

Double-crested and Pelagic Cormorant Inventory in the Strait of Georgia in 2000



Pelagic Cormorants on Gabriola Island

Authors:

Trudy A. Chatwin,
Ministry of Environment, Lands and Parks,
2080 Labieux Rd. Nanaimo BC V9T 6J9

Monica H. Mather
Ecological Consultant, Box 497 Lantzville BC V0R 2H0

Tanya Giesbrecht
6720 Schook Rd. Nanaimo BC V9V 1A1

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ABSTRACT

Since the early 1990's Double-crested and Pelagic Cormorant have shown alarming declines in nesting populations in the Strait of Georgia. This study was initiated in 2000 to provide a complete count of nesting colonies in the Strait and compare population estimate from counts completed in various years since the mid 1950's. A complete survey of all colonies was done in 1987. Before that, counts were done in many colonies, though not annually. We surveyed 34 Pelagic Cormorant and 17 Double-crested Cormorant historic and current colonies during the 2000 breeding season. Where possible we examined nest population trends at colonies with multiple years of data. Our analyses showed that overall counts of Pelagic Cormorants were down by half and Double-crested Cormorants had declined by two-thirds since 1987. Pelagic Cormorants showed a significant decline in total nests between 1959 and 2000; although during that period, an increase in the population at Mitlenatch Island was noted. At Double-crested Cormorant colonies, two significant increasing trends were noted. Since 1983 the population at Shoal Islands has slowly increased from zero to 104 nests in 2000. Likewise the population at Mitlenatch has also increased from zero to 70 nests. However these increases do not offset the very dramatic declines in overall population size. The most profound decreases were seen at Mandarte and Great Chain Islands where most of the Double-crested Cormorants were nesting in the late 1980's. At Mandarte Island, 1100 nests were observed in 1983, while only 215 were counted in 2000. We suggest that the causes of declines are possibly related to a combination of Bald Eagle disturbance, change in prey availability and human disturbance. Recommendations for management and conservation are discussed.

INTRODUCTION

Suspected declines in Double-crested Cormorants (*Phalacrocorax auritus*, DCCO) in the Strait of Georgia has led the province to list them as 'Blue' (Vulnerable) and examine their status (Moul 2001). As well, declines have been noted in Pelagic Cormorants (*P. pelagicus*, PECO) (Moul 2000). Cormorants are fish-eating seabirds that nest on rocky cliffs and islands (Campbell et al. 1990). Pelagic Cormorants nest on rock cliffs, caves and islets along the entire coast of British Columbia, while Double-crested Cormorants nest only in the Strait of Georgia on rocky islets.

Double-crested Cormorants have been recorded nesting in British Columbia only since the late 1920's (Drent and Guiguet 1961). Since then the population has risen in the Strait of Georgia until 1983 (Vermeer et al. 1989). However, surveys in the 1990's conducted by Ian Moul (2000) and Terry Sullivan (1998) demonstrated that the number of nests and nest success on some Double-crested Cormorant and Pelagic Cormorant colonies in the Strait of Georgia were declining. Given that there had not been a complete inventory since 1987, we decided to re-inventory the colonies to determine the extent of the decline and the distribution of cormorant colonies in the Strait of Georgia.

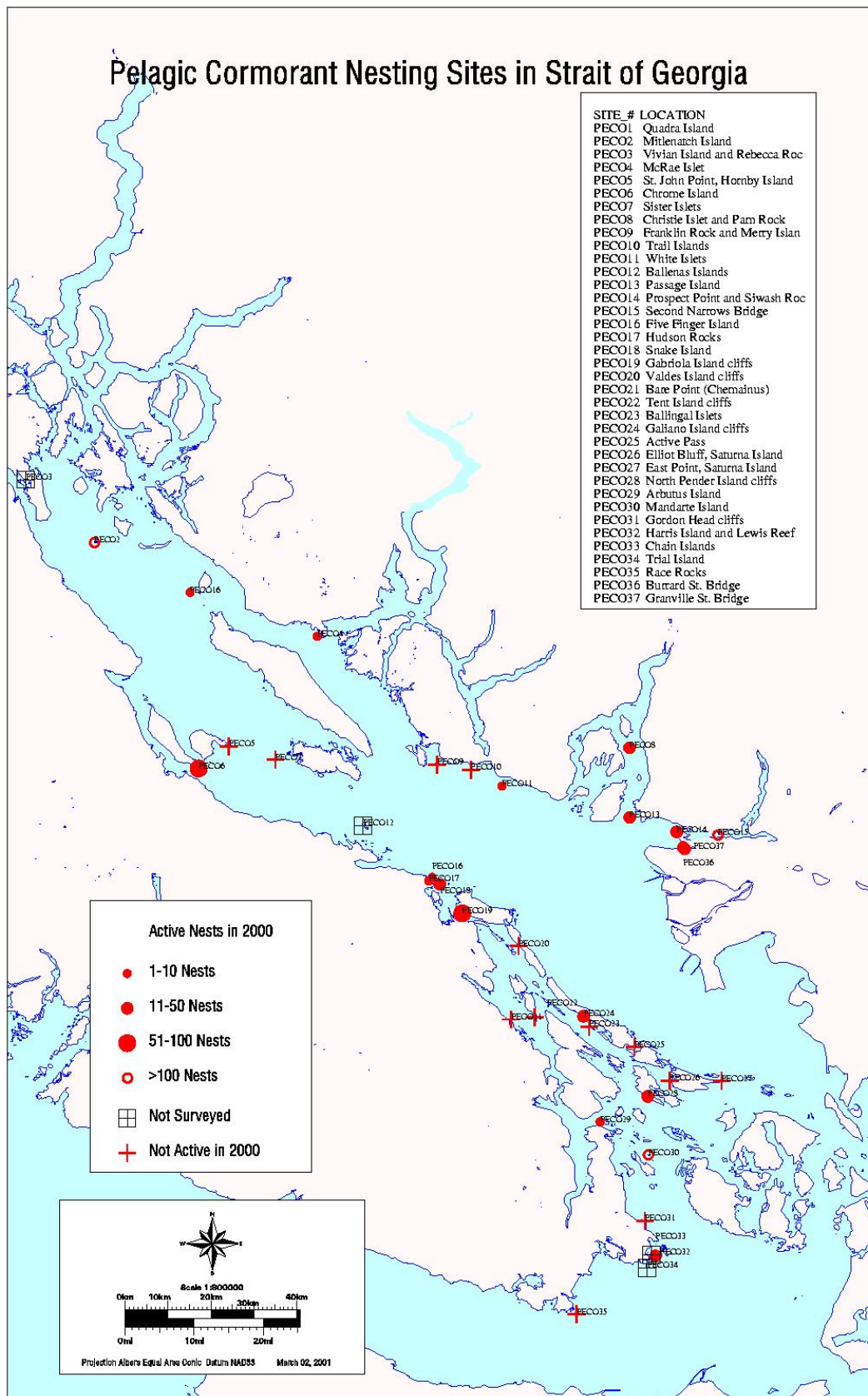
METHODS

Field Methods

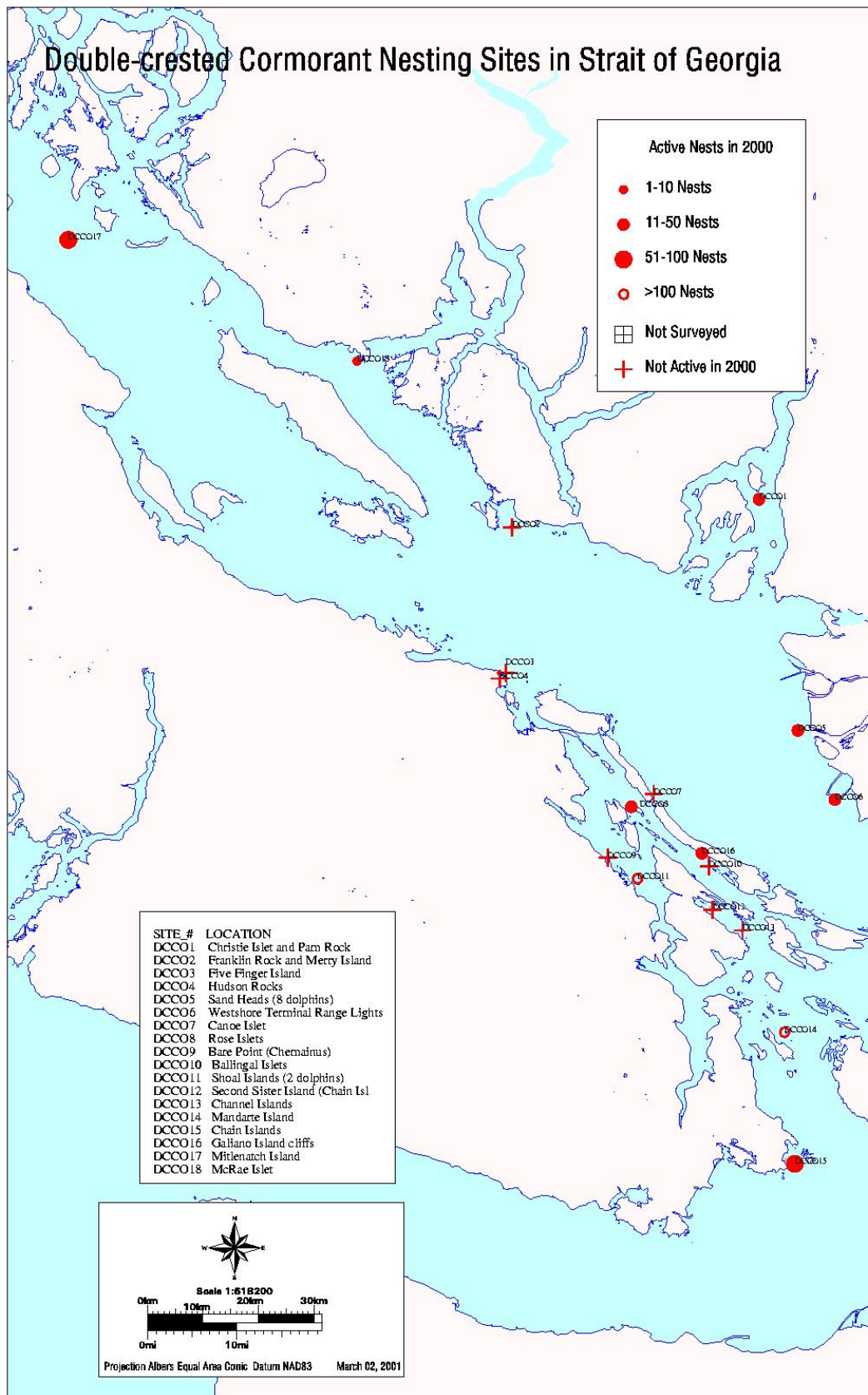
In order to assess the changes in cormorant numbers within the Strait of Georgia, previous records were examined (Vermeer et. al. 1989). As well, new colonies on Gabriola Island and in Vancouver were included (Sullivan, Chatwin, Pers. Comm.). We visited every colony in the Strait of Georgia¹. Nest counts were conducted at 34 historic or present Pelagic Cormorant and 17 Double-crested Cormorant colonies between July 18 2000 and October 23 2000 (Maps 1 & 2). T. Sullivan conducted nest counts in the northeast Strait and the Vancouver area. C. Slater surveyed Race Rocks Ecological Reserve, Marilyn Lambert counted nests at the Chain Islets Ecological Reserve and Alison Watt undertook the count at Mitlenatch Island. The authors, accompanied BC Conservation Officers and other volunteers visited all other colonies.

Colony counts were usually made from a motorboat. The colony on the Fraser River, Sandheads, was survey by T. Sullivan from a fixed winged plane. Once a colony was located, we determined its activity, and then made counts from approximately 25m offshore. We counted all nests, whether they were active or not. We made observations of cormorant numbers and young. Due to time and

¹ Quadra Island was not visited as there had been no records since 1959.



Map 1. Pelagic Cormorant active and inactive nest sites in the Strait of Georgia 2000.



/RS/003/OBS/HOME/VIR/L/RENEHAN/PROJECTS/WILD/LIFE/TR/UDY/COR/MDCO/MAP

Map 2. Double-crested Cormorant active and inactive nest sites in 2000.

observation limitations we did not measure productivity. Every attempt was made not to disturb birds. During the summer we could not accurately count the Double-crested Cormorant nests on Chain Islets Ecological Reserve or Mandarte Island without disturbing nesting birds. We returned to these colonies in October after the young had fledged to count the nests from land.

Statistical Analysis of Nest Counts

To provide an overall estimate of cormorant nesting population change in the Strait since 1987, we conducted pair-wise comparisons between nest counts at colonies surveyed in 1987 and in 2000 (Paired t-Test). These two data sets had the most complete counts from 29 Pelagic Cormorant colonies and 14 Double-crested Cormorant DCCO colonies.

Nest population trends for colonies with sufficient counts over multiple years were fitted to a linear regression model to see if populations showed significant changes. Due to the low sample size, an alpha of 0.1 was used to indicate statistical significance.

RESULTS

A total of 1088 Pelagic Cormorant and 602 Double-crested Cormorant nests were counted . (Table 1).

Table 1. Nest counts of Double-crested Cormorant and Pelagic Cormorant colonies in the Strait of Georgia, British Columbia during 2000.

Colony Location	PECO	DCCO
Mitlenatch Island	234	70
McRae Islets	7	1
Chrome Island	57	0
Christie Islet/Pam Rocks	19	42
White Islets	2	0
Passage Island	21	0
Prospect Point	12	0
Second Narrows Bridge	201	0
Burrard St. Bridge	39	0
Granville St. Bridge	47	0
Five Finger Island	2	15
Hudson Rocks	3	0
Snake Island	41	0
Gabriola Island cliffs	62	0
Galiano Island cliffs	11	14
North Pender Island cliffs	17	0
Arbutus Island	2	0
Mandarte Island	270	215
Chain Island	41	95
Sandheads	0	35
Westshore Terminal Lights	0	11
Rose Islet	0	15
Shoal Islands (2 Dolphins)	0	104
Total	1088	602

Comparisons with other years of survey

We compiled available data from 1959 to 1999 (Tables 2 and 3). Since the data from 1959, 1974, and 1990-1999 were not collected at all colony locations we could not compare overall nest population counts from each year. However certain trends were evident. Based on the nest counts between 1987 and 2000 (years when complete counts were done at all colonies), the population of Pelagic Cormorant has declined by half (from 2356 to 1088) and Double-crested Cormorant has declined by two-thirds (from 1981 nests to 602). A comparison between 1987 and 2000 for Pelagic Cormorant nest numbers per colony shows a significantly lower population in 2000 (Paired t-Test, $df=28$, $t=2.05$, $p<0.01$). The difference in the number of Double-crested Cormorant nests between 1987 and 2000 was not significant (Paired t-Test, $df=13$, $t=2.2$, $p>0.1$). Figures 1 and 2 show the fluctuations in nest numbers between 1987 and 2000.

Pelagic Cormorant Colonies in 1987 & 2000

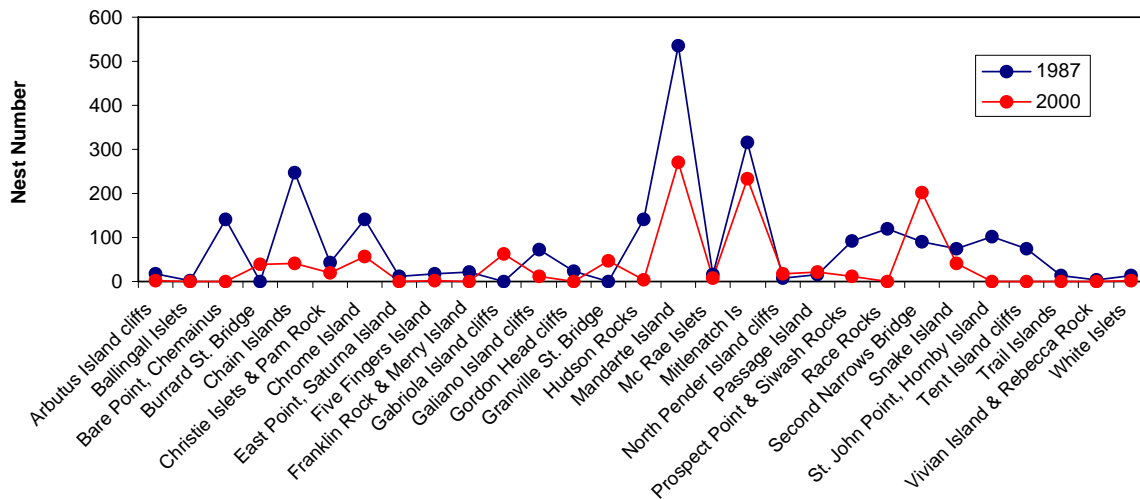


Figure 1. Number of nests of Pelagic Cormorants observed at Strait of Georgia colonies in 1987 and in 2000.

Double-crested Cormorant Colonies in 1987 & 2000

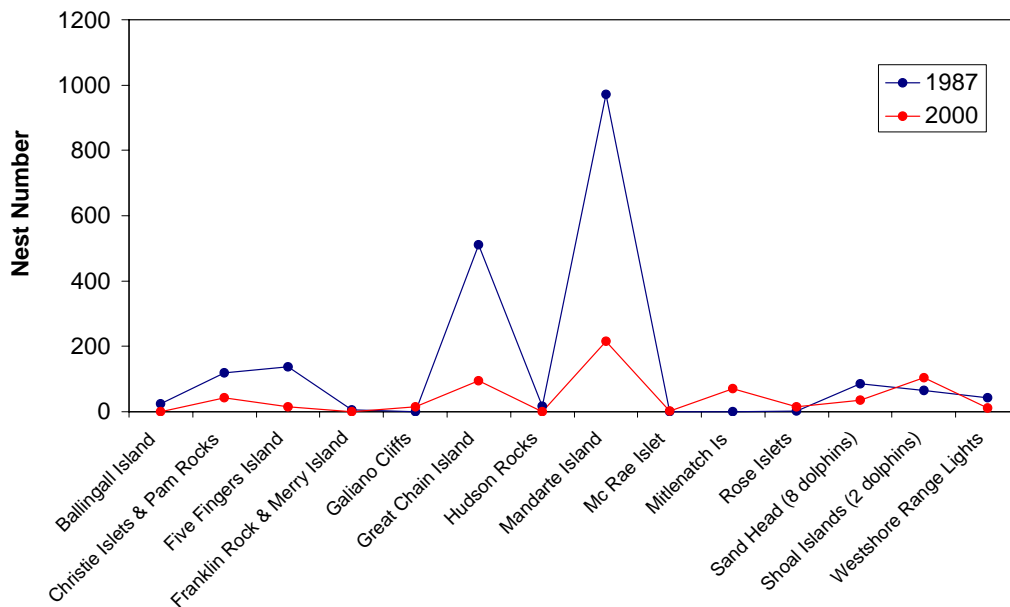


Figure 2. Number of nests of Double-crested Cormorants observed at Strait of Georgia colonies in 1987 and in 2000.

Table 2. Pelagic Cormorant Nest Counts

Location	1955	1959	1974	1983	1987	1990	1991	1992	1993	1994	1995	1998	1999	2000
Mitlenatch Is		155	286	318	315	334	330	332	311	337	338	222	311	234
Vivian Isl & Rebecca Rk			25	15	3									0
Mc Rae Islets				0	15									7
St. John Pt, Hornby	50		9	127	101									0
Chrome Island			54	78	141	80	67	122	171	220	212		134	57
Sisters Is			41	51	0									0
Christie Isl & Pam Rk			3	80	44									19
Franklin Rk & Merry Isl			130	18	22									0
Trail Islands			2	15	14									0
White Islets			4	38	13									2
Ballenas Islands			24	0	0									0
Passage Island			48	72	16									21
Prospect Pt & Siwash Rk				64	93									12
Second Narrows Bridge				10	90									201
Five Fingers Island				115	17	51	37	118	52	96	78		0	2
Hudson Rocks		38		30	142		40	39	31	59	61		37	3
Snake Island		15	22	60	74									41
Gabriola Island cliffs		7	367	0	0									62
Valdes Island cliffs	6			6	0									0
Bare Point, Chemainus		50	118	373	142	40						26	8	0
Tent Island cliffs				0	74									0
Ballingall Islets		11		0	2									0
Galiano Island cliffs				0	72									11
Active Pass			1	0	0									0
Elliot Bluff, Saturna Isl			10	0	0									0
East Point, Saturna Isl			54	53	12									0
N. Pender Island cliffs				0	8									17
Arbutus Island cliffs				16	18									2
Mandarte Island		375	443	550	536	311		297	405	280	206	91	37	270
Gordon Head cliffs	20		20	13	24							0		0
Harris Isl & Lewis Reef			54	0	0									0
Chain Islands		74	183	203	248	204			41	51	30	20	7	41
Trial Islands		107		0	0									0
Race Rocks		45	160	143	120									0
Burrard St. Bridge					0									39
Granville St. Bridge					0									47
Total nests observed	76	877	2058	2448	2356	1020	474	908	1011	1043	925	359	534	1088

Table 3. Double-crested Cormorant Nest Counts

Location	1959	1974	1983	1987	1990	1991	1992	1993	1994	1995	1996	1998	1999	2000
Christie Is & Pam Rocks	0	29	120	119										42
Franklin Rk & Merry Isl.	0	54	21	5										0
Five Fingers Island	0		0	138	153	118	191	306	378	295		43	42	15
Hudson Rocks	0		0	17		67	30	25	16	15		0	0	0
Sand Head (8 dolphins)	0		0	86										35
Westshore Range Lights	0		0	42										11
Canoe Islet	0	12	0	0										0
Rose Islets	0	80	12	2									6	15
Bare Point, Chemainus	0		198	0	18						23	19	11	0
Ballingall Island	28	14	20	25										0
Shoal Islands (2 dolphins)	0		0	65	44	78	74	74	75	71			83	104
Second Sister Island	9		0	0										0
Channel Islands	16		0	0										0
Mandarte Island	150	482	1100	972	473		280	458	403	288		178	43	215
Great Chain Island			135	510	686			339	444	432		300	100	95
Galiano Cliffs	0			0										14
Mitlenatch Is	0	0	0	0	0	0	0	10	33	43		46	47	70
Mc Rae Islet	0			0										1
Total Nests Observed	203	671	1606	1981	1374	263	575	1212	1349	1144	23	586	332	602

Changes in Cormorant Colony Occupation

In 2000, nine of 26 Pelagic Cormorant colonies were no longer active (St. John Point, Franklin Rock and Merry Island, Trail Islands, Bare Point, Tent Island cliffs, Ballingall Islets, East Point Saturna, Gordon Head cliffs and Race Rocks). However, two new Pelagic Cormorant colonies were found under Vancouver Bridges.

Similarly, two of 11 Double-crested Cormorant colonies were no longer active (Ballingall, Islets, Franklin and Merry Island). One new colony was found at Mitlenatch Island where 70 Double-crested Cormorant nests were counted in 2000.

Individual Colony trends

We found only two significant nest population trends at colonies for Pelagic Cormorants. At Mandarte Island, formally the largest colony in the Strait of Georgia, the nesting population declined significantly between 1959 and 2000 ($r^2 = 30\%$, $df = 11$, $F = 4.4$, $p = 0.06$). The number of nests at Mitlenatch showed a slight increase between 1950 and 2000 ($r^2 = 24\%$, $df = 12$, $F = 3.4$, $p = 0.09$) (Figure 3).

We also observed two significant increases in Double-crested Cormorant colony nests in the years they were counted. At Shoal Islands, the number of nests increased between 1983 and 2000 ($r^2 = 73\%$, $df=9$, $F = 21.2$, $p = 0.002$). Between 1992 and 2000, the number of Double-crest nests at Mitlenatch showed the greatest increase ($r^2 = 84\%$, $df = 6$, $F = 25.6$, $p = 0.004$) (Figure 4).

All other colonies showed no significant increasing or decreasing trends in the years nests were counted. However, the population of Double-crested Cormorants on Mandarte Island showed a very large increase between the late 1950's to late 1980's. The subsequent drop from 1983 to 2000 accounts for most of the population change in Double-crested Cormorant 's (Figure 4). A similar fluctuation can be seen in the Double-crested Cormorant population on Great Chain Island.

Figure 3. Pelagic Cormorant Trends

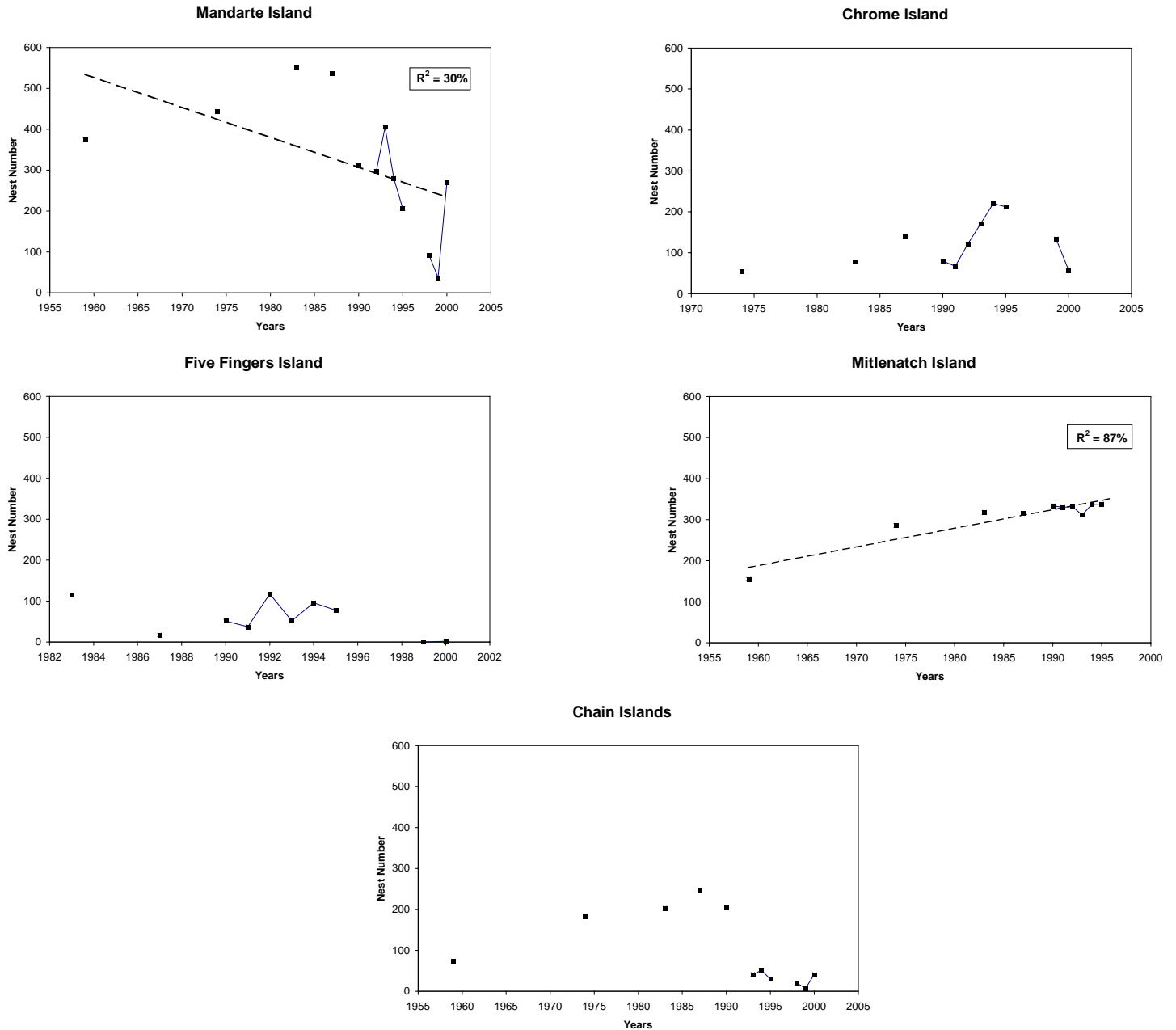


Figure 3. Number of nests of Pelagic Cormorants observed at five colonies within the Strait of Georgia, between 1955 and 2000. Lines connecting counts are for consecutive years. A simple regression model was fitted to the points; where significant ($p < 0.1$), the dotted line is shown. For Mitlenatch Island, $r^2 = 24\%$, $df = 12$, $F = 3.4$, $p = 0.09$; for Mandarte Island, $r^2 = 30\%$, $df = 11$, $F = 4.4$, $p = 0.06$.

Figure 4. Double-crested Cormorant Trends

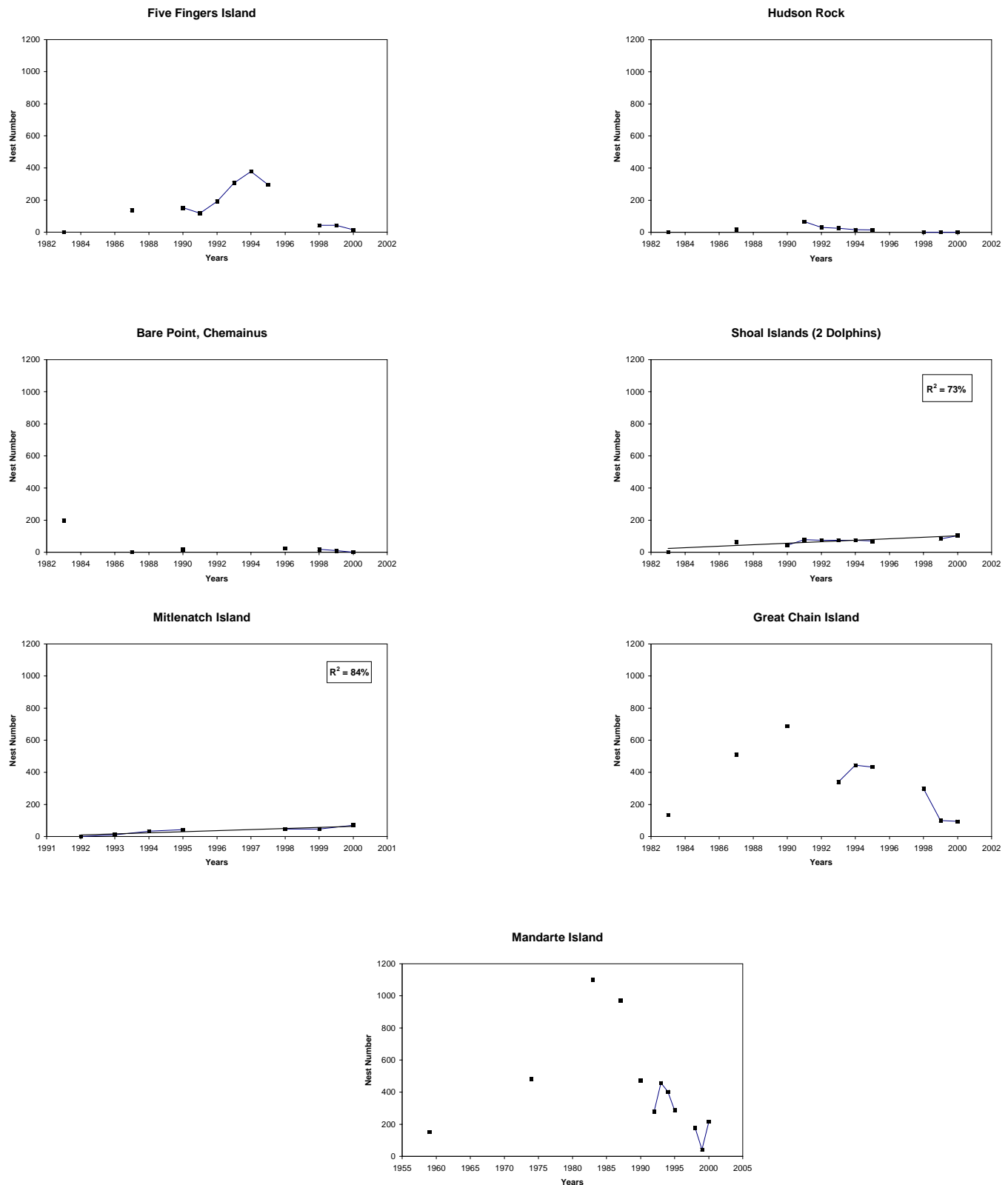


Figure 4. Number of DCCO nests observed at six colonies in the Strait of Georgia, between 1955 and 2000. Lines connecting counts are for consecutive years. A simple regression model was fitted to the points; where significant ($P < 0.1$), the dotted line is shown. For Mitlenatch Island, $r^2 = 84\%$, $df = 6$, $F = 25.6$, $p = 0.004$; . for Shoal Islands, $r^2 = 73\%$, $df = 9$, $F = 21.2$, $p = 0.002$.

DISCUSSION

Based on nest counts, the nesting populations of Pelagic and Double-crested Cormorants in the Strait of Georgia have shown alarming declines in the last few years. Concern is especially warranted when one compares the complete counts that were made in 1987 and 2000. The number of nests observed has decreased by 54% for Pelagic and 70% for Double-crested Cormorants.

A statistically significant decrease in number of nests between 1987 and 2000 was found for Pelagic Cormorants, although there was no statistically significant decrease indicated for Double-crested Cormorants, (despite lower nest numbers at Hudson Rock, Five Fingers, Great Chain, and Mandarte). The lack of significance was likely in part due to the small sample size of Double-crested Cormorant colonies and the minor increases at Shoal Islands and Mitlenatch Island. It is important to consider the biological significance of the decrease in total nest numbers, rather than the statistical significance. It will likely take several more years and/or more drastic declines to show a statistically significant change in the number of nests. Postponing implementing conservation/protection measures until statistical significance is achieved would likely be very detrimental to the persistence of the species in the region.

The populations of both cormorant species have fluctuated considerably over the 40 years of surveys. This could be due to changes in prey availability in the Strait. Cormorants feed on Pacific Herring, Gunnells, Shiner Perch and Salmon. It has been suggested that herring schools have moved north in the Strait of Georgia (Jane Watson, Pers. Comm.), which could account for the increase in both species of cormorants at Mitlenatch. However, this does not account for the loss of the Hornby Island Colony as there is a major herring spawn in that area. As well, it is difficult to explain the increase in the Shoal Islands Double-crested Cormorant colony, by shifts in herring populations.

Other concerns for nesting cormorants are predation by Bald Eagles (*Haliaeetus leucocephalus*) and disturbance from boat traffic. Eagle populations have increased on the east side of Vancouver Island (Karen Morrison, Pers. Comm.). Giesbrecht (2001) showed that Eagles were the main source of disturbance to nesting Double-crested Cormorant's in the Strait. She observed eagles flushing birds from their nests as well as direct predation on adults/juveniles. Recreational boating and kayaking have also increased in the Strait of Georgia. Although Giesbrecht (2001) did not observe flushing by boaters in her study, anecdotal information (Moul 2001) indicates that human disturbance either by landing at a colony or flushing birds by approaching too closely exposes chicks and eggs to predation by Northwestern Crows (*Corvus caurinus*), Glaucous-winged Gulls (*Larus glaucescens*) and Bald Eagles.

It is interesting to note that Double-crested Cormorants have established a colony on the Galiano Cliffs, directly across from the abandoned Ballingal Islet colony.

Perhaps the Galiano Cliffs provide a more secure nest site from people or eagles. Other location shifts are suspected: Pelagic Cormorants may have left St. John Point, on Hornby Island and moved north to Mitlenatch Island. However, the abandonment of nine Pelagic Cormorant colonies and two Double-Crested Cormorant colonies since Vermeer et al.'s 1987 inventory cannot be explained by movement and is a cause for concern.

Recommendations

1. Continue counts at all colonies annually. In particular, it is important to search for new colonies and to continue monitoring old colonies to determine if birds will re-colonize old sites or abandon them completely. For trend comparisons, it is especially important to record zero counts.
2. Observe key colonies, such as Mandarte and Chain Islets, throughout the breeding season to determine nest productivity.
3. Reduce boat disturbance around colonies during the breeding season (April-October).
4. Examine prey selection and abundance to determine the role of prey availability in the declines.

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Ian Moul provided the impetus for this project and helped with data summaries and corrections. Ken Morgan provided information on past counts.

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LITERATURE CITED

- Drent, R.H. and C.J. Guiguet. 1961. A catalogue of British Columbia sea-bird colonies. Occasional papers of the British Columbia Provincial Museum No. 12.
- Giesbrecht T. 2001. The effect of Bald Eagles and boat traffic on nesting Double-crested Cormorants (*Phalacrocorax auritus*) in the Strait of Georgia. Unpublished Report.
- Moul, I.E. 2000. Population trends of double-crested and pelagic cormorants nesting along the southeast coast of Vancouver Island, 1999. Unpublished report. Ministry of Environment Lands and Parks. 20 pp.
- Moul, I.E. and M.B. Gebauer. 2001. Status of Double-crested Cormorant in British Columbia. MELP, Victoria Branch.
- Sullivan, T.M. 1998. The timing in double-crested cormorants (*Phalacrocorax auritus albociliatus*): its effects on clutch size, nestling growth, diet and survival. Master of Science Thesis. University of British Columbia.
- Vermeer, K., K.H. Morgan, and G.E.J. Smith. 1989. Population trends and nesting habitat of double-crested and pelagic cormorants in the Strait of Georgia. Pp. 94-99 In: Vermeer, K. and R.W. Butler (eds.). The ecology and status of marine birds in the Strait of Georgia, British Columbia. Special publication, Canadian Wildlife Service, Ottawa.

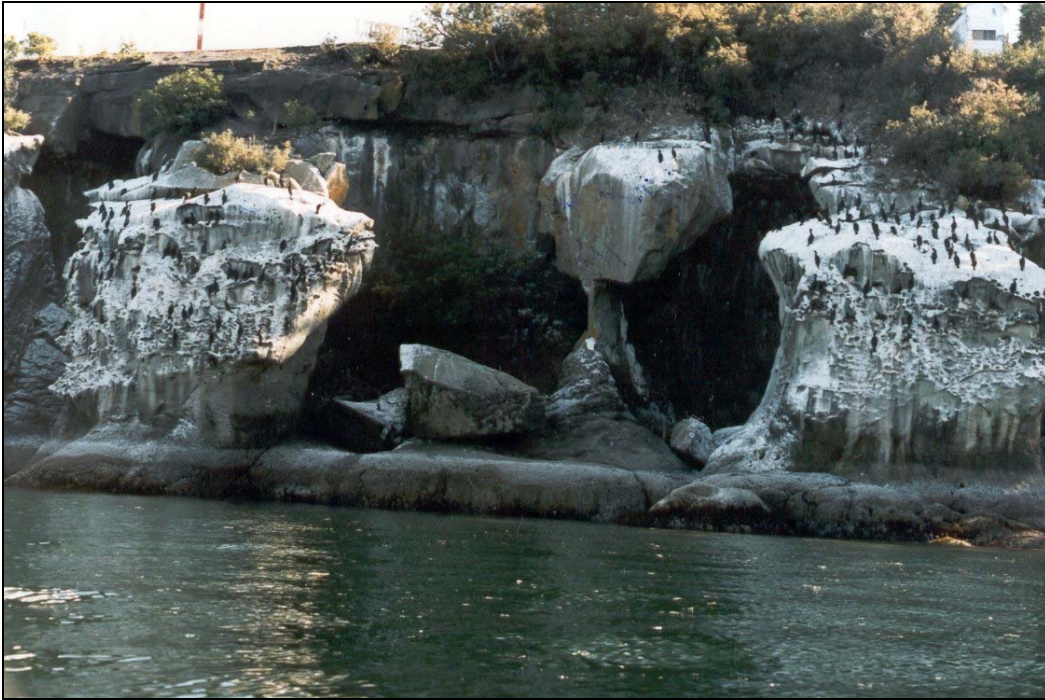
Photo Record
(Photo credits Trudy Chatwin)



Chain Island Double-crested Cormorant nests



Chain Island Double-crested Cormorants nests



Chrome Island Pelagic Cormorant nests on North side of island



Peter Pauwels, Conservation Officer holding survey boat at Mandarte Island



Shoal Islands (two dolphins) Double-crested Cormorants



Double-crested Cormorant nestlings on dolphins (July, 2000)



Abandoned Pelagic Cormorant colony St. John Point, Hornby Island



Snake Island