer, your responses capture a wonderful summary of the essence of conference-going. Members of the SAMPA III Steering Committee often found themselves nodding in agreement and occasionally laughing out loud. You applauded the volunteers, mentioning the moderator's assistants and the audio-visual assistants specifically. You liked the field trip in the middle of the week, a nice change of pace, and particularly the panel the day before that "set the stage". You appreciated the informative web-site and praised the conference bag!

One of the questions is "Which parts of the program did not work for you, and why?" Given this opportunity, you told us three things, that presenters and moderators must be more rigorous in respecting the allotted time slot, that five concurrent sessions on one day (all with excellent presentations) made choosing too difficult, that you were disappointed to see styrofoam cups at coffee breaks and disposable containers at the field trip lunch and banquet dinner. You also told us you can never get enough opportunity to question speakers or for talking with other conference-goers. Some of these concerns can be addressed by the conference organizers. Some we can broadcast through *Research Links*: Timeliness of moderators and presenters is vitally important to your audience; presenters who are well rehearsed are appreciated, and moderators who take the "tough love" approach are admired. Not less a matter of courtesy than of logistics.

Ths SAMPA Association Board has lots of good ideas for future SAMPA conference from your insightful and candid comments; your input is genuinely appreciated, thank you. Here is a small sample of some of the comments:

- SAMPA was stimulating, informative and as smoothly run as any conference I've ever attended (BETTER than most). I am sure that mine will be only one of the many accolades when I say that you have my heartfelt congratulations and thanks for having done so much to give the very many attendees a valuable and enjoyable experience.
- This is without question the best international conference I have attended in years.
- Excellent choice of plenary speakers and topics
- The moderators did an admirable job keeping speakers on track, but several speakers were not to be deterred. Perhaps in future, more effort could be made to impress upon speakers, prior to their arrival, that they have 15 minutes only. Anything beyond that steals from others.
- ...moving the location of the conference to various locations shows others the diversity within our country and allows the conference to examine various issues that have impact in different areas of the country.
- It would be good to have book publishers put a "stand" during the conference. Some offer a discount (15-25%) to participants and I have been able to get very important books this way.
- Instead of an exclusive presentation format, there could be some working group assignments to bring people together and attempt to tackle certain problems/issues of the day. And another similar suggestion: Promote workshops around key themes like MPAs, TPAs, GIS, habitat characterization. Assign or find an expert and facilitate linking to people working the theme to create a "core group" for organizing it.
- I think we need to look more closely at protecting the working landscape; after all it represents ~90% of the total landscape. I believe we need to look at preserving biodiversity across our entire landscape. We need to involve industry, private land owners to achieve this end. Dialogue and partnerships are key.
- SAMPA is clearly at a crossroads: it is still relying on science-oriented spokespersons for expression of the need for more understanding of values. The challenge for SAMPA lies in making the necessary contacts with those in the social sciences and humanities who study human values as they related to non-human realms, and who can speak to scientists and ecosystem managers in the language they understand. SAMPA will wither if it does not acknowledge and address it.

The papers from the concurrent and poster sessions are now being refereed. The SAMPAA will publish a comprehensive conference proceedings including the refereed papers, plenary talks, products of the workshops and resolutions prepared during SAMPA III. The aim is to have the proceedings available by December 1997 likely appearing as a 2-volume hardbound set costing about $75. There is no cost to conference delegates.

Research Links
Submission Guidelines

PUBLICATION OVERVIEW

Research Links is a peer reviewed research publication aimed at professionals, park managers and academics interested in research activities in Western Canada's National Parks and National Historic Sites. It is a multidisciplinary publication, highlighting research in natural, cultural and social sciences. It focuses on research activities and needs in Western Canada and accepts articles from other regions which may be of interest to its readers.

Contributors include Parks staff, researchers from other government departments, consultants, graduate students and university professors. It has four target audiences: Parks Canada senior managers and staff; university researchers, academic faculty and graduate students; other federal, provincial and municipal land and resource managers; consultants and other individuals.

CONTENT

Research Links publishes rigorous articles that:

- describe ongoing and recently completed research and scientific activities in Parks Canada, and highlight the implications of this research for management
- communicate requirements for natural, cultural and social research initiatives
- reflect and strengthen ties among academics, researchers and managers within and outside park boundaries
- reflect science and management issues in a manner which encourages subsequent dialogue and debate
- provide related book reviews, news of relevant events and a diversity of information on individuals' activities and accomplishments

QUESTIONS TO GUIDE PREPARATION

Authors should consider these questions while preparing feature articles for submission:

- What are the key ideas you would like to communicate to park researchers and managers?
- What successes are illustrated by your work?
- What problems remain, and what new issues have been identified?
- How are your thoughts or data being used in management or creation of protected areas?
- How are your advances being communicated to local individuals and communities?
- What are the highlights of your experience or research which can benefit others?

LENGTH

All articles must be as brief as the subject matter allows. The maximum length of a feature article must not exceed 1500 words.

FORMAT GUIDELINES

Paragraphs should be separated by hard returns (not tabs or spaces). Only one space should be inserted after punctuation. Referenced and point form lists should be written as straight text, separated by hard returns if desired. There should be no running footers, headers or page numbering, and no set paragraph indentation or columns.

ILLUSTRATIONS

Illustrations should be submitted as camera-ready hard copies. Line drawings, charts, graphs, colour or black and white prints and slides are all acceptable. If submitting illustrations electronically, a laser-printed hard copy should also be sent by regular mail.

Include a description for each illustration that describes the relationship of the illustration to the theme of the article.

AUTHOR INFORMATION

The author's name, title, address, telephone number, fax number and electronic mail address should be included with submitted material.

DEADLINES

Research Links is published three times per year, with submission deadlines as below:

Issue	Published	Deadline
Spring	April	Late Jan
Fall	August	Late May
Winter	November	Late Sept.

DELIVERY

Contributions may be sent to the production editor through e-mail or cc:Mail, with the word-processing software and version used indicated in the cover message (i.e. Word 6.0, WordPerfect 6.0 etc.). Authors without access to electronic mail may submit articles on Macintosh or IBM diskette (3.5").

A hard copy of the article should also be sent by fax or regular mail in case there is any difficulty retrieving the electronic version.

REVIEW PROCEDURES

Prior to submitting an article to *Research Links*, Parks Canada authors must obtain review and comment from their Superintendent.

Submitted manuscripts are edited for stylistic consistency, clarity, grammar and length. Authors are contacted with comments and questions following the Editorial Board meeting. If revisions to content are needed, the author will be contacted prior to publication.

CORRESPONDENCE

Send all correspondence and submissions to:

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What are Ecosystem

Garry J. Scrimgeour, Dan Wicklum and Shelley D. Pruss

The scientific community is deeply engrossed in the debate over whether "health" and "integrity" are relevant to the status of an ecosystem. While it may seem trivial to argue over semantics, Canada's National Parks Act legally establishes the concept of ecological integrity (Parks Canada 1994), making the debate more than an academic argument.

WHAT IS AN ECOSYSTEM APPROACH?

The ecosystem approach arguably dominates environmental resource management at present. It marks a shift from approaches dominated by chemical and physical monitoring to one that recognizes the complexity of ecological interaction, the intrinsic importance of humans within ecosystems, and the need for sustainable resource use. Although definitions of an ecosystem approach vary considerably, most involve one or more of the following characteristics: 1) the collection and synthesis of existing information, including cultural, social and natural history, to identify previous states or processes; 2) a holistic approach bridging different ecological, managerial and political levels; and 3) a management approach that is ecologically anticipatory and ethically correct.

The notion that ecosystems can have both health and integrity is key to the ecosystem approach (Scrimgeour and Wicklum 1996). However, reaching a consensus on what constitutes a healthy ecosystem and agreeing on related definitions have been elusive and contentious tasks, even though researchers, managers and regulators have already adopted these terms. The lack of consensus among scientists on acceptable definitions of ecosystem health and integrity and related terms seriously compromises the ability of scientists to contribute to resource management through the ecosystem approach. One extreme viewpoint is that healthy biotic communities and human bodies are both self-adjusting such that each exists in an optimum state maintained by feedback pathways. The other extreme is that the human body-ecosystem health analogy is invalid and only useful when used in a rudimentary, heuristic fashion to convey vague, subjective concepts of environmental quality.

"Ecological integrity is defined as the condition of an ecosystem where the structure and function of the system are unimpaired by stresses induced by human activity and the system retains resilience in that its biological diversity and supporting processes are likely to persist.

—Parks Canada

THE DEBATE

Biologists pay a lot of attention to definitions because the design of biological studies and the communication of results depend on carefully defined terms and parameters. Debate on what constituted integrity and health was initially problematic because scientists used the terms interchangeably or simply avoided the difficulty by not defining either term.

In 1995, American ecologist James Karr made progress toward a solution when he suggested that ecosystem integrity and health are fundamentally different. Karr defined ecosystem integrity in terms of conditions: "At sites with little or no influence from human actions; the organisms living there are products of the evolutionary and biogeographic processes influencing that site." In contrast, "health describes the preferred state of sites modified by human activity (e.g., cultivated areas, plantation forests, industrial parks, cities). Such sites do not have integrity in an evolutionary sense, but they may be considered "healthy" when present use neither degrades them in ways that preclude that use in the future nor degrades areas beyond their borders" (Karr 1995).

Andrew Dickinson

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Health and Integrity?

MAIN ARGUMENTS

Ecosystem Health

The human-ecosystem analogy assumes that ecosystems have homeostatic processes that maintain the system in a predetermined optimum condition such as how the human body reduces the amount of glucose in the blood stream by producing insulin, or when the body sweats to lose heat. Human medicine is largely based on identifying and rectifying dysfunctions that cause vital signs and blood chemistry to deviate from normal states. The similarity of vital signs among humans results from the interconnectedness of organ systems. If one system fails, the body shows adverse effects which can be life threatening. An optimal state in humans is easy to define as it is maintained by genetically evolved feedback mechanisms that determine health.

In contrast to human health, defining optimal ecosystem conditions and deviations from a "healthy" state is not straightforward. In fact, the concept of an optimal state may not apply to ecosystems and many biologists now talk of chaos or non-equilibrium theories or conditions. Unlike the human body, ecosystems have not evolved feedback mechanisms to defend an optimum state. While individual organisms within an ecosystem are highly interconnected, they survive by fending for themselves and do not work to produce conditions that are favourable to all members of the ecosystem. In fact, by fending for themselves, many species change habitiats so that they are less suitable for other species. There are no "vital signs" or clear indications of health so the human health/ecosystem health analogy is not particularly usefiul in this situation.

Ecological Integrity

Are ecosystem health and integrity merely philosophical conjectures? Although organisms may not work together to produce an optimal state within the ecosystem, it cannot be denied that all individuals are linked together at some level. What are measurable indicators of ecological integrity? It could be that systems with integrity contain many species (i.e. exhibit high biological diversity) or it could be that healthy systems are stable, self-regulating and bounce back from stresses and that they have low numbers of parasites.

The ecosystem/human health analogy gains more meaning if ecosystem health is defined in terms of societal use as described by James Karr. Healthy sites may be cultured areas, plantation forests or other environments modified by human activities. These areas may not contain native plants and animals, but they are "healthy" when present use does not degrade them in ways that prevent them from being used in the same manner in the future.

There are at least two advantages to using an ecosystem health approach. First, defining health in terms of maintaining a preferred state while fulfilling a social need requires that society and the scientific community work together on two levels: to identify possible resource uses, and to determine whether these uses are biologically feasible. Second, in the long-term, establishing bridges between scientists and social interest groups (stakeholders), increases public awareness and environmental knowledge.

The debate on ecosystem health and integrity is in its early stages and alternative viewpoints are bound to appear as it continues to provide fuel for the academic fire. If scientists agree that ecosystem health and integrity should be used to describe different ecosystem qualities, then the next debate will concern indicators of health and integrity. Which indicators are the most useful, and how can they be used by resource managers? Can ecosystem indicators be used to monitor ecosystem health in the same way as vital signs are used to monitor human health?

Garry J. Scrimgeour works with Sustainable Forest Management Network of Centers of Excellence, University of Alberta, Edmonton, Alberta T6G 2E9, Dan Wicklum is a PhD candidate in the Department of Organismal Biology and Ecology, University of Montana, Montana, USA, and Shelley D. Pruss is a PhD candidate in the Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada.

For more information, please contact Garry Scrimgeour. Tel: (403)492-6304, fax: (403)492-8160.

Andrew Dickinson

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Garry Scrimgeour

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MEETINGS OF INTEREST

September 15-17, 1997

Protected Areas and the Bottom Line, Annual Meeting of the Canadian Council on Ecological Areas (CCEA). Lord Beaverbrook Hotel, Fredericton, NB. The purpose of this meting is to consider the ecological, cultural and economic roles of protected areas in maintaining biodiversity and fostering sustainable development. Policies, practices and standards related to land-use planning and natural resource management will be explored from theoretical and economic perspectives, including: global economic trends, forest and marine conservation, ecosystem management, public and corporate initiatives, reconciling multiple values. Contact: CCEA Conference c/o Forest Recreation and Heritage Branch Department of Natural Resources and Energy, PO Box 6000, Fredericton, NB. E3B 5H1. Tel: (506)453-2730; fax: (506)453-6630; e-mail: CCEA97@gov.nb.ca; http://www.gov.nb.ca/dnre/ccea.htm

September 28-30, 1997

Fish and Wildlife Research and Management: Applying Emerging Technologies. Crowne Plaza, Edmonton, AB. The 37th Meeting of the Canadian Society of Environmental Biologists will examine innovative applications of technology in fish, wildlife and related research. Aquatic and Terrestrial program topics include radio/ultrasonic telemetry, water quality/pollution management/monitoring, GIS/GPS technology, habitat assessment/improvement techniques, computer applications/modeling/simulations, genetics/DNA identification. Contact: Scott McKenzie, RL&L Environmental Services Ltd. 17312 - 106 Ave. Edmonton, AB, T5S 1H9. Tel: (403)483-3499; fax: (403)483-1574; e-mail: cseb@freenet.edmonton.ab.ca; http://www.freenet.edmonton.ab.ca/cseb

September 28-30, 1997

People and Place: The Human Experience in Greater Yellowstone. Mammoth Hot Springs Hotel, Yellowstone National Park. The purpose of the biennial Greater Yellowstone conference series is to encourage wide-ranging, high calibre research on the region's cultural and natural resources by providing a forum for scholars from all disciplines to present and discuss research findings. The fourth biennial conference will focus on the human experience in the Greater Yellowstone, with particular emphasis on the changing relationships between cultures and on the challenges of preserving and interpreting the region's cultural heritage. Contact Joy Perius, Tel: (307)344-2209 or http://www.nps.gov.yell/ycr.html

October 2-5, 1997

Connections, the first conference of the Yellowstone to Yukon Conservation Initiative (Y2Y). The Bayshore Inn, Waterton Lakes National Park, AB. An educational and celebratory conference, Connections is a large-scale gathering of grassroots conservationists, scientists, government representatives, community leaders, park professionals and other stakeholders interested or involved in the Y2Y initiative. Participants will learn about the science, advocacy skills and strategies behind implementing the initiative on a regional basis. Key speakers include Dave Foreman (The Wildlands Project), Reed Noss (conservation biologist), Harvey Locke (CPAWS), Colleen McCrory (Valhalla Wilderness Society) and Sid Marty (poet, author, singer). Contact: Kathleen Wiebe, Conference Registrar, Tel./fax: (403)609-3099, e-mail: y2yconf@telusplanet.net

October 18-25, 1997

6th World Wilderness Congress. Bangalore, India. The Aldo Leopold Wilderness Research Institute and the Wilderness Society will co-chair an extended symposium entitled, "Wilderness Designation, Management and Research." There will be a wide array of sessions available covering such topics as threats and management of invasive species, wilderness site restoration methods and successes, restoration and management of fire, the use of historical and ecological information in wilderness management, issues related to protecting cultural and ancestral values, and management of human uses including recreation. Contact Alan Watson, Research Special Scientist, PO Box 8089, Missoula, MT 59807 USA. Tel: (406) 542-4197, Fax: (406) 543-2663, e-mail: /s=a.watson/oul=s22L01a@mhs-fswa.attmail.com, or Greg Aplet, ecologist, The Wilderness Society, Suite 410, 7475 Dakin Street, Denver, CO 80221 USA. Tel: (303) 650-5818, Fax: (303) 650-5942, e-mail: greg_aplet@tws.org