DISTRIBUTION AND ABUNDANCE OF WATERBIRDS IN BARKLEY SOUND AND THE LONG BEACH/TOFINO/GRICE BAY AREA IN SPRING 1989 FOLLOWING THE NESTUCCA OIL SPILL

Michael S. Rodway

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Abstract

To assess possible affects of the Nestucca oil spill on migrating waterbirds in Barkley Sound and the Long Beach/Tofino/Grice Bay area, 11 aerial surveys and 20 boat surveys were conducted during March and April 1989. The numbers of Surf Scoters and gulls aggregating at herring spawn sites in Barkley Sound were comparable to those recorded on previous surveys. The distribution of those aggregations was different, paralleling changes in the distribution of herring spawn. Western Grebes and cormorants were less abundant in Barkley Sound in 1989 than on previous surveys in 1979.

In the Tofino/Grice Bay area, herring spawn did not occur at traditional sites around Stubbs Island, and concentrations of Surf Scoters reported on previous surveys were absent in 1989. Numbers of American Wigeon, goldeneye and Mallard were lower in 1989 than on previous surveys. Migrating Brant stopped and foraged on Stubbs Island, and though their numbers did not approach the maximum recorded in the past, they appeared to be similar to those observed in recent years.

The Nestucca oil spill may have had an indirect effect on the distribution of scoters and gulls if changes in herring spawning locations were a reponse to the presence of oil at traditional sites. Declines of waterfowl in southern Clayoquot Sound were likely a continuation of declines noted since the 1950's, and not a result of the oil spill. Activity associated with the spill may have contributed to high levels of disturbance that have been implicated as the primary cause of those declines. Changes in numbers of grebes and cormorants in Barkley Sound could not be evaluated due to lack of comparative data.

Résumé

Afin de déterminer les impacts possibles du déversement de pétrole Nestucca sur les oiseaux aquatiques du détroit de Barkley et de la région de Long Beach, Tofino et de la baie Grice, 11 inventaires aériens et 20 inventaires en bateau furent effectués en mars et avril 1989. Les nombres de macreuses à front blanc et de goélands fréquentant les endroits de frai du hareng en 1989 étaient comparables à ceux enregistrés lors d'inventaires passés. La distribution de ces concentrations était cependant différente en 1989, réflétant les changements dans la distribution des endroits de frai du hareng. Les grèbes de l'ouest et les cormorants étaient moins abondant dans le détroit de Barkley en 1989 qu'en 1979.

Dans la région de Tofino/baie Grice, la frai du hareng ne s'est pas effectuée aux sites traditionnels près de l'île Stubbs, et les concentrations de macreuses à front blanc observées à cet endroit lors d'inventaires précédents étaient absentes en 1989. Les nombres de canards siffleurs d'amérique, de garrots et de mallards étaient plus bas en 1989 que lors d'inventaires antérieurs. Lors de leur migration printanière, les bernaches cravants s'arrêtèrent et s'alimentèrent autour de l'île Stubbs, et, bien que moindre que de par le passé, les effectifs étaient semblables à ceux observés lors des dernières années.

Le déversement d'huile Nestucca a pu avoir un effet indirect sur la distribution des macreuses et des goélands, si les changements dans les endroits de ponte du hareng furent une réponse à la présence d'huile aux sites traditionnels.

La diminution du nombre de sauvagine dans le détroit de Clayoquot est probablement une extension des déclins notés depuis les années 1950, et non pas une conséquence du déversement d'huile. L'activité humaine associée au déversement d'huile a possiblement contribué aux niveaux de dérangements élevés qui ont été avancés comme cause de ce déclin. Les changements dans les nombres de grèbes et de cormorants dans le détroit de Barkley n'ont pu être évalué à cause du manque de données comparables.

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Introduction

Oil from the barge "Nestucca", which was spilled off Grays Harbour, Washington on 23 December 1988, impacted the entire west coast of Vancouver Island during January and February 1989 (Duval *et al*. 1989). Waterbird mortality and the distribution and abundance of oil on breeding sites and wintering and migration areas was assessed at that time (Rodway *et al*. 1989). In Barkley Sound and the Long Beach/Tofino/Grice Bay area, large quantities of oil came ashore on the outer islands in the Broken Group, especially Wouwer and Benson islands, at the mouth of Ucluelet Inlet, along outer beaches from Ucluelet to Tofino, and on Wickaninnish and Stubbs islands. In Barkley Sound, less severe oiling extended through Macoah Passage, into Mayne Bay, on Clarke and Turtle islands in the Broken Group, and on the outer Deer Group (Environmental Protection database 9 March 1989). Areas from the mouth of Ucluelet Harbour to Mayne Bay, and Stubbs Island are traditional herring (*Clupea harengus*) spawn sites and attract large numbers of waterbirds during spring migrations (Campbell *et al*. in press, Hatler *et al*. 1978, Hay *et al*. 1989, Vermeer 1981). The extensive eelgrass (*Zostera marina*) bed on Clayoquot Spit on Stubbs Island is the primary stopover site for Brant (*Branta bernicla*) migrating north along the west coast of Vancouver Island (Hatler *et al*. 1978; see Rodway 1989). To assess possible affects of oil from the Nestucca spill on migrating waterbirds in those areas, I conducted aerial and boat surveys of Barkley Sound and the Long Beach/Tofino/Grice Bay area during March and April 1989. Records of marine mammals were also kept (Appendix Ie and IIe). Results of detailed observations of Brant behavior at Stubbs Island are reported elsewhere (Rodway 1989).

Methods

Eleven aerial surveys and 20 boat surveys of varying extent were conducted in Barkley Sound and the Long Beach/Tofino/Grice Bay area (Figs. 1, 2 & 3) between 16 March and 1 May 1989. Surveys in Barkley Sound focused on areas of waterbird concentrations. Other areas were explored periodically by boat and plane to detect changes in distribution. Aerial survey routes in the Tofino/Grice Bay area were similar to those used by Hatler (1973). Table 1 lists survey date, time, weather and areas covered for each survey. Aerial surveys were conducted from a Cessna 172 float plane flown at 60 to 100 m elevation. Observations were recorded on tape and transcribed later. A 16 foot Achilles inflatable was used for boat surveys.

Results

All sightings made during the surveys are presented in Appendices I and II. Acronyms used on tables throughout the text for species names are listed in Appendix III. Fifty-four species of waterbirds were recorded in the study area (Appendix IV).

Barkley Sound

In Barkley Sound, a maximum of 74,178 waterbirds were observed on 4 April (Table 2). Surf Scoters (*Melanitta perspicillata*) and gulls, primarily Glaucous-winged (*Larus glaucescens*) and Herring/Thayer's (*L. argentatus /thayeri*) gulls, were the dominant species, aggregated around herring spawn sites. Surf Scoters were predominant throughout April (Table 3), concentrated in dense rafts of up to 22,000 birds (Table 4). The largest concentrations initially occurred in the Hand Island area, but later in April, largest numbers were present in the vicinity of Turret and Turtle islands (Appendix Ib; Fig. 4). Maximum numbers occurred on 4 April, when a total of 52,000 were

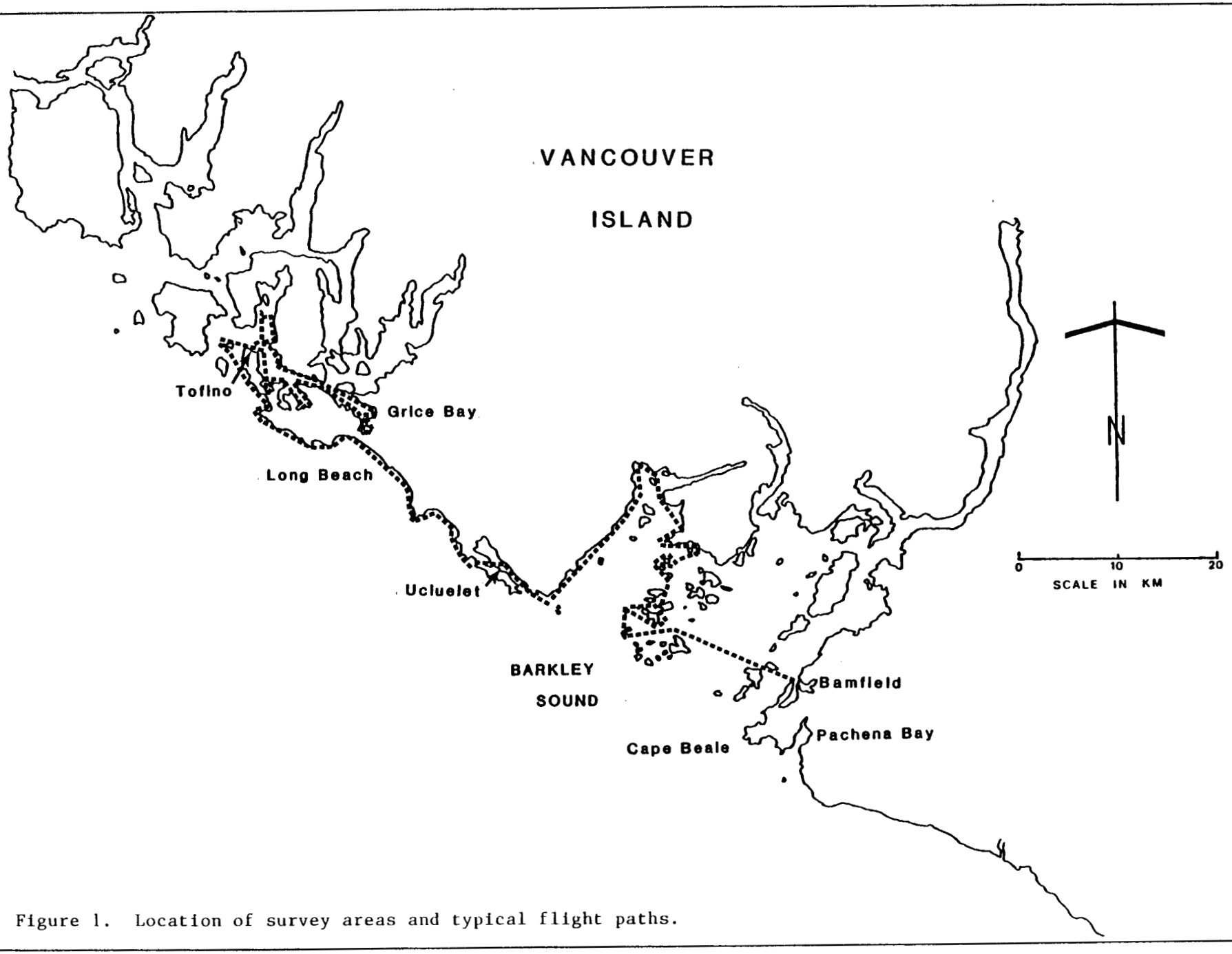


Figure 1. Location of survey areas and typical flight paths.

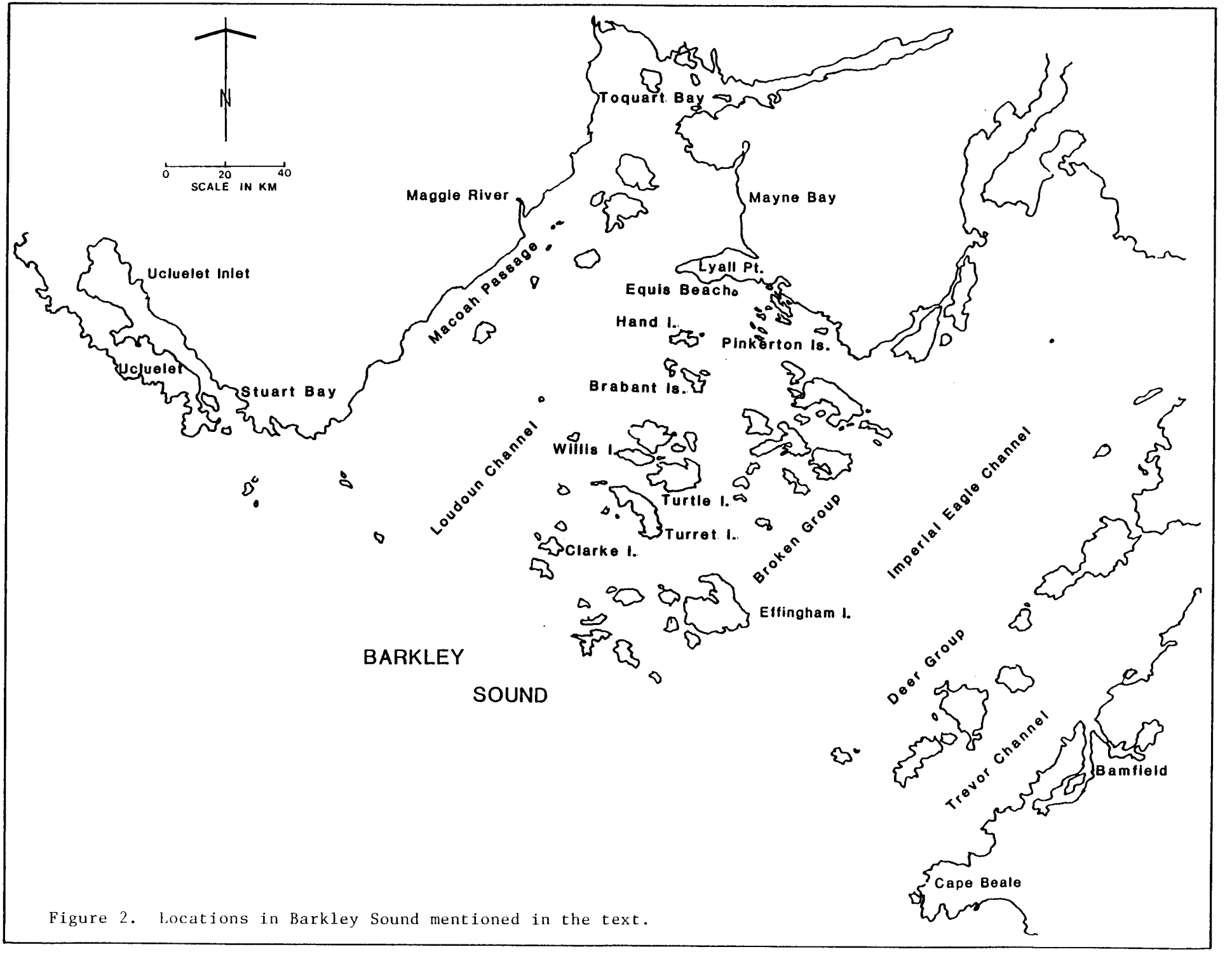


Figure 2. Locations in Barkley Sound mentioned in the text.

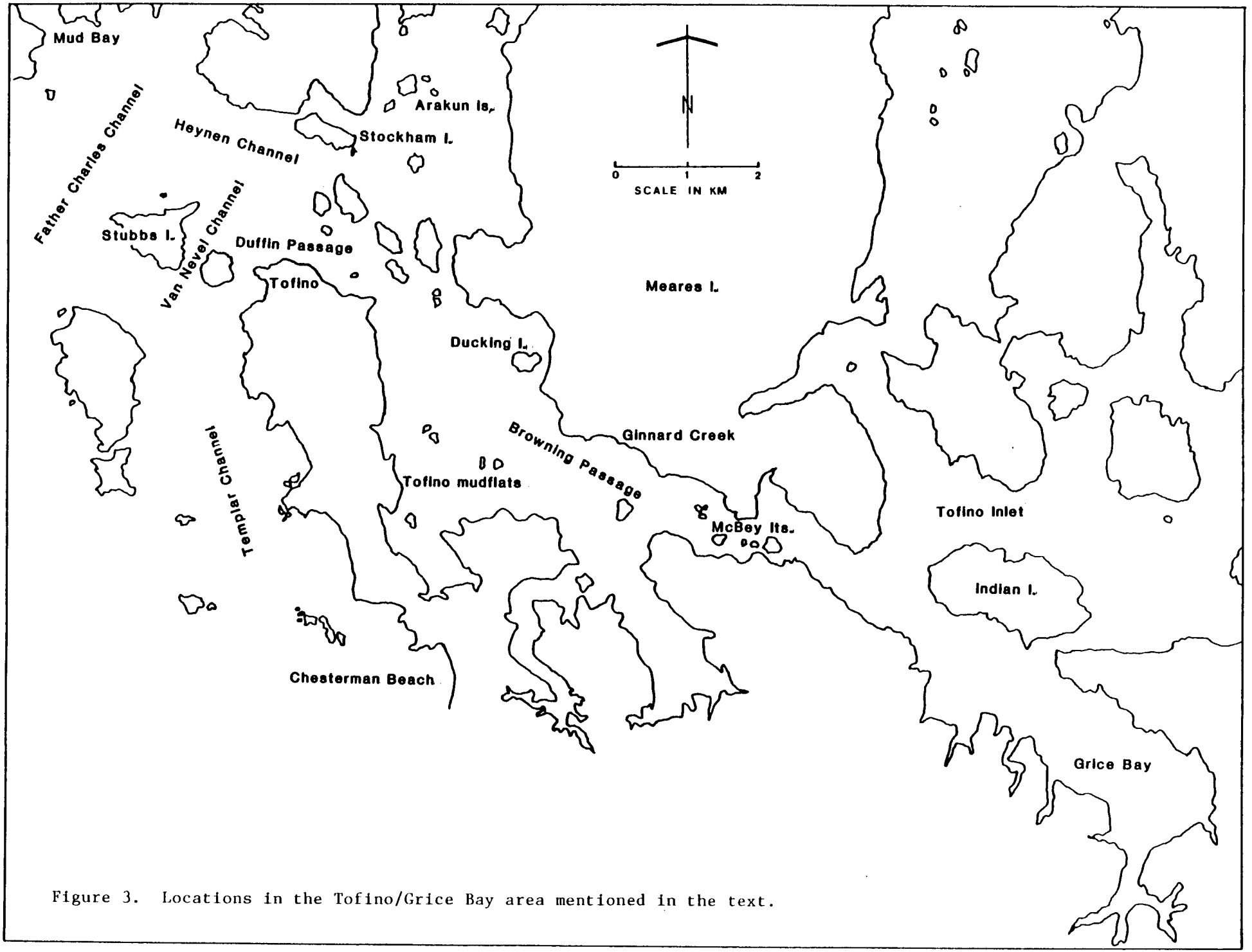


Figure 3. Locations in the Tofino/Grice Bay area mentioned in the text.

Table 1. Waterbird surveys conducted in Barkley Sound and the Long Beach/Tofino/Grice Bay area, spring 1989.

Date	Time (h-DST)	Type of survey	Weather Cloud	Weather Wind	Weather Visibility	Time of low tide (h-DST)	Area covered
16 Mar	1000-1600	boat	broken	light	good	1600	Carmanah Pt.-Bamfield, including Pachena Bay
17 Mar	0830-1700	boat	cloudy	moderate SE	good	1700	Bamfield-Broken Gp.(Harbour Ent.-Hand I.)-Mayne Bay-Toquart Bay-Ucluelet-Clarke I.-Bamfield
19 Mar	0930-1330	boat	sunny	light W	good	1820	Bamfield-Pachena Bay-Bamfield
20 Mar	1530-1620	plane	cloudy	light S	good	1850	Bamfield-Ucluelet-outer beaches-Tofino mudflats(Mud Bay-Grice Bay)
21 Mar	1512-1805	plane	rain	strong SE	fair-poor	1920	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay-Hand I.-Sechart Ch.-Bamfield
24 Mar	0930-1330	boat	cloudy	light SW	good	0745	Bamfield-Trevor Ch.-Folgers I.-Dodger Ch.-Bamfield
25 Mar	0930-1330	boat	broken	light SW	good	0815	Bamfield-Cape Beale-Bamfield
27 Mar	0930-1330	boat	rain	strong SE	fair	0930	Bamfield-Cape Beale-Bamfield
31 Mar	0930-1330	boat	rain	strong SE	fair	1350	Bamfield-Broken Gp.(Harbour Ent.-Hand I.)-Bamfield
2 Apr	0930-1330	boat	broken	strong SE	good	1650	Bamfield-Broken Gp.(Harbour Ent.-Hand I.)-Bamfield
3 Apr	0930-1330	boat	rain	moderate SE	fair	1735	Bamfield-Trevor Ch.-Folgers I.-Bamfield
3 Apr	1700-1815	plane	showers	moderate S	good	1735	Bamfield-Broken Gp.(Clarke I-Pinkerton Is.)-Toquart Bay-Ucluelet-outer beaches-Tofino mudflats(Mud Bay-Grice Bay)
4 Apr	1700-1807	plane	rain	moderate SE	fair-poor	0650	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay-Broken Gp.(Pinkerton Is.-Clarke I.)-Bamfield
7 Apr	0930-1330	boat	sunny	moderate W	good	0820	Bamfield-Trevor Ch.-Folgers I.-Dodger Ch.-Bamfield
7 Apr	1500-1800	boat	sunny	moderate W	good	0820	Bamfield-Deer Gp.(Helby I.-Bordelais Its.)-Bamfield
8 Apr	1045-1830	boat	sunny	light W	good	0910	Bamfield-Broken Gp.(Gibralter I.-Wouwer I.-Clarke I.-Hand I.)-Toquart Bay-Macoah Pass.-Bamfield
9 Apr	0930-1330	boat	sunny	moderate N	good	1000	Bamfield-Cape Beale-Folgers I.-Dodger Ch.-Bamfield
16 Apr	0930-1330	boat	cloudy	light var.	good	1700	Bamfield-Cape Beale-Folgers I.-Dodger Ch.-Bamfield
16 Apr	1530-1700	boat	cloudy	light var.	good	1700	Bamfield-Coaster Ch.-Clarke I.
17 Apr	0900-1010	plane	sunny	calm	good	1735	Broken Gp.(Clarke I.-Pinkerton Is.)-Toquart Bay-Ucluelet-outer beaches-Tofino mudflats(Stubbs I.-Grice Bay)
18 Apr	1835-1928	plane	showers	moderate SE	fair	0610	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay-Broken Gp.(Pinkerton Is.-Clarke I.)-Bamfield

cont'd

Table 1. (cont'd)

Date	Time (h-DST)	Type of survey	Weather Cloud	Wind	Visibility	Time of low tide (h-DST)	Area covered
19 Apr	0930-1330	boat	cloudy	moderate SE	good	0645	Bamfield-Pachena Bay-Folgers I.-Trevor Ch.-Bamfield
21 Apr	0930-1330	boat	rain	strong SE	fair-poor	0750	Bamfield-Broken Gp.(Harbour Ent.-Hand I.-Effingham Bay) -Bamfield
22 Apr	0728-0805	plane	rain	light SE	fair	0820	Bamfield-Wouwer I.-Ucluelet-outer beaches-Stubbs I.
22 Apr	1605-1657	plane	showers	moderate SE	fair	0820	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay -Broken Gp.(Pinkerton Is.-Clarke I.)-Bamfield
23 Apr	0930-1330	boat	sunny	light W	good	0855	Bamfield-Pachena Bay-Bamfield
24 Apr	0700-1100	boat	sunny	light W	good	0930	Bamfield-Broken Gp.(Effingham I.-Theipval Ch.)-Amphitrite Pt.-Tofino
25 Apr	0815-1425	land	sunny	light NE	good	1015	Stubbs I.
26 Apr	0815-1645	land	broken	light SE	good	1100	Stubbs I.
26 Apr	1908-2018	plane	cloudy	light SE	good	1100	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay -Broken Gp.(Pinkerton Is.-Clarke I.)-Ucluelet-outer beaches-Tofino
27 Apr	0800-1605	land	cloudy	calm	good	1155	Stubbs I.
28 Apr	0830-1600	land	sunny	calm	good	1300	Stubbs I./Long Beach
29 Apr	1045-1100	boat	sunny	calm	good	1405	Tofino-Stubbs I.
30 Apr	1923-2040	plane	sunny	calm	good	1510	Tofino mudflats(Stubbs I.-Grice Bay)-Maggie R.-Toquart Bay -Broken Gp.(Pinkerton Is.-Clarke I.)-Ucluelet-outer beaches-Tofino
1 May	1151-1216	plane	cloudy	light SE	good	1605	Tofino airport-outer beaches-Ucluelet-Macoah Pass.-Broken Gp.(Clarke I.-Pinkerton Is.)-Sechart Ch.-Port Alberni

Table 2. Total birds observed on surveys in Barkley Sound, spring 1989. Surveys on 31 March and 2 April covered only a portion of the study area. Species names and acronyms are listed in Appendix III.

Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	BRCO	PECO	GBHE	BRAN	CAGO	Duck sp.	GWTE
17 Mar		8		5	9	311	66	9	424	427	7		101		
21 Mar							20						50		
31 Mar							200	3	570	200					
2 Apr			1			195	70		60	15					
3 Apr											3	53	130	120	
4 Apr													115		
8 Apr		165	6		13	157		1	6	94	1	7	63		
17 Apr	2	8			3	155							0	26	
18 Apr		1	1			182	70						120	35	88
22 Apr	2		1				45			1					
24 Apr		1	2			15		1		9		25			
26 Apr			4			4				2				10	
30 Apr					1	3								190	
1 May		1				60									

Date	MALL	AMWI	Scaup sp.	HADU	SUSC	WWSC	Goldeneye sp.	COGO	BAGO	BUFF	HOME	COME	RBME	BAEA	Shore. sp.
17 Mar	6		25	2	1081	149	2	7	146	149	3	59	59	36	
21 Mar					400										
31 Mar					15110	30								20	
2 Apr					20401	21								10	
3 Apr	60	10	60	3	34500					100		4		3	60
4 Apr					52000									3	60
8 Apr		2	35	44	50200	84			245	37		2	25	18	
17 Apr					48990	5	30			24				1	20
18 Apr	7		8		35802					10			2	2	15
22 Apr			20		12431		19			32		4		5	
24 Apr					12200	24							3		
26 Apr	12		4		14192		34			20		2	20	1	60
30 Apr	50		134		3344		2			10			2	3	4
1 May			2		3311					8				7	

Date	BBPL	BLOY	BLTU	SURF	Gull sp.	BOGU	MEGU	CAGU	HEGU/ THGU	GWGU	COMU	PIGU	MAMU	RHAU	Total
17 Mar			4		35		1		3846	726	1	2	7		7713
21 Mar					9556										10026
31 Mar					1300										17433
2 Apr					3420							1			24194
3 Apr					21940									2	57048
4 Apr					22000										74178
8 Apr		2			4410	1	1542	600	570	4766	1	1	14		63112
17 Apr					1128										49264
18 Apr					200										36543
22 Apr				10	255					8					12833
24 Apr										84			14		12378
26 Apr					10					80					14455
30 Apr					18					430					4191
1 May															3389

Table 3. Percentage for each species of total birds observed on surveys in Barkley Sound, spring 1989. Surveys on 31 March and 2 April covered only part of the study area. Species names and acronyms are listed in Appendix III. Proportions < 0.5% are indicated by "t".

Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	BRCO	PECO	GBHE	BRAN	CAGO	Duck sp.	GWTE
17 Mar		t		t	t	4	1	t	5	6	t		1		
21 Mar							t						t		
31 Mar							1	t	3	1					
2 Apr			t			1	t		t	t					
3 Apr											t	t	t	t	
4 Apr													t		
8 Apr		t	t		t	t		t	t	t	t	t	t		
17 Apr	t	t			t	t							t	t	
18 Apr		t	t			t	t						t	t	t
22 Apr	t		t				t			t					
24 Apr		t	t			t		t		t		t			
26 Apr			t			t				t				t	
30 Apr					t	t								5	
1 May		t				2									

Date	MALL	AMWI	Scaup sp.	HADU	SUSC	WWSC	Goldeneye sp.	COGO	BAGO	BUFF	HOME	COME	RBME	BAEA	Shore. sp.
17 Mar	t		t	t	14	2	t	t	2	2	t	1	1	t	
21 Mar					4										
31 Mar					87	t								t	
2 Apr					84	t								t	
3 Apr	t	t	t	t	60					t		t		t	t
4 Apr					70									t	t
8 Apr		t	t	t	80	t			t	t		t	t	t	
17 Apr					99	t	t			t				t	t
18 Apr	t		t		98					t			t	t	t
22 Apr			t		97		t			t		t		t	
24 Apr					99	t							t		
26 Apr	t		t		98		t			t		t	t	t	t
30 Apr	1		3		80		t			t			t	t	t
1 May			t		98					t				t	

Date	BBPL	BLOY	BLTU	SURF	Gull sp.	BOGU	MEGU	CAGU	HEGU/ THGU	GWGU	COMU	PIGU	MAMU	RHAU	Total
17 Mar			t		t		t		50	9	t	t	t		100
21 Mar					95										100
31 Mar					7										100
2 Apr					14							t			100
3 Apr					38									t	100
4 Apr					30										100
8 Apr		t			7	t	2	1	1	8	t	t	t		100
17 Apr					2										100
18 Apr					1										100
22 Apr				t	2					t					100
24 Apr										1			t		100
26 Apr					t					1					100
30 Apr					t					10					100
1 May															100

Table 4. Concentrations of Surf Scoters sighted during boat and plane surveys in Barkley Sound, spring 1989. Only a portion of the study area was surveyed on 21 April. Some totals include small numbers of birds observed at sites not listed in this table (see Table 3 and Appendix Ib).

Date	Location	Number of birds sighted	Daily Total
17 Mar	Hand Island	25	
17 Mar	Mayne Bay	15	
17 Mar	Toquart Bay	636	
17 Mar	Macoah Passage	202	
17 Mar	Forbes I. to Beg Is.	158	1081
21 Mar	Toquart Bay	400	400
31 Mar	Brabant Islands	3000	
31 Mar	Hand Island	12000	
31 Mar	Pinkerton Islands	110^	15110
2 Apr	Hand Island	20400	20401
3 Apr	Clarke/Owens islands	720	
3 Apr	Turret/Trickett/Lovett is.	6000	
3 Apr	Brabant Islands	2000	
3 Apr	Hand Island	22000	
3 Apr	Pinkerton Islands	800	
3 Apr	Macoah Passage	3000	34520
4 Apr	Turret/Trickett/Lovett is.	10000	
4 Apr	Thiepval Channel	5000	
4 Apr	Brabant Islands	20000	
4 Apr	Hand Island	15000	
4 Apr	Macoah Passage	2000	52000
8 Apr	Clarke Island	7000	
8 Apr	Turret/Trickett/Lovett is.	1400	
8 Apr	Thiepval Channel	13000	
8 Apr	Brabant Islands	1800	
8 Apr	Hand Island	18000	
8 Apr	Equis Beach	3000	
8 Apr	Macoah Passage	6000	50200
17 Apr	Clarke Island	700	
17 Apr	Turret/Trickett/Lovett is.	16200	
17 Apr	Thiepval Channel	4500	
17 Apr	Turtle/Willis islands	14024	
17 Apr	Hand Island	11500	
17 Apr	Equis Beach	1800	
17 Apr	Mayne Bay	10^	
17 Apr	Toquart Bay	66	
17 Apr	Macoah Passage	190	48990
18 Apr	Clarke Island	600	
18 Apr	Turret/Trickett/Lovett is.	4000	
18 Apr	Thiepval Channel	17000	
18 Apr	Turtle/Willis islands	700	
18 Apr	Hand Island	12000	
18 Apr	Equis Beach	1400	

cont'd

Table 4. (cont'd)

Date	Location	Numbers of birds sighted	Daily Total
18 Apr	Toquart Bay	40	
18 Apr	Macoah Passage	62	35802
21 Apr	Brabant Islands	21	
21 Apr	Hand Island	3400	
21 Apr	Pinkerton Islands	350	3791
22 Apr	Clarke Island	1500	
22 Apr	Turret/Trickett/Lovett is.	3000	
22 Apr	Turtle/Willis islands	6000	
22 Apr	Hand Island	1800	
22 Apr	Equis Beach	20	
22 Apr	Mayne Bay	60	
22 Apr	Toquart Bay	21	
22 Apr	Macoah Passage	30	12431
24 Apr	Turret/Trickett/Lovett is.	1200	
24 Apr	Thiepval Channel	0	
24 Apr	Turtle/Willis islands	11000	12200
26 Apr	Clarke Island	2430	
26 Apr	Turtle/Willis islands	10200	
26 Apr	Hand Island	1262	
26 Apr	Equis Beach	300	14192
30 Apr	Clarke Island	0	
30 Apr	Turret/Trickett/Lovett is.	3030	
30 Apr	Thiepval Channel	0	
30 Apr	Turtle/Willis islands	0	
30 Apr	Brabant Islands	0	
30 Apr	Hand Island	284	
30 Apr	Pinkerton Islands	0	
30 Apr	Equis Beach	0	
30 Apr	Mayne Bay	0	
30 Apr	Macoah Passage	0	
30 Apr	Forbes I. to Beg Is.	30	3384
1 May	Clarke Island	40	
1 May	Turret/Trickett/Lovett is.	2020	
1 May	Thiepval Channel	45^	
1 May	Turtle/Willis islands	0	
1 May	Brabant Islands	0	
1 May	Hand Island	900	
1 May	Pinkerton Islands	0	
1 May	Equis Beach	300	
1 May	Macoah Passage	0	
1 May	Forbes I. to Beg Is.	6^	3311

^ flying

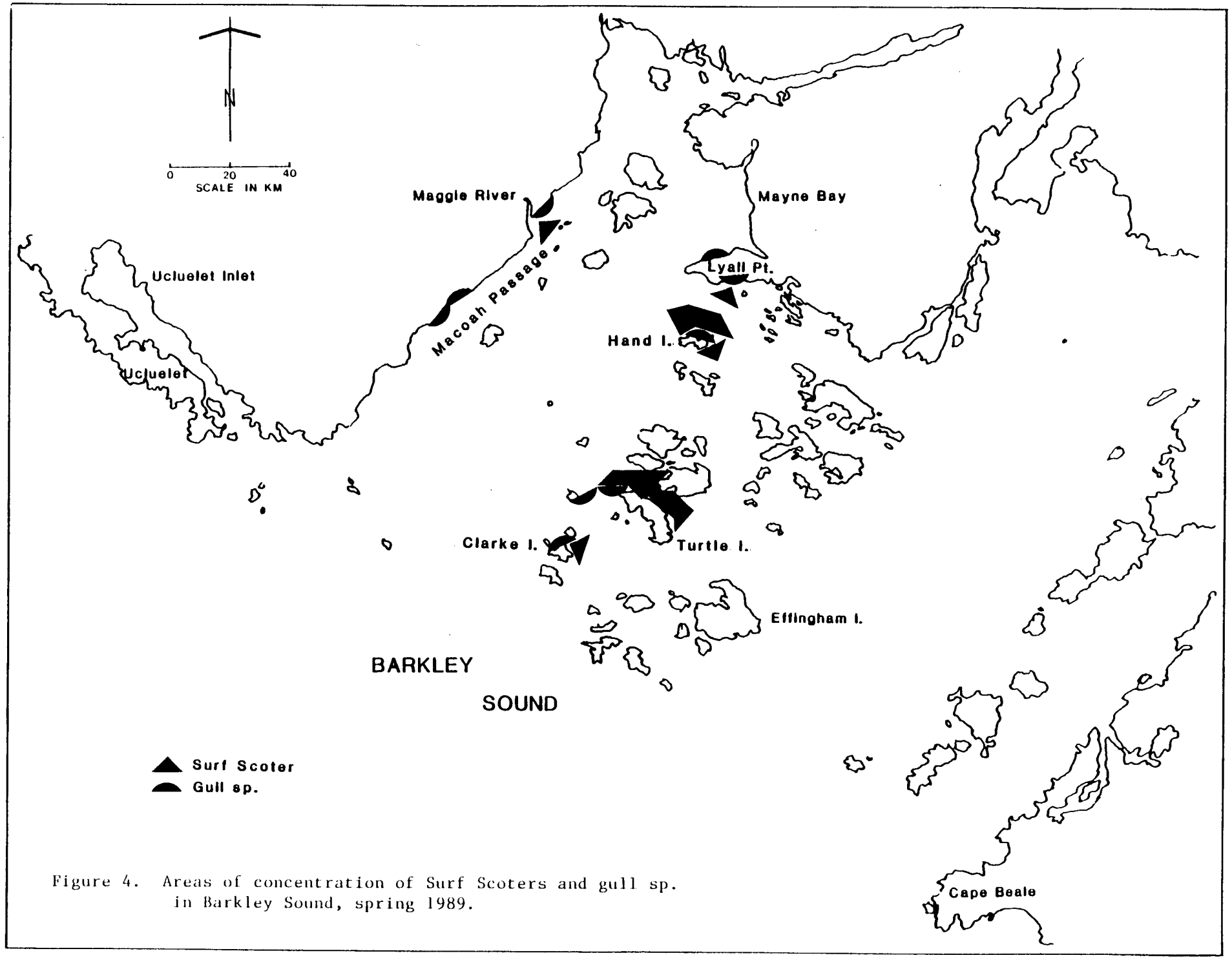


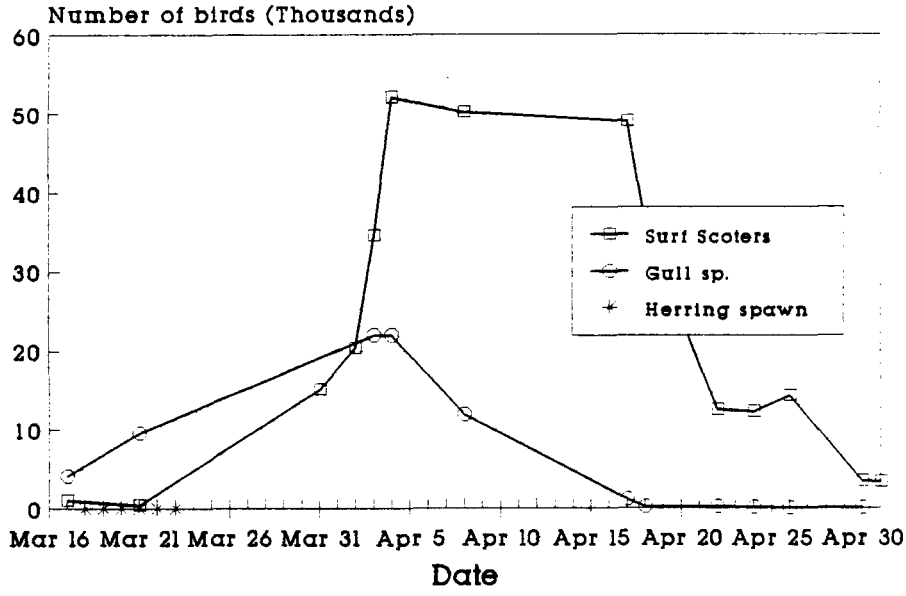
Figure 4. Areas of concentration of Surf Scoters and gull sp. in Barkley Sound, spring 1989.

estimated. Numbers of both Surf Scoters and gulls peaked in the first week of April, but large rafts of Surf Scoters were still present in the third week of April, about one week after most gulls had dispersed (Fig. 5).

Next to Surf Scoters, Glaucous-winged Gulls were the most abundant species in Barkley Sound during most of the study period (Table 3). They constituted the major portion of the large gull concentrations observed around herring spawn sites, though other species sometimes outnumbered them at specific locations (Table 5). The composition of Glaucous-winged Gull flocks changed between the end of March, when many adults were present, and the middle of April, when most adults had left and predominantly immatures remained.

Almost 3500 Herring/Thayer's Gulls (L. argentatus/thayeri) were clustered along the north shore of Barkley Sound from Toquart Bay to Beg Islands on 17 March (Table 5). They were mostly adults. Substantial numbers occurred in concentrations of gulls around herring spawn sites, but they were generally outnumbered by Glaucous-winged Gulls, especially on the outer southwest islands in the Broken Group. Large flocks of Mew Gulls (L. canus) and California Gulls (L. californicus) were identified on the boat survey on 8 April. A group of 1400 Mew Gulls were roosting on log booms in Toquart Bay. Smaller flocks of Mew Gulls, and 600 California Gulls were sighted on Hand Island and in Mayne Bay. No other large groups of those two species were identified during the study, though some Mew and California gulls likely were present in the large concentrations of unidentified gulls sighted during aerial surveys.

Highest numbers of Western Grebes (Aechmophorus occidentalis) and Brandt's and Pelagic cormorants (Phalacrocorax penicillatus and P. pelagicus) were present in Barkley Sound during the last half of March when herring were spawning (Fig. 5). Larger groups of Pelagic Cormorants were generally mixed



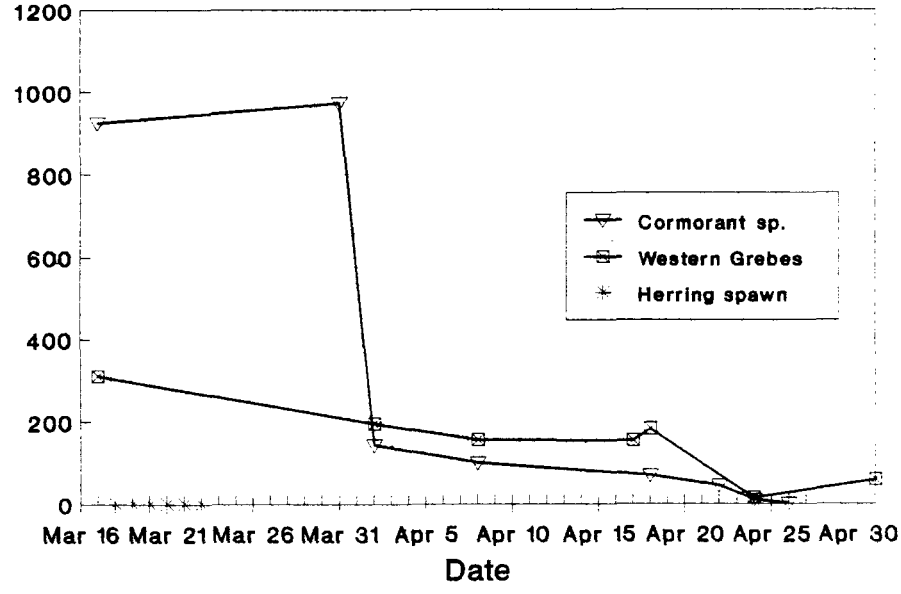


Figure 5. Numbers of Surf Scoters, gull sp., cormorant sp. and Western Grebes concentrated around herring spawn sites in Barkley Sound, spring 1989.

Table 5. Concentrations of gulls sighted during boat and plane surveys of Barkley Sound, spring 1989. Some totals include small numbers of gulls observed at sites not listed in this table (see Table 3 and Appendix Id). Surveys on 31 March and 2 April covered only a portion of the study area (see Table 1). Species names and acronyms are listed in Appendix III.

Date	Location	Gull sp.	MEGU	CAGU	HEGU/ THGU	GWGU	Daily Total
17 Mar	Tiny Group					150	
17 Mar	Brabant Islands					2	
17 Mar	Hand Island				6	340	
17 Mar	Mayne Bay		1			116	
17 Mar	Toquart Bay				290	3	
17 Mar	Macoah Passage				900		
17 Mar	Forbes I. to Beg Is.				2300	2	4115
21 Mar	Hand Island	9000					
21 Mar	Toquart Bay	50					
21 Mar	Macoah Passage	500					9550
31 Mar	Hand Island	800			x	x	
31 Mar	Equis Beach	500					1300
2 Apr	Hand Island	3400					3420
3 Apr	Clarke/Owens islands	5400					
3 Apr	Turret/Trickett/Lovett is.	4000					
3 Apr	Brabant Islands	80					
3 Apr	Hand Island	4000					
3 Apr	Equis Beach	6000					
3 Apr	Mayne Bay	900					
3 Apr	Macoah Passage	1560					21940
4 Apr	Turret/Trickett/Lovett is.	9000					
4 Apr	Hand Island	10000					
4 Apr	Equis Beach	1400					
4 Apr	Mayne Bay	800					
4 Apr	Macoah Passage	800					22000
8 Apr	Clarke Island	100				800	
8 Apr	Turret/Trickett/Lovett is.				300	3000	
8 Apr	Turtle/Willis islands					300	
8 Apr	Tiny Group					6	
8 Apr	Hand Island		42	100	20	600	
8 Apr	Equis Beach	600					
8 Apr	Mayne Bay		100	500	50	50	
8 Apr	Toquart Bay	110	1400		200		
8 Apr	Macoah Passage	3600					11888
17 Apr	Clarke Island	80					
17 Apr	Turret/Trickett/Lovett is.	300					
17 Apr	Thiepval Channel	60					
17 Apr	Turtle/Willis islands	502					
17 Apr	Hand Island	0					
17 Apr	Equis Beach	60					
17 Apr	Mayne Bay	0					
17 Apr	Toquart Bay	10					
17 Apr	Macoah Passage	80					1128

cont'd

Table 5. (cont'd)

Date	Location	Gull sp.	MEGU	CAGU	HEGU/ THGU	GWGU	Daily Total
18 Apr	Turret/Trickett/Lovett is.	200					
18 Apr	Equis Beach	0					200
21 Apr	Hand Island					101	101
22 Apr	Turret/Trickett/Lovett is.	50					
22 Apr	Turtle/Willis islands	80					
22 Apr	Hand Island	10					
22 Apr	Mayne Bay	0					
22 Apr	Macoah Passage	30					178
24 Apr	Turret/Trickett/Lovett is.					10	
24 Apr	Thiepval Channel					4	
24 Apr	Turtle/Willis islands					70	84
26 Apr	Turtle/Willis islands					20	
26 Apr	Mayne Bay	10					30
30 Apr	Turret/Trickett/Lovett is.	6					
30 Apr	Hand Island	10					
30 Apr	Equis Beach	0					
30 Apr	Mayne Bay	0					16

x: species present

with Brandt's Cormorants near herring spawn sites, but smaller, independent groups were encountered thoughout Barkley Sound, and Pelagic Cormorants were more frequently sighted in April than Brandt's Cormorants (Table 6).

Sizeable flocks of other waterfowl species were observed periodically in Barkley Sound. Largest numbers of White-winged Scoters (M. fusca), Barrow's Goldeneye (Bucephala islandica) and Bufflehead (B. albeola) occurred in March and early April (Table 2, Appendix IV). Flocks of up to 130 Canada Geese (Branta canadensis) were present in Toquart Bay and along Macoah Passage between 17 March and 8 April. Larger flocks flew over the area in mid-April (Table 7).

Table 6. Numbers of cormorants sighted during boat and plane surveys of Barkley Sound, spring 1989. Species names and acronyms are listed in Appendix III.

Date	Location	Cormorant sp.	DCCO	BRCO	PECO
16 Mar	S of Pachena Pt.				4
16 Mar	Cape Beale				20
17 Mar	Helby Island				3
17 Mar	Imperial Eagle Channel			3	1
17 Mar	Island Harbour to Weibe I.		1		7
17 Mar	Tiny Group	60	7	290	195
17 Mar	Peacock Channel			6	4
17 Mar	Brabant Islands			15	41
17 Mar	Hand Island			100	65
17 Mar	Mayne Bay	6	1		5
17 Mar	Toquart Bay				1
17 Mar	Macoah Passage				5
17 Mar	Forbes I. to Beg Is.				86
17 Mar	Loudoun Channel			10	13
21 Mar	Hand Island	20			
31 Mar	Tiny Group		3	200	200
31 Mar	Peacock Channel	200			
31 Mar	Pinkerton Islands			370	
2 Apr	Island Harbour to Weibe I.	70			
2 Apr	Tiny Group			60	15
7 Apr	Dodger Ch./Edward King I.		1i5a		18
8 Apr	Wouwer Island				30
8 Apr	Turret/Trickett/Lovett is.				18
8 Apr	Turtle/Willis islands			3i	5
8 Apr	Island Harbour to Weibe I.				2
8 Apr	Tiny Group				29
8 Apr	Hand Island		1	3	10
18 Apr	Imperial Eagle Channel	70			
21 Apr	Tiny Group				15
21 Apr	Hand Island		1		15
22 Apr	Wouwer Island				1
22 Apr	Macoah Passage	45			
24 Apr	Thiepval Channel		1		6
24 Apr	Loudoun Channel				3
26 Apr	Macoah Passage				2

i: immature
a: adult

Table 7. Numbers of geese sighted during boat and plane surveys of Barkley Sound and the Long Beach/Tofino/Grice Bay area, spring 1989.

Date	Location	Brant	Canada Goose
17 Mar	Toquart Bay		47
17 Mar	Macoah Passage		54
20 Mar	Ducking Island mudflats		20
20 Mar	Ginnard Creek		25
21 Mar	Toquart Bay		50
21 Mar	Stubbs Island	2	
21 Mar	Arakun Islands mudflats		55
21 Mar	Ducking Island mudflats		30
25 Mar	Cape Beale	22^	
27 Mar	Cape Beale	25^	
3 Apr	Mouth of Trevor Channel	53^	
3 Apr	Macoah Passage		130
3 Apr	Arakun Islands mudflats		18
3 Apr	Ginnard Creek		20
3 Apr	Grice Bay		15
4 Apr	Macoah Passage		115
4 Apr	Tofino Mudflats		25
7 Apr	Mouth of Trevor Channel		50^
8 Apr	S. of Turrett Island	7	
8 Apr	Hand Island		48^
8 Apr	Toquart Bay		12
8 Apr	Macoah Passage		13
16 Apr	Cape Beale	114^	
16 Apr	Mouth of Trevor Channel	250^	
16 Apr	Trevor Channel	110^	
16 Apr	Clarke Island		380^
17 Apr	Macoah Passage		0
17 Apr	Stubbs Island	366	
18 Apr	Macoah Passage		120^
18 Apr	Stubbs Island	480	670^
19 Apr	Cape Beale	50^	
22 Apr	Stubbs Island	379	40^
24 Apr	Loudoun Channel	25^	
25 Apr	Stubbs Island	98	
26 Apr	Wickaninnish Bay		300^
26 Apr	Stubbs Island	244	
27 Apr	Stubbs Island	139	
28 Apr	Stubbs Island	39	
29 Apr	Stubbs Island	0	
30 Apr	Stubbs Island	0	

^ flying

Outer beaches

Along the outer beaches between Ucluelet and Tofino, Glaucous-winged Gulls and Brandt's and Pelagic cormorants were the most abundant species, though total numbers of waterbirds observed never exceeded 1,000 (Tables 8 and 9). Most gulls occurred at roosts in Wickaninnish Bay, especially at the mouth of Sandhill Creek, and concentrations of cormorants were observed roosting on Gowlland Rocks. Occassional groups of Pacific Loons (*Gavia arctica*) were sighted near shore. All Canada Geese (*Branta canadensis*) and most Surf Scoters recorded in this area were flying north (see Appendix IIb).

Table 8. Total birds sighted on surveys along outer beaches from Ucluelet to Tofino, spring 1989. Only Chesterman Beach was surveyed on 21 March, and only Long Beach was surveyed on 28 April. The survey on 24 April was conducted by boat. Species names and acronyms are listed in Appendix III.

Date	PALO	RNGR	WEGR	Corm. sp.	BRCO	PECO	CAGO	MALL	SUSC	OSPR	BAEA	Shorebird sp.	SEPL
20 Mar												40	
21 Mar											2	0	
3 Apr				125							2		
17 Apr		1	4					2			2	0	
22 Apr									65		2	0	
24 Apr	54			80	306	106			214				
26 Apr							300						
28 Apr										1	3		74
30 Apr				300								50	
1 May	124			200					44				

Date	BLOY	SAND	WESA	DUNL	Gull sp.	CAGU	HEGU	GWGU	CATE	COMU	PIGU	MAMU	RHAU	Total
20 Mar					410									450
21 Mar						3	10	145						160
3 Apr					196									323
17 Apr					178			1						188
22 Apr					8			194						269
24 Apr	2							132		18	3	39	4	958
26 Apr					143			90						533
28 Apr		26	20	2					2					128
30 Apr					230			6						586
1 May								400						768

Table 9. Percentage for each species of total birds observed on surveys along outer beaches from Ucluelet to Tofino, spring 1989. Only Chesterman Beach was surveyed on 21 March, and only Long Beach was surveyed on 28 April. Species names and acronyms are listed in Appendix III. Proportions < 0.5% are indicated by "t".

Date	PALO	RNGR	WEGR	Corm. sp.	BRCO	PECO	CAGO	MALL	SUSC	OSPR	BAEA	Shorebird sp.	SEPL
20 Mar												9	
21 Mar											1	t	
3 Apr				39							1		
17 Apr		1	2					1			1	t	
22 Apr									24		1	t	
24 Apr	6			8	32	11			22				
26 Apr							56						
28 Apr										1	2		58
30 Apr				51								9	
1 May	16			26					6				

Date	BLOY	SAND	WESA	DUNL	Gull sp.	CAGU	HEGU	GWGU	CATE	COMU	PIGU	MAMU	RHAU	Total
20 Mar					91									100
21 Mar						2	6	91						100
3 Apr					61									100
17 Apr					95			1						100
22 Apr					3			72						100
24 Apr	t							14		2	t	4	t	100
26 Apr					27			17						100
28 Apr		20	16	2					2					100
30 Apr					39			1						100
1 May								52						100

Tofino/Grice Bay

In the Tofino mudflat area between Mud Bay and Grice Bay, Bufflehead (Bucephala albeola), Mallard (Anas platyrhynchos) and gulls were the dominant species during the first half of the study period. They were distributed throughout the area. Maximum totals of 482 Bufflehead and 296 Mallard were counted on 3 April. Largest numbers of gulls were recorded on 17 April when 612 were tallied (Tables 10 and 11). About 100 Mew Gulls were present on Clayoquot Spit on all visits during the last half of April. Over the week of 22 April, the composition of the flock changed from mostly adults to mostly immatures.

Numbers of Brant peaked during the middle of April (Table 7). They were sighted only on or near Stubbs Island. The first Brant observed were two birds sighted on 21 March. D. Banks (pers. comm.) reported about 60 Brant on Stubbs around 28 March and about 100 on 5 April. Those flocks remained for brief periods only. Flocks of up to 480 foraging Brant were present during the latter two weeks of April, but all had moved on by 29 April. As many as 670 Canada Geese were sighted flying over the area, but there were never more than 100 on the mud flats between Tofino and Grice Bay.

Shorebirds became the predominant species in the area by the end of April (Tables 10 and 11). A flock of 20 shorebirds were observed on Chesterman Beach on 20 March, and 200 were sighted in Grice Bay on 3 April, but the main influx of shorebirds did not begin until the last week of April (Table 12). More detailed information on each species is included in Appendix IV.

Evidence of oil observed during surveys

Small blobs of oil were found on beaches in the Broken Group on Clarke Island and Hand Island. Ribbons of sheen were observed emanating from the south point of Stuart Bay in Ucluelet Inlet on most aerial surveys. On Stubbs Island, scattered patches of eelgrass in the northwest bay were still coated with oil. No evidence of oil was discovered on the main eelgrass flats on the north end of the island where Brant were feeding.

Table 10. Total birds observed on surveys in the Tofino/Grice Bay area, spring 1989. Species names and acronyms are listed in Appendix III.

Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	GBHE	BRAN	CAGO	Duck sp.	GWTE	MALL	NOPI
20 Mar			3			30	6	1	2		45	112		262	
21 Mar	2									2	85		60	50	
3 Apr					20		20	2	1		53	36		296	
4 Apr			2		20						25			8	
17 Apr		15	6	1	35	27	15			366			48	36	
18 Apr									2	480	670		50	140	
22 Apr			3		1	10				379	40		15	40	14
26 Apr		60	2		20		20			244		4		36	
30 Apr			2		3	3				0		12		2	

Date	NOSL	AMWI	Scaup sp.	SUSC	Goldeneye sp.	BUFF	COME	RBME	OSPR	BAEA	PEFA	Shorebird sp.	BBPL	SEPL
20 Mar			23	30	37	443	3	4		1				
21 Mar			20	12		45				1				
3 Apr			46	48		482	16	37		2		200		
4 Apr			4	67		193		20		1	1			
17 Apr			46			258	1	57	1	1		10		
18 Apr	2			80	14	162				1		69		
22 Apr	4	16				81	35	8		3			1	
26 Apr			2	10		67	4	11		3		530	3	14
30 Apr			43			58	6	15		2		1750		

Date	WHIM	BLTU	SURF	Peeps	WESA	DUNL	SBDO	RNPL	Gull sp.	MEGU	CAGU	HEGU	GWGU	MAMU	Total
20 Mar									214						1216
21 Mar													6		283
3 Apr									165						1424
4 Apr											12	40	6		399
17 Apr				6					421	110	4	40	37		1541
18 Apr	140				35	8		12	235				8		2108
22 Apr		22	1	900	20	49	38		11	230			16	2	1939
26 Apr				620	80	1	2		155	36	1		150		2075
30 Apr	x			400			x		71	1					2368

x: species present

Table 11. Percentage for each species of total birds observed on surveys of the Tofino/Grice Bay area, spring 1989. Species names and acronyms are listed in Appendix III. Proportions < 0.5% are indicated by "t".

	Loon						Corm.					Duck			
Date	sp.	PALO	COLO	HOGR	RNGR	WEGR	sp.	DCCO	GBHE	BRAN	CAGO	sp.	GWTE	MALL	NOPI
20 Mar			t			2	t	t	t		4	9		22	
21 Mar	1									1	30		21	18	
3 Apr					1		1	t	t		4	3		21	
4 Apr			1		5						6			2	
17 Apr		1	t	t	2	2	1			24			3	2	
18 Apr									t	23	32		2	7	
22 Apr			t		t	1				20	2		1	2	1
26 Apr		3	t		1		1			12		t		2	
30 Apr			t		t	t				t		1		t	

			Scaup	Goldeneye							Shorebird			
Date	NOSL	AMWI	sp.	SUSC	sp.	BUFF	COME	RBME	OSPR	BAEA	PEFA	sp.	BBPL	SEPL
20 Mar			2	2	3	36	t	t		t				
21 Mar			7	4		16				t				
3 Apr			3	3		34	1	3		t		14		
4 Apr			1	17		48		5		t	t			
17 Apr			3			17	t	4	t	t		1		
18 Apr	t			4	1	8				t		3		
22 Apr	t	1				4	2	t		t			t	
26 Apr			t	t		3	t	1		t		26	t	1
30 Apr			2			2	t	1		t		74		

									Gull						
Date	WHIM	BLTU	SURF	Peeps	WESA	DUNL	SBDO	RNPL	sp.	MEGU	CAGU	HEGU	GWGU	MAMU	Total
20 Mar									18						100
21 Mar													2		100
3 Apr									12						100
4 Apr											3	10	2		100
17 Apr				t					27	7	t	3	2		100
18 Apr	7				2	t		1	11				t		100
22 Apr		1	t	46	1	3	2		1	12			1	t	100
26 Apr				30	4	t	t		7	2	t		7		100
30 Apr				17					3	t					100

Table 12. Numbers of shorebirds sighted during boat and plane surveys of the Long Beach/Tofino/Grice Bay area, spring 1989. Species names and acronyms are listed in Appendix III.

Date	Location	Shorebird sp.	BBPL	SEPL	BLOY	GRYE	WHIM	BLTU	SURF	SAND	Peeps	WESA	LESA	DUNL	SBDO	RNPL
20 Mar	Chesterman Beach	20														
20 Mar	Portland Pt. to Cox Pt.	20														
21 Mar	Chesterman Beach	0														
3 Apr	Grice Bay	200														
17 Apr	Chesterman Beach	0														
17 Apr	Stubbs Island										6					
17 Apr	Grice Bay	10														
18 Apr	Stubbs Island	9										35		8		12
18 Apr	Grice Bay	60					140									
22 Apr	Chesterman Beach	0														
22 Apr	Stubbs Island		1s					22	1		900	20		49	38	
24 Apr	Portland Pt. to Cox Pt.				2											
25 Apr	Stubbs Island		1	7							15	160	3	36	25	
26 Apr	Stubbs Island		3s	14							120	80		1	2	
26 Apr	Tofino Mudflats										500					
26 Apr	Grice Bay	530														
27 Apr	Stubbs Island		3			1					32	96		24	7	
28 Apr	Wickaninnish Bay			74						26		20		2		
30 Apr	Chesterman Beach	0														
30 Apr	Stubbs Island										20					
30 Apr	Arakun Islands mudflats	300									20					
30 Apr	Tofino Mudflats	800									360					
30 Apr	Grice Bay	650					x				x				x	
30 Apr	Amphitrite Pt. to Wya Pt.	50														

s: summer plumage
x: species recorded

Discussion

Barkley Sound

Comparing the results of this study with past surveys suggests differences in the abundance and/or distribution of some species. The only other extensive survey of the same area of Barkley Sound in the spring was conducted by M. Lemon between 7 and 21 March 1979 under the direction of K. Vermeer (unpub. Canadian Wildlife Service data). She observed large concentrations of Surf Scoters and gulls along the north shore of Barkley Sound from Stopper Islands to the mouth of Ucluelet Inlet. On 19, 20 and 21 March 1979 she estimated 19,300, 15,810 and 20,273 Surf Scoters, and 19,330, 4,640 and 24,732 gulls respectively in that area. No large groups were recorded in the Broken Group. In 1989, concentrations of up to 6,000 Surf Scoters and 3,600 gulls were observed in Macoah Passage. No other concentrations were observed in that area, but up to 50,000 Surf Scoters gathered in the Broken Group. In 1979, the first large concentrations of scoters and gulls were recorded on 14 March. Surveys ended on 21 March, so we do not know if numbers continued to increase. In 1989, large rafts of Surf Scoters were not observed until 31 March, though concentrations of gulls had gathered by 21 March. Three other surveys indicate that the dates when large concentrations of Surf Scoters gather may vary. A large raft of several thousand Surf Scoters was observed between Lyall Point and Hand Island on 13 March 1973 (Hatler et al. 1978) and Vermeer (1981) estimated 23,000 gathered along the north side of Barkley Sound on 22 March 1978, yet on 24 March 1980, K. Summers and A. Stewart (B.C. Ministry of Environment 1980) counted only 2,185 between Stopper Islands and Ucluelet Harbour.

Concentrations of Surf Scoters and gulls occur in the vicinity of herring spawn (Munro and Clemens 1931, Vermeer 1981), and the changes in bird distribution noted between 1979 and 1989 reflect changes in the distribution

of herring spawn. The main herring spawn area in Barkley Sound extends from Toquart Bay to Ucluelet Inlet. They have spawned in that area every year for the past 52 years (1937 to 1986 - Hay et al. 1989; 1987 and 1988 - V. Haist pers.comm.). No spawn occurred there in 1989. Spawning areas in 1989 were located between the south side of Mayne Bay and Benson Island in the outer Broken Group (D. Chalmers pres. comm.). Intermittent spawning has occurred over the last 50 years in the Mayne Bay/Hand Island area, but there are no previous records of spawning in some areas in the outer Broken Group where herring spawned in 1989 (Fig. 6). Even though spawning occurred in non-traditional sites in 1989, the distribution of Surf Scoters and gulls (Fig. 4) matched the distribution of herring spawn (Fig. 6), indicating that scoters and gulls were readily able to locate the displaced food resource.

The major concentrations of Surf Scoters in 1989 initially occurred in the vicinity of Hand Island, but by the latter part of April, the largest flocks were found in the Turtle and Turret islands area (Table 4). Differences in the timing of herring spawn, which began 18 March on Hand Island and 21 March on Turtle Island (D. Chalmers pers. comm.), probably accounts for the timing of Surf Scoter aggregations at those sites.

Fish-eating species were less numerous in 1989 than on past surveys. Large flocks of Western Grebes and cormorants were observed in Barkley Sound in 1979 (M. Lemon unpubl.). Maximum numbers recorded were 4,900 Western Grebes around the Tiny Group on 9 March, and 8,300 cormorants opposite Stopper Islands on 19 March. In 1989, numbers never exceeded 311 for Western Grebes and 973 for cormorant species (Table 2). Largest numbers were sighted at the beginning of the study period.

Vermeer (1981) noted that fish-eating species that had gathered to feed on herring in Ganges Harbour dispersed earlier than diving ducks which were

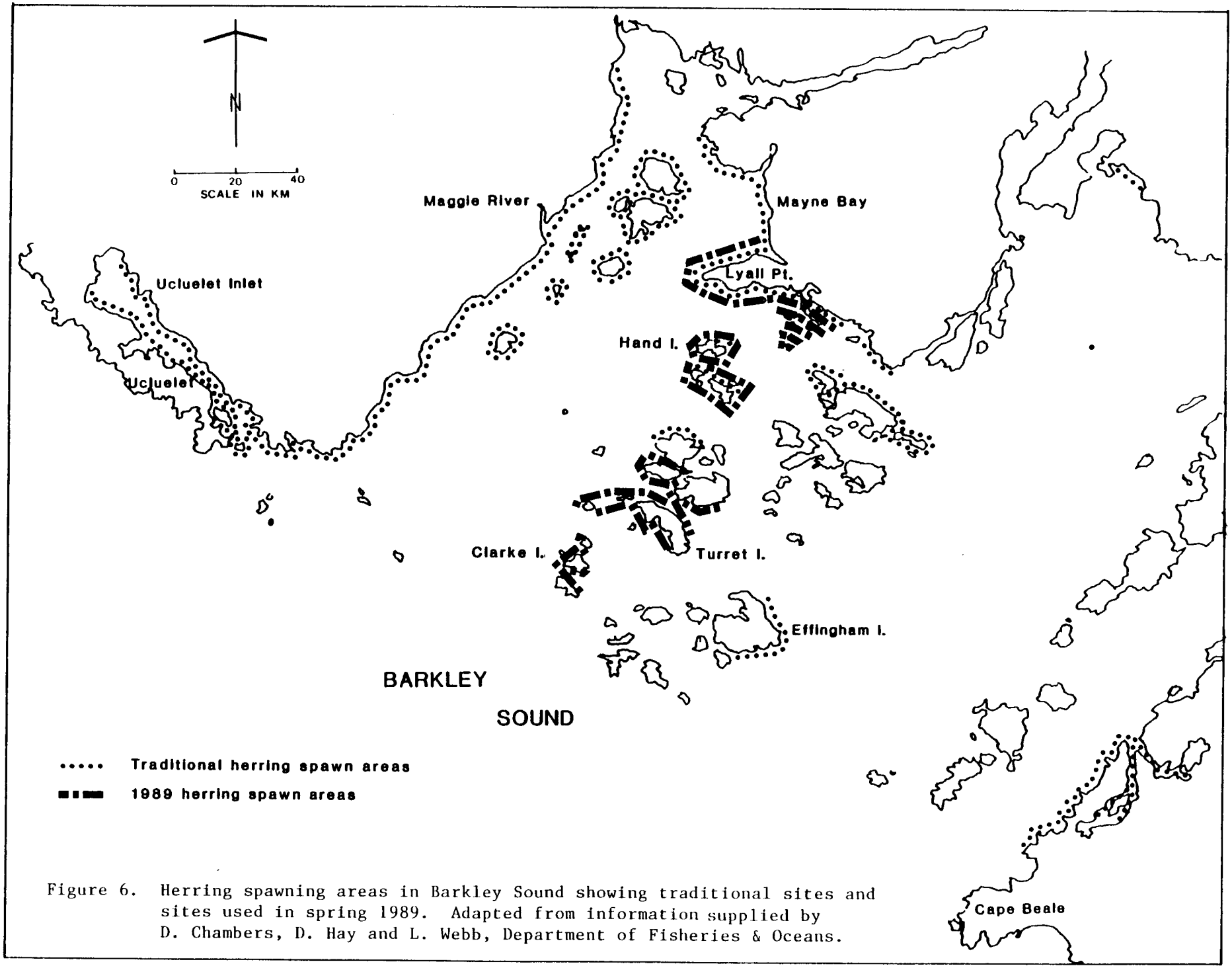


Figure 6. Herring spawning areas in Barkley Sound showing traditional sites and sites used in spring 1989. Adapted from information supplied by D. Chambers, D. Hay and L. Webb, Department of Fisheries & Oceans.

feeding on herring eggs. The lower numbers of grebes and cormorants sighted in 1989 than in 1979 may partly be explained by the later survey date after some of the birds had dispersed. However, there was overlap of survey dates between the two years, and herring spawned later in 1989 (18-23 March - D. Chalmers pers. comm.) than in 1979 (10 March - Hay et al. 1989). The period of abundance of fish-eating species would be expected to coincide with the timing of spawning. The absence of previously observed concentrations of those species suggests three possibilities: 1. numbers have declined between 1979 and 1989; 2. birds moved to areas outside Barkley Sound, perhaps because they were unable to locate herring away from traditional spawning locations; or 3. numbers of those species present in the area normally fluctuate. No conclusions can be drawn with only two, widely-spaced years of survey data. Repeated surveys are required to determine normal patterns of abundance, and its relation to timing of herring spawning.

Tofino/Grice Bay area

Hatler et al. (1978) reported concentrations of Surf Scoters near Clayoquot Spit on Stubbs Island. They counted a maximum of 4,000 birds on 25 March 1971. No aggregations of scoters were observed in that area in 1989. The area is a traditional herring spawn site, but no spawning took place there in 1989. Most herring spawn in Clayoquot Sound in 1989 occurred on Saranac Island and Yellow Bank, north of the study area. That area has supported herring spawns in the past, but not to the degree observed in 1989 (D. Chalmers pers. comm.). Concentrations of waterbirds may have occurred there, but because that area was generally not affected by the oil spill, it was not included in this study, and no surveys of the area were conducted.

Numbers of Canada Geese and dabbling ducks, especially wigeon and Mallard, using southern Clayoquot Sound during fall and winter declined

between 1950 and 1973 (Hatler 1973). Disturbance by hunters using powerboats was considered a decisive factor contributing to those declines. Results from this study suggest that declines have continued. Only 16 American Wigeon were seen on surveys in 1989, yet Hatler et al. (1978) list them as abundant in southern Clayoquot Sound from September to April. R. Davies (B.C. Ministry of Environment 1980) recorded 1,485 American Wigeon in Browning Passage and Grice Bay on 20 April 1976. Mallard and goldeneye were also more abundant on 20 April 1976 than on any survey in 1989. Davies counted 727 Mallard and 574 goldeneye in 1976 compared to maximum totals of 296 Mallard and 37 Goldeneye in 1989. During observations of Brant on Stubbs Island, frequent disturbances by eagles, boats and aircraft were recorded (Rodway 1989). High levels of disturbance may be deterring waterfowl from using the area. Activity associated with the oil spill may have exacerbated disturbance levels, but because declines have been occurring over an extended period, the oil spill cannot be implicated as a primary cause.

Conclusions

Relationships between Nestucca oil that impacted the study area, and detectable changes in distribution and abundance of important waterbird species, are difficult to interpret. The most dramatic changes in waterbird distribution paralleled changes in herring spawning locations. Scoters and gulls concentrated in expected numbers at spawning sites in Barkley Sound, including sites not previously used by herring. To what extent herring responded to the presence of oil in the vicinity of traditional spawning sites is beyond the scope of this study.

Changes in abundance of some species were detected in Barkley Sound and Clayoquot Sound. Numbers of grebes and cormorants in Barkley Sound were lower than during a past survey in 1979, but lack of other data made it impossible

to evaluate whether that observation indicated a real decline or just a normal fluctuation. In southern Clayoquot Sound, waterfowl have been declining since the 1950's, and further declines indicated in 1989 cannot be attributed to the oil spill, though the spill may have exacerbated the problem.

Small quantities of oil were observed in the study area, but no oiled birds were seen. Most small blobs of oil encountered on beaches in the Broken Group were partially buried. Birds roosting on those beaches could become contaminated if they disturbed the surface material, though I observed no evidence of oil on gulls using the area. Larger quantities of oil were probably present in Stuart Bay, judging from the ribbons of sheen seen emanating from the south point. That oil likely posed more of a threat to waterbirds, though very few birds were observed in that vicinity during these surveys. The persistence of oil on beaches and subtidal areas, and the use of those areas by waterbirds should be monitored.

To assess the impact of environmental contamination on waterbirds requires long-term monitoring of normal patterns of distribution, abundance and behavior. Future surveys in the Barkley Sound and Clayoquot Sound area should focus on temporal and spatial changes in waterbird concentrations in relation to predictable food resources such as spawning herring and eelgrass flats. Levels of disturbance and its influence on behavior and distribution of waterfowl should be investigated. During spring migration, surveys should be conducted at weekly intervals from the beginning of March to the end of May.

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Appendix Ia. Sightings of loons, grebes, cormorants and herons during boat and plane surveys in Barkley Sound, spring 1989.

Location	Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	BRCO	PECO	GBHE
S of Pachena Pt.	16 Mar										4	
Pachena Bay	16 Mar		1		1							
Pachena Bay	19 Apr		100			3						
Cape Beale	16 Mar		8								20	
Cape Beale	16 Apr					5						
Mouth of Trevor Channel	27 Mar					30						
Trevor Channel	18 Apr						120					
Dodger Ch./Edward King I.	7 Apr			3					1i5a		18	
Dodger Channel	9 Apr			2		1						
Dodger Channel	16 Apr		65			3						
Helby Island	17 Mar				1	1					3	
Imperial Eagle Channel	17 Mar									3	1	
Imperial Eagle Channel	8 Apr					12						
Imperial Eagle Channel	16 Apr		12			1						
Imperial Eagle Channel	18 Apr							70				
Effingham Island	21 Apr		23	2								
Wouwer Island	8 Apr										30	
Wouwer Island	22 Apr										1	
Clarke Island	16 Apr			3								
Turret/Trickett/Lovett is.	8 Apr		125	2			130				18	
Thiepval Channel	24 Apr								1		6	
Turtle/Willis islands	8 Apr									3i	5	
Turtle/Willis islands	17 Apr						80					
Turtle/Willis islands	24 Apr			1								
Island Harbour to Weibe I.	2 Apr							70				
Island Harbour to Weibe I.	8 Apr			2							2	
Island Harbour to Weibe I.	17 Mar					2			1		7	
Tiny Group	17 Mar		8					60	7	290	195	
Tiny Group	31 Mar								3	200	200	
Tiny Group	2 Apr			1			60			60	15	
Tiny Group	8 Apr		40	1							29	1
Tiny Group	21 Apr		42								15	
Peacock Channel	17 Mar									6	4	
Peacock Channel	31 Mar							200				
Peacock Channel	2 Apr						135					
Peacock Channel	8 Apr			1								
Peacock Channel	18 Apr						17					
Brabant Islands	17 Mar									15	41	
Brabant Islands	8 Apr					1						
Brabant Islands	26 Apr						4					
Hand Island	17 Mar									100	65	
Hand Island	21 Mar							20				
Hand Island	8 Apr						3		1	3	10	
Hand Island	17 Apr						10					
Hand Island	21 Apr								1		15	
Hand Island	26 Apr			2								

cont'd

Appendix Ia. (cont'd)

Location	Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	BRCO	PECO	GBHE
Pinkerton Islands	31 Mar									370		
Pinkerton Islands	17 Apr						10					
Pinkerton Islands	18 Apr						20					
Pinkerton Islands	1 May						60					
Mayne Bay	17 Mar				2	2s	1	6	1		5	1
Mayne Bay	8 Apr						24					
Mayne Bay	18 Apr						25					
Toquart Bay	17 Mar				1		10				1	
Toquart Bay	17 Apr						10					
Toquart Bay	18 Apr			1								
Toquart Bay	22 Apr			1								
Macoah Passage	17 Mar				1	4					5	
Macoah Passage	17 Apr	2	8			3	45					
Macoah Passage	18 Apr		1									
Macoah Passage	22 Apr	2						45				
Macoah Passage	26 Apr			2							2	
Macoah Passage	30 Apr					1s						
Forbes I. to Beg Is.	17 Mar						300				86	
Forbes I. to Beg Is.	1 May		1^									
Loudoun Channel	17 Mar									10	13	
Loudoun Channel	24 Apr		1	1			15				3	
Stuart Bay to Port Albion	17 Mar										1	3
Stuart Bay to Port Albion	3 Apr											3
Mercantile Creek mouth	17 Mar											1
Kvarno Island	17 Mar											1
Bay NW of Ucluelet	17 Mar											1
Bay NW of Ucluelet	30 Apr						3					

i: immature
a: adult
s: summer plumage
^: flying

Appendix Ib. Sightings of ducks and geese during boat and plane surveys of Barkley Sound, spring 1989.

				Duck					Scaup				Goldeneye						
Location	Date	BRAN	CAGO	sp.	GWTE	MALL	AMWI	sp.	HADU	OLDS	SUSC	WWSC	sp.	COGO	BAGO	BUFF	HOME	COME	RBME
Pachena Bay	16 Mar								1m1f	1	2m1f	2m1f							
Pachena Bay	19 Apr										10								
Cape Beale	25 Mar	22^									240^								
Cape Beale	27 Mar	25^									300^								
Cape Beale	16 Apr	114^									62^	23^							
Mouth of Trevor Channel	3 Apr	53^							1m2f^										
Mouth of Trevor Channel	5 Apr										7								
Mouth of Trevor Channel	7 Apr		50^								20^								
Mouth of Trevor Channel	16 Apr	250^									21^								
Mouth of Trevor Channel	19 Apr											2							
Trevor Channel	16 Apr	110^																	
Dodger Channel	24 Mar								2m2f		10					60			
Dodger Ch./Edward King I.	7 Apr								1m1f		6	31				64			34
Dodger Channel	9 Apr								1m		4m1f					35			
Dodger Channel	16 Apr								1m1f		6	4				13			
Helby Island	17 Mar										14			2m		10m8f			
Imperial Eagle Channel	8 Apr											2							
Clarke/Owens islands	3 Apr										720								
Clarke Island	8 Apr										7000								
Clarke Island	16 Apr		380^								380	4							
Clarke Island	17 Apr										700								
Clarke Island	18 Apr										600								
Clarke Island	22 Apr										1500								
Clarke Island	26 Apr										2430								
Clarke Island	30 Apr										0								
Clarke Island	1 May										40								
Turret/Trickett/Lovett is.	3 Apr										6000								
Turret/Trickett/Lovett is.	4 Apr										10000								
Turret/Trickett/Lovett is.	8 Apr	7							26		1400	30				30			3m3f
Turret/Trickett/Lovett is.	17 Apr										16200								
Turret/Trickett/Lovett is.	18 Apr										4000								
Turret/Trickett/Lovett is.	22 Apr										3000								

cont'd

Appendix Ib. (cont'd)

Location	Date	BRAN	CAGO	Duck sp.	GWTE	MALL	AMWI	Scaup sp.	HADU	OLDS	SUSC	WWSC	Goldeneye sp.	COGO	BAGO	BUFF	HOME	COME	RBME
Turret/Trickett/Lovett is.	24 Apr										1200	14							
Turret/Trickett/Lovett is.	30 Apr							15			3030								
Turret/Trickett/Lovett is.	1 May										2020								
Thiepval Channel	4 Apr										5000								
Thiepval Channel	8 Apr							5m			13000	50							
Thiepval Channel	17 Apr										4500								
Thiepval Channel	18 Apr										17000								
Thiepval Channel	24 Apr										0	1							2m1f
Thiepval Channel	30 Apr										0								
Thiepval Channel	1 May										45^								
Turtle/Willis islands	8 Apr								6										1m1f
Turtle/Willis islands	17 Apr										14024								
Turtle/Willis islands	18 Apr										700								
Turtle/Willis islands	22 Apr										6000								
Turtle/Willis islands	24 Apr										11000	2							
Turtle/Willis islands	26 Apr										10200								
Turtle/Willis islands	30 Apr										0								
Turtle/Willis islands	1 May							1m1f			0								
Island Harbour to Weibe I.	2 Apr										1	1							
Island Harbour to Weibe I.	8 Apr											2						1m	
Island Harbour to Weibe I.	17 Mar								1m1f		1				1m1f	2m1f		3m6f	2m2f
Tiny Group	17 Mar										5					1m1f		4m6f	10m8f
Tiny Group	8 Apr															1m1f			1m1f
Tiny Group	21 Apr										20								
Peacock Channel	17 Mar										1								
Brabant Islands	17 Mar															2m1f		1m1f	
Brabant Islands	31 Mar										3000								
Brabant Islands	3 Apr										2000								
Brabant Islands	4 Apr										20000								
Brabant Islands	8 Apr							1m1f			1800					1m1f			
Brabant Islands	21 Apr										21								
Brabant Islands	30 Apr										0								
Brabant Islands	1 May										0								

cont'd

Appendix Ib. (cont'd)

Location	Date	BRAN	CAGO	Duck sp.	GWTE	MALL	AMWI	Scaup sp.	HADU	OLDS	SUSC	WWSC	Goldeneye sp.	COGO	BAGO	BUFF	HOME	COME	RBME
Hand Island	17 Mar										25								
Hand Island	31 Mar										12000	30							
Hand Island	2 Apr										20400	20							
Hand Island	3 Apr										22000								
Hand Island	4 Apr										15000								
Hand Island	8 Apr		48^				1m1f		8m4f		18000				3m3f				
Hand Island	17 Apr										11500								
Hand Island	18 Apr										12000								
Hand Island	21 Apr							1m1f			3400	10							
Hand Island	22 Apr										1800								
Hand Island	26 Apr										1262								
Hand Island	30 Apr							15			284								
Hand Island	1 May										900								
Pinkerton Islands	31 Mar										110^								
Pinkerton Islands	3 Apr										800								
Pinkerton Islands	21 Apr										350								
Pinkerton Islands	30 Apr										0								
Pinkerton Islands	1 May										0								
Equis Beach	8 Apr										3000								
Equis Beach	17 Apr										1800								
Equis Beach	18 Apr				8						1400					10			
Equis Beach	22 Apr										20								
Equis Beach	26 Apr							4m			300								
Equis Beach	30 Apr										0								
Equis Beach	1 May										300								
Mayne Bay	17 Mar										15	40			15m13f	3m1f		19m15f	
Mayne Bay	8 Apr														39	1m2f			9
Mayne Bay	17 Apr										10^								
Mayne Bay	18 Apr																		1m
Mayne Bay	22 Apr										60								
Mayne Bay	26 Apr			6															20
Mayne Bay	30 Apr										0								

cont'd

Appendix Ib. (cont'd)

Location	Date	BRAN	CAGO	Duck sp.	GWTE	MALL	AMWI	Scaup sp.	HADU	OLDS	SUSC	WWSC	Goldeneye sp.	COGO	BAGO	BUFF	HOME	COME	RBME
Toquart Bay	17 Mar		47								636	48			81	21m13f		1m1f	1m2f
Toquart Bay	21 Mar		50								400								
Toquart Bay	8 Apr		12															1m	3
Toquart Bay	17 Apr										66					4			
Toquart Bay	18 Apr				60	7					40								
Toquart Bay	22 Apr										21		19			20		1m3f	
Toquart Bay	26 Apr					1m1f							32			2m8f		1m1f	
Toquart Bay	30 Apr					50		100											
Macoah Passage	17 Mar		54					1m1f			202	23			17m7f	18m12f			
Macoah Passage	3 Apr		130	120		20					3000					40			
Macoah Passage	4 Apr		115								2000								
Macoah Passage	8 Apr		13					28			6000				200				3
Macoah Passage	17 Apr		0	6							190	5	30			20			
Macoah Passage	18 Apr		120^	35	20			8			62								1m
Macoah Passage	22 Apr							20			30					7			
Macoah Passage	26 Apr			4									1m1f						
Macoah Passage	30 Apr			190		x					0		1m1f			10			
Macoah Passage	1 May										0								
Forbes I. to Beg Is.	17 Mar										158	3			6m			1f	
Forbes I. to Beg Is.	30 Apr										30								
Forbes I. to Beg Is.	1 May										6^								
Loudoun Channel	17 Mar										4								1m1f
Loudoun Channel	24 Apr	25^										7							
Stuart Bay to Port Albion	17 Mar										20				1m	10m8f	1m	1f	1m1f
Stuart Bay to Port Albion	3 Apr															20		4	
Mercantile Creek mouth	17 Mar							7m1f							1m3f	33	1m1f		2m4f
Kvarno Island	17 Mar													6m1f		2m2f			
Bay NW of Ucluelet	17 Mar					3m3f		15				35							24
Bay NW of Ucluelet	3 Apr					40	10	60								40			
Bay NW of Ucluelet	17 Apr			20															
Bay NW of Ucluelet	22 Apr															5			
Bay NW of Ucluelet	26 Apr					10										10			
Bay NW of Ucluelet	30 Apr							4											1m1f
Bay NW of Ucluelet	1 May															1m7f			

m: male
f: female
^: flying

Appendix Ic. Sightings of eagles and shorebirds during boat and plane surveys of Barkley Sound, spring 1989.

Location	Date	BAEA	Shorebird sp.	BBPL	BLOY	GRYE	SDSA	BLTU	SURF	RNPL
Pachena Bay	16 Mar				13					
Cape Beale	19 Apr									54
Mouth of Trevor Channel	16 Apr				2^					
Execution Rock	15 Apr						1	1	420	
Dodger Channel	9 Apr					1				
Helby Island	8 Apr				2					
Helby Island	16 Apr	1a	40^							
Effingham Island	21 Apr	6								
Clarke/Owens islands	3 Apr	1a								
Clarke Island	26 Apr	1a								
Turret/Trickett/Lovett is.	8 Apr	5								
Island Harbour to Weibe I.	2 Apr	9								
Island Harbour to Weibe I.	17 Mar	2								
Tiny Group	17 Mar	2i1a								
Tiny Group	2 Apr	1i								
Tiny Group	8 Apr	7								
Tiny Group	21 Apr								20	
Tiny Group	1 May	1a								
Peacock Channel	17 Mar	1i1a								
Brabant Islands	17 Mar	7i3a								
Brabant Islands	8 Apr	3								
Hand Island	17 Mar	6								
Hand Island	31 Mar	20								
Hand Island	8 Apr	3a								
Hand Island	21 Apr	2a		4^						
Pinkerton Islands	1 May	1a								
Equis Beach	4 Apr	3								
Equis Beach	17 Apr		20							
Mayne Bay	22 Apr	2a1n								
Toquart Bay	17 Mar	4								
Toquart Bay	3 Apr		60							
Toquart Bay	22 Apr	2a								
Toquart Bay	30 Apr	3a1n								
Macoah Passage	17 Mar							4		
Macoah Passage	3 Apr	1i								
Macoah Passage	4 Apr		60							
Macoah Passage	17 Apr	1a								
Macoah Passage	18 Apr	2a	15							
Macoah Passage	22 Apr								10	
Macoah Passage	1 May	5i								
Forbes I. to Beg Is.	17 Mar	7i2a								
Stuart Bay to Port Albion	3 Apr	1a								
Bay NW of Ucluelet	26 Apr		60							
Bay NW of Ucluelet	30 Apr		4							

i: immature
a: adult
n: nest
^: flying

Appendix Id. Sightings of gulls and alcids during boat and plane surveys of Barkley Sound, spring 1989.

Location	Date	Gull sp.	BOGU	MEGU	CAGU	HEGU/ THGU	WEGU	GWGU	BLKI	COMU	PIGU	MAMU	CAAU	RHAU
S of Pachena Pt.	16 Mar				50		2a	50	150	60				100
Pachena Bay	22 Mar												5	
Pachena Bay	19 Apr										4			
Cape Beale	16 Mar	100			x			x			6			10
Cape Beale	16 Apr											4		
Cape Beale	19 Apr									9		2		40
Cape Beale	23 Apr									1		4		8
Mouth of Trevor Channel	3 Apr													2
Mouth of Trevor Channel	5 Apr									1		4		2
Mouth of Trevor Channel	7 Apr											1w		
Mouth of Trevor Channel	16 Apr											4		
Mouth of Trevor Channel	19 Apr											2		
Trevor Channel	23 Apr											4		
Trevor Channel	24 Apr											2		
Dodger Channel	24 Mar										2s	2w		
Dodger Ch./Edward King I.	7 Apr							5a			2	8s		
Dodger Channel	16 Apr										1	7		
Helby Island	17 Mar										1			
Helby Island	16 Apr							1a						
Imperial Eagle Channel	17 Mar									1				
Imperial Eagle Channel	21 Mar	6												
Imperial Eagle Channel	21 Apr									2				
Imperial Eagle Channel	22 Apr	5												
Effingham Island	21 Apr											1		
Wouwer Island	8 Apr	-						10				8		
Wouwer Island	22 Apr							8						
Clarke/Owens islands	3 Apr	5400												
Clarke Island	8 Apr	100						800				4		
Clarke Island	16 Apr				1a			110i12a						
Clarke Island	17 Apr	80												
Turret/Trickett/Lovett is.	3 Apr	4000												
Turret/Trickett/Lovett is.	4 Apr	9000												
Turret/Trickett/Lovett is.	8 Apr					300		2000i1000a		1w	1s			
Turret/Trickett/Lovett is.	17 Apr	300												
Turret/Trickett/Lovett is.	18 Apr	200												
Turret/Trickett/Lovett is.	22 Apr	50												
Turret/Trickett/Lovett is.	24 Apr							10						
Turret/Trickett/Lovett is.	30 Apr	6												
Thiepval Channel	17 Apr	60												
Thiepval Channel	24 Apr							4						
Turtle/Willis islands	8 Apr							300						
Turtle/Willis islands	17 Apr	502												
Turtle/Willis islands	22 Apr	80												
Turtle/Willis islands	24 Apr							70						
Turtle/Willis islands	26 Apr							20i						
Island Harbour to Weibe I.	2 Apr	20									1s			
Island Harbour to Weibe I.	17 Mar							2						

cont'd

Appendix Id. (cont'd)

Location	Date	Gull sp.	BOGU	MEGU	CAGU	HEGU/ THGU	WEGU	GWGU	BLKI	COMU	PIGU	MAMU	CAAU	RHAU
Tiny Group	17 Mar							35i15a						
Tiny Group	8 Apr							6				2		
Tiny Group	21 Apr											14		
Peacock Channel	17 Mar							3						
Brabant Islands	17 Mar							2						
Brabant Islands	3 Apr	80												
Brabant Islands	21 Apr											1		
Hand Island	17 Mar					6		80i260a						
Hand Island	21 Mar	9000												
Hand Island	31 Mar	800				x		x						
Hand Island	2 Apr	3400												
Hand Island	3 Apr	4000												
Hand Island	4 Apr	10000												
Hand Island	8 Apr			42a	100	20		150i450a						
Hand Island	17 Apr	0												
Hand Island	21 Apr							100i1a						
Hand Island	22 Apr	10												
Hand Island	30 Apr	10												
Equis Beach	31 Mar	500												
Equis Beach	3 Apr	6000												
Equis Beach	4 Apr	1400												
Equis Beach	8 Apr	600												
Equis Beach	17 Apr	60												
Equis Beach	18 Apr	0												
Equis Beach	30 Apr	0												
Mayne Bay	17 Mar			1				116						
Mayne Bay	3 Apr	900												
Mayne Bay	4 Apr	800												
Mayne Bay	8 Apr		1	100	500	50		50						
Mayne Bay	17 Apr	0												
Mayne Bay	22 Apr	0												
Mayne Bay	26 Apr	10												
Mayne Bay	30 Apr	0												
Toquart Bay	17 Mar					290		3						
Toquart Bay	21 Mar	50												
Toquart Bay	8 Apr	110		1400		200								
Toquart Bay	17 Apr	10												
Macoah Passage	17 Mar					900								
Macoah Passage	21 Mar	500												
Macoah Passage	3 Apr	1560												
Macoah Passage	4 Apr	800												
Macoah Passage	8 Apr	3600												
Macoah Passage	17 Apr	80												
Macoah Passage	22 Apr	30												
Forbes I. to Beg Is.	17 Mar					2300		2			1			
Loudoun Channel	17 Mar							8				7w		
Loudoun Channel	24 Apr											12s		
Loudoun Channel	30 Apr							430						
Stuart Bay to Port Albion	17 Mar	35												

cont'd

Appendix Id. (cont'd)

Location	Date	Gull sp.	BOGU	MEGU	CAGU	HEGU/ THGU	WEGU	GWGU	BLKI	COMU	PIGU	MAMU	CAAU	RHAU
Stuart Bay to Port Albion	17 Apr	36												
Stuart Bay to Port Albion	22 Apr	20												
Stuart Bay to Port Albion	26 Apr							60i						
Stuart Bay to Port Albion	30 Apr	2												
Mercantile Creek mouth	17 Mar					350		20i80a						
Mercantile Creek mouth	20 Mar	20												
Kvarno Island	22 Apr	30												
Bay NW of Ucluelet	17 Mar													
Bay NW of Ucluelet	3 Apr	50												
Bay NW of Ucluelet	22 Apr	30												

i: immature
a: adult
x: species present
w: winter plumage
s: summer plumage

Appendix Ie. Sightings of marine mammals during boat and plane surveys of Barkley Sound, spring 1989.

Location	Date	Northern Sea-lion	California Sea-lion	Harbour Seal	Gray Whale
S of Pachena Pt.	16 Mar				2
Mouth of Pachena Bay	19 Mar				19
Mouth of Pachena Bay	22 Mar				12
Mouth of Pachena Bay	25 Mar				5
Mouth of Pachena Bay	23 Apr				4
Pachena Bay	16 Mar				2
Pachena Bay	19 Mar				1
Cape Beale	16 Mar				8
Cape Beale	25 Mar				17
Cape Beale	9 Apr				9
Mouth of Trevor Channel	19 Mar				20
Mouth of Trevor Channel	24 Mar				18
Mouth of Trevor Channel	26 Mar				7
Mouth of Trevor Channel	27 Mar				6
Mouth of Trevor Channel	29 Mar				13
Mouth of Trevor Channel	3 Apr				23
Mouth of Trevor Channel	5 Apr				6
Mouth of Trevor Channel	7 Apr				28
Mouth of Trevor Channel	9 Apr				4
Mouth of Trevor Channel	16 Apr				13
Mouth of Trevor Channel	19 Apr				5
Folger Island	3 Apr	4			
Folger Island	7 Apr	7			
Folger Island	9 Apr	1			
Folger Island	19 Apr		3		
Wouwer Island	8 Apr	9			3
Clarke Island	8 Apr				1
Clarke Island	18 Apr				1
Turret/Trickett/Lovett is.	30 Apr				1
Island Harbour to Weibe I.	17 Mar			1	
Tiny Group	2 Apr	4	1		
Brabant Islands	17 Mar		1		
Brabant Islands	31 Mar				1
Hand Island	2 Apr	24			2
Hand Island	3 Apr	8			3
Hand Island	4 Apr	4			1
Hand Island	8 Apr		26		
Hand Island	17 Apr				4
Hand Island	18 Apr				1
Hand Island	21 Apr				1
Hand Island	22 Apr				2
Mayne Bay	17 Apr				1
Macoah Passage	17 Mar	2		3	
Macoah Passage	21 Mar	15			
Macoah Passage	3 Apr		10	22	
Macoah Passage	8 Apr				2
Macoah Passage	18 Apr			15	
Forbes I. to Beg Is.	17 Mar	55			

Appendix IIa. Sightings of loons, grebes, cormorants and herons during boat and plane surveys of the Long Beach/Tofino/Grice Bay area, spring 1989.

Location	Date	Loon sp.	PALO	COLO	HOGR	RNGR	WEGR	Corm. sp.	DCCO	BRCO	PECO	GBHE
Amphitrite Pt. to Wya Pt.	24 Apr		26							6		
Florencia Bay	3 Apr							15				
Florencia Bay	17 Apr					1						
Wickaninnish Bay	24 Apr		28								6	
Wickaninnish Bay	30 Apr							300				
Wickaninnish Bay	1 May		124					200				
Portland Pt. to Cox Pt.	3 Apr							100				
Portland Pt. to Cox Pt.	24 Apr							80		300	100	
Chesterman Beach	3 Apr							20				
Templar Channel	17 Apr						4					
Duffin Passage	20 Mar			1				6	1			
Duffin Passage	3 Apr					20						
Duffin Passage	4 Apr					20						
Duffin Passage	17 Apr		15			35s	6	15				
Duffin Passage	26 Apr			2				20				
Duffin Passage	30 Apr					3						
Stubbs Island	4 Apr			1								
Stubbs Island	17 Apr			4	1s							
Stubbs Island	22 Apr			3								
Stubbs Island	25 Apr				1							2
Stubbs Island	26 Apr					15						
Stubbs Island	27 Apr		2	4	4	2	1					
Stubbs Island	28 Apr			3		10						
Stubbs Island	30 Apr			2								
Father Charles Channel	17 Apr						15					
Father Charles Channel	26 Apr		60			5						
Mud Bay	4 Apr			1								
Stockham Island	20 Mar						30					1
Stockham Island	3 Apr							20				
Arakun Islands mudflats	18 Apr											1
Ducking Island mudflats	20 Mar											1
Tofino Mudflats	18 Apr											1
Mcbey Islets	21 Mar	2										
Mcbey Islets	3 Apr								2			1
Mcbey Islets	17 Apr			1								
Mcbey Islets	22 Apr					1						
Mcbey Islets	30 Apr						3					
Indian Island	20 Mar			2								
Indian Island	17 Apr			1			6					
Indian Island	22 Apr						10					

s: summer plumage

Appendix IIb. Sightings of ducks and geese during boat and plane surveys of the Long Beach/Tofino/Grice Bay area, spring 1989.

		Duck								Scaup		Goldeneye					
Location	Date	BRAN	CAGO	sp.	GWTE	MALL	NOPI	NOSL	AMWI	sp.	CLDS	SUSC	sp.	BUFF	HOME	COME	RBME
Amphitrite Pt. to Wya Pt.	24 Apr											34^					
Wickaninnish Bay	17 Apr					2											
Wickaninnish Bay	22 Apr											65					
Wickaninnish Bay	24 Apr											100^					
Wickaninnish Bay	26 Apr		300^														
Wickaninnish Bay	1 May											44^					
Portland Pt. to Cox Pt.	24 Apr											80^					
Duffin Passage	20 Mar													15			2m2f
Duffin Passage	21 Mar											12		20			
Duffin Passage	3 Apr																22
Duffin Passage	4 Apr																20
Duffin Passage	17 Apr																15
Stubbs Island	20 Mar									20							
Stubbs Island	21 Mar	2								20				12			
Stubbs Island	4 Apr											7		8m7f			
Stubbs Island	17 Apr	366			14									2m11f			36
Stubbs Island	18 Apr	420	670^					1m1f									
Stubbs Island	22 Apr	379	40^		7m8f		6m6f	2m2f	16					1m8f			4m4f
Stubbs Island	25 Apr	98							1m1f		6			3m23f			7m7f
Stubbs Island	26 Apr	244								1m1f				1m29f			5m4f
Stubbs Island	27 Apr	139			9m10f	1m		3m3f	3m1f	13m7f	9	6		2f	1m1f	1m7f	25
Stubbs Island	28 Apr	39									7	8					15
Stubbs Island	29 Apr	0															
Stubbs Island	30 Apr	0								3							15
Father Charles Channel	26 Apr											10					
Mud Bay	3 Apr					30											
Stockham Island	20 Mar					140											
Stockham Island	17 Apr									20						1m	
Arakun Islands mudflats	20 Mar					35								115			
Arakun Islands mudflats	21 Mar		55			20											

cont'd

Appendix IIb. (cont'd)

Location	Date	BRAN	CAGO	Duck sp.	GWTE	MALL	NOPI	NOSL	AMWI	Scaup sp.	OLDS	SUSC	Goldeneye sp.	BUFF	HOME	COME	RBME
Arakun Islands mudflats	3 Apr		18	6		30								22			15
Arakun Islands mudflats	17 Apr				6									10			2
Arakun Islands mudflats	18 Apr				30	10											
Arakun Islands mudflats	22 Apr													3m12f			
Arakun Islands mudflats	30 Apr													2			
Ducking Island mudflats	20 Mar		20			35				3				84			
Ducking Island mudflats	21 Mar		30		60												
Ducking Island mudflats	3 Apr					4								44			
Ducking Island mudflats	17 Apr					30				6				14			
Ducking Island mudflats	18 Apr												6	15			
Ducking Island mudflats	22 Apr					6	1m1f										
Ducking Island mudflats	26 Apr					30								2m7f			
Ducking Island mudflats	30 Apr			12						40						6	
Tofino Mudflats	20 Mar			100		50						30		140			
Tofino Mudflats	3 Apr					134								245			
Tofino Mudflats	4 Apr		25							4		20		35			
Tofino Mudflats	17 Apr				28	6								52			2
Tofino Mudflats	18 Apr				20	120							8	83			
Tofino Mudflats	22 Apr					30								39		25	
Tofino Mudflats	26 Apr			4		6								2m26f			
Tofino Mudflats	30 Apr					1m1f								36			
Ginnard Creek	20 Mar		25														
Ginnard Creek	3 Apr		20							6							
Ginnard Creek	17 Apr													2			1m
Mcbey Islets	20 Mar												22	43		3	
Mcbey Islets	21 Mar													8			
Mcbey Islets	3 Apr			30		10										16	
Mcbey Islets	4 Apr					8								43			
Mcbey Islets	17 Apr													27			
Mcbey Islets	18 Apr					10								4			
Mcbey Islets	22 Apr													10			
Mcbey Islets	26 Apr																1m1f

cont'd

Appendix IIb. (cont'd)

Location	Date	BRAN	CAGO	Duck sp.	GWTE	MALL	NOPI	NOSL	AMWI	Scaup sp.	CLDS	SUSC	Goldeneye sp.	BUFF	HOME	COME	RBME
Indian Island	20 Mar												2	46			
Indian Island	3 Apr													17			
Indian Island	17 Apr													65			1m
Indian Island	18 Apr											80		60			
Grice Bay	20 Mar			12		2							13				
Grice Bay	21 Mar					30								5			
Grice Bay	3 Apr		15			88				40		48		154			
Grice Bay	4 Apr											40		90			
Grice Bay	17 Apr									20				75			
Grice Bay	22 Apr					4								8		5m5f	
Grice Bay	26 Apr															2m2f	
Grice Bay	30 Apr													2m18f			

m: male
f: female
^: flying

Appendix IIc. Sightings of eagles and shorebirds during boat and plane surveys of the Long Beach/Tofino/Grice Bay area, spring 1989.

Location	Date	OSPR	BAEA	BEFA	Shorebird sp.	BBPL	SEPL	BLOY	GRYE	WHIM	BLTU	SURF	SAND	Peeps	WESA	LESA	DUNL	SBDO	RNPL
Amphitrite Pt. to Wya Pt.	3 Apr		1a																
Amphitrite Pt. to Wya Pt.	30 Apr				50														
Florencia Bay	22 Apr		1a																
Wickaninnish Bay	17 Apr		1i																
Wickaninnish Bay	22 Apr		1a																
Wickaninnish Bay	28 Apr	1	3a				74						26		20		2		
Portland Pt. to Cox Pt.	20 Mar				20														
Portland Pt. to Cox Pt.	3 Apr		1aln																
Portland Pt. to Cox Pt.	17 Apr		1i																
Portland Pt. to Cox Pt.	24 Apr							2											
Chesterman Beach	20 Mar				20														
Chesterman Beach	21 Mar		2a		0														
Chesterman Beach	17 Apr				0														
Chesterman Beach	22 Apr				0														
Chesterman Beach	30 Apr				0														
Stubbs Island	20 Mar		1																
Stubbs Island	17 Apr	1	1a											6					
Stubbs Island	18 Apr		1a		9										35		8		12
Stubbs Island	22 Apr		1i1a			1s					22	1		900	20		49	38	
Stubbs Island	25 Apr		1a			1	7							15	160	3	36	25	
Stubbs Island	26 Apr		1i2a			3s	14							120	80		1	2	
Stubbs Island	27 Apr		1i1a			3			1					32	96		24	7	
Stubbs Island	28 Apr	1	1i2a																
Stubbs Island	30 Apr		1a											20					
Mud Bay	4 Apr		1	1															
Arakun Islands mudflats	30 Apr		1a		300									20					
Ducking Island mudflats	3 Apr		1aln																
Tofino Mudflats	22 Apr		1a																
Tofino Mudflats	26 Apr													500					
Tofino Mudflats	30 Apr				800									360					
Mcbey Islets	21 Mar		1																
Grice Bay	3 Apr		1a		200														
Grice Bay	17 Apr				10														
Grice Bay	18 Apr				60					140									
Grice Bay	26 Apr				530														
Grice Bay	30 Apr				650					x				x				x	

i: immature
a:adult
n: nest
s: summer plumage
x: species present

Appendix IId. Sightings of gulls and alcids during boat and plane surveys of the Long Beach/Tofino/Grice Bay area, spring 1989.

Location	Date	Gull sp.	MEGU	CAGU	HEGU/ THGU	GWGU	CATE	COMU	PIGU	MAMU	RHAU
Amphitrite Pt. to Wya Pt.	3 Apr										
Amphitrite Pt. to Wya Pt.	30 Apr					6					
Florencia Bay	3 Apr	16									
Florencia Bay	17 Apr					1					
Florencia Bay	22 Apr					4					
Florencia Bay	24 Apr							2		2	2
Florencia Bay	1 May					200					
Wickaninnish Bay	20 Mar	250									
Wickaninnish Bay	3 Apr	180									
Wickaninnish Bay	17 Apr	162									
Wickaninnish Bay	22 Apr					190					
Wickaninnish Bay	24 Apr							16	3	37	2
Wickaninnish Bay	26 Apr	143									
Wickaninnish Bay	28 Apr						2a				
Wickaninnish Bay	30 Apr	200									
Wickaninnish Bay	1 May					200					
Portland Pt. to Cox Pt.	20 Mar	140									
Portland Pt. to Cox Pt.	17 Apr	6									
Portland Pt. to Cox Pt.	24 Apr					132					
Portland Pt. to Cox Pt.	26 Apr					40					
Chesterman Beach	20 Mar	20									
Chesterman Beach	21 Mar			1i2	10a	70i75a					
Chesterman Beach	17 Apr	8									
Chesterman Beach	22 Apr	8									
Chesterman Beach	26 Apr					50					
Templar Channel	17 Apr	2									
Templar Channel	30 Apr	30									
Duffin Passage	20 Mar	100									
Duffin Passage	17 Apr	260									
Duffin Passage	26 Apr					130i					
Stubbs Island	20 Mar	28									
Stubbs Island	3 Apr	3									
Stubbs Island	4 Apr			12	40						
Stubbs Island	17 Apr		110	4	40	35i					
Stubbs Island	22 Apr		11i19a			5i10a				2	
Stubbs Island	25 Apr		36i40a	1a	8	7i6a	2a				
Stubbs Island	26 Apr	60	16i20a	1i		7i3a					
Stubbs Island	27 Apr		69i30a	1i1a		4a			3		
Mud Bay	20 Mar	20									
Stockham Island	20 Mar	30									
Stockham Island	3 Apr	160									
Stockham Island	17 Apr	20									
Arakun Islands mudflats	20 Mar	30									
Arakun Islands mudflats	17 Apr	15									
Arakun Islands mudflats	18 Apr	160									
Arakun Islands mudflats	26 Apr					10					
Arakun Islands mudflats	30 Apr	20									

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Appendix IId. (cont'd)

Location	Date	Gull sp.	MEGU	CAGU	HEGU/ THGU	GWGU	CATE	COMU	PIGU	MAMU	RHAU
Ducking Island mudflats	17 Apr	40									
Ducking Island mudflats	22 Apr		100								
Ducking Island mudflats	26 Apr	20									
Tofino Mudflats	17 Apr	33				2					
Tofino Mudflats	18 Apr	13				8					
Tofino Mudflats	22 Apr	2				1					
Tofino Mudflats	26 Apr	48									
Tofino Mudflats	30 Apr	39	1a								
Ginnard Creek	17 Apr	2									
Mcbey Islets	20 Mar	6									
Mcbey Islets	4 Apr					6					
Mcbey Islets	18 Apr	2									
Mcbey Islets	22 Apr	2									
Mcbey Islets	26 Apr	2									
Mcbey Islets	30 Apr	2									
Indian Island	3 Apr	2									
Indian Island	17 Apr	36									
Grice Bay	21 Mar					6					
Grice Bay	17 Apr	15									
Grice Bay	18 Apr	60									
Grice Bay	22 Apr	7									
Grice Bay	26 Apr	25									
Grice Bay	30 Apr	10									

i: immature
a: adult

Appendix IIe. Sightings of marine mammals during boat and plane surveys of the Long Beach /Tofino/Grice Bay area, spring 1989.

Location	Date	Northern Sea-lion	Harbour Seal
Stubbs Island	17 Apr		1
Mcbey Islets	17 Apr		1
Grice Bay	4 Apr		1
Grice Bay	17 Apr		2
Grice Bay	22 Apr		1
Portland Pt. to Cox Pt.	20 Mar	2	
Portland Pt. to Cox Pt.	3 Apr		60
Portland Pt. to Cox Pt.	17 Apr	1	
Wickaninnish Bay	20 Mar	x	
Wickaninnish Bay	3 Apr	300	
Wickaninnish Bay	17 Apr	4	
Wickaninnish Bay	22 Apr	60	
Wickaninnish Bay	26 Apr	3	
Wickaninnish Bay	30 Apr	6	

Appendix III. Index to species names and acronyms used on tables (following Campbell and Harcombe 1985).

Birds:		
Pacific Loon	*Gavia arctica*	PALO
Common Loon	*G. immer*	COLO
Horned Grebe	*Podiceps auritus*	HOGR
Red-necked Grebe	*P. grisegena*	RNGR
Western Grebe	*Aechmophorus occidentalis*	WEGR
Double-crested Cormorant	*Phalacrocorax auritus*	DCCO
Brandt's Cormorant	*Phalacrocorax penicillatus*	BRCO
Pelagic Cormorant	*P. pelagicus*	PECO
Great Blue Heron	*Ardea herodias*	GBHE
Brant	*Brant bernicla*	BRAN
Canada Goose	*B. canadensis*	CAGO
Green-winged Teal	*Anas crecca*	GWTE
Mallard	*A. platyrhynchos*	MALL
Northern Pintail	*A. acuta*	NOPI
Northern Shoveller	*A. clypeata*	NOSL
American Wigeon	*A. americana*	AMWI
Harlequin Duck	*Histrionicus histrionicus*	HADU
Oldsquaw	*Clangula hyemalis*	OLDS
Surf Scoter	*Melanitta perspicillata*	SUSC
White-winged Scoter	*M. fusca*	WWSC
Common Goldeneye	*Bucephala clangula*	COGO
Barrow's Goldeneye	*Bucephala islandica*	BAGO
Bufflehead	*Bucephala albeola*	BUFF
Hooded Merganser	*Lophodytes cucullatus*	HOME

cont'd

Appendix III. (cont'd)

Common Merganser	Mergus merganser	COME
Red-breasted Merganser	M. serrator	RBME
Osprey	Pandion haliaetus	OSPR
Bald Eagle	Haliaeetus leucocephalus	BAEA
Peregrine Falcon	Falco peregrinus	PEFA
Black-bellied Plover	Pluvialis squatarola	BBPL
Semipalmated Plover	Charadrius semipalmatus	SEPL
Black Oystercatcher	Haematopus bachmani	BLOY
Greater Yellowlegs	Tringa melanoleuca	GRYE
Spotted Sandpiper	Actitis macularia	SDSA
Whimbrel	Numenius phaeopus	WHIM
Black Turnstone	Arenaria melanocephala	BLTU
Surfbird	Aphriza virgata	SURF
Sanderling	Calidris alba	SAND
Western Sandpiper	C. mauri	WESA
Least Sandpiper	C. minutilla	LESA
Dunlin	C. alpina	DUNL
Dowitcher sp.	Limnodromus griseus/scolopaceus	SBDO
Red-necked Phalarope	Phalaropus lobatus	RNPH
Bonaparte's Gull	Larus philadelphia	BOGU
Mew Gull	L. canus	MEGU
California Gull	L. californicus	CAGU
Herring Gull	L. argentatus	HEGU
Thayer's Gull	L. thayeri	THGU
Western Gull	L. occidentalis	WEGU
Glaucous-winged Gull	L. glaucescens	GWGU
Black-legged Kittiwake	Rissa tridactyla	BLKI
Caspian Tern	Sterna caspia	CATE
Common Murre	Uria aalge	COMU
Pigeon Guillemot	Cepphus columba	PIGU
Marbled Murrelet	Brachyramphus marmoratus	MAMU
Cassin's Auklet	Ptychoramphus aleuticus	CAAU
Rhinoceros Auklet	Cerorhinca monocerata	RHAU
Mammals:		
Northern Sea Lion	Eumetopias jubatus	EUJU
California Sea Lion	Zalophus californianus	ZACA
Harbour Seal	Phoca vitulina	PHVT
Gray Whale	Eschrichtius robustus	ESRO

Appendix IV. Annotated list of species observed in the study area.

Pacific Loon (*Gavia arctica*): Occassional groups of up to 125 birds occurred in Pachena Bay, the outer half of Barkley Sound and in Wickaninnish Bay during April. Small numbers were observed in March.

Common Loon (*Gavia immer*): Scattered single birds and pairs were sighted throughout Barkley Sound and the Tofino/Grice Bay area.

Horned Grebe (*Podiceps auritus*): Few single birds were recorded in Barkley Sound and near Stubbs Island.

Red-necked Grebe (*P. grisegena*): A group of 30 were observed at the mouth of Trevor Channel on 27 March, and a flock of about 20 were regularly encountered in Duffin Passage and around Stubbs Island in April. Scattered individuals were seen thoughout the study area.

Western Grebe (*Aechmophus occidentalis*): Occassional flocks of up to 135 birds were sighted in Barkley Sound, and smaller groups occurred in deeper water in the Tofino area. No large concentrations comparable to those reported by M. Lemon (unpub.) in Barkley Sound between 7 and 17 March 1979 were encountered (see Discussion).

Double-crested Cormorant (*Phalacrocorax auritus*): Small numbers of adults and immatures were recorded in Barkley Sound (Table 8) and near Tofino, primarily during the latter part of March and early April.

Brandt's Cormorant (*P. penicillatus*): Concentrations of Brandt's Cormorants occurred mixed with Pelagic Cormorants in the vicinity of herring spawn sites in Barkley Sound during late March. Many were in breeding plumage at that time. About 300 were counted on Gowlland Rocks on 24 April. Larger numbers of cormorants were observed in Barkley Sound by M. Lemon (unpub.) during the first half of March 1979.

Pelagic Cormorants (P. pelagicus): Larger groups of Pelagic Cormorants were generally mixed with Brandt's Cormorants near herring spawn sites in Barkley Sound, and on Gowlland Rocks, but smaller, independent groups were encountered thoughout Barkley Sound. As with Brandt's Cormorants, the main concentrations occurred in March, but Pelagic Cormorants were more frequently sighted in April in Barkley Sound than Brandt's Cormorants. Many birds were in breeding plumage by late March.

Great Blue Heron (Ardea herodias): One to three herons were frequently observed in Ucluelet Inlet and on the mudflats around Tofino, and single birds were sighted in the Broken Group and in Mayne Bay.

Brant (Branta bernicla): In Barkley Sound, most Brant recorded were flying north across the mouth of the sound. One flock of seven birds was sighted on the water south of Turret Island on 8 April. In the Tofino/Grice Bay area Brant were sighted only on or around Stubbs Island, except for a brief 20 minute period on 27 April when the flock on Stubbs Island was scared off by a Bald Eagle and moved to the adjacent mudflat near Deadman Islets. The first Brant observed on Stubbs Island during the study period were two birds sighted on 21 March. D. Banks (pers. comm.) reported about 60 Brant on Stubbs around 28 March and about 100 on 5 April. Those flocks remained for brief periods only. Flocks of up to 420 foraging Brant were present on Stubbs Island during the latter two weeks of April, but all had moved on by 29 April. Detailed behavioral observations of Brant on Stubbs Island are reported in Rodway (1989).

Canada Goose (Branta canadensis): Flocks of up to 130 were sighted in Toquart Bay and along Macoah Passage in Barkley Sound and on the Tofino/Grice Bay mudflats between 17 March and 17 April. Larger flocks were observed flying over the study area.

Green-winged Teal (Anas crecca): Groups were identified along the shores of Equis Beach, Toquart Bay and Macoah Passage, and on the mudflats in the Tofino area.

Mallard (A. platyrhynchos): Mallard occurred in Toquart Bay, Macoah Passage and Ucluelet Inlet, but were most abundant in the Tofino mudflat area. Numbers were highest in late March and early April.

Northern Pintail (A. acuta): Pintail were sighted only on 22 April on Stubbs Island and the Ducking Island mudflats.

Northern Shoveler (A. clypeata): One to three pairs were seen on Stubbs Island between 18 and 27 April.

American Wigeon (A. americana): One pair were associated with a dense raft of Surf Scoters off Hand Island on 8 April, and small numbers were sighted in Ucluelet Inlet and on Stubbs Island during April.

Scaup sp. (Aythya marila/affinis): Small numbers of scaup were flocked with Surf Scoters around herring spawn sites in Barkley Sound. Larger groups of up to 60 birds were counted in Toquart Bay, Ucluelet Inlet and along the mudflats around Tofino.

Harlequin Duck (Histrionicus histrionicus): Scattered pairs occurred in Pachena Bay, the outer Deer Group and through the Broken Group. None were identified in the Tofino/Grice Bay area.

Oldsquaw (Clangula hyemalis): One oldsquaw was seen in Pachena Bay on 16 March, and six to nine birds frequented Heynen Channel, north of Stubbs Island, during April.

Surf Scoter (Melanitta perspicillata): Surf Scoters were the dominant species in Barkley Sound throughout April, concentrated in dense rafts of up to 22,000 birds around herring spawn areas. The largest concentrations initially occurred in the Hand Island area, but later in April largest numbers were present in the vicinity of Turret and Turtle islands. Maximum numbers

occurred on 4 April, when a total of 52,000 were estimated. Small flocks were sighted in the Long Beach/Tofino/Grice Bay area.

White-winged Scoter (*M. fusca*): Small numbers were mixed with rafts of Surf Scoters near herring spawn sites in the Broken Group.

Goldeneye sp. (*Bucephala clangula/islandica*): One group of 200 Barrow's Goldeneye was sighted in Macoah Passage on 8 April, but flocks were generally less than 30 birds. Most groups occurred along the north shore of Barkley Sound and in the Tofino/Grice Bay area, but a few goldeneye were encountered in the Broken and Deer groups.

Bufflehead (*B. albeola*): Bufflehead were the most abundant species in the Tofino/Grice Bay area during the latter part of March and the beginning of April. They were most numerous in Barkley Sound during the same period. A maximum total of 482 was counted on 3 April in the Tofino area. Males and females occurred in about equal proportions at the end of March, but by the end of April females outnumbered males 10 or 20 to one.

Hooded Merganser (*Lophodytes cucullatus*): Pairs of Hooded Mergansers were identified in Ucluelet Inlet and at Stubbs Island.

Common Merganser (*Mergus merganser*): Small flocks were sighted in the Broken Group, along the north shore of Barkley Sound, and in the Tofino/Grice Bay area.

Red-breasted Merganser (*M. serrator*): Scattered, small groups occurred through most of the study area except the outer beaches.

Osprey (*Pandion haliaetus*): An osprey occassionally flew over Stubbs Island, putting all foraging Brant in the air. One was seen deftly capture a fish out of the surf at Long Beach, only to immediately lose it to pirating Bald Eagles.

Bald Eagle (Haliaeetus leucocephalus): Eagles were frequent throughout the study area. The largest concentration noted was 20 birds gathered around the herring spawn site on Hand Island on 31 March. Eagles passing over Stubbs Island continually scared up foraging waterbirds, especially Brant. One was seen take what I suspected was a female Red-breasted Merganser.

Peregrine Falcon (Falco peregrinus): One falcon was sighted flying over Mud Bay on 4 April.

Black-bellied Plover (Pluvialis squatarola): One to three birds in summer plumage were foraging on Stubbs Island at the end of April. Four were sighted flying over Hand Island on 21 April.

Semipalmated Plover (Charadrius semipalmatus): Seventy-four were counted on Long Beach on 28 April. Smaller numbers were present on Stubbs Island on 25 and 26 April.

Black Oystercatcher (Haematopus bachmani): Sighted only in Pachena Bay, on Wizard Islet and on Gowlland Rocks.

Greater Yellowlegs (Tringa melanoleuca): Single birds were seen in Dodger Channel on 9 April, and on Stubbs Island on 27 April.

Spotted Sandpiper (Actitis macularia): One was spotted near Execution Rock on 15 April.

Whimbrel (Numenius phaeopus): There was a flock of 140 in Grice Bay on 18 April. I suspected that Whimbrel were a substantial portion of the groups of larger, unidentified shorebirds sighted in the area in the latter part of April.

Black Turnstone (Arenaria melanocephala): The largest number seen was 22 birds on Stubbs Island on 22 April. There were 4 birds in Macoah Passage on 17 March, and one on Execution Rock on 15 April.

Surfbird (Aphriza virgata): A flock of 420 Surfbirds were foraging along the rocky shore east of Execution Rock on 15 April, and small groups of 10 and 20

birds were sighted in Macoah Passage and on a reef in the Tiny Group on 21 and 22 April. One accompanied a flock of Black Turnstones on Stubbs Island on 22 April.

Sanderling (*Calidris alba*): There were 26 on Long Beach on 28 April.

Western Sandpiper (*C. mauri*): A small flock of 40 Western Sandpipers were reported on the Tofino mudflats on 3 April (D. Banks pers. comm.). Larger numbers were arriving in the area by 22 April.

Least Sandpiper (*C. minutilla*): Three Least Sandpipers on Stubbs Island on 25 April were the only ones identified during the study period, but others likely were present in the groups of unidentified peeps and shorebirds recorded in the area in late April.

Dunlin (*C. alpina*): Flocks of up to 49 Dunlin were identified on Stubbs Island in the latter half of April.

Dowitcher sp. (*Limnodromus griseus/scolopaceus*): Groups of up to 38 dowitchers were foraging on Stubbs Island at the end of April. Close flocks were identified as *L. griseus*. I suspected dowitchers formed a portion of the flocks of unidentified shorebirds sighted in the Tofino/Grice Bay area.

Red-necked Phalarope (*Phalaropus lobatus*): Fifty-four were sighted off Cape Beale on 19 April. Twelve landed amongst a flock of Brant at Stubbs Island on 18 April.

Bonaparte's Gull (*Larus philadelphia*): One was sighted in Mayne Bay on 8 April. Its head was almost all black.

Mew Gull (*L. canus*): A group of 1400 Mew Gulls were roosting on log booms in Toquart Bay on 8 April. Smaller flocks were seen on Hand Island and in Toquart Bay on the same day. Some Mew Gulls likely were present in the large concentrations of unidentified gulls sighted during aerial surveys. About 100 Mew Gulls were present on Clayoquot Spit on all visits during the last half of

April. Over the week of 22 April, the composition of the flock changed from mostly adults to mostly immatures.

California Gull (*L. californicus*): Six hundred California Gulls were identified on Hand Island and in Mayne Bay on the boat survey on 8 April. As with Mew Gulls, California Gulls were probably present in the concentrations of gulls observed during aerial surveys. Small numbers were seen on Chesterman Beach and Stubbs Island during the study period.

Herring/Thayer's Gull (*L. argentatus/thayeri*): Almost 3500 were clustered along the north shore of Barkley Sound from Toquart Bat to Beg Islands on 17 March. They were predominantly adults. Substantial numbers occurred in concentrations of gulls around herring spawn sites, but they were generally outnumbered by Glaucous-winged Gulls, especially towards the outer southwest islands in the Broken Group. Small flocks occurred on Chesterman Beach and Stubbs Island.

Western Gull (*L. occidentalis*): Two adults were sighted south of Pachena Point on 16 March.

Glaucous-winged Gull (*L. glaucescens*): Next to Surf Scoters, Glaucous-winged gulls were the most abundant species in Barkley Sound during most of the study period. They constituted the major portion of the large gull concentrations observed around herring spawn sites, though other species sometimes outnumbered them at specific locations. Gull numbers peaked in the first week of April and quickly declined after that. The composition of Glaucous-winged Gull flocks changed between the end of March, when many adults were present, and the middle of April, when most adults had left and predominantly immatures remained. Various sized groups of Glaucous-winged Gulls occurred throughout the study area.

Black-legged Kittiwake (*Rissa tridactyla*): A group of 150 was sighted south of Pachena Point on 16 March. About half were immatures and half were adults,

two of which were in summer plumage.

Caspian Tern (Sterna caspia): Two adults were roosting on Clayoquot Spit on 25 April, and two adults were flying over Long Beach on 28 April.

Common Murre (Uria aalge): Scattered murres were noted off and south of Cape Beale, in Trevor and Imperial Eagle channels, and offshore of the outer beaches between Ucluelet and Tofino.

Pigeon Guillemot (Cepphus columba): Occassional birds occurred through much of the study area. Some molting birds were observed on 17 March, but others sighted were in summer plumage.

Marbled Murrelet (Brachyramphus marmoratus): Marbled Murrelets were sporadic through most of Barkley Sound. They were most frequently sighted in Trevor Channel. The majority of birds were still in winter plumage at the end of March, molting into summer plumage early in April. They were scattered along the outer beaches on 24 April, and two were seen off Stubbs Island on 22 April.

Cassin's Auklet (Ptychoramphus aleuticus): Five birds were in Pachena Bay on 22 March.

Rhinoceros Auklet (Cerorhinca monocerata): Rhinoceros Auklets were common off Cape Beale, and small numbers were sighted along the outer beaches.