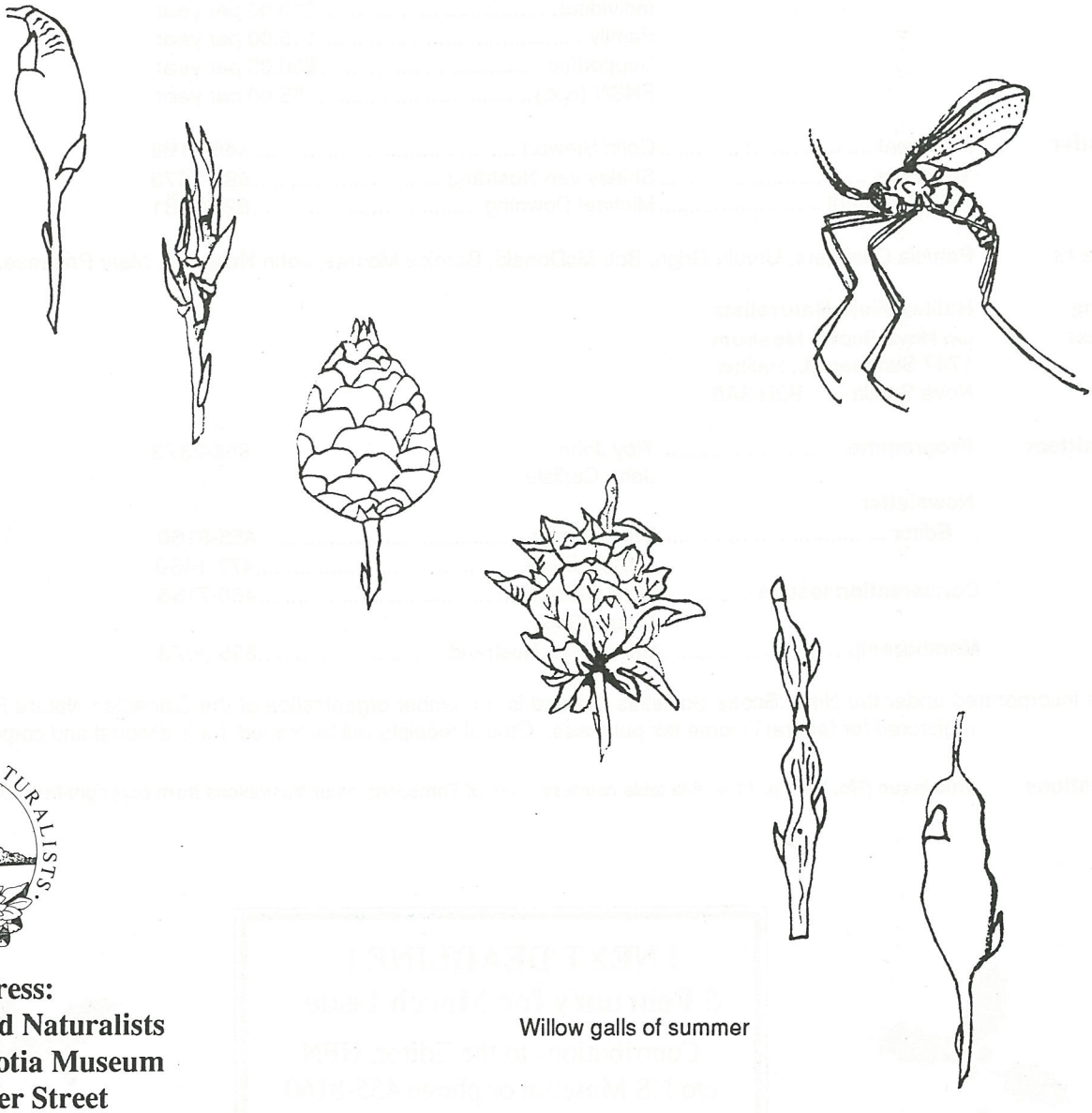
HALIFAX FIELD NATURALISTS' NEWSLETTER

December 1993 to February 1994 **No. 73**



Willow galls of summer

Return address:
Halifax Field Naturalists
c/o Nova Scotia Museum
1747 Summer Street
Halifax, NS B3H 3A6

HALIFAX • FIELD • NATURALISTS

Objectives To encourage a greater appreciation and understanding of Nova Scotia's natural history, both within the membership of HFN and in the public at large. To represent the interests of naturalists by encouraging the conservation of Nova Scotia's natural resources.

Meetings On the first Thursday of every month at 8:00 pm in the auditorium of the Nova Scotia Museum, 1747 Summer Street, Halifax.

Field Trips Are held at least once a month, **and it is appreciated if those travelling in someone else's car share the cost of the gas.**

Membership Is open to anyone interested in the natural history of Nova Scotia. Memberships are available at any meeting of the society, or by writing to: Membership Chairman, Halifax Field Naturalists, c/o NS Museum. New memberships starting from September 1 will be valid until the end of the following membership year. The regular membership year is from January 1 to December 31. Members receive the HFN Newsletter and notices of all meetings, field trips, and special programmes. The fees are as follows:

Individual	$10.00 per year
Family	$15.00 per year
Supporting	$20.00 per year
FNSN (opt.)	$5.00 per year

Executive 1993

President	Colin Stewart	466-7168
Treasurer	Shirley van Nostrand	835-3673
Past President	Michael Downing	823-2081

Directors Patricia Chalmers, Ursula Grigg, Bob McDonald, Bernice Moores, John Newbery, Mary Primrose, Bonnie Saxton

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Programme	Roy John	868-2373
	Jane Carlisle	
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Editor	Ursula Grigg	455-8160
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Conservation Issues	Colin Stewart	466-7168
	Ursula Grigg	
Membership	Shirley van Nostrand	835-3673

HFN is incorporated under the Nova Scotia Societies Act and is a member organization of the Canadian Nature Federation. It is registered for federal income tax purposes. Official receipts will be issued for individual and corporate gifts.

Illustrations **This Issue (No. 73):** p. 11 — tide table courtesy Dept. of Transport; other illustrations from copyright-free sources.

! NEXT DEADLINE !
5 February for March Issue
Contributions to the Editor, HFN
c/o NS Museum or phone 455-8160

HFN NEWS AND ANNOUNCEMENTS

EDITORIAL

Because of difficulties in getting the Newsletter out on time, the Directors have decided to mail programmes before the first event date and let a late Newsletter catch up in the next quarter. So some mailings may contain no Newsletter and some may hold two, but at least members will know what is going on.

Newsletter delays happen because people - including me - miss deadlines, or cannot be contacted after their copy is received. The paper may then be held past the last minute for the printer's, or even taken apart and rearranged, with hasty insertion of extra copy.

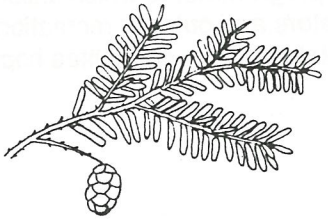
In the fall I asked for articles on other people's favourite organisms, and happily received two - Marcel Cornect's on insect galls on willows, and Cathy Strugnell's acid comments on a rare falcon which dined off one of her precious Piping Plovers.

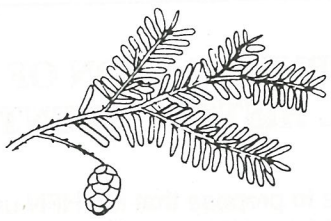
However, one of these articles showed up another Newsletter problem: copy sent to the Museum occasionally goes astray. There's an easy way round this; if writers will just phone me when they have sent a piece (455-8160), I will collect it immediately. Copy which needs quick publication must meet the deadline, but can be speeded up by dropping copy through my letterbox (2560 Joseph St., off Chebucto Road opposite the Bay parking garage) if you are in Halifax. Anything coming after the deadline is simply early for the next issue!

Enough of this dull stuff! Look at the programme for next year's CNF conference, and ask for an information pack, ready in January. Look for willow galls, exposed now that the leaves are off, and spend time outside enjoying the beauty of Nova Scotia in winter; walk outside at night and admire our magnificent constellations. Then please sit down and share your experiences, in a piece for the HFN Newsletter, or a contribution to Roy John's proposed record of observations.

I wish for all of us a happy and fulfilling year in 1994.

Ursula Grigg





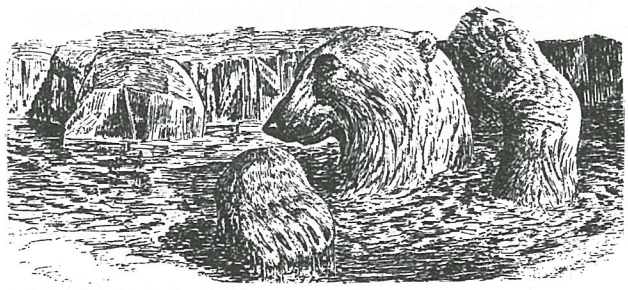
PARKING TICKETS

The "no parking except while in the Museum" rule is now being enforced, so we must remember not to leave our cars in the parking lot while we go on field trips.

However, we have been invited to leave our cars in the employees' parking lot, down the ramp on the other side of the Museum building. Of course we can continue to park in the public lot while we are in the Museum for meetings.

NEXT YEAR'S DUES

It's time to pay dues for 1994. They can be sent to the Treasurer, Shirley van Nostrand, at the Museum, or given to her at meetings. Thanks to members who have already renewed!



CONTENTS

SPECIAL REPORTS:

ANNUAL PUBLICATION OF NATURAL HISTORY EVENTS

I would like to propose that the HFN undertakes to produce a booklet containing articles on events of importance in our region. The long-term intent is that this should be an annual publication, but I think it is easier to concentrate on one issue for now. The following are topics which might be included:

Mammals a summary of whale and dolphin sightings

a commentary on other mammals (bears)

Birds a summary of the spring and fall migration, highlighting the rarities, including the Piping Plover programme

Herptiles status of vulnerable species (Blanding's Turtle)

Fish comments on introductions, status of populations

Insects breeding success, changes in populations

Plants a review of how well plants grew
new plant finds (new species or locations

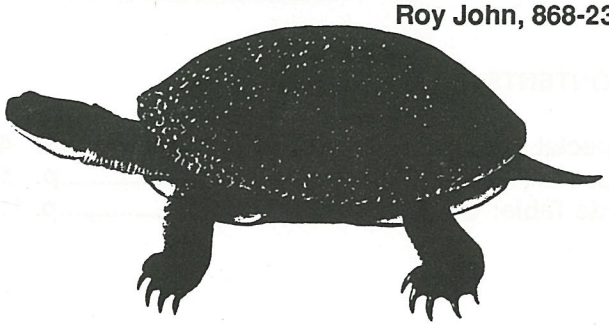
Other fossils, lichen, mosses etc

I already have volunteers for whales and birds. I would be delighted to hear from others, either to contribute to these ideas or with additional suggestions. I would be happy to act as editor, to pull it all together, arrange for illustrations and get it printed.

We should attempt to sell the booklets for a low price to bring money to the HFN and to promote awareness of our club and the environment. We may be able to get some funding for the printing.

Please let me have your comments and suggestions; I would be delighted to hear from volunteers.

Roy John, 868-2373



23RD CNF ANNUAL CONFERENCE

One of the pleasures of winter is planning for next summer! There are family plans and seed catalogues of course, and then there is the delight of picking out that special workshop or expedition which caters to one's own interest.

In 1994 HFN members will have a special event right on the doorstep, with the Canadian Nature Federation Annual General Meeting, to be held at Mount St. Vincent University, and invited here by our club.

Dates for the meeting are 4-7 August, with excursions both before and afterwards. The theme, A Journey from Forest to Sea, gives plenty of scope, and Bob McDonald's organising committee has taken full advantage of it, and of the resources of local universities and experts.

At three days, the conference is a day longer than usual; the extra time will be used for a special session on pressing national issues, on August 4. This will be chaired by Joy Finlay and David Wake, officers of CNF.

The theme for August 5 is The Land, the Forests - Touching the Sea, and includes Nova Scotia's geography, wildlife, plants, Bald Eagles, and adaptations in shape and colour for insect and spider survival. (This is picking my favourites!)

On August 6, The Coast and The Sea are considered. This day includes presentations on the history and future of the Annapolis River-Estuary System; Cape Chignecto; Brier and Pearl Islands. Again, I am being selective.

Outside the meeting rooms, there are ample opportunities for socialising, plus early bird walks, star-gazing, and bug-hunting. The list of excursions is also extensive, ranging from Freewheeling Cycle Tours, Sea Kayaking and a nature photography workshop, to visits to most of the places discussed during indoor sessions.

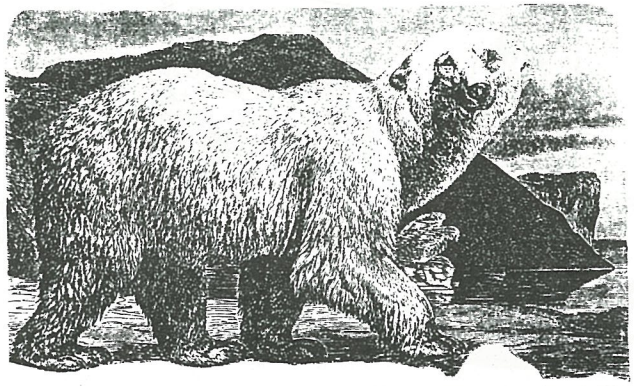
One of the best features of this conference is the Young Naturalists' programme, to which children's authors and illustrators and outdoor recreation specialists will contribute. The committee hopes that

local youth will sign up for this, to make friends with visiting children and introduce them to favourite diversions; local children don't necessarily have to be with parents.

This is a priceless opportunity for all of us to get an over-view of Nova Scotia's wonderful diversity, and to see it in the company of the professionals and amateurs who so often remain in their back rooms (protective coloration!).

So, get a registration pack (details on the back page of this Newsletter) and plan a holiday at home in 1994. Better still, volunteer to help the various committees putting the conference on, and see it from the inside. Encourage your children to come along too! Send information to friends and relatives, and note that Air Canada offers a conference discount to travellers registered here.

Ursula Grigg



SPECIAL ARTICLES

WILLOW GALL MIDGES IN NOVA SCOTIA

Over millions of years of evolution, plant-feeding insects have developed numerous ways of feeding on plants, some more specialized than others. The larval stages of many species are external leaf feeders, some are leaf miners, others are stem or root borers, while still others feed on plant seeds. Gall midges are internal plant feeders with a difference: their presence stimulates the formation of a gall.

Many organisms, including bacteria, fungi and nematodes, can stimulate gall formation, but the majority are caused by insects and mites. Although many orders of insects contain gall forming species, most are found in three families: Cecidomyiidae (gall midges), Cynipidae (gall wasps) and Eriosomatidae (gall aphids.)

The gall itself is an abnormal growth of plant tissue that takes on a particular shape and structure, depending on the organism that stimulates its formation (Figure 1). It may form on any part of the plant including the root, stem, leaf, flower or bud. The mechanism by which this tumour-like growth comes about is not precisely understood, but it is thought that the intruding organism introduces a chemical substance called a "plant growth regulator" that stimulates the aberrant growth. Apparently these growth regulating chemicals are specific to each species of gall former, since the gall that forms is also species specific. Even closely related species can be distinguished based on the galls they form.

Willows suffer more than most plants from gall insects, particularly from the attacks of gall midges. Some of the most conspicuous and well studied of this group of midges belong to the genus *Rhabdophaga* (Figure 2). At least five species of *Rhabdophaga* occur in Atlantic Canada, forming galls on several species of willow.

Not all willows are susceptible to gall midges, but the most common willow species are. Pussy-willow *(Salix discolor)* , small pussy-willow *(S. humilis)*, balsam willow *(S. pyrifolia)*, and beaked willow *(S. bebbiana)* are all native to Nova Scotia and susceptible to gall midges. Although the pinecone

gall and beaked gall can probably be found on most of these, other gall midges are less common and may be more specific in the willows they attack. At least two introduced species of willow are also susceptible to gall midges, common osier *(S. viminalis)* and purple osier *(S. purpurea)*.

Gall midges form galls on twigs or buds. Bud galls form at the tips of twigs and contain only one chamber and one larva. Stem galls, on the other hand, are swellings of the twig that usually contain a group of chambers with several feeding larva (Figure 1).

Adult gall midges are small, delicate flies resembling mosquitoes, but unlike mosquitoes they don't bite (Figure 2). They emerge from galls in mid-

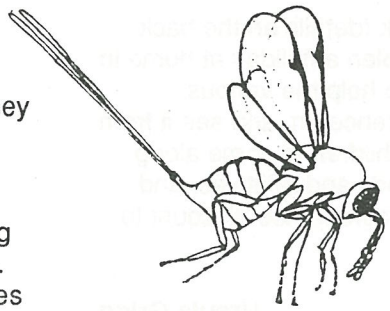
May in Nova Scotia. Recently vacated galls are easily identified by the pupal skins which cling for a time to the exit holes of newly vacated galls. Mting occurs shortly after emergence, and females lay their eggs singly or in groups on willow twigs. When the eggs hatch, small maggot-like larvae burrow into the bases of terminal or lateral buds and begin to feed. The presence of feeding larvae stimulates formation and growth of the gall. Larval feeding and gall growth continue over the summer, terminatin gin autumn as the larvae reach maturity. The galls now become convenient over-wintering chambers for the fuly-formed larvae, which pupate and emerge as adults the following spring.

At first glance, life as a willow gall midge might seem ideal: a feeding place with an unlimited food supply, and sheltered from changing weather conditions and the ravages of predators. In fact, the advantages with respect to food supply are even better than they apppear. But as far as shelter from weather and predation are concerned, galls have been found to be highly over-rated.

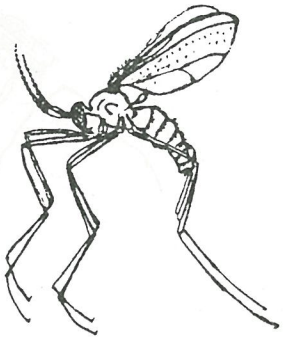
For those that have been studied, midge galls are known to be nutrient sinks. In effect, twigs with galls can divert food resources from other twigs and out-compete them - all to the benefit of the larvae contained within, of course. Evidence of this nutrient sink effect has been demonstrated by measuring the diameters of twigs with galls and those without. Twigs with galls are significantly larger in diameter than twigs without galls.

As mentioned earlier, diverse groups of insects contain species that attack plants and stimulate the formation of galls. In other words, this way of life has evolved separately in unrelated groups of insects. Fortunately for the plants however, gall feeding as a way of life has also stimulated the evolution of a vast number of insects that specialise in parasitising or otherwise feeding on gall insects.

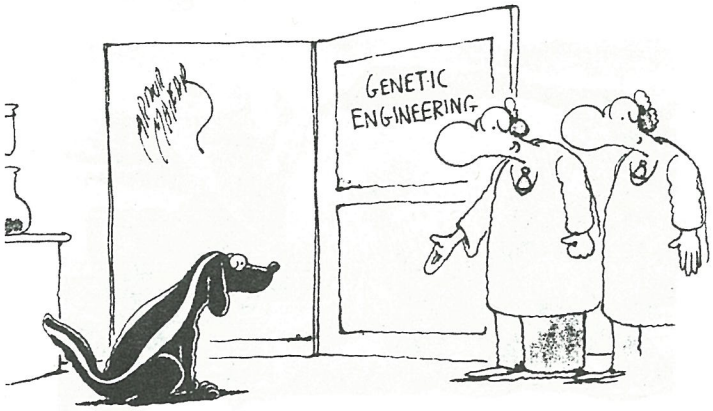
This group of parasites may in fact be so effective that it counterbalances any apparent advantage gall insects have over other less specialised plant feeders. Gall formers appear to have more parasites associated with them than insects that do not form galls. As a result, for a given species of gall midge, the



Torymus cecidomyiae



Rhabdophaga sp.



"We've done it, Rothchild! The perfect watchdog."

percentage of galls attacked by parasites is quite high, approaching 100% in some cases.

Specialised parasites of willow gall midges include at least two species of hymenoptera in the genus *Torymus* (Figure 3). These, mostly iridescent green wasp-like insects, are no more than a few millimetres long. Females seek out midge galls and, using their long ovipositors, inject an egg inside. The egg hatches into a larva that feeds on the gall former and emerges from the gall as an adult parasite.

Many questions about the biology and ecology of midge gall parasites still remain. Questions also remain concerning the mode of action of plant growth regulators, and the nature of susceptibility and resistance in willows. Despite their apparent simplicity, willow gall midges are by no means fully understood.

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Marcel Cornect, July 1993.

potato gall

R. salicisbatatas

wheat-ear gall

R. salicistriticoides

pinecone gall

R. strobiloides

cabbage gall

R. salicisbrassicoides

nodula gall

R. salicisnodulus

beaked gall

Rhabdophaga rigidae

Willow galls of summer

PEREGRINES AND PLOVERS

Oh, the irony of it all! Here we are, in the Piping Plover Guardian Program, trying to preserve an endangered species from extinction; putting in hour after hour of volunteer time, in cold and rain, sun and sweltering heat, battling bugs and avoiding Poison Ivy, and what happens? One of our endangered species is EATEN by another of our endangered species - a Peregrine Falcon!!

This happened at Waterside Beach, in Fundy National Park, New Brunswick. At least, that is what we THINK happened...

Alain Clavette made the discovery of the evidence - nothing but a few feathers - Piping Plover feathers - in the sand. This is typical of a Peregrine Falcon attack.

The majority of peregrine kills are made within twenty feet of the ground, on the wing. This is especially true of attacks on shorebirds.

Peregrine Falcons (*Falco peregrinus*) are crow-sized birds of prey. There are three subspecies in North America. Peale's Falcons (*F. p. pealei*) nest mainly in Alaska and are for the most part only slightly migratory. Tundra Falcons (*F. p. tundrius*) breed in the Arctic, and the Anatums (*F. p. anatum*) are found south of the tree line to Mexico. Both the Tundra and Anatum subspecies are migratory, wintering in southern North America, Central and South America.

The Latin name 'peregrinus' is translated as 'wanderer,' or 'coming from foreign parts.'

While the three subspecies differ slightly in colouration, they can generally be described as follows: The top of the head, cheeks and 'moustache' are dark slate grey. The upper back is a dark bluish, spotted and barred with brown. The rump is lighter, and the tail is barred with black bands, edged with white. The breast and belly are light or buffy, barred with brown. The legs are greenish yellow. Female and male adults are coloured alike: they stand 38-50 cm. tall, with females being noticeably larger than males. The young are brown, with dark streaks. Life span in captivity is 15-20 years, but a 12-15 year wild bird would be considered old. The mortality rate of peregrines in their first year is estimated at about 60%.

Twentytwo races of peregrines are known, nearly world-wide, and in the past they have been a favourite of falconers; they were known as the 'bird of princes.'

After the second world war, the increased use of organochlorine pesticides such as DDT caused these chemicals to appear in the falcons' food species. The result was devastating, as one of the breakdown products (DDE) built up in the peregrines' bodies and caused eggshell thinning. The eggs broke, and few nests were successful. There were behaviour changes too, and parents actually ate their own eggs. Peregrine numbers declined drastically, the Anatum race being most affected.

Since DDT was banned in North America in the early 1970s there is a relatively low level of chemicals in food species in most of Canada. There is a continuing problem with migratory prey species, which are still exposed to DDT in Central and South America, where they spend their winters.

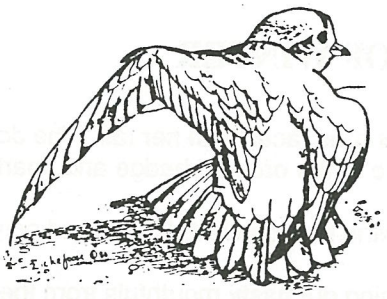
For several years now, the Canadian Wildlife Service (CWS) has been breeding captive Anatum Peregrine Falcons in Wainwright, Alberta, for release into the wild. These young birds are hacked and gradually freed. The releases have a two-fold purpose: to re-establish extirpated populations, and to replenish native populations in areas where the birds still nest.

Between 1982 and 1991, several birds were released in Nova Scotia and New Brunswick. No nesting sites have resulted in Nova Scotia, but there are five known sites in New Brunswick. One pair, known as the 'Fundy Park Pair,' has been nesting successfully since 1989; this year they fledged four chicks. Steven Flemming, a Fundy Park biologist, tells me that one of the parents is a released bird and the other is thought to be an American 'immigrant.'

Evidence suggests that one of this pair took the Piping Plover at Waterside; they are the closest to that vicinity, and peregrines are territorial in their nesting and hunting grounds (or air space!).

The peregrine release programme has been very fruitful. The initial goal for the area from the Ontario/ Quebec border eastward through the Maritimes was to have ten pairs producing approximately 15 young a year by 1995. Bruce Johnson (CWS) tells me that the goal has already been exceeded; there are about 19 pairs now producing 25-30 young. The released Canadian birds are identified by a red leg band.

Hacking will still take place in Ontario and Alberta for another three or four years, although there will be no more releases in our area unless the population becomes endangered again.



The peregrine is a magnificent raptor to observe in action. During an attack it plunges from above at an estimated speed of over 300 km/h, knocking the prey out of the air with a powerful talon. The victim is then either caught in the air, or allowed to fall and retrieved from the ground.

Robie Tufts, in "Birds of Nova Scotia," notes that sometimes the falcon "appears to enjoy pursuing prey only for the sport." He recounts having watched a peregrine terrorise a flock of sandpipers for several minutes before it cut short its aerial manoeuvres, and headed "empty-handed towards the wooded shore."

SO - while we lament the loss of one of our Piping Plovers, we can rejoice in the knowledge that the Peregrine Falcon is making a successful comeback in the wilds of Canada. That is truly cause for celebration!

BUT - those Rotten Peregrines better not take any more Pipers, or we could become rather annoyed!!!!!

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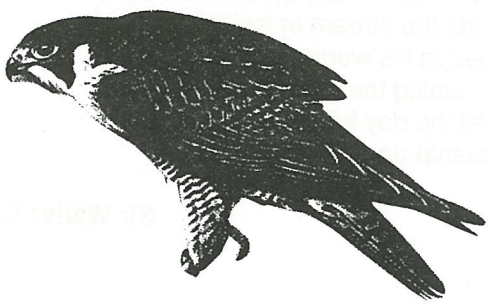
<Catherine Strugnell, September 1993



PARROT POWER

"The world's favorite talking bird has emerged as an ambassador in the fight to save the rain forest."

No other specimen is more intensely hunted in the international bird trade than parrots. The pressure is something they can do without. Because they are fundamentally birds of the rain forest, parrots are losing their habitat at an alarming rate. Of 333 species in the order Psittaciformes - a group that includes macaws, cockatoos, lovebirds, lorikeets and budgerigars - no fewer than 71 are in danger of extinction.

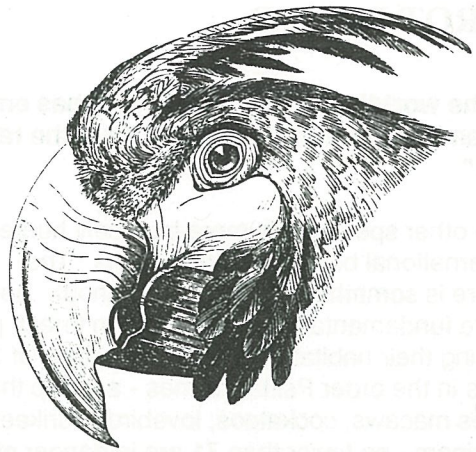
This double threat has drawn attention world-wide to their plight. Recent attempts to save endangered Caribbean parrots have proven their ability to arouse human sympathy. Now, conservationists around the world are hoping to enlist parrots as 'flagship species' to draw attention to the pressing need for rain forest preservation.

The appeal of parrots is as old as history itself. There was a touching hymn to the beauty of parrots in the Rig Veda, an Indian classic, 3,500 years ago. The ancient Romans valued parrots more highly than slaves; they were an essential component of the patrician equipage. And long before Captain Cook sailed into Botany Bay, cartographers from Mercator on identified a tantalising empty space in the southern Indian Ocean as Psitacorum Regio - the Region of Parrots.

To humans the appeal of parrots is more personal - they are so much like us. In captivity macaws and cockatoos can live as long as humans. Biologists have observed parrots in the wild exhibiting behaviour that can only be described as play. And a parrot's exceptionally dexterous yoke-toed feet are the closest things in the bird world to hands. Many species of parrot mate for life, and unlike most birds they love to be touched and preened. Parrots which transfer their affection to human ownership can become distraught and inconsolable when separated; some claim that parrots can die from grief at the loss of a mate or human owner.

Of course it is a parrot's ability to talk, a talent beyond the scope of even our closest relatives - the monkeys and apes - that has won it such enduring human esteem. Parrots can imitate noises with astounding accuracy, anything from the sound of a dripping tap to a particular human voice.

Unfortunately their attractiveness to humans is



proving fatal. Over the past 25 years, cheap, fast air transportation has revolutionised the trade in wild birds. As one of the biggest markets for wild birds, the United States imports at least 250,000 parrots a year, representing as many as 96 of the 141 species native to South America. A fledgling macaw knocked out of its nest by a Brazilian peasant and sold for $5 may fetch $6,000 in a fashionable New York pet shop. The majority of wild-caught birds embark on a journey to death. Some are killed by the initial shock of capture and as many as 25% succumb shortly after. If overcrowding is serious, the mortality rate may double, carpeting the dealers' aviaries with piles of feathered corpses. The long trail of mortality continues as consignments are shipped around the world in the cold cargo holds of aircraft. Smuggled birds fare worse - shipped in makeshift, badly ventilated cages, often drugged, with their bodies bound and beaks taped shut. It is estimated that for every bird that reaches the marketplace, three or four others die.

Although laws prohibiting the commercial trade in wild birds are currently under consideration in the U.S. (though not in Canada), regulations aimed at protecting officially endangered birds have already proved ineffective.

There is one brightening glimmer of hope in this otherwise dismal picture. The most effective method of parrot conservation yet devised began on the Caribbean island of St. Lucia when British ornithologist Paul Butler agreed to help the island's government save the St. Lucia amazon. At that time there were less than 100 birds. His aim was to make the islanders so proud of the bird that they would never kill or capture one. His unscientific methods using videos, billboards, songs, church sermons and school visits succeeded and today there are 300 birds...

From Tony Soper's article in the Globe & Mail Destinations Magazine, Sept. 1991, by way of the Catherine Traill Naturalists' Club, December 1991

SIGNS OF WINTER

The cat runs races with her tail. The dog
Leaps o'er the orchard hedge and knarls the grass.
The swine run round and grunt and play with straw,
Snatching out hasty mouthfuls from the stack.
Sudden upon the elm-tree tops the crow
Unceremonious visit pays and croaks,
Then swops away. From mossy barn the owl
Bobs hasty out - wheels round and, scared as soon,
As hastily retires. The ducks grow wild
And from the muddy pond fly up and wheel
A circle round the village and soon, tired,
Plunge in the pond again, The maids in haste
Snatch from the orchard hedge the mizzled clothes
And laughing hurry in to keep them dry.

John Clare

OTTER AND HAWK

Forth from his den the otter drew, -
Grayling and trout their tyrant knew,
As between reed and sedge he peers,
With fierce round snout and sharpen'd ears,
Or, prowling with the moonbeam cool,
Watches the stream or swims the pool;-
Perched in his wonted eyrie hig h,
Sleep sealed the tercelet's weary eye,
That all the day had watched so well
The cushat dart across the dell.

Sir Walter Scott

HALIFAX AST Z+4

1994

JANUARY–JANVIER

Day	Time	Ht./ft.	Ht./m	Jour	Heure	H./pi	H./m
1	0410	1.7	.5	16	0510	1.7	.5
	1000	6.2	1.9		1055	5.9	1.8
SA	1640	.7	.2	SU	1725	1.3	.4
SA	2240	6.2	1.9	DI	2320	5.9	1.8
2	0505	1.8	.5	17	0600	1.8	.5
	1045	6.0	1.8		1135	5.6	1.7
SU	1730	.8	.2	MO	1805	1.6	.5
DI	2325	6.2	1.9	LU			
3	0610	1.8	.5	18	0000	5.7	1.7
	1135	5.8	1.8		0645	1.9	.6
MO	1825	1.0	.3	TU	1220	5.2	1.6
LU				MA	1845	1.8	.5
4	0015	6.1	1.9	19	0040	5.5	1.7
	0715	1.8	.5		0730	1.9	.6
TU	1230	5.5	1.7	WE	1305	4.9	1.5
MA	1925	1.2	.4	ME	1930	2.1	.6
5	0110	6.0	1.8	20	0125	5.3	1.6
	0820	1.7	.5		0820	1.9	.6
WE	1330	5.2	1.6	TH	1400	4.7	1.4
ME	2025	1.4	.4	JE	2020	2.2	.7
6	0210	5.9	1.8	21	0220	5.2	1.6
	0920	1.5	.5		0915	1.9	.6
TH	1440	5.0	1.5	FR	1505	4.5	1.4
JE	2130	1.6	.5	VE	2115	2.3	.7
7	0315	5.9	1.8	22	0320	5.1	1.6
	1025	1.3	.4		1010	1.8	.5
FR	1600	5.1	1.6	SA	1610	4.6	1.4
VE	2235	1.6	.5	SA	2215	2.3	.7
8	0425	6.0	1.8	23	0420	5.3	1.6
	1130	1.0	.3		1105	1.6	.5
SA	1710	5.2	1.6	SU	1710	4.7	1.4
SA	2340	1.5	.5	DI	2310	2.1	.6
9	0525	6.1	1.9	24	0520	5.5	1.7
	1225	.6	.2		1200	1.3	.4
SU	1815	5.5	1.7	MO	1805	5.0	1.5
DI				LU			
10	0040	1.4	.4	25	0000	1.9	.6
	0620	6.3	1.9		0605	5.8	1.8
MO	1315	.4	.1	TU	1245	1.0	.3
LU	1905	5.7	1.7	MA	1850	5.3	1.6
11	0130	1.3	.4	26	0050	1.7	.5
	0715	6.4	2.0		0650	6.0	1.8
TU	1405	.3	.1	WE	1325	.7	.2
MA	1955	5.9	1.8	ME	1930	5.7	1.7
12	0215	1.2	.4	27	0135	1.4	.4
	0800	6.5	2.0		0735	6.3	1.9
WE	1445	.3	.1	TH	1410	.5	.2
ME	2040	6.1	1.9	JE	2015	6.0	1.8
13	0300	1.3	.4	28	0220	1.3	.4
	0845	6.4	2.0		0820	6.4	2.0
TH	1530	.4	.1	FR	1450	.3	.1
JE	2120	6.1	1.9	VE	2055	6.2	1.9
14	0345	1.4	.4	29	0305	1.2	.4
	0930	6.3	1.9		0900	6.4	2.0
FR	1610	.6	.2	SA	1535	.3	.1
VE	2200	6.1	1.9	SA	2140	6.4	2.0
15	0430	1.5	.5	30	0355	1.2	.4
	1015	6.1	1.9		0945	6.4	2.0
SA	1650	.9	.3	SU	1620	.4	.1
SA	2240	6.0	1.8	DI	2220	6.5	2.0
				31	0450	1.3	.4
					1035	6.2	1.9
				MO	1710	.7	.2
				LU	2305	6.4	2.0

FEBRUARY–FEVRIER

Day	Time	Ht./ft.	Ht./m	Jour	Heure	H./pi	H./m
1	0555	1.3	.4	16	0545	1.6	.5
	1120	5.9	1.8		1145	5.3	1.6
TU	1810	1.0	.3	WE	1750	1.8	.5
MA	2355	6.2	1.9	ME	2355	5.4	1.6
2	0655	1.4	.4	17	0630	1.7	.5
	1210	5.6	1.7		1225	5.0	1.5
WE	1910	1.3	.4	TH	1835	2.1	.6
ME				JE			
3	0045	6.0	1.8	18	0035	5.2	1.6
	0800	1.4	.4		0725	1.8	.5
TH	1310	5.2	1.6	FR	1310	4.7	1.4
JE	2015	1.5	.5	VE	1930	2.2	.7
4	0140	5.7	1.7	19	0125	5.0	1.5
	0905	1.3	.4		0825	1.8	.5
FR	1420	4.9	1.5	SA	1405	4.5	1.4
VE	2120	1.7	.5	SA	2035	2.3	.7
5	0250	5.5	1.7	20	0225	4.9	1.5
	1010	1.2	.4		0925	1.8	.5
SA	1545	4.9	1.5	SU	1515	4.4	1.3
SA	2230	1.7	.5	DI	2135	2.3	.7
6	0410	5.6	1.7	21	0335	5.0	1.5
	1115	1.0	.3		1025	1.6	.5
SU	1705	5.0	1.5	MO	1630	4.6	1.4
DI	2330	1.6	.5	LU	2235	2.1	.6
7	0515	5.7	1.7	22	0440	5.3	1.6
	1210	.8	.2		1120	1.4	.4
MO	1805	5.3	1.6	TU	1730	5.0	1.5
LU				MA	2330	1.8	.5
8	0030	1.5	.5	23	0535	5.6	1.7
	0615	6.0	1.8		1210	1.0	.3
TU	1300	.6	.2	WE	1820	5.4	1.6
MA	1855	5.6	1.7	ME			
9	0115	1.3	.4	24	0025	1.5	.5
	0705	6.2	1.9		0625	5.9	1.8
WE	1345	.5	.2	TH	1255	.7	.2
ME	1940	5.9	1.8	JE	1905	5.9	1.8
10	0200	1.2	.4	25	0115	1.2	.4
	0745	6.3	1.9		0710	6.2	1.9
TH	1425	.5	.2	FR	1345	.4	.1
JE	2020	6.0	1.8	VE	1945	6.3	1.9
11	0240	1.2	.4	26	0200	.9	.3
	0830	6.3	1.9		0800	6.4	2.0
FR	1505	.6	.2	SA	1430	.2	.1
VE	2055	6.1	1.9	SA	2030	6.5	2.0
12	0320	1.2	.4	27	0250	.7	.2
	0910	6.2	1.9		0845	6.5	2.0
SA	1540	.8	.2	SU	1515	.2	.1
SA	2135	6.1	1.9	DI	2115	6.7	2.0
13	0355	1.3	.4	28	0340	.7	.2
	0950	6.1	1.9		0930	6.4	2.0
SU	1610	1.1	.3	MO	1600	.4	.1
DI	2210	6.0	1.8	LU	2200	6.7	2.0
14	0430	1.3	.4				
	1025	5.8	1.8				
MO	1640	1.3	.4				
LU	2245	5.8	1.8				
15	0505	1.4	.4				
	1105	5.6	1.7				
TU	1715	1.6	.5				
MA	2320	5.6	1.7				

MARCH–MARS

Day	Time	Ht./ft.	Ht./m	Jour	Heure	H./pi	H./m
1	0435	.7	.2	16	0425	1.1	.3
	1020	6.2	1.9		1035	5.5	1.7
TU	1655	.6	.2	WE	1630	1.6	.5
MA	2245	6.5	2.0	ME	2245	5.6	1.7
2	0535	.8	.2	17	0500	1.2	.4
	1110	5.9	1.8		1115	5.2	1.6
WE	1755	1.0	.3	TH	1710	1.9	.6
ME	2330	6.2	1.9	JE	2320	5.4	1.6
3	0640	1.0	.3	18	0545	1.4	.4
	1200	5.6	1.7		1150	5.0	1.5
TH	1900	1.4	.4	FR	1755	2.1	.6
JE				VE	2355	5.2	1.6
4	0020	5.8	1.8	19	0640	1.6	.5
	0745	1.1	.3		1230	4.8	1.5
FR	1255	5.2	1.6	SA	1855	2.2	.7
VE	2005	1.6	.5	SA			
5	0120	5.5	1.7	20	0040	5.0	1.5
	0850	1.1	.3		0740	1.7	.5
SA	1405	4.9	1.5	SU	1325	4.6	1.4
SA	2115	1.8	.5	DI	2000	2.3	.7
6	0230	5.2	1.6	21	0135	4.9	1.5
	0950	1.1	.3		0845	1.6	.5
SU	1535	4.8	1.5	MO	1430	4.6	1.4
DI	2215	1.8	.5	LU	2105	2.2	.7
7	0355	5.2	1.6	22	0240	4.9	1.5
	1050	1.1	.3		0940	1.5	.5
MO	1655	5.0	1.5	TU	1545	4.8	1.5
LU	2320	1.7	.5	MA	2205	2.1	.6
8	0505	5.4	1.6	23	0355	5.1	1.6
	1150	.9	.3		1040	1.3	.4
TU	1755	5.3	1.6	WE	1650	5.2	1.6
MA				ME	2305	1.8	.5
9	0015	1.5	.5	24	0500	5.4	1.6
	0600	5.6	1.7		1130	1.0	.3
WE	1240	.8	.2	TH	1745	5.6	1.7
ME	1835	5.6	1.7	JE			
10	0100	1.3	.4	25	0000	1.4	.4
	0645	5.8	1.8		0600	5.7	1.7
TH	1325	.8	.2	FR	1225	.7	.2
JE	1915	5.9	1.8	VE	1835	6.1	1.9
11	0145	1.1	.3	26	0055	1.0	.3
	0730	6.0	1.8		0650	6.1	1.9
FR	1400	.8	.2	SA	1315	.4	.1
VE	1950	6.0	1.8	SA	1920	6.5	2.0
12	0220	1.0	.3	27	0145	.6	.2
	0810	6.0	1.8		0735	6.3	1.9
SA	1435	.9	.3	SU	1405	.3	.1
SA	2025	6.1	1.9	DI	2005	6.8	2.1
13	0255	.9	.3	28	0235	.3	.1
	0845	6.0	1.8		0825	6.4	2.0
SU	1505	1.0	.3	MO	1455	.3	.1
DI	2100	6.0	1.8	LU	2050	6.8	2.1
14	0325	.9	.3	29	0330	.2	.1
	0925	5.9	1.8		0915	6.3	1.9
MO	1535	1.2	.4	TU	1545	.5	.2
LU	2135	5.9	1.8	MA	2135	6.7	2.0
15	0355	1.0	.3	30	0420	.2	.1
	1000	5.7	1.7		1005	6.2	1.9
TU	1600	1.4	.4	WE	1640	.8	.2
MA	2210	5.8	1.8	ME	2220	6.5	2.0
				31	0520	.4	.1
					1055	5.9	1.8
				TH	1740	1.1	.3
				JE	2310	6.1	1.9

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