The Log
www.ecoreserves.bc.ca
Autumn/Winter 2016/17
FRIENDS OF ECOLOGICAL RESERVES NEWSLETTER

What Lies Below at Baeria Rocks Ecological Reserve?

By Isabelle Côté and Siobhan Gray

With funding from the Friends of Ecological Reserves, the instructors of the Bamfield Marine Science Centre (BMSC) Scientific Diving class mounted an expedition to survey the waters around Baeria Rocks Ecological Reserve. The reserve consists of small rocky islets in the middle of Imperial Eagle Channel, in Barkley Sound. It is a remote and beautiful place, accessible only by boat.

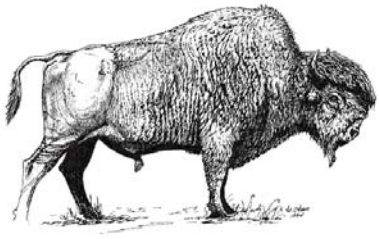
On 19 May 2016, 15 divers (including the whole of the Scientific Diving class) were ready to plunge in. The excitement was palpable. This was the capstone exercise of a physically and academically grueling course. All divers were well trained in survey techniques and identification. One diver was assigned to videography. Surveys were conducted by six dive teams. Three teams conducted roving timed surveys and three teams conducted transects. As in previous years, the teams were deployed around the north islets for the first dive and around the south islet for the second dive, alternating roving and transect teams long the shore.

Each roving team carried out a 30 to 50 minute roving survey, from a maximum depth of 50 feet (14 metres), where possible, to the top of the reef, swimming in a semi-systmatic zigzag pattern from deep to shallow water. Both divers counted every individual observed of each species listed on an underwater roving survey sheet. When a species was very abundant (i.e., more than 100 individuals), surveyors recorded numbers as 'lots'. Divers noted the duration of each roving survey, as well as the depth range surveyed.

The maximum number of each species recorded between the two divers in each buddy pair was retained, and maximum numbers were averaged across roving teams for each islet. This method generates an

Continued on page 2

Inside ...



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The Log

Autumn/Winter 2016/17

The LOG is published two times a year by the Friends of Ecological Reserves to promote the establishment, management and maintenance of Ecological Reserves in British Columbia. *The LOG* is distributed to members, volunteer wardens, affiliates, supporters, government, friends and the enquiring public.
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Articles for publication are invited. The deadline for submissions for the Spring/Summer 2017 issue of *The LOG* is May 15, 2016.

Editor
Louise Beinhauer
Design and Production
L.B. Word Works

Contributors to this issue:
Isabelle Côté and Siobhan Gray, Linda Kennedy, Adrian de Groot, Mike Fenger and Jim Pojar

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FRIENDS OF ECOLOGICAL RESERVES
PO BOX 8477 STN CENTRAL
VICTORIA, BC V8W 3S1
Email: ecoreserves@hotmail.com
Website: http//www.ecoreserves.bc.ca

Canada Post Agreement No: 40020740

Baeria Rocks ER Cont'd. from page 1

index of abundance for each species expressed in number of individuals per 30 minutes.

The transact method used in 2016 is identical to that used in 2009, 2011 and 2014. Each transect team ran three transects, one at each of three depths (10 ft (3 m), 25 ft (8 m), and 40 ft (13 m). Each transect was 20 m long and 4 m wide. Once a team had laid a transect line, the divers waited for at least three minutes away from the line to allow fish to re-enter the transect area. The divers then swam slowly along either side of the transect in one direction, recording the number of individuals of all fish species listed on a printed transect survey sheet. In the return direction, they recorded all individuals of all invertebrates species on the survey sheet. Each member of a buddy pair surveyed one (2-m wide4) side of the transect.

For each species, the numbers were summed within a buddy pair for each transect, and then averaged across teams for each depth of each site. This method generates estimates of absolute density.

So what did we find? A grand total of 70 species of invertebrates, 17 species of fish, one mammal (harbour seal) and eight species of birds (see Table 1), with two, glaucous-winged gulls and black oystercatchers nesting on the islets in larger numbers than two years ago. Double-crested cormorants and northwestern crow were on the islets but not nesting. The number of seabirds is undoubtedly underestimated since the bird survey was not carried out systematically over water. No one went ashore.

Most notable because of their sheer diversity were the seastars:

Spiny red sea star.

14 species ranging from the very common leather stars (which smell of garlic!) to the very rare spiny red sea star, which is seen only once in a blue moon. We were also treated to many colourful sea slugs – everyone loves nudibranchs! – an unusual umbrella crab, and a large wolf eel, with the tell-tale midden of shells at the entrance of its den.

The BMSC Scientific Diving class has been carrying out subtidal surveys at Baeria Rocks more or less every other year since 2007. The value of continued monitoring is becoming evident because the time-series accumulated have the power to detect major shifts in the subtidal community.

For example, in 2014, Baeria divers noted the presence of some seastars (especially sunflower stars *Pycnopodia helianthoides*) with curled arms, and a few others (like ochre stars *Pisaster ochraceus*) with a limp appearance, reminiscent of the sea star wasting disease that affected sea stars in the Strait of Georgia in Fall 2013. These observations suggested that the disease had just reached Barkley Sound.

Our Baeria time series data now show that there was a marked decline of sunflower star abundance between 2014 and 2016, particularly around the South islets. This happened at the same time as a dramatic increase in abundance of green urchins. The same pattern, involving the same two species, was documented in Howe Sound, a year after the mass seastar mortality in that area. In Howe Sound, the rise of herbivorous urchins also led to an 80% drop in seaweed abundance. The same might therefore be expected at Baeria Rocks.

Frosted nudibranch.

The density of abalones has roughly halved between 2014 and 2016. Also, the abundance of rockfish was low, with several species not recorded on

Continued on page 4

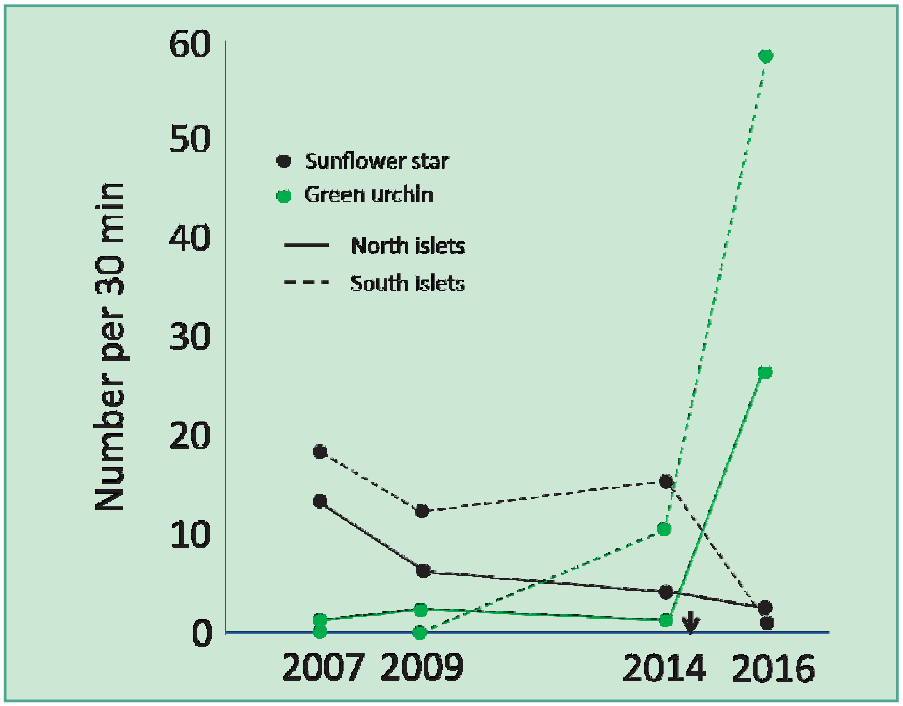


Figure 1. Abundance of sunflower stars and green urchins,derived from subtidal surveys, from 2007 to 2016, at each islet group of the Baeria Ecological Reserve. The black arrow denotes the probable onset of seastar wasting disease in Barkley Sound.

Baeria Rocks ER Cont'd. from page 3

transects (copper, black, China), and density was approximately half of what it was in 2014.

The densities of kelp greenling and lingcod were similar to those of 2014, but they were markedly lower (though not significantly so) than in 2009. Divers did not report any evidence of lost or derelict fishing ear on the bottom, but divers did see some relatively fresh fish carcasses on the bottom (i.e., a head, a jaw and a backbone.) This, and the low abundance of fishes of fishing interest, suggests that some fishing might occur in the reserve.

Two invasive species – European green crab and gold star tunicate – are still absent from Baeria Rocks. We will keep monitoring these species, although it seems unlikely that they will become established at Baeria because of its isolation and lack of suitable habitat.

The Baeria Rocks surveys now span the years 2007 to 2016 and are beginning to represent a valuable time series of information on an area that experiences relatively limited human impact.

One possible addition for the future could be to take photographs of the bottom to generate a permanent record of the substrate composition. The decline in predatory seastars and increase in herbivorous urchins detected at Baeria over the past two years should lead to a decline in algal cover, but cannot detect this important change without baseline information about benthic community composition.

Scientific diving class that participated in the surveys.

The ornithological expertise is usually limited among the survey team. We believe that there would be value in inviting a competent bird biologist to join the team and provide more complete information about the birds of Baeria Rocks. We will continue monitoring over the coming years to record the ecological story that unfolds.

Thank you to the Friends of BC Ecological Reserves for the funding which made our 2016 Baeria Rocks survey possible.

Species	Common name	Numbers on North islets	Numbers on South islets
Corvus caurinus	Northwestern crow	0	3
Laurus glaucescens	Glaucous-winged gull	203	118
Haematopus bachmani	Black oystercatcher	4	6
Phalacrocorax auritus	Double-crested cormorant	13	25
Histrionicus histrionicus	Harlequin duck	0	5
Brachyramphus marmoratus	Marbled murrelet	4	4
Uria aalge	Common murre	3	2
Cepphus columba	Pigeon guillemot	6	2

Table 1. Birds present on and around Baeria Rocks Ecological Reserve on 19 May 2016.

Campbell Brown Ecological Reserve #77

By Linda Kennedy

The Campbell Brown Ecological Reserve was established in 1977. It is an example of transitional dry forest where it changes from mainly Ponderosa pine with open areas of blue bunch wheat grass to the south to mainly Douglas fir northwards. It lies above Highway 97 south of Vernon and is mostly steep dry hillside but has a surprising number of variations in the vegetation. It also contains two dens (hibernacula) where rattlesnakes overwinter.

Rapid development in the Okanagan has created a huge demand for gravel which has resulted in the reserve being bookended by large gravel pits to the north and the south. This may be limiting the movement of the rattlesnakes looking for food in the summer.

The fences are not in good shape but at the present time there are no animals in the surrounding pastures so it is not an issue.

The Pine Beetle attack has ended. Most of the dead trees fell making a tangled mess but now, four years later there are lots of young pine trees – in fact there are too many, crowding out the undergrowth.

Invasive weeds have been unwelcome invaders of the reserve starting with Russian Knapweed in the early 1900s. Biological controls have been very effective in reducing the knapweed. Now it is Cinquefoil and St. John's Wort which are slowly establishing themselves. BC Parks tried some very limited spraying of the Cinquefoil with little effect. Hand pulling doesn't work and to date there are no biological controls for either plant.

Campbell Brown Ecological Reserve – Arrowleaf Balsamroot (*Balsamorhiza sagitatta*) in full bloom.

The biggest event on the reserve has been a research project at the rattlesnake dens which involves capturing and tagging the snakes with Pit tags (rice grain sized barcodes) which are inserted under the snake's skin and can be read with a reader. Each snake's length, weight, sex, general

Continued on page 6

Campbell Brown ER Cont'd. from page 5

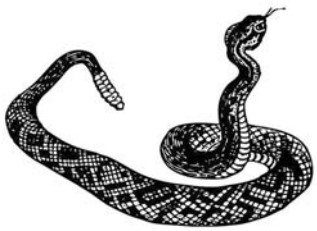
condition are recorded along with the tag number at the time the tag is inserted. The tags are permanent so each snake can be identified individually thus facilitating long term research on health and habits of the snakes. Members of the N. Okanagan Naturalists' Club have volunteered many hours to monitoring snake dens for the emergence of the snakes in the spring and their return in the fall and to helping the biologist, Mike Dunn with the capture, marking and recording of information. This project was funded with the help of the BC. Habitat Conservation Trust Foundation through their Public Conservation Assistance Fund, the B C Naturalists' Foundation and the North OKanagan Naturalists Club (Vernon).

We have not captured the number of snakes that we anticipated so we are hoping that the work we will do in April when they are emerging will see a greater number of snakes tagged. If funding becomes available, this will include working with students on a project under TRU and Dr. Karl Larson, a long time supporter of work at Campbell Brown Ecological Reserve and the North Okanagan as well as Dr. Michael Russello from UBC and Dr. Purnima Govindarajulu from the Ministry of Environment, Small Animal and herpatofauna division.

Biologist Mike Dunn with rattlesnake about to be tagged.

Please see our website www.ecoreserves.bc.ca for more information on Campbell Brown Ecological Reserve.

Biologist Mike Dunn inserting a Pitt tag into a large rattlesnake captured on the Campbell Brown Ecological Reserve.



Det San Ecological Reserve #154

By Adrian de Groot

Det San Ecological Reserve is a 5.8 hectare reserve in the Bulkley Valley, near Smithers that protects an old Rocky Mountain juniper (*Juniperinus scopulorum*) stand on a steep south-facing slope with trees up to 250 years old. It also contains a rare and sensitive savanna/steppe ecosystem. The open savanna/steppe ecosystem in the reserve is under threat from trembling aspen encroachment.

Det San is the Wet'suwet'en name for juniper. The ecological reserve lies within the territory of the Gitdumden Clan of the Wet'suwet'en. These open juniper ecosystems in the Bulkley Valley have long been used by the Wet'suwet'en for hunting, and for gathering food species such the nodding onion (*Alliium cernuum*).

The ecological reserve was created from private land acquired in 2009. It is surrounded by small acreage rural residential properties. There is an access corridor to the reserve, but it is not readily identifiable or signed. As a result very few people in the community know of the existence of the ecological reserve and even fewer would know where it is and how to get there. Use of the reserve is mostly by neighbouring land owners going for recreational walks.

The reserve is likely the only ecological reserve in the province with a sauna. The former owner constructed a steep dirt road up the property and built a structure containing a sauna, as well as doing some gardening. Discussions with BC Parks have been held about removing the structure; however, given the low level of use and the lack of impacts it was decided to not spend effort on this.

Figure 1: The Malaise trap deployed at Det San Ecological Reserve in 2014 with ER volunteers.

The gardening in the grassland has left a legacy of invasive plants in the disturbed soil, especially hawkweeds from the subgenus *Pilosella*, and a few asparagus plants. Efforts were made in the past to control the invasive plants by covering them with black plastic and mulch, but there has not been on-going effort into this.

In 2014, the Biodiversity Institute of Ontario at the University of Guelph, working with local volunteer Rosamund Pojar, set up a malaise trap (Figure 1) in the reserve to document the diversity of insect life in the reserve.

Twenty samples were collected over the summer, and only one of these samples has been analyzed so far. This sample had over 2,000 specimens and 414 DNA barcode clusters or Barcode Index Numbers (BIN), which is a proxy for species (Figure 2). Of these, 97 were identified to species, with the rest identified to genus or family. At this time, 31 BINs are unique to Det San ER, 17 are parasitoid wasps and 12 are fly species. Of the ten sample sites in BC, Det San ER

Continued on page 8

Det San ER Cont'd. from page 7

had an above average number of specimens, and the 3rd highest diversity.

My favourite time of year in the ER is the spring. The warm slopes lose their snow early and the first plant to flower is the sagebrush buttercup (*Ranunculus glaberrimus*); soon afterwards, the pin cherry (*Prunus pensylvanica*) trees that line the old road flower, producing an avenue of white blossoms.

Species that use the ER include mule deer, which are common in the winter, and chipmunks, which are uncommon in the Bulkley Valley.

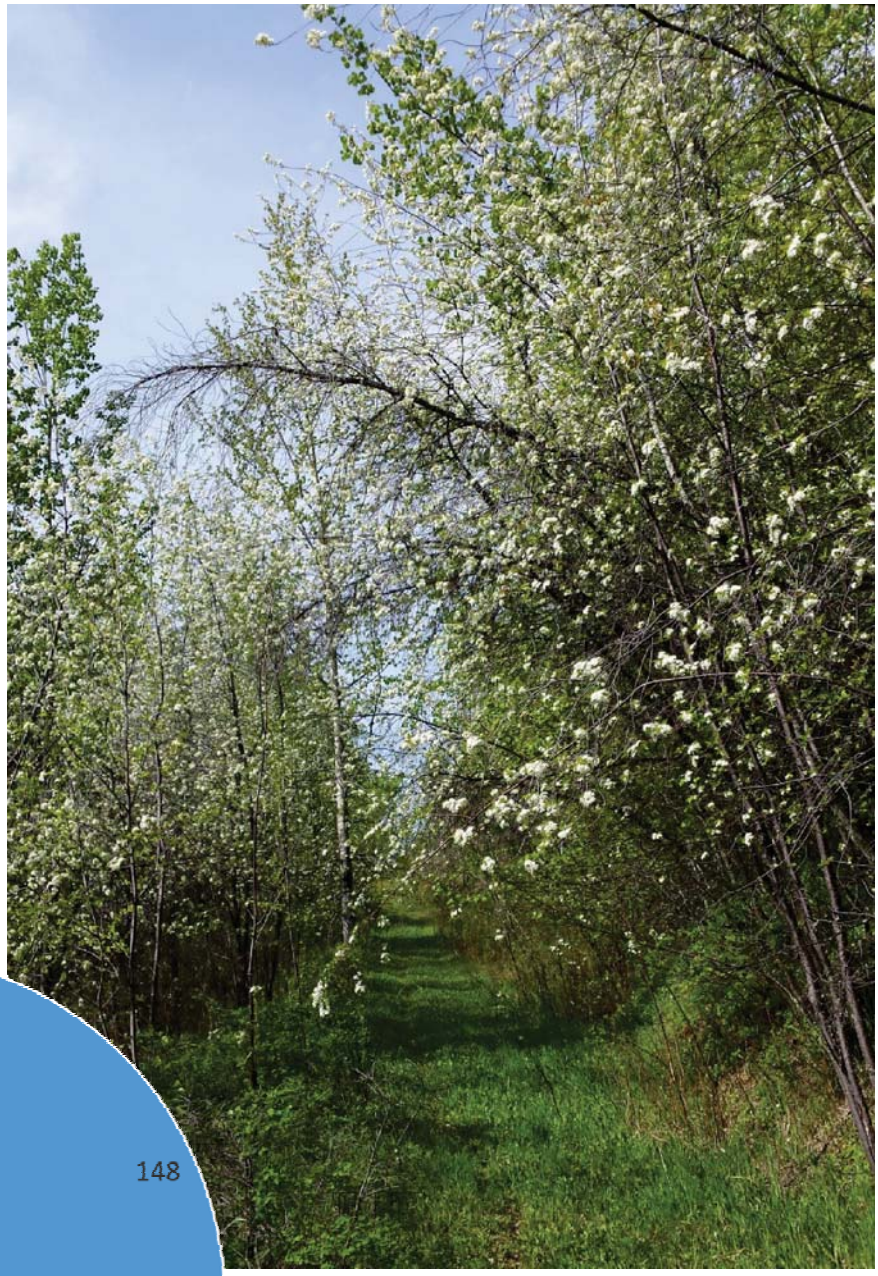


Figure 3: Cherry trees along the old road at the bottom of the Ecological Reserve.

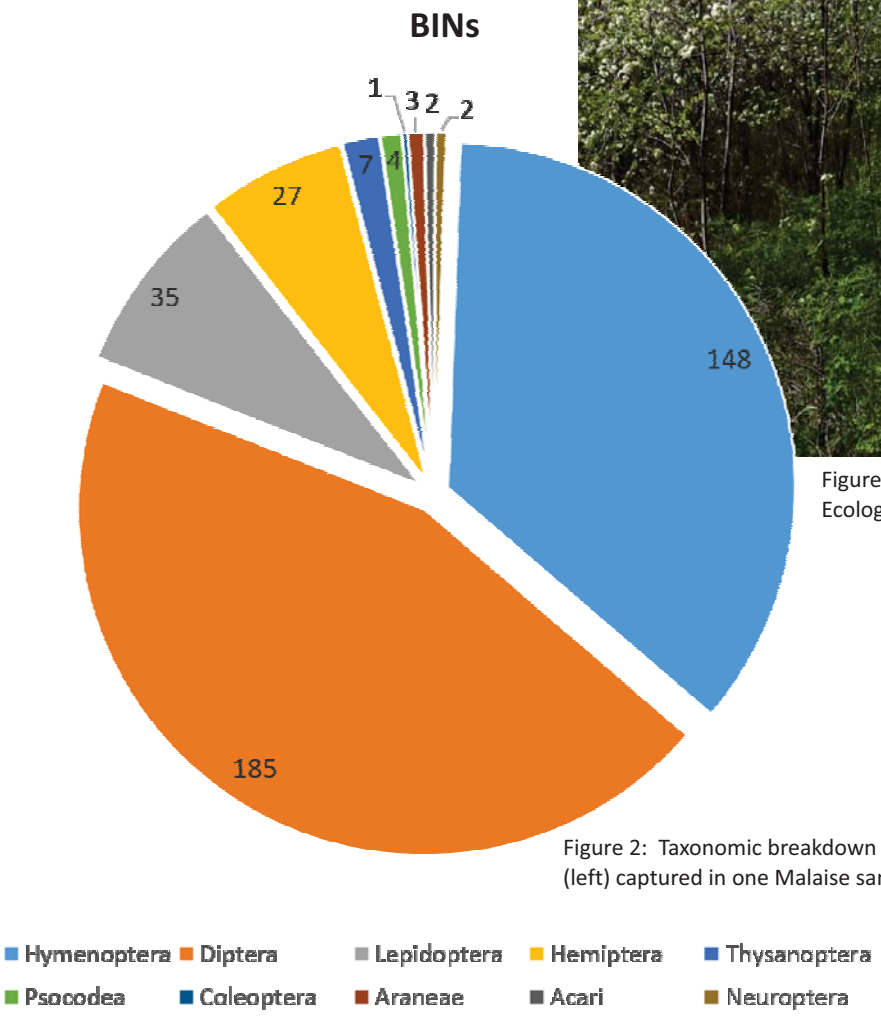


Figure 2: Taxonomic breakdown of 423 total BINs (left) captured in one Malaise sample.

Kinder Morgan Pipeline Project Needs Additional Permit Conditions Says FER President

Mike Fenger, President of The Friends of Ecological Reserves submitted the following letter to the Globe and Mail before the federal government's decision to approve the Kinder Morgan Trans Mountain Pipeline expansion. It was not published.

U.S. Navy craft are anchored along the shoreline as Navy and civilian personnel position hoses during oil clean-up efforts on Smith island after the Exxon Valdez spill. (Photo: Wikimedia Commons)

The National Energy Board approved the Kinder Morgan(KM) pipeline project in May 2016 with no conditions regarding science and research costs needed to know how to monitor and deal with their product, diluted Bitumen (dilbit) if it enters marine waters.

Unfortunately, marine ecosystems are poorly understood. There is a lack of quantitative baseline information on the condition and productivity in West Coast marine waters. In the event of a dilbit oil spill, tanker owners bear the cost of cleanup. In a post-spill environment there is need to restore these ecosystems to their former state. Since there is inadequate baseline information, how can marine ecosystems be restored?

Such lack of pre-spill baseline information was the biggest concern voiced by Alaska Fish and Game after the 1986 Exxon Valdez spill. Alaskan's lamented in 1990 that "*Since the consequences of being unprepared seem to be greater costs and greater uncertainty about injured resources, their recovery and need for restoration, what should we be doing now in order to be better prepared to assess damages resulting before the next oil spill? The answers seem clear in retrospect – ongoing monitoring programs collecting data on intertidal and subtidal zones, annual counts of sea otters, eagles, murres and other sea birds and gathering more experimental information on oil toxicology on common species.*

Without well maintained baseline information it is hard to restore or to understand how to compensate or enhance damaged resources. KM did no new studies in marine waters in their application and were unable or unwilling to quantify marine environmental assets based on government data.

The KM approval will be made by the Federal government by the end of December. There is currently no obligation on the part of KM to assist financially to improve basic understanding of marine resources over the life of the their permit.

Responsibilities for marine waters and ecosystems are complex and shared between Federal and Provincial agencies, with little or no First Nations' and Environment organizations' involvement. However, research and monitoring of marine ecosystems is already done by environmental volunteer organizations (such as Friends of Ecological Reserves), whale

Continued on page 10

KM Conditions Needed Cont'd. from page 9

watching companies, First Nations, Federal and Provincial governments, Metro Port of Vancouver and universities.

Kinder Morgan has volunteered to support research and monitoring at a level of their choosing for some selected organizations. This means that KM: decides what research is in their best interest, sets the terms of reference, sets a funding limit and duration of funding, decides who is worthy of funding, and decides on information availability or whether findings are proprietary. It is doubtful that KM-lead research will address research priorities in the broader public interest.

A different research funding model is needed. Research and monitoring should not be left entirely to Federal and Provincial agencies supported solely by tax dollars and subject to annual changes in budget cycling. Research and monitoring of marine resources is an activity that needs to be done collaboratively and funded over the long term.

Funding a marine research and monitoring program must largely be a financial responsibility for KM and the Western Canada Oil Producers so they and the public can learn how to mitigate risk from dilbit transportation. KM in its final arguments state "*Western Canadian oil producers are expected to see a profit (netbacks) of approximately $73.5 billion over the first 20 years of the Project's operations.*"

The Federal government must ensure that KM and the Western Canadian oil producers set aside $US 450,000,000 in a secure Endowment Fund to generate funding equal to that of the current annual budget allocated by the Exxon Valdez Trust Council . An Endowment of 450 million US represents 6/100th of 1% of the forecasted netbacks and so this is a very modest insurance investment on behalf of Canadians.

Oiled shore birds after the Exxon Valdez spill. (Photo: Wikimedia Commons)

A new collaborative, open and transparent approach to understanding the complexities of dilbit spills in the marine environment is needed and such an Endowment must be steered by representatives of the Federal and Provincial agencies, KM, First Nations, and Environmental Organizations, who collectively set research priorities and transparently report on findings. The status quo will not expedite the acquisition or transfer of knowledge in a way described as, "world class" and without a KM funded endowment it means Canadian taxpayers will need to support marine research and monitoring rather than KM with regard to understanding resources at risk from dilbit spilled into marine waters. The Canadian Government needs to require KM to pay its way.

Mike Fenger is President of Friends of Ecological Reserves of British Columbia and was an intervenor in the Kinder Morgan process lead by the NEB. FER submissions that clarify the logic and outline a new collaborative research and monitoring program can be found at http://ecoreserves.bc.ca/

Biological Diversity – Why is it Important?

By Jim Pojar, Ph.D, M. Bio

Excerpted from an article by Dr. Jim Pojar in the Spring, 1990 issue of Bioline, published by the Association of Professional Biologists of BC and printed as two parts in the November, 1990 and August 1991 editions of the Friends of Ecological Reserves LOGs.

Northern Saw-whet Owl (*brooksi) subspecies, (Aegolius acadicus brooksi)*, endemic to Haida Gwaii, is blue-listed.

Biodiversity is the variety of life in an area, which could be as small as a decaying log or as large as the biosphere. The full range of natural variety includes the genetic diversity of populations, the number and kind of different species, the distribution and abundance of plant and animal communities and of ecosystems, and the myriad of ways in which living things actually live and interact.

Genetic diversity involves genotypic variation within a taxon. Species diversity is a measure of the richness of different species, both in numbers and in relative abundances. Ecosystem diversity is a landscape concept. And functional diversity transcends all three of these levels of organization and reflects the variety of processes whereby organisms interact with other organisms and with their physical environment.

Why Conserve Biological Diversity?

Let me count the whys:

1. It's going fast. Biodiversity is being reduced at a rate without precedent in human history. During the next few decades, human activities will cause the extinction of more species than at any time since the dinosaurs disappeared 65 million years ago.
2. For its intrinsic value. This is the ethical, deep-ecology view, that all living things have the substantive right to exist, and it would be presumptuous to assume that some species, especially our own, are more valuable and deserving of attention than others.
3. Biodiversity is also valuable as a source of intellectual and scientific knowledge, recreation and aesthetic pleasure.
4. Humans depend on plants, animals and micro-organisms for food, medicine, shelter and other products. Reduced biological diversity could mean losses of resources for research, agriculture, medicine and industry. In this regard, it is worth noting the concern of the International Society of Chemical Ecology, a group not renowned for its environmental awareness, over the implica-

Continued on page 12

Biological Diversity Cont'd from page 11

tions of species impoverishment to the future discovery of useful natural products. A resolution passed in 1989 draws attention to our dependence on naturally occurring chemicals, urging conservation measures to stem the tide of species extinction, and calling for much more chemical 'prospecting' to discover more of these precious resources.

5. Reduced biodiversity could also harm the functioning of ecosystems and critical ecosystem processes that moderate climate, govern nutrient cycles and soil conservation, control pests and diseases, and degrade wastes and pollutants.
6. Maintaining existing natural diversity makes sense because we cannot predict which biological resources will be most important to future needs.
7. It could be that systems with greater biological diversity are more stable in the long term, are more resistant to disturbances, to destructive oscillations in populations and to biological invasions.

Mormon Metalmark (*Apodemia mormo)* is blue-listed. There is one known population near Keremeos in the Southern Okanagan.

Caribou (boreal population) *(Rangifer tarandus pop)* is red-listed.

Diversity and Stability

The notion that greater species diversity in ecosystems is associated with greater community stability was among the most influential beliefs in ecology from the 1960s to the mid-1970s, sometimes reaching the status of a home truth or 'core principle'. Then some theoreticians, like Robert May,

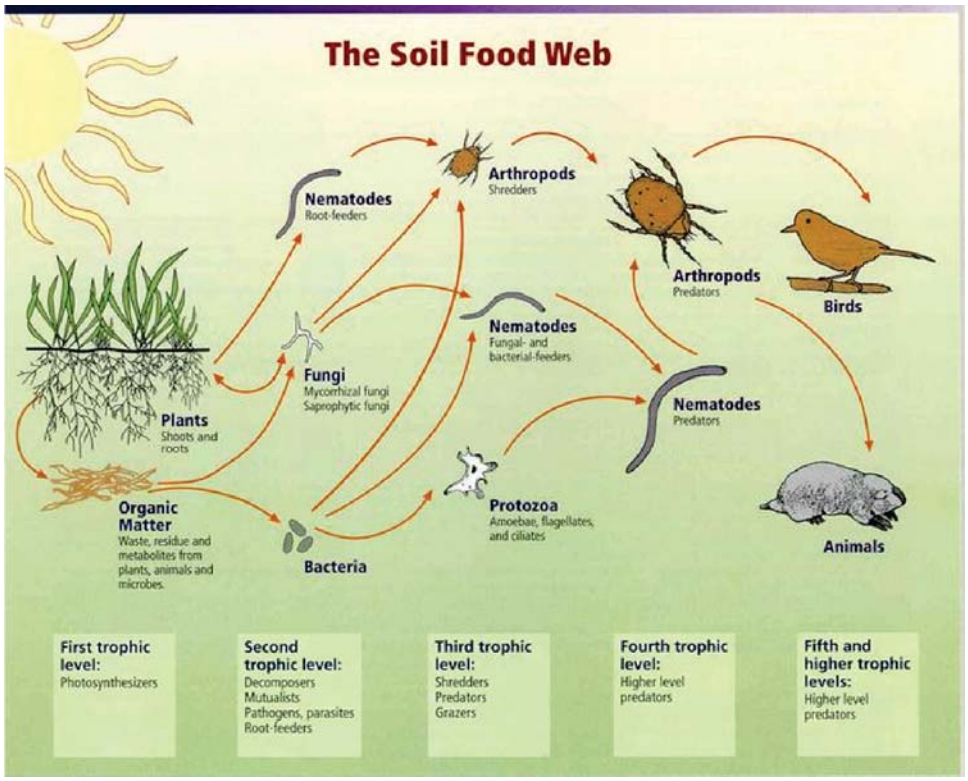
Continued on page 13

Biological Diversity Cont'd. from page 12

began questioning the relationship, pointing out that, as a mathematical generality, increased complexity should decrease community stability, and that it is not true that in the natural world population stability is uniformly associated with floral and faunal diversity and trophic complexity. Even, May however, allowed that natural ecosystems are the product of a long history of co-evolution, and intricate evolutionary processes could have produced mathematically atypical systems with long-term stability. Chaos theory now tells us that these systems could be typical in new mathematics – but that's another story.

Evidence from, for example, below-ground food webs in an American grassland now suggest that the compartmentalization, reduced connectance and interaction strength associated with greater diversity can stabilize food webs. The number of energy 'channels' increases with diversity, so compartmentation increases as communities become more complex, and food-web connectance and average interaction strength decline. Population stability can exist in complex food webs.

Painted Turtle, Pacific Coast Population *Chrysemys picta pop. 1)* is red-listed.



Relationship between soil food web, plants, organic matter and birds and mammals. (image courtesy of USDA Natural Resources Conservation Service)

What Needs to be Done?

Biological diversity is disappearing most rapidly outside North America, particularly in the tropical rainforests. Prominent biologists are calling for an immediate effort to chart the biodiversity of Earth – a 'quick and dirty survey. There is no time for exhaustive studies, for science as usual. Projects should take two or three years to complete. The plan is not to do detailed inventories and taxonomic surveys, but rather to identify areas rich in biodiversity so that something can be done before they disappear.

Continued on page 14

Biological Diversity Cont'd. from p. 13

Biological impoverishment is also a serious problem in British Columbia. We too need some quick biotic surveys – the sort of work that should have been done decades ago but for a variety of reasons wasn't. We need a provincially- or nationally-co-ordinated effort to collect, synthesise, and disseminate such information. The idea would be to select a few taxonomic groups, communities and geographic areas. We could try, for example, freshwater fish, ground beetles, butterflies, vascular plants, birds, amphibians and mammals. In British Columbia we already know which communities and which areas to concentrate on. And we already know enough about some species, communities and areas – the Vancouver Island marmot, the Garry oak savannah, the Osoyoos semiarid biotic area – to do something for them immediately.

We need to move beyond the traditional conservation strategies of establishing habitat reserves and preserving endangered species. Some species have already disappeared and some clearly are doomed, and we will never have reserves in sufficient number and sufficient size to 'save' biodiversity. In such areas of the province as the Lower Mainland and southeastern Vancouver Island it is probably too late for some species and ecosystems.

We need land-use planning for biodiversity, and management not just of the wilderness but also of the 'semi-natural' matrix where many species now largely reside, used by humans for forestry, grazing livestock, mining and dispersed settlement. Management for biodiversity is not simply some form of 'special purpose' management in specific locations or circumstances.

Intact Garry oak (*Quercus garryana)* ecosystems are a rich mosaic of plant, animal and insect species. Land conversion for agricultural, residential and industrial development has vastly reduced the extent of Garry oak ecosystems. Less than 5% now remains in a near-natural condition, and that too is threatened. Threats include habitat loss, fragmentation of larger areas of habitat into smaller, more vulnerable patches, encroachment of woody species as a consequence of fire suppression, and invasion of exotic species that outcompete native species. (from the Garry Oak Ecosystems Recovery Team website: http://goert.ca/)

We need to broaden our vision. The real challenge is to think and manage in broad terms as well as in detail, to address the biodiversity of large areas. Of course, expanded horizons could throw up uncomfortable heterodox ideas, as for example:

- *Lots of 'edge' isn't necessarily good,*
- *Progressive clearcutting sometimes makes better ecological sense than patchwork logging, and*
- *Such disturbances as fire, logging and agricultural clearing can maintain, even augment landscape diversity and biodiversity.*

"Biological diversity is a new term and an enlarged focus for things we have long cared about," Hal Salwasser writes. We need to understand the natural world first because we are scientists, second in order to manage the biosphere sustainably, and third to develop strategies for preserving some species and habitats while exploiting others in ways that maintain the original levels of overall diversity – at least to allow some fraction of the original biota to persist. Nothing we can do as biologists is more important.

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Fauchea lacineata photo taken by Bamfield Marine Station student Andrew McCurdy on a dive to Baeria rocks. For more information see http://ecoreserves.bc.ca/2012/04/05/fauchea-lacineata-image-by-andrew-mccurdy/

The Log

Friends of Ecological Reserves
PO Box 8477 Stn Central
Victoria, BC V8W 3S1

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ecoreserves@hotmail.com
Website:
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