
Bird use of Baynes Sound - Comox Harbour, Vancouver Island British Columbia 1980 - 1981

Neil K. Dawe

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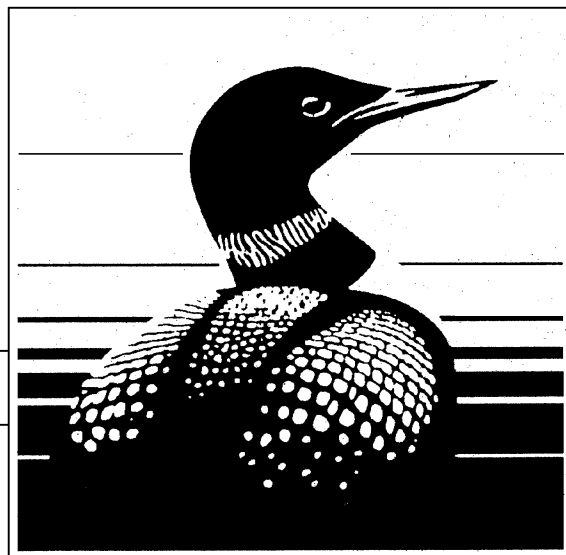
Donald E.C. Trethewey

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BIRD USE OF BAYNES SOUND - COMOX HARBOUR
VANCOUVER ISLAND, BRITISH COLUMBIA
1980-1981

Neil K. Dawe,
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Donald E.C. Trethewey.

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Abstract

Baynes Sound, British Columbia is internationally recognized as important for migratory waterbirds. Comox Harbour, which bounds Baynes Sound on the north is one of the largest low gradient deltaic deposits on the east coast of Vancouver Island. Together these protected waters and their many freshwater inputs function as a single estuary which, in British Columbia, is second only to the Fraser River in the number of birds it supports. The shoreline, which is described in some detail, has a great diversity of habitat ranging from kilometres wide intertidal mud and sand flats to rocky shorelines overlooking deep water. Much of the shore is in a relatively natural condition. To determine the abundance and distribution of migratory and resident birds on the Baynes Sound - Comox Harbour study area, weekly surveys were conducted from 11 October 1980 to 10 October 1981.

The number of bird species recorded using the study site was 176 including 67 species of passerines, 31 species of waterfowl, 19 species of shorebirds, 13 species of gulls (larids) and 13 species of raptors.

The study area supported a minimum of 59,053 birds in at least one stage of their life history during the year of study. The area near Roy Creek and the Trent River and another location just north of Hart Creek and Union Point recorded the highest bird use.

In spring 1981, more than half of the birds reported were waterfowl; shorebirds and passerines shared a distant second ranking. Summer 1981 had the lowest bird use during the year of study; the number of passerines and gulls became dominant in that season. In the autumn (1980 and 1981), waterfowl were again the highest user group. The highest bird use was recorded in winter. Diving ducks consistently outnumbered the dabbling ducks by approximately 2 or 3 to 1.

An annotated species list discusses arrival and departure dates, highest numbers seen in one day, important bird-use locations, and other details for each of the species. Some species, notably Western Grebes and Black Turnstones approached the provincial maxima for a one day count.

Concluding comments note human impacts particularly from direct disturbance of the birds and discuss possibilities for minimizing this disturbance. Suggestions are also made for further study of the avifauna that would complete the picture of bird use of the Baynes Sound - Comox Harbour area.

Résumé

Le détroit de Baynes, en Colombie-Britannique, est reconnu mondialement à cause de son importance pour les oiseaux aquatiques migrateurs. Le port de Comox, situé à son extrémité nord, constitue l'un des plus vastes dépôts deltaïques à faible pente de la côte est de l'île de Vancouver. Ces étendues d'eau abritées et les nombreux cours d'eau douce qui s'y jettent forment un estuaire qui vient au deuxième rang en Colombie-Britannique, après celui du Fraser, quant au nombre d'oiseaux qu'il accueille. La côte, décrite en détail, se compose de nombreux habitats différents, depuis les estrans de boue et de sable ayant plusieurs kilomètres de largeur jusqu'aux falaises rocheuses bordant des zones d'eau profonde. La majeure partie de la côte est encore à peu près dans son état naturel. On a effectué des relevés chaque semaine du 11 octobre 1980 au 10 octobre 1981 dans le but de déterminer le nombre et la distribution des oiseaux migrateurs et résidents dans la région étudiée, qui comprend le détroit de Baynes et le port de Comox.

Le relevé a permis de dénombrer 176 espèces d'oiseaux dans la région à l'étude : 67 espèces de passereaux, 31 espèces de sauvagine, 19 espèces d'oiseaux de rivage, 13 espèces de laridés (mouettes et goélands) et 13 espèces de rapaces.

Au cours de l'année où les relevés ont eu lieu, la région a accueilli au moins 59 053 oiseaux à au moins une étape de leur cycle biologique. Les environs du ruisseau Roy et de la rivière Trent et un autre endroit situé juste au nord du ruisseau Hart et de la pointe Union étaient les plus fréquentés par l'avifaune.

Au printemps de 1981, plus de la moitié des oiseaux observés appartenaient au groupe de la sauvagine, suivis de loin par les oiseaux de rivage et les passereaux. C'est à l'été de 1981 qu'on a enregistré le plus petit nombre d'oiseaux, en majeure partie des passereaux et des laridés. À l'automne (de 1980 et de 1981), les espèces de sauvagine formaient la majorité des oiseaux. C'est en hiver qu'on a enregistré le plus grand nombre d'individus. Les canards plongeurs surpassaient constamment en nombre les canards barboteurs dans un rapport d'environ 2 pour 1 ou 3 pour 1.

Une liste annotée des espèces indique les dates d'arrivée et de départ, le nombre maximum d'individus observés en une journée et les principaux lieux de fréquentation et fournit d'autres renseignements sur chaque espèce. Certaines espèces, notamment le Grèbe élégant et le Tournepierré noir, sont proches du maximum provincial pour le nombre d'individus observés en une journée.

Des remarques sur les effets des activités humaines, en particulier la perturbation directe des oiseaux, sont présentées en conclusion, et on traite des moyens possibles de réduire celle-ci le plus possible. De plus, on formule des suggestions concernant des études futures qui permettraient de compléter les connaissances sur l'utilisation du détroit de Baynes et du port de Comox par la faune avienne.

Table of Contents

Abstract	iii
Résumé	iv
Table of Contents	v
List of Tables	vii
List of Figures	viii
List of Appendices	xvii
Acknowledgements	xviii
Introduction	1
The Study Area	2
Methods and Limitations	18
Results and Discussion	24
Bird Use of the Baynes Sound - Comox Harbour Area	24
Habitat Use	29
Seasonal Numbers	30
Species Composition	33
Loons	33
Grebes	38
Cormorants	43
Hérons	46
Swans	47
Geese	49
Dabbling Ducks	53
Diving Ducks	64
Raptors	87
Pheasants, Grouse and Quails	90
Rails, Coots and Cranes	91
Shorebirds	93
Gulls and Terns	110
Alcids	119
Doves and Pigeons	122
Swifts	122
Hummingbirds	123
Kingfishers	123
Woodpeckers	123
Passerines	124
<i>Flycatchers</i>	126
<i>Swallows</i>	127
<i>Crows and Jays</i>	129
<i>Chickadees</i>	131
<i>Bushtits</i>	131
<i>Nuthatches</i>	131
<i>Creepers</i>	131
<i>Wrens</i>	132
<i>Dippers</i>	132
<i>Kinglets and Thrushes</i>	132
<i>Pipits</i>	136
<i>Waxwings</i>	136
<i>Shrikes</i>	136
<i>Starlings</i>	136

<i>Vireos</i>	136
<i>Wood Warblers, Sparrows and Blackbirds</i>	137
Warblers	137
Tanagers	138
Sparrows	138
Blackbirds	142
<i>Finches</i>	142
<i>Weaver Finches</i>	144
Conclusions	144
Comparative Significance of the Baynes Sound - Comox Harbour Area	144
Bird Use and Recreational Activities	149
Management Recommendations	149
Future Studies	150
Literature Cited	152
Appendices	155

List of Tables

Table 1.	<i>Shorezone units used during the Baynes Sound - Comox Harbour bird survey, 11 October 1980 through 10 October 1981 (see Figures 2 and 5 to 12).</i>	19
Table 2.	<i>Estimated minimum numbers of birds dependent on the Baynes Sound - Comox Harbour study area, 11 October 1980 through 10 October 1981, based on the maximum number of each species observed on migratory bird surveys. (For species names, see Appendix IV.)</i>	25
Table 3.	<i>Bird-use days calculated for each species and species group in each season on Baynes Sound - Comox Harbour, 11 October 1980 through 10 October 1981. (For species and group names, see Appendix IV.)</i>	26
Table 4.	<i>Maximum number of individuals of selected species seen on some estuaries of the Strait of Georgia from 1 November to 31 March (modified from Butler et al. 1987). Notes are explained on the following page. (For species names, see Appendix IV.)</i>	145
Table 5.	<i>Species with numbers on the Baynes Sound - Comox Harbour study area, 11 October 1980 through 10 October 1981, that surpassed the global thresholds for congregatory species.</i>	148

List of Figures

Figure 1.	<i>Location of the Baynes Sound - Comox Harbour study area (from Trethewey 1979).</i>	3
Figure 2.	<i>Comox Harbour landmarks and shorezone units (1 to 25) used to count birds, 11 October 1980 to 10 October 1981.</i>	5
Figure 3.	<i>Foreshore vegetation of Comox Harbour (from Trethewey 1979, courtesy Department of Fisheries and Oceans).</i>	6
Figure 4.	<i>Foreshore vegetation of the Baynes Sound area (from Trethewey 1979, courtesy Department of Fisheries and Oceans). The pattern of foreshore vegetation within each shorezone unit on Baynes Sound is shown in Figures 5 to 12.</i>	7
Figure 5.	<i>Shorezone units (23 to 26) and foreshore vegetation around Gartley Point. For details about vegetation mapping, see Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	8
Figure 6.	<i>Shorezone units (27 to 29) and foreshore vegetation, Beacon Creek to Union Point. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	9
Figure 7.	<i>Shorezone units (29 and 48) and foreshore vegetation near Henry Bay, Denman Island. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	10
Figure 8.	<i>Shorezone units (29 to 32) and foreshore vegetation near Union Bay. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	11
Figure 9.	<i>Shorezone units (33 to 36) and foreshore vegetation, Hindoo Creek to Buckley Bay. For key to vegetation see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	12
Figure 10.	<i>Shorezone units (37 to 39) and foreshore vegetation, Tsolum River to Ship Peninsula. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	13

Figure 11.	<i>Shorezone units (40 to 43 and 47) and foreshore vegetation, Ship Peninsula to Rosewall Creek. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	14
Figure 12.	<i>Shorezone units (44 to 46) and foreshore vegetation near Mapleguard Point. For key to vegetation see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).</i>	15
Figure 13.	<i>Herring spawning areas of Baynes Sound (from Trethewey 1979, courtesy Department of Fisheries and Oceans).</i>	16
Figure 14.	<i>Herring spawning areas of Comox Harbour (from Trethewey 1979, courtesy Department of Fisheries and Oceans).</i>	17
Figure 15.	<i>Proportional species group use of the Baynes Sound - Comox Harbour study area, spring 1981.</i>	30
Figure 16.	<i>Proportional species group use of the Baynes Sound - Comox Harbour study area, summer 1981.</i>	31
Figure 17.	<i>Proportional species group use of the Baynes Sound - Comox Harbour study area, autumn 1980 (beginning 11 October).</i>	32
Figure 18.	<i>Proportional species group use of the Baynes Sound - Comox Harbour study area, autumn 1981 (ending 10 October).</i>	32
Figure 19.	<i>Proportional species group use of the Baynes Sound - Comox Harbour study area, winter 1980-1981.</i>	33
Figure 20.	<i>Seasonal variations in the distribution of Pacific Loons (dashed line) and all loons combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	34
Figure 21.	<i>Seasonal fluctuations in the numbers of Pacific Loons (dashed line) and all loons combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	35
Figure 22.	<i>Seasonal variations in the distribution of Common Loons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	36
Figure 23.	<i>Seasonal fluctuations in the numbers of Common Loons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	37

Figure 24.	<i>Seasonal fluctuations in the numbers of Western Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	39
Figure 25.	<i>Seasonal fluctuatibns in the numbers of Horned Grebes (dotted line) and Red-necked Grebes (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	40
Figure 26.	<i>Seasonal variations in the distribution of Western Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	41
Figure 27.	<i>Seasonal variations in the distribution of Horned Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	42
Figure 28.	<i>Seasonal variations in the distribution of Red-necked Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	43
Figure 29.	<i>Seasonal fluctuations in the numbers of Double-crested Cormorants (dashed line), Pelagic Cormorants (dotted line) and all cormorants combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	44
Figure 30.	<i>Seasonal variations in the distribution of cormorants on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	45
Figure 31.	<i>Seasonal variations in the distribution of Great Blue Herons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	46
Figure 32.	<i>Seasonal variations in the distribution of Trumpeter Swans on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	47
Figure 33.	<i>Seasonal fluctuations in the numbers of Trumpeter Swans on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	48
Figure 34.	<i>Seasonal variations in the distribution of Brant on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	49
Figure 35.	<i>Seasonal fluctuations in the numbers of Brant on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	50

Figure 36.	<i>Seasonal variations in the distribution of Canada Geese on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	51
Figure 37.	<i>Seasonal fluctuations in the numbers of Canada Geese on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	52
Figure 38.	<i>Seasonal fluctuations in the numbers of dabbling ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	54
Figure 39.	<i>Seasonal variations in the distribution of dabbling ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	55
Figure 40.	<i>Seasonal fluctuations in the numbers of American Wigeon on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	56
Figure 41.	<i>Seasonal variations in the distribution of American Wigeon on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	57
Figure 42.	<i>Seasonal fluctuations in the numbers of Mallards on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	58
Figure 43.	<i>Seasonal variations in the distribution of Mallards on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	59
Figure 44.	<i>Seasonal fluctuations in the numbers of Northern Pintails on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	60
Figure 45.	<i>Seasonal variations in the distribution of Northern Pintails on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	61
Figure 46.	<i>Seasonal fluctuations in the numbers of Green-winged Teal (dashed line) and Blue-winged Teal (dotted line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	62
Figure 47.	<i>Seasonal variations in the distribution of Green-winged Teal on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	63

Figure 48.	<i>Seasonal fluctuations in the numbers of diving ducks (solid line) and birds recorded simply as ducks (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	65
Figure 49.	<i>Seasonal variations in the distribution of diving ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	66
Figure 50.	<i>Seasonal variations in the distribution of White-winged Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	67
Figure 51.	<i>Seasonal fluctuations in the numbers of White-winged Scoters (dashed line) and all scoters combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	68
Figure 52.	<i>Seasonal variations in the distribution of Surf Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	69
Figure 53.	<i>Seasonal fluctuations in the numbers of Surf Scoters (dotted line) and Black Scoters (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	70
Figure 54.	<i>Seasonal variations in the distribution of Black Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	71
Figure 55.	<i>Seasonal variations in the distribution of scaups on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	72
Figure 56.	<i>Seasonal fluctuations in the numbers of Greater Scaup (dashed line), Lesser Scaup (dotted line) and all scaups combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	73
Figure 57.	<i>Seasonal variations in the distribution of Bufflehead on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	74
Figure 58.	<i>Seasonal fluctuations in the numbers of Bufflehead on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	75
Figure 59.	<i>Seasonal variations in the distribution of Common Mergansers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	76

Figure 60.	<i>Seasonal fluctuations in the numbers of Common Mergansers (dashed line), Red-breasted Mergansers (dotted line) and all mergansers combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	77
Figure 61.	<i>Seasonal variations in distribution of Red-breasted Mergansers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	78
Figure 62.	<i>Seasonal fluctuations in the numbers of Harlequin Ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	80
Figure 63.	<i>Seasonal variations in the distribution of Harlequin Ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	81
Figure 64.	<i>Seasonal variations in the distribution of Common Goldeneye on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	82
Figure 65.	<i>Seasonal fluctuations in the numbers of Common Goldeneye (dashed line), Barrow's Goldeneye (dotted line) and all goldeneye combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	83
Figure 66.	<i>Seasonal variations in the distribution of Barrow's Goldeneye on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	84
Figure 67.	<i>Seasonal fluctuations in the numbers of Oldsquaw on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	85
Figure 68.	<i>Seasonal variations in the distribution of Oldsquaw on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	86
Figure 69.	<i>Seasonal fluctuations in the numbers of Bald Eagles on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	88
Figure 70.	<i>Seasonal variations in the distribution of Bald Eagles on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	89
Figure 71.	<i>Seasonal variations in the distribution of American Coots on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	91

Figure 72.	<i>Seasonal fluctuations in the numbers of American Coots on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	92
Figure 73.	<i>Seasonal fluctuations in the total numbers of shorebirds (solid line) and the number of birds identified simply as shorebird species (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	94
Figure 74.	<i>Seasonal variations in the distribution of shorebirds on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	95
Figure 75.	<i>Seasonal variations in the distribution of Black Turnstones on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	96
Figure 76.	<i>Seasonal fluctuations in the numbers of Black Turnstones on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	97
Figure 77.	<i>Seasonal fluctuations in the numbers of Dunlin on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	98
Figure 78.	<i>Seasonal variations in the distribution of Dunlin on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	99
Figure 79.	<i>Seasonal fluctuations in the numbers of Sanderlings on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	100
Figure 80.	<i>Seasonal variations in the distribution of Sanderlings on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	101
Figure 81.	<i>Seasonal variations in the distribution of Killdeer on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	102
Figure 82.	<i>Seasonal fluctuations in the numbers of Killdeer on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	103
Figure 83.	<i>Seasonal variations in the distribution of Black-bellied Plovers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	104
Figure 84.	<i>Seasonal fluctuations in the numbers of Black-bellied Plovers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	105

Figure 85.	<i>Seasonal fluctuations in the numbers of Western Sandpipers (solid line) and Least Sandpipers (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	107
Figure 86.	<i>Seasonal variations in the distribution of Greater Yellowlegs on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	108
Figure 87.	<i>Seasonal variations in the distribution of gulls on the Baynes Sound -Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	110
Figure 88.	<i>Seasonal fluctuations in the numbers of Glaucous-winged Gulls (dashed line) and all gulls combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	112
Figure 89.	<i>Seasonal variations in the distribution of Glaucous-winged Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	113
Figure 90.	<i>Seasonal fluctuations in the numbers of Mew Gulls (solid line) and Bonaparte's Gulls (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	114
Figure 91.	<i>Seasonal variations in the distribution of Mew Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	115
Figure 92.	<i>Seasonal variations in the distribution of Bonaparte's Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	116
Figure 93.	<i>Seasonal fluctuations in the numbers of Herring Gulls (dashed line) and Thayer's Gulls (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	117
Figure 94.	<i>Seasonal variations in the distribution of Herring Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	118
Figure 95.	<i>Seasonal fluctuations in the numbers of all alcids (solid line) and Common Murres (dotted line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	120
Figure 96.	<i>Seasonal variations in the distribution of alcids on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	121

Figure 97.	<i>Seasonal fluctuations in the numbers of all passerines combined (solid line), European Starlings (dotted line) and Northwestern Crows (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	125
Figure 98.	<i>Seasonal variations in the distribution of passerines on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	126
Figure 99.	<i>Seasonal fluctuations in the numbers of Barn Swallows (solid line) and Violet-Green Swallows (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	128
Figure 100.	<i>Seasonal variations in the distribution of Barn Swallows on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	129
Figure 101.	<i>Seasonal variations in the distribution of Violet-green Swallows on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	130
Figure 102.	<i>Seasonal fluctuations in the numbers of American Robins (solid line) and Golden-crowned Kinglets (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	133
Figure 103.	<i>Seasonal variations in the distribution of American Robins in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	134
Figure 104.	<i>Seasonal variations in the distribution of Golden-crowned Kinglets on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	135
Figure 105.	<i>Seasonal variations in the distribution of Dark-eyed Juncos in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	139
Figure 106.	<i>Seasonal fluctuations in the numbers of Dark-eyed Juncos (dashed line) and Pine Siskin (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	140
Figure 107.	<i>Seasonal variations in the distribution of Pine Siskins in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.</i>	143

List of Appendices

Appendix I.	<i>Bird surveys on Baynes Sound - Comox Harbour study area.</i>	156
Appendix II.	<i>List of surveyors and their initials, survey dates, and sundry remarks for the Baynes Sound - Comox Harbour study area.</i>	158
Appendix III.	<i>Key to Baynes Sound marine vegetation maps (Figures 5 to 12) including methods, descriptions and references.</i>	168
Appendix IV.	<i>Baynes Sound - Comox Harbour bird check-list.</i>	169
Appendix V.	<i>Seasonal variations in the distribution of all birds combined on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981. The Methods and Limitations section should be consulted when interpreting this chart.</i>	174
Appendix VI.	<i>Bird species diversity by shorezone unit for all birds (A) and for waterfowl (B; the numbers of diving duck species are shown in diagonal pattern) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981. The Methods and Limitations section should be consulted when interpreting these charts.</i>	175
Appendix VII.	<i>Baynes Sound - Comox Harbour bird surveys: Seasonal bird numbers, 11 October 1980 to 10 October 1981. Data is in ASCII code on 3.5 inch IBM-format diskette. Explanation of appendix and instructions</i>	176
Appendix VIII.	<i>Baynes Sound - Comox Harbour study area birds surveys: Seasonal bird use by shorezone unit, 11 October 1980 to 10 October 1981. Data is in ASCII code on 3.5 inch IBM-format diskette. Explanation of appendix and instructions</i>	177

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Once again, members of the Comox-Strathcona Natural History Society have taken a local initiative and worked hard to gather information on the bird use, both migratory and resident, of a most important habitat--Baynes Sound (see also Brooks et al. 1994). As one of the most active field-naturalist organizations in the province, they participated in weekly bird surveys of this large area for an entire year. The contributions of the members of the Society to their communities and the avifauna of the Baynes Sound area should not be underestimated.

Phil Capes (Comox Strathcona Natural History Society) coordinated the surveys. Members assisting Capes with the surveys included, in alphabetical order, Jean Allan, June Belsom, Sid Belsom, Tonia Billie, G. Brandie, J. Cartwright, Vi Chungranes, Mac Beddle, Steve Ellis, Erma Fitzpatrick, Michael Fitzpatrick, Walter Fitzpatrick, Dulcie Hamilton, Willie Haras, Allan Hendriks, Gus Hendriks, Keith Henn, Eric Hyde, Jim Lunam, Georgina McCuig, Isobel McLeish, Brian Mahoney, Diana Maloff, Ruth Masters, Anaka Meyers, Doris Miller, June Miller, M. Miller, Maureen Mills, Keith Morton, Norma Morton, M. O'Neil, Wilma Patterson, Maureen Pegler, Ann Perkins, Adele Routledge, Dave Routledge, Nini Smith, Pat Smith, Lilian Stewart, Howard Telosky, Ruth Towers, and Olga Whipps.

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Introduction

Estuaries along coastal British Columbia are important to a diverse wildlife fauna, particularly resident and migratory birds (Dawe 1976, 1980, Dawe and Lang 1980, Dawe et al. 1994, Butler and Cannings 1989, Butler et al. 1989, Vermeer et al. 1992). This diverse fauna occurs as a result of two major factors: the variety of habitats that meet on these systems and the productivity of those habitats.

Habitats often associated with typical estuarine ecosystems include marine deep water areas, intertidal sand and gravel flats, cobble beaches, mudflats, spits, river and associated riparian habitats, brackish and saline estuarine marshes with their accompanying dendritic channels, and upland grass, forb, and shrub areas that grade to coastal forests.

This concentration of habitats with its accompanying edges and niches supports a tremendous diversity and abundance of wildlife. For example, inventories from the Little Qualicum River estuary, with an upland area of less than 40 ha, have reported minimums of 14 species of algae, 55 species of fungi, 22 species of bryophytes, 234 species of vascular plants, 29 species of molluscs, 62 families of arthropods, 15 species of fishes, 4 species of amphibians, 4 species of reptiles, 220 species of birds, and 20 species of mammals (Dawe 1976, 1980, unpublished).

Nutrients and sediments brought down from the watersheds by the rivers are deposited on the deltas providing rich substrates and growing conditions for estuarine marsh plants that, along with marine vegetation such as eelgrass (*Zostera* sp.) and algae, drive the detritus-based estuarine food web. Net primary production of these systems with their attendant marshes and algal beds rival, and in some cases exceed, the production of the tropical rain forests (Ricklefs 1979).

These estuarine ecosystems are important to the survival of both resident and migratory birds. Estuaries act as stepping stones to the millions of birds that migrate along our coast each year providing areas where they can rest and feed during their northern and southern journeys.

In addition, British Columbia's estuaries support Canada's largest wintering populations of waterbirds. Estuaries, in concert with farmlands and freshwater wetlands, form part of a wetlands complex (Eamer 1985) that supports hundreds of thousands of wintering waterbirds. However, during periods of freezing when farmlands and freshwater marshes are no longer accessible, estuaries become critical habitat to the birds' survival (see Dawe 1980 and Eamer 1985). They are the only ice free areas that have enough food to support the birds over the freezing periods.

The Canadian Wildlife Service (CWS) has long recognized the importance of these areas and over the past 15 years has gathered data on the bird use of many estuaries. This report documents bird use and numbers on Baynes Sound and Comox Harbour, British Columbia over the period 11 October 1980 through 10 October 1981, and highlights the importance of this area to resident and

migratory birds. The purpose of the report is to provide information for wildlife managers and others involved in the management and decision-making process. The intention is that it will assist them in maintaining the migratory birds resources of their districts and communities. The results will also be of interest to the birdwatching public who want to know more about the avifauna of Baynes Sound and Comox Harbour.

The Study Area

Baynes Sound is situated between the east coast of Vancouver Island, British Columbia, and Denman Island. The Baynes Sound - Comox Harbour study area (Figure 1) extends from the Courtenay River estuary at the head of Comox Harbour (49°41'N, 124°58'W) to Deep Bay and Mapleguard point (49°28'N, 124°44'W) approximately 35 kilometres to the southeast. From Willemar Bluff (southwest of Cape Lazo) and Goose Spit around to Gartley Point, the study area covers both sides of Comox Harbour as well as the coastal areas on Vancouver Island and Denman Island.

Baynes Sound is a shallow coastal channel fringed by protected bays, more than 5000 hectares of open foreshore, inshore marshes and adjacent forests. The area includes the tidal estuaries of not less than 23 creek or river systems (Clermont in preparation). Comox Harbour is one of the largest low gradient estuaries on the east coast of Vancouver Island and Baynes Sound exhibits many of the same characteristics (Trethewey 1979).

The surficial geology is predominantly glacial (unconsolidated sands, gravels and tills) and glacial marine, overlain in some areas by fluvial or organic deposits (Jungen 1985). These unconsolidated deposits dominate most of the beaches except on Denman Island and some of the headlands where exposed or nearly exposed bedrock has formed a significant portion of the coastline. Ship Peninsula, for example, is described by Jungen (1985) as having a rock platform shoreline with a beach veneer (see Table 1, shorezone unit 39).

The mean daily temperature at Comox Airport ranges from a monthly average of 2.1°C in January to 17.4°C in July; the yearly average is 9.3°C. The area has a mean annual precipitation of 1207 mm and includes 106 cm of snow (Environment Canada AES records 1941-1970). The summer months are relatively dry but variable. The rainshadow of the Vancouver Island Mountains and the Beaufort Range affects precipitation; the relationship between topography and wind direction often creates large variations in the rainfall at various locations within the study area.

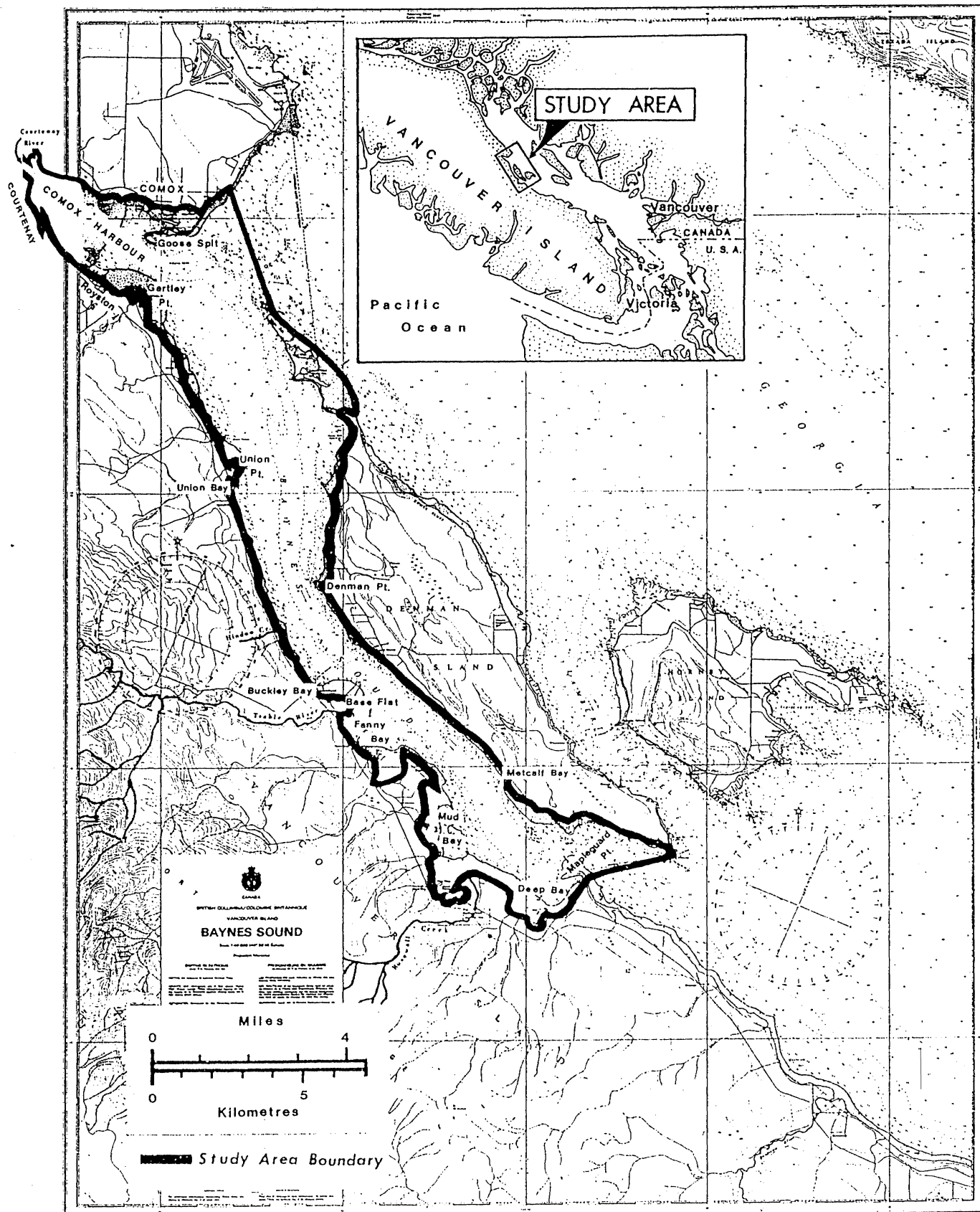


Figure 1. Location of the Baynes Sound- Comox Harbour study area (from Trethewey 1979).

The Courtenay River is the major source of freshwater flowing into Comox Harbour; it carries the combined flow of the Puntledge River (mean annual discharge = $42.6 \text{ m}^3/\text{s}$) and the Tsolum River ($10.8 \text{ m}^3/\text{s}$). The flow of the Puntledge River has been regulated by a dam since 1913. The other major streams in the study area drain the Beaufort Range to the south: the Trent River; Hart Creek (Washer Creek); Hindoo Creek; Tsable River ($7.8 \text{ m}^3/\text{s}$); Cowie Creek ($1.4 \text{ m}^3/\text{s}$) including its tributary, Cougar-Smith Creek; Wilfred Creek (Coal Creek); Waterloo Creek; Rosewall Creek ($2.6 \text{ meter}^3/\text{second}$); McNaughton Creek; Chef Creek (Cook Creek); and Lymn Creek.

Vancouver Island, in the area west of Baynes Sound is described as being primarily in the Coastal Western Hemlock Biogeoclimatic Zone whereas Denman Island and areas to the east are mostly in the Coastal Douglas Fir Zone. Plant associations present around the Sound vary depending on the chronology of land uses, especially logging, drainage, grazing and other disturbances. The dominant species on wet ground are Western Red Cedar, Red Alder, Skunk Cabbage and Slough Sedge. Detailed mapping of the marine vegetation in the study area is shown in Figures 3 to 12.

Salmon and herring at various stages in their life cycles are important resources to the birds of the area. At least 15 of the streams flowing into the Baynes Sound - Comox Harbour area are known to be used by spawning salmonids including Coho, Chum, Chinook, Pink, Sockeye, Steelhead and Cutthroat Trout. In 1975, about 45,000 adult salmon and their broods passed through the Comox harbour on their way upstream and on their way out to sea. Efforts to rebuild the major salmon runs on the Puntledge River have been undertaken since the runs were damaged by human activities including the construction of a dam and later the development of hydro-electric facilities (Morris et al. 1979). A new hatchery started operations in 1980 - 1981. Baynes Sound is an important rearing area for juvenile salmon from streams within the study area as well as from streams that enter the Strait of Georgia farther south.

Pacific Herring use is also high and good spawning sites are abundant, as shown in Figures 13 and 14. The locations within the study area where herring spawning was considered most important to migratory birds were: around Goose Spit and Comox Bar, inside Comox Harbour, along the south shore from Gartley Point to Beacon Creek, and from Union Bay south to Hindoo Creek (Trethewey 1979).

Land uses in and around the study area are diverse, ranging from near wilderness along some parts of Baynes Sound to urban and suburban development, especially in the cities of Courtenay and Comox. Nearby, there are large areas of commercial pasture and crop lands. In addition, Baynes Sound is the most important area in the province for oyster mariculture. An overview of the history and significance of the Baynes Sound - Comox Harbour area in terms of its environmental and social values is presented by Morris et al. (1979), Clermont (in preparation) and Fry (in preparation). Human activities are discussed, including conservation and development and the impacts of these activities on the values of Baynes Sound.

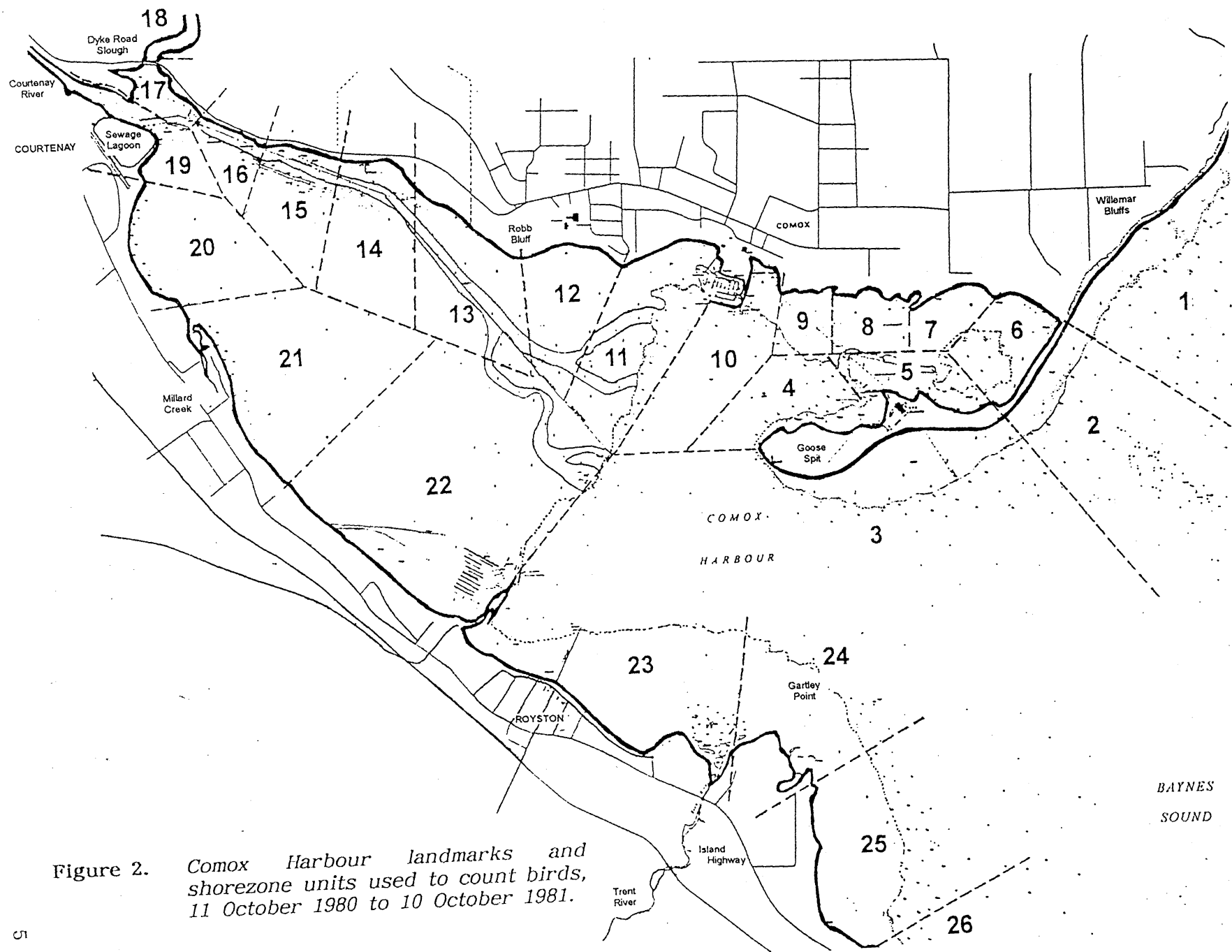


Figure 2. Comox Harbour landmarks and shorezone units used to count birds, 11 October 1980 to 10 October 1981.

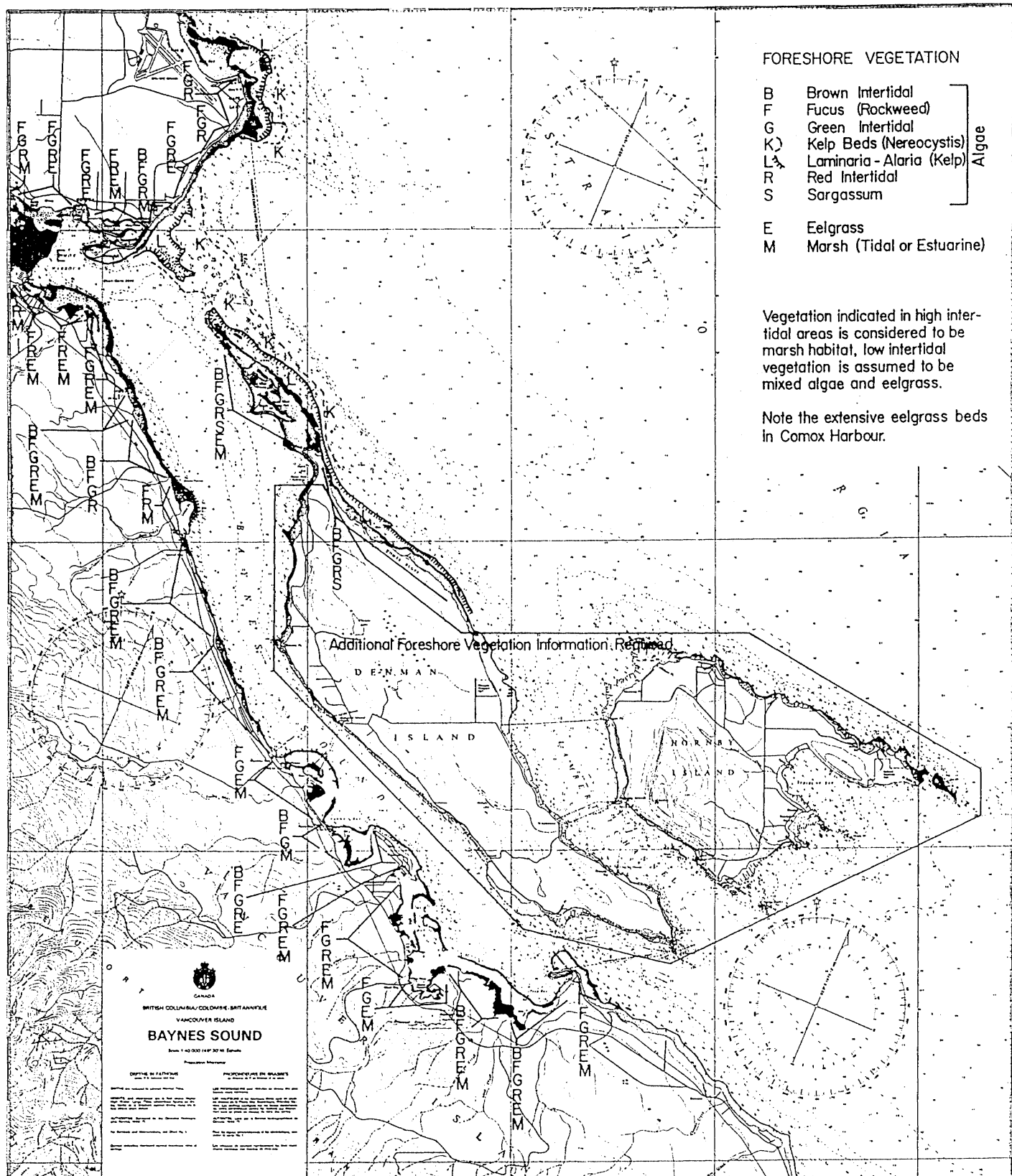


Figure 4. Foreshore vegetation of the Baynes Sound area (from Trethewey 1979, courtesy Department of Fisheries and Oceans). The pattern of foreshore vegetation within each shorezone unit on Baynes Sound is shown in Figures 5 to 12.

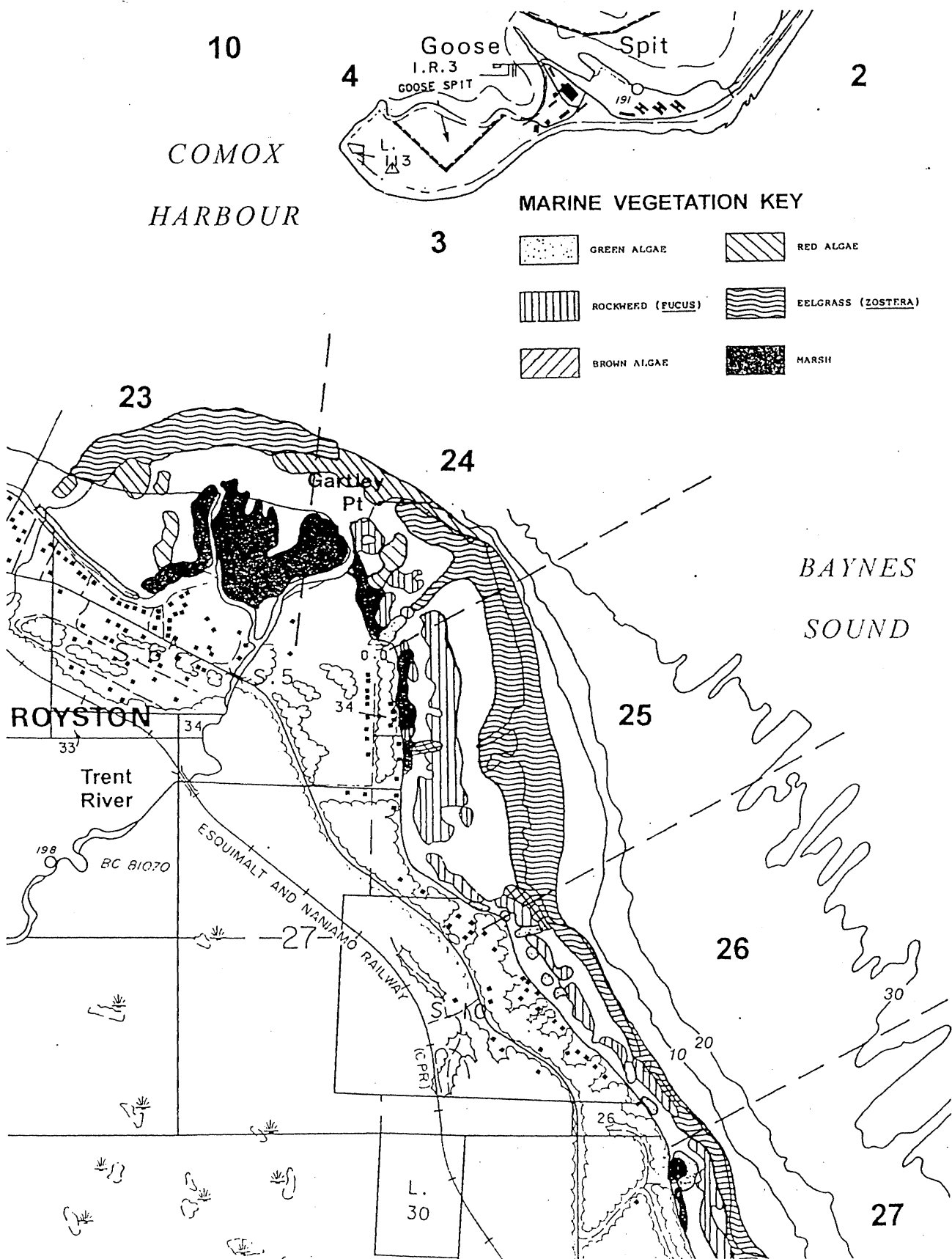
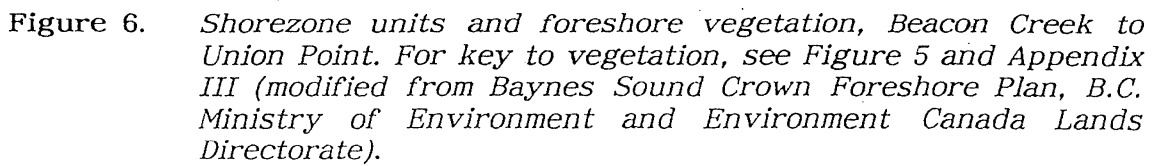


Figure 5. Shorezone units and foreshore vegetation around Gartley Point. For details about vegetation mapping, see Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).



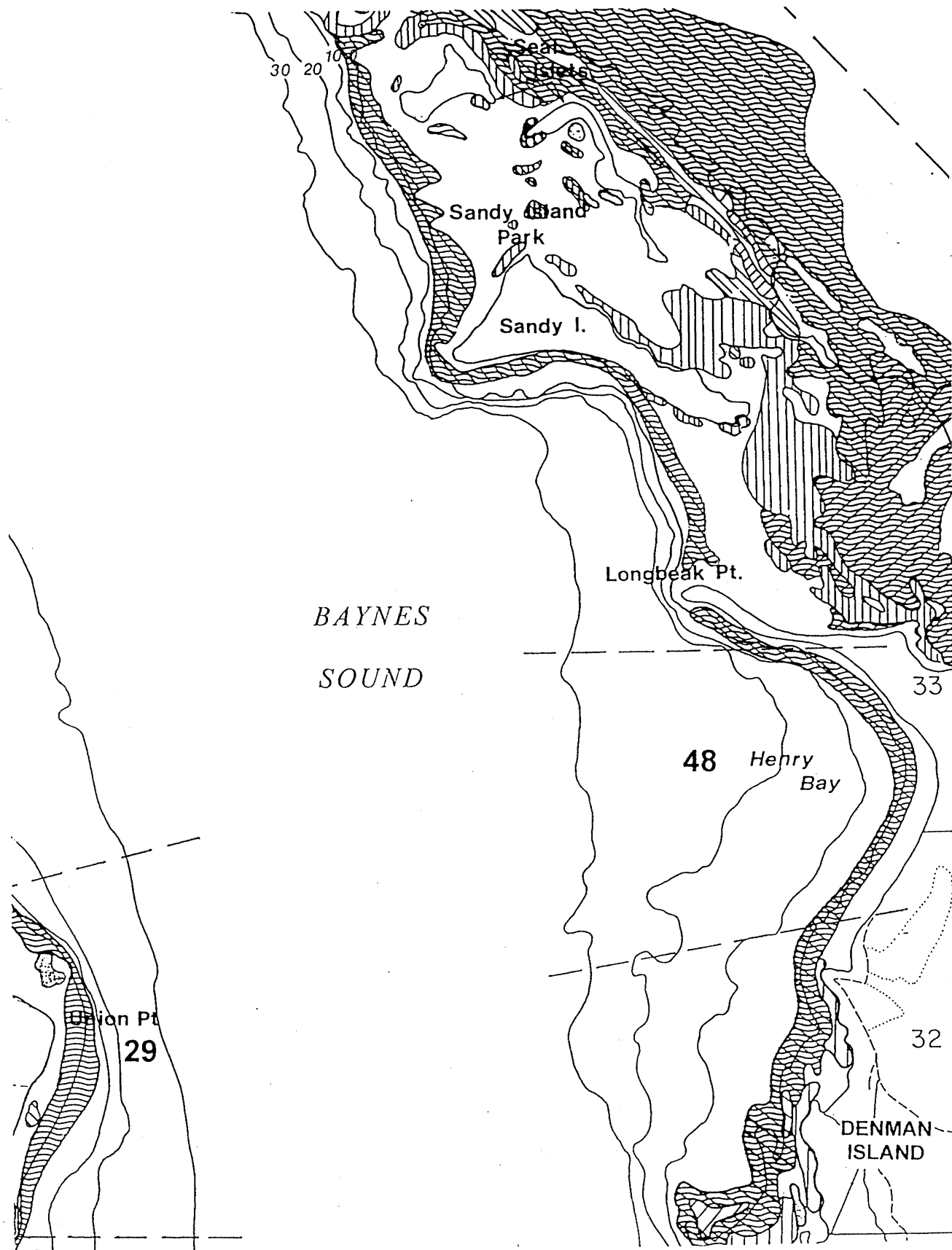


Figure 7. Shorezone units and foreshore vegetation near Henry Bay, Denman Island. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).

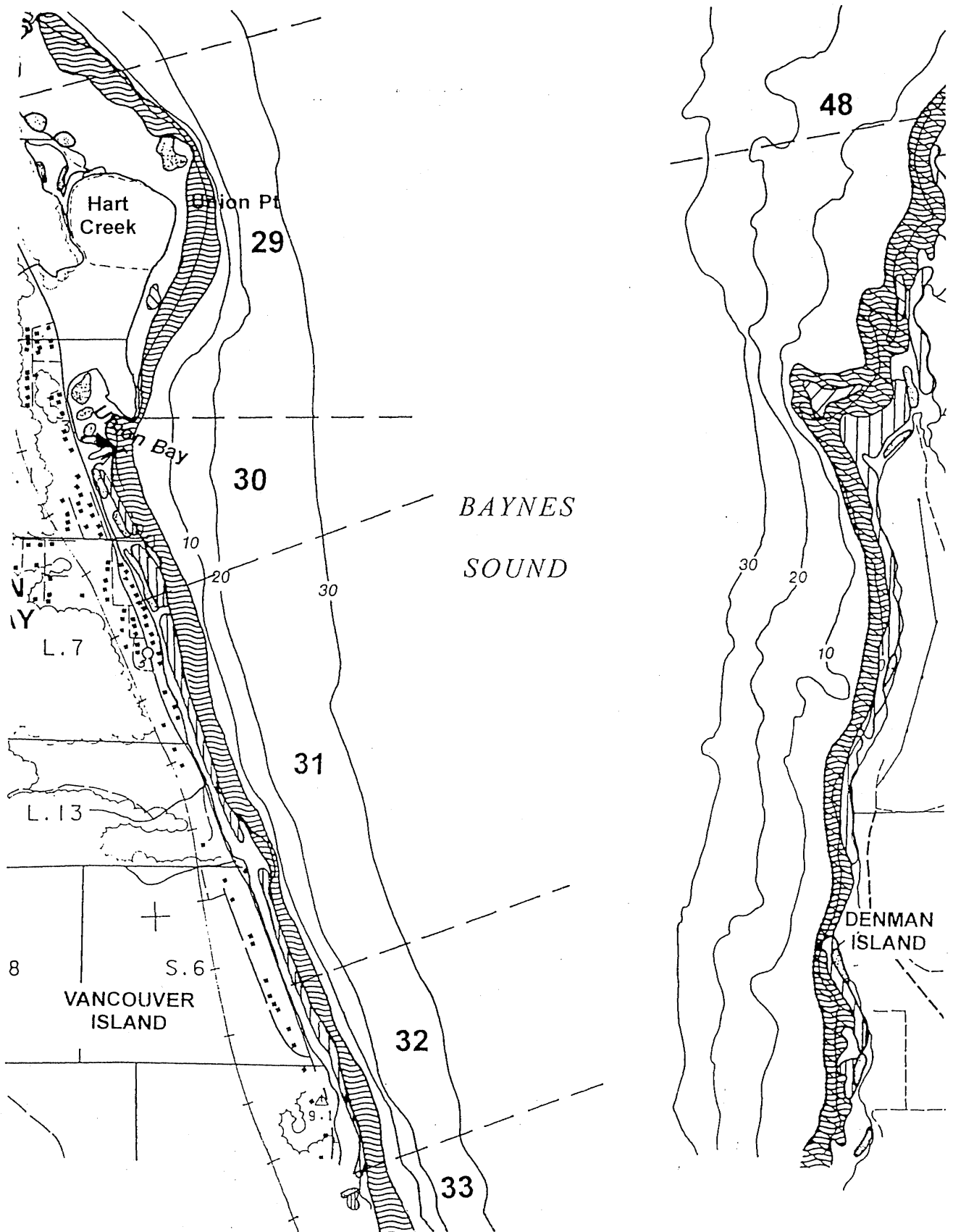


Figure 8. Shorezone units and foreshore vegetation near Union Bay. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).

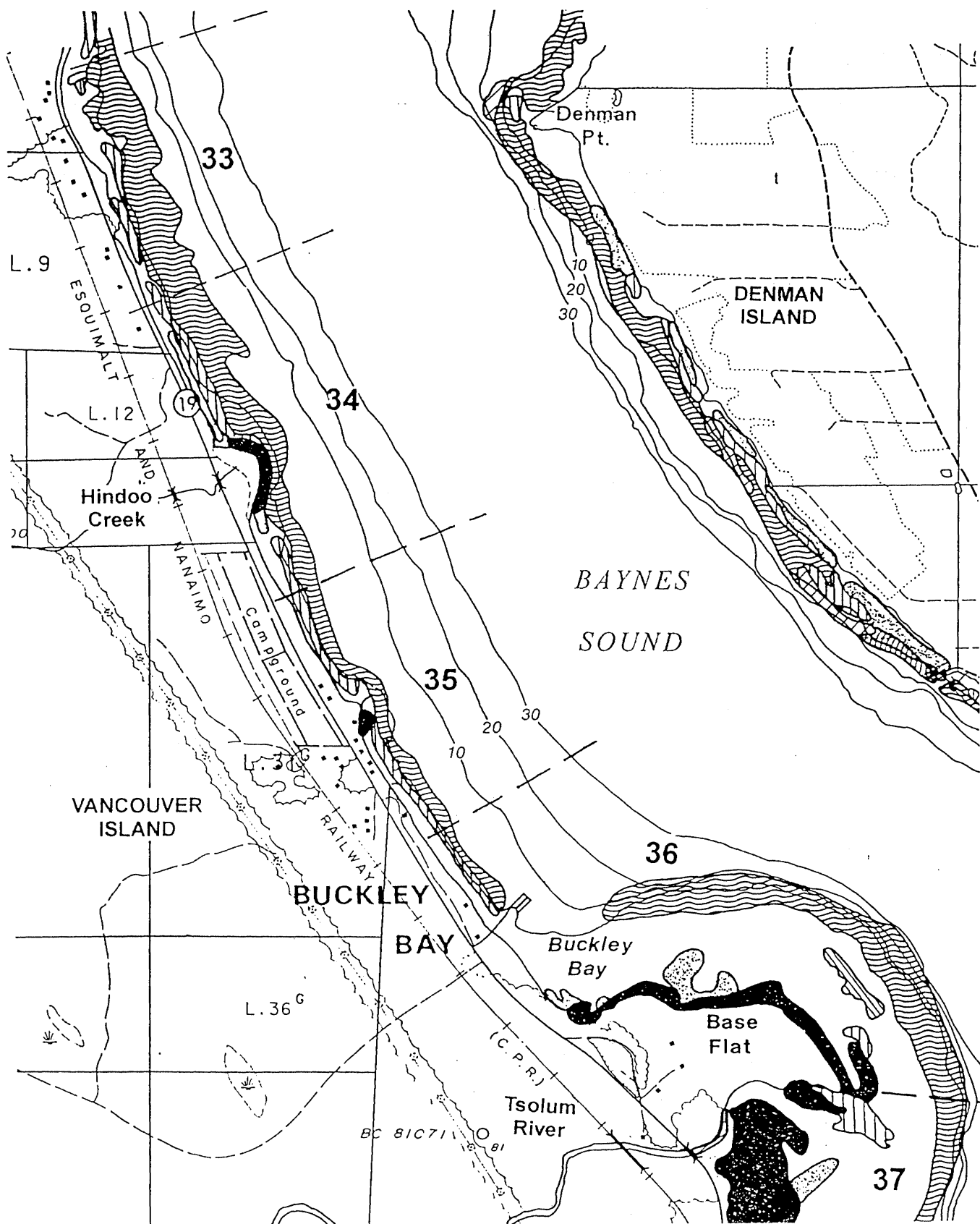


Figure 9. Shorezone units and foreshore vegetation, Hindoo Creek to Buckley Bay. For key to vegetation see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).

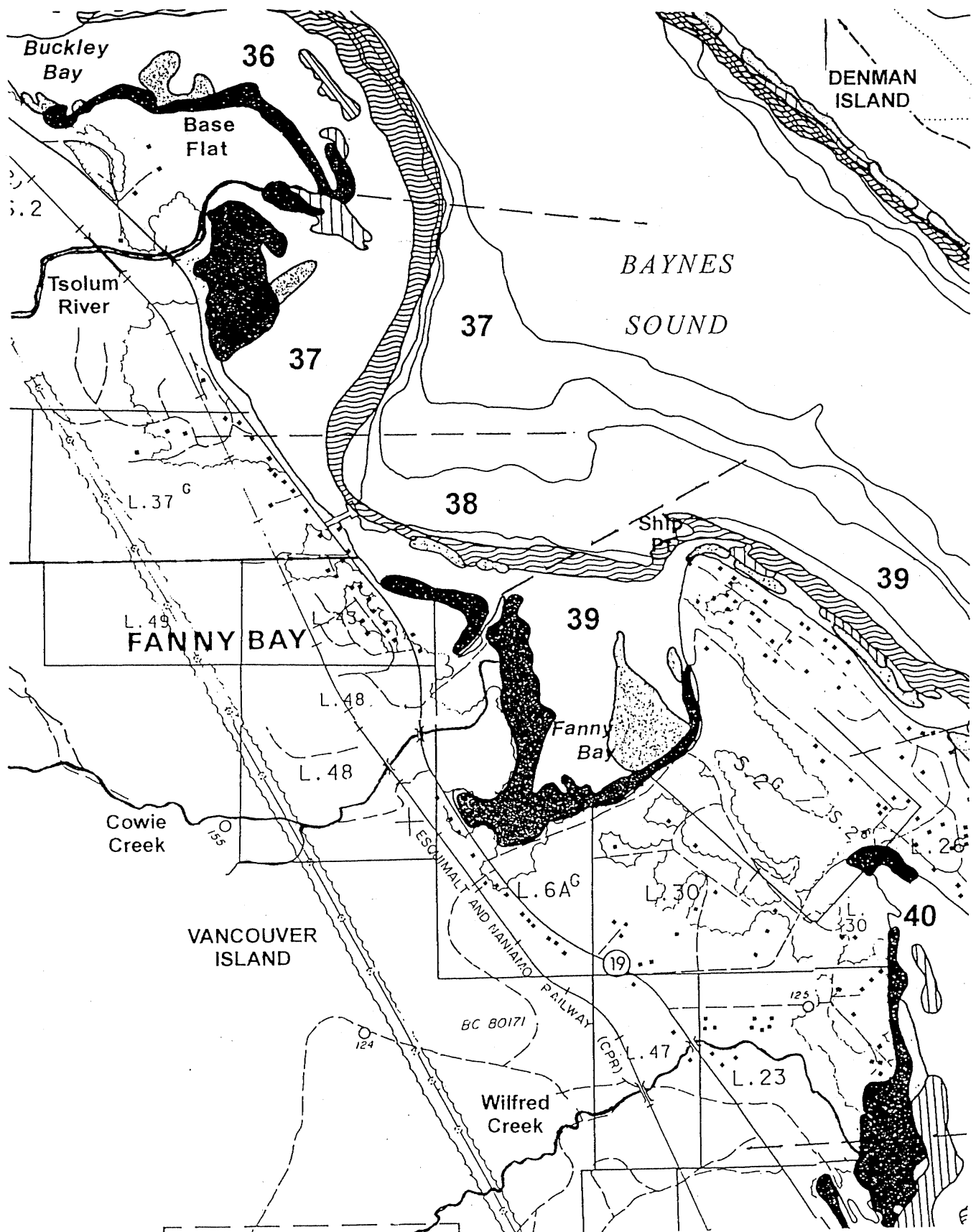


Figure 10. Shorezone units and foreshore vegetation, Tsolum River to Ship Peninsula. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).

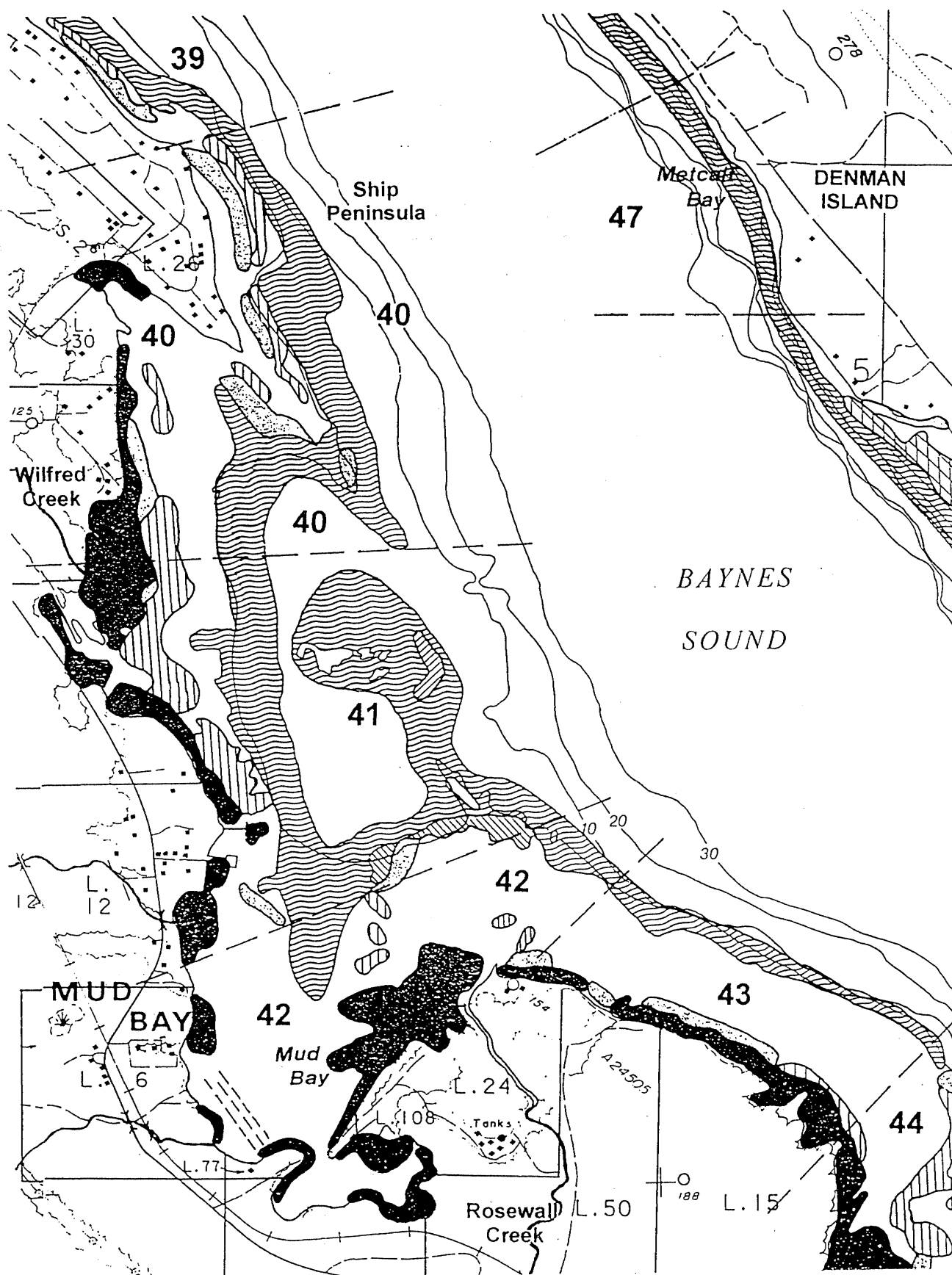


Figure 11. Shorezone units and foreshore vegetation, Ship Peninsula to Rosewall Creek. For key to vegetation, see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).

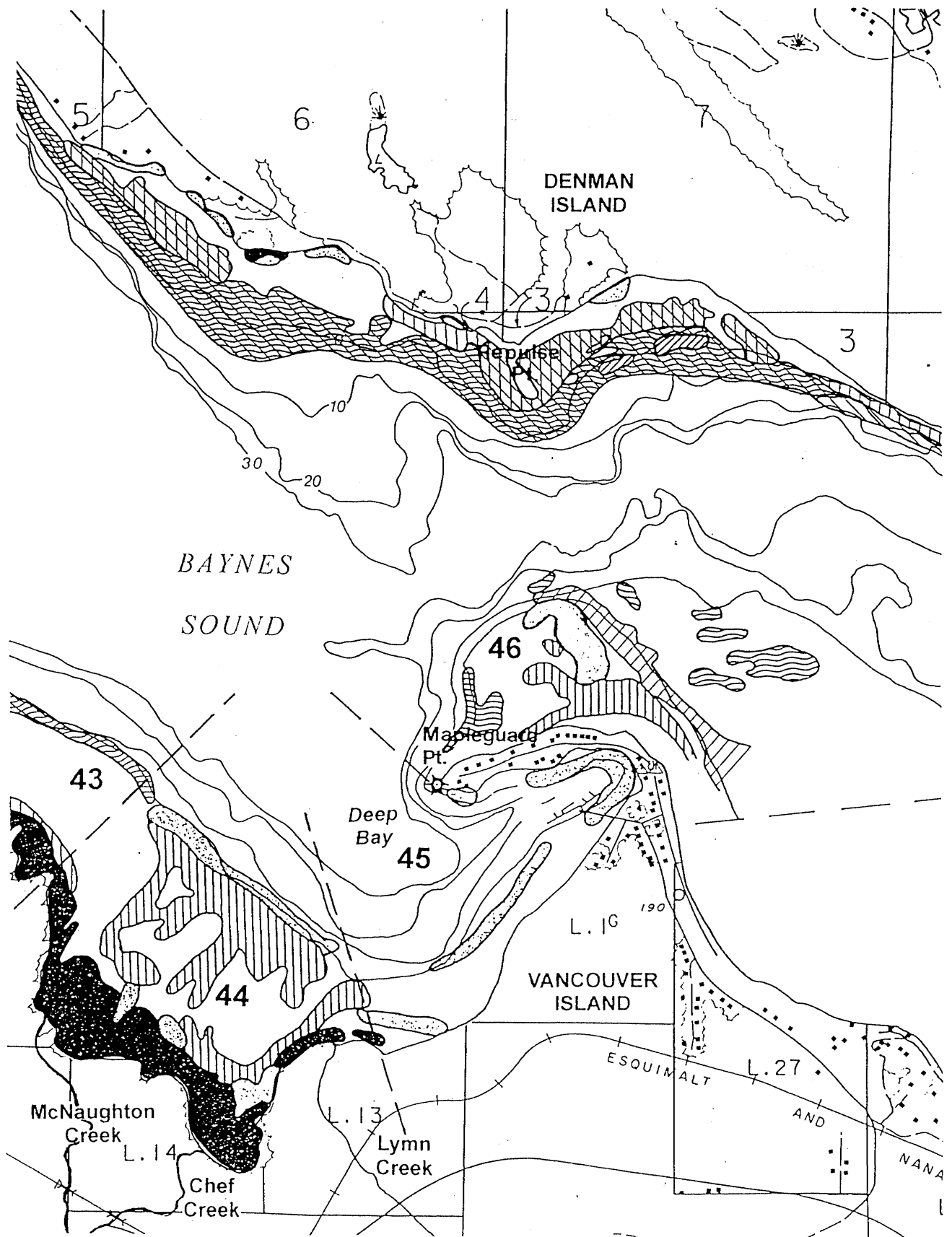
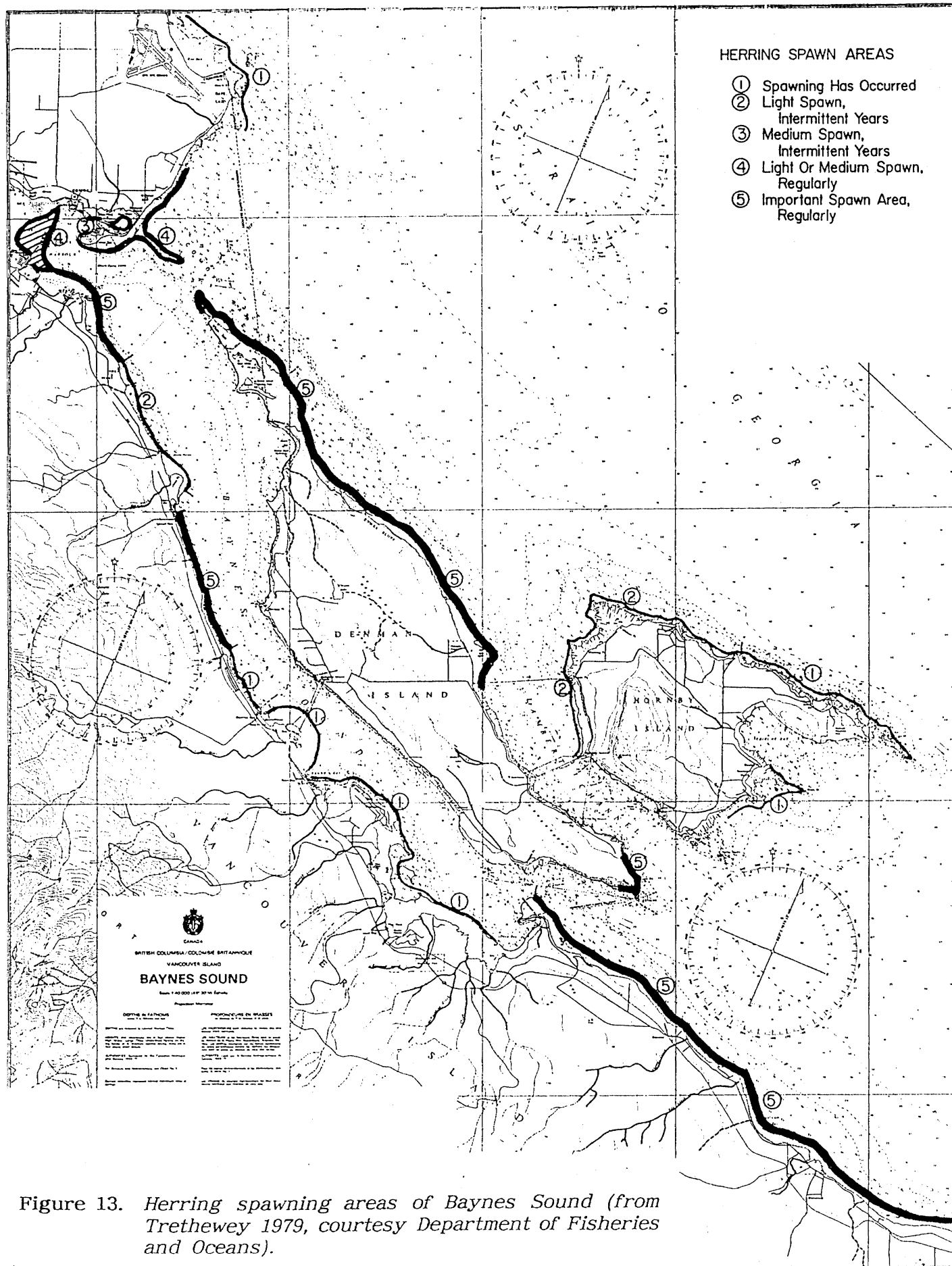


Figure 12. Shorezone units and foreshore vegetation near Mapleguard Point. For key to vegetation see Figure 5 and Appendix III (modified from Baynes Sound Crown Foreshore Plan, B.C. Ministry of Environment and Environment Canada Lands Directorate).



Methods and Limitations

The study area was divided into 48 shorezone units to determine locations of high bird use within Baynes Sound and Comox Harbour (Table 1 and Figures 2 and 5 to 12). Each survey team covered a number of adjacent shorezone units, thus avoiding the problem of counting the same birds twice on the same day. Although teams used different numbering systems to describe the areas they covered, all the data have been compiled into shorezone units numbered from 1 to 48 starting at Willemar Bluffs in the northeast, counting around Goose Spit and Comox Harbour, and then south along the Vancouver Island coast of Baynes Sound to shorezone unit 46 at Mapleguard Point. Unit 47 is at Metcalf Bay on Denman Island across Baynes Sound from Ship Peninsula and unit 48 is at Henry Bay on the north end of Denman Island. The shorezone units cover virtually all of the coastal waters of Vancouver Island which lie within the study area. However, the 2 shorezone units on the Denman Island side of the Baynes Sound - Comox Harbour study area represent only a small sample of the coastline there.

The study was instigated and designed by Neil K. Dawe and Donald E.C. Trethewey with assistance from Phil Capes and other members of the Comox-Strathcona Natural History Society. Week to week logistics were handled by Trethewey and Capes. Survey participants covered the study area by car and on foot and, using binoculars and telescopes, counted and recorded all birds observed within the area assigned to each shorezone unit. Weekly surveys were conducted from 11 October 1980 through 10 October 1981.

Various kinds of landmarks were arbitrarily designated to divide the beach and coastal waters into non-overlapping areas. However, participants were sometimes obliged to survey an area from a different location or locations because of seasonal or permanent changes in access or visibility. Some units were omitted for short periods (see Appendix I) and, on occasion, units were combined or subdivided or new surveyors interpreted the boundaries of the areas in slightly different ways. Where possible, the counts have been redistributed to provide consistent data (see Appendices I and II). These factors should be taken into consideration when comparing the data of adjacent units.

Surveyor effort is important when comparing bird counts or season totals. Figures showing seasonal fluctuations in the numbers of many species and species groups are included in the annotated species list (see Species Composition); the data points represent actual birds counted on the whole (or nearly the whole) of the study area on a single day so they are only slightly affected by surveyor effort. However, to compare the total counts between seasons it is necessary to consult Appendix I which shows the number of surveys per season and Table 3 which shows the bird-use days for each season. For example, only one survey was completed in December 1980 (except at shorezone units 47 and 48 where 2 surveys were completed) but in November 1980 and in January 1981 there were 4 or 5 surveys performed each month at most shorezone units. Thus, the number of birds observed in December and the whole of winter is lower relative to other months or seasons. In this case, the December 6 survey was omitted from the seasonal fluctuations charts for all species; bird-use days are interpolated over that period to provide meaningful comparisons between seasons. Note also the lack of summer surveys on Denman Island (units 47 and 48).

Table 1. *Shorezone units used during the Baynes Sound - Comox Harbour bird survey, 11 October 1980 through 10 October 1981 (see Figures 2 and 5 to 12).*

Shorezone unit ¹	Location ²	Shore Description ^{3,4}	Deepest Water ⁵
I 1	at Willemar Bluffs, E of Comox, looking SE and E towards entrance of Baynes Sound.	sand and boulders below cliffs [200m intertidal width]; broad, shallow ⁶ subtidal bar almost to Denman Island	5m
I 2	on isthmus of Goose Spit, looking SE from Spit Rd, towards Baynes Sound.	broad sandy beach [200m] with >1 km of shallow ⁶ water beyond and some offshore bars	3m
I 3	S side of Goose Spit (excluding isthmus) from guardhouse to tip, looking S and SW.	broad sandy beach [400m] becomes narrow near the western tip and the deeper water of the harbour	35m
I 4	N side of Goose Spit from tip to CFB Quadra wharf, looking NW and N.	narrow sandy beach near deep water to W; mud beach, wharf, dolphins and piles to E and N	22m
I 5	N side Goose Spit (excluding isthmus) from CFB Quadra wharf to guardhouse, looking N.	broad [600m] mud and sand beach with some protected shallow ⁶ water; water is divided into units 5 and 8	1m
I 6	inner area west of Goose Spit isthmus as seen from Spit Rd, looking NW to point.	intertidal mud flats and shallow ⁶ water lagoon divided into units 6 and 7 [>600m total width between high tide lines]	2m
I 7	between small points, as seen from beach access, S end of Croteau Rd (off Lazo Rd).	intertidal mud flats and sheltered shallow ⁶ water [>600m total width across units 7 and 6]	2m
I 8	mouth of Brooklyn Ck to point near outfall pipe, as seen from S end of Filberg Rd.	intertidal mudflats with a mud and gravel delta to W; some shallow ⁶ water to S, towards unit 5	1m
I 9	at beach access, bottom of Jane St hill, looking S and E to point near outfall.	intertidal mud and sand [300-400m wide] with a small area of deeper water visible,	15m
I 10	at government wharf, off Port Augusta St, looking 270° from Jane St to breakwater.	modified beach with boulders, causeway, wharf and breakwater overlooking water	20m
I 11	at Port Augusta Park (Beaufort Ave-Carthew St) viewing the breakwater to Beach Drive.	mud and sand with boulders, stones and gravel, [200m wide]; some deeper water visible	14m
I 12	at the end of Beach Drive, looking W and SW as far as Robb Bluff and a line of buoys.	edge of intertidal flats [>2km total width] with sand, gravel and mud cut by changeable river channels	inter-tidal ⁷
II 13	between Robb Bluff and the bottom of "Comox hill", looking S.	mud and sand flats and changeable river channels [>2km total width across units 13 and 23]	inter-tidal ⁷

Shorezone unit ¹	Location ²	Shore Description ^{3,4}	Deepest Water ⁵
II 14	between bottom of "Comox hill" and 2 waterfront homes at 3035 and 3235, Comox Drive.	intertidal mud and sand flats [>2km total width] with several channels including the major river channel	inter-tidal ⁷
II 15	between waterfront homes (3035 and 3235 Comox Drive) and "Sonny Billie's" boat ramp.	estuary with intertidal mud and sand flats [2km total width]; major river channel in foreground	inter-tidal ⁷
II 16	between "Sonny Billie's" boat ramp, Comox Dr and "cement plant" hopper, looking S.	estuary of intertidal mud and sand flats [1km wide]; major river channel in the foreground	inter-tidal ⁷
II 17	the entrance of Dyke Rd Slough W of "cement plant" hopper and S of bridge.	fluvial sediments, often overlain by organic materials; booming grounds visible	inter-tidal ⁷
II 18	that part of Dyke Rd Slough from bridge on Comox Dr (Dyke Rd) and N.	sediments and organic materials	inter-tidal ⁷
II 19	Courtenay R mouth, sewage lagoon, and S to gravel bar near end of airfield runway.	river outflow into channel across intertidal mud and sand flats plus artificial sewage basin	inter-tidal ⁷
II 20	between gravel bar and tip of point near Millard Ck, as seen from Mansfield Drive.	intertidal mud and sand flats [several km wide]	inter-tidal ⁷
III 21	Millard Ck, adjacent point and Millard Rd beach access, from ck mouth to Marriot Dr.	intertidal mud and sand flats [1-2km wide]; some gravel on beach near Marriot Dr	inter-tidal ⁷
III 22	between Marriot Rd and breakwater, looking NE over CZ booming grounds and Comox Hbr.	mud and sand flats to edge of intertidal area [total width >2km] divided by units 22 and 13; mud flats, booming grounds near shore	1m
III 23	breakwater, pilings, Roy Ck, and Trent R mouth, at Royston waterfront, Marine Drive.	mud and gravel at beach grading to intertidal mud [200-500m wide]; deep water beyond breakwater	10m
III 24	on Gartley Point, looking N and E over the entrance to Comox Hbr.	sandy gravel delta with tidal channels; [intertidal width >500m]; depths increasing quickly to 30m just beyond intertidal area	35m
IV 25	Gartley Beach, between Gartley Point and Capeman Ck, looking NE.	sandy gravel beach with some sandy areas [500m wide]; 30m depths beyond intertidal	35m
IV 26	between Capeman Ck and nautical beacons, at Beacon Ck, looking NE.	cobbly pebbly boulder beach with some sand and shell hash. [100-200m wide]; >20m depths just beyond intertidal	30m

Shorezone unit ¹	Location ²	Shore Description ^{3,4}	Deepest Water ⁵
IV 27	Beacon Ck, Spindrift Drive and Craigdarroch subdivision, looking NE from Argyle Rd.	small sandy gravel delta [300m wide]; cobbly pebbly boulder beach with some sand and shell hash [200m wide]; >20m depths just beyond intertidal	30m
IV 28	looking NE from Glover's Rd booming ground to the area N of the mouth of Hart Ck. ⁹	small gravelly sand delta [80m]; sandy beach [20-50m wide] modified ⁸ by cobbles and boulders; sandy gravel delta modified ⁸ by coal and debris [>200m wide]	26m
V 29	on Union Point overlooking Hart Ck ⁹ mouth and Baynes Sd.	sandy gravel delta and gravel beach [up to 400m wide] modified ⁸ by coal and debris; gravelly sand beach [20-80m]; >25m depths beyond intertidal	33m
V 30	Union Bay and S, as seen from public boat ramp across Island Hwy from post office.	muddy sand tidal flat [up to 100m across bay] below old coal slag pile; gravelly sand beach [10-50m]; entire area close to highway rip-rap	27m
V 31	just north of Baynes Sound Oyster Co. and small ck adjacent to it, looking E.	gravelly sand beach [10-50m] divided by a small sandy gravel delta [100m]; some areas modified ⁸ by shell mounds; highway rip-rap nearby	35m
V 32	litter barrels by hwy near Garvin Rd at point of land 4.5 km N of Buckley Bay ferry terminal.	gravelly sand beach [10-20m]; gravelly sand beach with shell hash [>50m]; entire tideline close to highway rip-rap	42m
V 33	near rest stop, Island hwy; Denman Point appears directly across Baynes Sd to E.	gravelly sand beach [>50m wide] with shell hash N of viewing spot; narrower beach [20-50m] to S; entire tideline close to highway rip-rap	42m
V 34	Hindoo Ck and Joe Walker Beach, as seen from small point of land S of Hindoo Ck.	gravelly sand delta with multiple tidal channels [>50m] surrounded on either side by gravelly sand beaches [20-50m] close to highway rip-rap	40m
V 35	near Island Highway-Mckay Rd intersection, 1 km N of Buckley Bay ferry terminal.	2 gravelly sand beaches with shell hash; sandy gravel delta with multiple channels; a low cliff above entire tideline; [10-50m wide, narrower to S]	37m
V 36	Buckley Bay, Base Flats and E, almost to mouth of Tsable R, looking NE and E.	gravelly sand beach with shell hash [10-20m]; part of beach modified by ferry terminal; muddy pebbly sand delta with multiple channels [400m]	35m

Shorezone unit ¹	Location ²	Shore Description ^{3,4}	Deepest Water ⁵
VI 37	mouth of Tsable R and up to, but not including, Fanny Bay waterfront, looking E	muddy pebbly sand delta with multiple channels [500m wide]	>31m
VI 38	Fanny Bay waterfront and wharf and E to the mouth of Cowie Ck ⁹ , looking NE and E.	shell-mounds and rip-rap near Island Hwy [10-20m]; mixed beach; sandy gravel delta with multiple channels [variable up to 500m wide]	25m
VI 39	the head of Fanny Bay and around most of Ship Peninsula.	sandy gravel delta with multiple channels [400-500m wide]; muddy sand tidal flat [800m across bay]; rock platform with beach veneer [20-50m wide] on peninsula	55m
VI 40	the S end of Ship Peninsula, Little Bay and S to the mouth of Wilfred Ck ⁹ .	rock platform with beach veneer [20-50m] and S 800m on intertidal point; muddy sand tidal flat [600m across bay entrance]; edge of sandy gravel delta with multiple channels	47m
VI 41	Wilfred Ck ⁹ , Waterloo Ck and S almost to piles and log booms at Mud Bay waterfront.	2 sandy gravel deltas with multiple channels [200-800m]; a sandy gravel beach [to 200m] between deltas; edge of tidal flats to S	6m
VII 42	Mud Bay log booms and Rosewall Ck mouth (inclusive), as seen from either end.	muddy sand tidal flats [1000m intertidal width from head of Bay]; sandy gravel delta with multiple channels [400m]; some deep water visible	26m
VII 43	between Rosewall Ck and McNaughton Ck (exclusive), near Wavell Rd off Berray Rd.	sandy gravel beach with some shell hash [400m]; good views of deep water beyond	56m
VII 44	McNaughton Ck, Chef Ck ⁹ and Lymn Ck ⁹ , from the mouth of Chef Ck, looking N.	muddy, gravelly sand deltas with overlapping multiple channels in a broad intertidal bay [800m intertidal width] adjacent to Deep Bay; the edge of deep water is just visible	20m
VII 45	Deep Bay including waters between point of land E of Lymn Ck ⁹ and Mapleguard Point.	cobbly, pebbly, sand beach, with some shell hash [20-80m]; 5 to 10m high cliff above beach; large government dock near base of Mapleguard Point	47m
VII 46	on Mapleguard Point, looking NW, N and NE	sand spit with sand beach, narrow to NW and N [20-40m] but broad to NE [400-600m]; good views of deep water	51m
VIII 47	Metcalf Bay, Denman Island, looking W and SW.	rock platform with beach veneer [10-50m] and some pebbly cobbly sand sediments; gravelly sand beaches and some shell hash [10-20m]; views of deep water 2km across to unit 40	51m

Shorezone unit ¹	Location ²	Shore Description ^{3,4}	Deepest Water ⁵
VIII 48	Henry Bay, Denman Island, looking W and SW.	sandy gravel beach, pebbly cobble beach over sand and shell hash [10-50m]; sand beach [>100m]; sandy gravel delta with shell hash [20-50m]	22m

Table 1 Abbreviations and Notes:

CFB = Canadian Forces Base, Department of National Defence;
 CZ = Crown Zellerbach, a forestry company;
 St = street; Rd = road; Ave = avenue; Dr = drive; Hwy = highway;
 Hbr = harbour; Sd = sound; Ck = creek; R = river;
 N, E, S and W are the compass directions from true north;
 m = meter or meters; km = kilometre or kilometres;
 > means "greater than" ; < means "less than"

note¹ Numbers 1 to 48 have replaced all other numbering systems originally used by survey groups. Each Roman numeral represents an area for which surveys were performed or at least organized by the same group of people, thereby providing continuity.

note² Locations are defined: landmarks, nautical markers, the centerline of a water body as judged from either side. In some cases, the unit is defined by the edges of what is visible from a particular location.

note³ Based on nautical charts (Canadian Hydrographic Service, 1975, 1977) and, for shorezone units 24 to 48, on maps of shore units produced under the supervision of M.M. Wayne as part of the Baynes Sound Crown Foreshore Plan (B.C. Ministry of Environment and Environment Canada Lands Directorate, 1983).

note⁴ Square brackets indicate intertidal widths in meters perpendicular to the tide lines unless otherwise specified.

note⁵ Maximum water depths in meters within 1 kilometre of surveyors' position. This is considered the limit of consistent identification using a spotting scope (Butler et al. 1989).

note⁶ The adjective "shallow" refers here to depths of 1 to 3 meters below lowest normal tides.

note⁷ Some channels and slough areas are permanently flooded; depths vary.

note⁸ "modified" refers to human (i.e. anthropogenic) alterations

note⁹ Many creeks in the area have several names in regular use by local residents, highway signs, etc. Herein creek names follow Surveys and Mapping Branch, B.C. and Canadian Hydrographic Service.

Washer Ck = Hart Ck

Cougar-Smith Ck is a tributary of Cowie Ck

Coal Ck = Wilfred Ck

Chef Ck = Cook Ck

Lymn Ck = Sandy Ck

The numbers of birds recorded are considered to be generally accurate for the areas surveyed but are undoubtedly conservative due to inherent limitations (see Dawe 1982). Poor visibility due to weather, and birds underwater or shielded by vegetation during the period of observation would lead to an underestimation of the numbers of birds recorded. The data are based on observations at a particular point in time and do not necessarily reflect the total bird use of the area under observation. For example, birds dependent on the estuaries and deeper waters of the sound only for a few days during spring and autumn migration could be missed altogether if observation periods occurred on either side of their arrival and departure. Also, data were not collected at night; however, low tides on the study area during the winter months occur mostly during the night. Thus, in winter, observations were not made when the intertidal areas and algal beds were exposed, i.e. at times when they would likely be used by birds such as dabbling ducks.

Survey data were summarized using BASIC programs written by Allan Keller, CWS, and modified to create seasonal summaries and statistics by the senior author (Appendices VII and VIII). The summarized data were analysed and much of the first draft of the report written by Ron Buechert under contract to the Mid Island Wildlife Watch Society. His contribution was reviewed and edited by Dawe and Trethewey.

Results and Discussion

Bird Use of the Baynes Sound - Comox Harbour Area

Over the study period, 176 species of birds were identified on the Baynes Sound - Comox Harbour study area. A total of 696,199 birds was recorded; however, any individual bird that was seen again on a subsequent survey would be tallied more than once over the study period.

To estimate the minimum number of birds dependent on the study area, the maximum single day bird numbers for each species were summed (Table 2). The result is that a minimum of 59,053 birds depended on the Baynes Sound - Comox Harbour area for some aspect of their life history.

The bird-use day is a statistic that represents 1 bird that is present in an area for 1 day. Although a bird count does not involve watching any particular bird for a continuous 24 hour period, extrapolation between bird surveys is used to estimate the numbers of bird-use days for each species or species group, for each season and for the whole year of study (Table 3). Estimates of bird-use days are less affected by surveyor effort; therefore bird-use days (instead of bird counts totalled over many surveys) are used to compare abundance between seasons in the annotated species list (see Species Composition) and between this and other bird use studies.

Species	Number	Season	Species	Number	Season	Species	Number	Season
RTLO	22	Win 80	CAQU	3	Spr 81	BASW	145	Sum 81
PALO	1005	Win 80	AMCO	112	Aut 80	STJA	40	Aut 81
COLO	160	Aut 81	SACR	5	Aut 80	NOCR	1003	Win 80
YBLO	1	Aut 80	BBPL	426	Aut 81	CORA	23	Win 80
PBGR	26	Spr 81	LGPL	7	Win 80	CBCH	169	Aut 80
HOGH	206	Aut 80	SEPL	1	Win 80	BUSH	15	Sum 81
RNGR	357	Aut 81	KILL	115	Aut 80	RBNU	9	Aut 81
EAGR	18	Aut 80	BLOY	4	Aut 80	BRCR	2	Aut 80
WEGH	10356	Win 80	GRYE	58	Aut 81	BEWR	13	Win 80
DCCO	98	Win 80	LEYE	18	Aut 81	HOWR	1	Spr 81
BRCO	16	Aut 80	SPSA	224	Sum 81	WIWR	25	Win 80
PECO	263	Win 80	WHIM	10	Spr 81	AMDI	2	Aut 80
GBHE	136	Sum 81	RUTU	1	Aut 81	GCKI	163	Win 80
TUSW	2	Win 80	BLTU	3093	Aut 80	RCKI	21	Spr 81
TRUS	179	Win 80	SURF	36	Aut 80	SWTH	37	Sum 81
GWFG	1	Aut 80	SAND	500	Sum 81	HETH	1	Spr 81
SNGO	39	Aut 80	WESA	223	Sum 81	AMRO	345	Spr 81
BRAN	5291	Spr 81	LESA	46	Aut 81	VATH	15	Spr 81
CAGO	195	Aut 80	DUNL	2020	Win 80	AMPI	35	Aut 81
GWTE	132	Spr 81	SBDO	82	Aut 81	CEWA	19	Sum 81
MALL	2001	Aut 80	LBDO	21	Sum 81	NOSH	2	Aut 80
NOPI	673	Win 80	COSN	15	Spr 81	EUST	2283	Aut 81
BWTE	65	Spr 81	PAJA	3	Aut 81	SOVI	1	Sum 81
CITE	6	Spr 81	SPSK	1	Aut 81	HUVI	2	Spr 81
NOSL	34	Aut 81	FRGU	1	Aut 80	WAVI	1	Sum 81
GADW	1	Spr 81	BOGU	1356	Aut 81	REVI	2	Sum 81
EUWI	7	Spr 81	MEGU	1256	Spr 81	OCWA	57	Spr 81
AMWI	2254	Spr 81	RBGU	3	Sum 81	YEWA	17	Spr 81
CANV	48	Spr 81	CAGU	50	Aut 80	MGWA	2	Sum 81
RNDU	18	Win 80	HEGU	934	Win 80	YRWA	36	Spr 81
GRSC	2265	Win 80	THGU	257	Win 80	BTGW	2	Spr 81
LESC	205	Aut 80	WEGU	2	Win 80	TOWA	7	Spr 81
HADU	387	Spr 81	GWGU	6250	Win 80	COYE	6	Spr 81
OLDS	143	Win 80	GLGU	9	Sum 81	WIWA	5	Sum 81
BLSC	960	Aut 80	COTE	68	Aut 81	WETA	2	Spr 81
SUSC	1847	Aut 80	COMU	138	Win 80	RSTO	32	Win 80
WWSC	2436	Aut 80	PIGU	55	Spr 81	ATSP	4	Win 80
COGO	458	Aut 80	MAMU	63	Sum 81	CHSP	5	Spr 81
BAGO	205	Spr 81	RODO	87	Aut 80	SAVS	127	Aut 81
BUFF	672	Spr 81	BTPI	40	Sum 81	FOSP	27	Win 80
HOME	15	Aut 80	MODO	1	Spr 81	SOSP	77	Aut 81
COME	644	Spr 81	BLSW	3	Sum 81	WTSP	2	Sum 81
RBME	812	Win 80	VASW	8	Aut 81	GCSP	28	Aut 81
RUDU	1	Win 80	RUHU	46	Spr 81	WCSP	25	Spr 81
TUVU	18	Aut 81	BEKI	29	Aut 81	DEJU	241	Aut 80
OSPR	5	Sum 81	RBSA	1	Win 80	RWBL	58	Spr 81
BAEA	354	Win 80	DOWO	2	Spr 81	WEME	1	Spr 81
NOHA	2	Aut 81	HAWO	5	Spr 81	BRBL	30	Win 80
SSHA	3	Aut 80	NOFL	24	Spr 81	BHCO	21	Sum 81
COHA	3	Aut 81	PIWO	6	Spr 81	NOOR	3	Sum 81
NOGO	1	Aut 81	OSFL	1	Sum 81	ROFI	2	Aut 80
SWHA	1	Aut 80	WWPE	2	Spr 81	PIGR	11	Win 80
RTHA	3	Win 80	WIFL	5	Sum 81	PUFI	29	Spr 81
GOEA	2	Aut 80	HAFL	1	Sum 81	HOFI	60	Aut 80
AMKE	1	Aut 80	PSFL	1	Spr 81	PISI	676	Aut 81
MERL	2	Aut 80	TRSW	25	Spr 81	AMGO	77	Sum 81
PEFA	1	Win 80	VGSW	141	Spr 81	EVGR	14	Win 80
RNPH	2	Aut 80	NRWS	16	Spr 81	HOSP	2	Spr 81
RUGR	6	Sum 81	CLSW	19	Sum 81			
						Total	59053	

Table 2. *Estimated minimum numbers of birds dependent on the Baynes Sound - Comox Harbour study area, 11 October 1980 through 10 October 1981, based on the maximum number of each species observed on migratory bird surveys. For species names, see Appendix IV.*

Table 3. Bird-use days calculated for each species and species group in each season on Baynes Sound - Comox Harbour, 11 October 1980 through 10 October 1981. For species and group names, see Appendix IV.

Species / Group	Autumn 1980	Winter 1980-81	Spring 1981	Summer 1981	Autumn 1981	TOTAL
#LOO	7770	31090	16879	2169	5301	63209
LOON	34	496	127	40	17	714
RTLO	346	1059	359	34	117	1915
PALO	2625	20853	11981	649	580	36688
COLO	4750	8667	4395	1429	4577	23818
YBLO	6	0	3	0	0	9
#GRE	111523	497468	161985	2306	55579	828861
GREB	0	98	252	28	9	387
PBGR	45	103	225	0	25	398
HOGH	7564	12481	5551	152	4277	30025
RNGR	2190	3771	2391	1211	8502	18065
EAGR	126	20	175	0	26	347
WEGR	101592	480971	153372	905	42729	779569
#COR	7004	14506	5521	1526	3248	31805
CORM	77	207	112	30	357	783
DCCO	1496	3731	1228	206	508	7169
BRCO	156	129	259	0	6	550
PECO	5271	10421	3906	1285	2372	23255
#HER	1707	2714	3889	6585	2692	17587
GBHE	1707	2714	3889	6585	2692	17587
#SWA	1458	9434	674	60	35	11661
TUSW	6	35	0	0	0	41
TRUS	1451	9393	674	60	35	11613
#GEE	1679	1130	158085	1851	3066	165811
GWFG	3	0	0	0	0	3
SNGO	272	0	0	0	0	272
BRAN	0	0	157147	0	0	157147
CAGO	1403	1130	935	1851	3066	8385
#DAB	142129	239773	136347	20593	45273	584115
DABL	140	0	3130	1600	1644	6514
GWTE	912	1175	5599	305	1066	9057
MALL	67634	117993	44164	16093	16253	262137
NOPI	9221	29008	4049	1121	4518	47917
BWTE	0	0	1221	616	216	2053
CITE	0	0	162	59	7	228
NOSL	90	22	704	167	731	1714
GADW	0	0	6	0	0	6
EUWI	43	265	172	0	24	504
AMWI	64075	91267	77113	588	20794	253837
#DIV	415035	770168	459835	103022	167312	1915372
DIVE	30337	35714	31097	750	4196	102094
CANV	185	666	716	0	14	1581
RNDU	0	208	10	0	0	218
SCAU	22928	27816	28907	4299	2613	86563
GRSC	21547	129963	64962	599	4242	221313
LESC	1573	3337	1334	1044	31	7319
HADU	9863	17155	13575	1174	5664	47431
OLDS	2070	8736	2928	0	4	13738
SCOT	11888	30209	27512	35742	38346	143697
BLSC	27684	38661	21045	3055	4919	95364
SUSC	63738	102985	51293	2825	27623	248464
WWSC	83985	129667	68395	38391	54169	374607
GOLD	280	0	1460	0	0	1740
COGO	6583	30778	14858	97	9	52325
BAGO	1641	7913	4579	0	0	14133
BUFF	15303	35310	24595	29	128	75365
MERG	0	1562	1112	86	122	2882
HOME	290	341	14	3	32	680
COME	970	15550	20584	10534	6633	54271
RBME	3880	21469	11961	688	578	38576
RUDU	0	6	0	0	4	10
DUCK	110256	132008	68813	3615	17946	332638

Table 3. (continued)

Species / Group	Autumn 1980	Winter 1980-81	Spring 1981	Summer 1981	Autumn 1981	TOTAL
#RAP	895	11526	4339	2531	757	20048
TUVU	6	35	98	224	270	633
OSPR	0	0	45	200	96	341
HAWK	0	6	14	6	4	30
BAEA	689	11320	4051	2015	241	18316
NOHA	3	6	6	0	20	35
SSHA	51	14	10	0	9	84
COHA	24	30	13	0	23	90
NOGO	0	0	0	0	3	3
SWHA	6	0	0	0	0	6
RTHA	20	61	72	23	46	222
GOEA	26	0	0	0	0	26
AMKE	13	0	6	6	14	39
MERL	43	10	9	18	7	87
PEFA	0	14	0	0	0	14
RNPH	18	13	14	9	0	54
RUGR	6	83	65	68	20	242
CAQU	0	0	26	0	0	26
#RAI	2551	1371	1086	67	723	5798
AMCO	2511	1364	1086	53	702	5716
SACR	37	6	0	14	20	77
#SHO	53525	193807	69279	27065	23252	366928
SHOR	1623	25982	30301	11450	406	69762
BBPL	1783	1975	1440	140	4853	10191
LGPL	0	48	0	0	3	51
KILL	2267	1828	1610	2414	2098	10217
BLOY	39	108	13	0	13	173
GRYE	490	583	799	815	1241	3928
LEYE	6	0	0	295	299	600
YELL	0	0	0	0	172	172
SPSA	0	0	71	1822	86	1979
WHIM	0	0	126	4	0	130
RUTU	0	0	0	0	6	6
BLTU	20741	122462	1663	214	6252	151332
SURF	258	0	0	0	6	264
SAND	2349	3294	1841	7102	1991	16577
WESA	280	0	2835	1840	885	5840
LESA	0	0	0	350	516	866
DUNL	23230	37468	28253	77	2789	91817
SBDO	19	0	138	159	911	1227
LBDO	387	0	61	309	606	1363
DOWI	0	0	0	6	67	73
COSN	26	13	103	0	6	148
#GUL	91855	400477	256012	134516	93651	976511
GULL	13054	92936	85175	37023	33718	261906
PAJA	0	0	0	5	25	30
SPSK	0	0	0	0	3	3
FRGU	6	0	0	0	0	6
BOGU	5087	208	31233	45645	26242	108415
MEGU	9307	37283	37113	12036	10235	105974
RBGU	3	20	18	33	20	94
CAGU	350	220	216	62	9	857
HEGU	9742	30368	3487	2320	2161	48078
THGU	12	1904	3873	74	131	5994
WEGU	0	14	0	0	0	14
GWGU	54254	237474	94877	37226	21120	444951
GLGU	28	6	0	62	0	96
COTE	0	0	0	608	954	1562
#ALC	1145	7065	2492	1202	274	12178
COMU	830	6088	776	15	0	7709
PIGU	132	387	950	249	127	1845
MAMU	179	574	758	930	143	2584

Table 3. (continued)

Species / Group	Autumn 1980	Winter 1980-81	Spring 1981	Summer 1981	Autumn 1981	TOTAL
RODO	1394	1637	1095	1154	879	6159
BTPI	66	0	147	1435	319	1967
MODO	0	0	6	6	0	12
BLSW	0	0	0	26	0	26
VASW	0	0	0	22	114	136
HUMM	0	0	17	27	0	44
RUHU	0	0	1596	673	0	2269
BEKI	819	1213	623	1031	802	4488
#WOO	530	1198	1343	594	575	4240
RBSA	0	6	26	6	0	38
DOWO	11	12	78	26	12	139
HAWO	0	151	111	132	65	459
NOFL	474	887	894	374	462	3091
PIWO	43	119	215	41	28	446
#PAS	85223	147742	132262	121046	84891	571164
FLYC	0	0	4	48	4	56
OSFL	0	0	0	6	0	6
WWPE	0	0	19	53	0	72
WIFL	0	0	0	131	3	134
HAFI	0	0	0	6	0	6
PSFL	0	0	11	12	0	23
SWAL	0	0	430	352	28	810
TRSW	0	0	636	417	0	1053
VGSW	0	18	5230	3051	66	8365
NRWS	0	0	313	736	25	1074
CLSW	0	0	0	155	0	155
BASW	0	0	2362	6207	1118	9687
STJA	553	691	282	166	1122	2814
NOCR	27884	60074	38022	27123	19001	172104
CORA	265	928	708	255	343	2499
CBCH	3903	8609	3366	2620	1999	20497
BUSH	37	56	165	291	72	621
RBNU	34	250	223	130	188	825
BRCR	46	65	85	29	10	235
WREN	0	0	26	0	26	52
BEWR	23	213	439	180	108	963
HOWR	0	0	21	18	6	45
WIWR	296	802	1190	387	289	2964
AMDI	28	6	0	14	4	52
GCKI	2076	5896	3047	1037	1398	13454
RCKI	82	191	428	115	158	974
SWTH	0	0	232	1160	24	1416
HETH	0	0	17	0	0	17
AMRO	1027	6190	20534	6261	2399	36411
VATH	20	42	325	3	29	419
AMPI	23	6	0	0	250	279
CEWA	14	0	40	430	194	678
NOSH	26	31	0	0	4	61
EUST	28759	27527	23848	54452	37291	171877
VIRE	0	0	0	34	0	34
SOVI	0	0	0	9	3	12
WAVI	0	0	0	16	0	16
HUVI	6	0	33	0	0	39
REVI	0	0	6	63	3	72
WARB	0	0	52	0	0	52
OCWA	0	0	1953	855	0	2808
Yewa	14	0	326	333	0	673
YRWA	6	0	930	154	243	1333
BTGW	0	0	45	8	0	53
TOWA	0	6	114	0	14	134
PAWA	0	0	0	0	0	1
MGWA	0	0	22	65	6	93

Table 3. (continued)

Species / Group	Autumn 1980	Winter 1980-81	Spring 1981	Summer 1981	Autumn 1981	TOTAL
COYE	0	0	139	124	25	288
WIWA	0	0	88	86	20	194
WETA	0	0	24	18	0	42
RSTO	1026	1682	1228	519	414	4869
SPAR	32	27	0	0	0	59
ATSP	0	70	0	0	0	70
CHSP	0	0	81	43	28	152
SAVS	173	0	1378	517	3147	5215
FOSP	354	1388	180	122	160	2204
SOSP	2040	4340	4283	2664	1972	15299
WTSP	0	0	0	14	6	20
GCSP	125	61	384	14	278	862
WCSP	41	103	726	481	210	1561
DEJU	8730	13658	2428	37	2035	26888
RWBL	0	337	3071	1216	42	4666
WEME	0	0	6	0	0	6
BRBL	0	135	333	260	0	728
BHCO	3	0	126	421	23	573
NOOR	0	0	0	54	0	54
ROFI	14	0	0	0	0	14
PUFI	10	41	959	79	48	1137
HOFI	1245	1202	1283	1538	1038	6306
PISI	6256	12799	8608	2727	8641	39031
AMGO	0	0	1214	2269	227	3710
EVGR	0	125	62	71	25	283
HOSP	3	0	23	14	0	40
#TOT	926368	2332520	1413701	430382	489806	5592777

Habitat Use

Bird use of habitat was not directly recorded in this study. However, surveyors recorded the shorezone unit in which birds were seen. The 48 shorezone units are defined in Table 1 and mapped in Figures 2 and 5 to 12.

Unit 23 (near Roy Creek and the Trent River; Figure 2) and unit 28 (just north of Union Point; Figure 6) recorded the highest numbers of birds; the totals of all the birds viewed in these 2 units were approximately equivalent to each other but 12% higher than at any other unit. Over the study period, the total for unit 23 included approximately 24,000 ducks (mostly diving ducks), 11,000 Western Grebes and 11,000 gulls. The total for unit 28 was bolstered by more than 19,000 shorebirds (mostly Black Turnstones), 8000 Western Grebes and 12,000 ducks (mostly diving ducks). Unit 47 (Metcalf Bay on Denman Island) ranked third in total bird use and unit 41 (Wilfred Creek to Mud Bay) ranked fourth; the proximity between shorezone units 47 and 41 across Baynes Sound is shown in Figure 11. The locations that recorded the lowest bird use during this study were around shorezone units 32 to 35, 15, 16, 2 and 8 (Figures 8, 9 and 2). Appendix V shows seasonal variations in the distribution of all birds combined.

A discussion of the locations that were used most by each species can be found in the annotated species list (see Species Composition below); this is more meaningful than total bird use because large, short term, aggregations of one species such as the European Starling can skew the totals. In the text, the shorezone unit numbers are given in sequence of decreasing observed use. Accompanying figures show variations in the distribution of a species or species group by shorezone unit for each season during the 1980-1981 study period.

The numbers of bird species by shorezone unit are shown in Appendix VI. In comparing bird use or diversity between shorezone units caution should be used; refer to the Methods and Limitations section, Table 3 and Appendix I.

Seasonal Numbers

The estimated number of bird-use days was highest in winter, second highest in autumn and spring and lowest in summer, as shown in Table 3.

For comparisons of proportions between seasons and within each season, the totals of birds counted are used. In autumn, winter and spring the numbers of waterfowl were higher than the numbers of any other bird group. In every season, the proportion of diving ducks to dabbling ducks was greater than 2:1.

Spring: Figure 15 shows the proportions of species group use on the estuary in the spring of 1981. Waterfowl accounted for more than half of all the birds seen. This was the only season in which geese, mostly Brant, were a significant portion of the waterfowl. The gulls were the second most abundant group and the grebes and passerines approximately shared third ranking. The seasonal total was 172,509 birds.

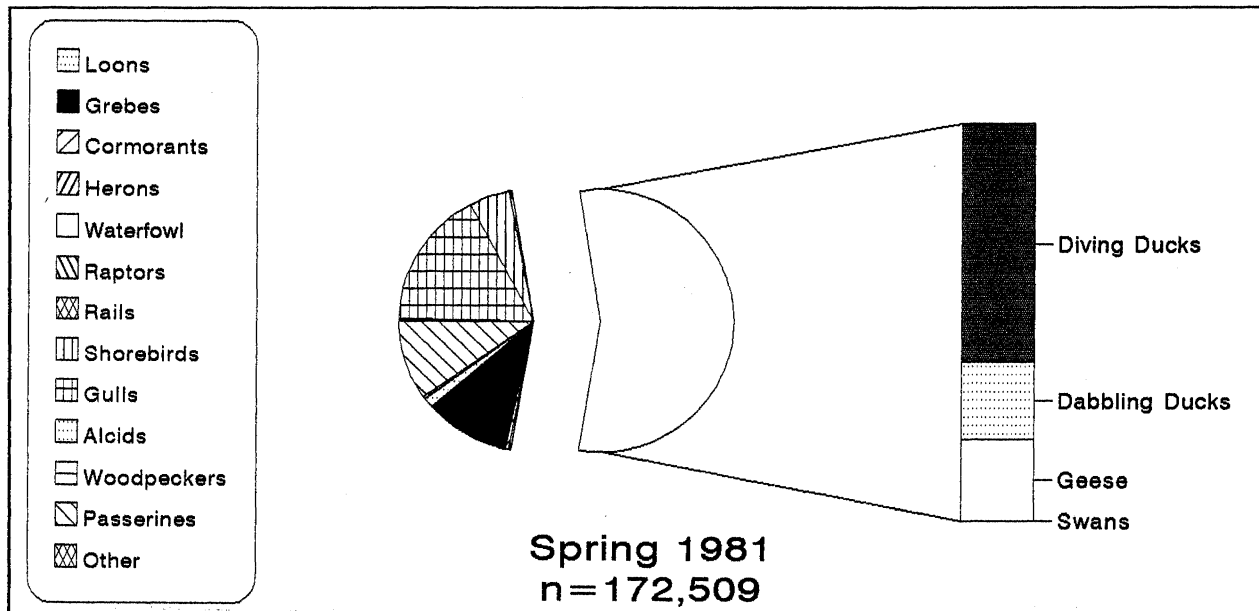


Figure 15. Proportional species group use of the Baynes Sound - Comox Harbour study area, spring 1981.

Summer: Figure 16 shows the proportions of species group use on the estuary in the summer of 1981. The gulls were the most abundant group followed by the passerines and then the waterfowl; this was the only season in which the waterfowl did not dominate the numbers of birds seen. Summer had a total of 52,682 birds recorded.

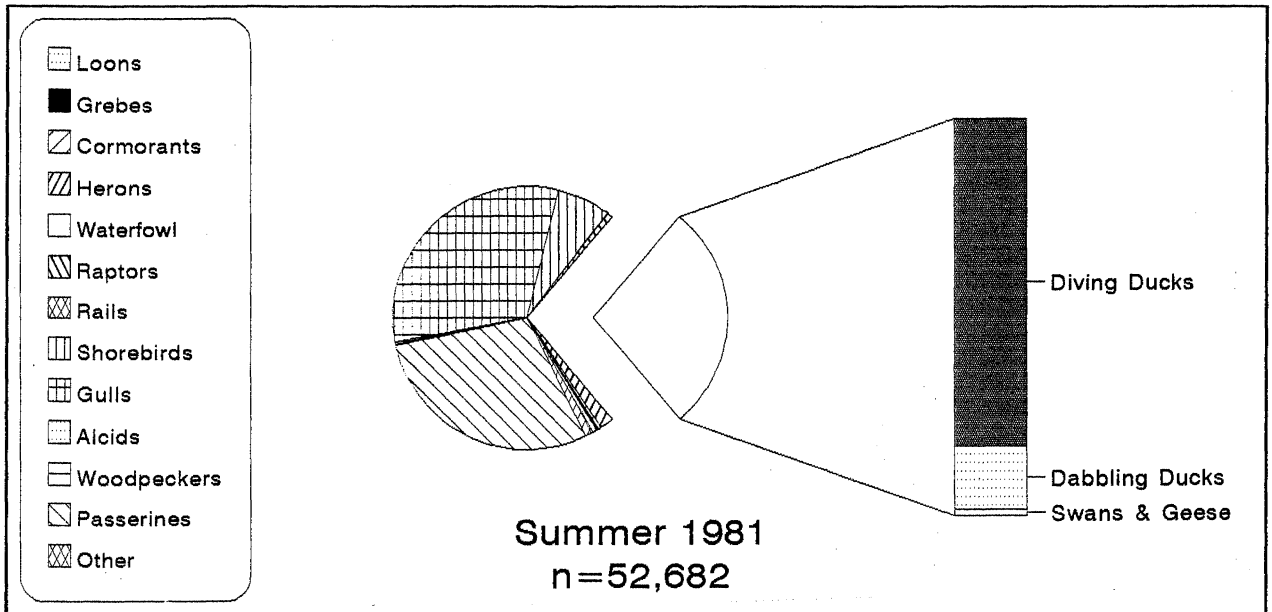


Figure 16. Proportional species group use of the Baynes Sound - Comox Harbour study area, summer 1981.

Autumn: Figures 17 and 18 show the proportions of species group use on the estuary in the autumn of 1980 (starting on 11 October) and in the autumn of 1981 (ending on the 10 October) respectively. Next to the waterfowl, the highest user group in late autumn 1980 was the grebes which were followed by the gulls and then the passerines. The proportions in early autumn of 1981 were similar to the proportions in late autumn of 1980, but in autumn 1981 less than half of the birds seen were waterfowl; and both the gulls and the passerines were more abundant than the grebes. The total of all birds counted in late autumn of 1980 was 139,800 birds and the total number in early autumn of 1981 was 75,905 birds. Although these totals are not comparable, the numbers can be combined to provide an estimate; a total of 215,705 birds might be seen over one complete autumn period using the survey methods of this study.

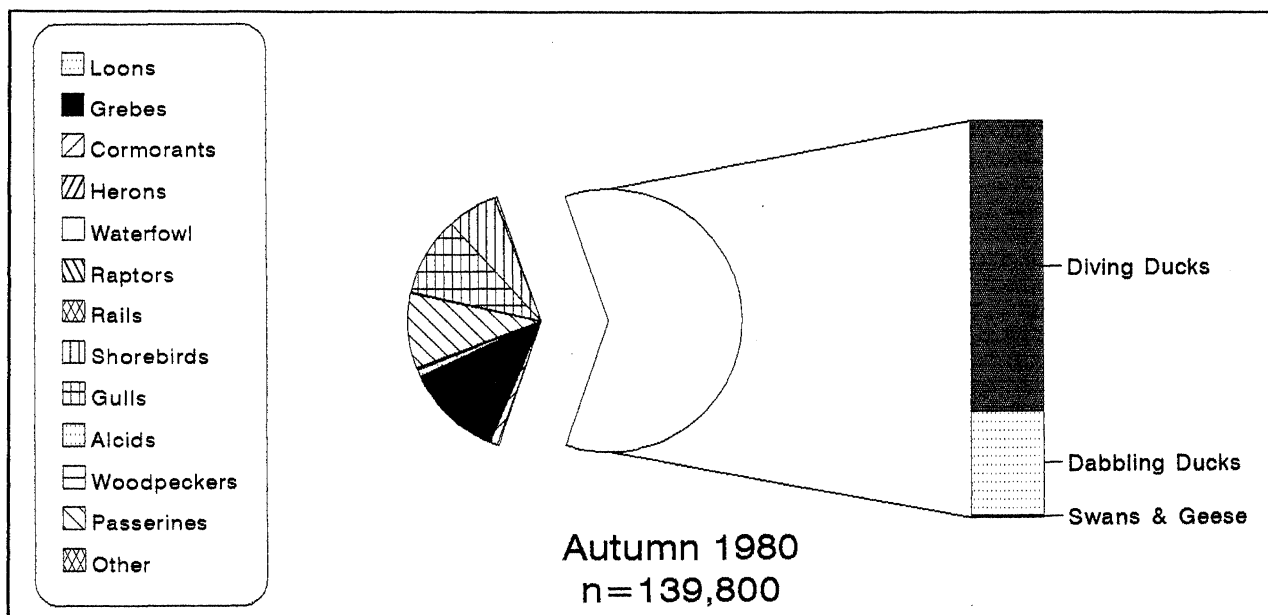


Figure 17. *Proportional species group use of the Baynes Sound - Comox Harbour study area, autumn 1980 (beginning 11 October).*

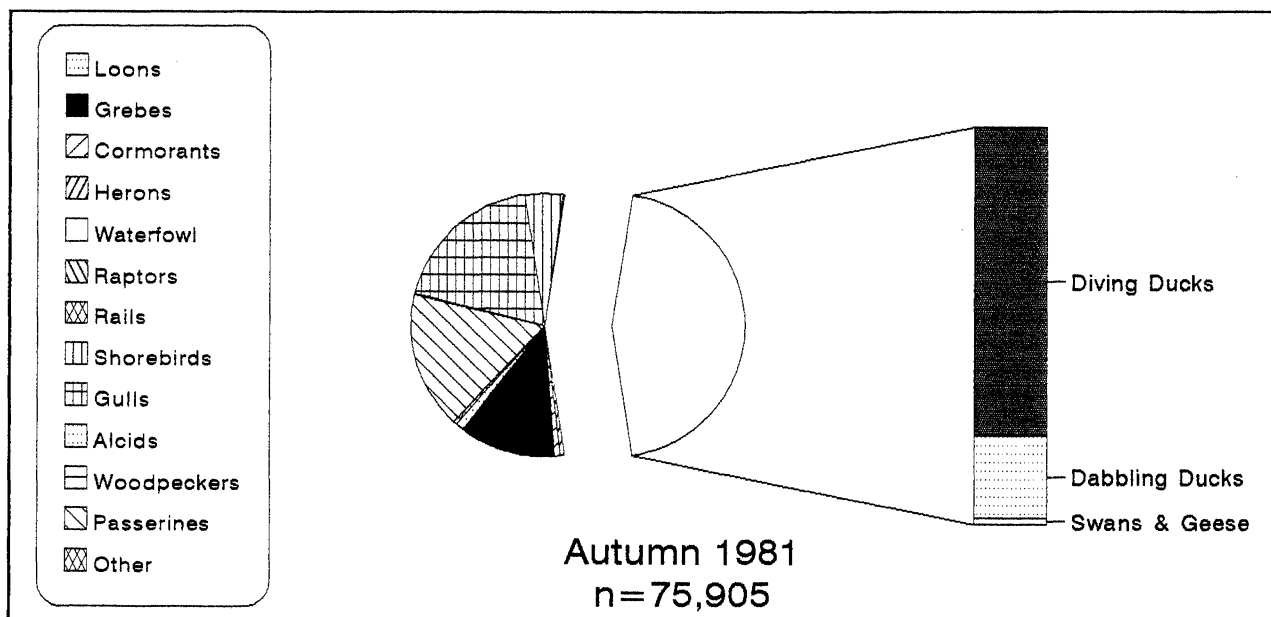


Figure 18. *Proportional species group use of the Baynes Sound - Comox Harbour study area, autumn 1981 (ending 10 October).*

Winter: Figure 19 shows the proportions of species group use on the estuary in the winter of 1980-1981. In terms of numbers, waterfowl had the highest counts that season; grebes ranked second followed closely by gulls. The total count in winter 1980-1981 was 255,303 birds. Thus, during the year of study, bird use of the Baynes Sound - Comox Harbour area was highest in winter.

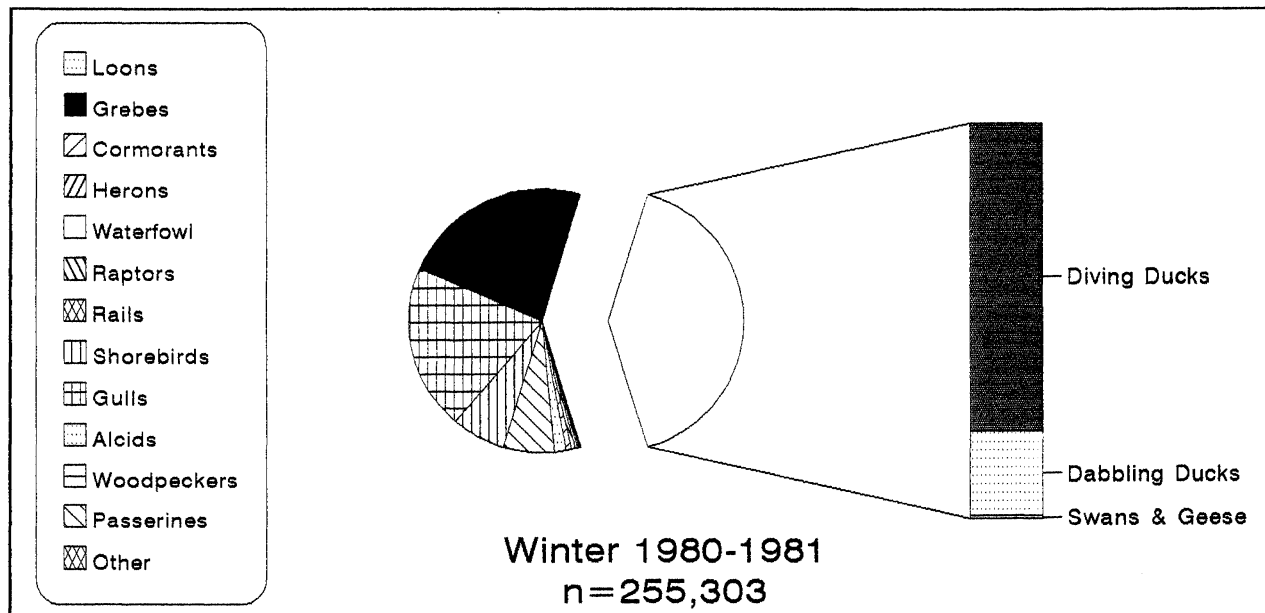


Figure 19. *Proportional species group use of the Baynes Sound - Comox Harbour study area, winter 1980-1981.*

Species Composition

The following annotated species list includes summarized data from the survey period. Species groups are presented in taxonomic order. Within each group or subgroup, species are discussed in decreasing order of highest use of the study area during the survey. Shorezone units are defined in Table 1 and in the maps, Figures 2 and 5 to 12.

Loons: Four species of loons were recorded over the study period. The Pacific Loon was the most abundant loon in winter and spring whereas the Common Loon was the most abundant loon in autumn. The 2 other species, the Red-throated and the Yellow-billed, were far less numerous. A combined total of 8141 loons were observed (1% of all birds) including 98 birds that were identified simply as loon species. Seasonal fluctuations in the total number of loons (Figure 21, solid line) were dominated by the movements of Pacific Loons (Figure 21, dashed line). Habitat use was different among the species, as described below.

A total of 4779 Pacific Loons was seen (59% of all loons). Between the earliest arrival on 5 September (1981) and the latest departure on 4 July (1981), the frequency of occurrence was 100%. However, the numbers present fluctuated (Figure 21, dashed line). Most of the birds were seen in winter (56% of bird-use days); a peak number of 1005 birds was recorded on 21 February 1981 when 900 birds were viewed from Metcalf Bay. This peak is higher than any other one-day count recorded between 1 November and 31 March at six other major estuaries around the Strait of Georgia including the Fraser River (Table 4). Highest use areas are shown in Figure 20. Although the majority of Pacific Loons in this study were observed in the southern end of Baynes Sound (units 43 to 47; Figures 11 and 12), outside of this study period some of the highest counts on record are from the north end near Comox (Campbell et al. 1990).

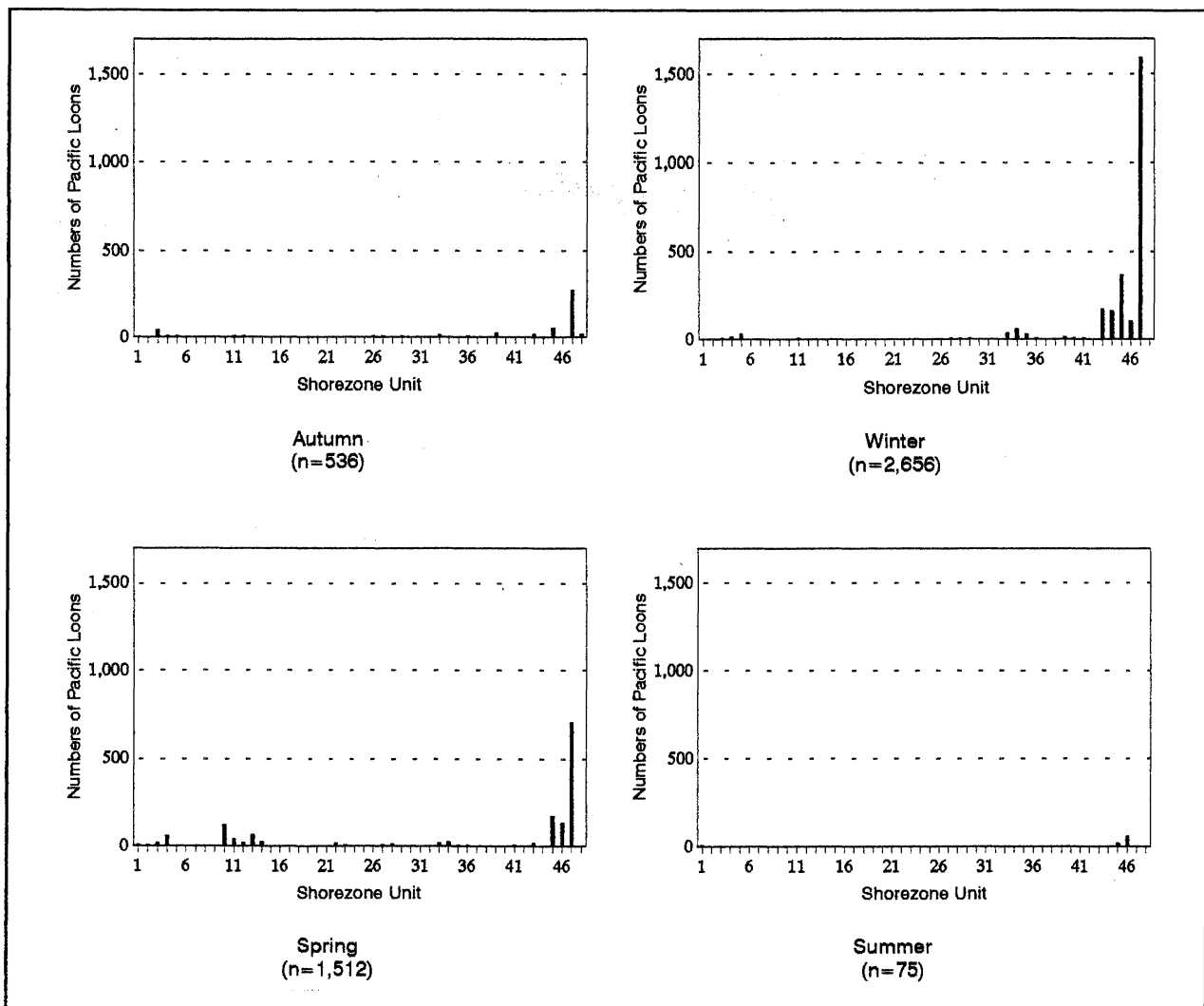


Figure 20. Seasonal variations in the distribution of Pacific Loons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

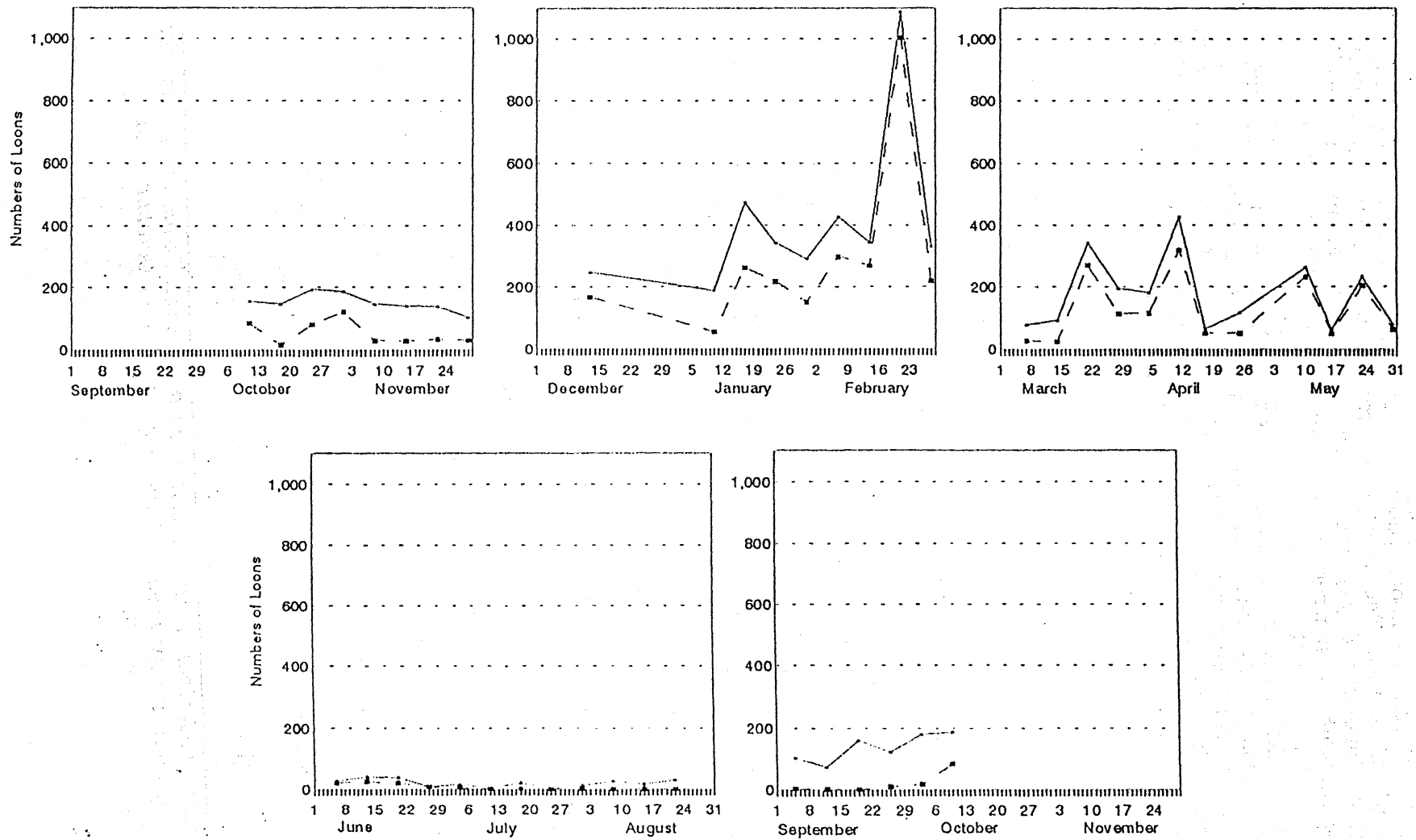


Figure 21. Seasonal fluctuations in the numbers of Pacific Loons (dashed line) and all loons combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The tally of Common Loons reached a total of 3028 birds over the study period (37% of all loons). The numbers recorded were relatively constant in autumn (39% of bird-use days) and winter (36%) but declined in spring and remained low throughout summer (Figure 23); 27 June 1981 was the only survey where this species was not reported. A peak of 160 birds was observed on 3 October 1981. Unlike the Pacific Loon, the Common Loon was seen in significant numbers from almost every unit with high counts being recorded from a number of clusters of adjacent shorezone units (Figure 22). Nevertheless the Common Loon, like the Pacific Loon, used the areas around Deep Bay, Mapleguard Point and Metcalf Bay (units 45, 46 and 47; Figures 11 and 12) more than other locations.

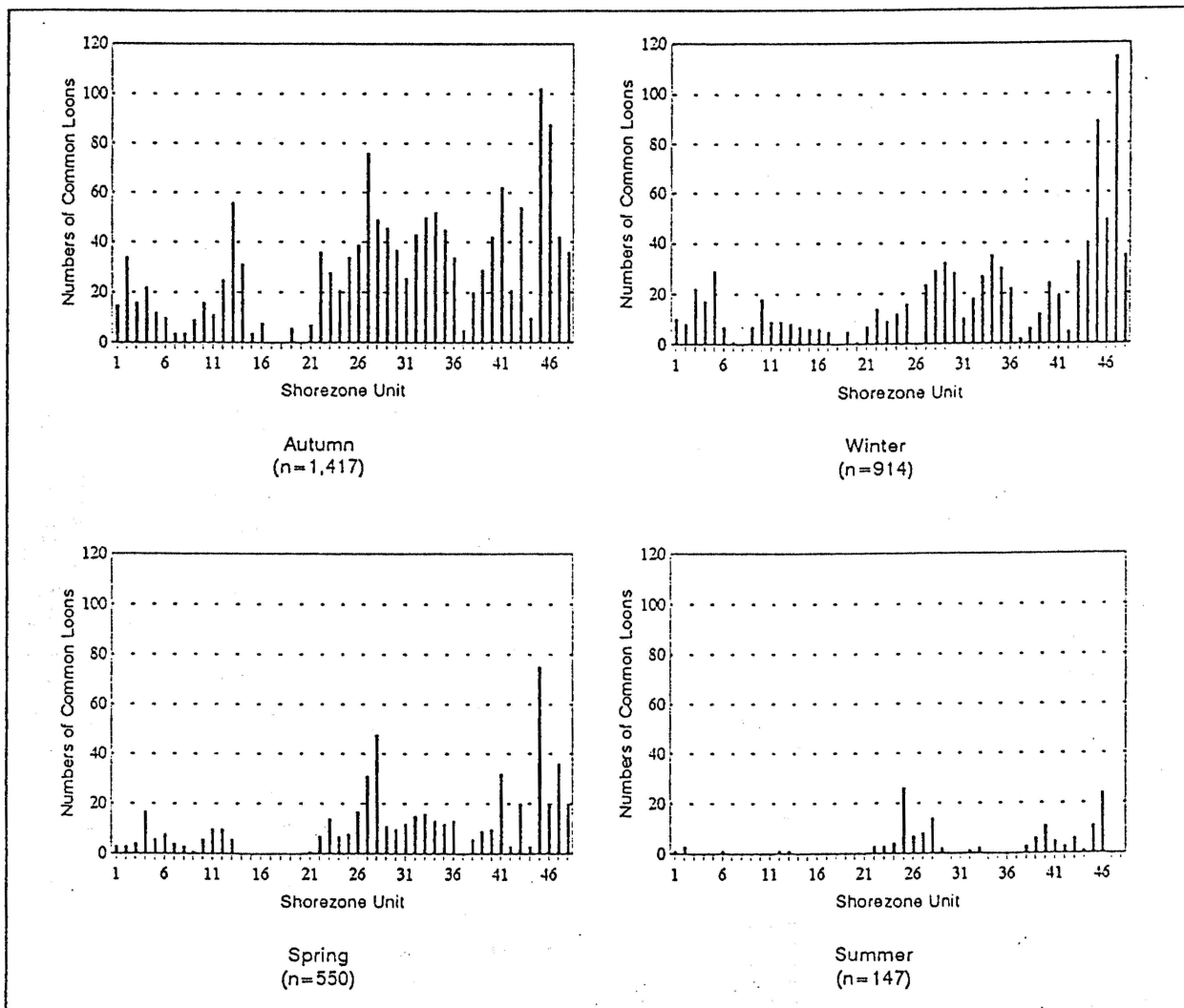


Figure 22. Seasonal variations in the distribution of Common Loons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

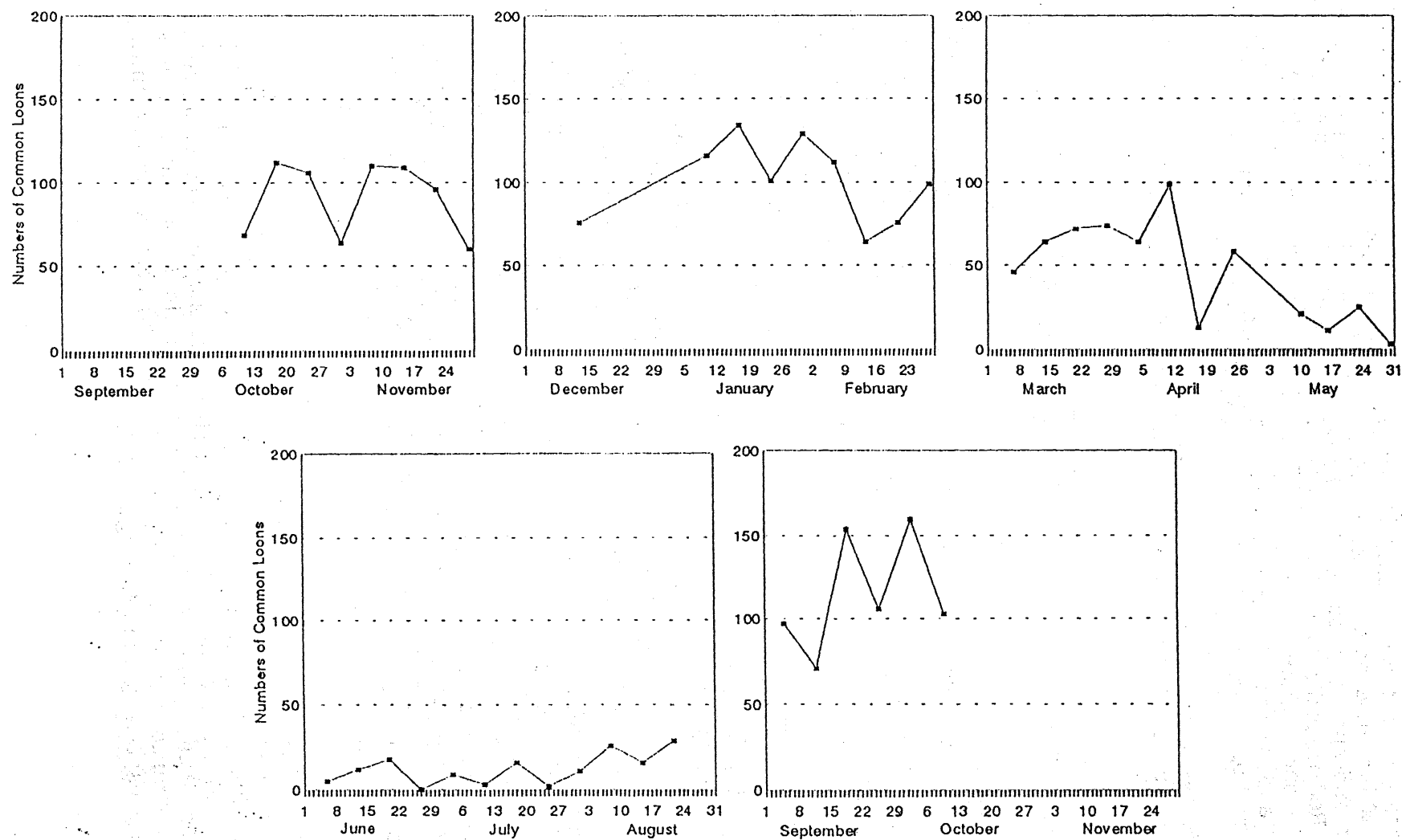


Figure 23. Seasonal fluctuations in the numbers of Common Loons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

We recorded a total of 234 Red-throated Loons, about half of them in winter (55% of bird-use days), when a peak of 22 birds was seen on 24 January 1981. Autumn and spring accounted for the remainder except for a summer record of one bird. Red-throated Loons used much of the coast along the Sound without favouring any one location, but their use was loosely clustered around units 5, 9, 23, 27, 32 and 47 and the units nearby. Slight seasonal variations occurred; unit 13 for example, received significant use only in spring.

Two Yellow-billed Loons were observed: 1 bird on 8 November 1980 from unit 40 and 1 bird on 7 March 1981 from unit 41. This species is considered an uncommon migrant by Campbell et al. (1990).

Grebes: Five species of grebes, the Western, Horned, Red-necked, Pied-billed and Eared, were recorded with a combined total of 102,477 birds (15% of all birds).

The Western Grebe was the most abundant of any species of bird identified in this study; a total of 96,142 birds were seen (94% of all grebes). In summer, occurrence was sporadic (from 1 to 30 birds), but thereafter numbers climbed steadily in fall and winter to a peak of 10,356 birds on 7 February, 1981. Since that time an observation of 15,174 birds from Deep Bay on 27 December 1983 has given Baynes Sound one of the highest Christmas Bird Counts on record for this species in North America (Campbell et al. 1990). Through spring, huge numbers of Western Grebes moved in and out of the study area (Figure 24). Habitat use in autumn and spring was centred around units 23 and 28 and adjacent units (Figures 2 and 6), but in winter, most of the grebes were seen using the sound from Ship Peninsula south (units 40 to 47; Figures 11 and 12) as shown in Figure 25. For example, 2,000 Western Grebes were reported from Metcalf Bay on each of 5 surveys from 10 January to 7 February 1981; outside of this period, few of the grebes were seen from that location. In winter, when the species was present at Mud Bay (unit 41), the average count there was almost 2000 birds.

The Horned Grebe ranked second in abundance with a total of 3782 birds recorded (4% of all grebes). The earliest arrival was 22 August (1981) and the latest departure was 3 stragglers on 22 June (1981). Through autumn, winter and spring, the occurrence of this species was almost continuous (Figure 26). The highest numbers were present in winter (41% of bird use days) and autumn (39%); the peak of 206 birds, recorded on 15 November 1980, included 74 birds in the narrow central portion of Baynes Sound (units 35 to 31). Horned Grebes were seen at one time or another along most of the coast surveyed (Figure 27) but areas in the south received the highest use (units 45, 46 and 47; Figures 11 and 12).

The total of Red-necked Grebes tallied was 2395 birds. Occurrence was almost continuous from the earliest arrival on 8 August (1981) to the latest departure on 27 June (1981). Numbers were highest in autumn (59% of bird-use days); a peak of 357 birds counted on 26 September 1981 included 300 birds seen from Mapleguard Point (unit 46; Figure 26, dashed line). Habitat use was concentrated in a number of disparate nodes (Figure 28) centred around units 1, 11, 29, 33, and especially unit 46 (Figure 12).

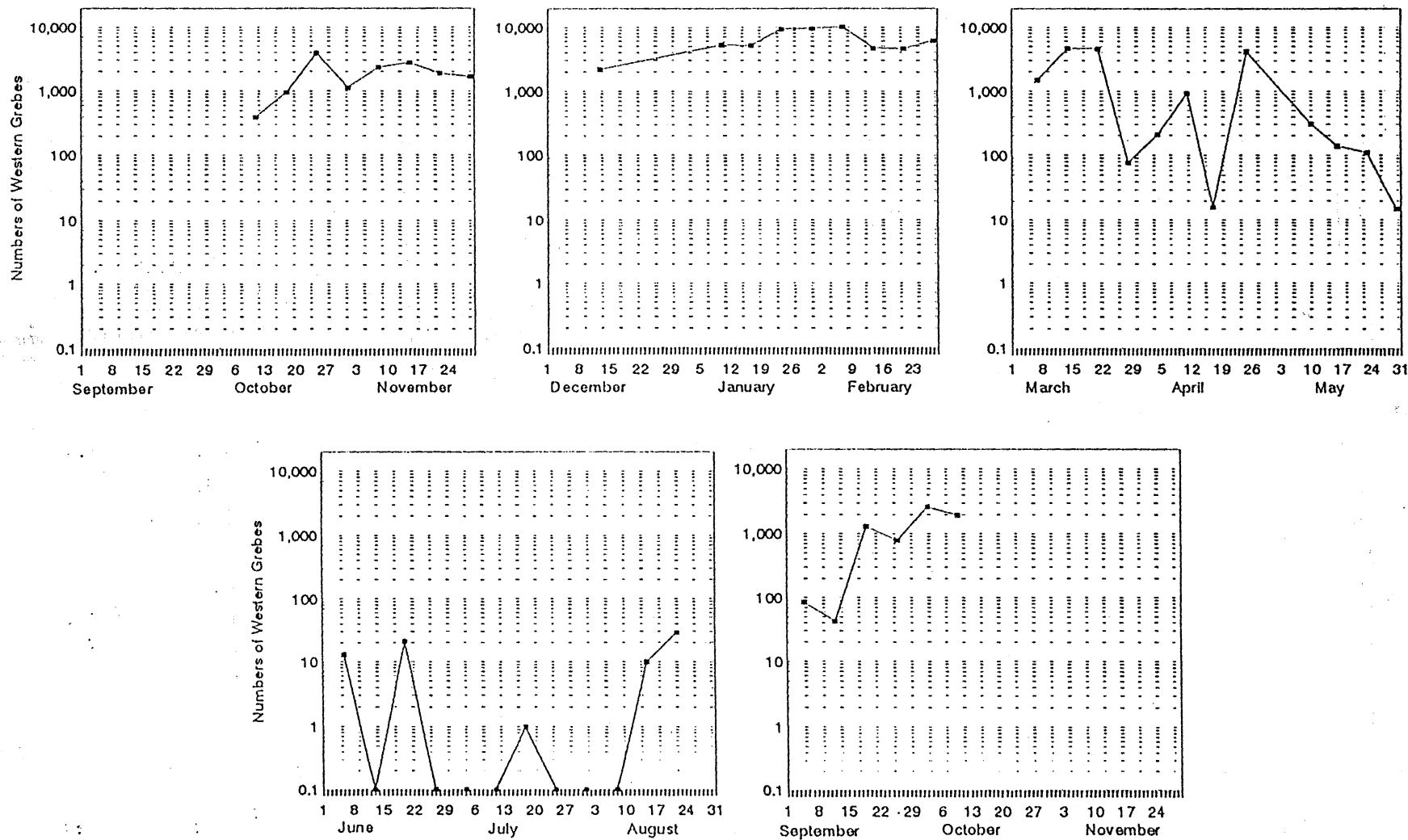


Figure 24. Seasonal fluctuations in the numbers of Western Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

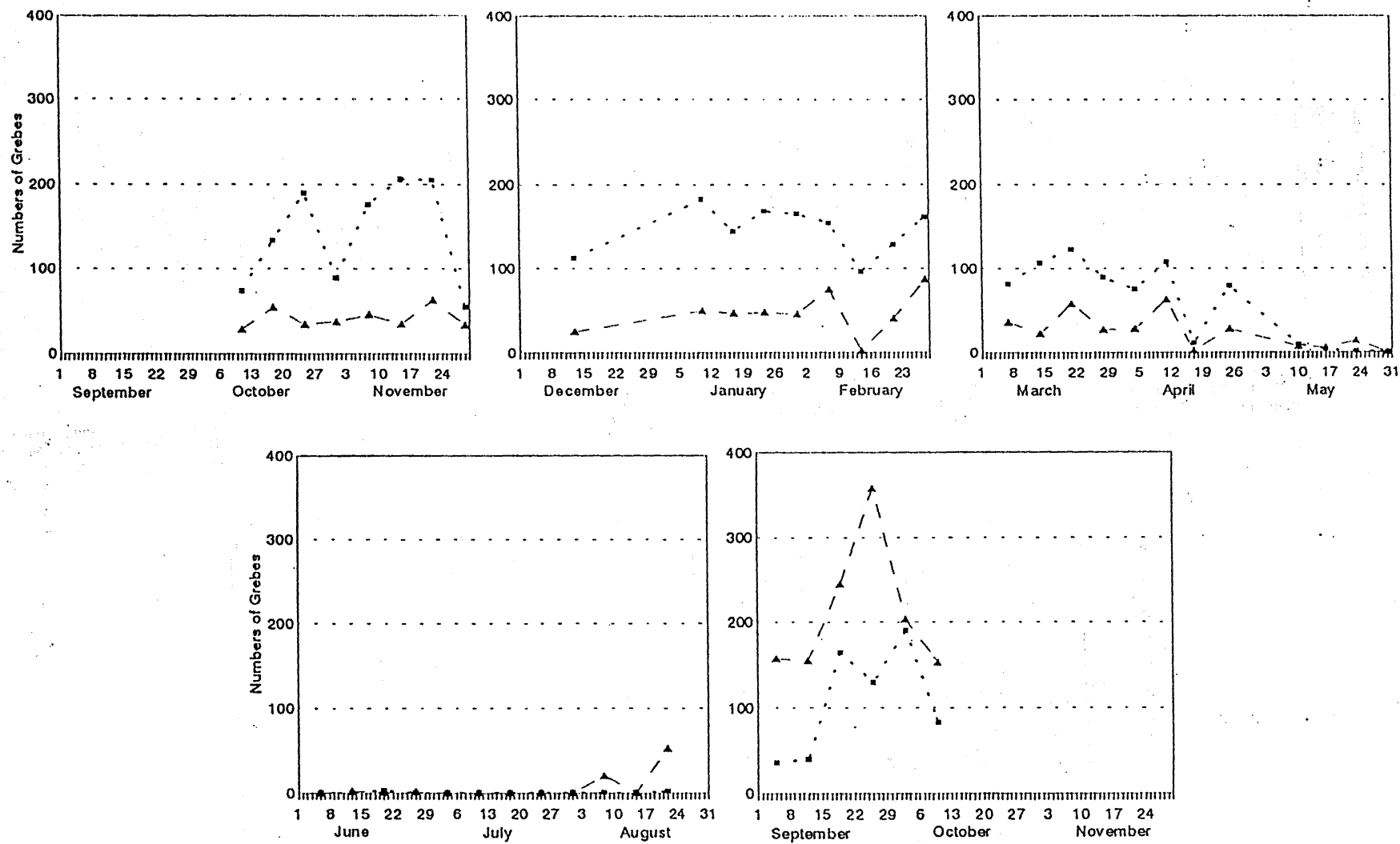


Figure 25. Seasonal fluctuations in the numbers of Horned Grebes (dotted line) and Red-necked Grebes (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

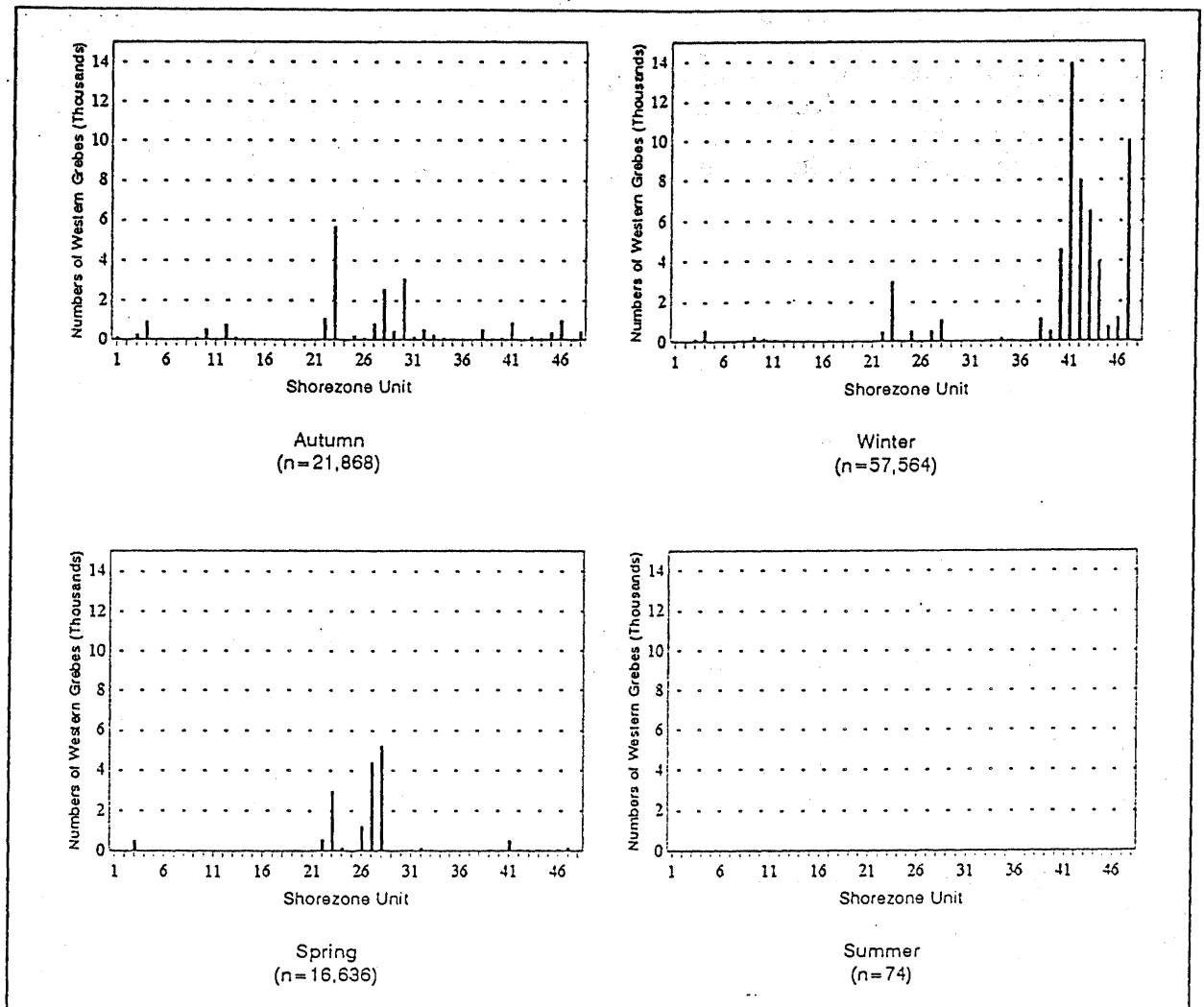


Figure 26. Seasonal variations in the distribution of Western Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total of 58 Pied-billed Grebes were seen over the study period. They occurred in small numbers (<5 birds) on most of the surveys from the earliest arrival on 5 September (1981) until the latest departure when a peak of 26 spring migrants were observed on 4 April (1981); 24 of these birds were in the area north of Hindoo Creek (unit 33). Habitat use was highest in the proximity of shorezone units 4, 11, 18, 33, and 47. Campbell et al. (1990) note that the Pied-billed Grebe prefers fresh water.

A total of 44 Eared Grebes was recorded over the study period; their occurrence was intermittent from the earliest arrival on 12 September (1981) to

the latest departure on 25 April (1981). Most of the birds appeared during migrations; the autumn peak of 18 birds was observed on 25 October 1980 and the spring peak of 10 birds on 25 April 1981. Habitat use in spring and autumn centred almost entirely around the coast from Beacon Creek to Hart Creek and the water northwest of Royston (units 27, 28 and 22; Figures 2 and 6). The few Eared Grebes seen in winter occurred elsewhere on the study area.

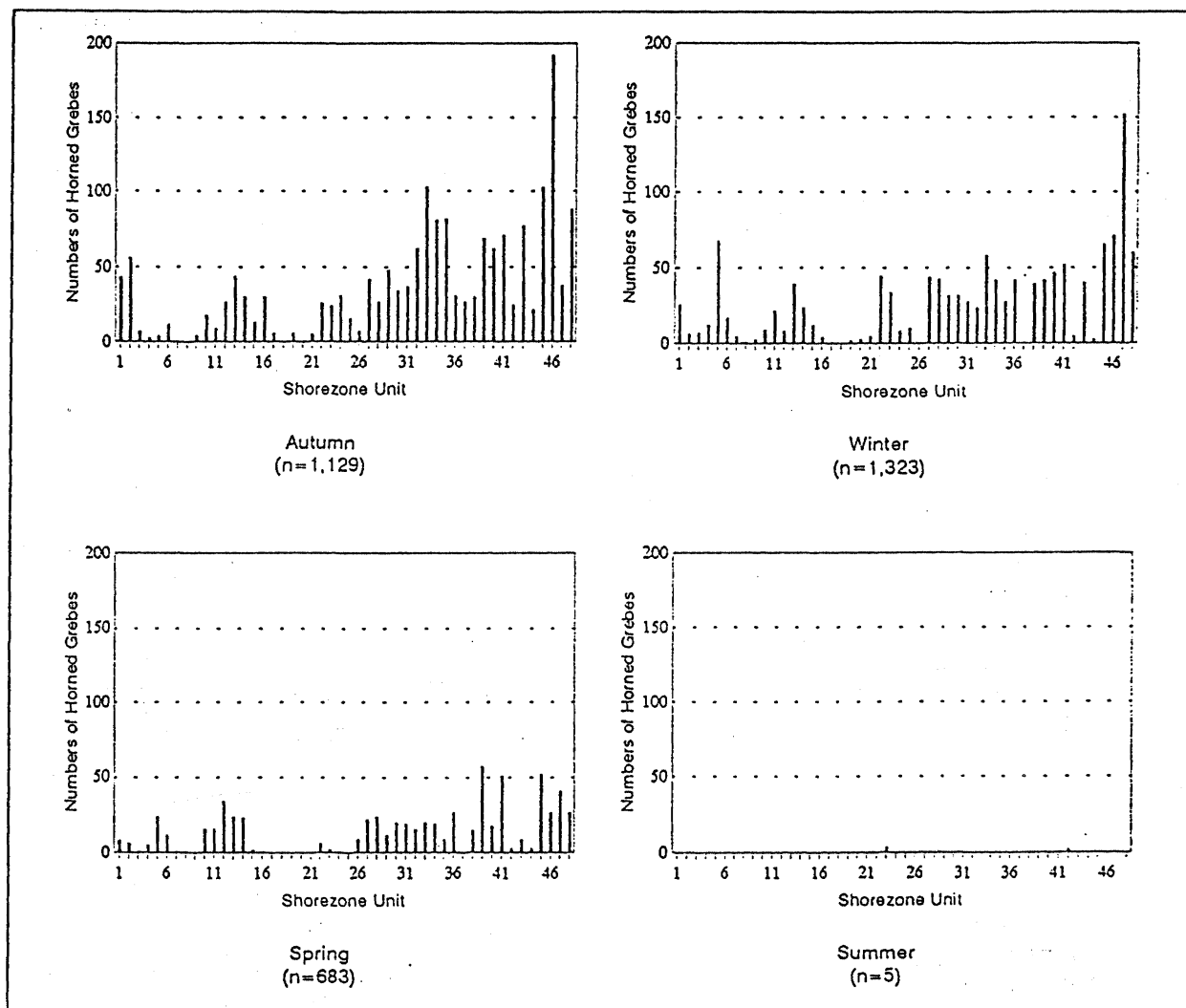


Figure 27. Seasonal variations in the distribution of Horned Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

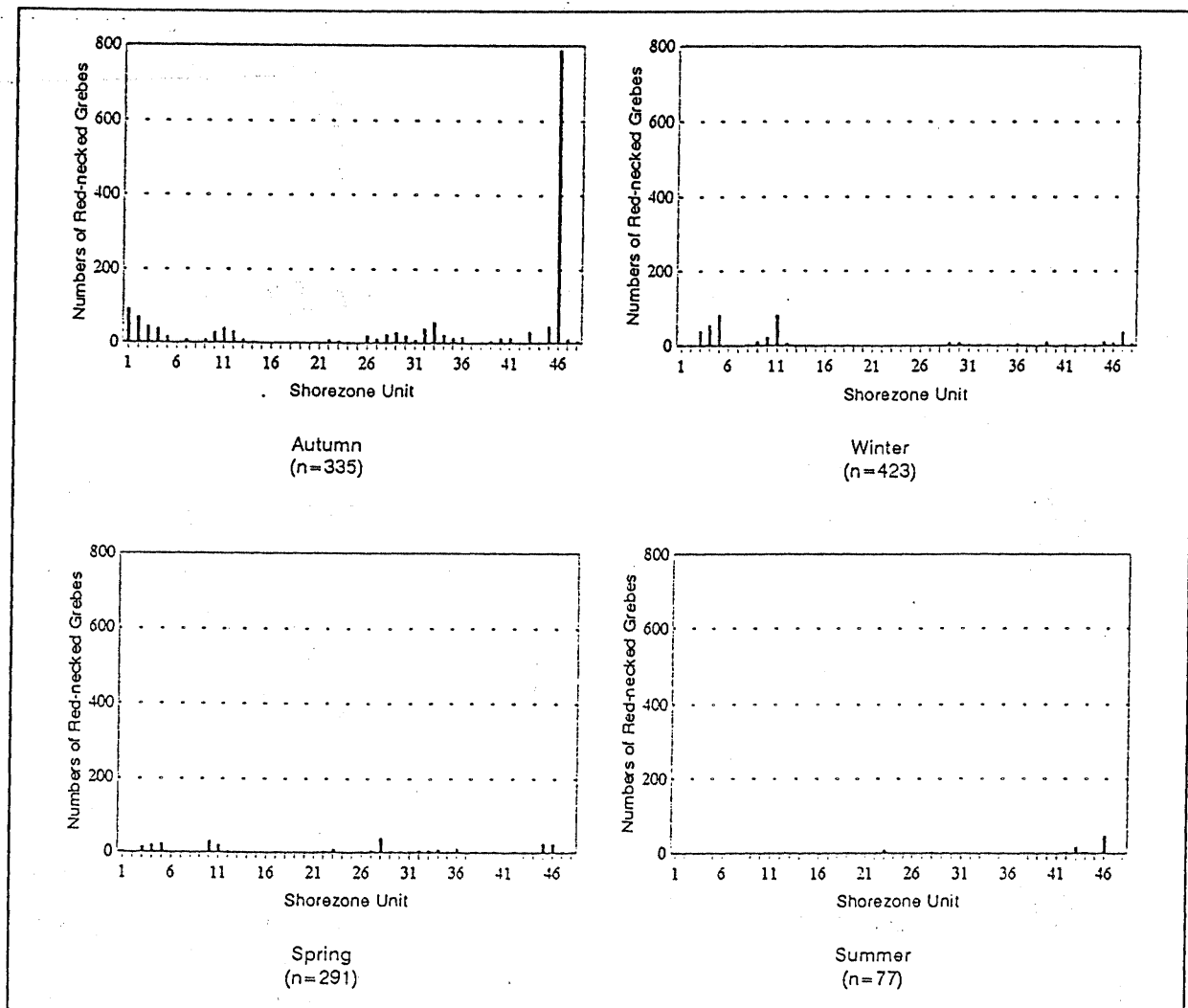


Figure 28. Seasonal variations in the distribution of Red-necked Grebes on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Cormorants: Three species of cormorants were reported: Pelagic, Double-crested and Brandt's. Their combined total was 3975 birds (<1% of all birds) including 116 birds reported simply as cormorant species. Seasonal fluctuations in the numbers of all cormorants combined are shown in Figure 29 (solid line). Although cormorants were seen from most of the shorezone units (Figure 30), the largest tally in every season was from Metcalf Bay (unit 47; Figure 11).

The Pelagic was the most abundant cormorant; a total of 2893 birds was observed (73% of all cormorants). Occurrence in the study area was continuous except for 2 surveys in summer but the numbers seen fluctuated (Figure 29). The highest seasonal totals were in winter (44% of bird-use days) and autumn (32%). A peak of 263 cormorants was recorded on 17 January 1981. The area used most by Pelagic cormorants was around unit 47 (Figure 11).

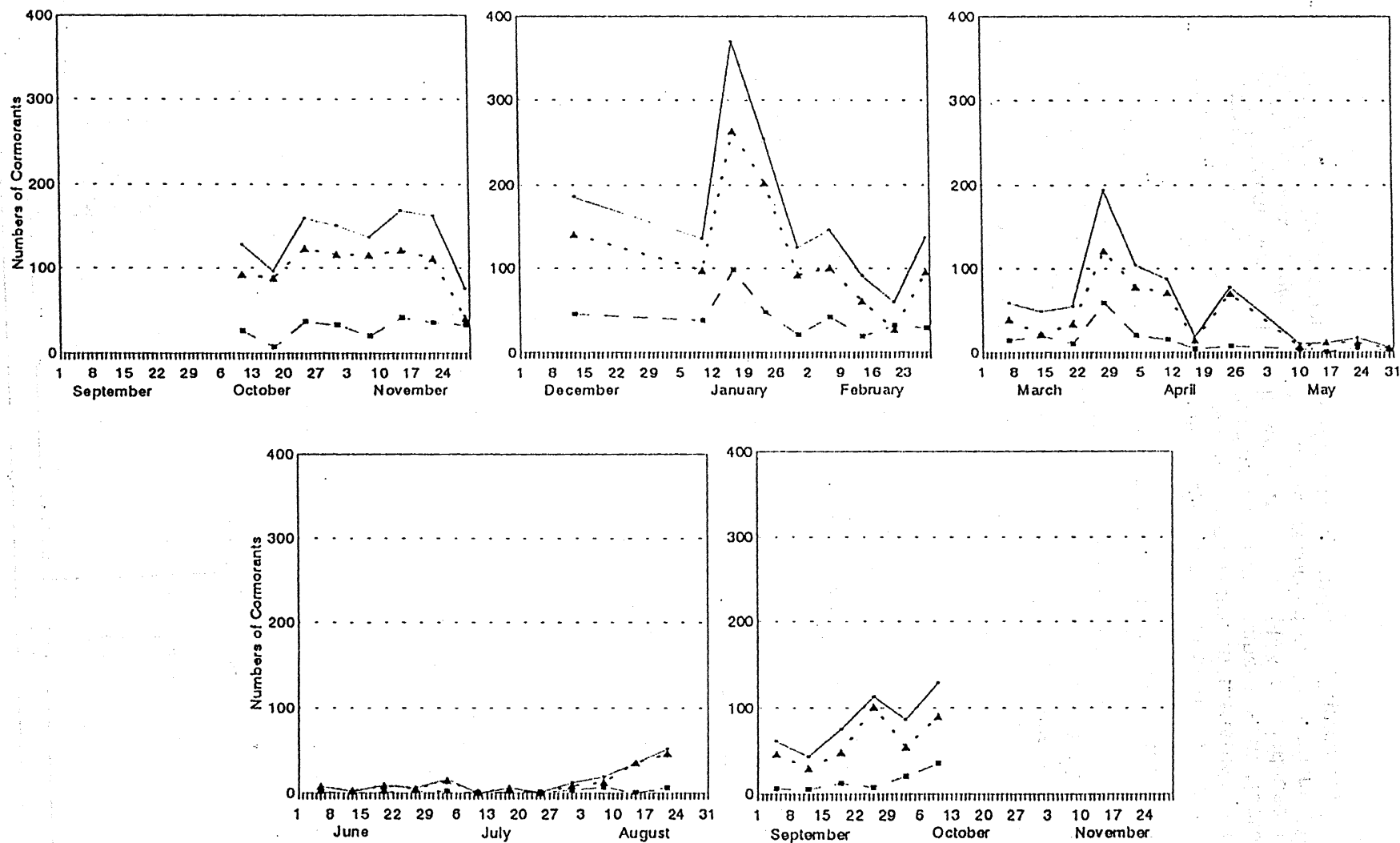


Figure 29. Seasonal fluctuations in the numbers of Double-crested Cormorants (dashed line), Pelagic Cormorants (dotted line) and all cormorants combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

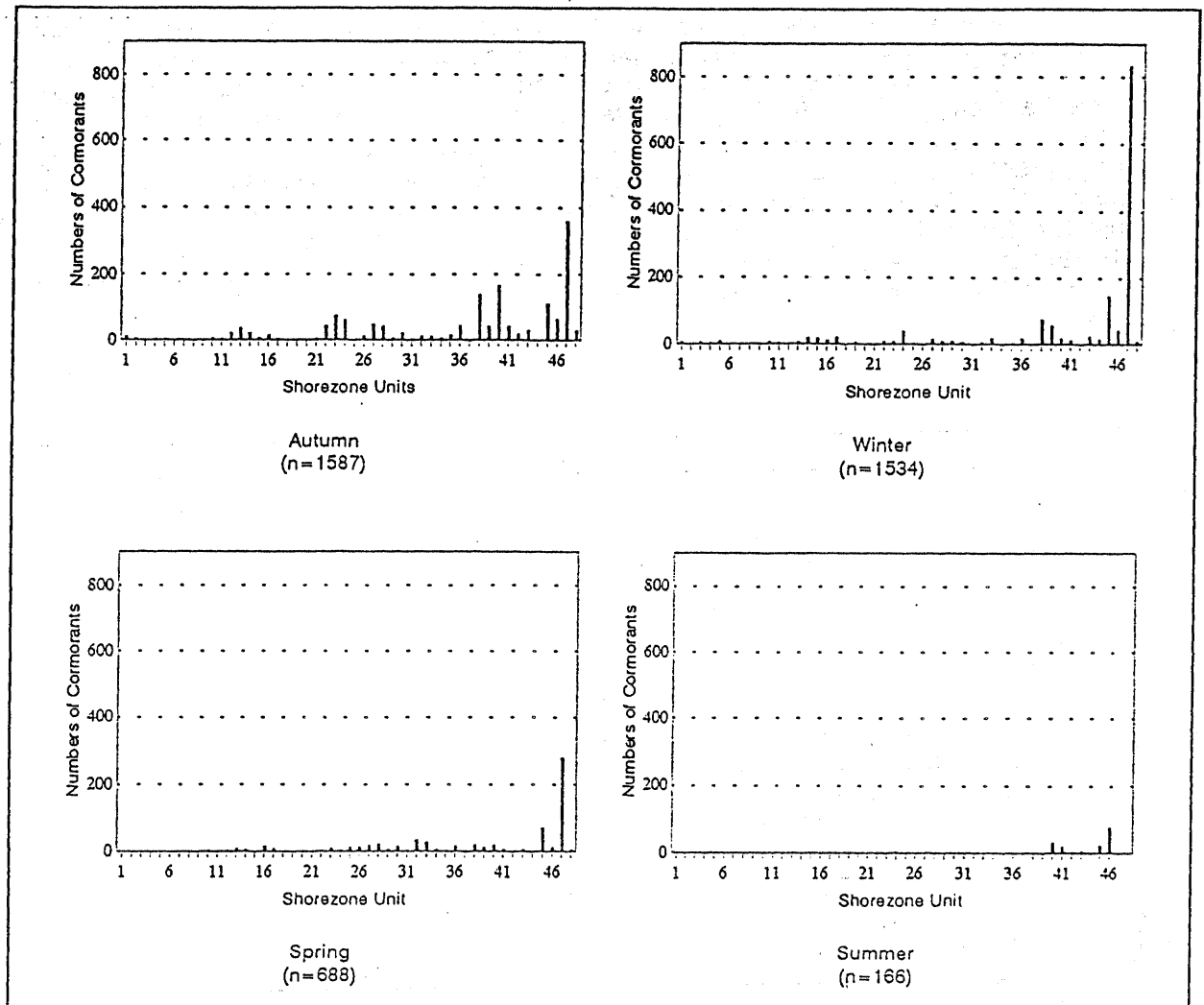


Figure 30. Seasonal variations in the distribution of cormorants on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The total number of Double-crested Cormorants recorded was 887 birds (22% of all cormorants). The species was present on the Sound almost continuously, its numbers often fluctuating in a pattern similar to those of the Pelagic Cormorant but at a lower magnitude (Figure 29). The peak of 98 Double-crested Cormorants was observed on 17 January 1981, the same date the numbers of Pelagic Cormorants peaked. Seasonal totals were highest in winter (52% of bird use days) and autumn (27%); summer had the lowest tally. The birds were most numerous around Metcalf Bay (unit 47; Figure 11).

The tally of Brandt's Cormorants over the study period was 79 birds. They were present in autumn, winter and especially spring (47% of bird-use days), but not in summer. A peak of 16 birds was observed on 22 November 1980. Almost all of the Brandt's Cormorants were seen near Metcalf Bay (unit 47; Figure 11).

Hérons: The Great Blue Heron was the only species of heron reported. It was seen throughout the study period; a total of 2359 birds were counted (<1% of all birds). The greatest numbers occurred in summer (37% of bird-use days) when a peak of 136 individuals was seen on 13 June 1981 (including 46 birds seen from unit 20). Almost every shorezone unit recorded some use by the Great Blue Heron but the amount of use varied through the seasons (Figure 31). The south side of Comox Harbour (unit 21 and adjacent units; Figure 2) was favoured by the birds in autumn, spring and summer; Henry Bay on Denman Island (unit 48; Figure 7) received high use in autumn and winter. Breeding was indicated by the presence of one young heron on 1 August 1981 in Comox Harbour (unit 13).

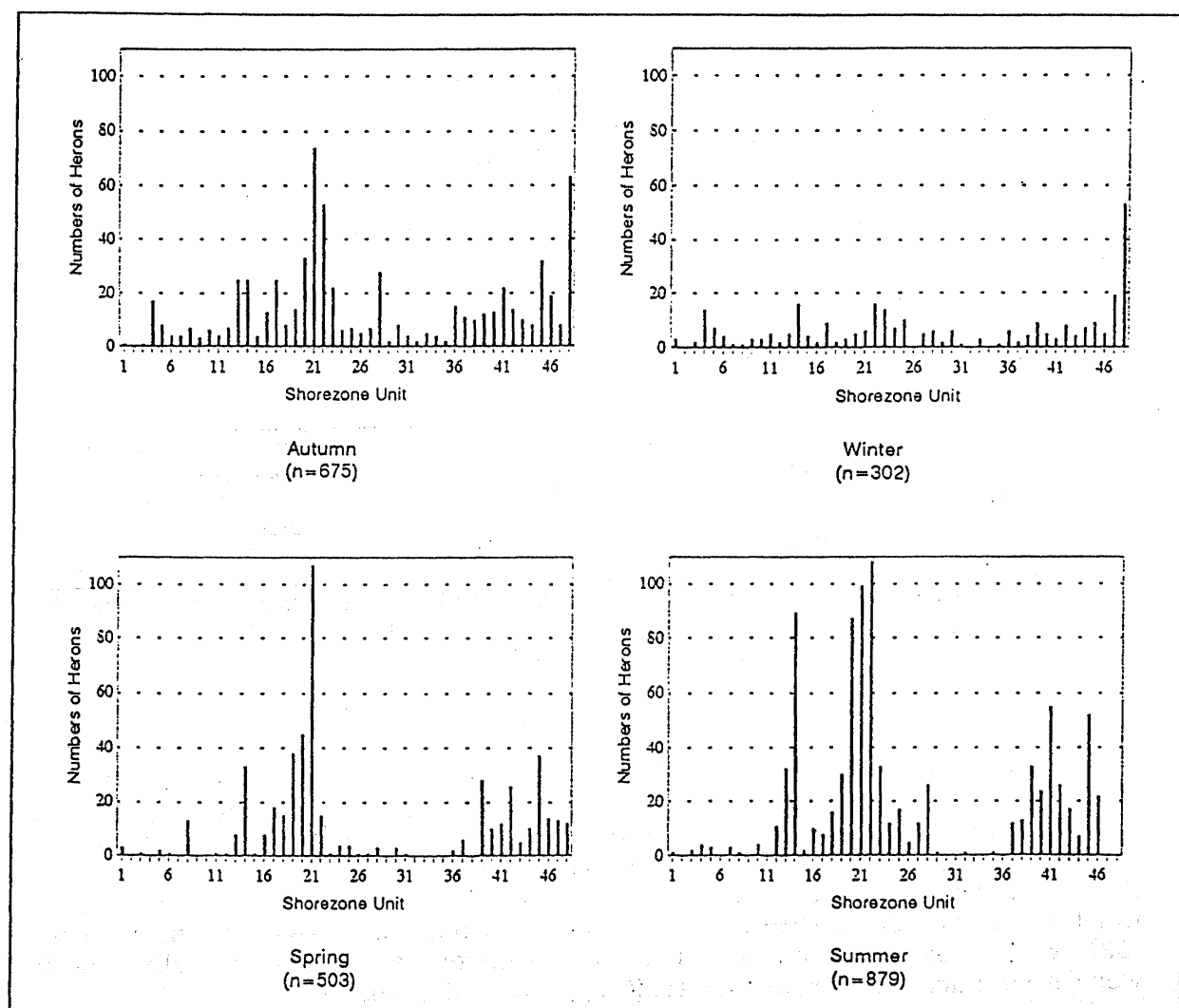


Figure 31. Seasonal variations in the distribution of Great Blue Herons on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Swans: Two species of swans were identified during the survey. The Trumpeter Swan, with a total of 1089 birds recorded (<1% of all birds), accounted for all but 3 of the swans seen. Although sightings, each of a single bird, were noted from June to October, the earliest record involving several Trumpeter Swans was 1 November (1980). The latest departure of the overwintering birds was 28 March (1981). Most of the swans were observed in winter (80% of bird-use days) with a peak of 179 birds occurring on 13 December 1980 (Figure 33); this count included 111 birds in the area from units 20 to 22. Comox Harbour is an important wintering area for this species; in 1978-1979 a maximum of 271 birds

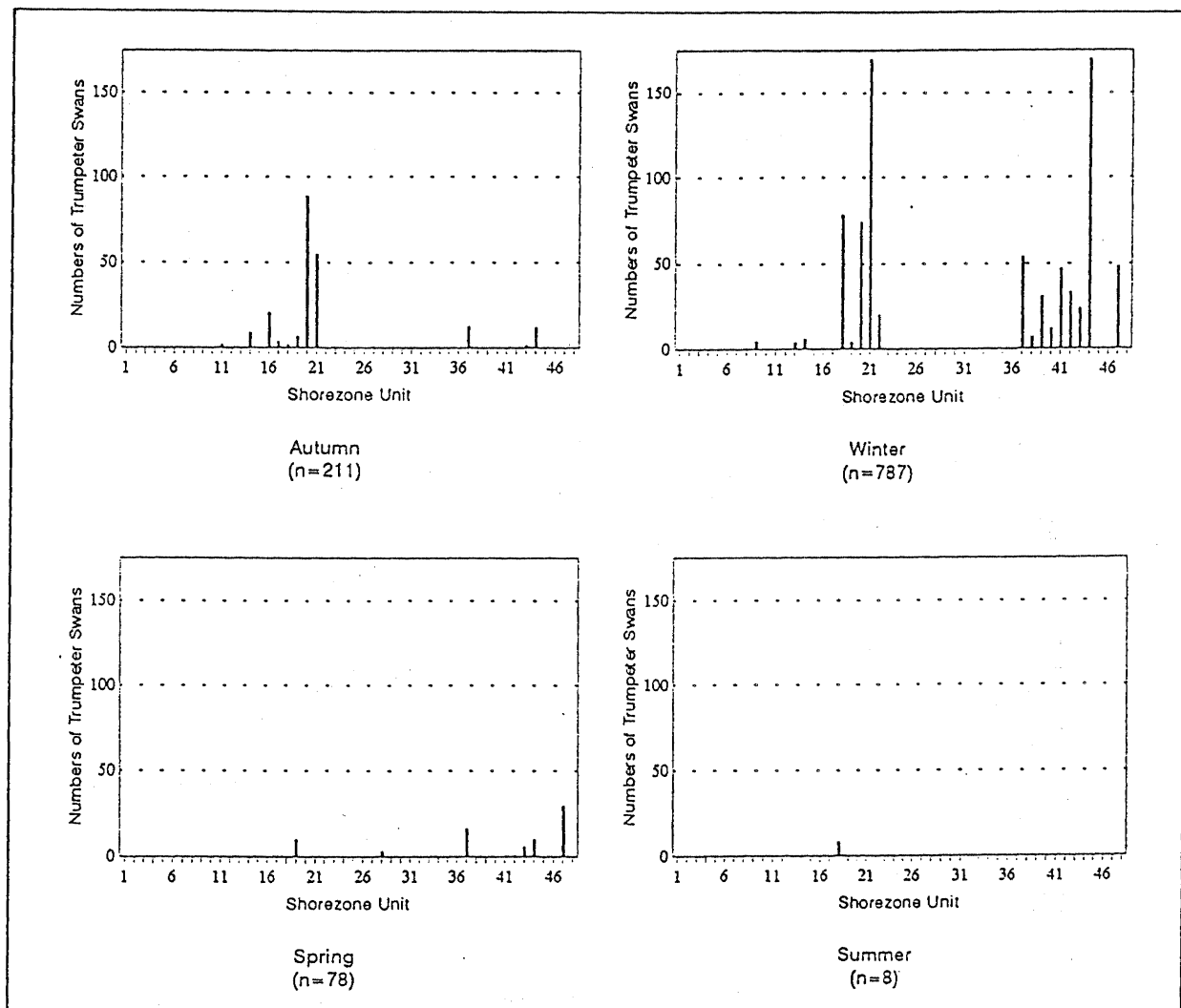


Figure 32. Seasonal variations in the distribution of Trumpeter Swans on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

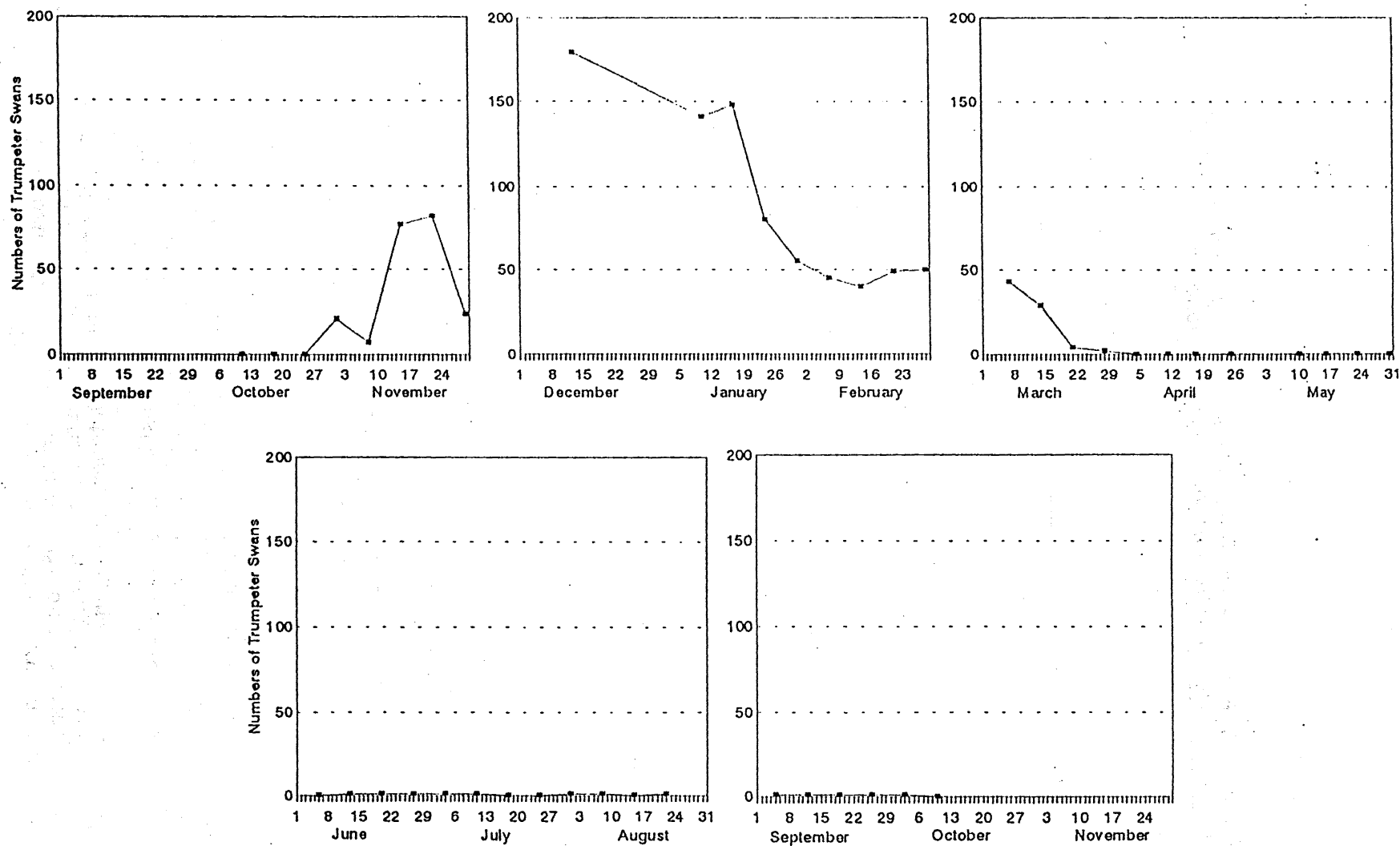


Figure 33. Seasonal fluctuations in the numbers of Trumpeter Swans on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

was reported by McKelvey (Trethewey 1979) and an all-time North American high Christmas Bird Count of 712 swans was made on the Comox count of 16 December 1984. In autumn, habitat use (Figure 32) was almost entirely at the head of Comox Harbour from units 16 to 21 (Figure 2), but in winter birds were also seen using the southern portion of Baynes Sound (units 37 to 44, and unit 47). By spring, the total counts were lower and the centre of highest use had shifted to Metcalf Bay on Denman Island (unit 47).

Three Tundra Swans were seen: 1 bird on 22 November 1980 from unit 44 in Deep Bay and 2 birds on 13 December 1980 from unit 47 at Metcalf Bay.

Geese: Four goose species with a combined total of 20,328 birds (3% of all birds) were recorded during the study period. Most of them were Brant which

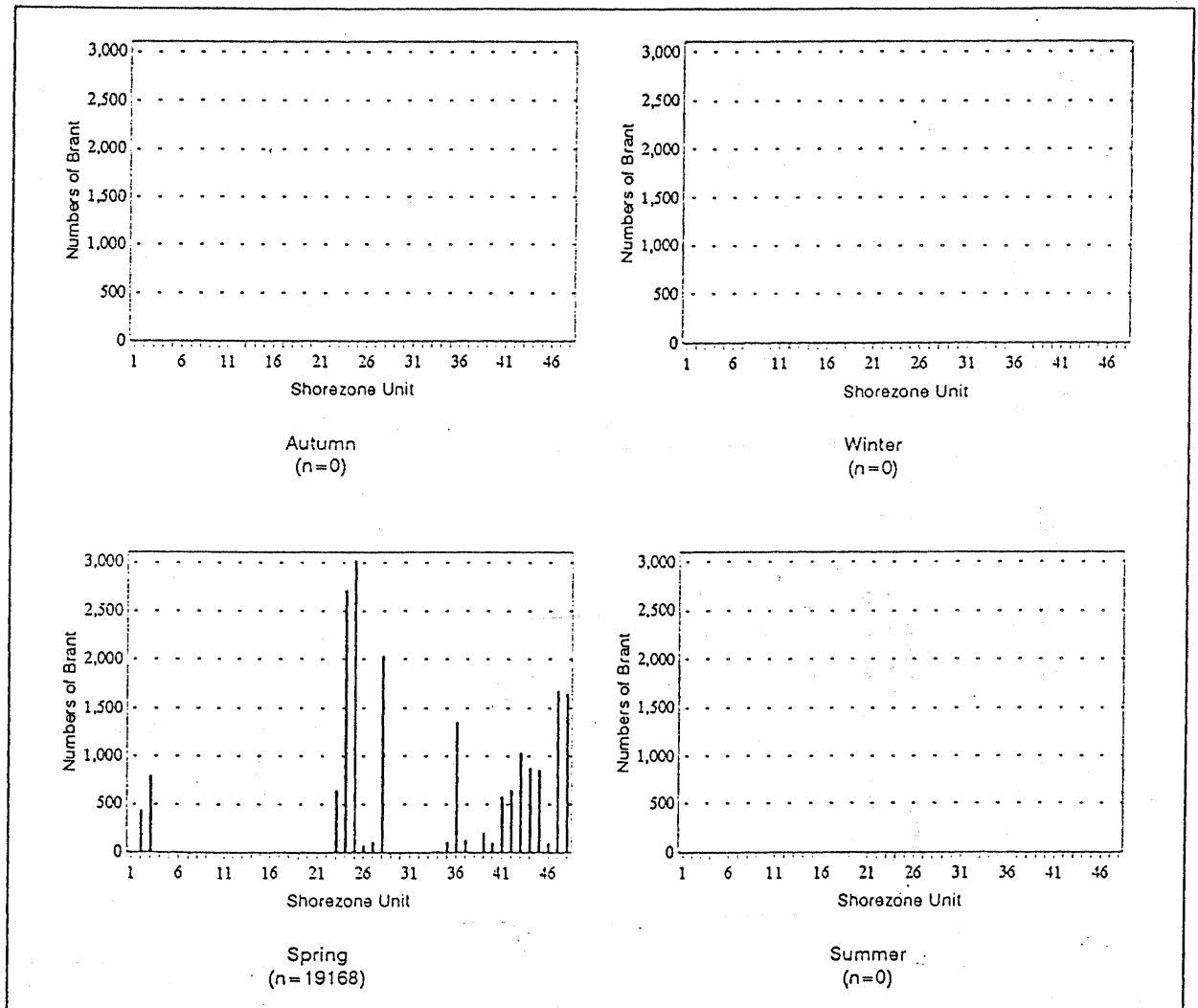


Figure 34. Seasonal variations in the distribution of Brant on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

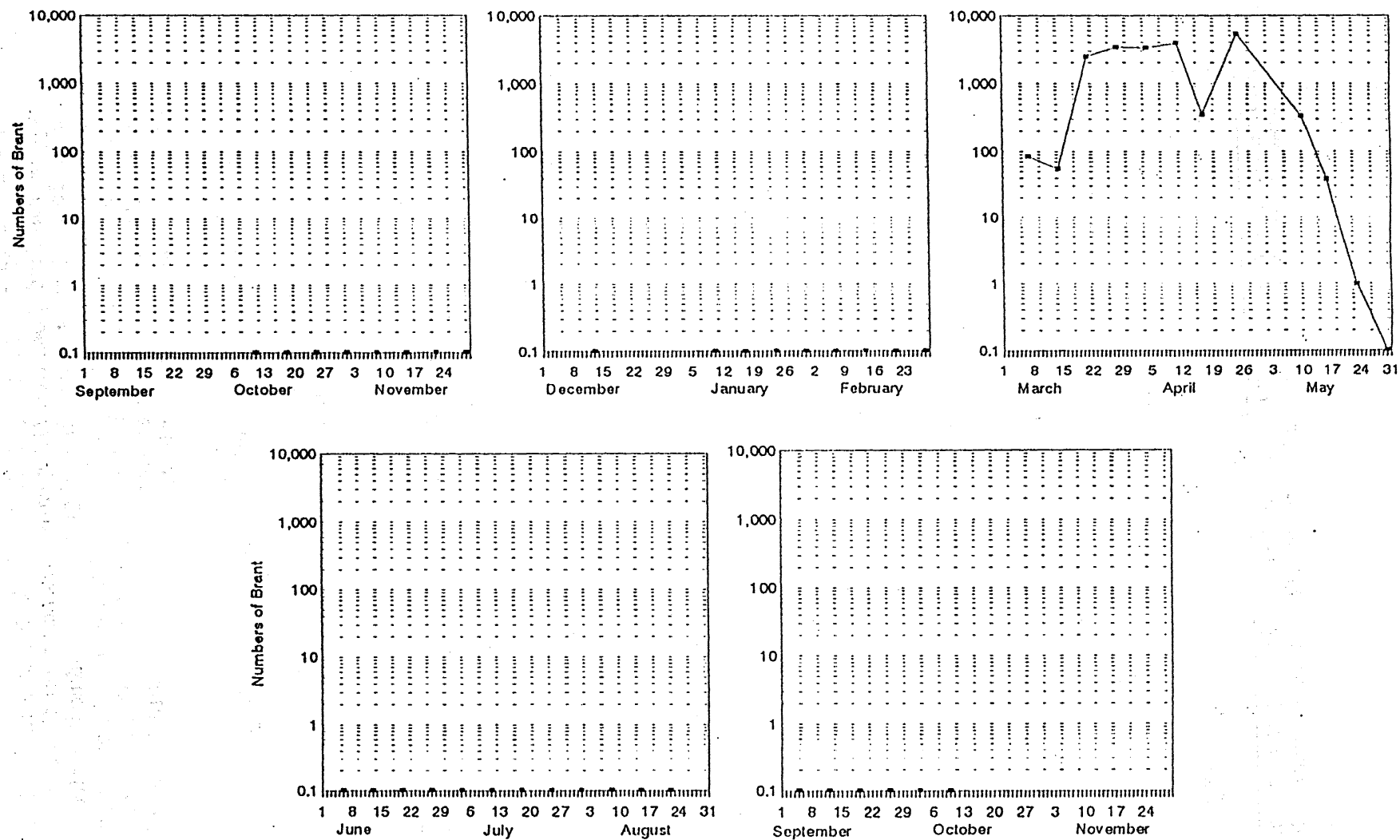


Figure 35. Seasonal fluctuations in the numbers of Brant on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

totalled 19,168 birds (94% of all geese). However, the species was present only in the spring from the earliest arrival on 7 March (1981) to the latest departure, a single bird on 21 May (1981). A peak of 5,291 Brant was seen on 25 April 1981 (Figure 35). The birds were selective about the areas that they used (Figure 34). Although both sides of the outer entrance to Comox Harbour were used, the inner harbour (units 4 to 22) did not receive much use. Highest use occurred near the Trent River (units 23 to 25; Figures 2 and 5) and to a lesser degree around units 28, 36, 41 to 45, plus units 47 and 48 on Denman Island.

We recorded 1,120 Canada Geese in total. From the earliest arrival on 21 February (1981) to the latest departure on 29 November (1980) the frequency of occurrence was never less than 50%; the species was not seen on the study area

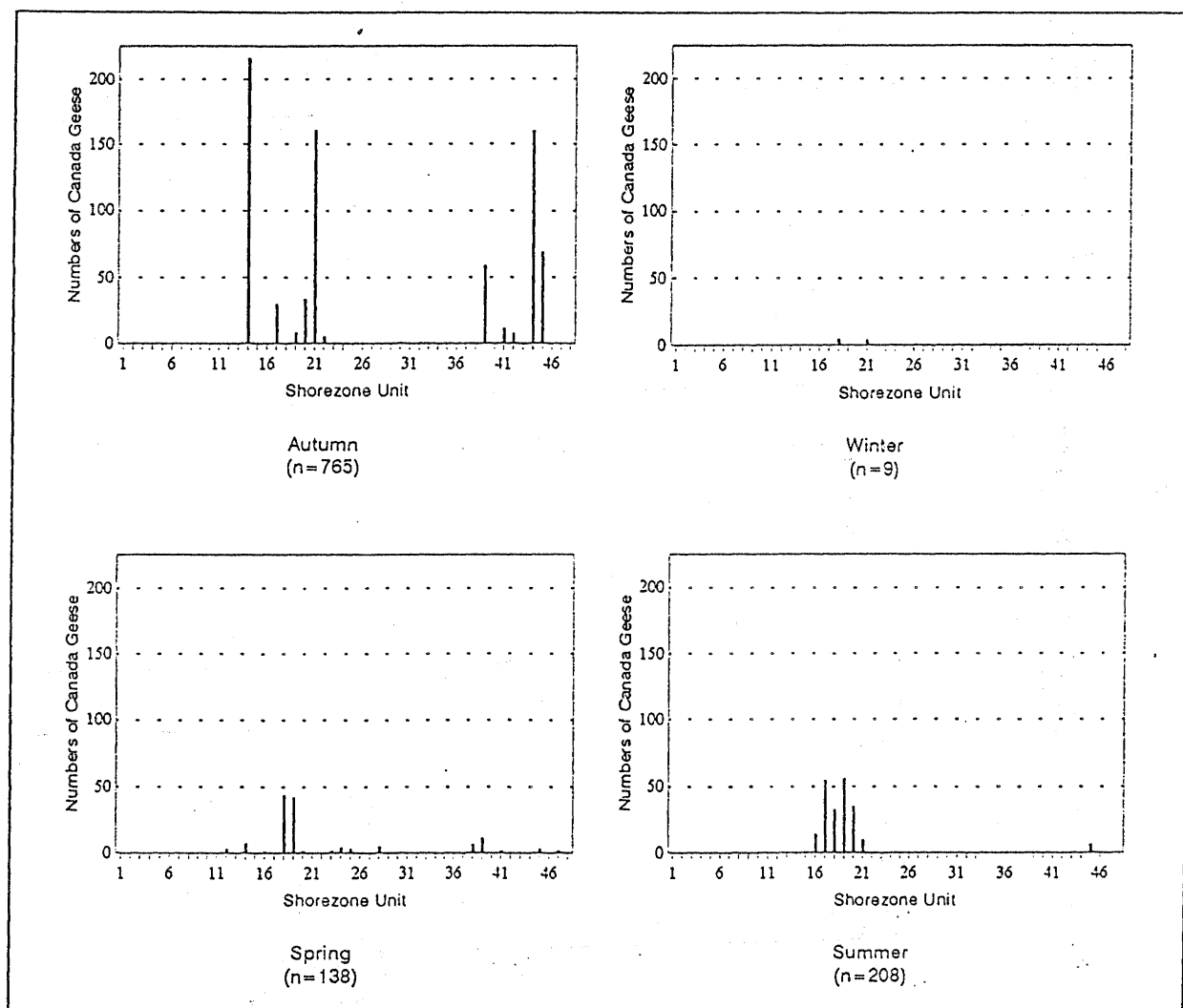


Figure 36. Seasonal variations in the distribution of Canada Geese on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

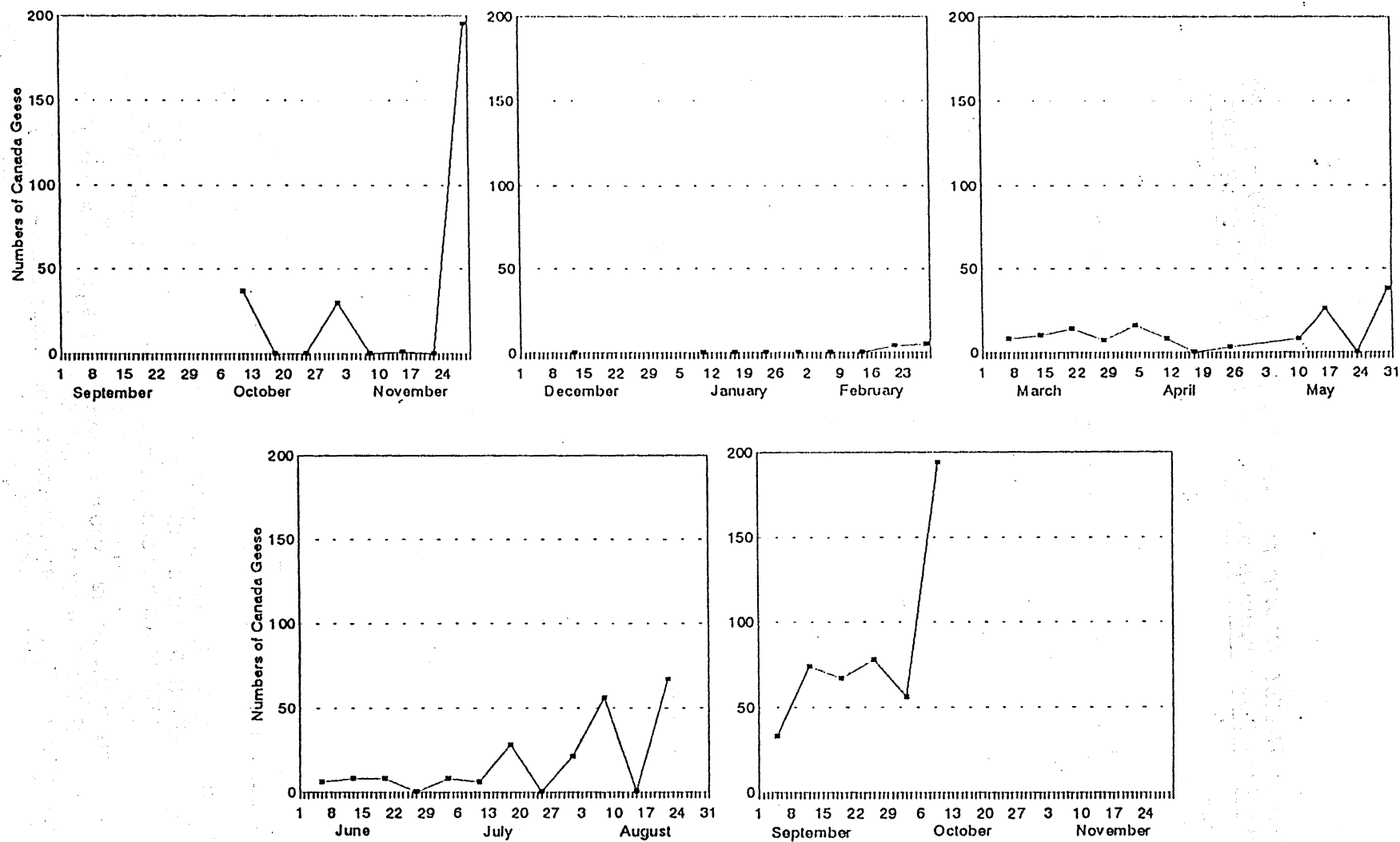


Figure 37. Seasonal fluctuations in the numbers of Canada Geese on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

during the interim weeks of winter. The highest seasonal total was in autumn (53% of bird-use days) when the following peaks were observed: 195 birds on 29 November 1980 and 194 birds on 10 October 1981 (Figure 37). The locations preferred by Canada Geese varied with the seasons; units 14 and 21 (Figure 2) in Comox Harbour and unit 44 (Figure 12) near Deep Bay received the most use, as shown in Figure 36. The presence of young (the earliest was 10 May 1981) documented breeding near Dyke Rd Slough (unit 18).

One Greater White-fronted Goose was recorded on 11 October 1980 near Millard Creek in Comox harbour (unit 21). Autumn migrants were also recorded at Campbell River: one bird on 10 September 1983 and one bird on 1 October 1983 (Dawe et al. 1995). For the most part, the Greater White-fronted Goose bypasses British Columbia during its annual migration to and from the Alaskan and western Canadian arctic breeding grounds (Campbell et al. 1990).

A total of 39 Snow Geese was seen on 1 November 1980; 38 of them were near Millard Creek in Comox Harbour (unit 21; Figure 2) and one individual was spotted from Metcalf Bay on Denman Island (unit 47).

Dabbling Ducks: During the study period, 9 species of dabbling ducks were recorded representing a combined total of 72,436 birds (10% of all birds). The most abundant was the American Wigeon but the Mallard ranked a close second. The remaining species (together comprising about 10% of dabbling ducks) were: Northern Pintail, Green-winged Teal, Blue-winged Teal, Northern Shoveler, Eurasian Wigeon, Cinnamon Teal and Gadwall. In addition, the total includes 1004 birds recorded simply as dabblers. Dabbling ducks were seen on every survey but the counts varied with the seasons (Figure 38). From a low of 15 birds on 25 July, the tally climbed to 3000 birds and remained around that number through much of the winter. However, during autumn and spring migration, peaks were higher: 3,775 birds (mostly Mallards) on 15 November 1980 and 3799 birds (mostly American Wigeons) on 21 March 1991. In mid-April the numbers plummeted to an early summer population of between 200 and 500 birds, most of them Mallards that were probably local breeders. The locations used by dabbling ducks changed over the seasons (Figure 39) but through autumn, winter and spring their numbers remained highest near Millard Creek in Comox harbour (unit 21; Figure 2).

The American Wigeon was the most abundant dabbling duck with a total of 33,109 birds recorded (46% of dabbling ducks). The species occurred on all but one of the surveys from earliest arrival on 22 August (1981) to latest departure on 20 June (1981). The peak in autumn was 1677 birds on 15 November 1980 which included 600 birds near Millard Creek (unit 21). The larger peak was in spring: 2254 birds were seen on 21 March 1981 (Figure 40). Nevertheless, the seasonal total for winter was 35% of the bird-use days for the year, slightly above the totals for autumn and spring. Most of the survey units in this study recorded some use by American Wigeons (Figure 41) but unit 21 near Millard Creek in Comox Harbour (Figure 2) received the greatest use in every season except summer.

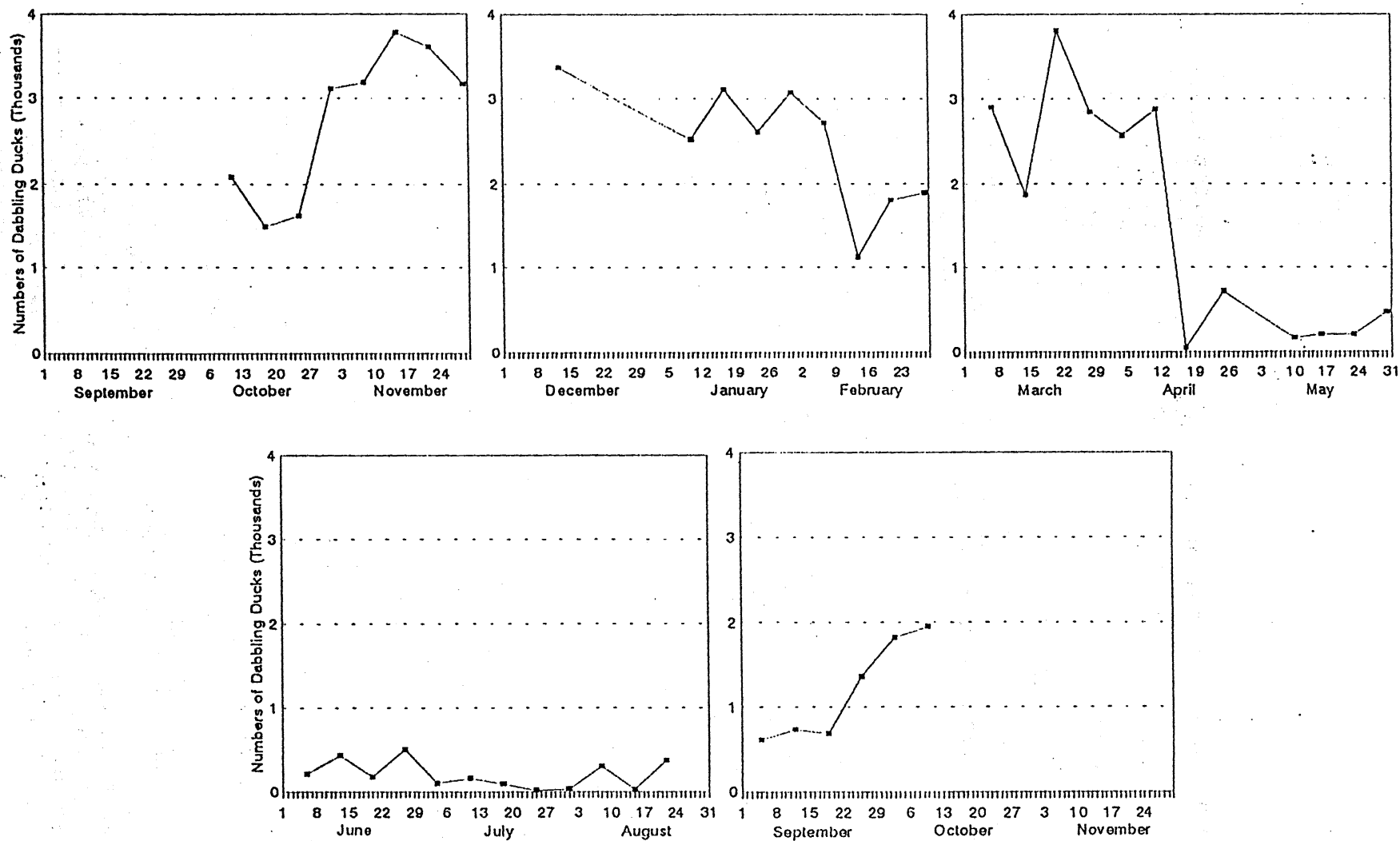


Figure 38. Seasonal fluctuations in the numbers of dabbling ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

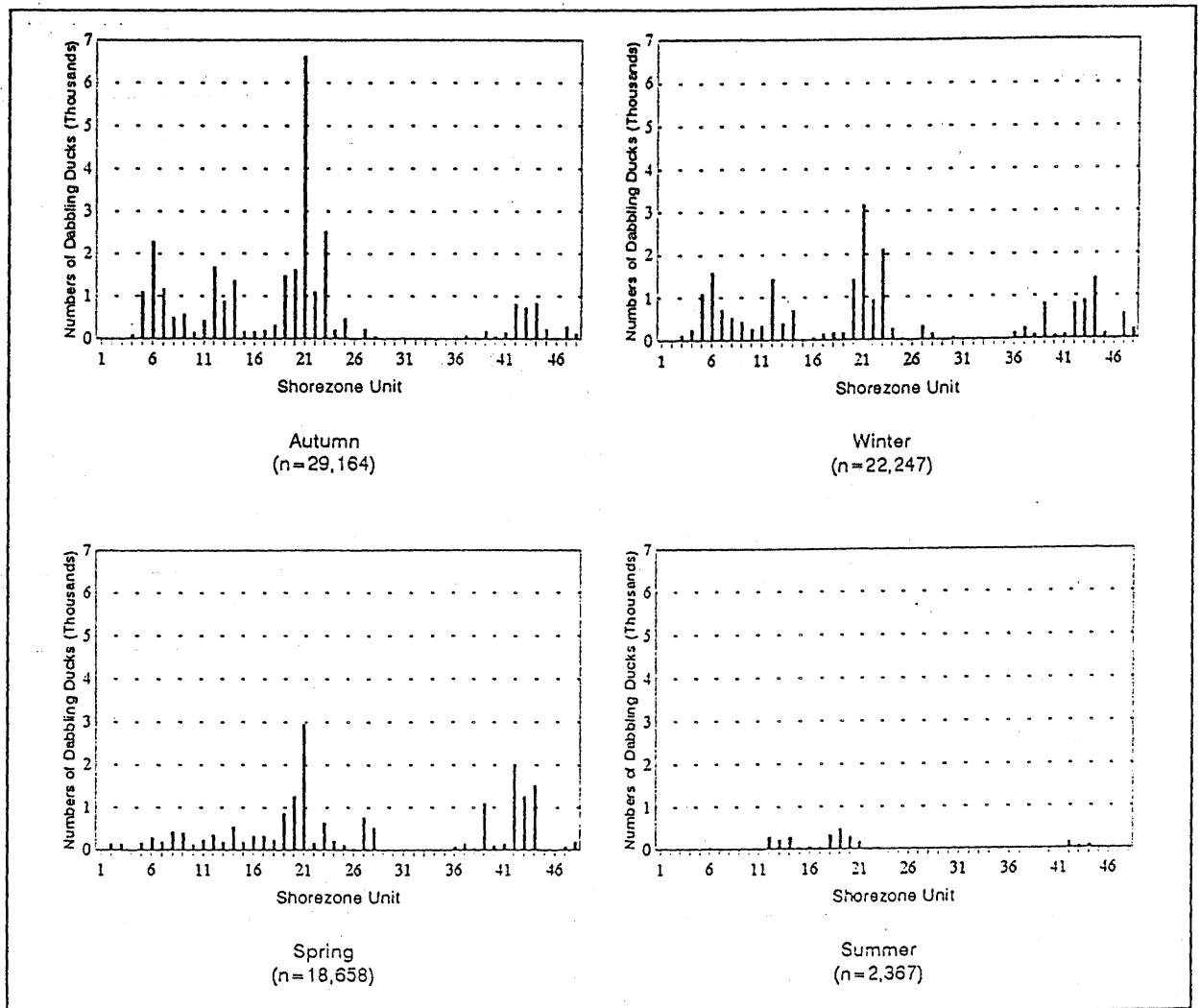


Figure 39. Seasonal variations in the distribution of dabbling ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The total number of Mallards seen was 31,560 birds (44% of dabbling ducks). Every survey throughout the year of study recorded this species; the lowest count was 4 Mallards on 15 August 1981. By autumn, numbers were increasing (Figure 42); a peak of 2001 birds was observed on 15 November 1980 which included 600 birds near Millard Creek (unit 21). Then numbers generally declined through winter and spring except for a smaller migrational peak of 1176

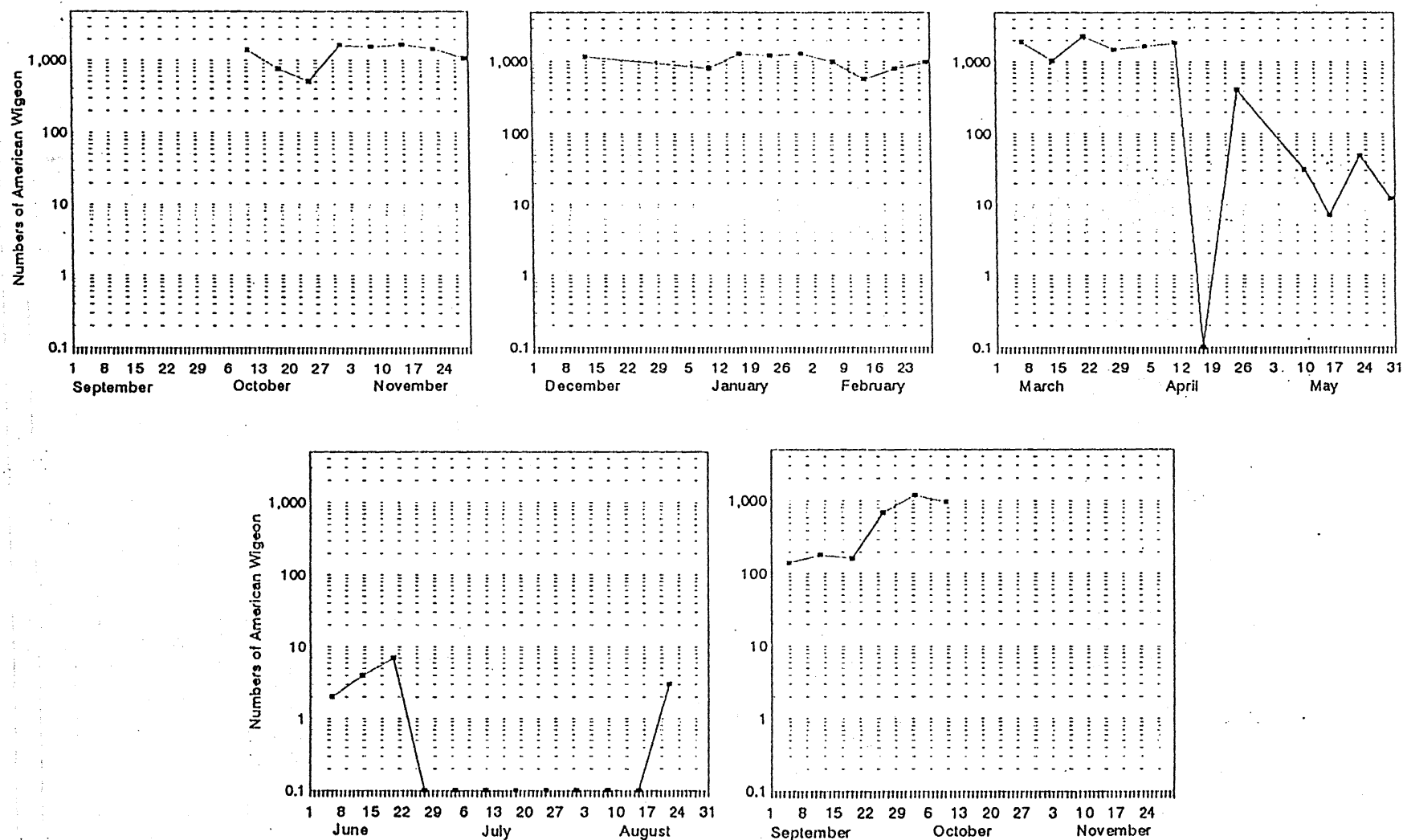


Figure 40. Seasonal fluctuations in the numbers of American Wigeon on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

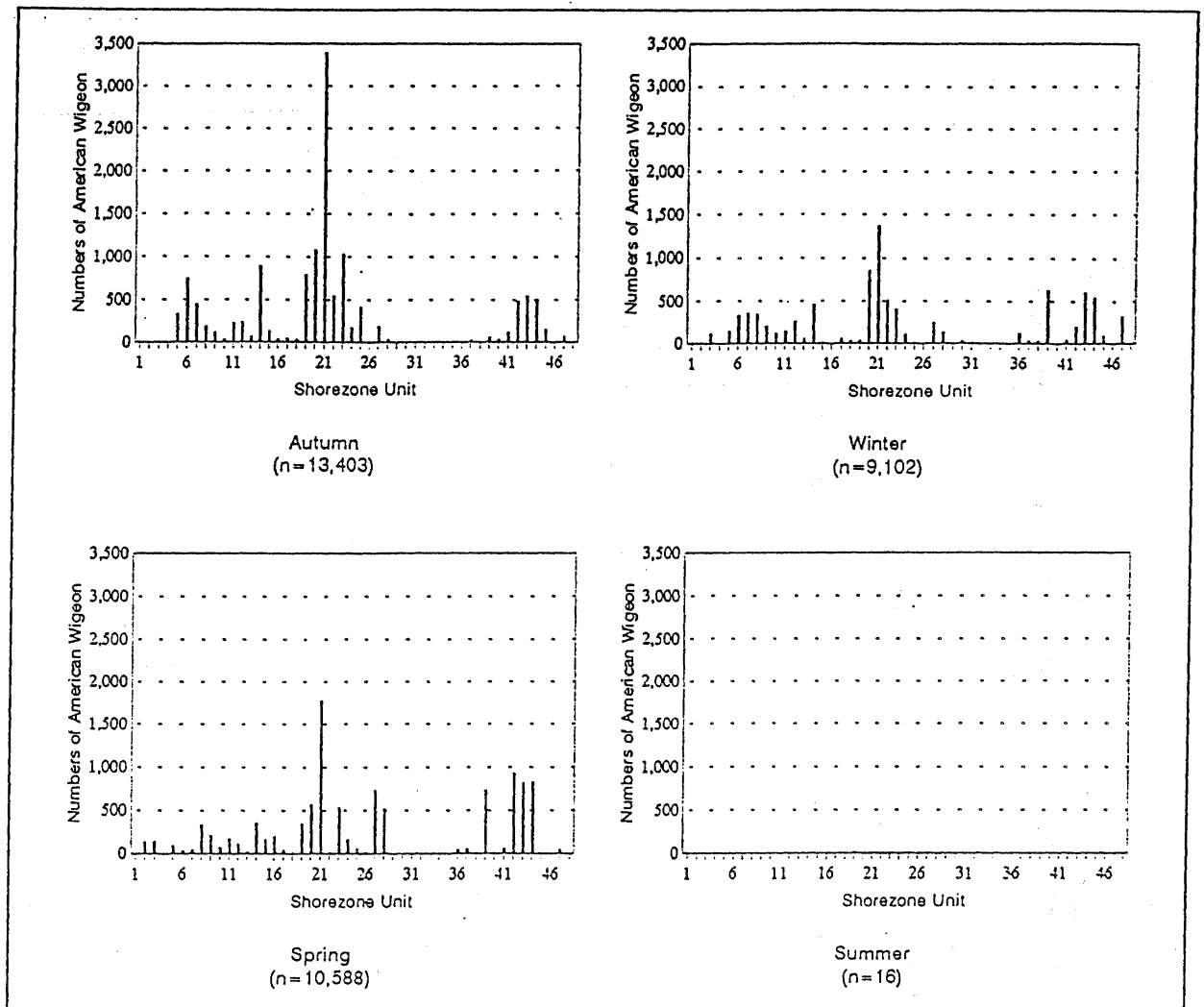


Figure 41. Seasonal variations in the distribution of American Wigeon on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

birds on 28 March 1981; again Millard Creek area had the highest abundance with 529 Mallards recorded there on that day. The largest proportion of Mallards was recorded in winter (45% of bird-use days). Mallards were seen from most of the units surveyed (Figure 43) but, like the wigeons, their highest use was in Comox Harbour, especially near Millard Creek (unit 21; Figure 2) in every season except summer. Breeding in the study area was documented by the presence of 26 Mallard ducklings near Courtenay River mouth (unit 19) on 16 May 1981 and 9 eggs in a nest at Mud Bay marsh on the same date; more sightings followed.

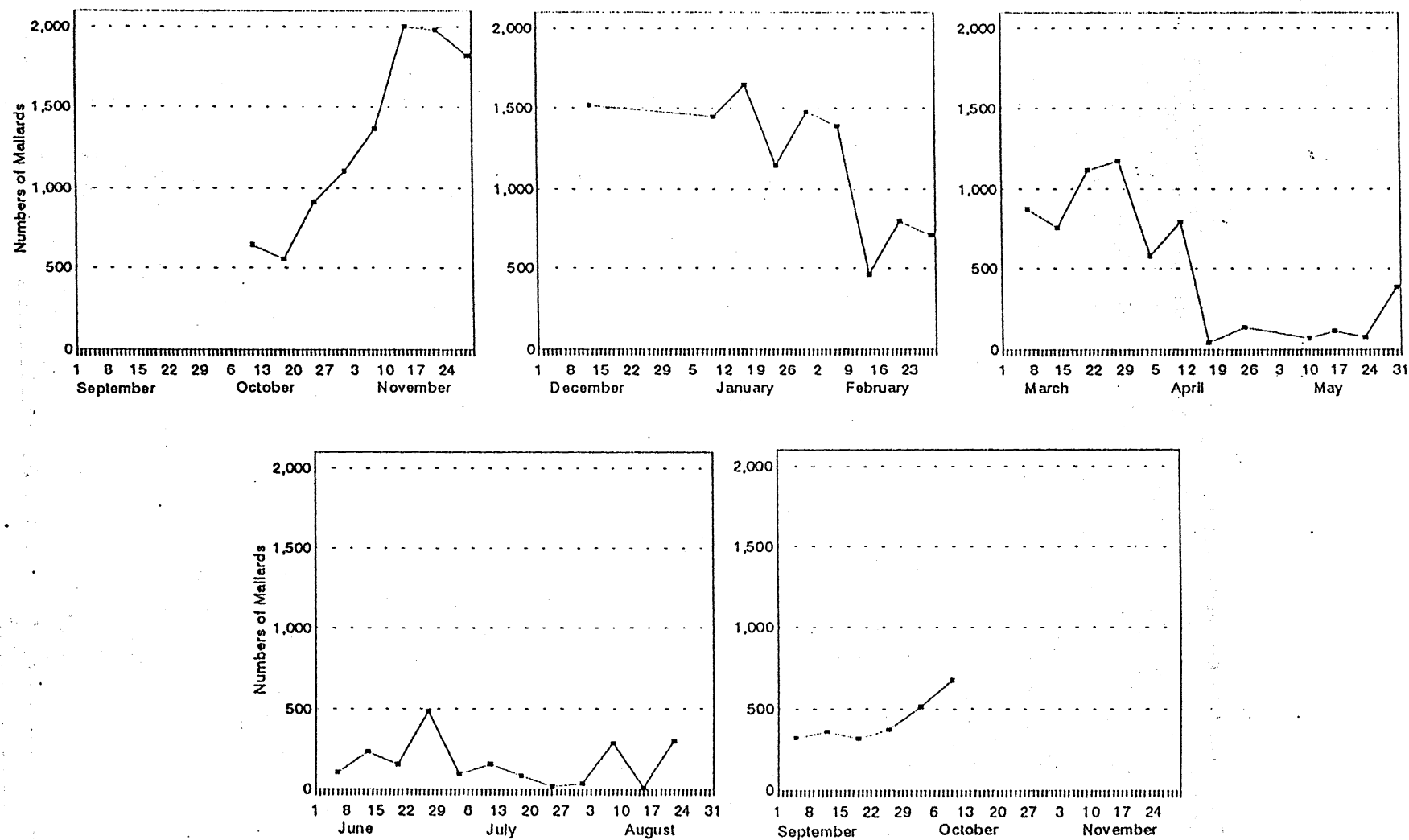


Figure 42. Seasonal fluctuations in the numbers of Mallards on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

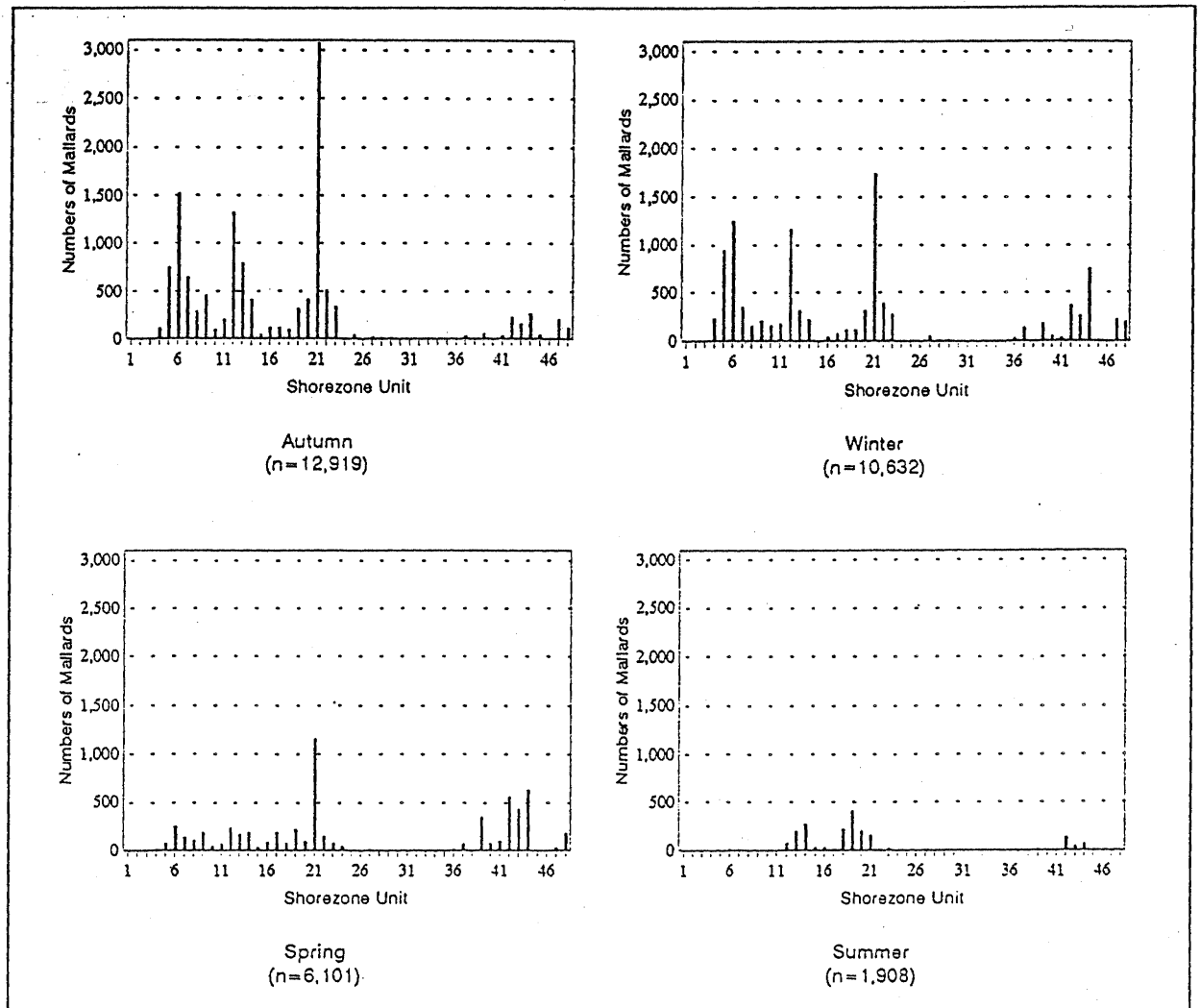


Figure 43. Seasonal variations in the distribution of Mallards on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Northern Pintail numbers totalled 4922 birds (7% of dabbling ducks). From earliest arrival on 22 August (1981) to latest departure on 4 July (1981), the frequency of occurrence was high (between 75% and 100%). The ducks were most abundant in winter (60% of bird-use days). A peak of 673 birds (including 605 birds near unit 23) occurred on 13 December 1980 (Figure 44). The observed activity of the Northern Pintail was more concentrated than that of the American Wigeon or the Mallard, as shown in Figure 45. For example, over the entire study period, 52% of all pintails were seen in the area around the outflow of the Trent River (unit 23; Figure 2).

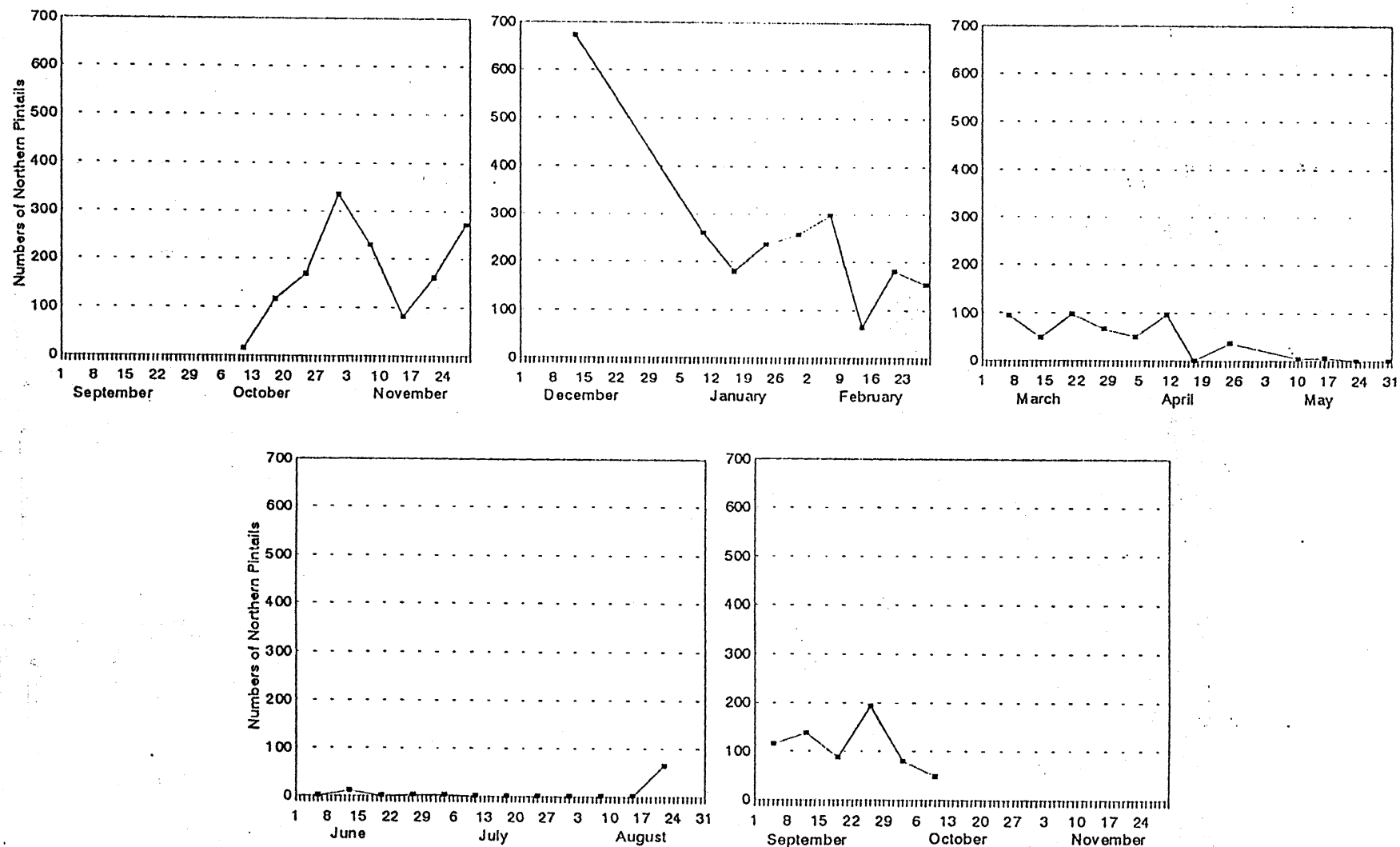


Figure 44. Seasonal fluctuations in the numbers of Northern Pintails on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

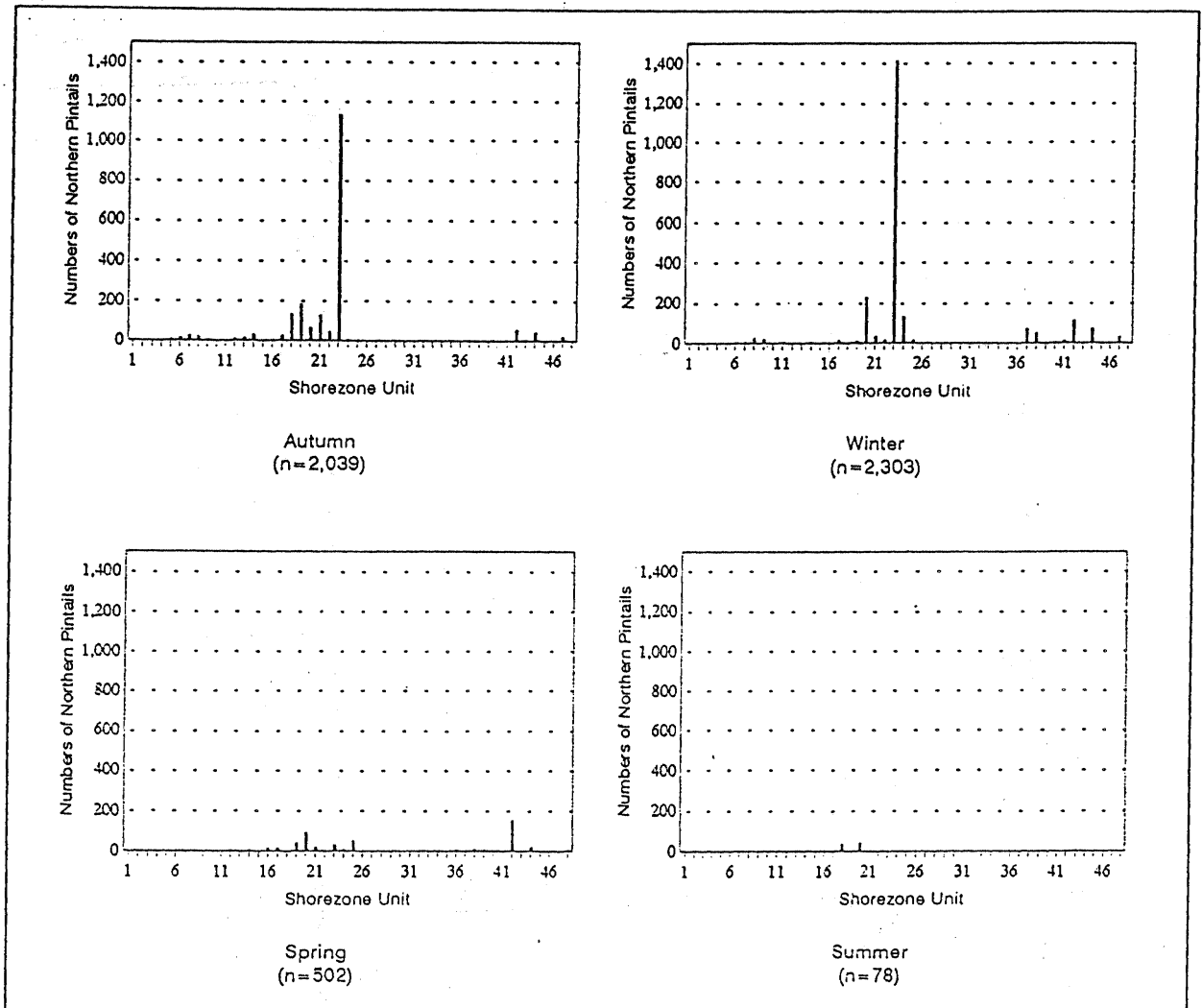


Figure 45. Seasonal variations in the distribution of Northern Pintails on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Of the 3 species of teal recorded during the surveys, the most abundant was the Green-winged Teal; in total, 1234 of the birds were seen (2% of dabbling ducks). Their numbers fluctuated from zero in the December-January period to a peak of 132 birds on 25 April 1981 and then returned to zero again on the majority of surveys in July and August (Figure 46). Most of the birds were seen in spring (61% of bird-use days). The locations preferred by the Green-winged Teal varied with the seasons (Figure 47). Note that the numbers counted in the area around the mouth of the Courtenay River (unit 19 and adjacent units; Figure 2) were roughly equivalent in autumn and spring but that the birds' use of the Mud Bay area (unit 42; Figure 11) changed with the seasons becoming higher in winter and especially in spring.

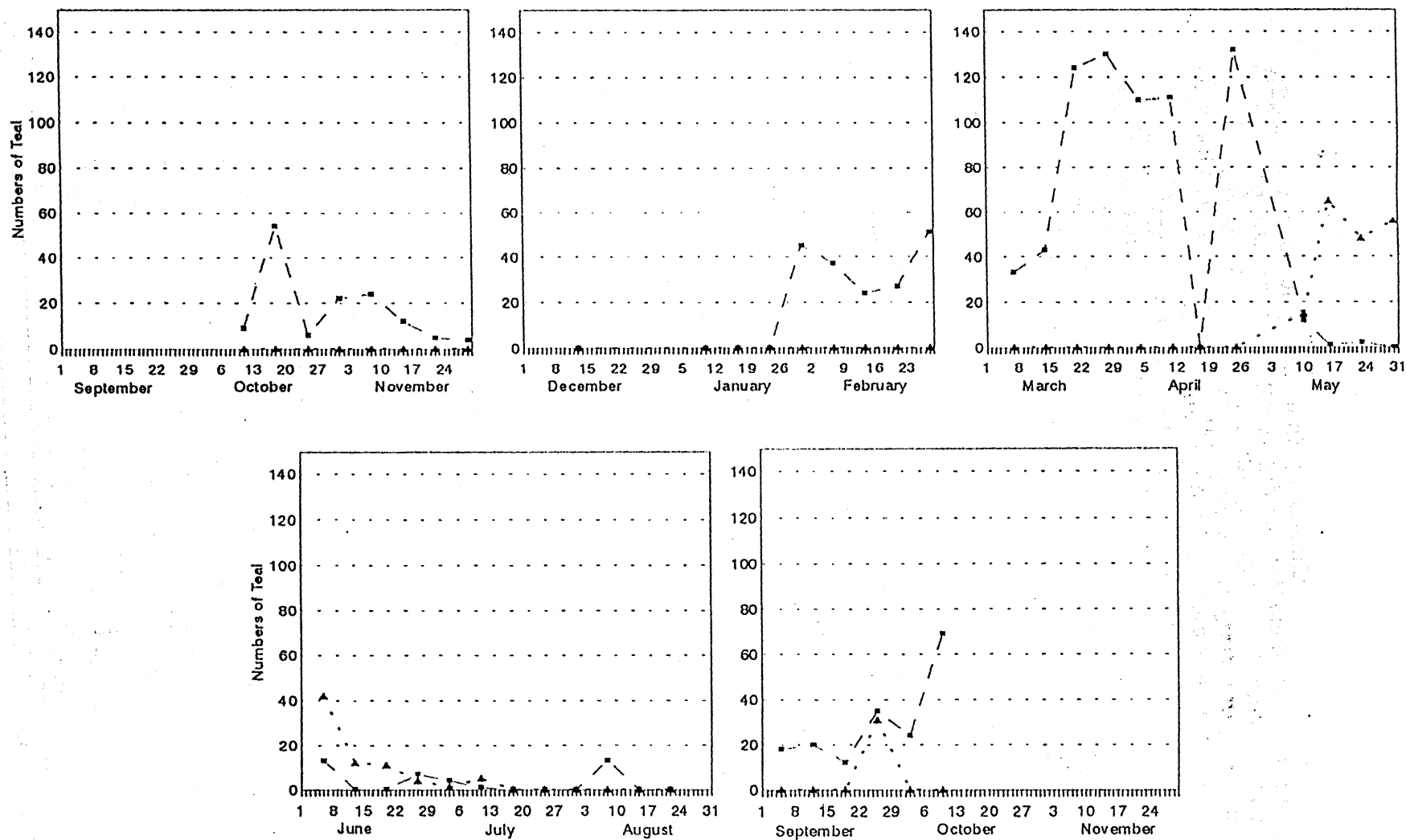


Figure 46. Seasonal fluctuations in the numbers of Green-winged Teal (dashed line) and Blue-winged Teal (dotted line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

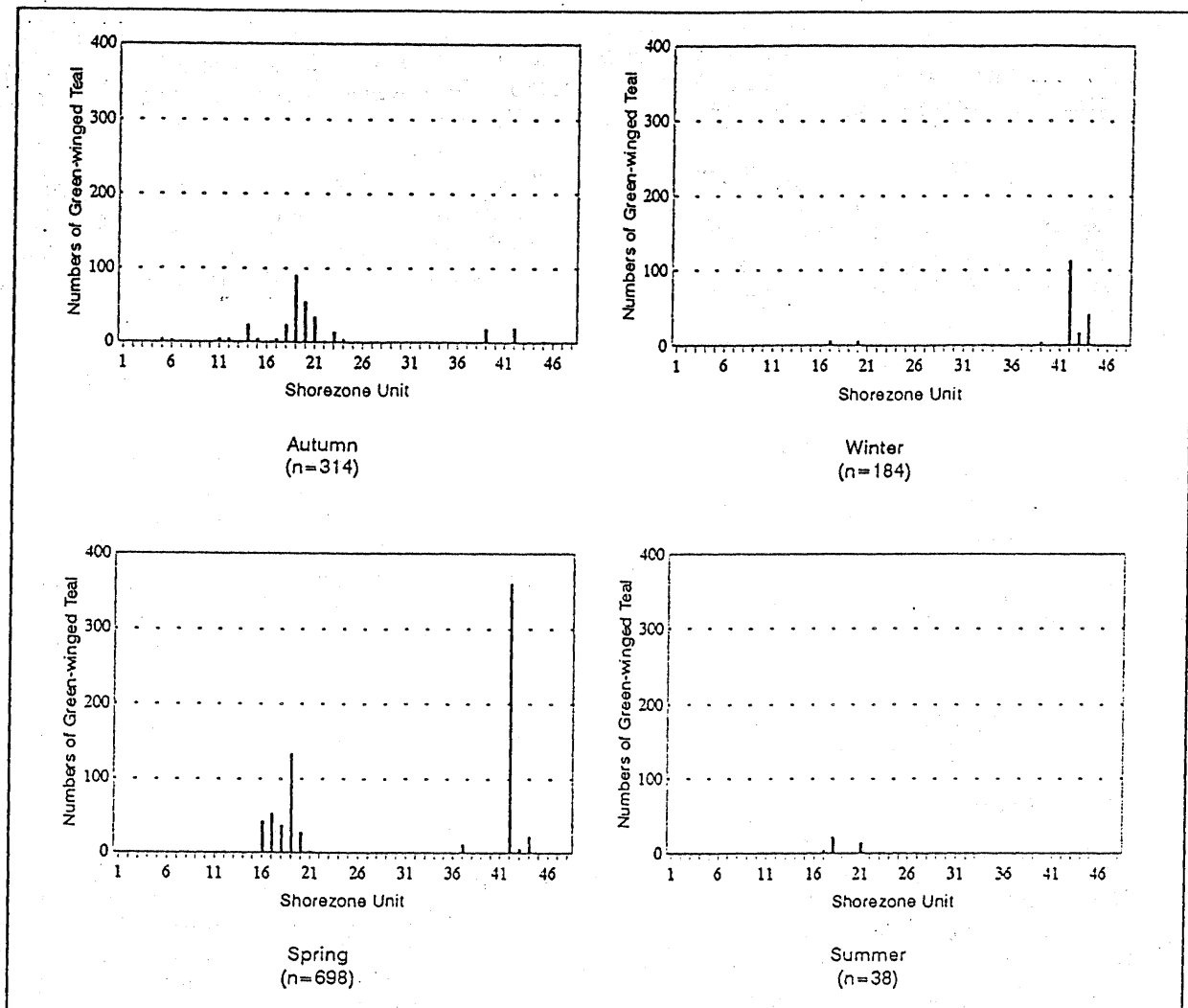


Figure 47. Seasonal variations in the distribution of Green-winged Teal on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total of 290 Blue-winged Teal was recorded during the survey. In autumn 31 migrants were seen on 26 September 1981. All other birds occurred in the period from the first arrival on 10 May (1981) to the latest departure on 11 July (1981). A peak of 65 birds was recorded on 16 May 1981; 57 of these birds were seen near the mouth of the Courtenay River (units 17, 18 and 19; Figure 2). Over the entire study period, these 3 units accounted for 82% of the Blue-winged Teal numbers but the species also made some use of the area from Fanny Bay to Deep Bay (units 39 to 45).

A total of 30 Cinnamon Teal were reported. Two autumn migrants were seen 22 August 1981 and one was seen 5 September 1981. All the others occurred in

a period from the earliest arrival on 17 April (1981) to the latest departure on 20 June (1981). The maximum count was 6 birds which occurred on 10 May 1981 and again on 23 May 1981. Most Cinnamon Teal were observed near the mouth of the Courtenay River (units 18 and 19; Figure 2).

A total of 224 Northern Shovelers was recorded between earliest arrival on 25 April (1981) and latest departure on 29 November (1980). Most of the birds were seen in autumn (47% of bird-use days) and spring (41%) when the migrational peaks were recorded: 34 birds on 26 September 1981 and 29 birds on 10 May 1981. The Northern Shovelers observed in this study focused most of their time at the mouth of the Courtenay River; unit 19 accounted for 67% of the birds tallied and most of the remainder were seen at units adjacent to unit 19 (Figure 2).

The Eurasian Wigeon is most often found within larger flocks of American Wigeon and therefore frequents similar habitats (Campbell et al. 1990). In this study a total of 62 birds were seen mostly in winter and spring; the ratio for each season was 1 or 2 Eurasian Wigeons per thousand American Wigeons. Earliest arrival was 19 September (1981) and latest departure was 11 April (1981). The largest number observed in one day was 7 birds. Like the American Wigeon, the Eurasian was seen most near units 20 to 23, unit 27 and unit 43 (Figures 2, 6 and 11).

One Gadwall was seen on 4 April 1981 near the mouth of Rosewall Creek (unit 43; Figure 11).

Diving Ducks: During the study period, 16 species of diving ducks were reported with a combined total of 238,678 birds (34% of all birds) including 12,820 diving ducks for which the species was not identified. A total of 40,141 birds that were recorded simply as ducks is also included here because the majority of them were likely to have been diving ducks a distance from shore. The most numerous of those identified was the White-winged Scoter, followed closely by Surf Scoter, Greater Scaup and Black Scoter; the Bufflehead, Common Merganser, Harlequin Duck, Common Goldeneye and Red-breasted Merganser also occurred in good numbers. The remaining diving ducks (Barrow's Goldeneye, Oldsquaw, Lesser Scaup, Canvasback, Hooded Merganser, Ring-necked Duck and Ruddy Duck) together comprised less than 2% of all diving ducks.

Throughout the year, diving ducks were present during surveys on Baynes Sound; the lowest number recorded was 136 birds on 27 June 1981. Most of the diving ducks were observed in winter (40% of bird-use days) and autumn (30%). A minimum of nearly 6000 birds was present on the sound from October until April; a peak of 12,185 birds occurred on 31 January 1981. Figure 48 shows seasonal fluctuations in combined numbers of all diving ducks (solid line) and, for comparison, the number of birds recorded simply as ducks (dashed line). The locations used most by diving ducks varied with the seasons (Figure 49). For example, in autumn Comox Harbour (unit 13 and 12; Figure 2) was used much more than other areas especially by scoters and scaup but in spring and summer there were more diving ducks near the mouth of the Trent River (unit 23; Figure 2) partly because of the high proportion of use given at times by Surf Scoters and Common Mergansers.

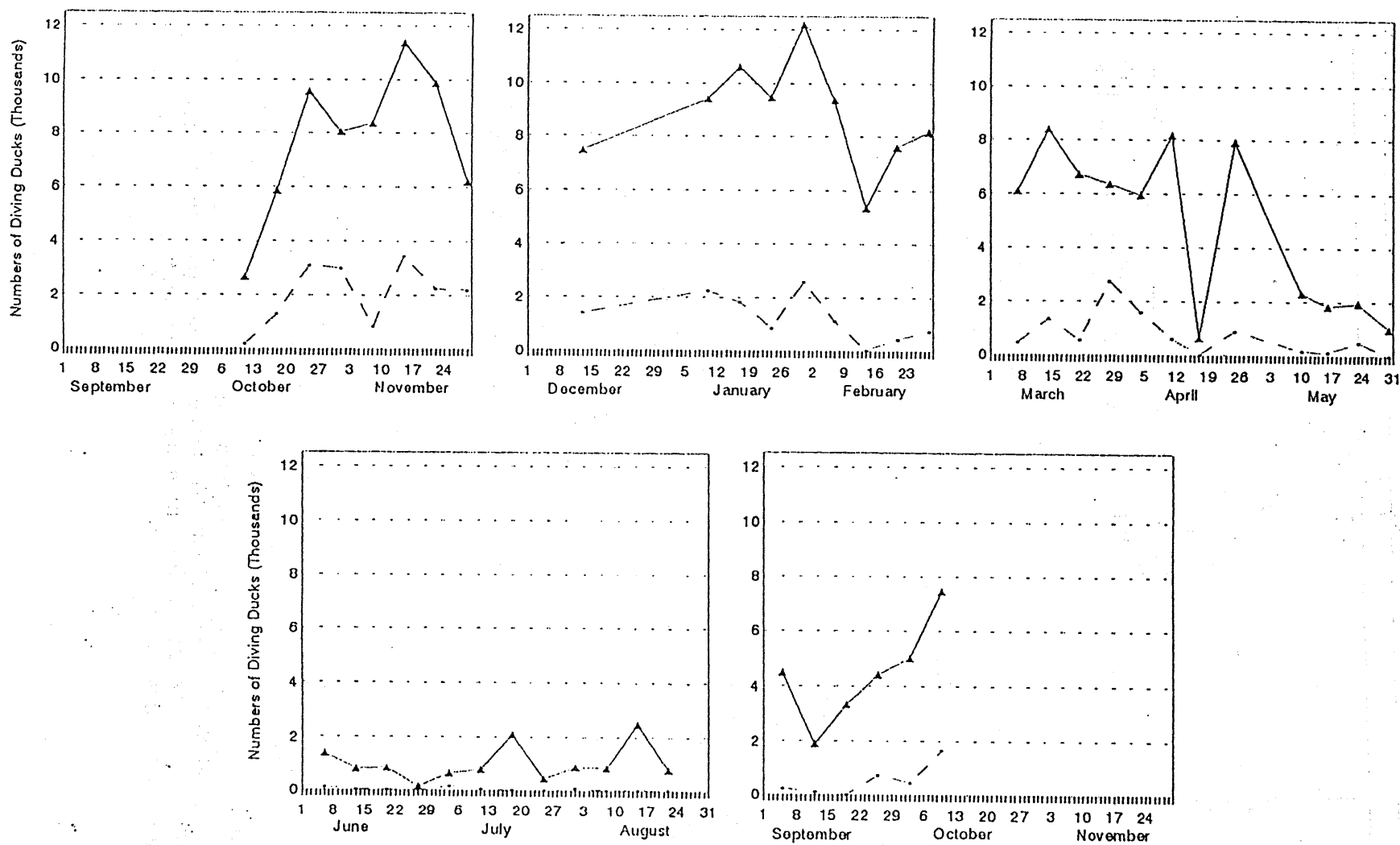


Figure 48. Seasonal fluctuations in the numbers of diving ducks (solid line) and birds recorded simply as ducks (dashed line) on the Baynes Sound -Comox Harbour study area, 11 October 1980 to 10 October 1981.

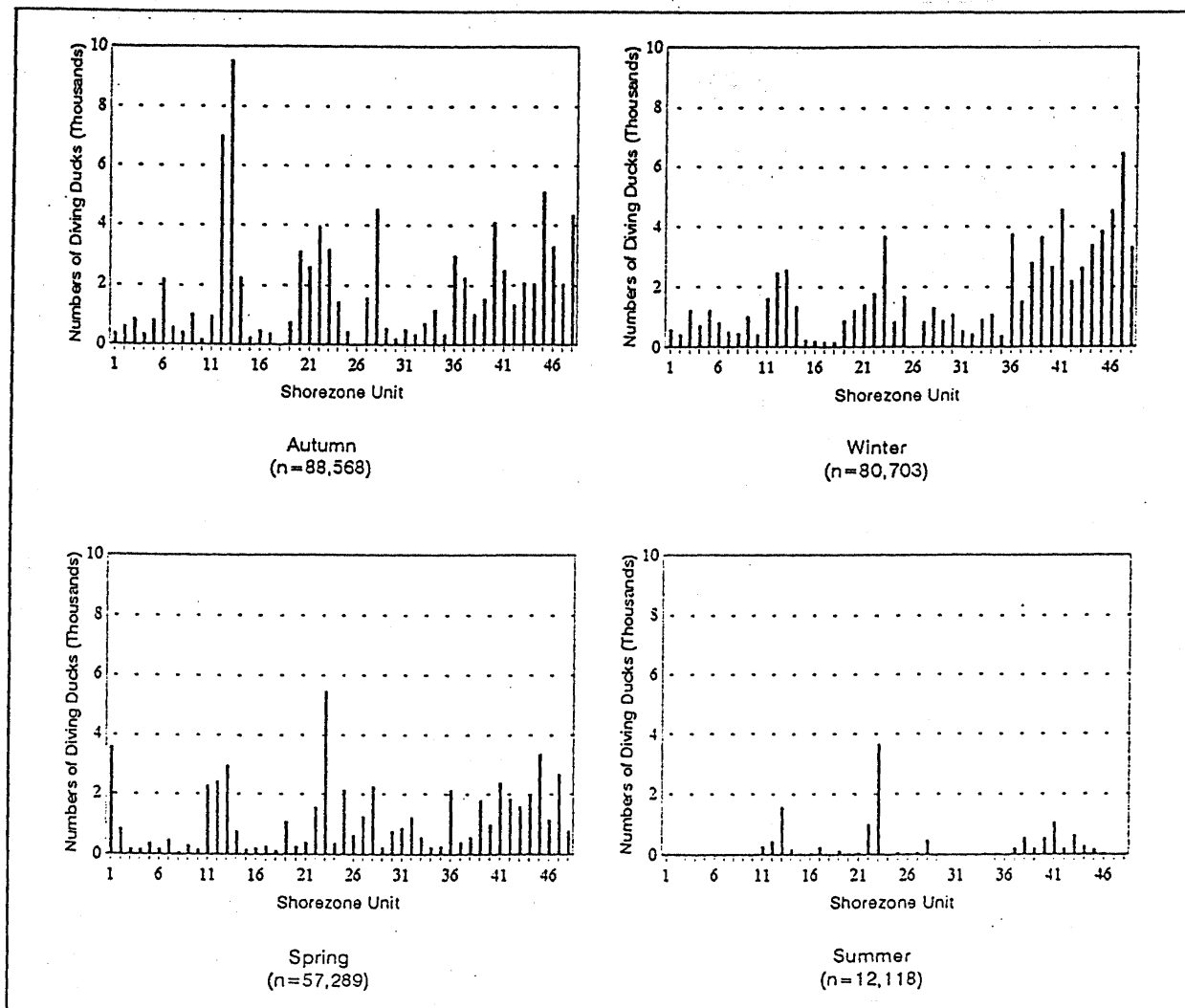


Figure 49. Seasonal variations in the distribution of diving ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Three species of scoters, the Surf Scoter, White-winged Scoter and Black Scoter, together accounted for 46% of all diving ducks. This figure includes 19,122 birds recorded simply as scoters (17% of all scoters). Seasonal fluctuations in the numbers of all scoters combined are shown in Figure 51 (solid line) compared with the numbers of White-winged Scoters (dashed line). White-winged Scoters accounted for about half of all scoters identified throughout the year of study, except at the end of April, when a large number of Surf Scoters and unspecified scoters were reported, and in summer when most of the birds were identified simply as scoters.

The most numerous diving duck and the third most abundant species in this study was the White-Winged Scoter with a total of 47,666 birds identified (20% of diving ducks). The species was observed on every survey throughout the seasons but numbers fluctuated (Figure 51, dashed line); in summer, counts varied from 32 to almost 600 birds whereas in autumn and winter there were more than 1000 White-winged Scoters on Baynes Sound most of the time. Most of the White-winged Scoters were seen in autumn (36% of bird-use days) and winter (34%). A peak of 2436 birds was recorded on 15 November 1980. Preferred locations, as shown in Figure 50, were from the entrance of Comox Harbour south (units 23 to 48, Figures 5 to 12); the inner harbour received comparatively little use by White-winged Scoters except for the area near units 12 and 13 in autumn.

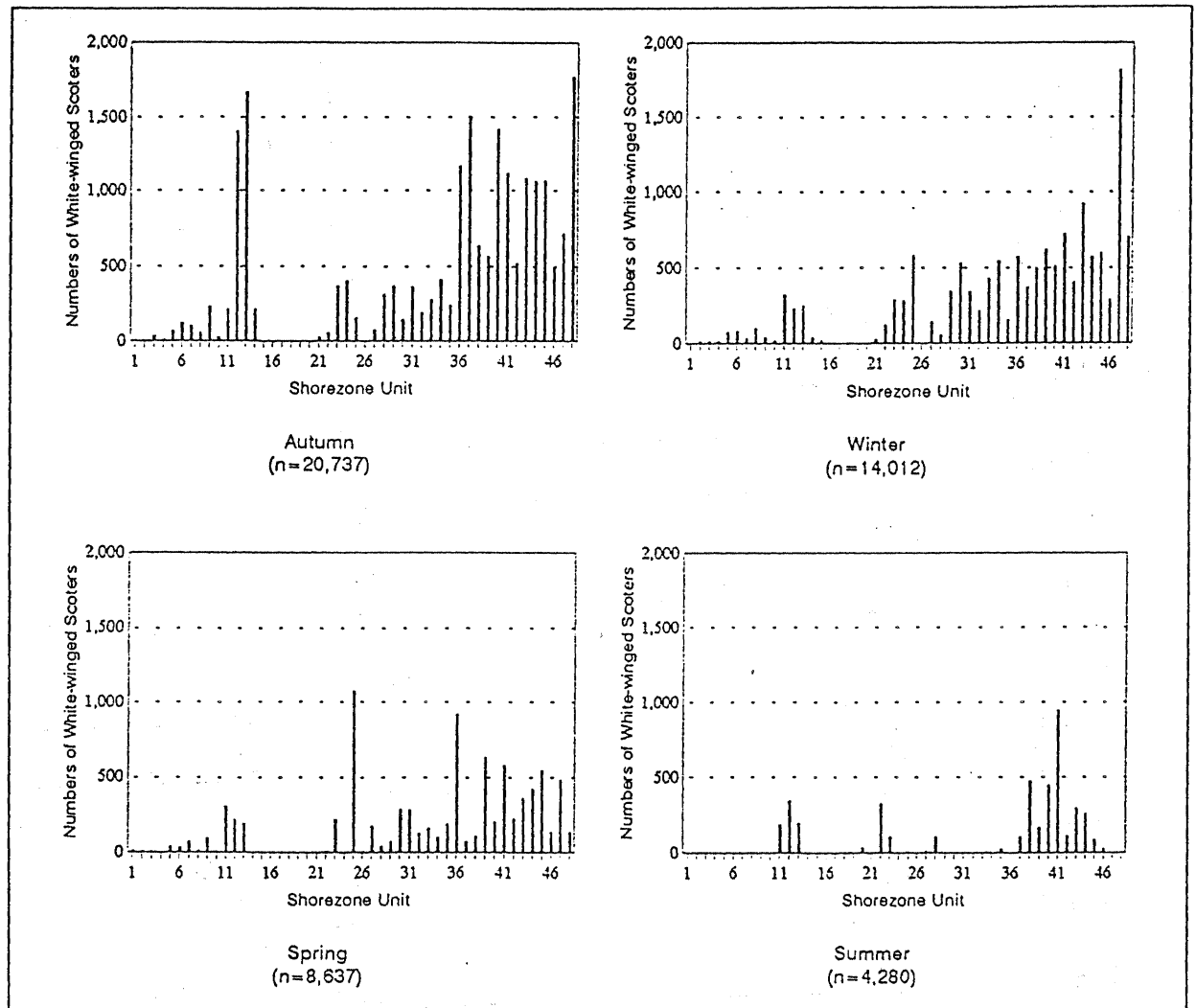


Figure 50. Seasonal variations in the distribution of White-winged Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

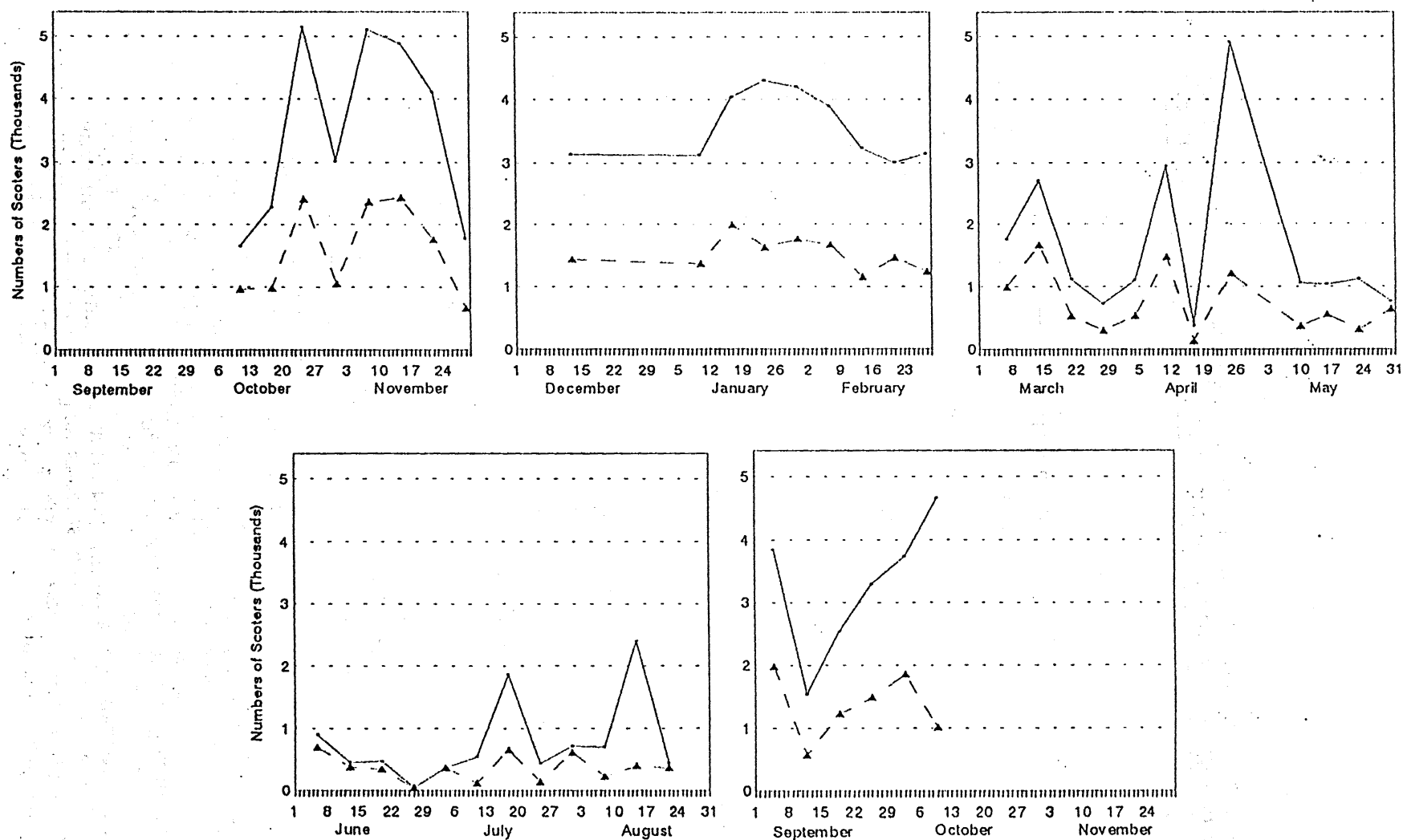


Figure 51. Seasonal fluctuations in the numbers of White-winged Scoters (dashed line) and all scoters combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total 30,777 Surf Scoters was tallied (13% of all diving ducks); the species was recorded on every survey but one. Each season their numbers were roughly two-thirds those of the White-winged Scoters except in summer when the number of unspecified scoters recorded makes analysis difficult. The Surf Scoter was most abundant in winter (41% of bird-use days), but the highest one-day counts occurred during autumn and spring migrations: a peak of 1847 birds was recorded on 25 October 1980 and a similar peak of 1826 birds was recorded on 25 April 1981 (Figure 53, dotted line). Like the White-winged Scoter, the Surf Scoter appeared to prefer sites away from the shallow head of Comox Harbour (Figure 52). Higher use was recorded towards the southern end of the study area, especially from unit 39 and south (Figures 10 to 12) and from units 48 and 47 (Figures 7 and 11). However, Surf Scoters used much of the north side of the inner harbour and the area around Goose Spit (units 1 to 11) more than the White-winged Scoter, especially in autumn and winter.

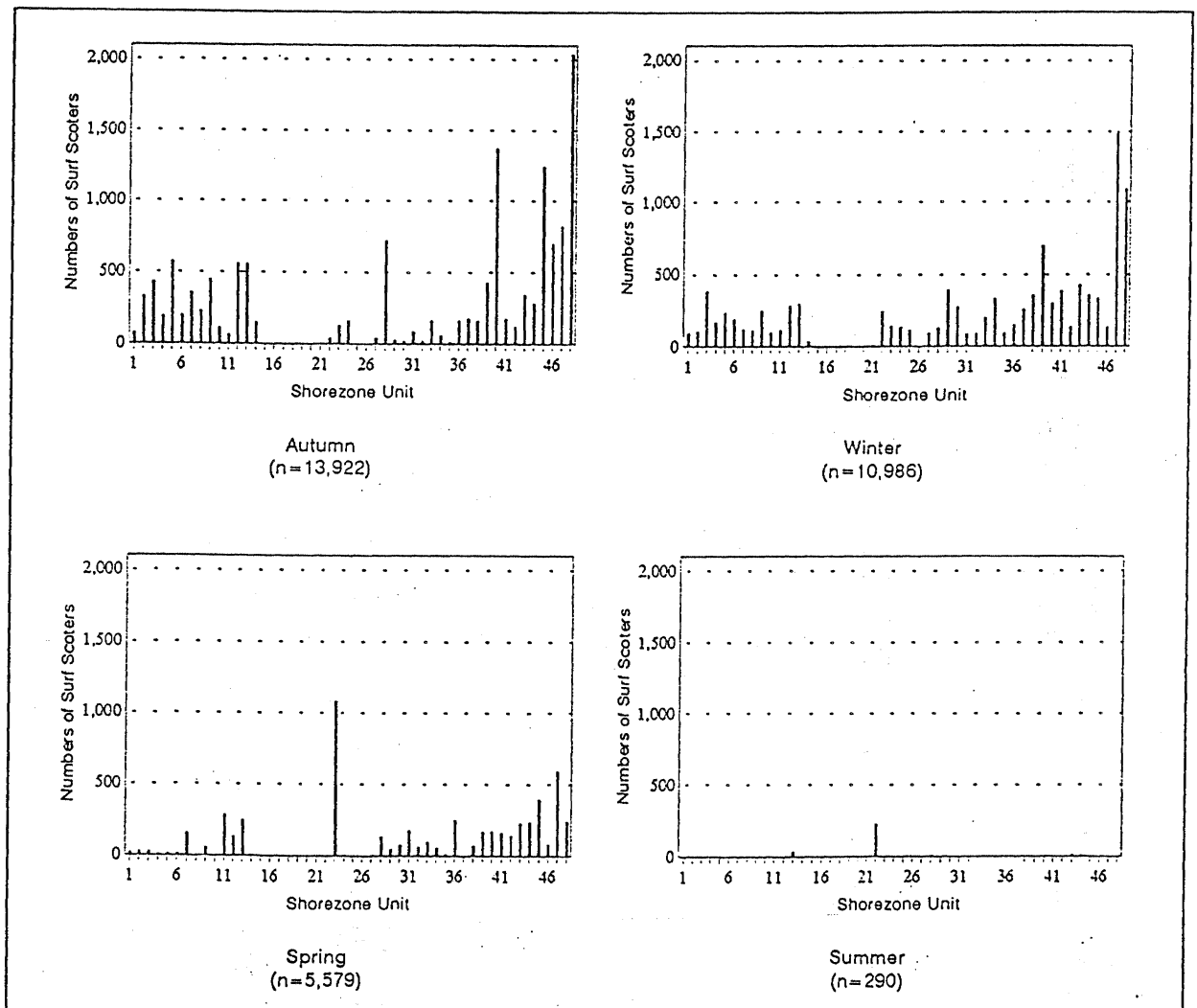


Figure 52. Seasonal variations in the distribution of Surf Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

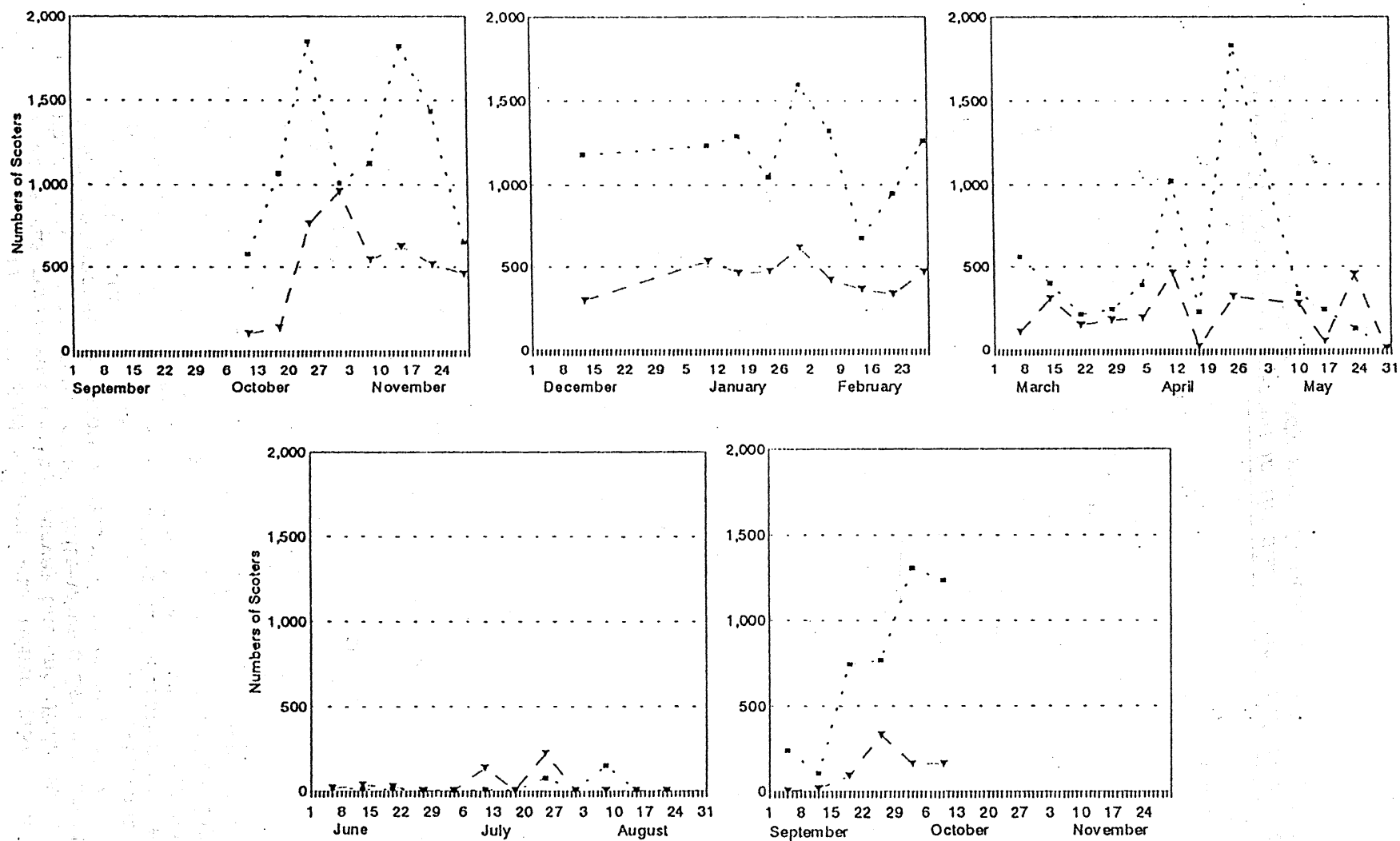


Figure 53. Seasonal fluctuations in the numbers of Surf Scoters (dotted line) and Black Scoters (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

We counted a total of 11,790 Black Scoters (5% of all diving ducks). The species was present in every season but their numbers fluctuated (Figure 53, dashed line) from a low in summer to a high in winter (40% of bird-use days). When a peak of 960 birds was observed on 1 November 1980 (including 550 birds at unit 13), the numbers of Black Scoters were almost equal to the numbers of each of the other two species of scoters. Black Scoter use of Baynes Sound was concentrated in fewer locations than the other two scoter species; these preferred locations changed with the seasons (Figure 54).

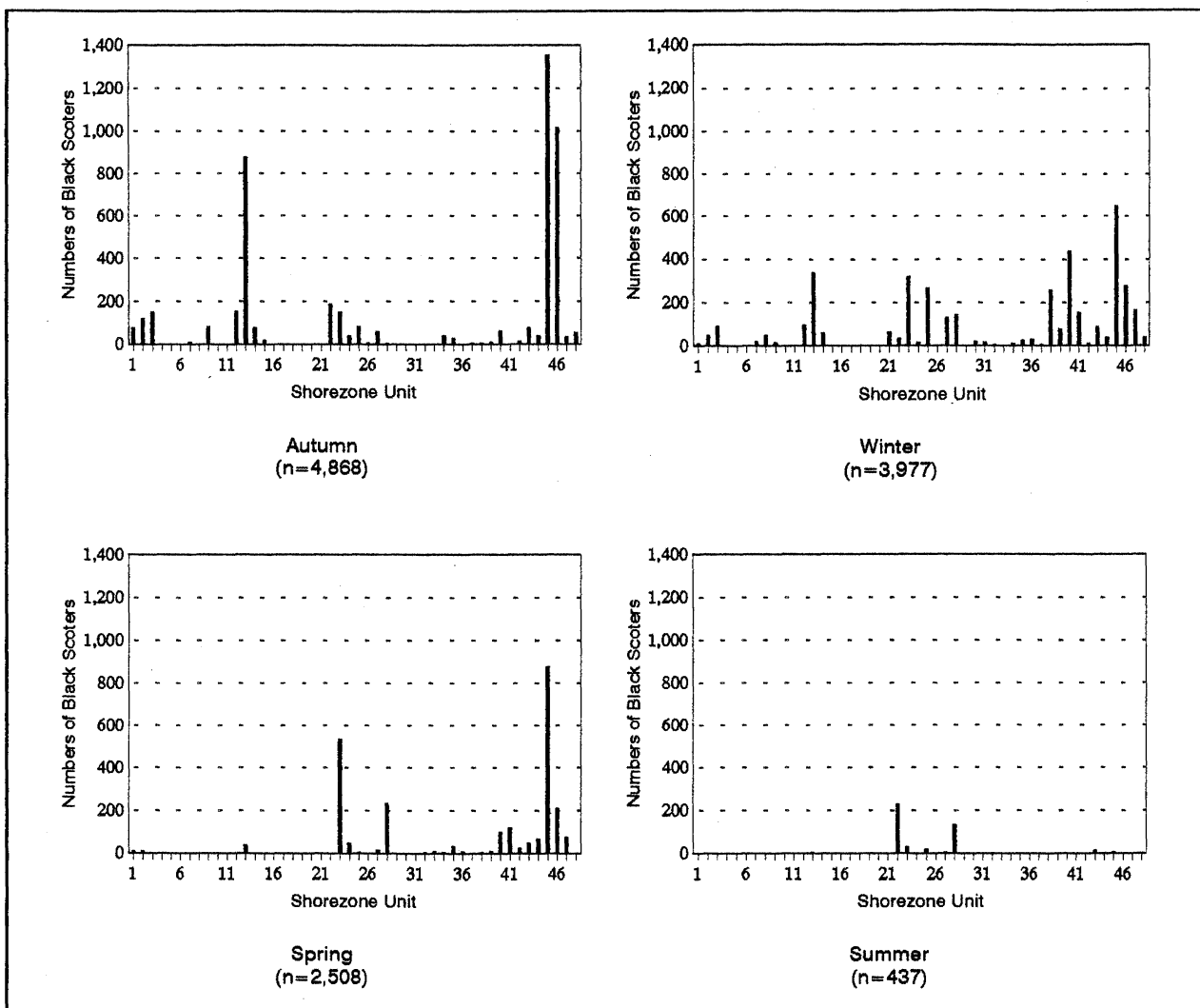


Figure 54. Seasonal variations in the distribution of Black Scoters on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Both the Greater Scaup and the Lesser Scaup were observed in this study, however the numbers of each species are underrepresented because a total of 11,001 birds were recorded simply as Scaup species. Nevertheless, the Greater Scaup was the third most abundant diving duck with a total of 27,313 birds

reported (11% of all diving ducks). From the earliest arrival on 19 September (1981) to the latest departure on 20 June (1981), the Greater Scaup was present continuously; in summer its occurrence was intermittent. More than half the total for the year was seen in winter (58% of bird-use days); a peak of 2265 birds was recorded on 31 January 1981. Fluctuations in the numbers of Greater and Lesser Scaup are shown along with the numbers of all scaup combined in Figure 56. The majority of the areas in the study area were used by the Greater Scaup but some locations were used only seasonally (Figure 55; cross hatched bars). Most of the scaup seen near Goose Spit were identified simply as scaup species (Figure 55; empty white bars); it is likely that a high proportion of these birds are also Greater Scaup.

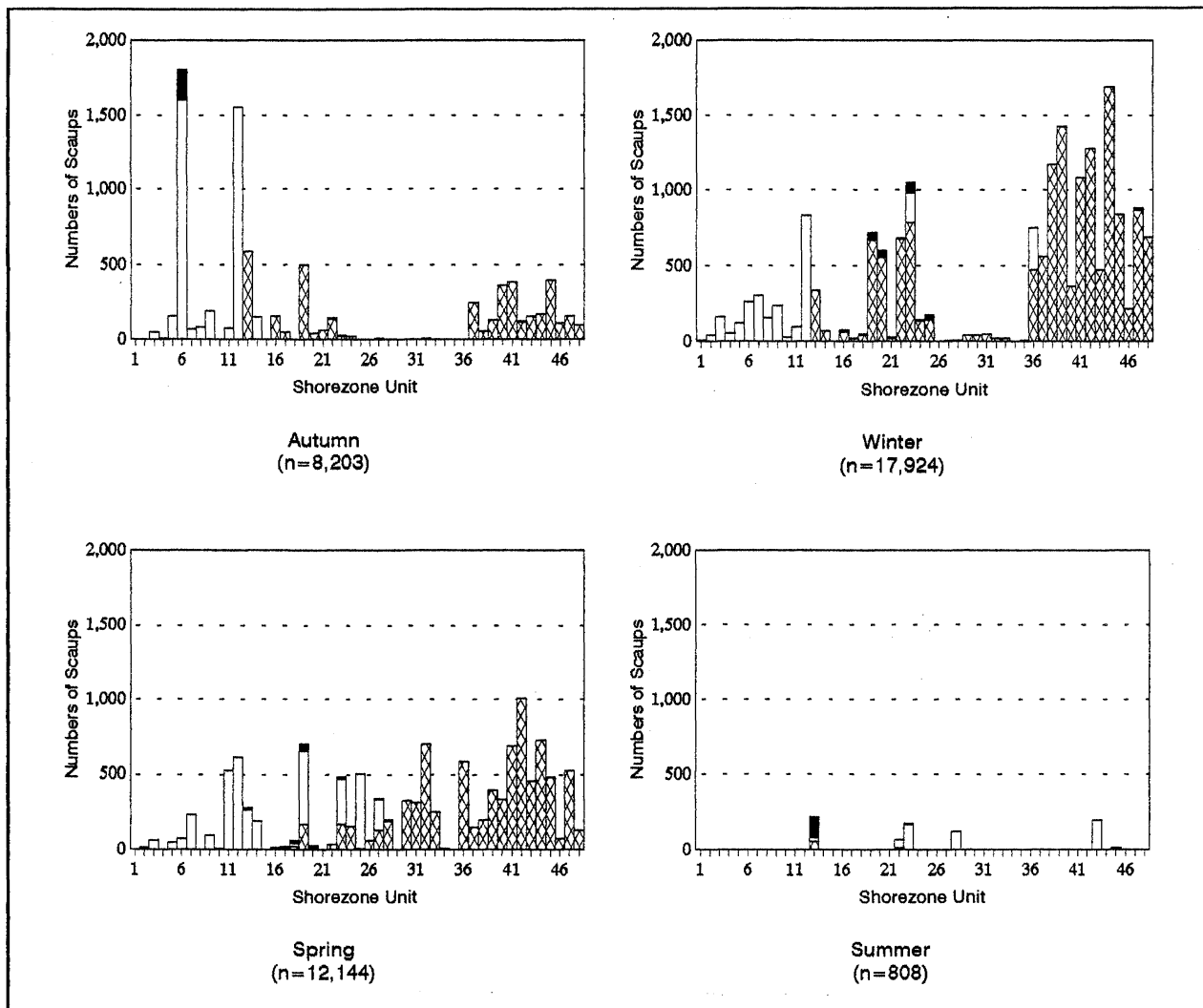


Figure 55. Seasonal variations in the distribution of scaup on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981. Greater Scaup are shown as cross hatching, Lesser Scaup are solid black and birds identified simply as scaup species are represented by empty (white) segments.

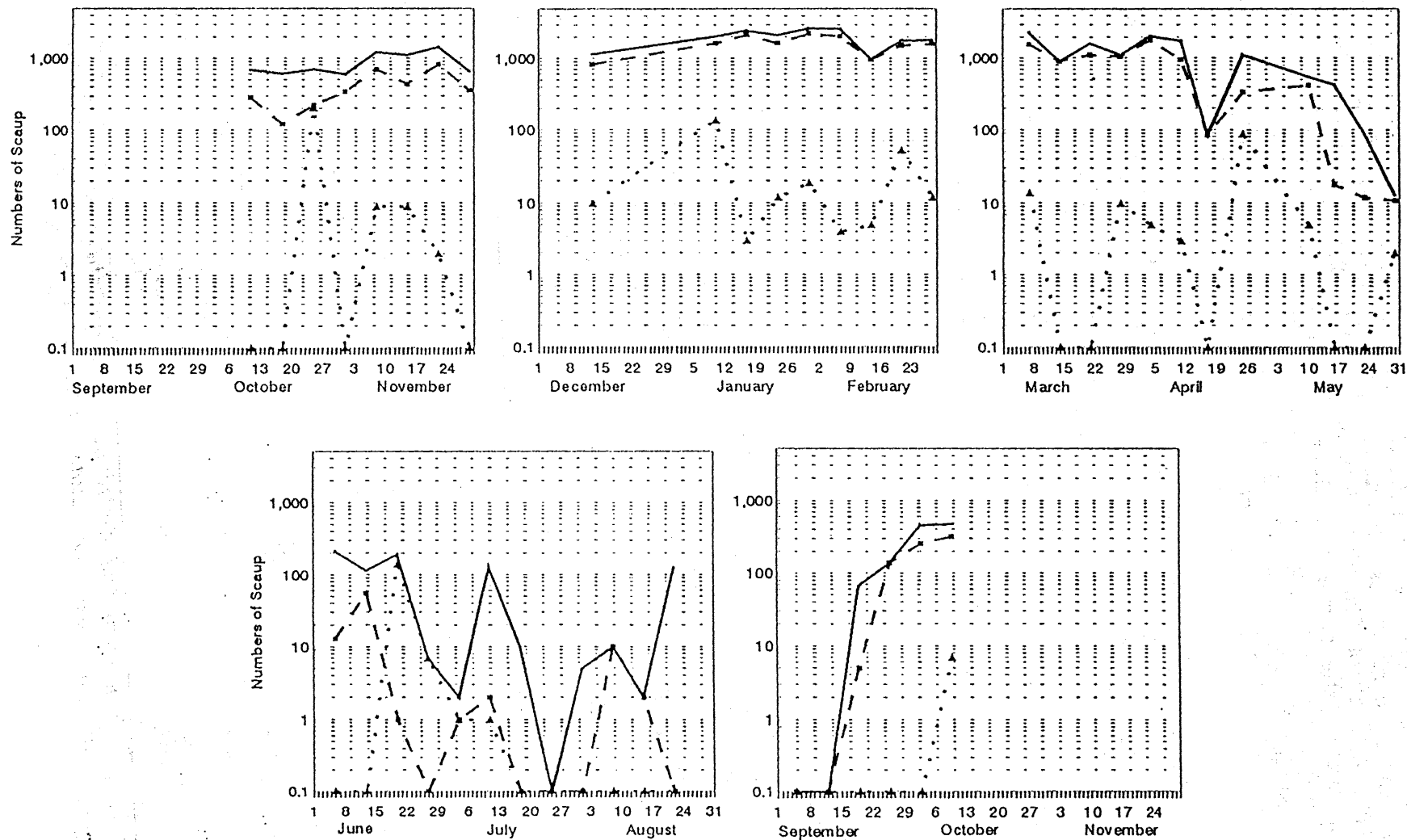


Figure 56 Seasonal fluctuations in the numbers of Greater Scaup (dashed line), Lesser Scaup (dotted line) and all scaups combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Over the study period we identified a total of 765 Lesser Scaup (2% of all scaup). The earliest arrival was 10 October (1981) and the latest departure was 11 July (1981). A peak of 205 birds was observed on 25 October 1981. At that time and on two of the surveys in June, the Lesser Scaup was reported in numbers equivalent to, or greater than, the Greater Scaup. Otherwise the Greater Scaup was usually between 15 and 60 times more numerous than the Lesser Scaup. The locations of highest use changed with the seasons (Figure 56; solid black bars).

A total of 8959 Bufflehead was recorded (4% of all diving ducks). Apart from 3 birds seen in summer, the earliest arrival was 5 September (1981) and the latest departure was 16 May (1981). Through most of this period their numbers remained relatively steady at around 400 birds except for 2 similar migrational peaks: 610 birds on 15 November 1980 and 672 birds on 14 March 1981 (Figure 58). Bufflehead were observed at every location surveyed (Figure 57) but the numbers using each unit varied with the seasons.

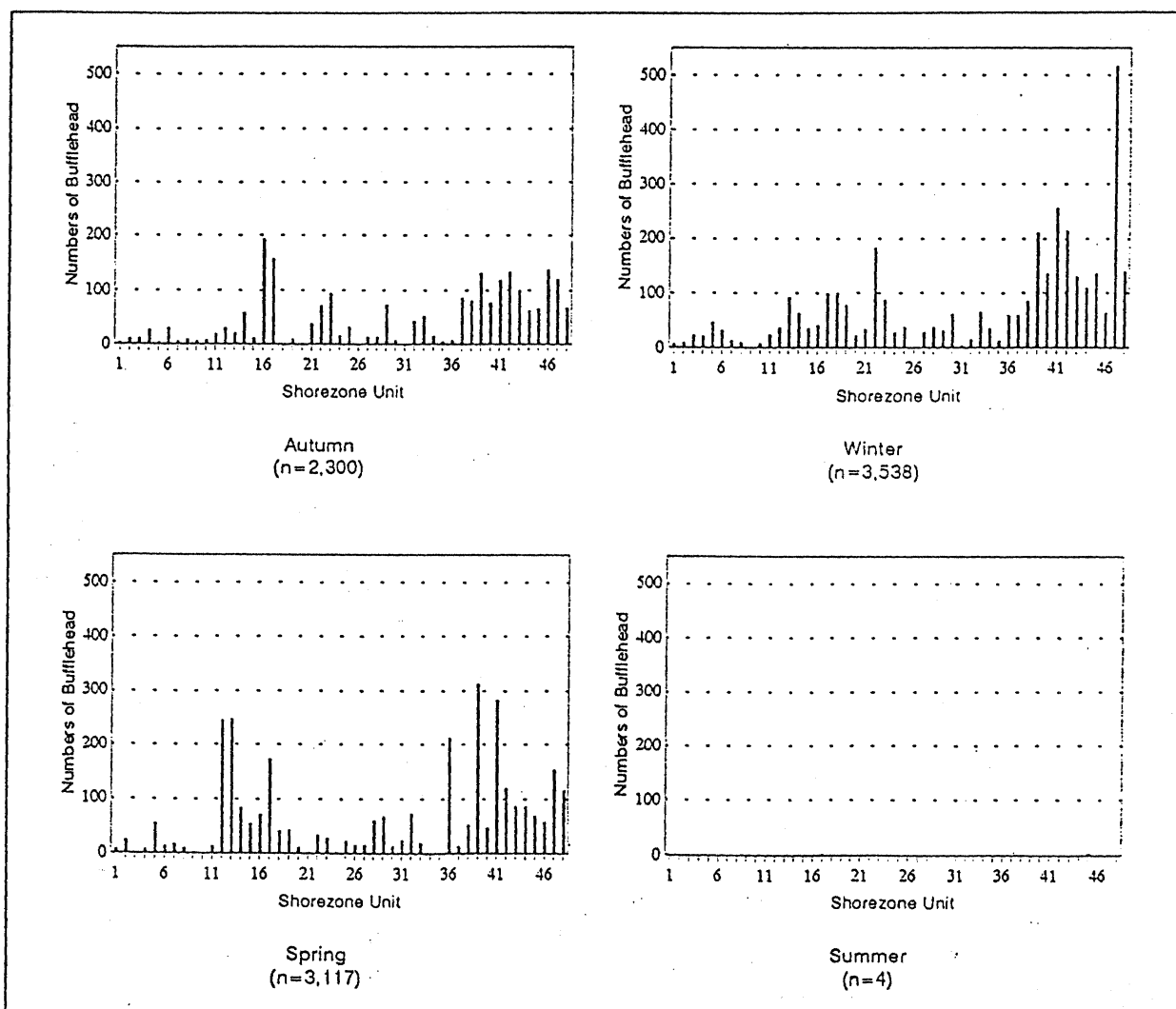


Figure 57. Seasonal variations in the distribution of Bufflehead on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

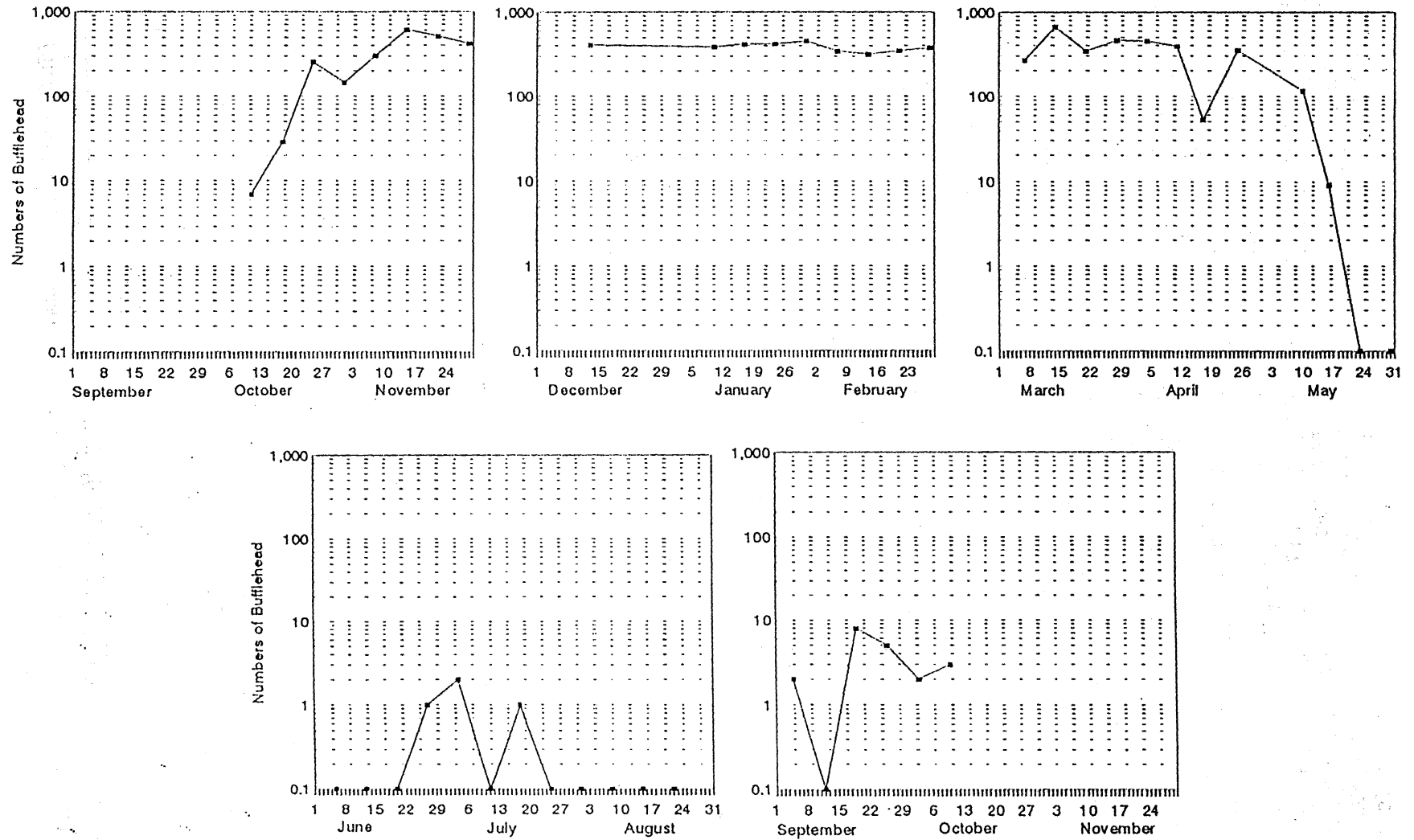


Figure 58. Seasonal fluctuations in the numbers of Bufflehead on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Three species of mergansers were seen: the Common Merganser, the Red-breasted Merganser and the Hooded Merganser. In addition, 389 birds were identified simply as merganser species. Seasonal fluctuations in the numbers of all mergansers are shown in Figure 60 (solid line) for comparison with the Common Merganser (dashed line) and the Red-Breasted Merganser (dotted line).

The Common Merganser, with a total of 7153 birds recorded (3% of all diving ducks), was the most abundant of the mergansers. It was present in every season of the study; the frequency of occurrence varied from 90% during the summer-autumn period to 100% through winter and spring. Most of the Common Mergansers were seen in spring (37% of bird-use days) and winter (28%). Seasonal fluctuations are shown in Figure 60 (dashed line). The peak of 644 birds was recorded on 21 March 1981 from disparate locations including 214 birds near Metcalf Bay (unit 47), 165 birds (unit 22) and 120 birds (unit 14) on opposite sides of Comox Harbour. Common Merganser use of the area was not evenly distributed as shown in Figure 59. Through summer most of the birds were seen

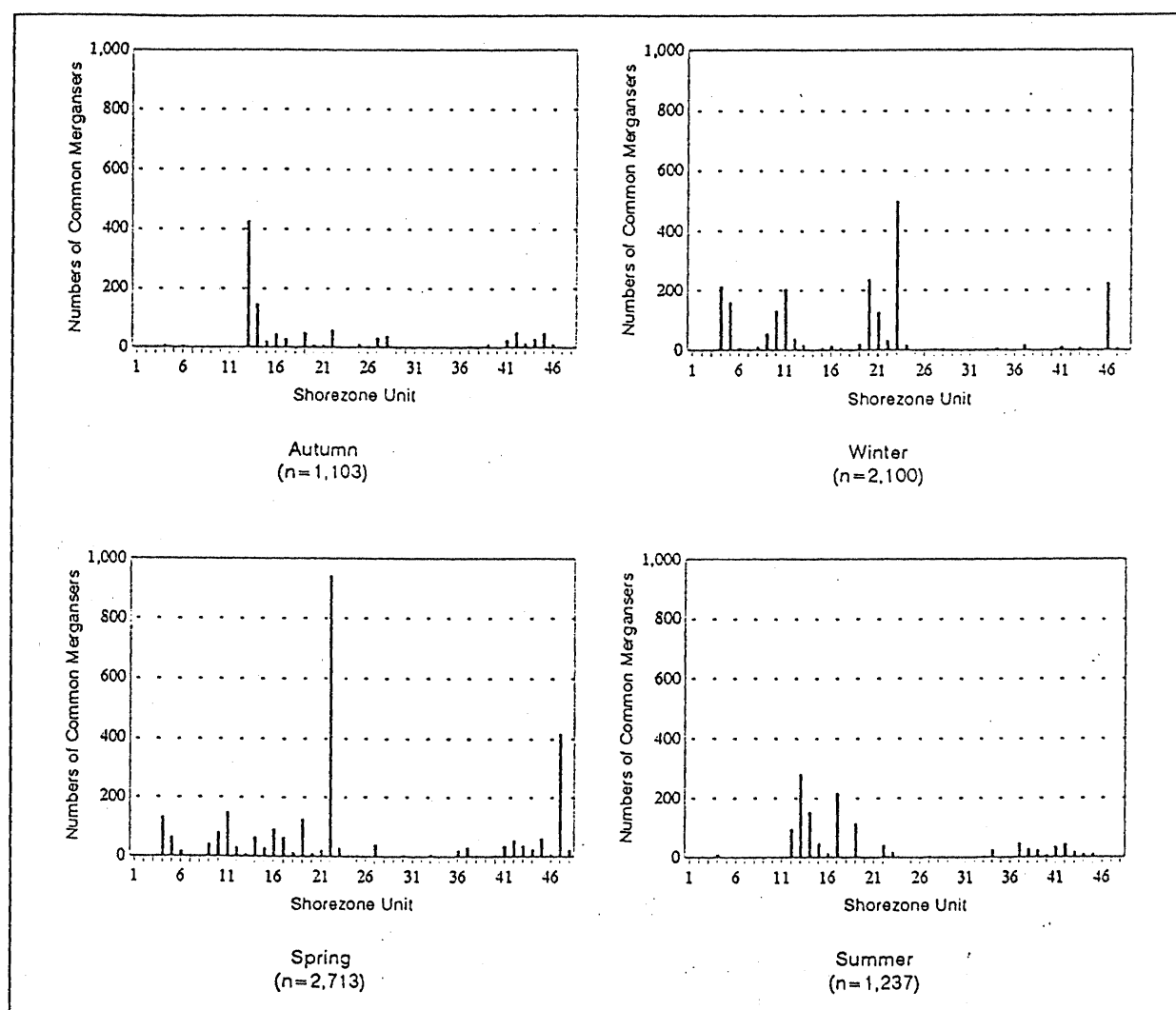


Figure 59. Seasonal variations in the distribution of Common Mergansers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

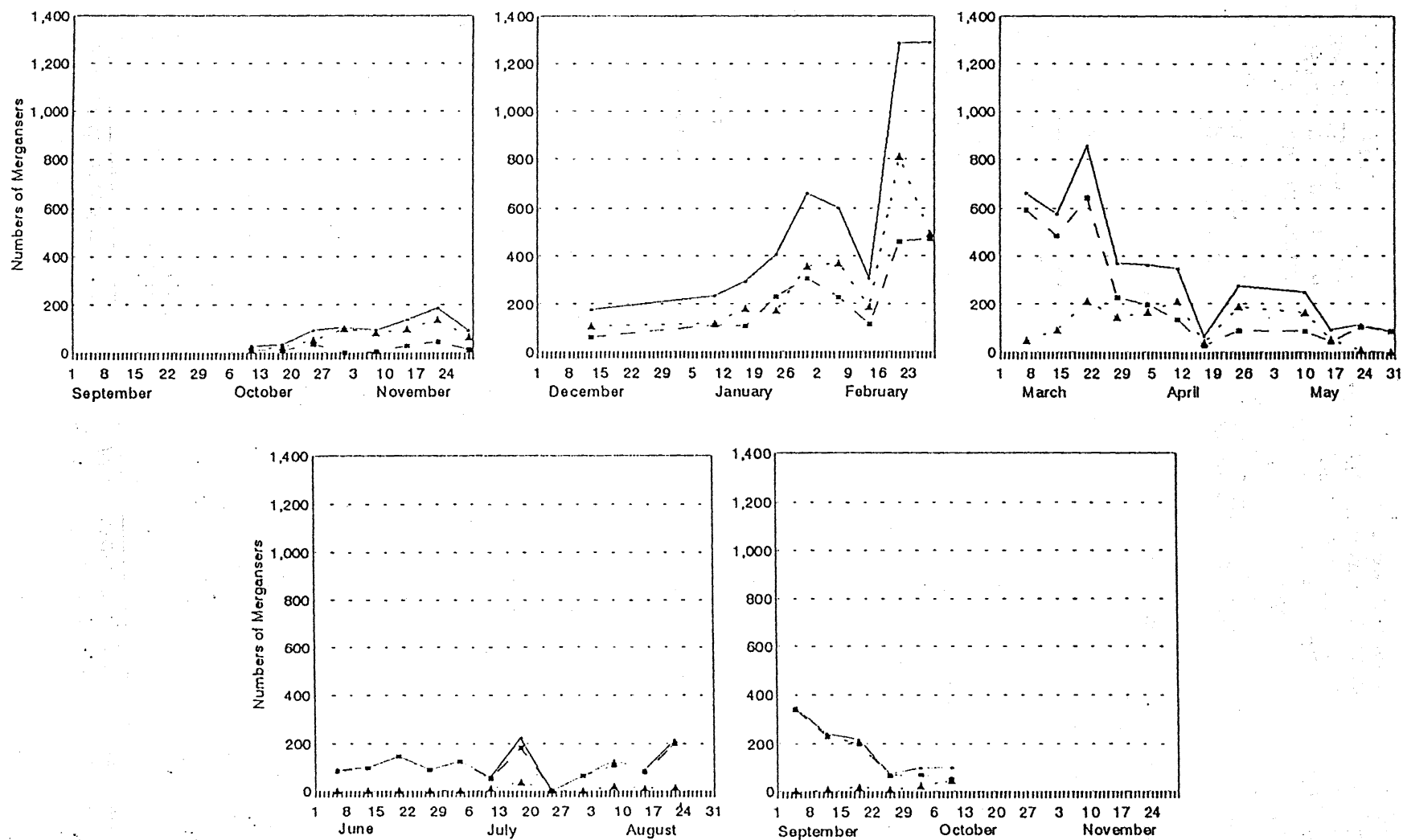


Figure 60. Seasonal fluctuations in the numbers of Common Mergansers (dashed line), Red-breasted Mergansers (dotted line) and all mergansers combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

along the shores and sloughs west of Comox (units 12 to 19; Figure 2) with numbers becoming concentrated around Robb Bluff (unit 13) in autumn. In winter and spring the birds were more dispersed; the highest use occurred across the harbour near Royston (units 23 and 22 respectively). Breeding in the study area was documented by observations of chicks and young birds, the earliest was on 23 May 1981, from units 15, 16, 17 and 22. On 20 June 1981, a total of 106 Common Merganser ducklings were included in the count (for details, see Appendix II).

Red-breasted Merganser numbers totalled 4898 birds (2% of all diving ducks). Although noted in every season (Figure 60, dotted line), the species was not seen from 30 May (1981) to 27 June (1991) and numbers remained relatively low until 10 October (1981). Most were seen in winter (55% of bird-use days) when a peak of 812 birds were observed on 21 February 1981; this count

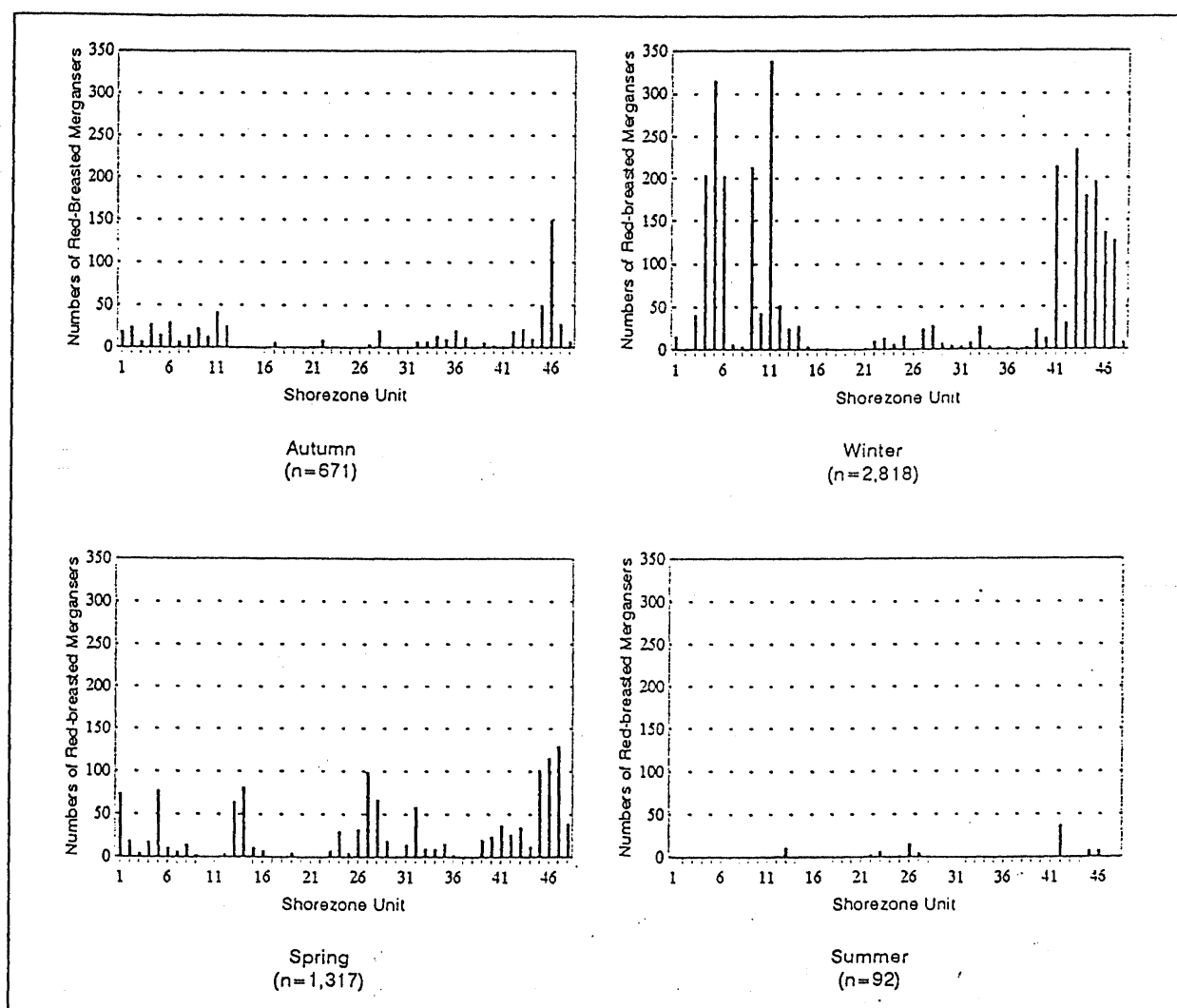


Figure 61. Seasonal variations in distribution of Red-breasted Mergansers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

included 201 birds seen from Wilfred Creek to Mud Bay (unit 41) and 289 birds in the sheltered waters from Goose Spit to Comox wharf (units 6, 9 and 10). Over the year of study, the Red-breasted Merganser had a lower tally than the Common Merganser but during the period from October to February the Red-breasted Merganser was often the more abundant of the 2 species. The Red-breasted Merganser was seen from many locations around the Sound but did not exhibit strong preferences to locations (Figure 61), except in summer when units 4 to 6, 9, 11, 41 and 43 to 47 received much higher use (Figures 2, 11 and 12). Breeding in the Comox Harbour area was documented by an observation of 8 ducklings with an adult on 11 July 1981 (unit 13).

A total of 77 Hooded Mergansers was recorded. At least 1 bird was seen in each season but most were counted in winter (50% of bird-use days) and autumn (47%) during the period from the earliest arrival on 26 September (1981) to the latest departure on 14 February (1981). A peak of 15 birds was observed on 29 November 1980. More than half of the Hooded Mergansers reported were using the north shore of Comox Harbour (units 10 to 18, and especially units 12 and 13; Figure 2).

The numbers of Harlequin Ducks totalled 6110 birds (3% of all diving ducks). Apart from 7 nonbreeding summer birds, the earliest arrival was 22 August (1981) and the latest departure was 20 June (1981). During this time the frequency of occurrence was 100% but their numbers fluctuated (Figure 62). The highest seasonal tally was for winter (36% of bird-use days) but the peak numbers occurred in autumn and spring: 292 birds were recorded on 22 November 1980 and 387 birds were counted on 28 March 1981, including 130 birds just south of Gartley Point (unit 26; Figure 2) and 109 birds between Union Bay and Buckley Bay (units 32 and 31; Figure 8). On the same two stretches of coastline, which are considered of the highest importance for herring spawning within the study area (Figure 13), herring spawning is a regular event that takes place shortly before the time of year that these peak bird observations were made. It is likely the ducks were present to utilize this temporary, but significant resource. However, there were no significant aggregations of Harlequin Ducks observed near the Trent River during the spring of 1987 (Brooks et al. 1994).

The locations where Harlequin Ducks were seen most seemed to vary over the seasons (Figure 63). In addition to Gartley Point, the waterfront west of Comox (unit 14) and Deep Bay (unit 45) recorded high counts in spring. In autumn the birds were most numerous near Mud Bay (unit 41) but in winter the numbers were greatest near Metcalf Bay (unit 47). Throughout the autumn-winter-spring period, Harlequin Ducks were observed from both Henry Bay (unit 48) and Willemar Bluffs (unit 1), on either side of the shallow northern entrance to Baynes Sound.

Two species of goldeneyes were recorded and 258 birds were reported simply as goldeneye species. On most of the surveys, the Common Goldeneye was approximately 4 times more numerous than the Barrow's Goldeneye. The major exception was in October and early November when the numbers of Barrow's Goldeneye counted were often the higher of the two species or the numbers of unspecified Goldeneye obscured this proportion. Seasonal fluctuations in the numbers of all Goldeneye combined are shown in Figure 65 (solid line).

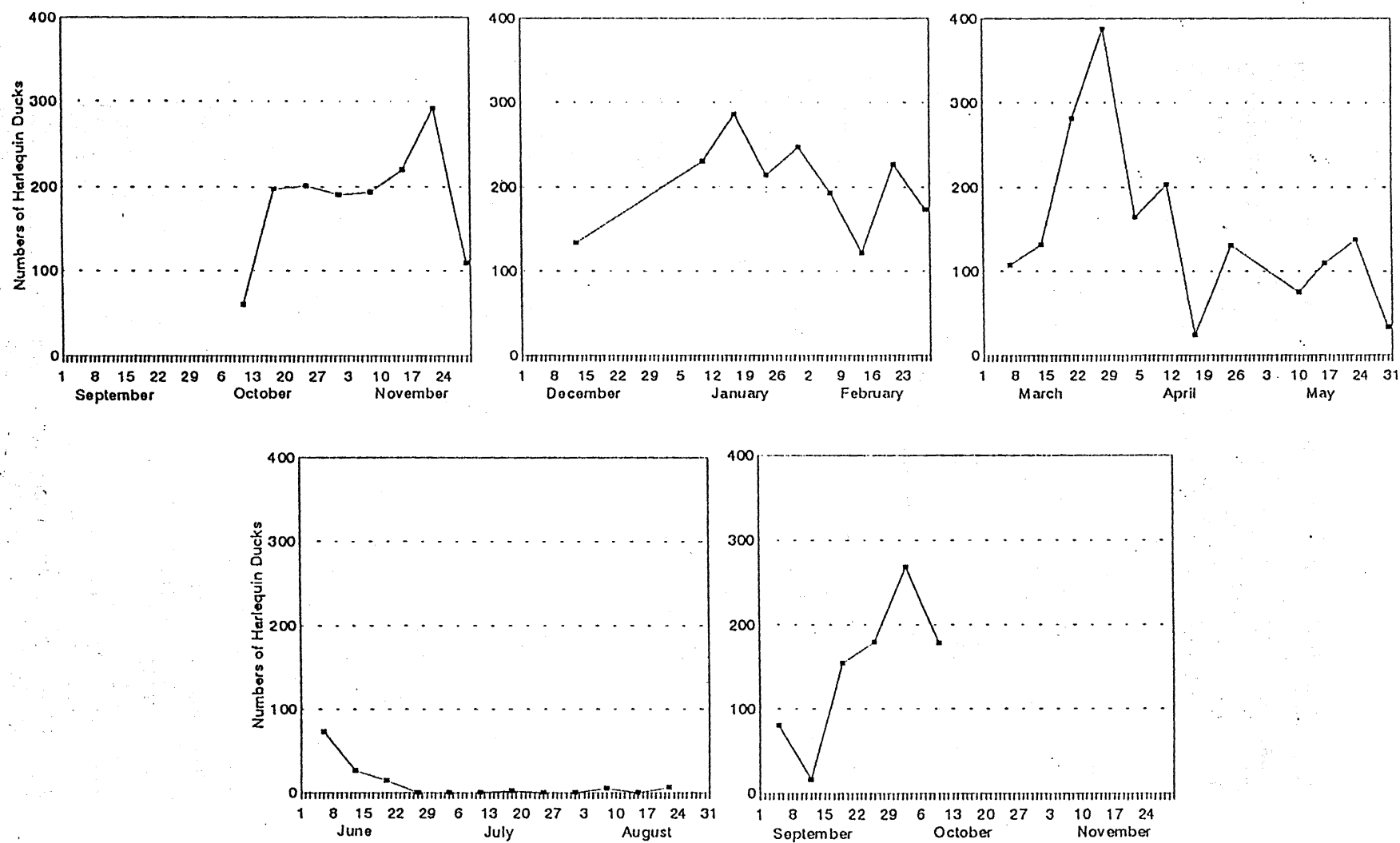


Figure 62. Seasonal fluctuations in the numbers of Harlequin Ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

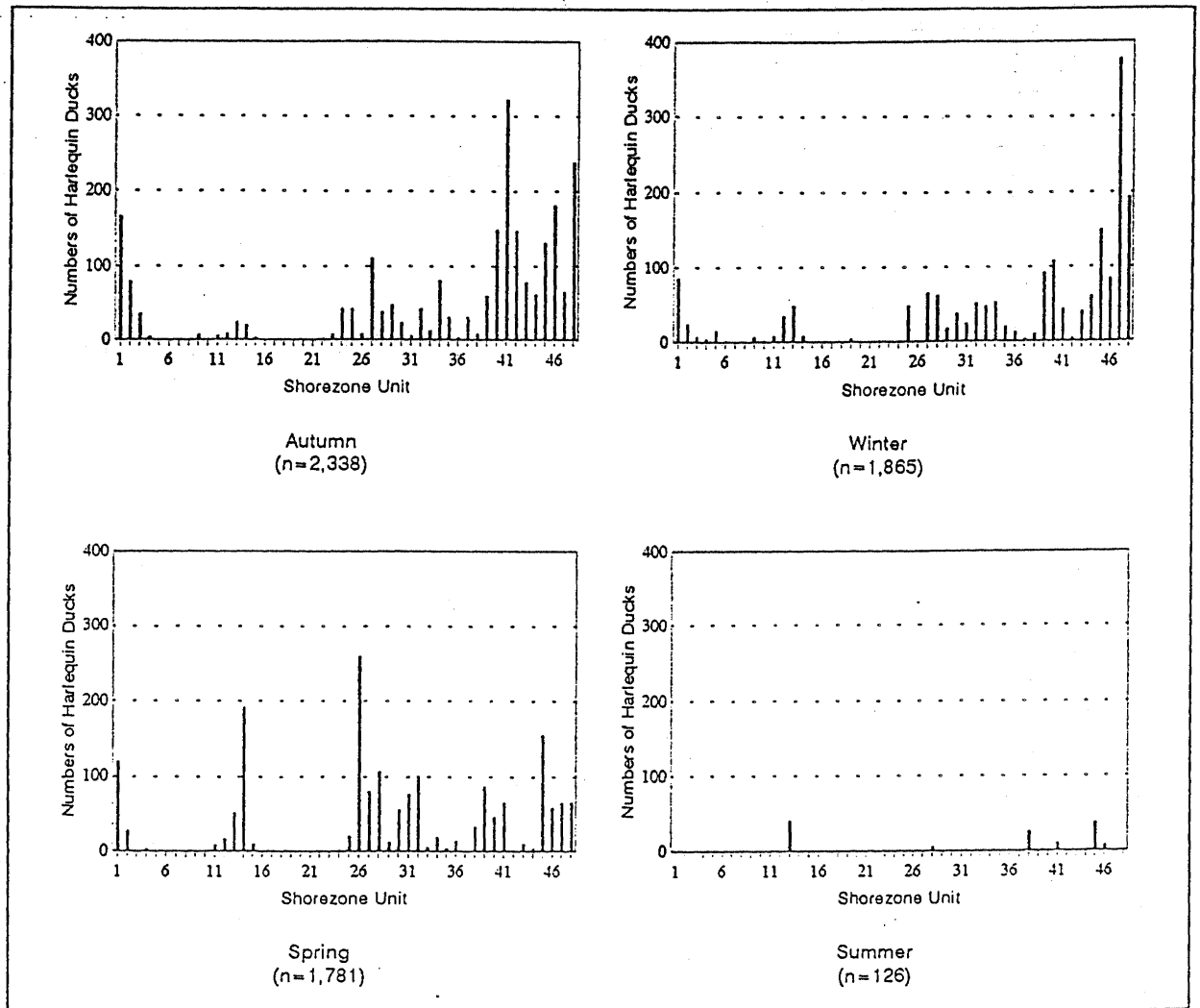


Figure 63. Seasonal variations in the distribution of Harlequin Ducks on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Common Goldeneyes totalled 6003 birds (3% of all diving ducks). On 25 October 1980, numbers began to climb to a plateau which remained relatively constant at around 300 birds throughout the winter but by 13 June 1981 numbers had declined (Figure 65); the frequency of occurrence during this period was 100%. Although the species was also observed from late June through September, no survey in this period recorded more than one bird. The peak numbers of autumn and spring migrants were similar: 458 birds on 22 November 1980 and 439 birds on 14 March 1981. The Common Goldeneye logged some use on almost all of the areas surveyed (Figure 64) but the counts for some units were higher than others. For example, Metcalf Bay (unit 47; Figure 11) received the most use in winter and in spring the area north of Union Point (units 27 and 28; Figure 6) and a stretch of Comox waterfront towards Robb Bluff (Figure 2) received higher use.

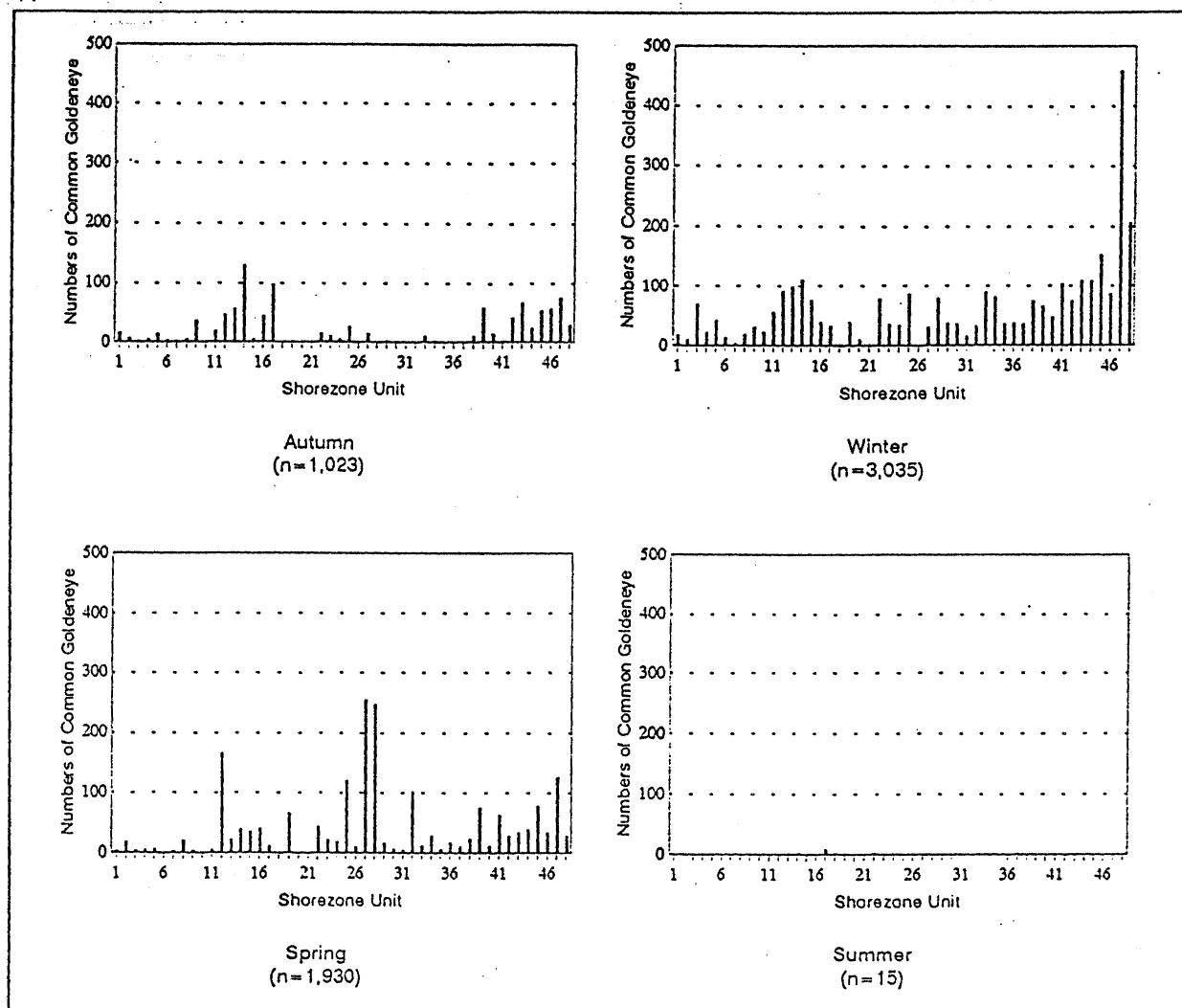


Figure 64. Seasonal variations in the distribution of Common Goldeneye on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The total number of Barrow's Goldeneye observed over the study period was 1693 birds, half of them in winter. From the earliest arrival on 18 October (1980) to the latest departure on 30 May (1981), the frequency of occurrence was 93%. The majority of Barrow's Goldeneye seemed to have arrived and departed earlier than the Common Goldeneye. The only distinct peak was 205 Barrow's Goldeneye seen on 21 March 1981 (Figure 65, dotted line); 175 of these birds were seen from unit 28 north of Union Point. Together units 28 and 27 (Figure 6) account for 73% of the birds seen in spring. In winter most Barrow's Goldeneye were observed between the Trent River and Hart Creek (units 22 to 28; Figures 2, 5 and 6). Details of shorezone use are shown in Figure 66.

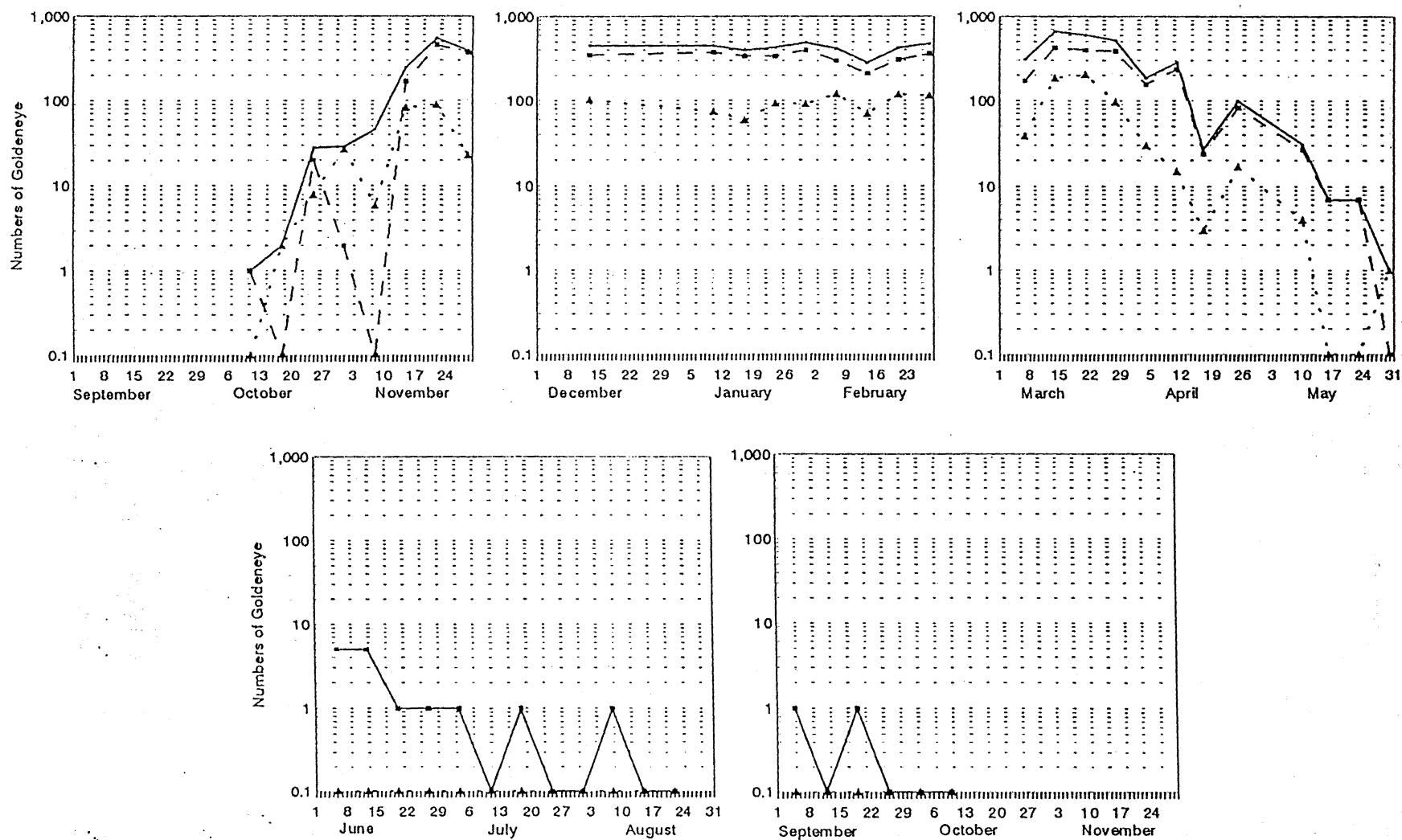


Figure 65. Seasonal fluctuations in the numbers of Common Goldeneye (dashed line), Barrow's Goldeneye (dotted line) and all goldeneye combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

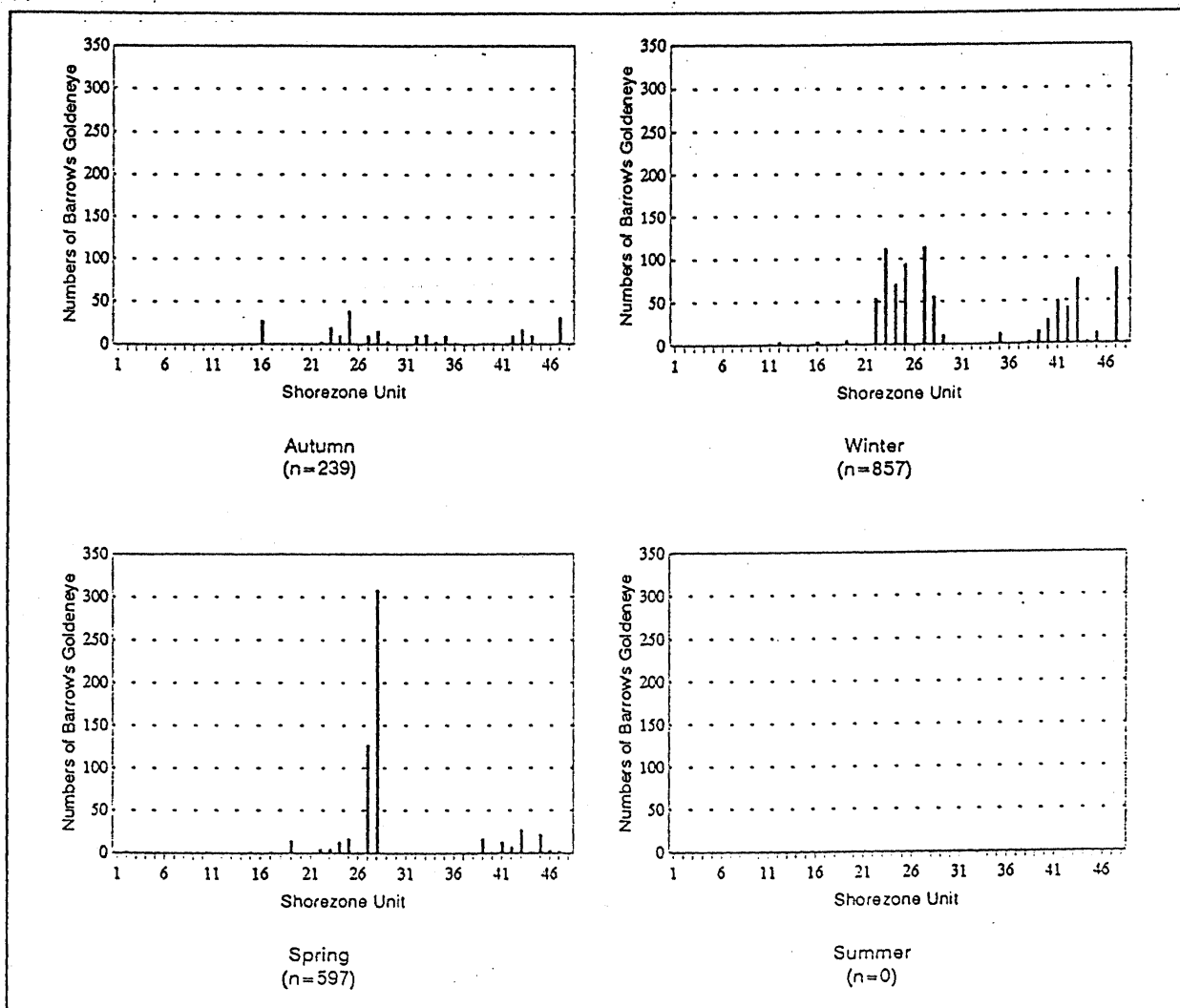


Figure 66. Seasonal variations in the distribution of Barrow's Goldeneye on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

We recorded a total of 1510 Oldsquaw. Earliest arrival was on 10 October (1981) and latest departure was 16 May (1981). The season with the highest total count was winter (63% of bird-use days) even though the numbers in that season were erratic; a peak of 143 birds was seen on 10 January 1981 (Figure 67). Oldsquaw used some locations more than others and this varied over the seasons (Figure 68). For example, in winter the areas on either side of the shallow northern entrance to Baynes Sound (units 3 and 48; Figures 2 and 7) logged the heaviest use.

A total of 199 Canvasbacks was observed during the period from earliest arrival on 3 October (1981) to latest departure on 11 April (1981). Most of the birds were recorded in spring (45% of bird-use days) and winter (42%). A peak of 48 birds occurred on 21 March 1981 (32 of these birds were seen from unit

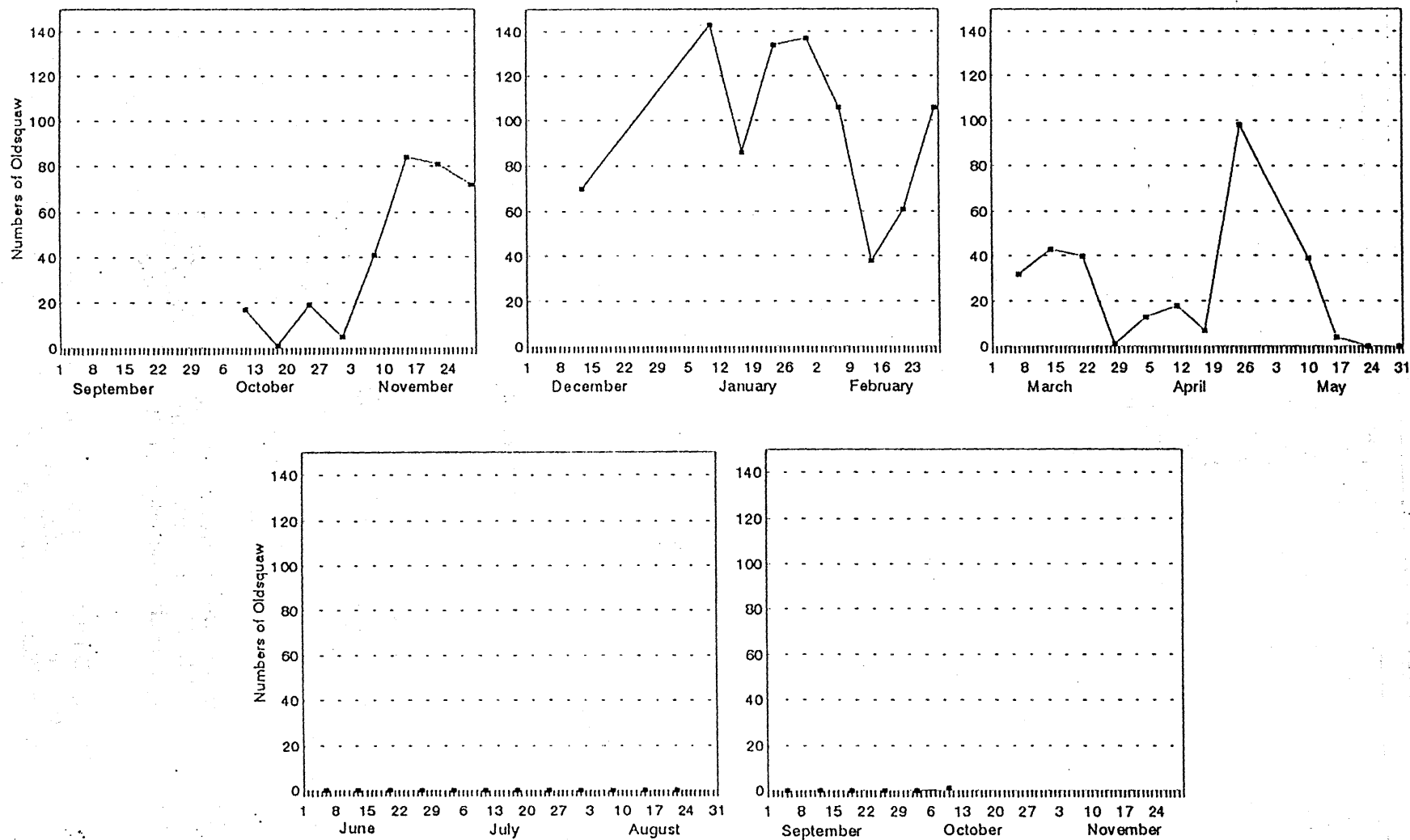


Figure 67. Seasonal fluctuations in the numbers of Oldsquaw on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

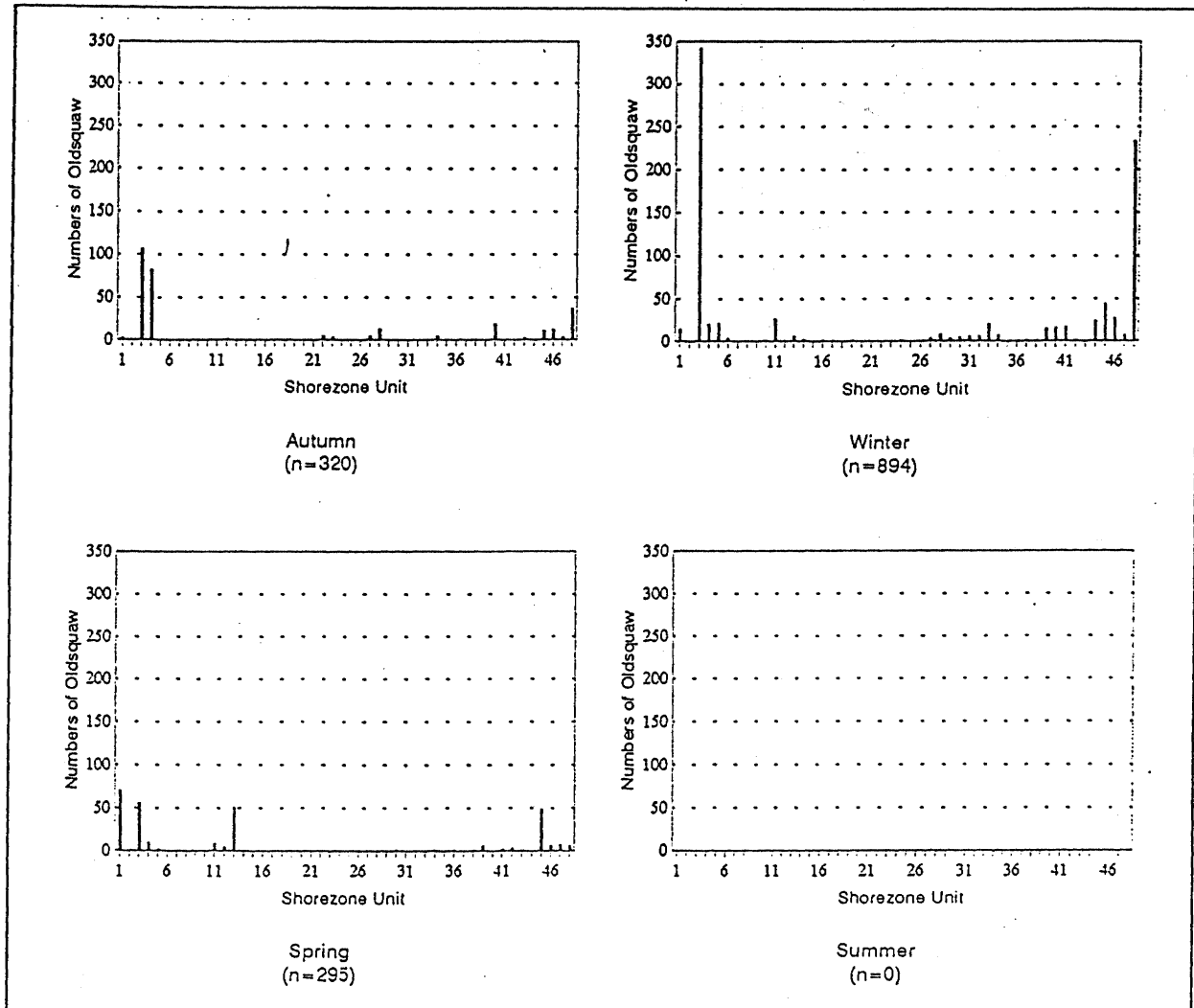


Figure 68. Seasonal variations in the distribution of Oldsquaw on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

20). Migration in autumn was marked by a smaller peak of 18 birds on 15 November. On winter surveys, the frequency of occurrence was high (70%) but the average count was only 10 Canvasbacks. Although there were some seasonal variations, almost all of the Canvasbacks were seen along the south shore of Comox Harbour and especially on either side of Millard Creek; units 19 to 22 (Figure 2) accounted for 95% of the total.

A total of 32 Ring-necked Ducks were reported: 1 bird on 17 January 1991, 18 birds on 24 January 1981, 11 bird on 7 February 1991, and 2 birds on 7 March 1991. All of them were seen from Metcalf Bay on Denman Island (unit 47; Figure 11).

We observed 2 Ruddy Ducks: 1 bird on 10 October 1981 near Dyke Road Slough and the mouth of the Courtenay River (unit 17) and 1 bird on 14 February 1981 just north of Hart Creek (unit 28).

Raptors: Thirteen species of raptors were seen with a combined total of 2424 birds (approximately 0.3% of all birds). The Bald Eagle was by far the most abundant; the other species (together amounting to less than 10% of the raptor total) were the Turkey Vulture, Osprey, Red-tailed Hawk, Merlin, Sharp-shinned Hawk, Cooper's Hawk, American Kestrel, Northern Harrier, Golden Eagle, Northern Goshawk, Swainson's Hawk and Peregrine Falcon. In addition, 5 birds were recorded simply as hawk species.

A total of 2200 Bald Eagles was tallied (91% of raptors). The species was seen on every survey throughout the year of study. Abundance reached its highest levels in winter (61% of bird-use days) when there were usually more than 100 birds on Baynes Sound and a single day count of 354 Bald Eagles was recorded on 7 February 1981 (Figure 69). On that day 250 eagles were seen from Metcalf Bay (unit 47). The Bald Eagle was observed from every shorezone unit but in unequal numbers (Figure 70); the largest congregations occurred at the south end of the study area from Mud Bay to Mapleguard Point and on Denman Island (units 42 to 48; Figures 7, 11 and 12).

The Turkey Vulture was the second most abundant raptor with a total 81 birds seen. Earliest arrival was 7 March (1981) and latest departure was 13 December (1980). However, all but 3 of the birds recorded were from the period March to September when the frequency of occurrence was above 60%. The autumn migration was marked by a peak of 18 birds on 12 September 1981 (including 8 birds each at units 19 and 21) whereas the spring migration appeared to be more dispersed. Use of the study area by the Turkey Vulture was unevenly distributed. In spring all but one of the birds were seen from Metcalf Bay on Denman Island (unit 47; Figure 11). Summer and autumn use was centred to varying degrees around the mouth of the Courtenay River (units 17 to 21; Figure 2) and the stretch of coast from Rosewall Creek to Lymn Creek (units 43 and 44; Figures 11 and 12).

In total, 45 Osprey were recorded from the date of earliest arrival on 11 April (1981) to the latest departure on 3 October (1981). Throughout this period, the frequency of occurrence was high (above 50%) but the numbers were low; the maximum was 5 birds seen on 18 July 1981 and on 5 September 1981. Osprey used about half of the locations surveyed but the majority of the birds were seen in the southern part of the study area, from the Tstable River to Mapleguard Point and near Metcalf Bay on Denman Island (units 37 to 47; Figures 10 to 12). The south side of Comox Harbour was also used, but to lesser degree.

Counts of 1, 2 or 3 Red-tailed Hawks occurred on a number of surveys each season; the total was 33 birds over the study period. The frequency of occurrence was lower in summer (25%) than in the other seasons (40%). Most of the Red-tailed Hawks were seen in that part of the study area south of the Tstable River and near Metcalf Bay (units 37, 40 to 44, and 47; Figures 10 to 12).

A total of 14 Merlins was seen on 12 surveys: 1 - 7 March 1981, 2 - 22 August 1981, 1 - 5 September 1981, 1 - 11 October 1980, 1 - 25 October 1980, 1 - 1 November 1980, 2 - 8 November 1980, 1 - 15 November 1980, 1 - 22 November 1980, 1 - 6 December 1980, 1 - 24 January 1981, 1 - 28 February 1981. There were sightings around Metcalf Bay (unit 47; Figure 11) in every month from October to March, which accounted for 8 of the birds. Five birds occurred near the Courtenay River mouth (units 18 and 19) in August, September and November and 1 bird was seen near Henry Bay on 25 October 1980.

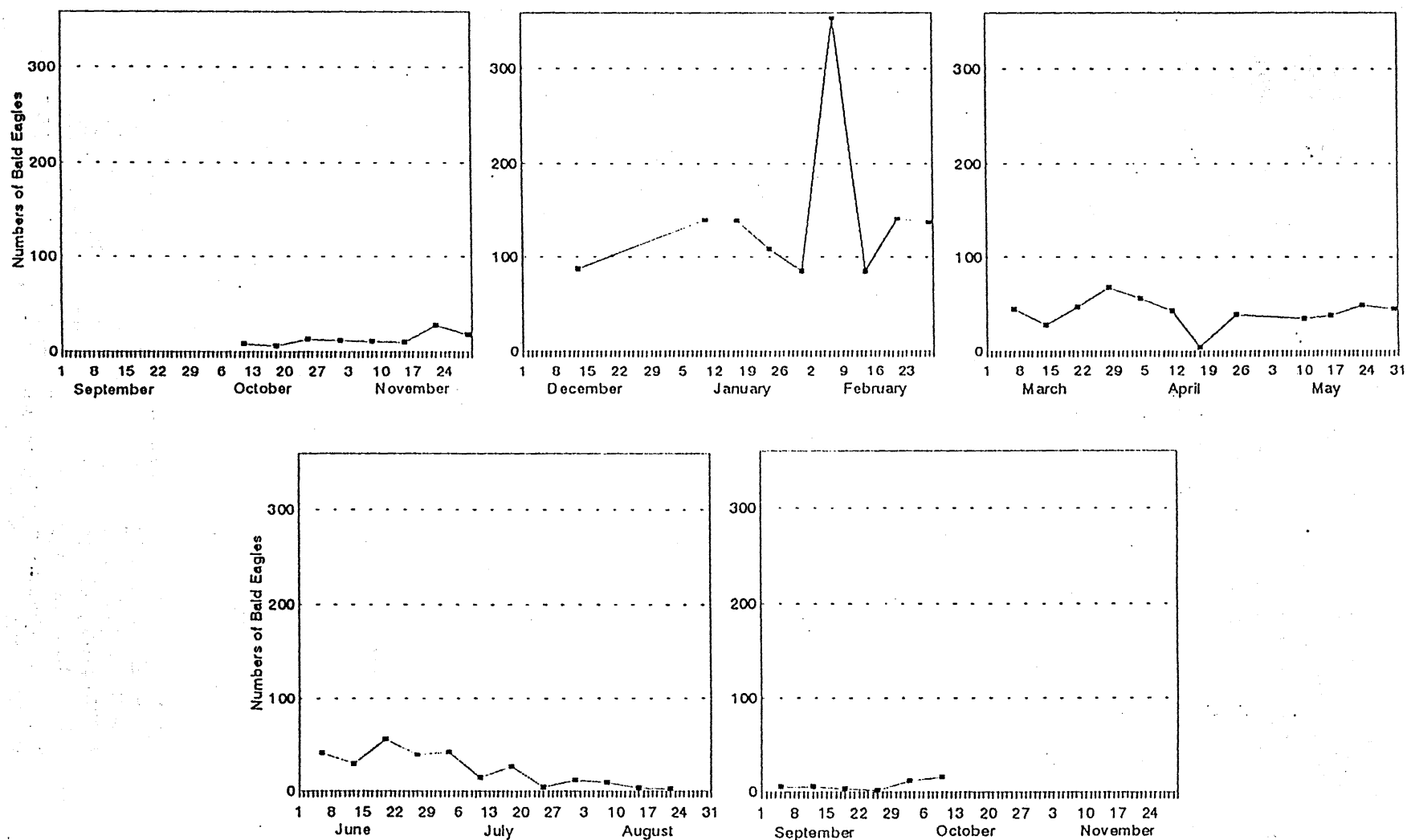


Figure 69. Seasonal fluctuations in the numbers of Bald Eagles on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

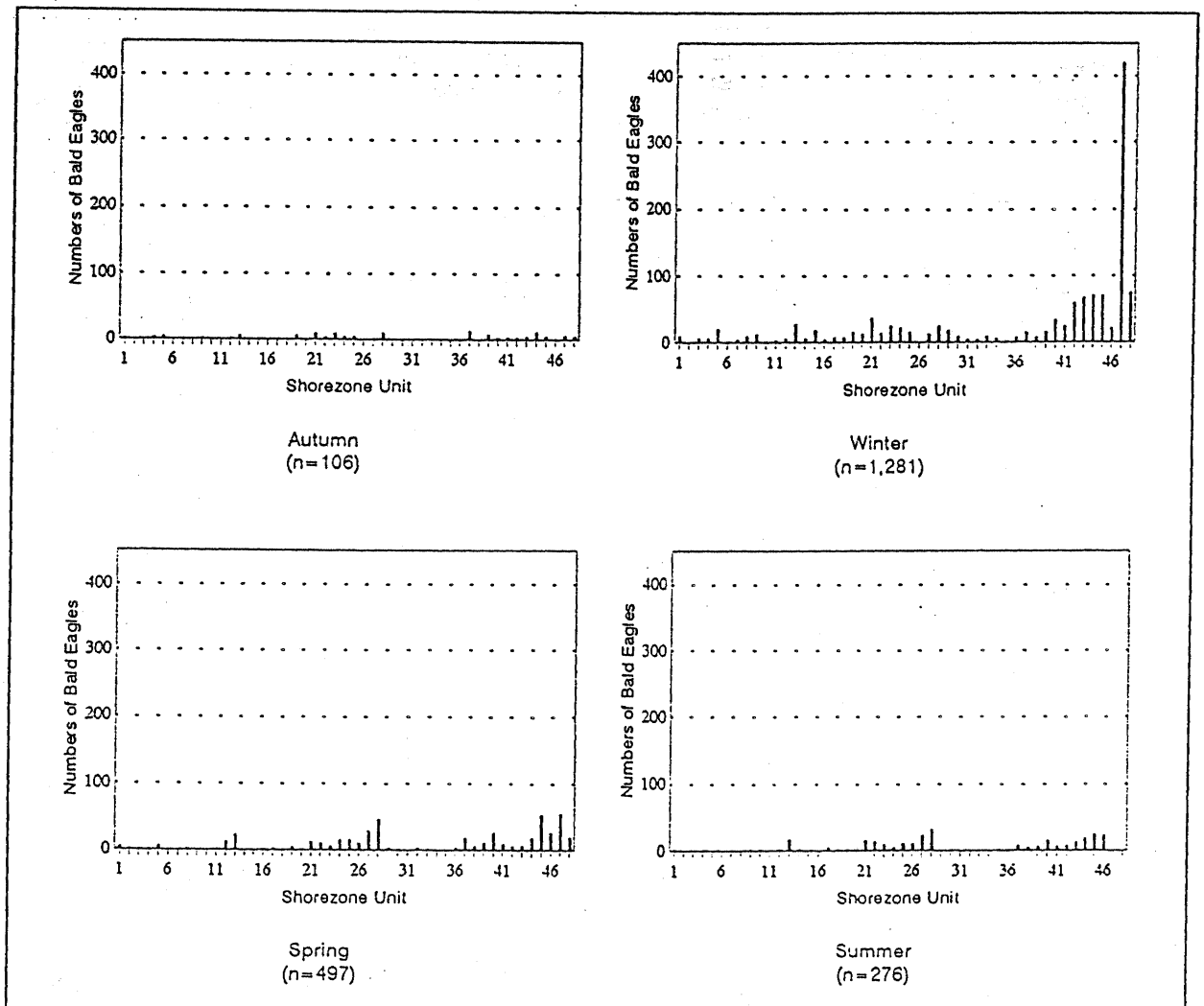


Figure 70. Seasonal variations in the distribution of Bald Eagles on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total of 13 Sharp-shinned Hawks was recorded; 12 of the birds were seen from the earliest arrival on 10 October (1981) to latest departure on 13 December (1980) suggesting that many were autumn migrants. Within that period, the frequency of occurrence was 43%, but the numbers were always low; the peak was 3 birds seen on 11 October 1980. The only other sighting was a single bird seen in spring on 10 May 1981. The Sharp-shinned Hawk used many disparate locations around Baynes Sound (units 4, 14, 20, 21, 25, 27, 28 and 40; Figures 2 5, 6 and 11).

We also saw 13 Cooper's Hawks in total. The Cooper's Hawk, like the Sharp-shinned Hawk, was seen most in autumn (8 birds) and not at all in summer. In addition, there were 3 Cooper's Hawks seen in winter and 2 birds in spring;

earliest arrival in this study was 5 September (1981) and latest departure was 11 April (1981). The maximum number recorded was 3 birds on 19 September 1981. Although a number of different locations were used (units 4, 9, 24, 40, 47), the majority of the birds were seen north and west of Goose Spit (7 birds near unit 4; Figure 2).

There were 7 sightings of the American Kestrel over the study period, each involving a single bird: 4 April 1981, 1 August 1981, 5 September 1981, 12 September 1981, 10 October 1981, 1 November 1980 and 8 November 1980. The birds were seen at a variety of locations (units 18, 46, 45, 45, 40, 21 and 21 respectively).

Six Northern Harriers were tallied over the study period: 1 bird on 26 September 1981 and 1 bird on 3 October 1981, both near Fanny Bay (unit 39); 1 bird on 3 October 1981, 1 bird on 11 October 1980 and 1 bird on 24 January 1981, all near Goose Spit (units 3 and 4); and 1 bird on 23 May 1981 near Mud Bay (unit 42).

A total of 4 Golden Eagles were recorded in the autumn of 1980: 1 bird on 18 October 1980 and 1 bird on 22 November 1980 near the mouth of the Courtenay River (units 20 and 18 respectively); and 2 birds on 15 November 1980 near Hindoo Creek (units 34 and 35). The data on Golden Eagles should be used with caution because suitable documentation is not available.

One Northern Goshawk was recorded on 5 September 1981 at Deep Bay (unit 45).

One Swainson's Hawk was recorded on 25 October 1980 near the mouth of the Courtenay River (unit 19). This record should be used with caution because suitable documentation is not available.

A few weeks later on 13 December 1980, a Peregrine Falcon was seen, also near the mouth of the Courtenay River (unit 19).

Pheasants, Grouse and Quails: The most abundant species of this group was the Ruffed Grouse, a resident. A total of 36 birds was tallied, mostly in winter (14 birds) and summer (11 birds). The highest counts were 6 birds on 6 June 1981 and 4 birds on 28 February 1981. In this study, all of the Ruffed Grouse were observed south of the Tsable River and on Denman Island (units 37, 38, 42 to 45, 47 and 48); abundance was highest in the area around McNaughton and Chef Creeks and around Metcalf Bay (Figures 12 and 11).

The Ring-necked Pheasant is an introduced species that is resident in a number of areas around Baynes Sound. A total of 9 birds was seen during the study period: 4 birds near the mouth of the Courtenay River (units 18 and 19), 3 birds at Metcalf Bay on Denman Island (unit 47) and 1 bird south of Comox wharf (unit 9).

Four California Quails were observed, 3 birds on 21 March 1981 and 1 bird on 16 May 1981; all were seen near the base of Goose Spit (unit 5). This is another introduced species that is resident in at least one area.

Rails, Coots and Cranes: A total of 844 American Coots was seen. Earliest arrival was 5 September (1981) and most birds had left by mid-April. Observed numbers (Figure 72) appear to follow an annual cycle but there were relatively large fluctuations. Most of the birds were seen in autumn (56% of bird-use days) when 2 migrational peaks occurred: 112 birds on 25 October 1980 and 103 birds on 22 November 1980. There was also a winter peak of 53 birds on 24 January 1981 but numbers in spring remained constant at about 22 birds until 11 April. Most of the American Coots were observed around the intertidal mud and sand delta at the head of Comox Harbour (Figure 71), especially near the river mouth

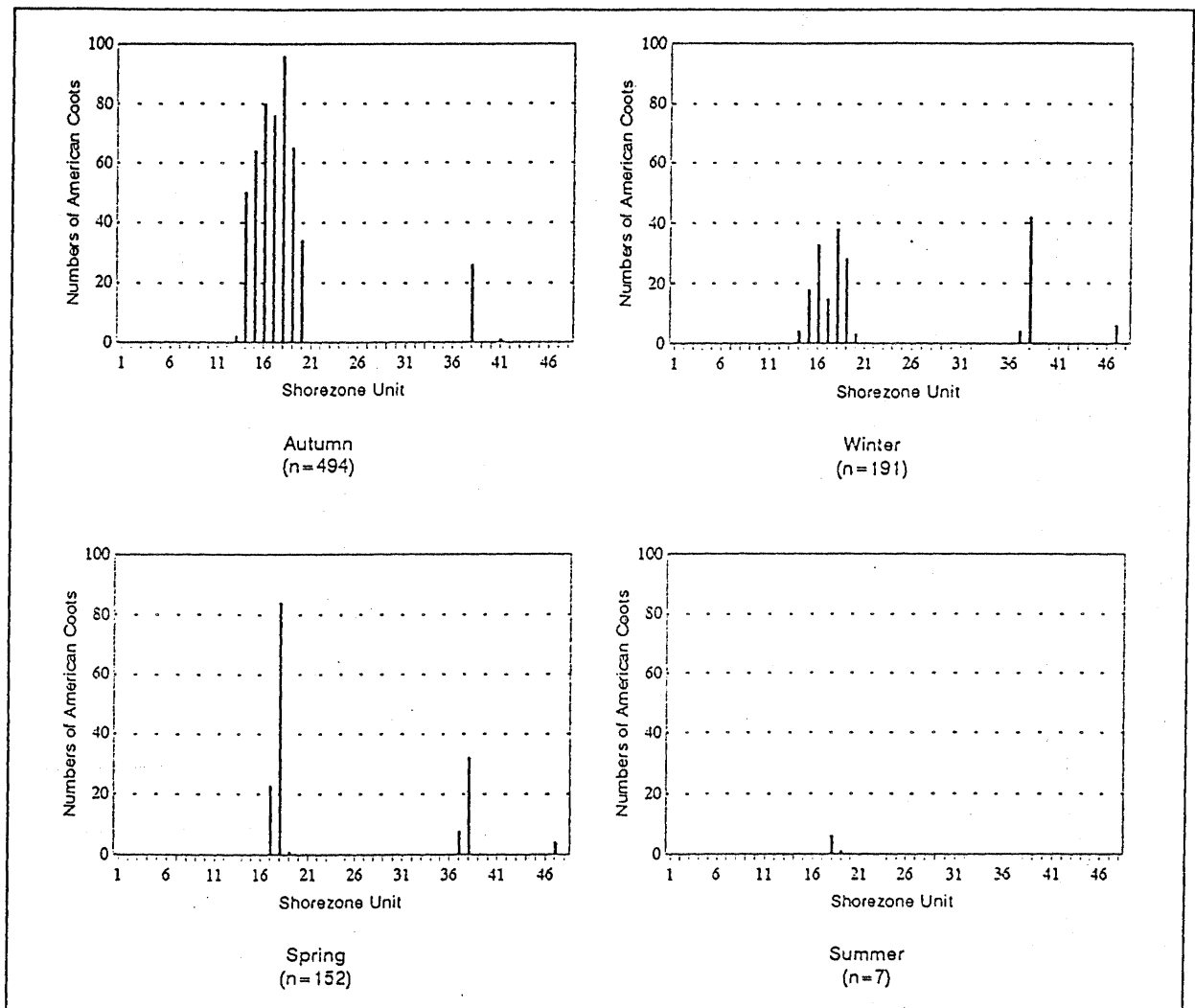


Figure 71. Seasonal variations in the distribution of American Coots on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

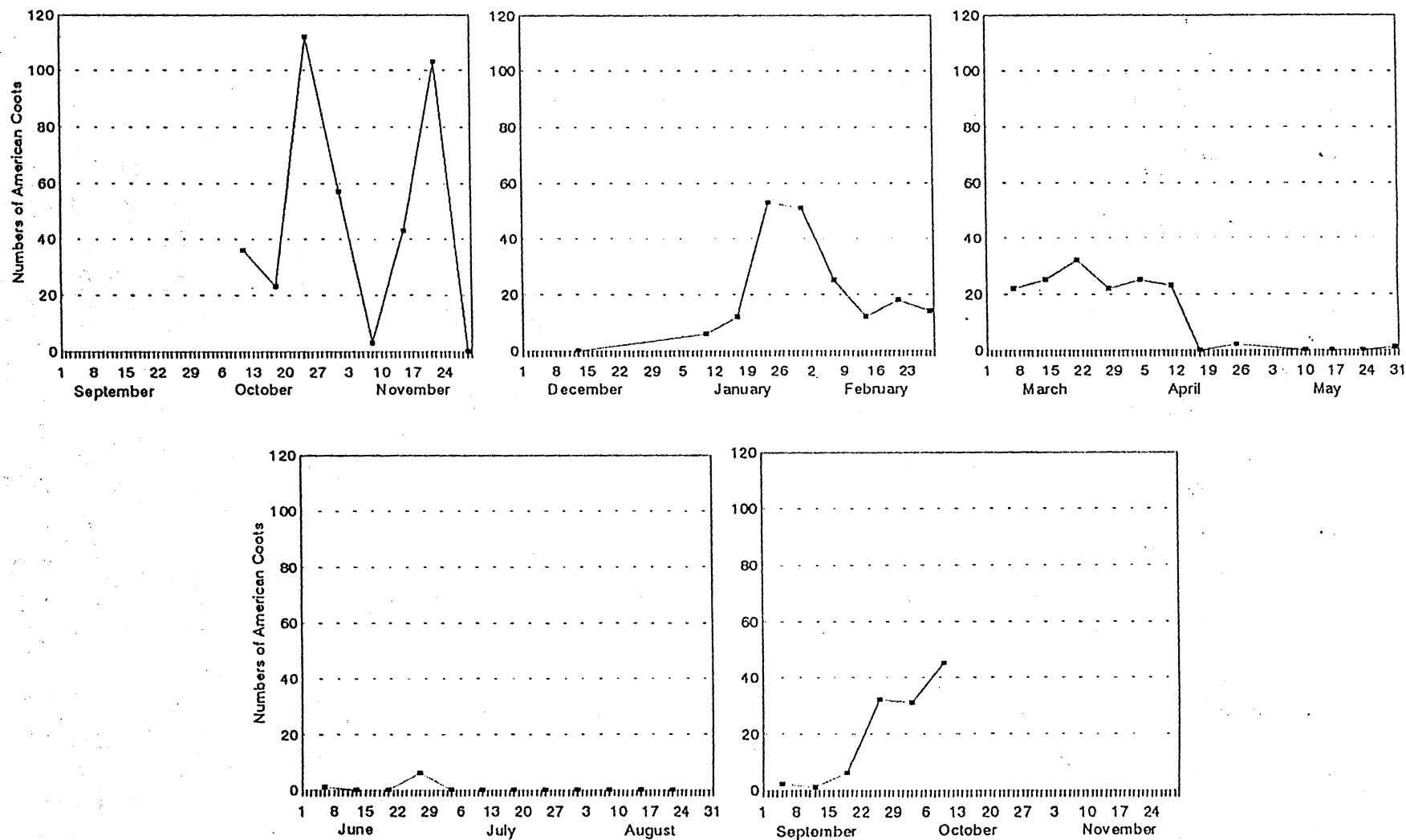


Figure 72. Seasonal fluctuations in the numbers of American Coots on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

and adjacent sloughs (85% of the year's total were near units 13 to 20; Figure 2). Fanny Bay (unit 38 and 37) and Metcalf Bay (unit 47) also received significant use. One observation of 4 downy chicks with adults on 27 June 1981 documented breeding in Comox Harbour, in the vicinity of unit 18.

Over the study period, 14 Sandhill Cranes were tallied at a variety of locations: 2 birds on 13 June 1981, 1 near unit 40 and another near unit 12; 3 birds on 3 October 1981 near unit 28; 5 birds on 11 October 1980 near unit 10; 3 birds on 25 October 1980 near unit 18 and 1 bird on 17 January 1981 near unit 18.

Shorebirds: In total, 40,004 shorebirds (6% of all birds) were seen during this study. This total represents at least 19 species of which the Black Turnstone and Dunlin were by far the most abundant. The other species present (in decreasing order) were: Sanderling, Killdeer, Black-bellied Plover, Western Sandpiper, Greater Yellowlegs, Spotted Sandpiper, Long-billed Dowitcher, Short-billed Dowitcher, Least Sandpiper, Lesser Yellowlegs, Surfbird, Black Oystercatcher, Common Snipe, Whimbrel, Lesser Golden-Plover, Semipalmated Plover and Ruddy Turnstone. Birds recorded simply as shorebird species (26% of all shorebirds) are included in the total.

Most of the shorebird use was in winter (52% of bird-use days); the lowest use was in summer (7%). Fluctuations in the numbers of all shorebirds combined are shown in Figure 73 (solid line) along with that portion of shorebird counts which were identified simply as shorebird species (dashed line). This relationship should be considered when interpreting shorebird data, especially those recorded in February, March and July.

The location used most was immediately north of Union Point and the mouth of Hart Creek, known as Glover's Booming Ground (unit 28; Figure 74). Black Turnstones and Black-bellied Plovers account for this use in autumn; Black Turnstones and 3700 unspecified shorebirds (from 2 surveys in February) account for the use of this area in winter. In spring, when the peak of 4749 shorebirds was tallied from the entire study area on 7 March 1981, 4500 of these birds were recorded simply as shorebird species from unit 28. Since the major species involved are unknown, this large count is potentially important for interpreting the numbers of any of the wintering or migrating shorebirds. Henry Bay on Denman Island was the location that ranked second in use by shorebirds because thousands of Dunlin were seen there in autumn, winter and spring.

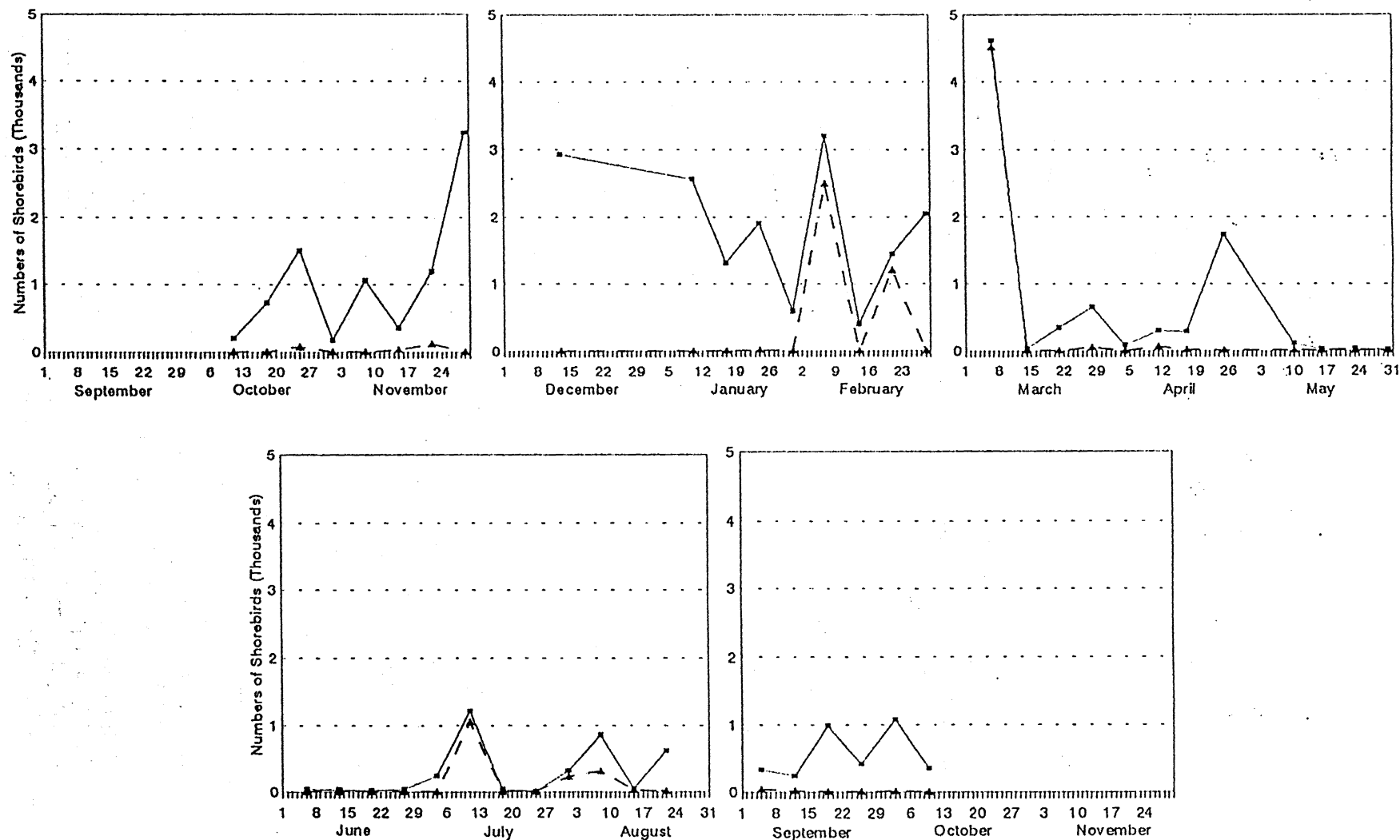


Figure 73. Seasonal fluctuations in the total numbers of shorebirds (solid line) and the number of birds identified simply as shorebird species (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

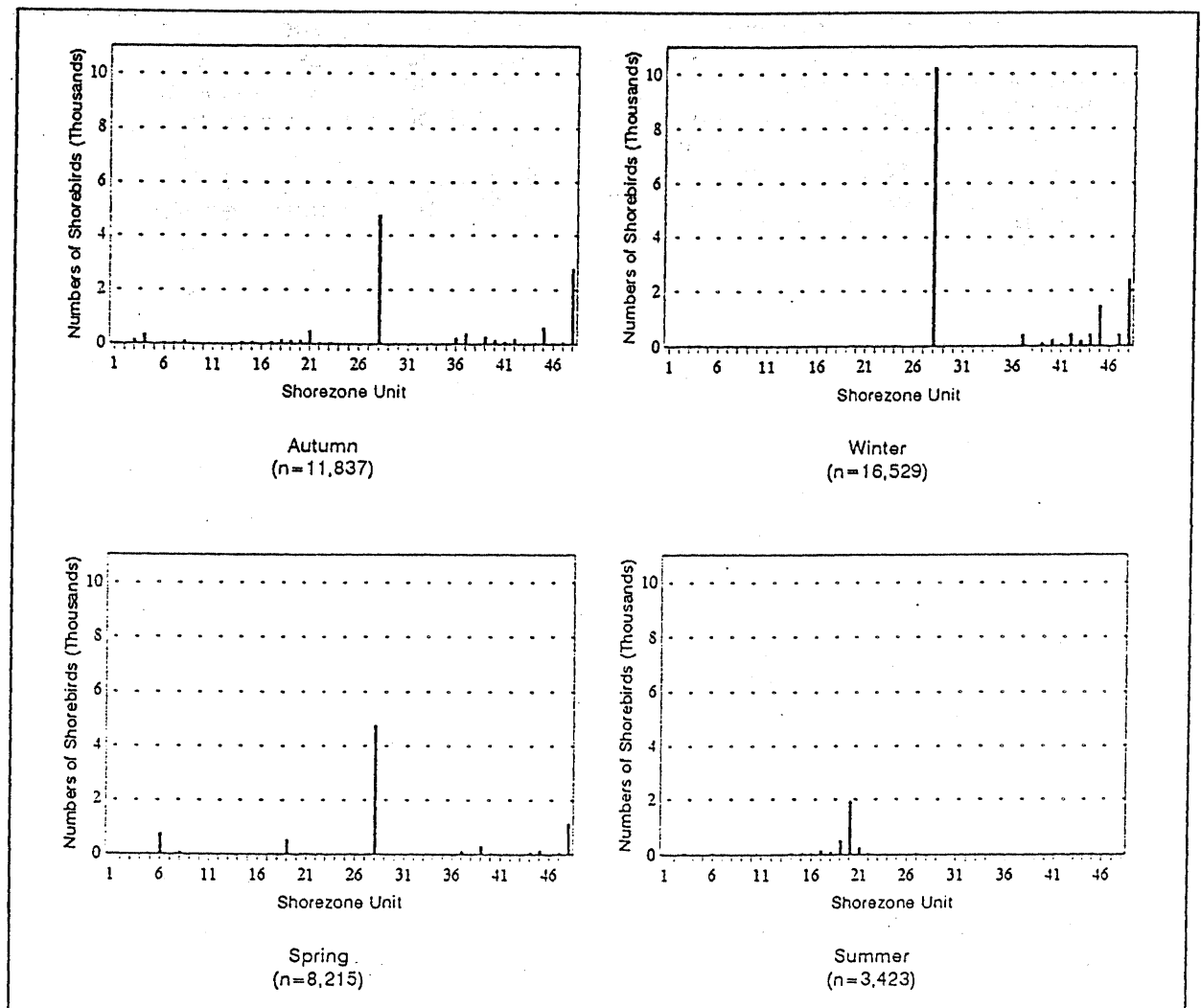


Figure 74. Seasonal variations in the distribution of shorebirds on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The total number of Black Turnstones was 12,504 birds (31% of all shorebirds). On the surveys that fell between the earliest arrival on 5 September (1981) and latest departure on 17 April (1981), the frequency of occurrence was 94%. The Black Turnstone is faithful to specific wintering localities year after year (Gill et al. 1983); the Baynes Sound - Comox Harbour area supports the largest numbers wintering in the province (Campbell et al. 1990). The highest count was 3093 Black Turnstones seen on 29 November 1980; 3000 of these birds were at one roost on log booms north of Union Point (unit 28; Figure 6). Seasonal fluctuations in numbers on the study area are shown in Figure 76. Most of the Black Turnstones identified occurred in winter (80% of bird-use days); autumn accounted for most of the remainder (17% of bird-use days). As shown in Figure 75, a large majority (82%) were seen from unit 28 (Figure 6).

A total of 10,560 Dunlin was tallied, ranking the species as the second most abundant shorebird (26% of all shorebirds). The earliest arrival was 22 August (1981) and latest departure was 25 April (1981). The numbers overwintering remained between 100 and 1000 birds for most of this period, however a peak of 2020 birds was recorded on 28 February 1981 (including 2000 birds at unit 48) and another peak of 1350 birds on 25 April 1981 (Figure 77). A variety of locations were used by the Dunlin (Figure 78); these fluctuated with the seasons. Henry Bay (unit 48; Figure 7) received the most use in each season.

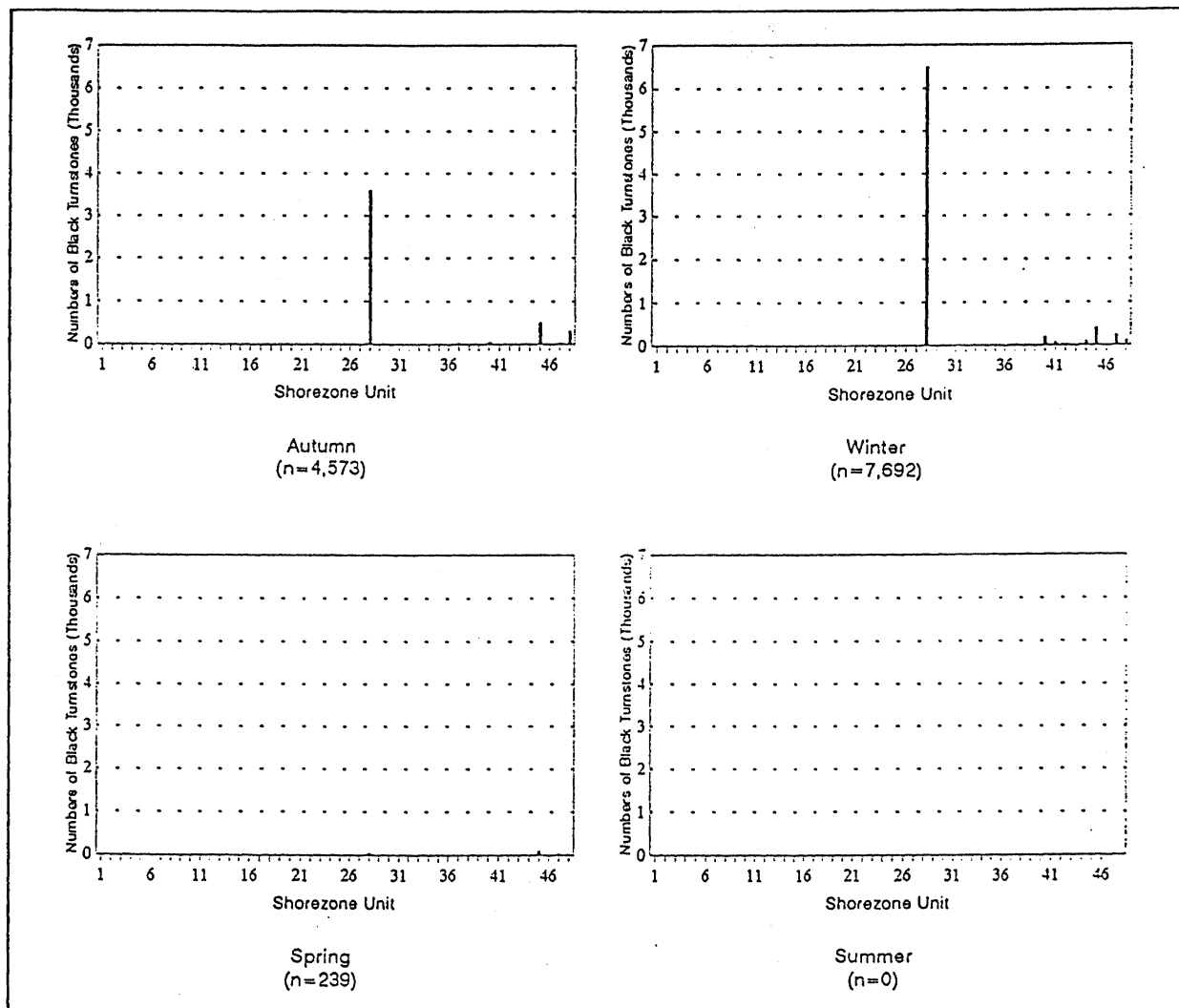


Figure 75. Seasonal variations in the distribution of Black Turnstones on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

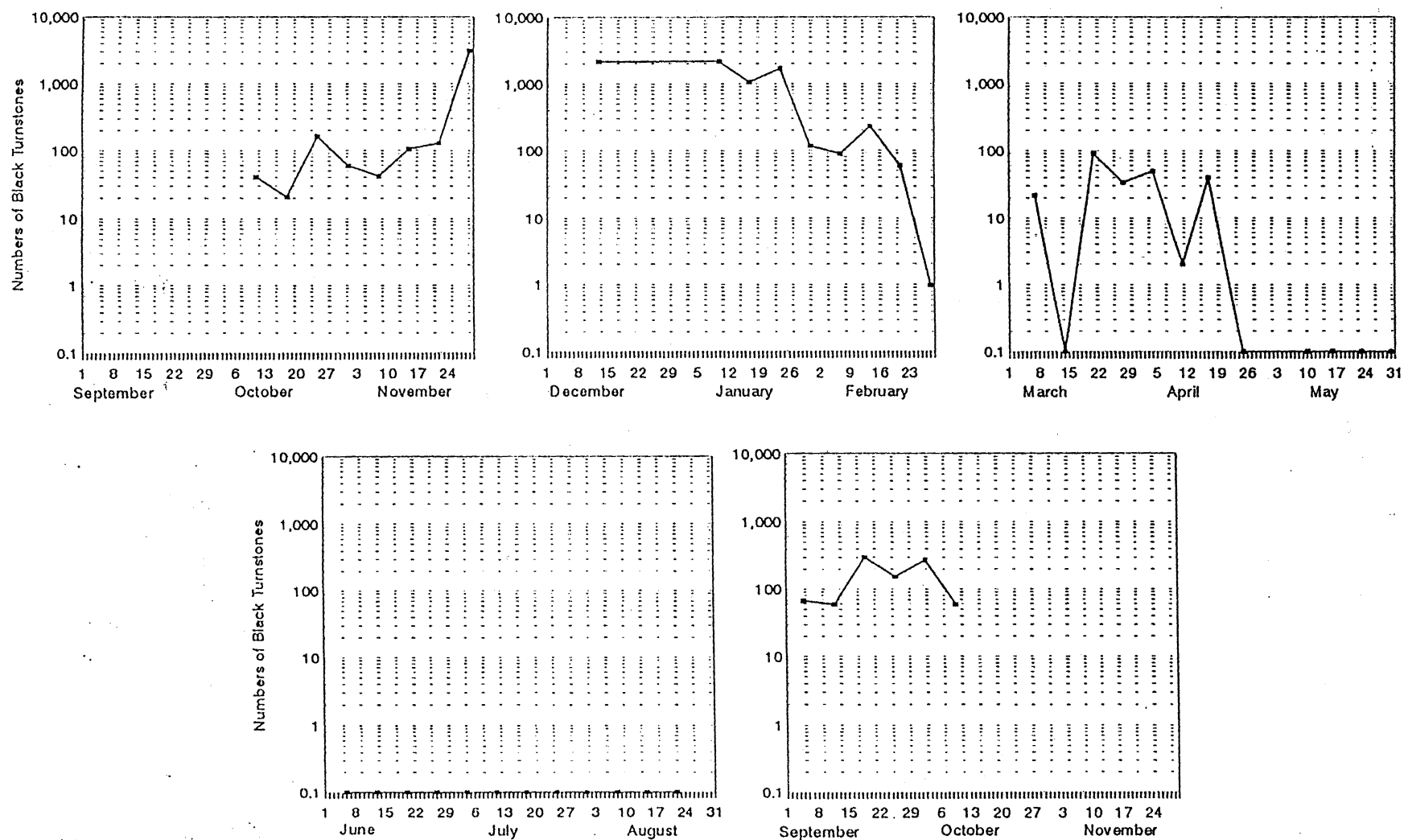


Figure 76. Seasonal fluctuations in the numbers of Black Turnstones on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

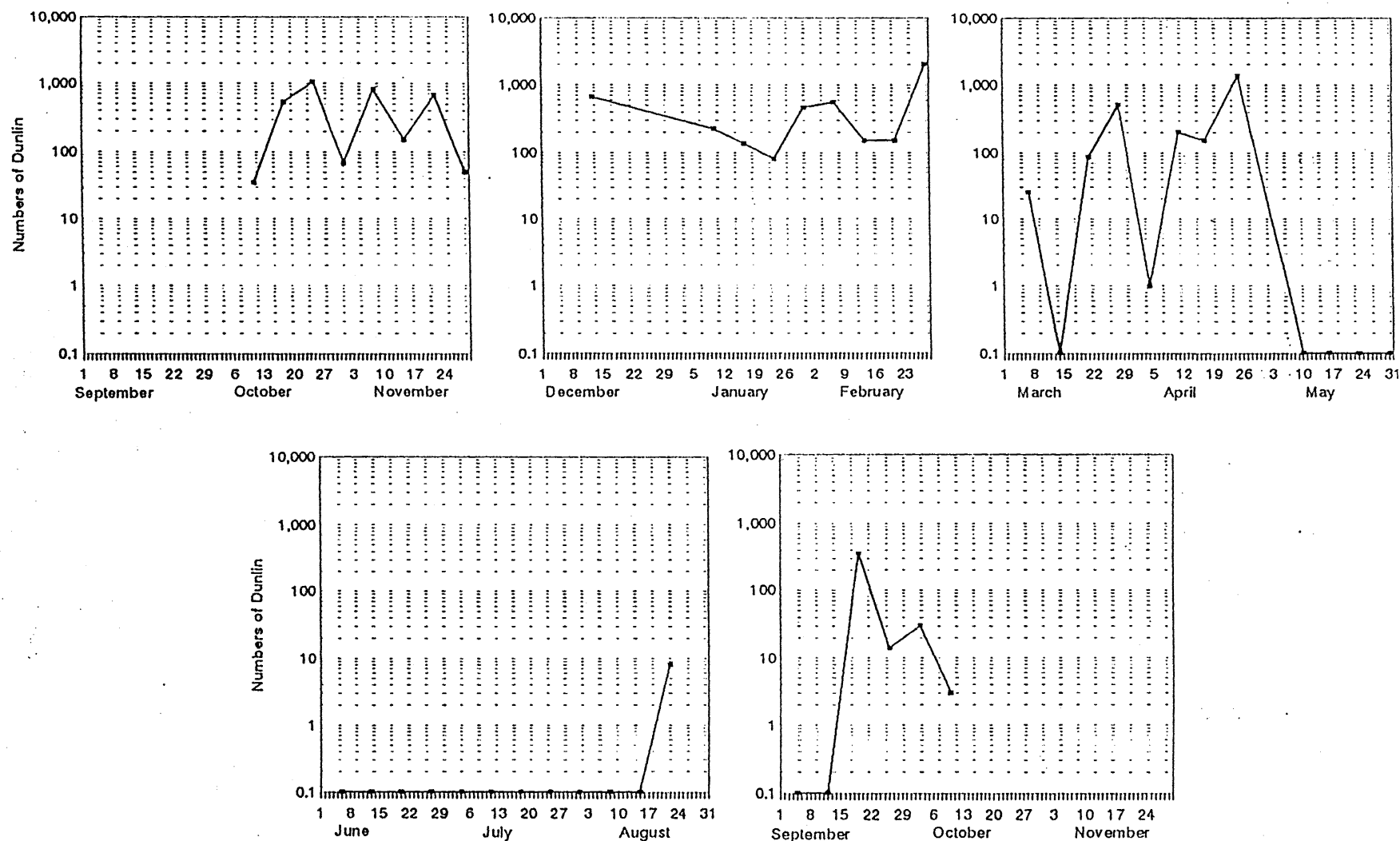


Figure 77. Seasonal fluctuations in the numbers of Dunlin on the Baynes Sound -Comox Harbour study area, 11 October 1980 to 10 October 1981.

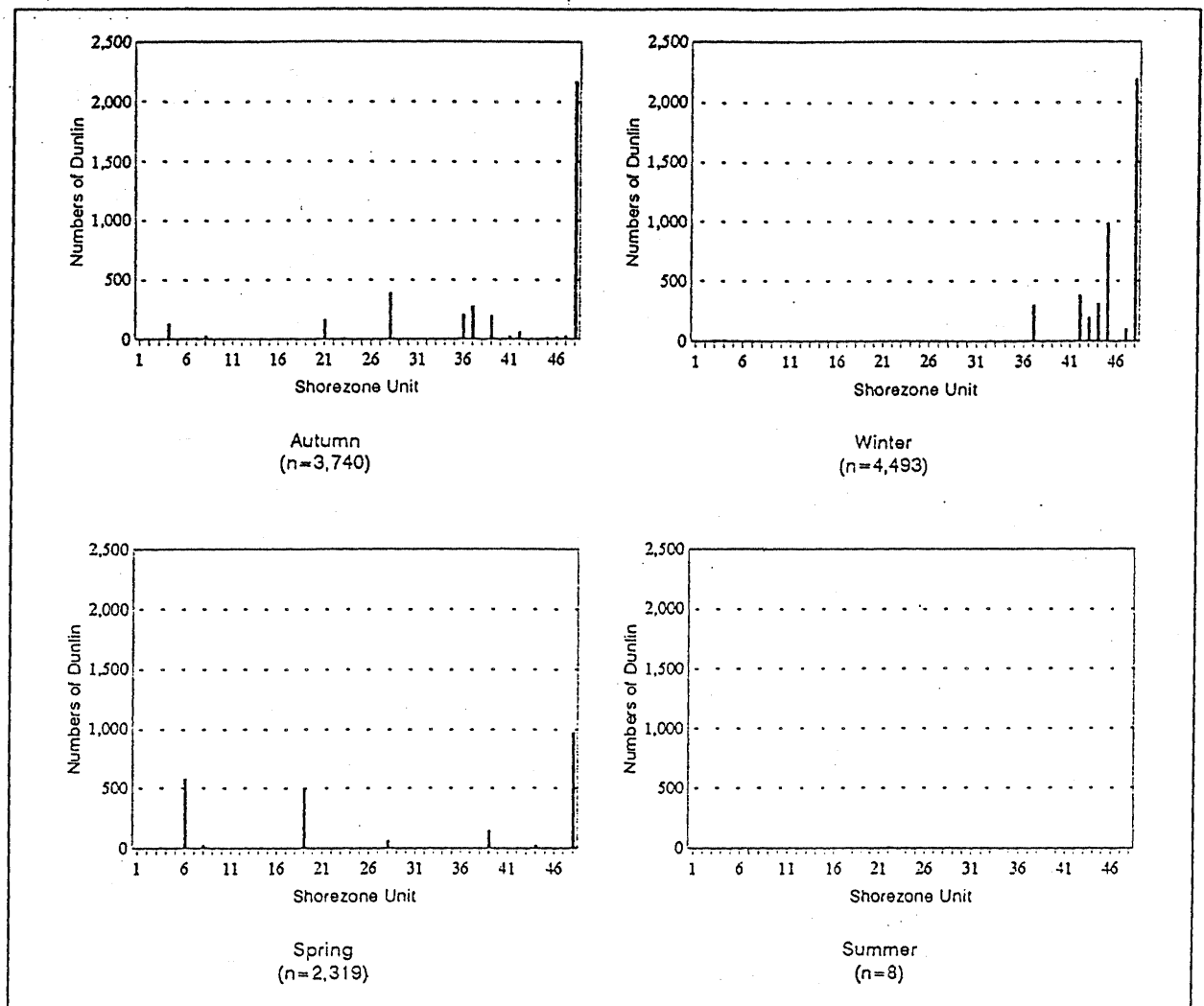


Figure 78. Seasonal variations in the distribution of Dunlin on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The third most abundant shorebird was the Sanderling; a total of 1749 birds was counted (4% of all shorebirds). In every season, the numbers fluctuated between zero and more than 100 birds as large groups came and went intermittently (Figure 79). As a result, the frequency of occurrence was often low (from 25% in spring and summer to 65% in autumn and winter). The highest seasonal total was in summer (42% of bird-use days); all the Sanderlings in that season were viewed near the mouth of the Courtenay River (units 17 to 20) including the peak of 500 birds seen on 22 August 1981 near unit 20. The count for autumn was also high (26% of bird-use days) but the birds were often in smaller groups. Sanderlings used from 1 to 4 locations each season but the locations varied over the year (Figure 80). In autumn the birds preferred the same booming area north of Union Point (unit 28; Figure 6) as did many Black Turnstones, Black-bellied Plovers and Dunlin.

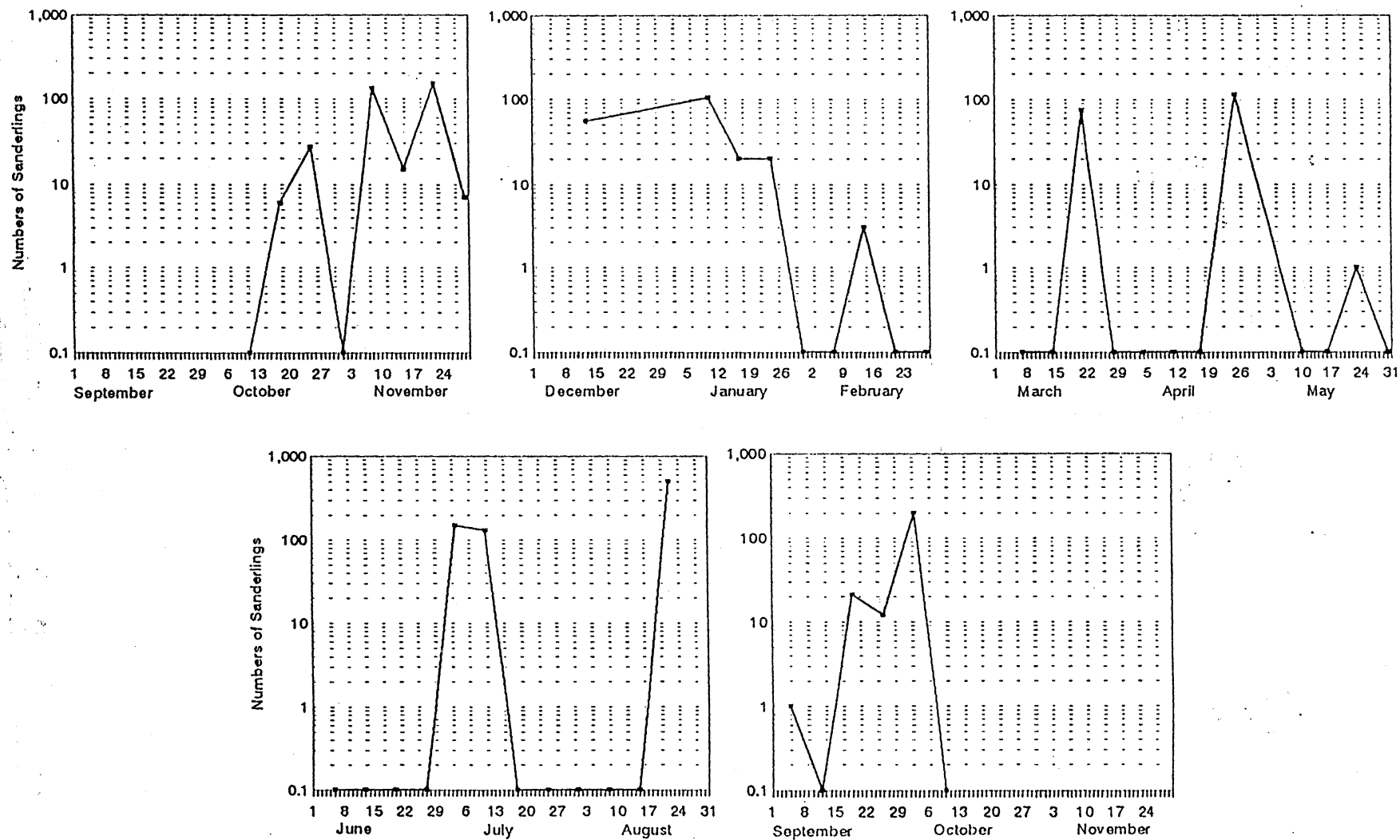


Figure 79. Seasonal fluctuations in the numbers of Sanderlings on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

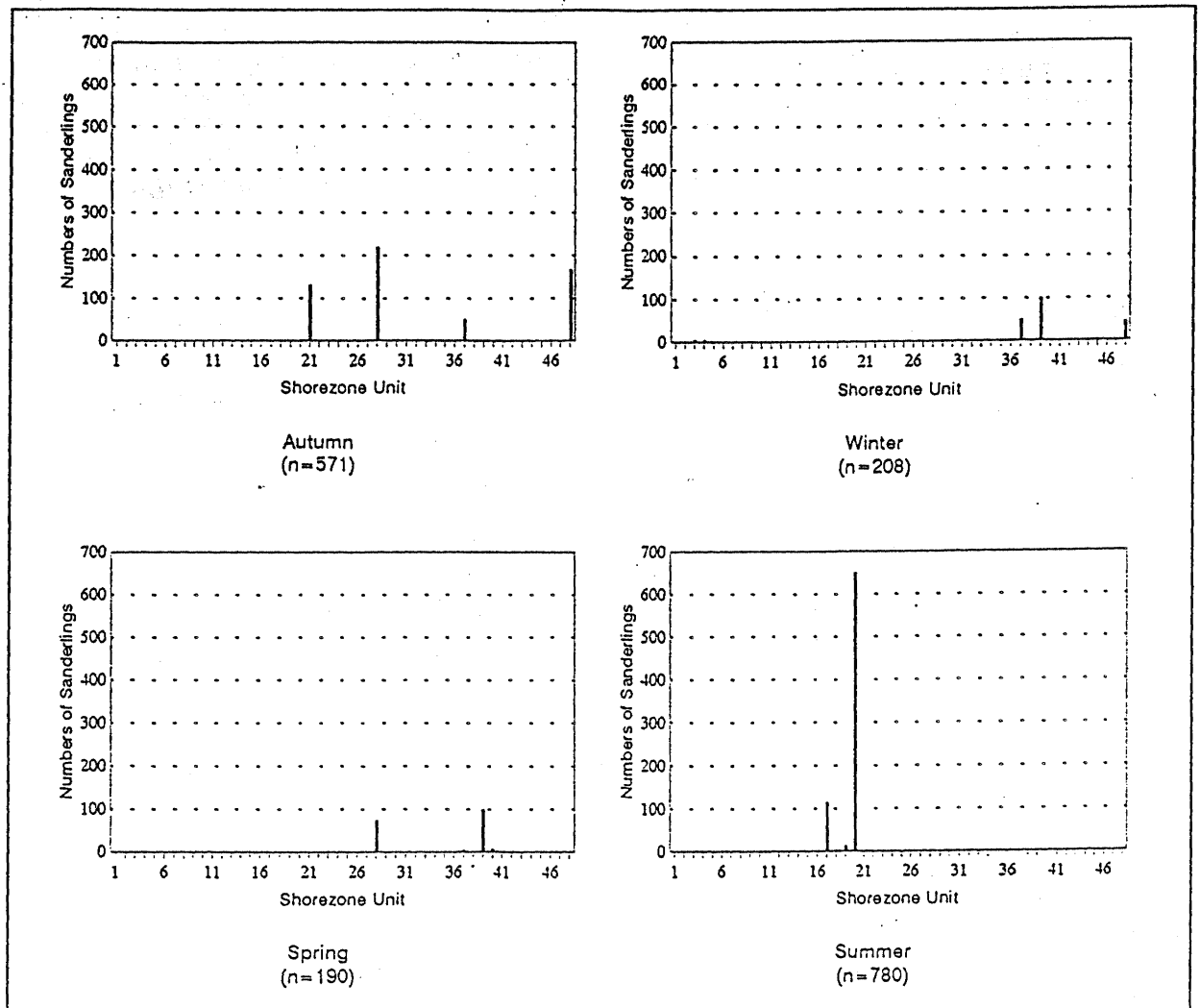


Figure 80. Seasonal variations in the distribution of Sanderlings on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

We counted 1357 Killdeer in total (3% of all shorebirds). This resident was most abundant in autumn (42% of bird-use days) and least abundant in spring (15%) and winter (17%) but its frequency of occurrence was 100% throughout the year. The observed number of Killdeer in the study area was always below 60 birds except in September and October (Figure 81). The peak of 115 birds, recorded on 25 October 1981, included 51 birds seen at unit 18 and 27 birds seen at unit 4; this was the only survey in which 2 units each recorded more than 20 Killdeer on the same day. Five other surveys recorded 20 or more Killdeer at one unit but it was a different unit each time: 22 birds on 19 September 1981

(unit 8), 28 birds on 10 October 1981 (unit 14), 29 birds on 18 October 1980 (unit 4), 25 birds on 10 January 1981 (unit 24), and 28 birds on 17 January 1981 (unit 37). This suggests that the same Killdeer might have made use of a number of different sites around the Baynes Sound - Comox Harbour area. In any case, it is clear that these plovers utilized many of the locations surveyed and that there were large variations in their preferences over the seasons (Figure 82).

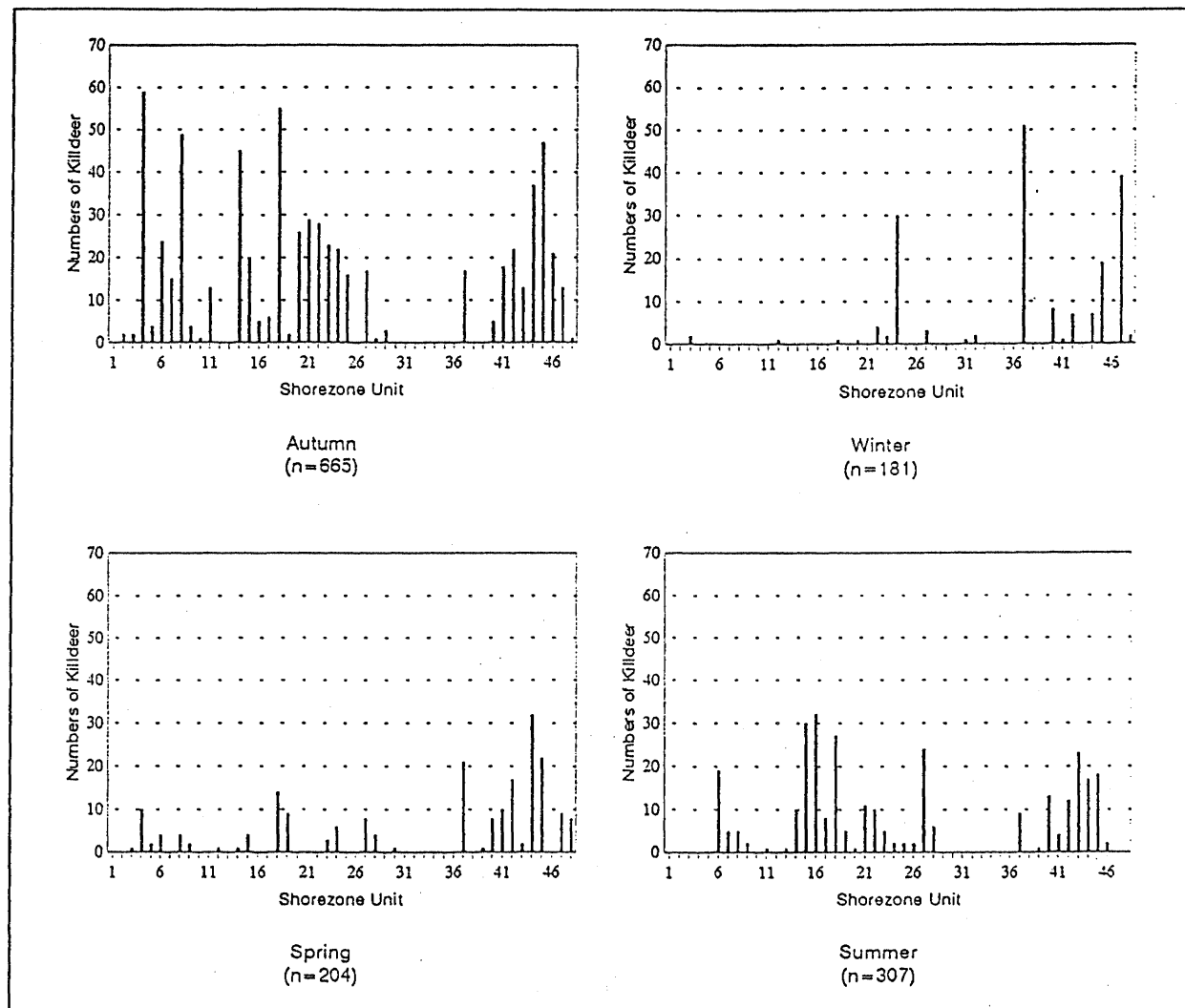


Figure 81. Seasonal variations in the distribution of Killdeer on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

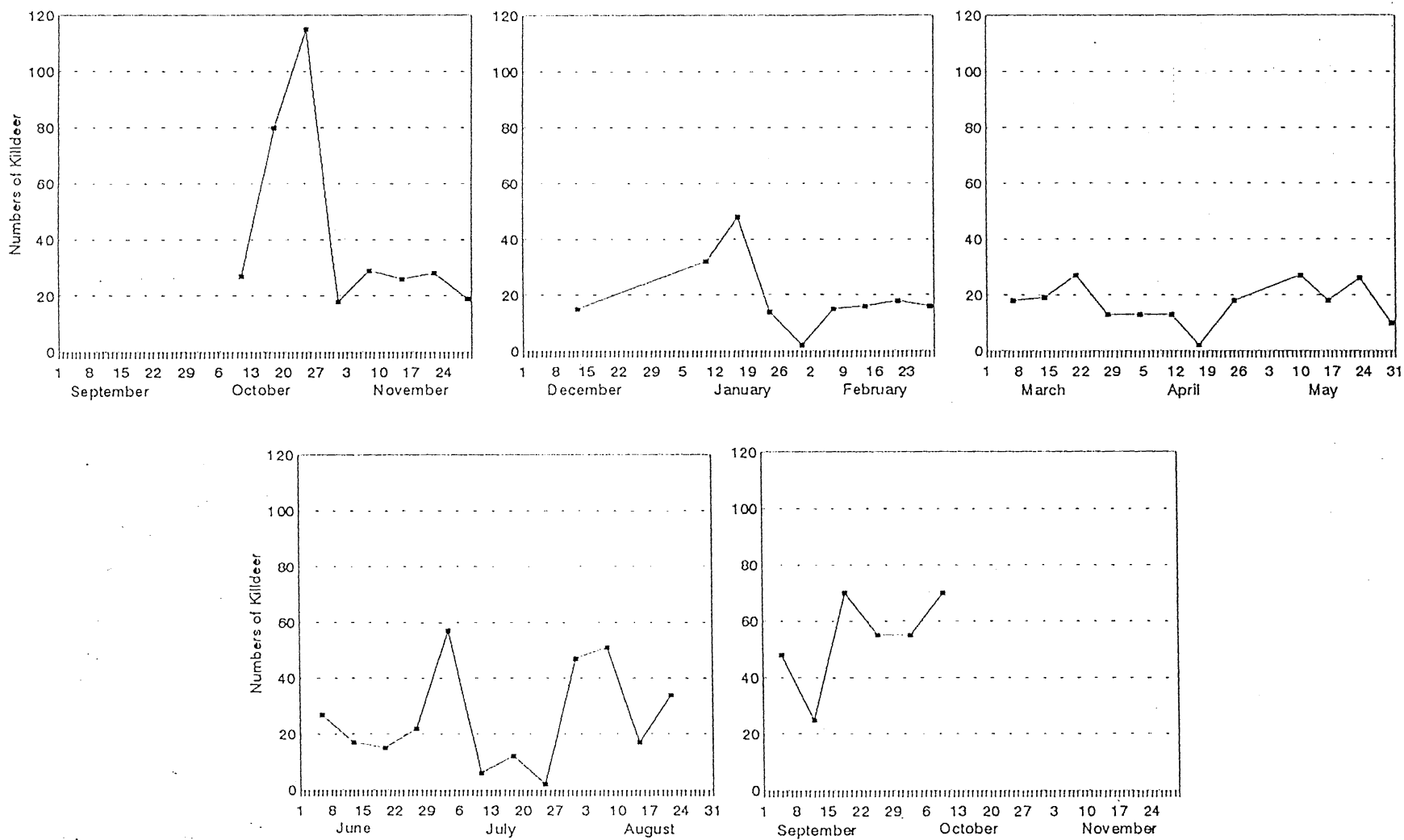


Figure 82. Seasonal fluctuations in the numbers of Killdeer on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The total number of Black-bellied Plovers reported was 1355 birds (3% of all shorebirds). From the earliest arrival on 5 September (1881) to the latest departure on 10 May (1981), the frequency of occurrence was high (80% to 90%). Most of the birds were seen in autumn (65% of bird-use days); a peak of 426 birds was recorded on 3 October 1981 (Figure 84). The numbers identified in winter never exceeded 60 birds and the peak for spring was not much higher; 75 birds were observed on 17 April 1981. Like the Black Turnstone, the Black-bellied Plover made considerable use of the booming area north of Union Point in autumn (unit 28; Figure 6) but, of the two species, the Black-bellied Plover generally had a wider distribution around the study area (Figure 83).

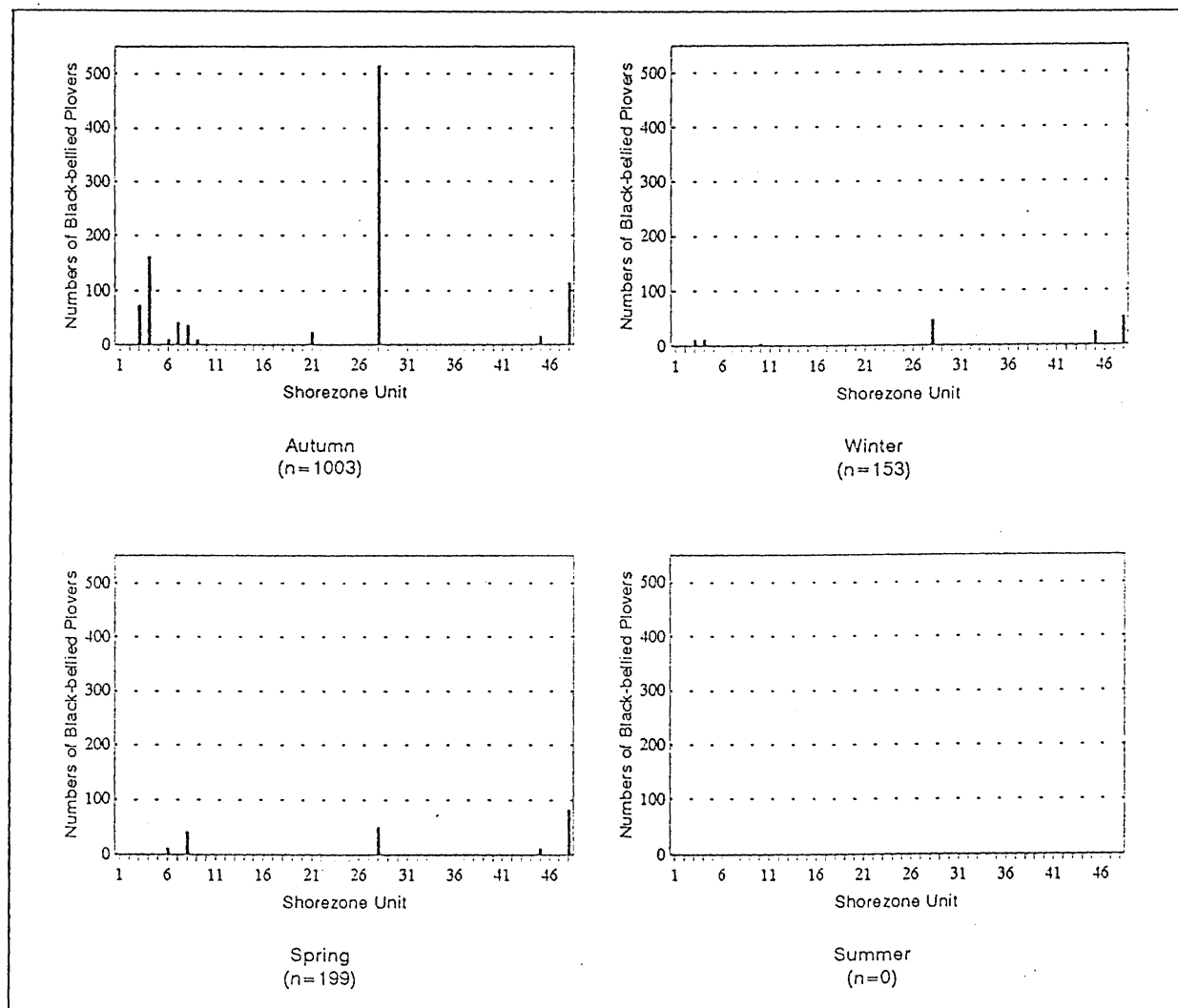


Figure 83. Seasonal variations in the distribution of Black-bellied Plovers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

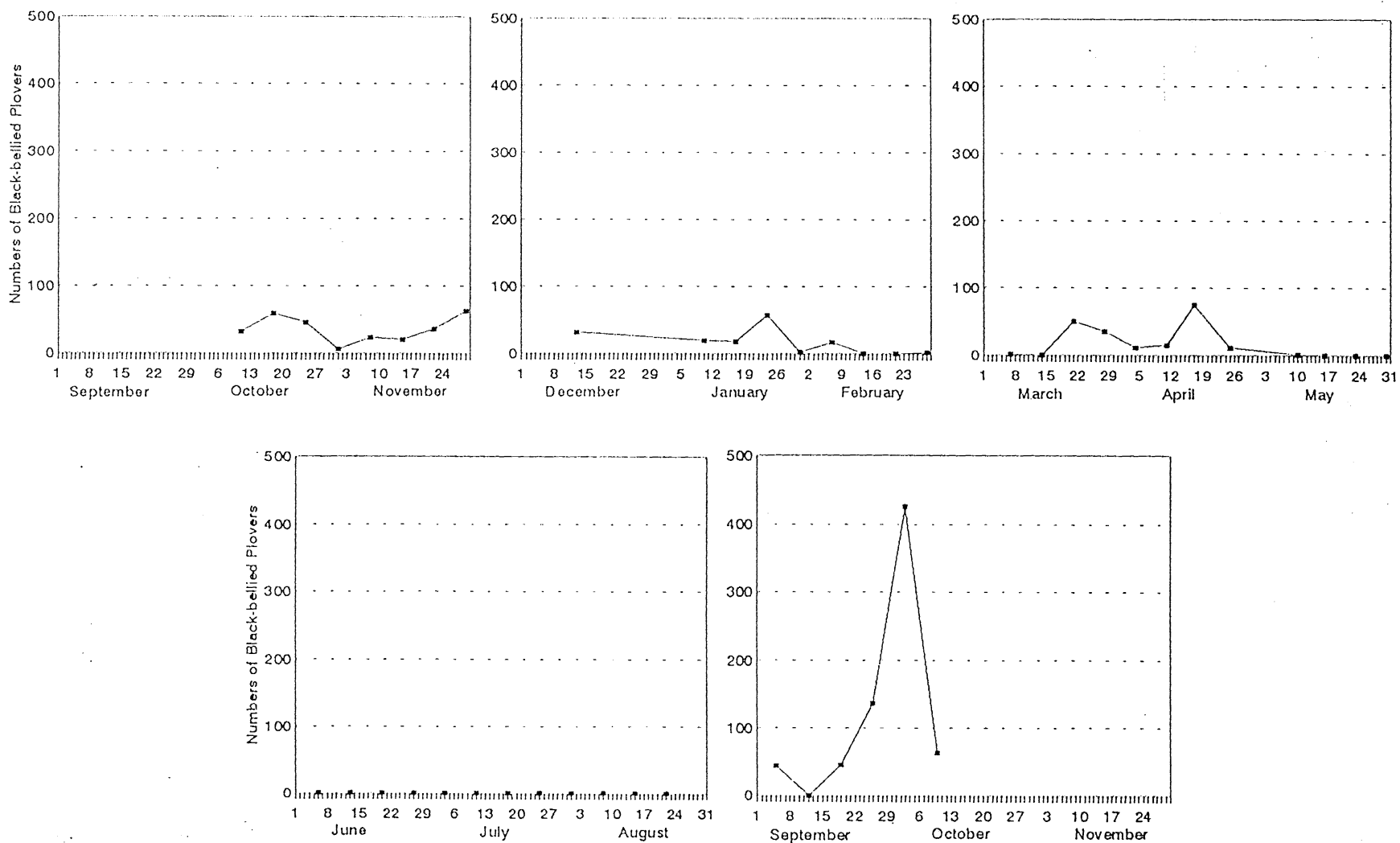


Figure 84. Seasonal fluctuations in the numbers of Black-bellied Plovers on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total of 671 Western Sandpipers was reported (2% of all shorebirds). Surveys when 25 birds or more were reported at one of the units account for 85% of this total. The earliest arrival in this study was 200 birds on 25 April 1981 (Figure 85, solid line); 150 of the birds were near the base of Goose Spit (unit 6) and 50 of the birds were in the vicinity of Fanny Bay (unit 39). Only a few birds were observed through the summer until the peak of 223 birds occurred on 8 August 1981; 200 of these birds were seen near Millard Creek, Comox Harbour (unit 21). After the height of the southbound movement, smaller numbers of migrants continued to be seen; the latest record of departure was 40 birds on 22 November 1980. The locations used most by the Western Sandpiper were on the southwestern shore of Comox Harbour; units 21, 20 and 22 (Figure 2) together counted 307 birds, almost half of the total. In analyzing the numbers of Western Sandpipers or other peeps, consideration should be given to the large numbers of birds identified simply as shorebird species (Figure 73, dashed line).

The only other peep observed was the Least Sandpiper in summer and autumn for a total of 112 birds: 11 birds on 4 July 1981, 4 birds on 18 July 1981, 24 birds on 22 August 1981, 1 bird on 5 September 1981, 46 birds on 12 September 1981, 23 birds on 19 September 1981 and 3 birds on 10 October 1981 (Figure 85, dashed line). The preferred locations for the Least Sandpiper were near the mouth of the Courtenay River (unit 19; Figure 2) and on the north shore of Comox Harbour (unit 15); units 3, 4, 8 and 17 were also used.

Both the Greater Yellowlegs and the Lesser Yellowlegs were noted in this study, as well as 25 birds reported simply as yellowlegs species. Almost every survey throughout the year added to the tally of Greater Yellowlegs; the total was 526 birds. The frequency of occurrence was high (above 90%) except in summer when it dropped to 67%. Nevertheless, the seasonal totals were similar for winter, spring and summer (from 14% to 20% of bird-use days). The highest use was in autumn (44%). In August numbers climbed towards the peaks of 58 birds seen on 5 September 1981 and the same number again on 19 September 1981. Northbound migrants appeared to be less concentrated: 19 birds on 7 February 1981, 12 or more birds on all 4 surveys in March (the peak was 20 birds on 21 March 1981) and 16 birds on 25 April 1981. The Greater Yellowlegs made use of approximately half of the locations surveyed; seasonal variations are shown in Figure 86. The highest use was around Comox Harbour (unit 21 especially in autumn and unit 14 in winter and spring; Figure 2) and at Metcalf Bay (unit 47; Figure 11).

During the study a total of 76 Lesser Yellowlegs was counted. Earliest arrival was 1 bird on 27 June 1981 and latest departure was 1 bird on 8 November 1980 but these 2 sightings were isolated; all of the other 74 birds were recorded from 1 August to 10 October, 1981. The peak was 18 birds observed on 19 September 1981, all of them on the south side of Comox Harbour (unit 21; Figure 2). The nearby locations around the mouth of the Courtenay River received equivalent use, especially units 19 and 17.

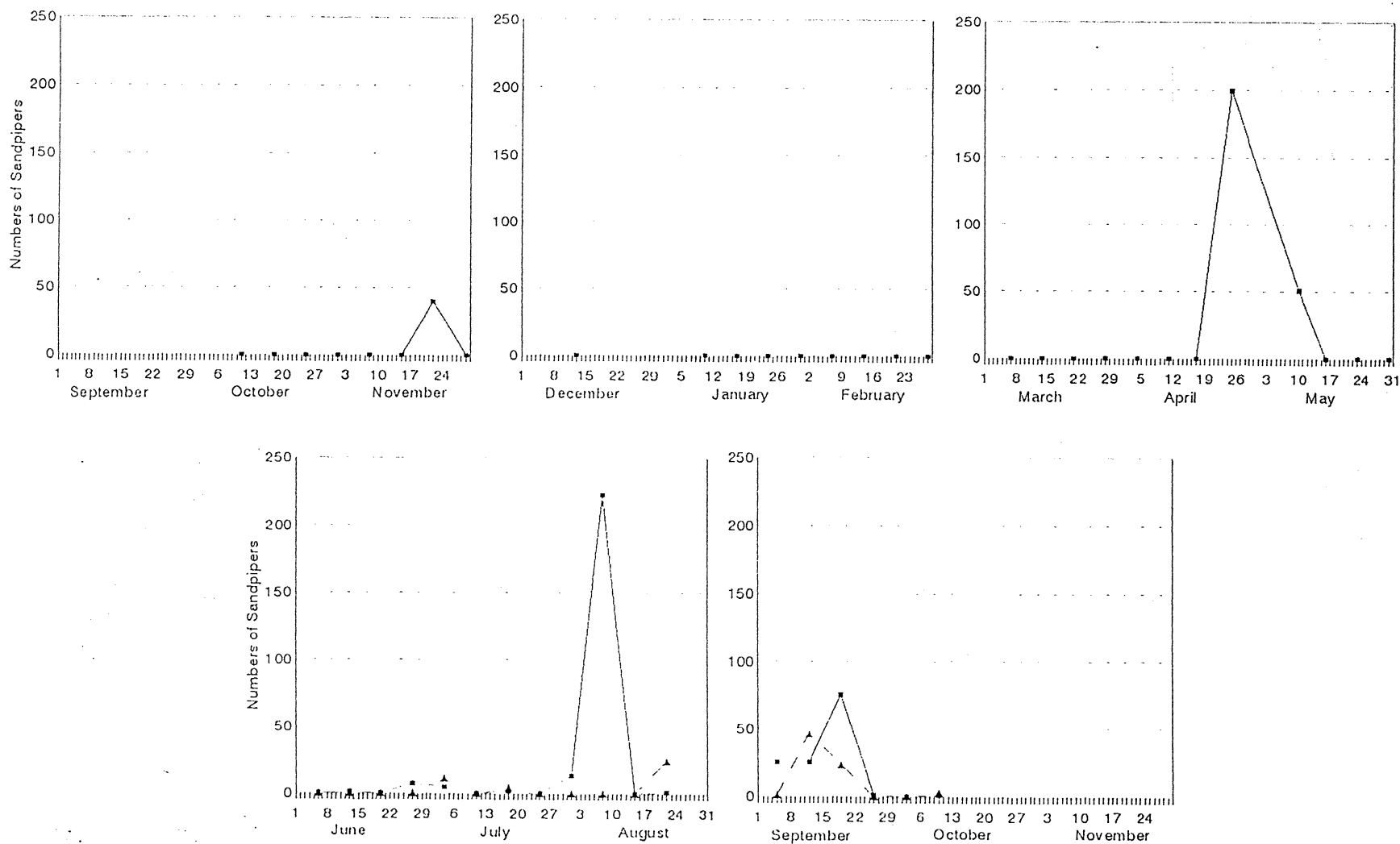


Figure 85. Seasonal fluctuations in the numbers of Western Sandpipers (solid line) and Least Sandpipers (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

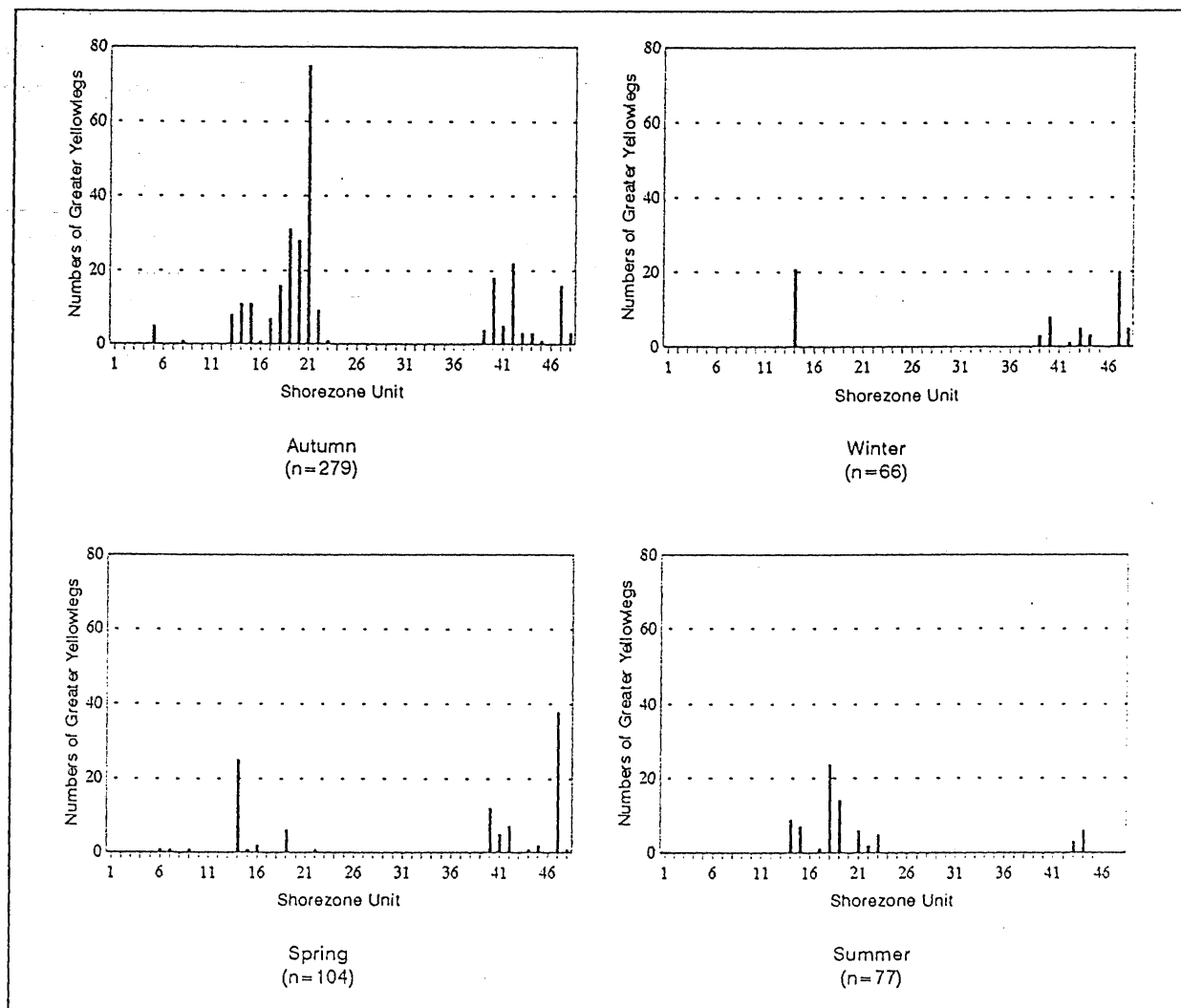


Figure 86. Seasonal variations in the distribution of Greater Yellowlegs on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

We recorded 278 Spotted Sandpipers in total, almost all of them in summer (92% of bird-use days). The earliest arrival was 10 May (1981) and latest departure was 10 October (1981). The peak of 224 birds on 8 August 1981 included 200 birds seen near the mouth of the Courtenay River (unit 19); however, this record should be used with caution because Spotted Sandpipers are a solitary species. All other surveys reported less than 10 birds. The frequency of occurrence was high (above 77%). The locations used by the Spotted Sandpiper were the areas near units 19 to 15 (Figure 2) and units 42, 8, 4 and 3.

Similar numbers of Long-billed and Short-billed Dowitchers were observed in this study. In addition, 15 birds were recorded simply as dowitcher species on 10 October 1981 from near Millard Creek (unit 21).

The total number of Long-billed Dowitchers was 202 birds. Although earliest arrival was 10 May (1981) and latest departure was 29 November (1980), only 4 surveys recorded this species in spring and summer: 4 birds on 10 May 1981, 3 birds on 16 May 1981, 14 birds on 11 July 1981 and a peak of 21 birds on 8 August 1981. Most of the birds (79%) were seen after 5 September (1981) and before 8 November (1980); counts of 17 or more autumn migrants were recorded on 7 of the 11 surveys in this period. Eleven of the locations surveyed were used by the Long-billed Dowitcher with only slight variations over the seasons. Use was centred on the inner portion of Comox Harbour (units 14 and 17 to 21; Figure 2) especially near the mouth of the Courtenay River (units 18 and 19 together accounted for half of the year's total). Fanny Bay to Wilfred Creek also logged some use (units 39 and 40).

Over the study period, the count of Short-billed Dowitchers reached a total of 197 birds. The pattern of occurrence around the study area was similar to that of the Long-billed Dowitcher, however the two species were often present on different dates. Five surveys recorded the Short-billed Dowitcher in spring and summer: 12 birds on 25 April 1981 (from unit 6), 2 birds on 4 July 1981, 16 birds on 18 July 1981 (11 birds from unit 19), 3 birds on 1 August 1981 and 1 bird on 22 August 1981. Most of the birds were seen in autumn (75% of bird-use days); the major movement started 12 September 1981 and continued until the peak of 82 birds was observed on 10 October 1981. Thereafter there were 3 sightings, each of a single straggler; the latest departure was 15 November (1980). More than 78% of the Short-billed Dowitchers seen were using the area around the mouth of the Courtenay River (units 17 to 20; Figure 2). In addition, a number of birds used Mud Bay (unit 42).

All 38 Surfbirds recorded in this study occurred in autumn: 1 bird on 19 September 1981 (unit 43), 36 birds on 18 October 1980 immediately north of Union Point (unit 28) and 1 bird on 1 November 1980 (unit 29).

A total of 24 Black Oystercatchers was seen; 19 of the birds occurred in the period from 15 November 1980 to 21 February 1981. The maximum count of 4 birds occurred on 22 November 1980 and on 24 January 1981. Other sightings include a single bird each on 4 April 1981 and 11 April 1981, and 3 birds on 10 October 1981. Deep Bay and, to a lesser degree, Mapleguard Point and Metcalf Bay (units 45, 46 and 47; Figures 11 and 12) were the only locations used by the Black Oystercatcher.

A total of 23 Common Snipes was recorded. Three birds were seen on 28 February 1981 in the area around McNaughton and Chef Creeks (unit 44; Figure 12) and then the following week 15 birds occurred at the same location on 7 March 1981. The only other areas where Common Snipes were observed were near the mouth of the Courtenay river (unit 18) in November and 1 bird near Fanny Bay (unit 39).

A total of 14 Whimbrel was recorded. Ten birds occurred on 10 May 1981 on the north side of Comox Harbour: 5 birds from unit 6, 4 birds from unit 8 and 1 bird from unit 11. One week later 1 bird was viewed from unit 22 on 16 May 1981 and 2 weeks after that (on 30 May 1981), 2 birds were seen near unit 11 and 1 bird near unit 15.

Eight Lesser Golden-Plovers were seen in total over the year of study: 7 birds on 24 January 1981 from Henry Bay (unit 48; Figure 7) and 1 bird on 5 September 1981 on the south side of Goose Spit (unit 3).

One Semipalmated Plover was recorded on 6 December 1980 in the vicinity of Henry Bay (unit 48).

A single Ruddy Turnstone was seen on 26 September 1981 just north of Union Point (unit 28) on the same survey that more than 220 Black Turnstones and Black-bellied Plovers were present at that location.

Gulls and Terns: Ten species of gulls were recorded on Baynes Sound during the study; the total was 124,967 gulls (18% of all birds). Of the gulls identified, the Glaucous-winged was by far the most abundant while second ranking was approximately shared by the Mew Gull and the Bonaparte's Gull. The Herring Gull was also present in large numbers. The other species together

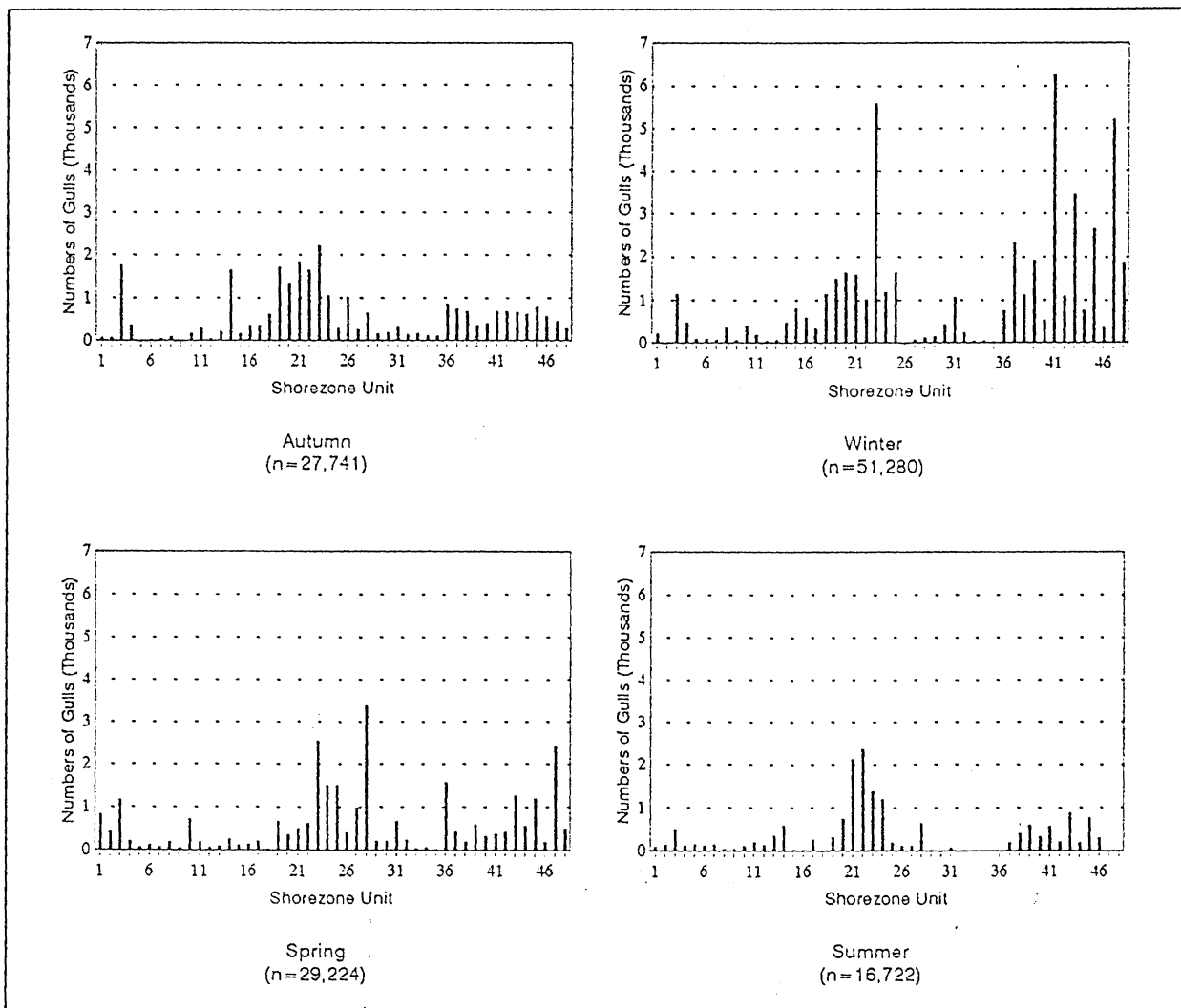


Figure 87. Seasonal variations in the distribution of gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

accounted for less than 1% of all gulls. In decreasing order they were: Thayer's Gull, California Gull, Ring-billed Gull, Glaucous Gull, Western Gull and Franklin's Gull. Of all gulls, 29% were reported simply as gull species. Seasonal fluctuations in the numbers of gulls were large (Figure 88, solid line) reaching a peak of 13,604 birds on 28 February 1981 at about the time Pacific Herring spawn; winter accounted for 41% of the total bird-use days for gulls. Fewer gulls were seen in spring (26% of bird-use days), autumn (18%) and summer (13%). Although gulls used every location surveyed (Figure 87), preferences varied through the year partly because of changes in the relative abundance of the major gull species involved.

We identified a total of 54,908 Glaucous-winged Gulls. Described by Campbell et al. (1990) as *the "sea gull" of the coast*, the Glaucous-winged Gull was seen in every season; fluctuations are shown in Figure 88 (dashed line) for comparison with the total numbers of all gulls. The species accounted for 44% of all gulls over the year of study but the proportion varied; from October to February Glaucous-winged Gulls were the majority but from April to September the species was usually a much smaller percentage of the total. The peak of 6,250 birds seen on 28 February 1981 may be an underestimate; it is possible that many of the 5772 unspecified gulls reported on the same survey were Glaucous-winged Gulls. Figure 89 shows that many areas were used. The largest aggregations occurred around Mud Bay as numbers there climbed to 3,000 birds on 28 February 1981 (counted from unit 41; Figure 11). An aggregation near the mouth of the Trent River 2 weeks earlier had the next greatest numbers; 1,000 Glaucous-winged Gulls and 1,000 gulls identified simply as gull species were counted on 14 February 1981 from unit 23 (Figure 2).

The second most abundant gull was the Mew Gull; a total of 14,114 birds was tallied (11% of all gulls). The species was present in every season with a 100% frequency of occurrence, but the numbers in summer (11% of bird-use days) were low until they began to climb in August (Figure 90, solid line). Counts fluctuated between 100 and 400 birds through autumn and winter until another climb began; 1,154 birds were observed on 21 February 1981. The peak of 1,256 birds was reached on 21 March 1981. As a result, the highest tallies were for winter and spring (35% of bird-use days in each season). Mew Gulls often showed strong preferences for some areas over others but these changed with the seasons (Figure 91).

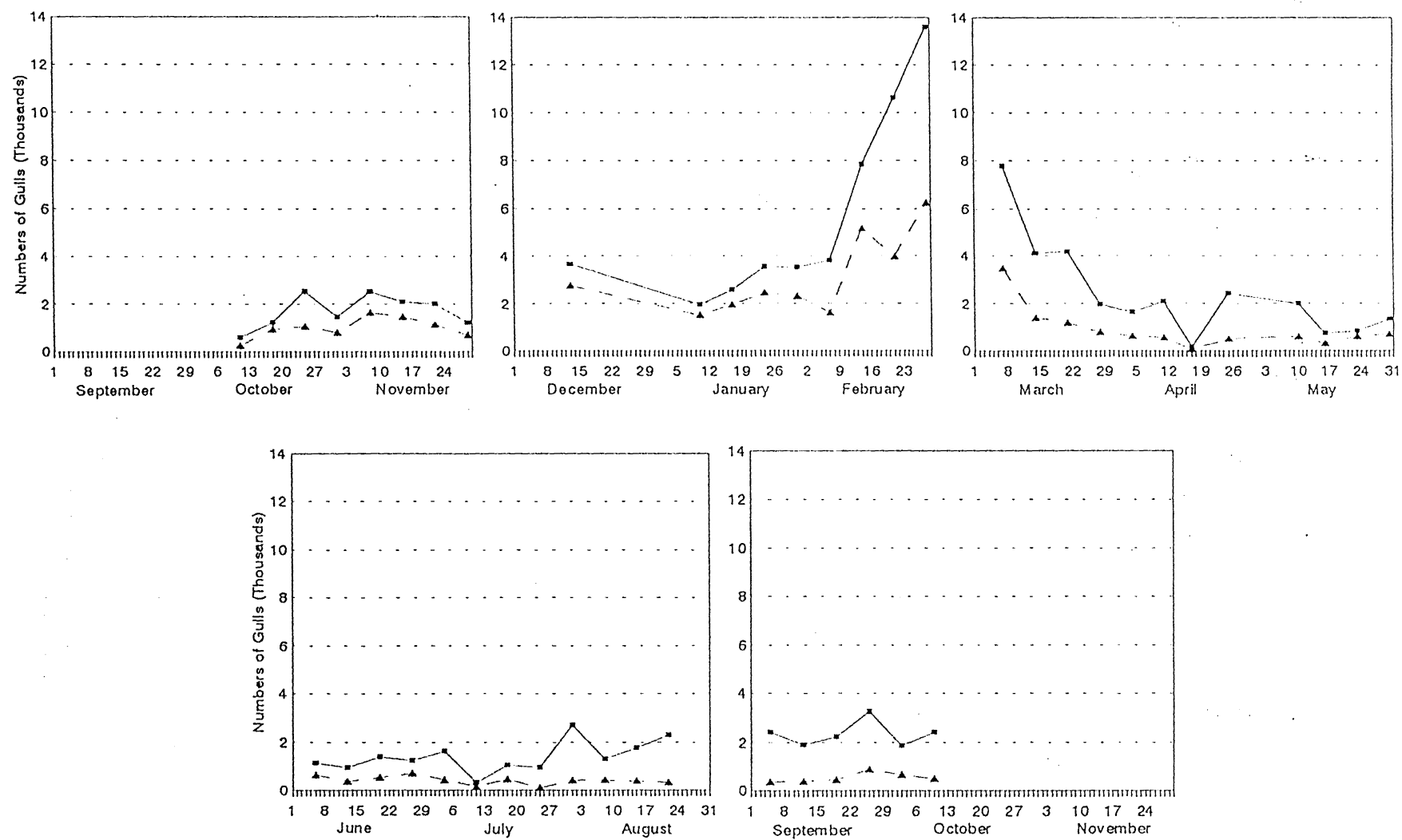


Figure 88. Seasonal fluctuations in the numbers of Glaucous-winged Gulls (dashed line) and all gulls combined (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

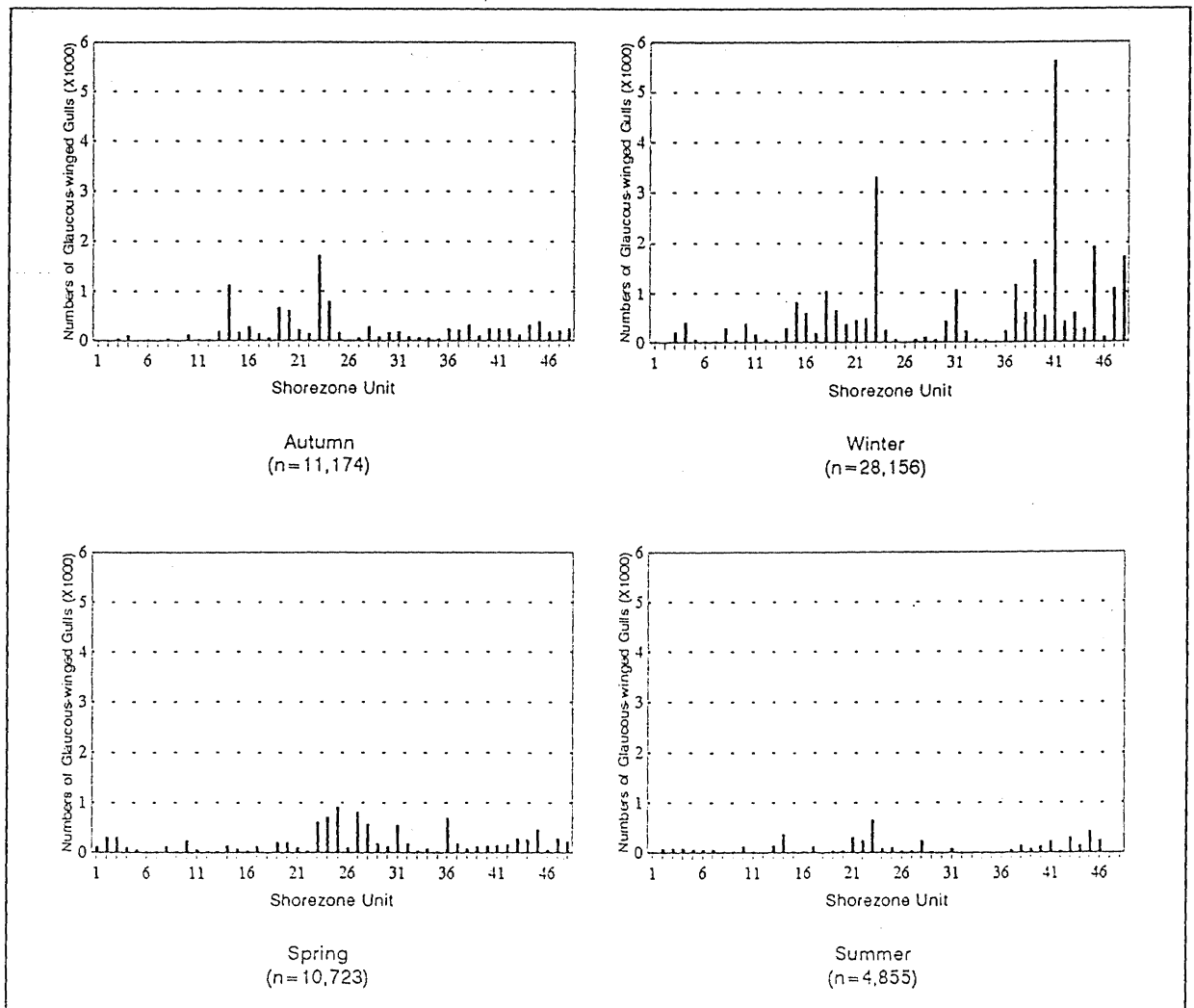


Figure 89. Seasonal variations in the distribution of Glaucous-winged Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Of the identified gulls, the Bonaparte's Gull ranked third in abundance, with a total of 13,281 birds (11% of all gulls). The earliest arrival was 21 March (1981) and the latest departure was 13 December (1980). Although there were more Mew Gulls counted in total, the Bonaparte's Gull was the more abundant of the 2 species from mid-April through to the end of September (Figure 90, dashed line). The counts for autumn and spring were the same (28% of bird-use days each) different and the migrational peaks involved similar numbers: 1,301 birds on 25 April 1981 and 1,356 birds on 5 September 1981. Nevertheless, the highest seasonal total was in summer (42% of bird-use days). The Bonaparte's Gull was seen at every location surveyed but some areas received higher use; the changing seasonal preferences are shown in Figure 92.

A total of 5,569 Herring Gulls was recorded (4% of all gulls). Throughout the year of study, the species was seen often (frequency of occurrence varied from 100% in autumn and winter to about 70% in spring and summer). However,

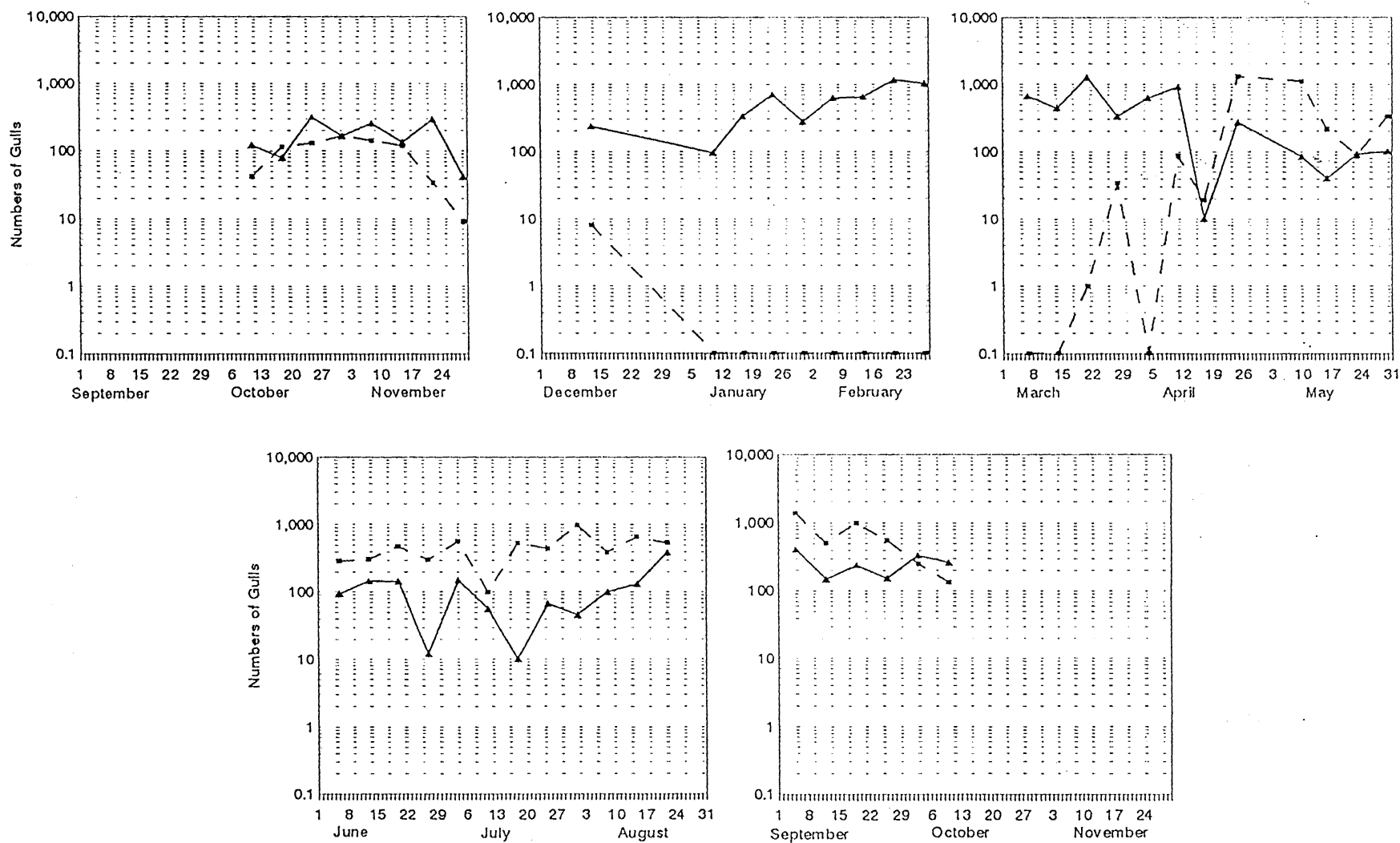


Figure 90. Seasonal fluctuations in the numbers of Mew Gulls (solid line) and Bonaparte's Gulls (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

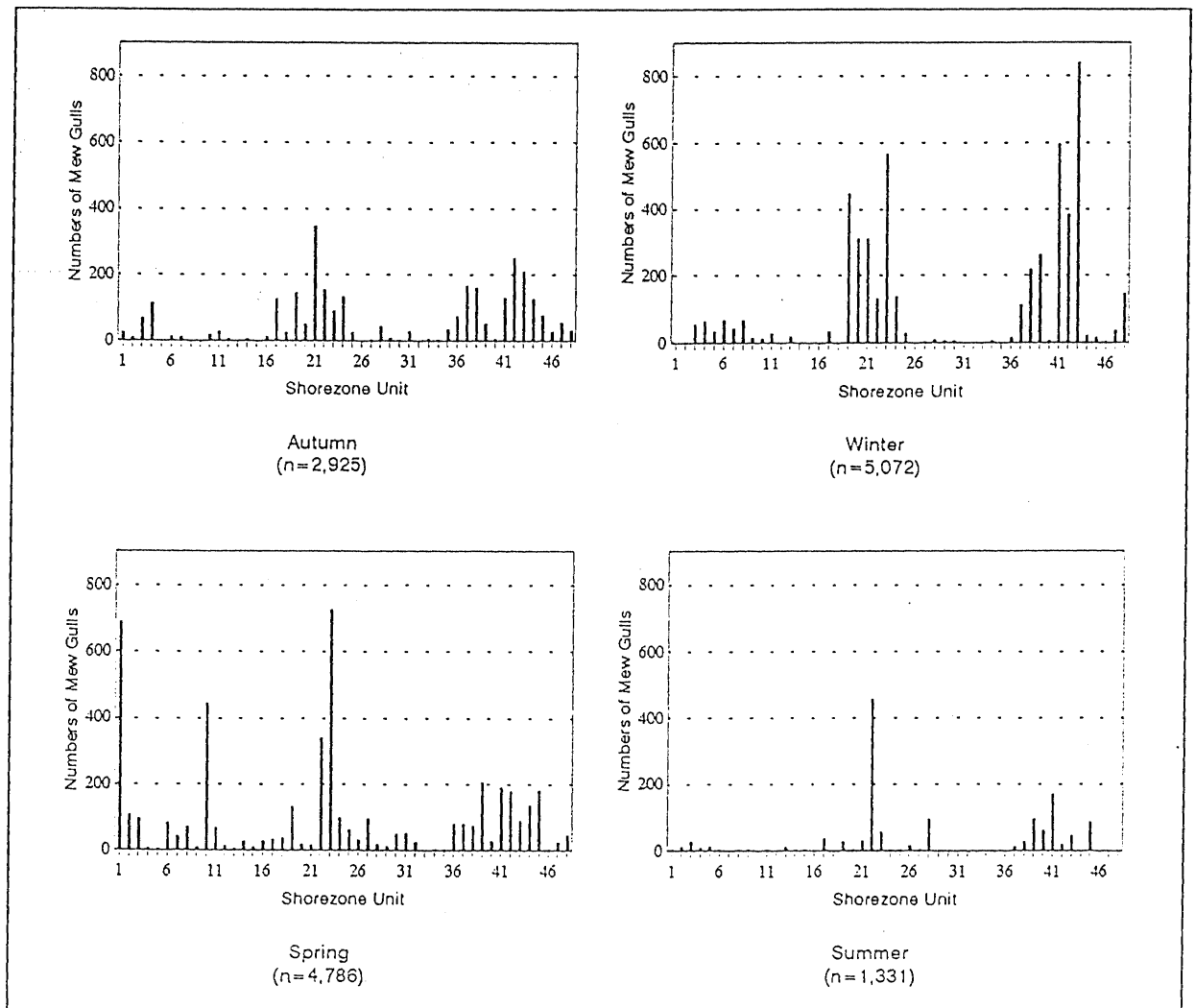


Figure 91. Seasonal variations in the distribution of Mew Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

the numbers of birds fluctuated (Figure 93, dashed line); more than half of these gulls were viewed in winter (63% of bird-use days). The totals for spring and summer were low (7% and 4% respectively). The peak was 934 birds on 21 February 1981 of which 825 birds were observed (near unit 43) likely making use of Pacific Herring spawn near Rosewall Creek and Mud Bay. The second highest count was 477 birds on 29 November 1980; most of the birds (300 birds near unit 18 and 150 birds near unit 19) might have gathered to feed on Chum Salmon carcasses around the mouth of the Courtenay River. These 2 general locations (units 18 and 19; Figure 2) recorded most of the Herring Gulls in autumn and winter but in spring and summer the birds were more dispersed (Figure 94).

Other studies along the east coast of Vancouver Island have found that the Thayer's Gull far outnumbers the Herring Gull during the winter and spring (Dawe 1976, Dawe and Lang 1980, Vermeer et al. 1994). Since these two species are very similar in appearance, data for both the Herring Gull and Thayer's Gull should be used with caution.

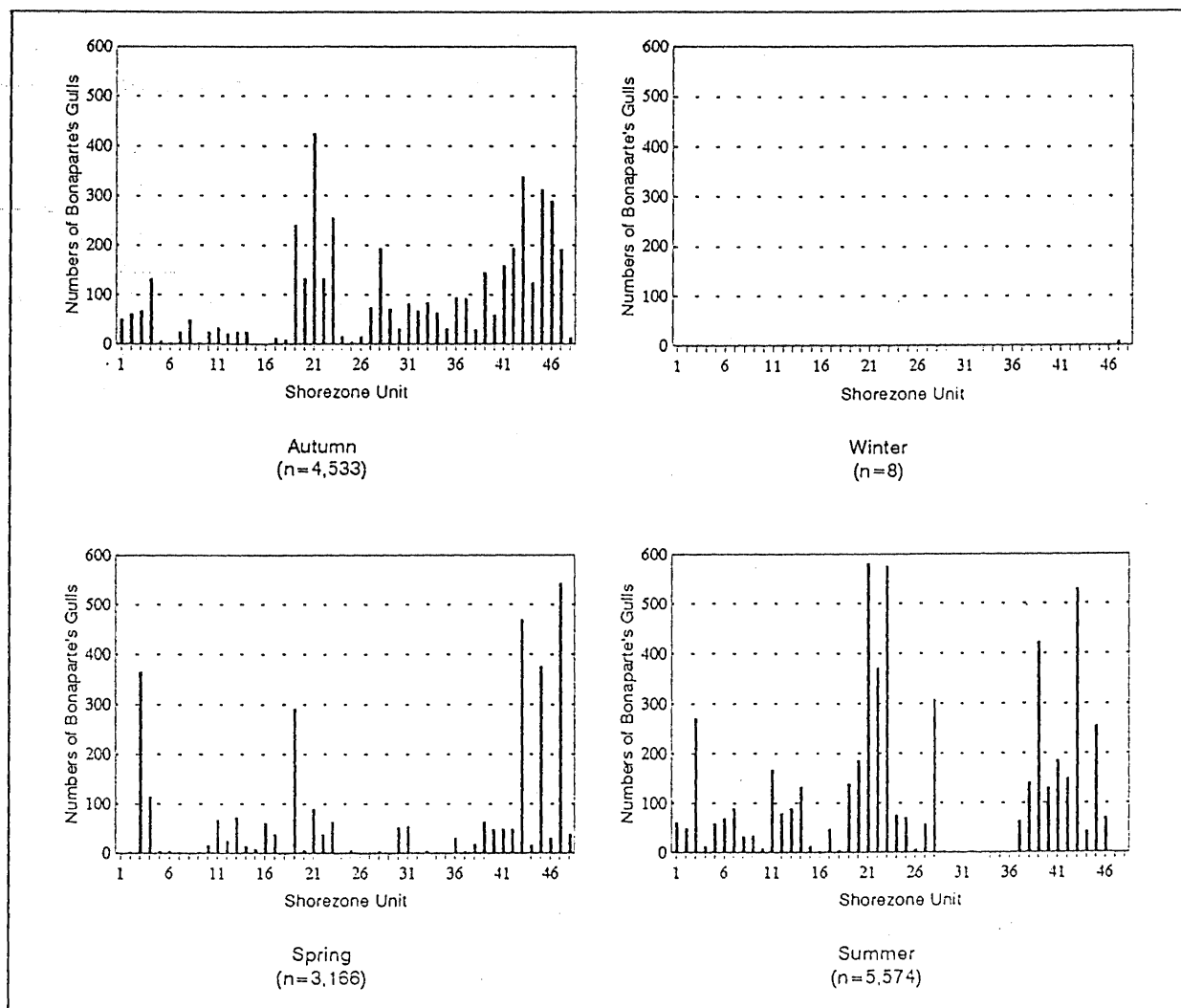


Figure 92. Seasonal variations in the distribution of Bonaparte's Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Thayer's Gulls were recorded in every season for a total of 847 birds, but almost all of them occurred in spring (64% of bird-use days) and winter (31%). Although earliest arrival was 5 September (1981) and latest departure was 6 June (1981), observed activity was centred on the period from 21 February 1981 to 14 March 1981 as numbers built up and then declined (Figure 93, solid line) especially around Rosewall Creek and adjacent areas; approximately 78% of all Thayer's Gulls in this study were counted from units 43, 45 and 42 (Figures 11 and 12) during this short period. The peak was 257 birds recorded on 28 February 1981, most of them in the vicinity of Rosewall Creek (130 birds near unit 43) and Deep Bay (120 birds near unit 45). Like the Glaucous-winged Gull and the Herring Gull, the Thayer's Gull apparently utilized herring spawn in this

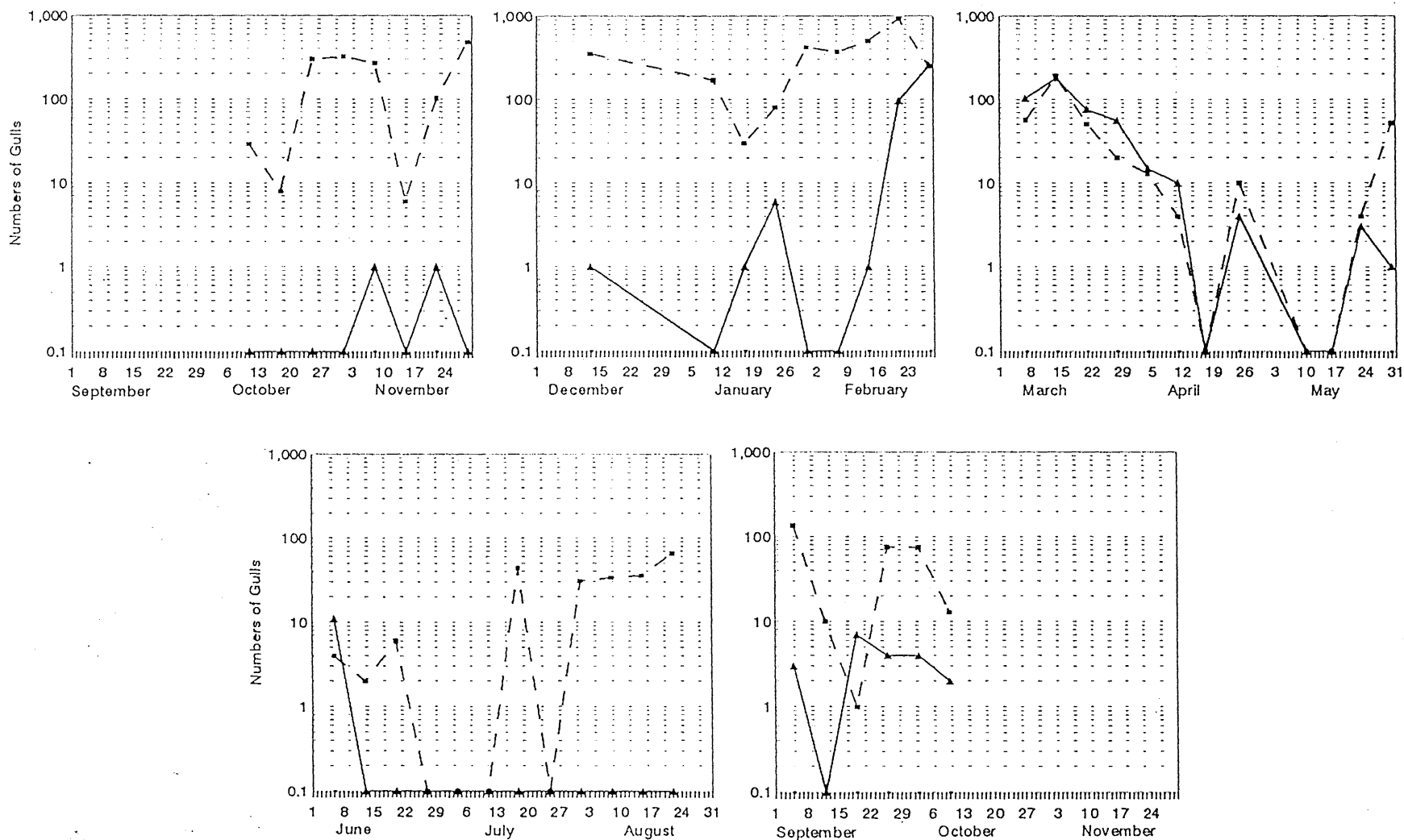


Figure 93. Seasonal fluctuations in the numbers of Herring Gulls (dashed line) and Thayer's Gulls (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

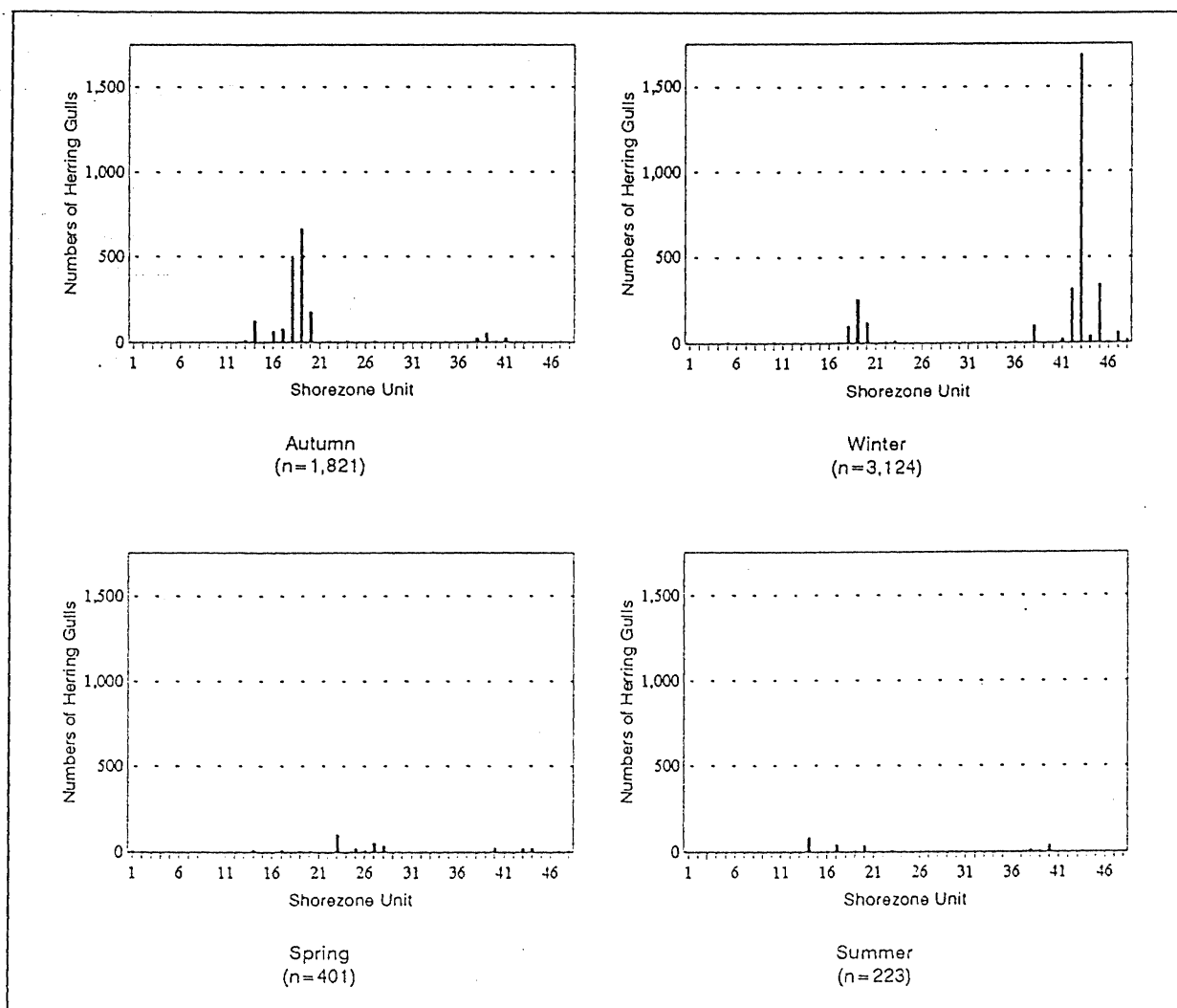


Figure 94. Seasonal variations in the distribution of Herring Gulls on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

area but, unlike the other species, the Thayer's Gull was not seen to aggregate at any other time of the year. However, these figures should be used with caution; some surveyors may have had difficulty distinguishing Thayer's Gulls from Herring Gulls (Appendix II).

California Gulls were reported intermittently through every season in the study for a total of 120 birds. Most of them were counted on 2 dates at locations around Comox Harbour (Figure 2): 50 birds on 22 November 1980 near unit 14; 49 birds on 28 February 1981 including 29 birds near unit 19 and 20 birds near unit 20. Nine other surveys reported California Gulls (never more than 6 birds) in the period from April to September; they were seen at a variety of locations (units 43, 3, 45, 42, 39 and 28).

A total of 14 Ring-billed Gulls were counted: 2 birds on 19 September 1981 (unit 19), 1 bird on 3 October (unit 27), 1 bird on 11 October 1980 (unit 6), 1 bird on 13 December 1980 (unit 43), 1 bird on 31 January 1981 (unit 48), 2 birds on 23 May 1981 (unit 41), 1 bird on 30 May 1981 (unit 45), 1 bird on 13 June 1981 and 1 bird on 20 June 1981 (both near unit 43), 1 bird on 4 July 1981 (unit 28) and 2 birds on 4 July (unit 11).

The total number of Glaucous Gulls counted was also 14 birds: 2 birds on 1 November 1980 (unit 3), 2 birds on 1 November 1980 (unit 4), 1 bird on 14 February 1981 (unit 19), 1 bird on 13 June 1981 (unit 19) and 8 birds on 13 June 1981 (unit 14; Figure 2).

Two Western Gulls were seen on 31 January 1981 just south of Union Bay (near unit 31).

One Franklin's Gull was seen 1 November 1980 near the mouth of the Courtenay River (unit 17).

Three other species in the gull family (*Laridae*) were observed during the surveys: the Common Tern, the Parasitic Jaeger and the South Polar Skua.

A total of 182 Common Terns were counted on 7 surveys. Six of the surveys occurred consecutively from the earliest arrival on 22 August (1981) to the latest departure on 3 October (1981). The peak of 68 birds was observed on 12 September 1981. The only other records were of 9 birds on 27 June 1981 in the vicinity of Roy Creek and Millard Creek (units 23 and 21). Most of the Common Terns were seen near Deep Bay (80% from unit 45; Figure 12), although the birds also used nearby units (43 and 42), and there was 1 record of 12 birds on 5 September 1981 viewed from the south side of Goose Spit (unit 3).

Four Parasitic Jaegers were seen in total. Near Deep Bay (unit 45) 2 birds were seen on 5 September 1981 harassing terns and gulls. One bird occurred at the same location on 12 September 1981, also at a time when numerous migrating Common Terns were present. Another sighting on 5 September 1981, was of 1 bird at Comox Harbour (unit 13).

One South Polar Skua was seen at the same time and place as the terns and jaegers on 5 September 1981 near Deep Bay (unit 45).

Alcids: Three species of alcids were recorded. Seasonal fluctuations in the numbers of all alcids combined are shown in Figure 95 (solid line). Some units tallied a high proportion of the birds in 1 or 2 seasons but over the year of study, use varied geographically (Figure 96).

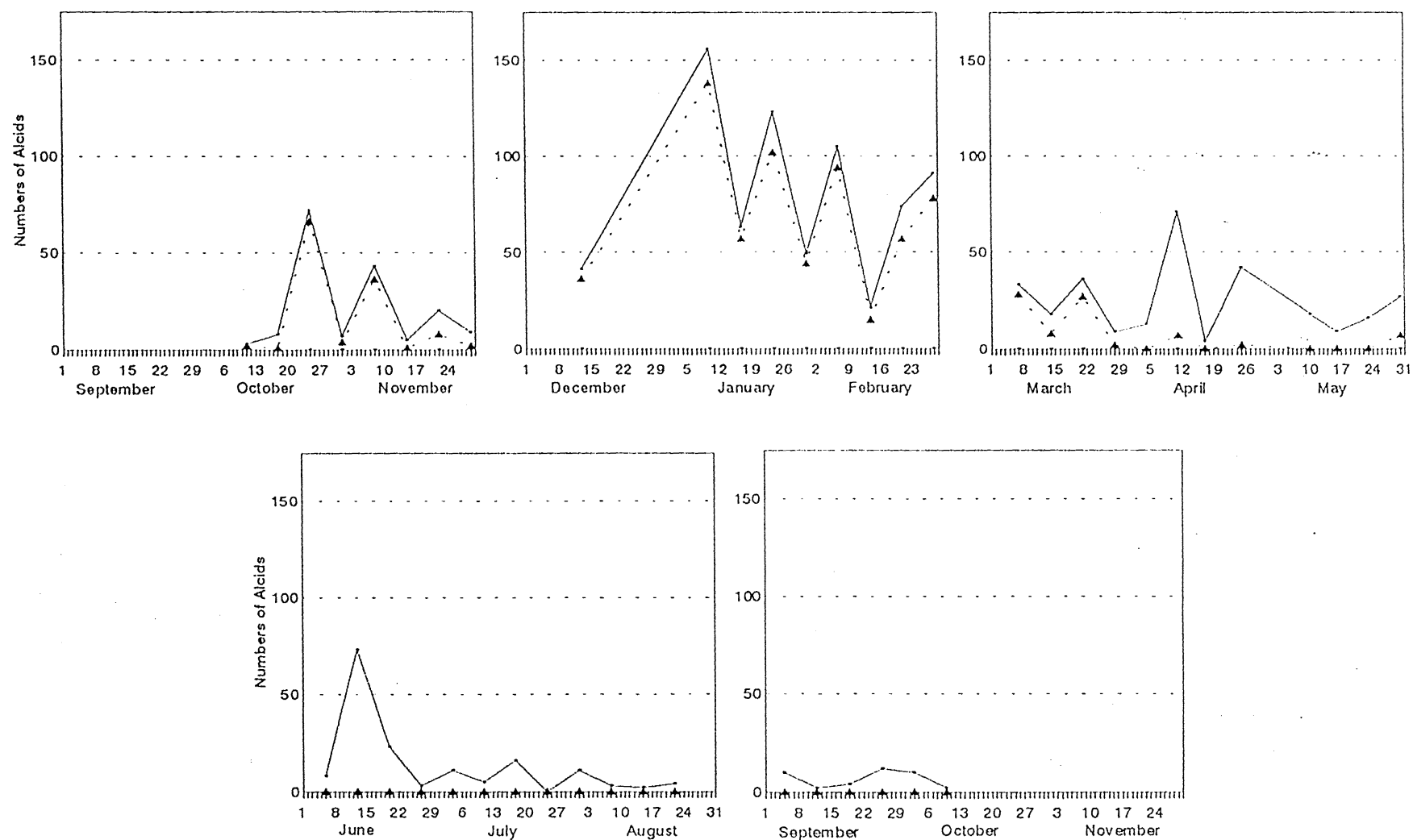


Figure 95. Seasonal fluctuations in the numbers of all alcids (solid line) and Common Murres (dotted line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

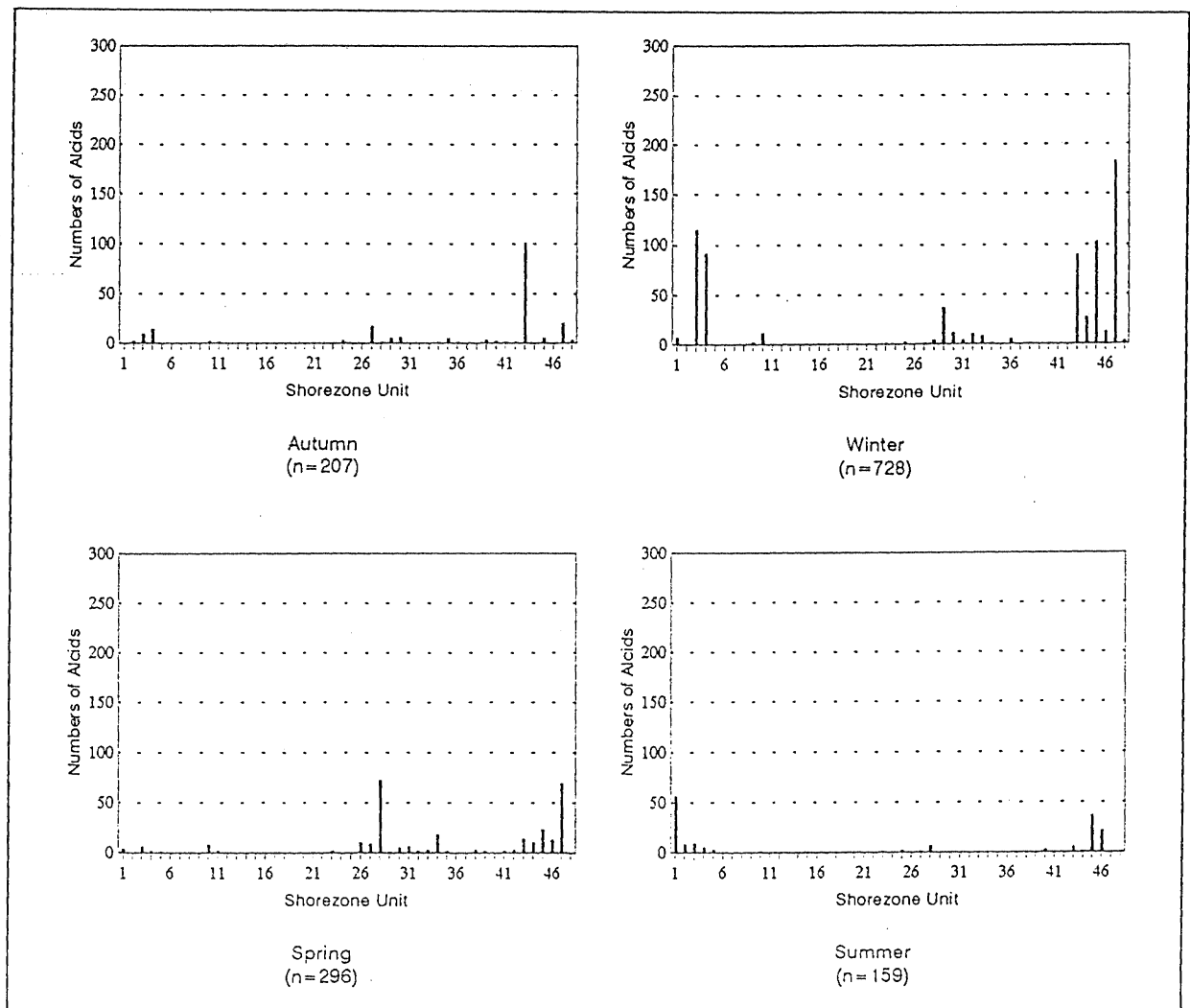


Figure 96. Seasonal variations in the distribution of alcids on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The majority of alcids were Common Murres; a total of 822 birds (59% of all alcids) was seen from the earliest arrival on 11 October (1980) to the latest departure on 30 May (1981). From October through March the species accounted for a majority of the alcids seen (Figure 95; dotted line). Most of the Common Murres were counted in winter (78% of bird-use days) when the frequency of occurrence was high (90%); the peak, 138 birds recorded on 10 January 1981, included 58 birds seen south of Goose Spit (unit 3) and 50 birds in the waters off Rosewall Creek (unit 43). Aggregations larger than that occurred twice in this study at approximately the same 2 locations noted: 65 birds on 7 February 1981 from unit 4 and 64 birds on 25 October 1980 from unit 43. Site preferences of the Common Murre in autumn and winter are equivalent to those shown for all alcids in Figure 96; in spring most of the Common Murres were seen at unit 47 (37 birds), unit 34 (13 birds) and unit 46 (13 birds).

The second most abundant alcid was the Marbled Murrelet with a total of 328 birds (24% of all alcids). The species was recorded on every survey except one but their numbers showed seasonal variations; the birds were most numerous in summer (35% of bird-use days). The peak of 63 birds, observed on 13 June 1981, included the largest aggregation in this study - 47 birds viewed from near Willemar Bluff (unit 1); no other unit recorded more than 10 birds on any survey. The second highest was of 30 birds on 25 April 1981 but this count was a tally from at least 5 units. Marbled Murrelets used many locations around Baynes Sound but they were seen most near Metcalf Bay (unit 47; Figure 11) in autumn, winter and spring. Deep Bay (unit 45) was another place with some high counts in summer.

The total number of Pigeon Guillemots seen was 240 birds (17% of all alcids), the majority were seen in spring (51% of bird-use days). Frequency of occurrence was high in each season (80% to 100%) except in summer when it dropped to 50%. The peak of 55 birds was seen on 11 April 1981; 47 of these birds were observed from the booming area immediately north of Union Point (unit 28; Figure 6). Many other units recorded this species but in smaller numbers; the most used area in autumn was also near Union Point (unit 27) but in winter Metcalf Bay (unit 47) had the highest total.

Doves and Pigeons: A total of 791 Rock Doves were seen. The seasonal totals for this introduced resident were relatively consistent; the highest abundance was in autumn (36% of bird-use days). The peak was 87 birds on 25 October 1980 but no unit counted more than 30 birds on any one day. This ubiquitous bird was seen at many locations but high year round use was confined to the areas around units 45, 38, 16, 10 and 22. Large numbers of the birds occupied additional sites in autumn (especially near units 18, 33, 5, 15, 41 and 7). For example, 100 Rock Doves were tallied near Dyke Slough by the mouth of the Courtenay River (unit 18) during surveys in September (1981), October (1980) and November (1980).

A total of 258 Band-tailed Pigeons was recorded. The earliest observed arrivals were 2 birds on 7 March 1981 (near unit 17) and 1 bird on 28 March 1981. All of the other pigeons were seen in the period from 10 May (1981) to the latest departure on 18 October (1980); the frequency of occurrence was 100% during this time of year. Two similar peaks were seen: 39 birds on 13 June 1981 (including 35 birds at unit 21) and 40 birds on 22 August 1981. In every season, the preferred locations of the Band-tailed Pigeon were near Millard Creek (unit 21; Figure 2), in the area from Beacon Creek to Union Point (unit 27 and 28; Figure 6) and near McNaughton and Chef Creeks (unit 44; Figure 12). However other locations were also used; for example, 6 birds were seen on 10 May 1981 near Metcalf Bay on Denman Island (unit 47).

Two Mourning Doves were seen: 1 bird on 13 June 1981 in the vicinity of Rosewall Creek (unit 43) and 1 bird on 28 March 1981 in the area of Buckley Bay and the Tsable River (unit 36).

Swifts: Two species of swifts were recorded. Vaux's Swift was the more numerous, with a total of 17 birds seen: 8 birds on 5 September 1981 near Fanny Bay (unit 39; Figure 10), 3 birds on 12 September 1981 from the north side of Comox Harbour (unit 13) and 6 birds on 19 September 1981 in the area north of Union Point (unit 28).

Three Black Swifts were observed on 22 August 1981 at Mud Bay (unit 42; Figure 11).

Hummingbirds: A total of 286 Rufous Hummingbirds was recorded and 6 birds were reported simply as hummingbird species. The earliest arrival was 21 March (1981) and the latest departure was 8 August (1981); during this period the frequency of occurrence was 100%. Gradually, numbers increased until the peak of 46 hummingbirds was observed on 23 May 1981 which included 22 birds seen in the area around Deep Bay (unit 45). By the start of June, the numbers in the study area were declining. Rufous Hummingbirds were seen from 26 of the 48 shorezone units. Sixteen of these areas (units 13, 20, 21, 26, 27, 28 and 37 through 45) were used in both spring and summer with approximately the same number of birds recorded in each season. Metcalf Bay (unit 47) appears to be an exception; 63 birds were recorded from 21 March 1981 to 10 May 1981 but none were recorded in summer because Denman Island was not surveyed in that season. Most of the hummingbirds seen in this study occurred in spring (70% of bird-use days) as a result of the high counts at units 45 and 47 (Figures 11 and 12) in that season.

Kingfishers: A total of 579 Belted Kingfishers was recorded. This species is a resident; it was observed on every survey in numbers that fluctuated without revealing any seasonal cycle. The average count for the surveys within each season ranged from 6 birds in spring to 18 birds in autumn when 36% of bird-use days were recorded. The peak was 29 birds recorded on 5 September 1981. Every location surveyed was used by the Belted Kingfisher except the exposed area from Willemar Bluff to Goose Spit (units 1, 2 and 3) and unit 33 north of Hindoo Creek. The highest counts were near Royston (units 22 and 24; Figure 2), the mouth of the Courtenay River (units 18 and 19; Figure 2), Mud Bay (unit 42 and nearby; Figure 11) and the booming area north of Hart Creek (unit 28; Figure 6).

Woodpeckers: Five species in this group were recorded over the study period; their combined total was 541 birds.

The Northern Flicker, with a total of 397 birds, accounted for most of the woodpeckers seen (73%). This species was noted on all but one of the surveys. Although numbers fluctuated from week to week, the counts averaged over each season remained relatively constant at between 5 and 11 birds per survey. Similarly, the seasonal totals in autumn, winter and spring accounted for approximately 29% of the bird-use days each but in summer the total bird-use days dropped to 12%. The peak was 24 birds seen on 21 March 1981. Northern Flickers used 38 of the 48 locations surveyed, showing highest use around Metcalf Bay (unit 47; Figure 11), the area from Fanny Bay to Deep Bay (units 38 to 45; Figures 10 to 12) and at 2 locations in the north (units 28 and 13; Figures 6 and 2).

Sixty Pileated Woodpeckers were tallied from numerous sightings involving one or two birds each; the maximum count was 6 birds on 28 March 1981. The species was seen in every season; the lowest frequency of occurrence was in summer (17%). Almost half of the birds occurred in spring (48% of bird-use days) when the frequency of occurrence climbed to 100%. Although 16 locations were used by the Pileated Woodpecker, most of the birds were seen from 3 units:

Metcalf Bay (Unit 47, 25%; Figure 11), near McNaughton and Chef Creeks (unit 44; Figure 12) and in the area just north of Union Point (unit 28; Figure 6).

A total of 57 Hairy Woodpeckers was recorded; in each season the numbers were equivalent and the frequency of occurrence was steady (approximately 60%). The maximum count was 5 birds on 28 March 1981. Observed use of the Baynes Sound - Comox Harbour area was often in low numbers at widespread and disparate locations. Nevertheless 2 units recorded almost half of the Hairy Woodpeckers: the area around McNaughton and Chef Creeks (unit 44; Figure 12) and the area immediately north of Union Point (unit 28; Figure 6).

The total number of Downy Woodpeckers seen was 21 birds. Surveys recorded 1 or 2 birds occasionally throughout the year but in spring the frequency of occurrence was relatively high (67%); as a result, about half of the birds were seen in that season. Like the Pileated and the Hairy Woodpeckers, the Downy Woodpecker used a number of locations in low numbers, but logged high use at only a few places; more than half the tally was made in the area immediately north of Union Point (unit 28; Figure 6).

One Red-breasted Sapsucker was recorded in each of 6 sightings: 24 January 1981 (near unit 47), 10 May 1981 (unit 45), 7 March 1981 (unit 44), 4 April 1981 (also unit 44), 28 March 1981 (unit 37) and 8 August 1981 (unit 25).

Passerines: Although portions of the forested sections of the Baynes Sound - Comox Harbour study area were surveyed, the focus of the study was primarily to determine water bird use, so passerine information is limited. Over the course of the study, recorded numbers of songbirds were lower than would otherwise be expected, with many of the family groups scantily represented or missing entirely from the species list (especially the flycatchers, vireos and warblers). Unlike the Englishman River estuary study (Dawe et al. 1994), there were few other sources from which to draw passerine data; additional studies would help to complete the picture of passerine use in this area.

Nevertheless, 18 families with a total of 67 species and 74,351 birds were tallied (11% of all the birds seen during the study) which ranks the passerines as third in abundance after waterfowl and gulls. In summer, the passerines were more numerous than the waterfowl and second only to the gulls in abundance (Figure 16). However, the highest seasonal total was in autumn (29% of passerine bird-use days). The combined numbers of all passerines fluctuated with the seasons, as shown in Figure 97 (solid line); Northwestern Crows (dashed line) and European Starlings (dotted line) are included in Figure 97 to show the high proportion of passerines accounted for by each of these 2 species on some surveys. For example, the peak of 2,917 passerine birds occurred on 12 September 1981; 78% of these birds were European Starlings. Two thousand starlings were gathered near the mouth of the Courtenay River on that day and, as a result, the highest passerine use in the entire study was recorded at unit 19. In another example, the second highest passerine count was on 7 February 1981; 2,520 birds were seen of which 1,003 were Northwestern Crows. For seasonal changes in the locations used by all passerines combined, refer to Figure 98.

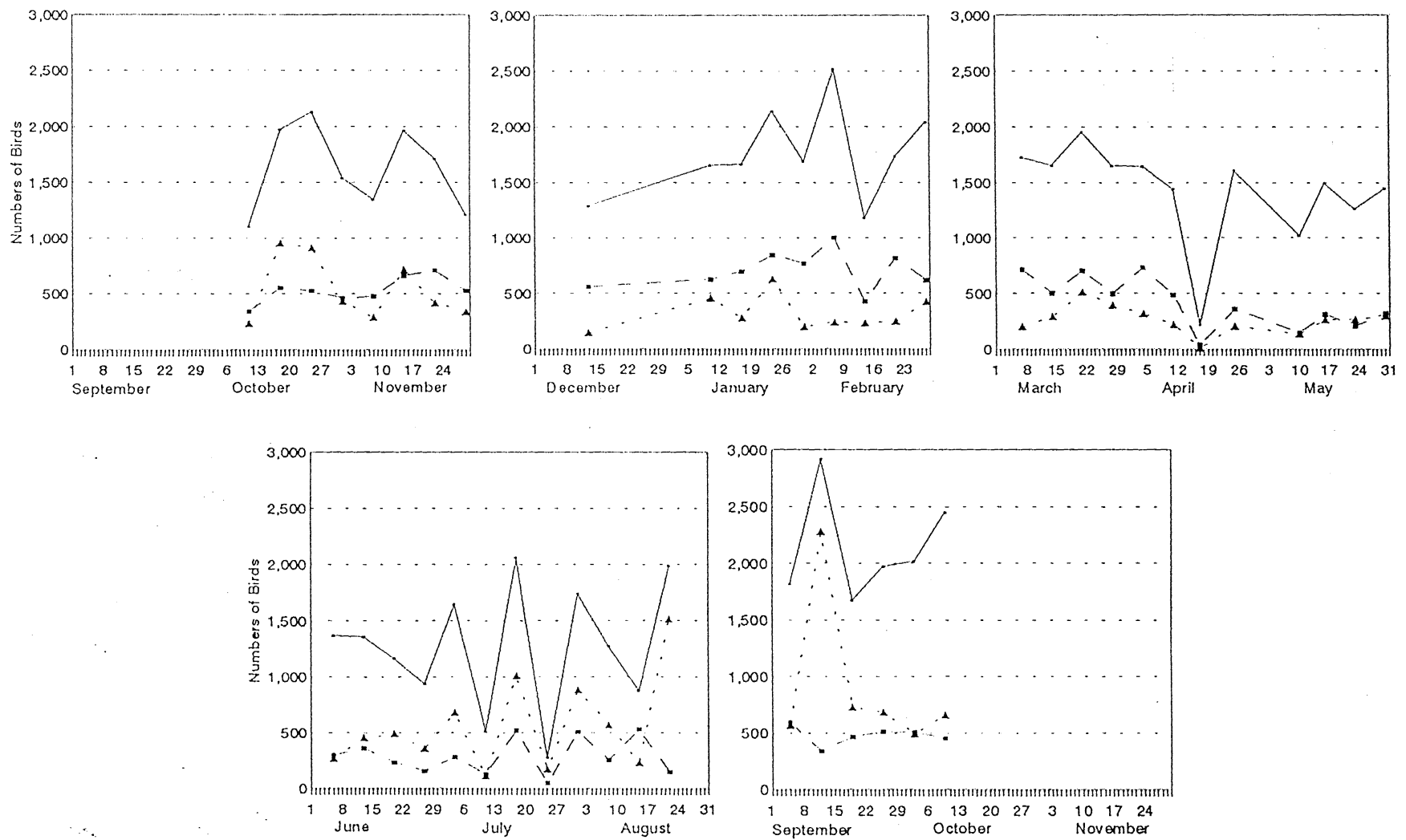


Figure 97. Seasonal fluctuations in the numbers of all passerines combined (solid line), European Starlings (dotted line) and Northwestern Crows (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

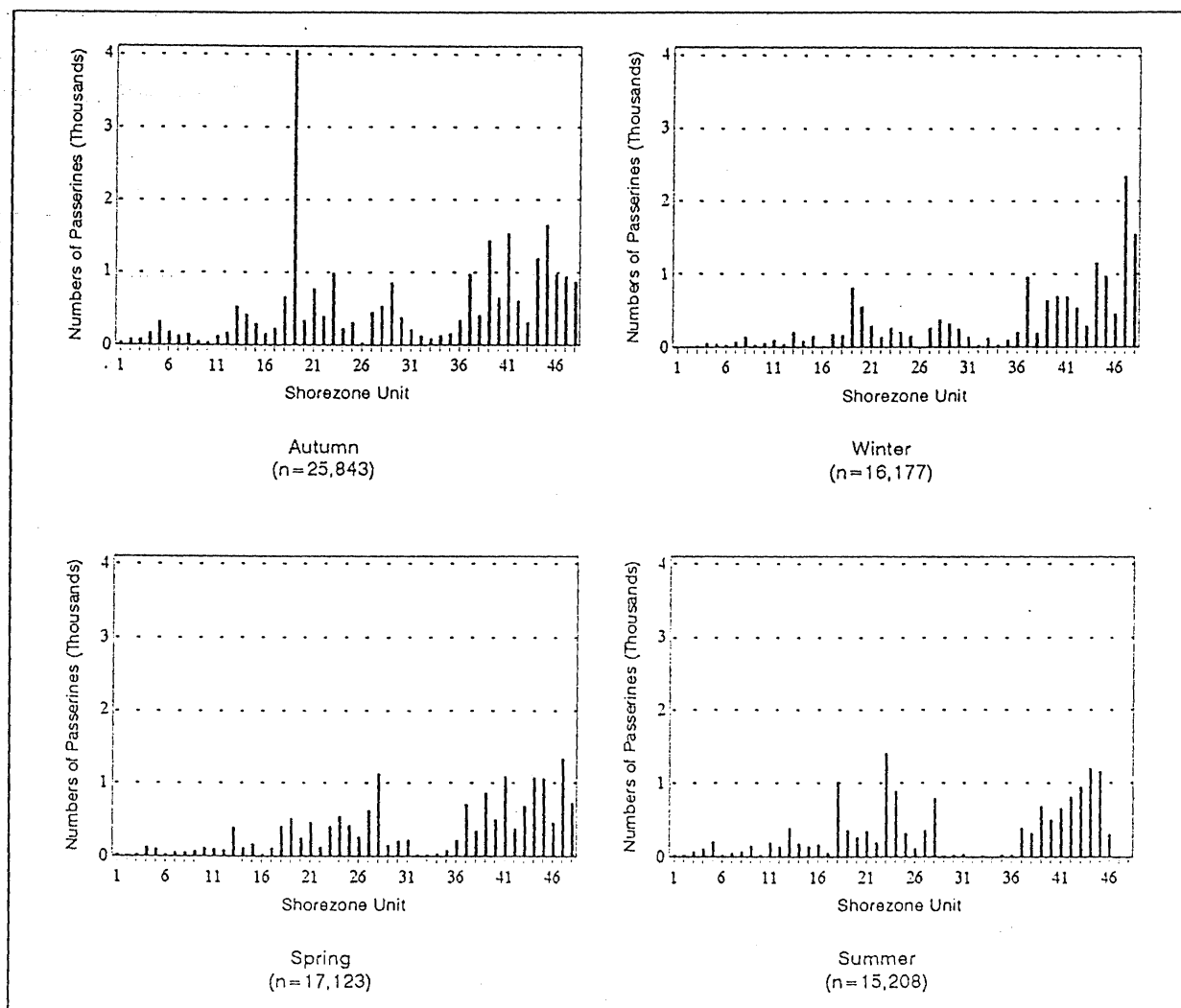


Figure 98. Seasonal variations in the distribution of passerines on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

Flycatchers: Five species of flycatchers were recorded with a combined total of 46 birds including 9 birds recorded simply as flycatcher species. The most abundant was the Willow Flycatcher with a total of 20 birds counted. The species was recorded on every survey in the period from the earliest arrival on 13 June (1981) to 18 July 1981. The only record outside of this period was 1 bird on 5 September 1981. The maximum was 5 birds on 4 July 1981. Three general areas were used by the Willow Flycatcher in equivalent numbers: near Millard Creek (units 20 and 21; Figure 2), from Beacon Creek to Union Point (units 27 and 28; Figure 6) and the Mud Bay to Chef Creek area (units 42 and 44; Figure 11).

Eleven Western Wood-Pewees were recorded: 2 birds on 23 May 1981 and 1 bird 30 May 1981 (unit 44); 1 bird on 6 June 1981 (unit 28); 1 bird 6 June 1981 (unit 39); 1 bird on 4 July 1981 (unit 40); 1 bird 18 July 1981 (unit 39); 1 bird on 18 July 1981 (unit 45); 1 bird on 5 August 1981 (unit 41) and 2 birds 22 August 1981 (unit 45).

Four Pacific-slope Flycatchers were observed. One bird on 23 May 1981 and 1 bird on 30 May 1981 were seen north of Union Point (unit 28); 1 bird on 4 July 1981 and 1 bird on 18 July 1981 occurred on the north shore of Comox Harbour (unit 13).

The Olive-sided Flycatcher was recorded once, a single bird on 11 July 1981 near Millard Creek (unit 21).

One Hammond's Flycatcher was observed on 20 June 1981 near Mud Bay (unit 41).

Swallows: The swallows were represented by 5 species during the survey with a combined total of 2714 birds including 115 swallows that were identified simply as swallow species. The Barn Swallow and Violet-green Swallow were most abundant followed at a distance by the Tree Swallow, Northern Rough-winged Swallow and Cliff Swallow.

The total number of Barn Swallows observed was 1231 (45% of all swallows). The species was seen on every survey from the earliest arrival on 25 April (1981) to the latest departure, a single bird on 19 September 1981. Most of the birds were seen in the summer (64% of bird-use days). The peak of 145 Barn Swallows on 8 August 1981 included 50 birds at unit 23 and 40 birds at unit 42; this peak occurred after the majority of Violet-green Swallows had left. Seasonal fluctuations in the numbers seen on the study area are shown in Figure 99 (solid line). In every season the preferred locations for Barn Swallows were from Mud Bay to Deep Bay (shorezone units 42 to 45; Figures 11 and 12), from the mouth of the Courtenay River to Union Point (units 16 to 28; Figures 2, 5 and 6) and around the tip of Goose Spit (centred on unit 4; Figure 2). The amount of use given to each unit in each season is shown in Figure 100.

The second most abundant swallow was the Violet-green; 1075 birds were recorded (40% of all swallows). From earliest arrival on 28 February 1981 to latest departure on 12 September 1981, the frequency of occurrence was about 92%, but most of the birds were seen in spring (62% of bird-use days). Numbers increased until the peak of 141 birds was seen on 25 April 1981 including 50 birds at Henry Bay (unit 48); thereafter the numbers declined (Figure 99; dashed line). This peak coincided with the earliest arrival of Barn Swallows in the study area. Violet-green Swallows used many of the same locations as Barn Swallows (Figure 101); the highest numbers were seen near Metcalf Bay (unit 47; Figure 11).

A total of 137 Tree Swallows (5% of all swallows) were counted over the spring and summer. The earliest arrival was of 2 birds on 21 March 1981; all of the others were seen in the period from 25 April 1981 to the latest departure on 8 August 1981. The peak was 25 birds on 10 May 1981. Tree Swallows were viewed from 17 units, especially from the mouth of the Courtenay River to Union Point and from Fanny Bay to Deep Bay; 2 units at extreme ends of the study area, Dyke Road Slough and Deep Bay (units 18 and 45; Figures 2 and 12), accounted for more than half of the total seen in this study although units 28 and 39 were also well used.

A total of 133 Northern Rough-winged Swallows was recorded (5% of all swallows). On the date of the earliest arrival, a peak of 16 birds was recorded, 25 April 1981. The same number, 16 birds, was seen again on 22 August 1981, shortly before the latest departure on 5 September (1981). Although numbers

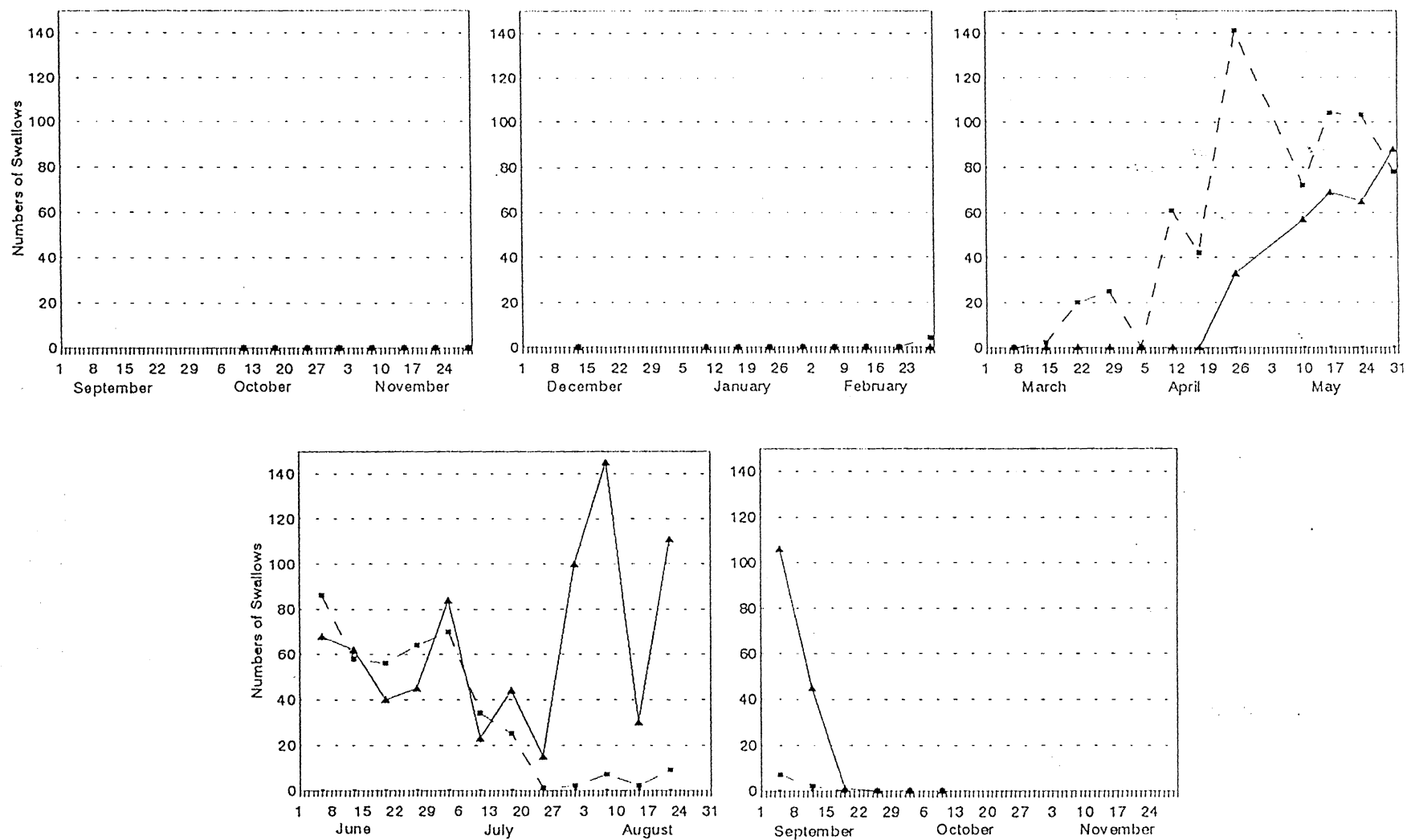


Figure 99. Seasonal fluctuations in the numbers of Barn Swallows (solid line) and Violet-Green Swallows (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

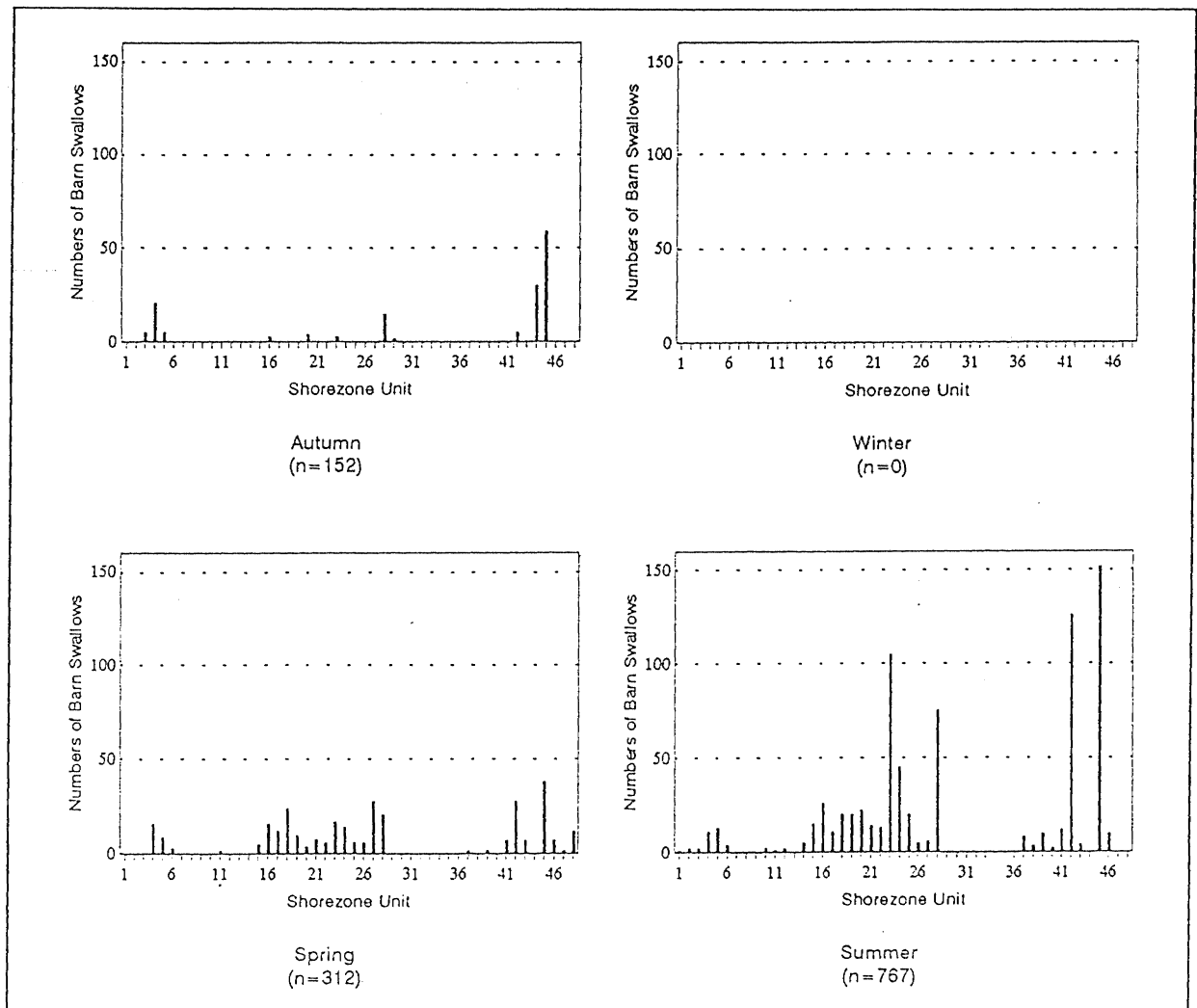


Figure 100. Seasonal variations in the distribution of Barn Swallows on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

were low the frequency of occurrence was high (over 90%). The areas around 16 units were used by Northern Rough-winged Swallows, mostly from Fanny Bay to Mapleguard Point; the highest tallies were at Mud Bay (24% at unit 42; Figure 11), Fanny Bay, Deep Bay and Henry Bay (units 39, 45 and 48; Figures 10, 12 and 7).

A total of 23 Cliff Swallows was observed: 4 birds on 6 June (unit 45); 16 birds on 8 August 1981 in the vicinity of Roy Creek and the Trent River (unit 23) and 3 birds 22 August (unit 24).

Crows and Jays: Three species of corvids with a combined total of 22,781 birds accounted for 31% of the passerine total, ranking them as the most abundant passerine family, just ahead of the European Starling. The Northwestern Crow accounted for almost all of the corvids (22,081 crows; 97% of the corvid total). Crows were present in every season with minor fluctuations;

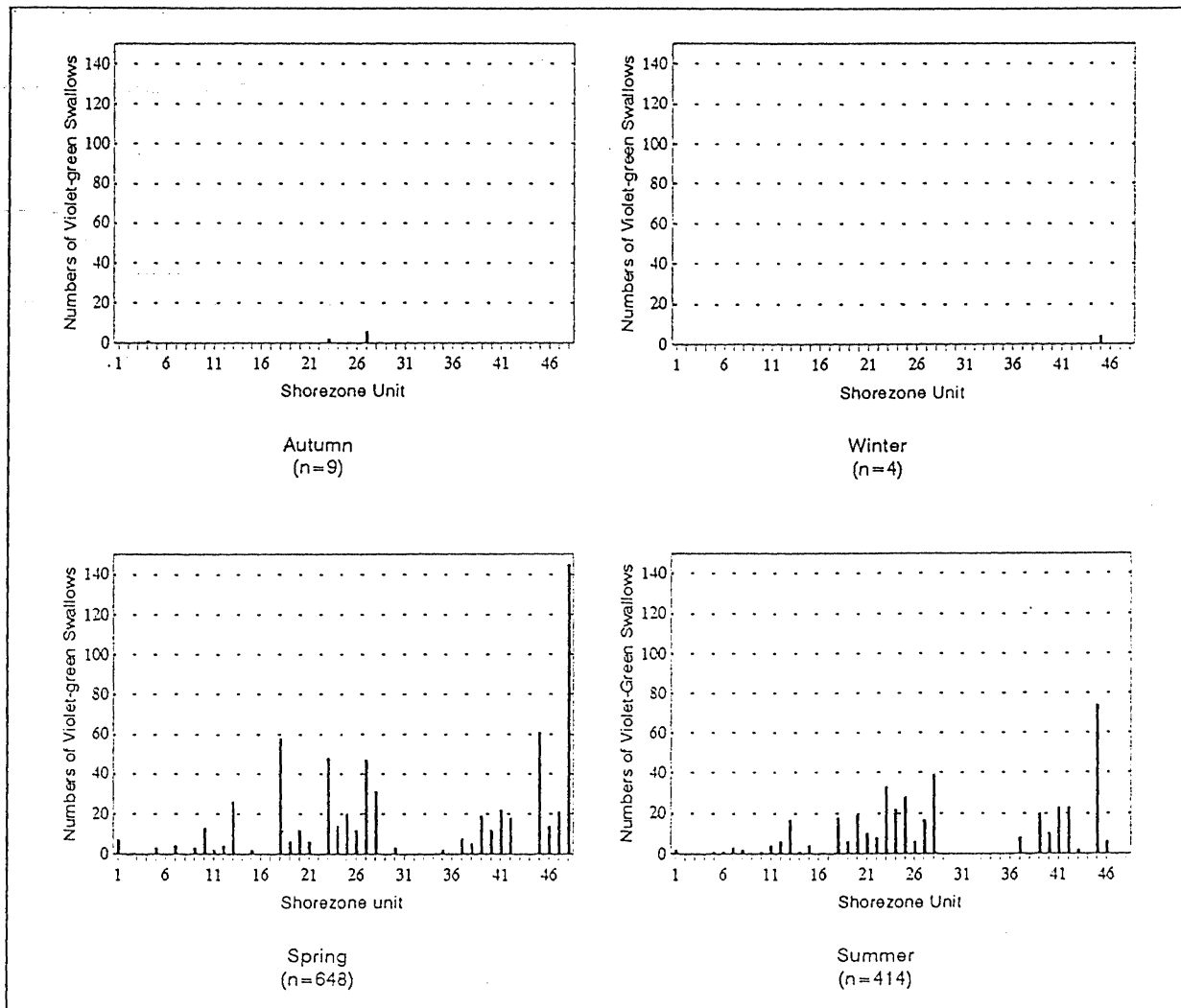


Figure 101. Seasonal variations in the distribution of Violet-green Swallows on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

(Figure 97, dashed line); the highest seasonal total occurred in winter (34% of bird-use days) and the lowest in summer (15%). No survey recorded fewer than 40 crows on the Baynes Sound - Comox Harbour study area and no season averaged less than 280 birds per survey; the peak was 1,003 birds seen on 7 February 1981. Every location received regular use by this species, however, recorded numbers were highest near the Courtenay River mouth and sewage lagoon (unit 19; Figure 2). On 30 May 1981, approximately 30 crows were observed in the vicinity of Mansfield Drive (unit 20) mobbing a raccoon that was climbing back and forth from branch to branch high in a tree, possibly searching for a crow's nest.

A total of 374 Steller's Jays was recorded. Although the species is resident, the numbers fluctuated; 59% of the bird-use days occurred in autumn. In summer, when 5% of the bird-use days were recorded, the frequency of occurrence dropped to 50%. The maximum was 40 birds seen on 26 September

1981. The Steller's Jay used 33 of the locations surveyed; almost all of the use was within 3 general areas: from Buckley Bay to Mapleguard Point (units 36 to 46), from the mouth of the Courtenay River to Union Point (units 18 to 28) and on the north shore of Comox Harbour (units 7 to 13).

The Common Raven was seen in every season for a total of 326 birds over the study period (frequency of occurrence approximately 90%). The seasonal total was lowest in summer (10% of bird-use days) and highest in winter (37%) when a peak of 23 ravens was seen on 28 February 1981. Common Ravens were seen at 37 locations; all but 3 of the birds were seen in the areas around units 1 to 8, 18 to 21, 26 to 46, 47 or 48. Highest use was near McNaughton and Chef Creeks (unit 44; Figure 12), Metcalf Bay and Mud Bay (units 47 and 42; Figure 11).

Chickadees. The total of 2529 Chestnut-backed Chickadees were observed over the study (frequency of occurrence was 98%). The highest abundance was in winter (42% of bird-use days) and the lowest was in summer (12%). We observed a peak of 169 birds on 25 October 1981 which included 50 birds seen at unit 44 and 50 birds at unit 45. Chestnut-backed Chickadees were observed at 36 of the 48 locations surveyed (units 1, 7 and 8, 11 to 14, 16 to 29 and 34 to 48); the largest numbers were seen near McNaughton and Chef Creeks (16% at unit 44; Figure 12), Metcalf Bay (unit 47; Figure 11) and Fanny Bay (unit 39; Figure 10).

Bushtits. A total of 87 Bushtits was recorded. The species was present in every season but only 3 birds were seen in winter; the highest seasonal total was in summer (46% of bird-use days) when the frequency of occurrence was at its highest (42%). The peak of 15 birds was recorded on 1 August 1981, all of them at Mapleguard Point (unit 46). The second highest survey recorded 14 birds on 28 March 1981, 12 of them near the Tsable River (unit 37). Over the study period, this unit accounted for 24 of the Bushtits recorded. Of the 9 other locations where the Bushtit was observed, the highest use occurred near the mouth of the Courtenay River (18 birds at unit 18; Figure 2).

Nuthatches. Red-breasted Nuthatches were seen in every season for a total of 101 birds. Seasonal tallies did not vary much in autumn, winter and spring; the lowest was in summer (15% of bird-use days). Nevertheless, the frequency of occurrence was always high (between 50% and 75%). The peak was 9 birds seen on 5 September 1981. Use by the Red-breasted Nuthatch was recorded at 17 locations but 71% of the birds were seen from 4 of these sites: Metcalf Bay, Fanny Bay, the McNaughton Creek - Chef Creek area and on the north side of Comox harbour (units 47, 40, 44 and 13 respectively; Figures 11, 12 and 2).

Creepers. Although no survey recorded more than 2 Brown Creepers, a total of 32 birds was seen over the study period. As a result the frequency of occurrence was relatively high (about 50%); the lowest seasonal count was in summer (5 birds). Ten locations were used by at least 1 Brown Creeper: units 8, 21 and 48 recorded 4 birds each and Metcalf Bay (unit 47; Figure 11) accounted for 13 of the birds.

Wrens: Three species of wrens were identified. In every season, the most numerous was the Winter Wren with records totalling 384 birds (72% of all wrens; frequency of occurrence was 95%). Counts were lowest in summer (13% of bird-use days) and highest in spring (40%), but the peak of 25 birds was on 28 February 1981, tallied from many different units. The Winter Wren used 26 of the locations surveyed including the entire area from Buckley Bay to Mapleguard Point (units 35 to 46) where 2 sites (units 44 and 41; Figures 12 and 11) together amounted to 32% of all the birds. Metcalf Bay (unit 47) also received much use. Three young Winter Wrens with no tails were observed vocalizing on 30 May 1981 near Comox (unit 13).

A total of 131 Bewick's Wrens was recorded. This species, like the Winter Wren, was present in every season but most abundant in spring (45% of bird-use days); the peak number (13 birds) was also recorded on 28 February 1981. In spite of lower numbers, the Bewick's Wren had a frequency of occurrence (between 60% and 80%) almost as high as that of the Winter Wren. Bewick's Wrens were seen at 25 of the 48 shorezone units. The highest numbers of Bewick's Wrens were recorded just north of Union Point (28 birds at unit 28; Figure 6) and near Comox (unit 13).

Seven sightings of the House Wren were made during this study, each was of a single bird near Willemar Bluff (unit 1) on the following dates: 10 May 1981, 23 May 1981, 30 May 1981, 13 June 1981, 4 July 1981, 18 July 1981, and 3 October 1981.

Dippers: A total of 8 American Dippers was recorded. One bird was seen on 10 October 1981 at unit 42. All the others occurred near the Tsable River estuary (unit 37; Figure 10): 2 birds on 15 November 1980, 2 birds on 22 November 1980, 1 bird on 31 January 1981, and 2 birds on 20 June 1981.

Kinglets and Thrushes: In numbers, the muscicapids ranked fourth among the passerine families. They were represented by 6 species with a cumulative total of 7107 birds (10% of all passerines).

The American Robin was the most abundant member of the group (69% of muscicapids). Records from throughout the study period (frequency of occurrence = 98%) totalled 4928 robins. The highest numbers were seen in spring (56% of bird-use days) when the peak of 345 birds occurred on 11 April 1981 (Figure 102, solid line); they were dispersed over many units including 50 birds near unit 48 and 45 birds near unit 41. Many locations were used by robins year round but the relative numbers changed; in winter the highest use was around the multiple estuaries of Mud Bay (unit 41; Figure 11) but in summer it was near Henry Bay. (unit 48, Figure 103).

The Golden-crowned Kinglet was the second most abundant muscicapid, with a total of 1785 birds seen. Numbers fluctuated within and between all seasons (Figure 102, dashed line). The highest seasonal total was winter (43% of bird-use days); the lowest was summer (7%) when the frequency of occurrence dropped to 83%. The peak of 163 birds was recorded on 31 January 1981; it included 100 birds seen on that day at Henry Bay (unit 48). At the same location, a count of

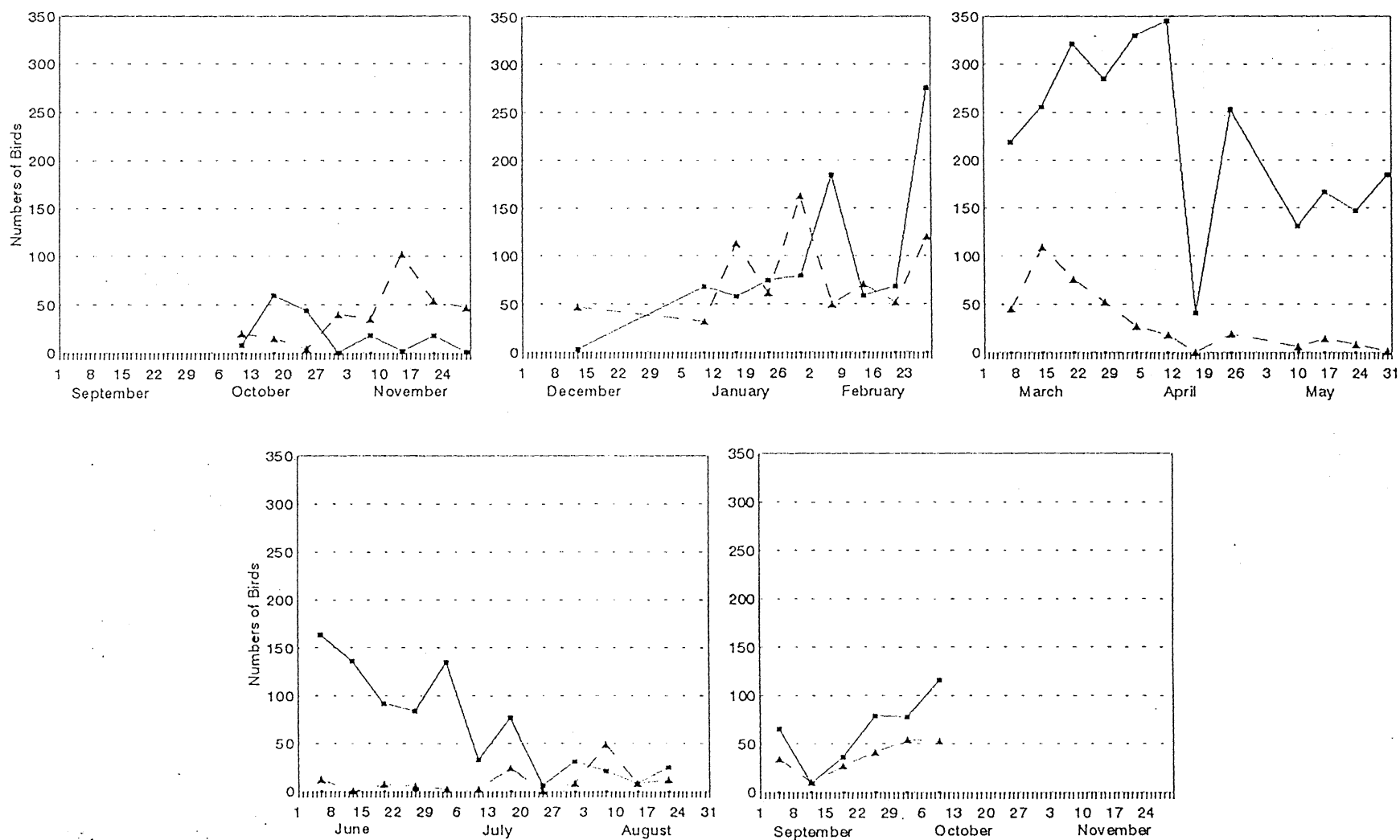


Figure 102. Seasonal fluctuations in the numbers of American Robins (solid line) and Golden-crowned Kinglets (dashed line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

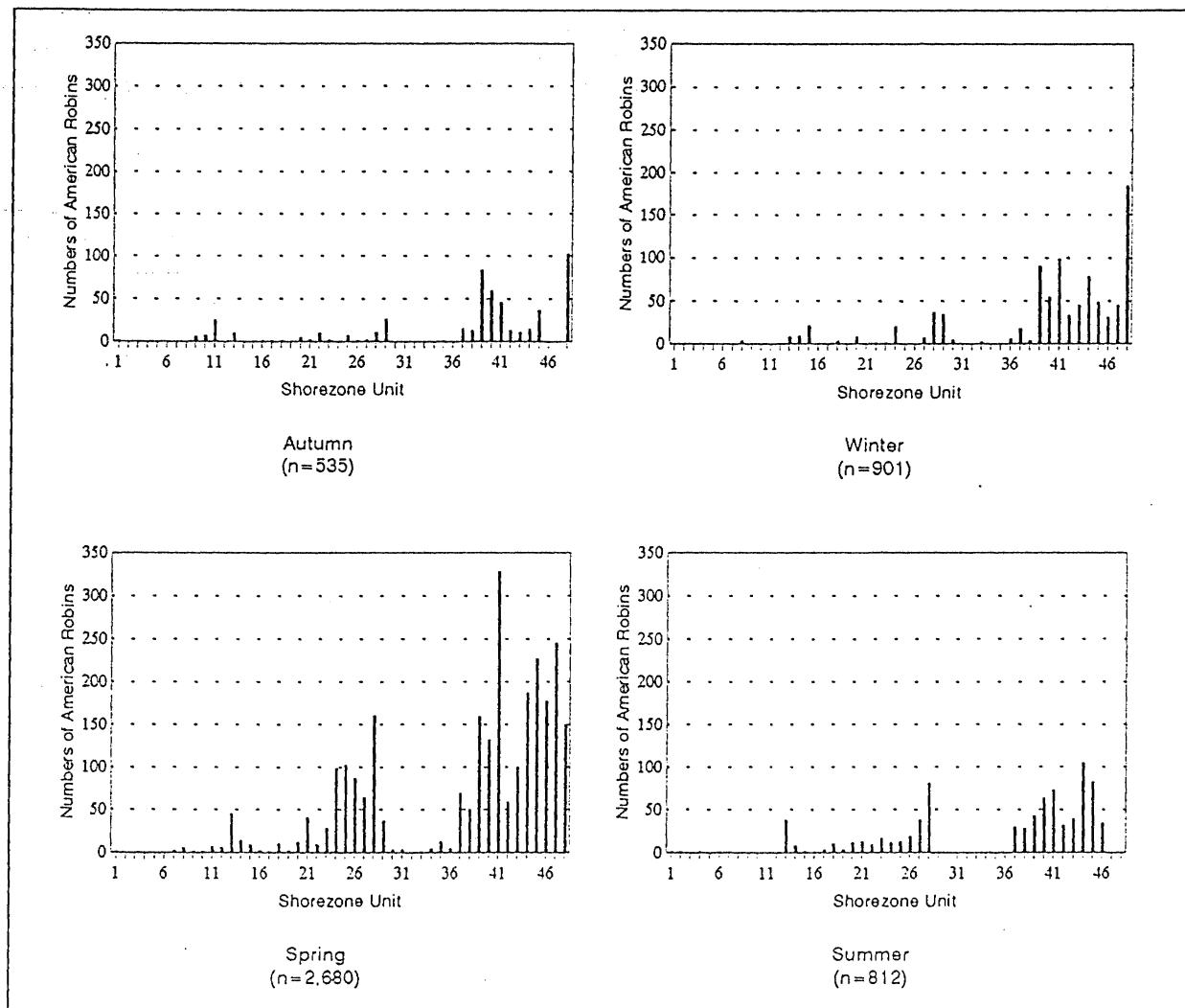


Figure 103. Seasonal variations in the distribution of American Robins in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

100 birds was also made on 5 November 1980. Figure 104 shows that Metcalf Bay and the McNaughton Creek - Chef Creek area also received high use (units 47 and 44, Figures 11 and 12).

A total of 204 Swainson's Thrushes was recorded, most of them in summer (81% of bird-use days). Earliest arrival was 16 May (1981). From 23 May 1981 to 18 July 1981 there was at least 12 birds recorded on every survey. Thereafter sightings were small and sparse until the latest departure, a single bird on 26 September 1981. Although we never saw more than 9 birds from a single unit, a peak of 37 birds was noted on 4 July 1981. Half of the locations surveyed in this study received some use including: units 13, 14, 17 to 24 and 37 to 46. Highest use was north of Union Point and in the vicinity of McNaughton and Chef Creeks (units 28 and 44 respectively); combined these 2 units accounted for 33% of the birds seen.

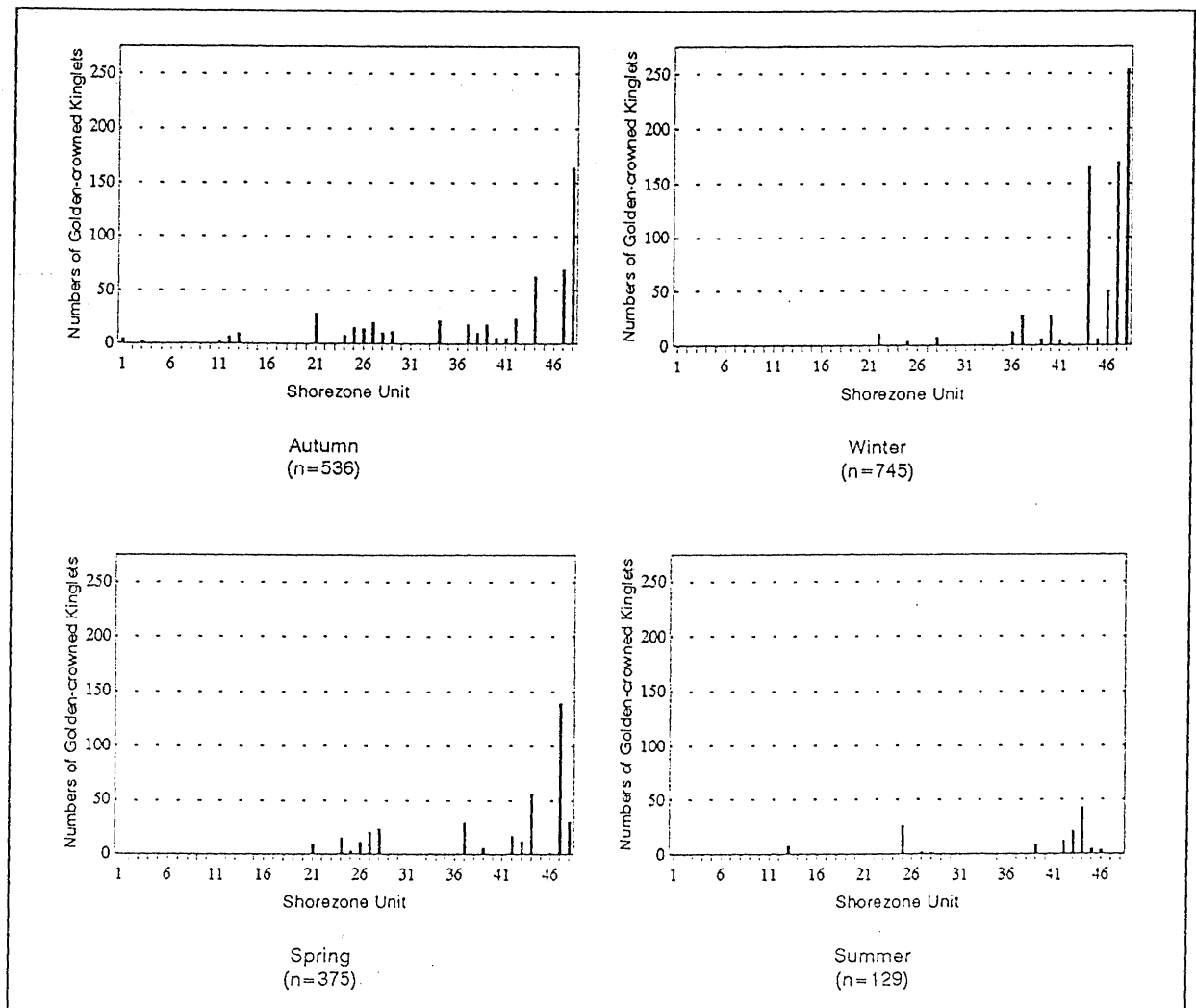


Figure 104. Seasonal variations in the distribution of Golden-crowned Kinglets on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

A total of 127 Ruby-crowned Kinglets was recorded. They occurred in every season; the highest total was from spring (43% of bird-use days) and the lowest was from summer (11%). However the frequency of occurrence ranged from high (90%) in winter and spring to low (50%) in summer and autumn. The species is known to breed on Vancouver Island (Campbell et al. 1997). The peak was 21 birds on 28 March 1981, of which 15 birds were seen at Henry Bay (unit 48; Figure 7). The only other time any unit recorded as many as 15 birds was on 5 September 1981 near McNaughton and Chef Creeks (unit 44). In all, 22 locations were used by the Ruby-crowned Kinglet, including units 8, 11 to 13, 22 to 28, 37, 38 and 41 to 48.

Varied Thrushes were seen intermittently for a total of 60 birds over the study period; most of them appeared in spring (77% of bird-use days) when the

frequency of occurrence was at its highest (50%). Except for 1 thrush on 6 June 1981, all of the birds were recorded either from 21 February (1981) to 25 April (1981) or in the season between 3 October (1981) and 6 December (1980). A peak of 15 birds was repeated consecutively on 28 March 1981 and 4 April 1981; all of these birds were observed in the vicinity of McNaughton and Chef Creeks (unit 44; Figure 12); this location accounted for 78% of all the Varied Thrushes seen. Other sites were used but in small numbers: units 21, 24, 28, 38, 39, 43, 47 and 48.

Three Hermit Thrushes in total were recorded: 1 bird 11 April 1981 near McNaughton and Chef Creeks (unit 44), 1 bird on 17 April near Metcalf Bay (unit 47) and 1 bird on 30 May 1981 in the area immediately north of Union Point (unit 28).

Pipits: A total of 42 American Pipits was recorded of which 35 birds occurred on 19 September 1981 at Goose Spit (unit 3; Figure 2). The remainder were seen at Goose Spit and Mud Bay: 1 bird on 3 October 1981 (unit 4), 3 birds on 11 October 1980 (unit 4), 1 bird on 18 October (unit 3), 1 bird on 15 November 1981 (unit 4) and 1 bird on 21 February 1981 (unit 41).

Waxwings: The only species reported from this group was the Cedar Waxwing, with a total of 95 birds tallied. From the earliest arrival on 23 May (1981) until 15 birds were seen on 19 September 1981, waxwings were recorded on every survey but one. Two other birds occurred later in the year, on the date of the latest departure, 25 October 1980. A peak of 19 birds was recorded on 6 June 1981; 10 of them near Dyke Road Slough (unit 18). In all, 19 sites were used by the Cedar Waxwing but 58% of the birds were seen from around the mouth of the Courtenay River to the Trent River (units 17 to 23; Figure 2). Surveyors noted a Cedar Waxwing nest on 22 August 1981 near unit 43.

Shrikes: Seven Northern Shrikes were seen in total: 1 bird on 10 October 1981 (unit 39), 2 birds on 18 October 1980 near Union Point (unit 29), 1 bird on 25 October 1980 (unit 18), 1 bird on 15 November 1980 (unit 29), 1 bird on 13 December 1980 (unit 29) and 1 bird on 10 January 1981 (unit 6).

Starlings: The gregarious European Starling was the most abundant passerine species with 22,473 birds tallied (30% of the passerine total). Starlings were present year round, but with some fluctuations in the numbers (Figure 97, dotted line). The seasonal totals were highest in autumn (38% of bird-use days) and summer (31%); lowest in spring (13%). A peak of 2,283 birds was recorded on 12 September 1981; 2,000 of these starlings were counted near the mouth of the Courtenay River (unit 19; Figure 2). There were only 2 other aggregations greater than 500 birds: 750 birds on 22 August 1981 (unit 18) and 557 birds on 18 October 1980 (unit 19). European starlings were seen from every location surveyed; highest use was near units 18, 19, 23, 24 and 43 to 45.

Vireos: Four species of vireos were observed in small numbers plus 5 birds that were recorded simply as vireo species.

A total of 12 Red-eyed Vireos was recorded. Nine of the birds occurred in the period from 6 June 1981 to 5 September 1981 in the vicinity of McNaughton

and Chef Creeks (unit 44) and 1 bird was seen nearby on 5 August 1981 (unit 43). Other sightings were of 1 bird on 23 May 1981 immediately north of Union Point (unit 28) and 1 bird nearby on 11 July 1981 (unit 27).

Five Hutton's Vireos were recorded; 4 of them were using the area from Hart Creek and just north (unit 28): 1 bird on 21 March 1981, 2 birds on 10 May 1981 and 1 bird on 16 May 1981. One bird was seen on 18 October 1981 in the area around Rosewall Creek (unit 43).

Three Solitary Vireos were recorded. One bird was seen on 6 June 1981, 1 bird on 20 June 1981 and 1 bird on 5 September 1981; all 3 sightings occurred near McNaughton, Chef and Lymn Creeks (unit 44; Figure 12).

There were also 3 records of Warbling Vireos. One bird was on 6 June 1981 and 1 bird on 20 June 1981; both were in the vicinity of McNaughton and Chef Creeks (unit 44). Nearby, 1 bird was seen on 27 June 1981 at Deep Bay (unit 45).

Wood Warblers, Sparrows and Blackbirds: The emberizids are a large and diverse group that ranked third in abundance among passerine families with a total of 8783 birds counted (12% of all passerines). Eight species of warblers, 1 species of tanager, 10 species of sparrows and 5 species of blackbirds were all recorded over the study. The sparrows were by far the most abundant of the sub-groups in this family followed in numbers by the blackbirds and the warblers.

Warblers: The Orange-crowned Warbler, with a total of 350 birds seen over the study period, was the most abundant warbler. Earliest arrival was 4 April (1981) and latest departure was 1 August (1981). The peak of 57 birds on 25 April 1981 included birds viewed at many different units; 16 birds recorded on that date at unit 44 was the largest number from 1 unit in this study. A total of 29 sites were used by the Orange-Crowned Warbler. The highest use was in the area from Hart Creek to Beacon Creek (units 28 and 27 shown in Figure 6 together accounted for 32% of the birds) and in the vicinity of McNaughton and Chef Creeks (unit 44; Figure 12).

A total of 161 Yellow-rumped Warblers were recorded. Earliest arrival was 14 March (1981) and latest departure was 8 November (1981). However, for most of this period, numbers were often small and sightings intermittent. The peak of 36 birds occurred on 25 April 1981; 17 of these birds were seen in the vicinity of McNaughton and Chef Creeks (unit 44). The height of autumn migration was marked by 28 birds seen on 19 September 1981, all of them near Union Point (unit 29). Of the 24 places where Yellow-rumped Warblers were seen, the area around Hart Creek and Deep Bay (units 44, 45, 29 and 28; Figures 12 and 6) accounted for 60% of the tally for this species.

A total of 94 Yellow Warblers was recorded. From the earliest arrival on 25 April (1981) until 1 August 1981, the species was observed on every survey but one. The only birds seen outside of this period were 2 stragglers on 15 November 1981, the latest record of departure in this study. The peak was 17 birds on 23 May 1981; a number of locations contributed to this tally. Yellow Warblers were seen from 23 units with the highest numbers from near the mouth

of the Courtenay River (in the map in Figure 2, unit 18 counted 27 birds and unit 20 had 10 birds).

We recorded 38 Common Yellowthroats in total from the earliest arrival, 6 birds on 10 May 1981 to the latest departure on 5 September (1981). The maximum count of 6 birds occurred again on 18 July 1981. Although 12 units were used by the Common Yellowthroat, 2 (units 44 and 28; Figures 12 and 6) accounted for about half of the birds.

The total number of Wilson's Warblers recorded was 26 birds. The frequency of occurrence was high from the earliest arrival on 25 April (1981) until 4 July 1981; thereafter the species was not noted until 22 August 1981. Sightings, each of a single bird, occurred occasionally until the latest departure on 3 October (1981). The maximum count was 5 birds on 6 June 1981. Eleven locations were used by Wilson's Warblers but about half of the birds were seen in the McNaughton - Chef Creek area (unit 44 as shown on the map in Figure 12, counted 14 birds).

A total of 14 Townsend's Warblers was recorded from 4 locations. In the vicinity of Hart Creek (unit 28), 1 bird occurred on 25 April 1981, 3 birds on 10 May 1981, 1 bird on 23 May 1981 and 2 birds on 19 September 1981. Two birds were seen on 25 April 1981 and 2 birds on 10 May 1981 at Metcalf Bay (unit 47). Two birds were also seen on 10 May 1981 in the McNaughton - Chef Creek area (unit 44). A sighting of 1 bird on 31 January 1981 at Mapleguard Point (unit 46) was unusual.

On each of 9 surveys, 1 or 2 MacGillivray's Warblers were recorded for a total of 13 birds over the study period. As with several other warblers, the earliest arrival was 10 May (1981). After 11 July 1981 there was a period where the species was not seen and then 2 birds occurred on 22 August 1981 and 1 bird on the date of the latest departure, 12 September 1981. All of the birds were seen in the vicinity of McNaughton and Chef Creeks (unit 44; Figure 12) except for 1 bird seen on 20 June 1981 near Hart Creek (unit 28).

Six Black-throated Gray Warblers were observed; 5 of them occurred in the area from Royston to Union Point: 1 bird on 25 April 1981 (unit 28), 1 bird on 25 April 1981, 1 bird on 10 May 1981 and 1 bird on 30 May 1981 (all 3 at unit 26) and 1 bird on 23 May 1981 (unit 23). The sixth sighting was of single bird on 6 June 1981 in the vicinity of McNaughton and Chef Creeks (unit 44).

Tanagers: A total of 6 Western Tanagers was recorded at 4 locations: 1 bird on 10 May 1981 (unit 47), 2 birds on 23 May 1981 (unit 27), 2 birds on 1 August 1981 (unit 43) and 1 bird on 22 August 1981 (unit 44).

Sparrows: The Dark-eyed Junco was the most abundant sparrow with a total of 3,399 birds seen. Apart from 1 bird seen on 18 July 1981, the earliest arrival was 5 September (1981) and the latest departure was 25 April (1981). The seasonal total was greatest in winter (50% of bird-use days); autumn ranked close behind (40%). The frequency of occurrence was high through autumn, winter and spring (above 65%). Observed numbers changed gradually over the seasons (Figure 106, dashed line) except in autumn when the peak of 241 birds was recorded on 25 October 1981. The areas used most by Dark-eyed

Juncos varied with the seasons (Figure 105). For example, in autumn the birds were dispersed over many units whereas in winter over half of the birds were seen at Metcalf Bay (unit 47; Figure 11).

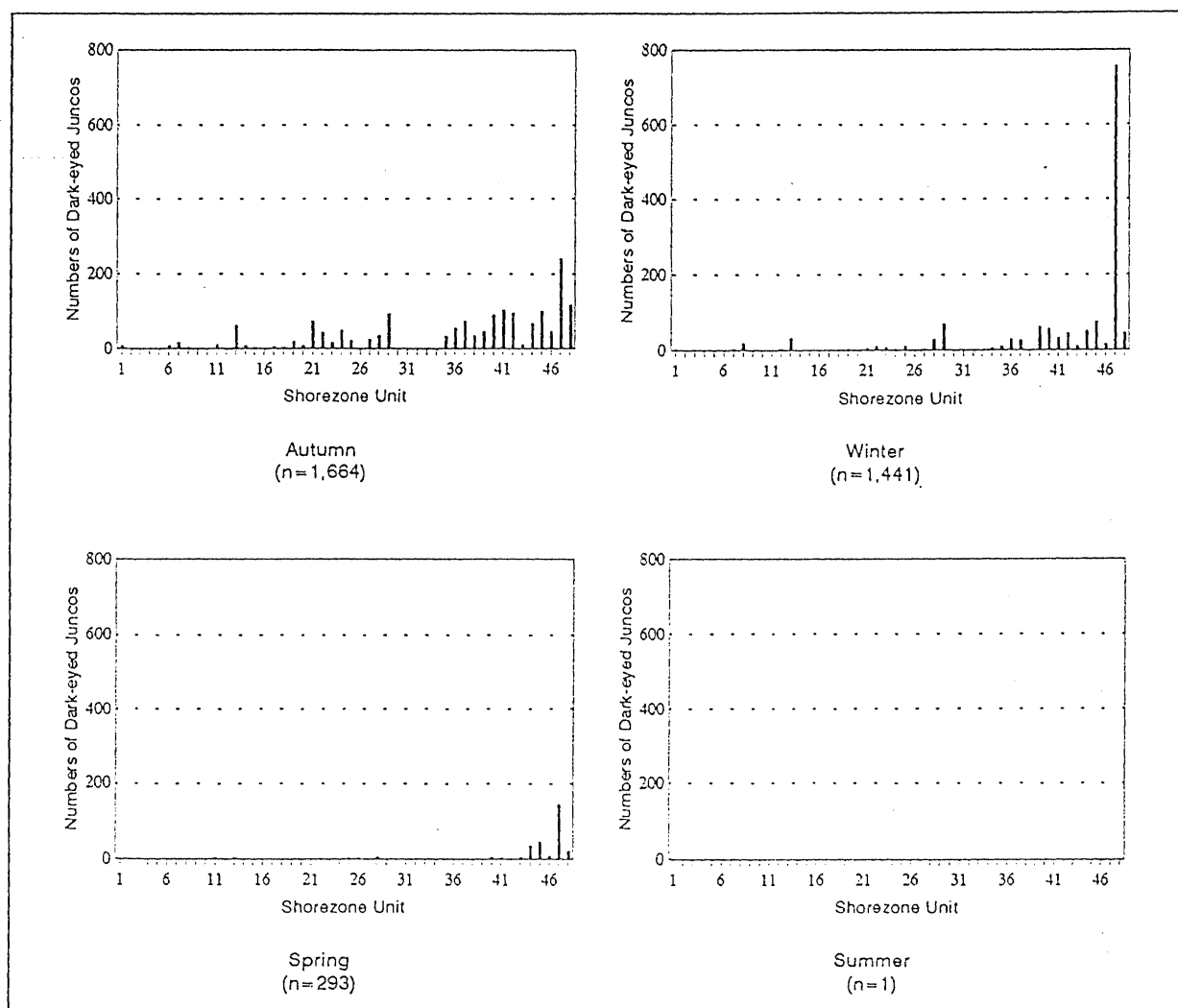


Figure 105. Seasonal variations in the distribution of Dark-eyed Juncos in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The Song Sparrow, with a total of 1985 birds, was the second most abundant sparrow observed over the study period. This ubiquitous resident was seen throughout the period surveyed (frequency of occurrence = 100%). The seasonal totals for autumn, winter and spring were equivalent (approximately 27% of bird-use days) but summer was lower (17%). A peak number of 77 birds was seen on 3 October 1981. Every unit received some use by the Song Sparrow; the tally over the study period was highest at Metcalf Bay, from McNaughton Creek to Deep Bay, Mud Bay and in the vicinity of Hart Creek (units 47, 45 to 44, 41 and 28; Figures 11, 12 and 6).

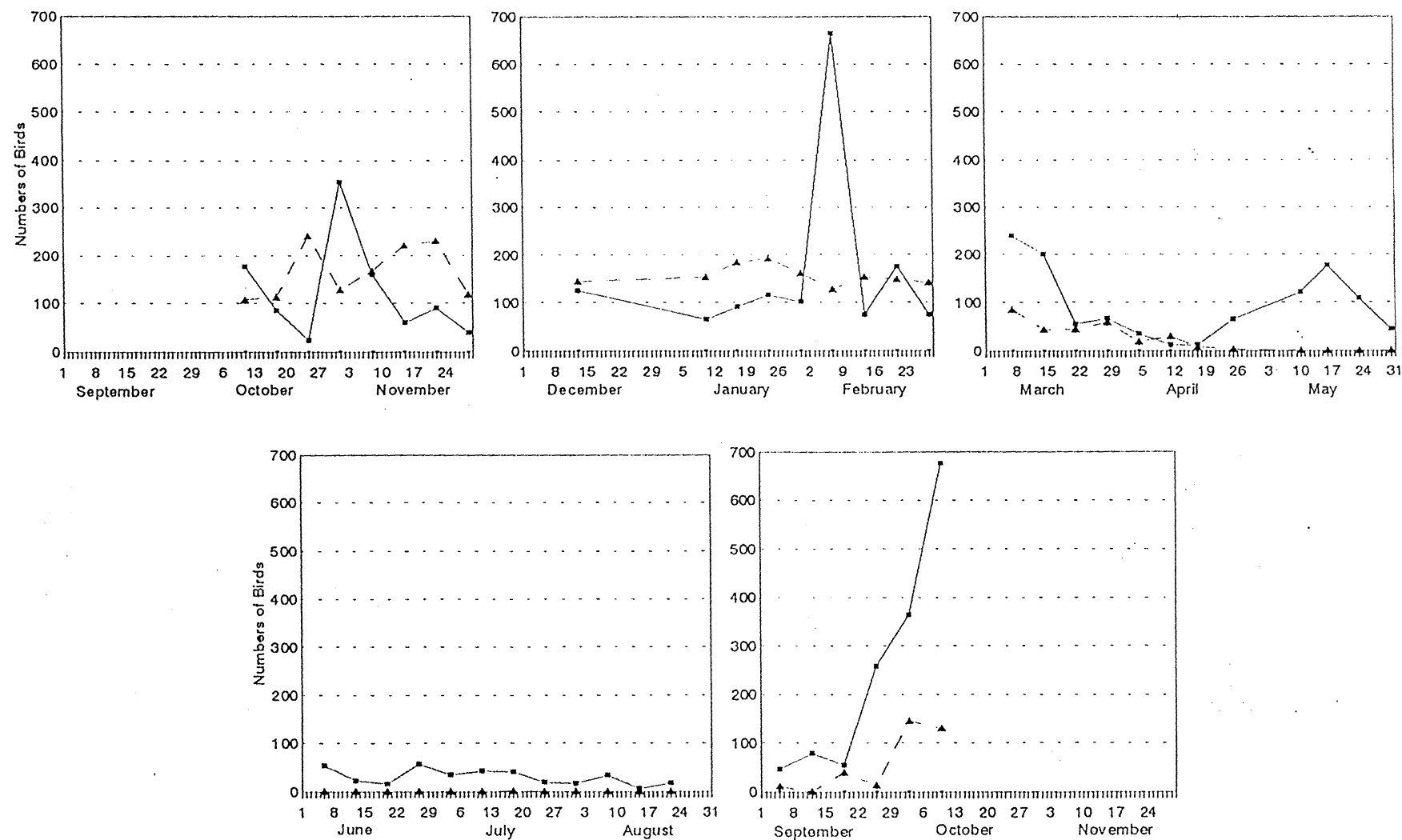


Figure 106. Seasonal fluctuations in the numbers of Dark-eyed Juncos (dashed line) and Pine Siskin (solid line) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The third most numerous sparrow was the Savannah Sparrow with a total of 652 birds seen from the earliest arrival on 17 April (1981) to the latest departure on 6 December (1981). Most of the birds were seen in autumn (63% of bird-use days) and spring (26%); abundance was low in summer and winter. A peak of 127 birds was tallied on 26 September 1981 from observations at a number of different units. Over the study period, 31 locations recorded Savannah Sparrows; Dyke Road Slough (22% at unit 18; Figure 2) and Deep Bay (14% at unit 45; Figure 12) were the areas used most.

The number of Rufous-sided Towhees tallied was 628 birds over the study period. Every survey except 2 in August recorded the presence of this resident but there were fluctuations in abundance; winter had the highest total bird-use days (34%) and summer had the lowest (10%). The peak was 32 birds seen on 28 February 1981. The Rufous-sided Towhee was almost cosmopolitan in its use of the study area; the species was seen from 39 of 48 units. Highest use was near Metcalf Bay (29% at unit 47; Figure 11) and units 28, 39 and 13.

A total of 249 Fox Sparrows was recorded, most of them in winter (62% of bird-use days) and autumn (23%), but this resident was also seen in spring and summer with a frequency of occurrence that never dropped below 50%. The peak was 27 birds observed on 13 December 1980, 13 of these were seen at Metcalf Bay (unit 47). Most of the Fox Sparrows were seen from the mouth of the Courtenay River, along the south side of Comox Harbour, south to Mapleguard Point and on Denman Island; Metcalf Bay and the area from Mud Bay to Fanny Bay received the highest use (units 47 and 41 to 39; Figures 11 and 10).

A total of 198 White-crowned Sparrows were seen. The species was present in every season but records were not consecutive; for example, in this study the birds were not seen at all in November or February. Abundance was highest in spring (frequency of occurrence = 83%) when 46% of bird-use days were tallied and lowest in winter (frequency of occurrence = 30%; seasonal tally = 6%). The peak of 25 birds was observed on 25 April 1981. The White-crowned Sparrow was viewed from 27 units; the area from Fanny Bay to Deep Bay (units 39 to 45; Figures 10 to 12) accounted for 61% of all the birds seen. Relatively high use was also observed at units 13 and 29.

Golden-crowned Sparrows were also observed in every season for a total of 115 birds. However most of the birds were seen on 3 surveys: 23 birds on 25 April 1981, 19 birds on 3 October 1981 and the peak 28 birds 10 October 1981. No other surveys recorded more than 8 birds. Frequency of occurrence was high in autumn and spring (above 60%) but low in winter (20%). In summer only 2 birds were seen on 1 August 1981. Golden-crowned Sparrows used 23 locations without concentrating on any one site; the records from Rosewall Creek and Goose spit (units 43 and 4) were slightly higher than the other places surveyed.

A total of 19 Chipping Sparrows was recorded; 15 of the birds occurred from the earliest arrival on 25 April (1981) to the 4 July 1981. The record of latest departure was 4 birds on 26 September 1981 near the mouth of the Courtenay River (unit 19). The maximum count was 5 birds on 10 May 1981. Chipping Sparrows were seen in small numbers at 6 locations including units 13, 19, 42 and 47.

Four American Tree Sparrows were seen on 10 January 1981 around Comox Harbour: 2 birds near unit 16, 1 bird near unit 19 and 1 bird near unit 13.

The White-throated Sparrow was also observed in the study period: 2 birds on 18 July 1981 near Buckley Bay-Base Flats (unit 36) and 1 bird on 26 September 1981 in the area immediately north of Union Point (unit 28).

Blackbirds: The most abundant bird of this group was the Red-winged Blackbird with a total of 625 birds seen from the earliest arrival on 7 February (1981) to the latest departure on 10 October (1981). Most of the birds occurred in the spring (65% of bird-use days) and summer (26%), periods when the frequency of occurrence was above 80%. The peak of 58 birds on 16 May 1981 included 25 birds near Fanny Bay (units 39 and 38). Use of the study area by the Red-winged Blackbird was mainly concentrated in 4 areas: the channel and slough near the mouth of the Courtenay River (units 20 to 17, Figure 2, together account for 31%), Henry Bay (unit 48 recorded 25%), Fanny Bay (units 38 and 39) and Goose Spit (units 4 and 3).

A total of 98 Brewer's Blackbirds was recorded. All of them occurred in the period from 28 February 1981, when the peak of 30 birds was seen near Mud Bay (unit 41) to 22 August 1981. Other large counts were each tallied from a number of units: 13 birds on 7 March 1981, 11 birds on 25 April 1981, 13 birds on 6 June 1981 and 12 birds on 8 August 1981. Sightings were often intermittent (frequency of occurrence was approximately 50%). Brewer's Blackbirds were seen at 13 units but most of them were observed at Mud Bay; units 41 and 42 (Figure 11) together accounted for 62% of the total.

Eighty Brown-headed Cowbirds were recorded over the study period; most of them were seen in the summer (73% of bird-use days) when the frequency of occurrence was high (67%). Earliest arrival was 10 May (1981) and latest departure was 11 October (1980). A peak of 21 birds was observed on 18 July 1981 which included 20 birds seen near Mud Bay (unit 41; Figure 11); all other counts were of 10 birds or fewer. The only other location that received relatively high use by Brown-headed Cowbirds was on the north side of Comox Harbour (unit 13, 13 birds); in all, the species was seen from 18 locations.

Eight Northern (Bullock's) Orioles were seen in total: 1 bird on 4 July 1981 (unit 19) and 1 bird on 11 July 1981 (unit 18); 1 bird on 18 July 1981 and 3 birds 1 August 1981, all 4 near Deep Bay (unit 45) and 2 birds on 25 July 1981 (unit 24).

A single Western Meadowlark was observed on 23 May 1981 near Mud Bay (unit 42).

Finches: Seven species of finches were recorded over the study period with a combined total of 6983 birds.

The Pine Siskin was the most abundant of the finches with a total of 5453 birds tallied. The species was observed on every survey but the numbers fluctuated (Figure 106, solid line). On 2 surveys the numbers jumped to more than 300 birds: 354 birds seen on 1 November 1980 included 100 birds near Metcalf Bay (unit 47); 665 birds seen on 7 February 1981 included 400 birds at

Henry Bay (unit 48) and 170 birds in the vicinity of McNaughton and Chef Creeks (unit 44). As the study ended, a series of surveys recorded that the numbers of siskins in the study area was climbing again; the peak of 676 birds on 10 October 1981 included 178 birds near Mud Bay (unit 41). Described as nomadic in fall and winter and an irruptive species by Ehrlich (1988), the Pine Siskin can be unpredictably observed at any time of year. The locations used by Pine Siskins are shown for each season in Figure 107.

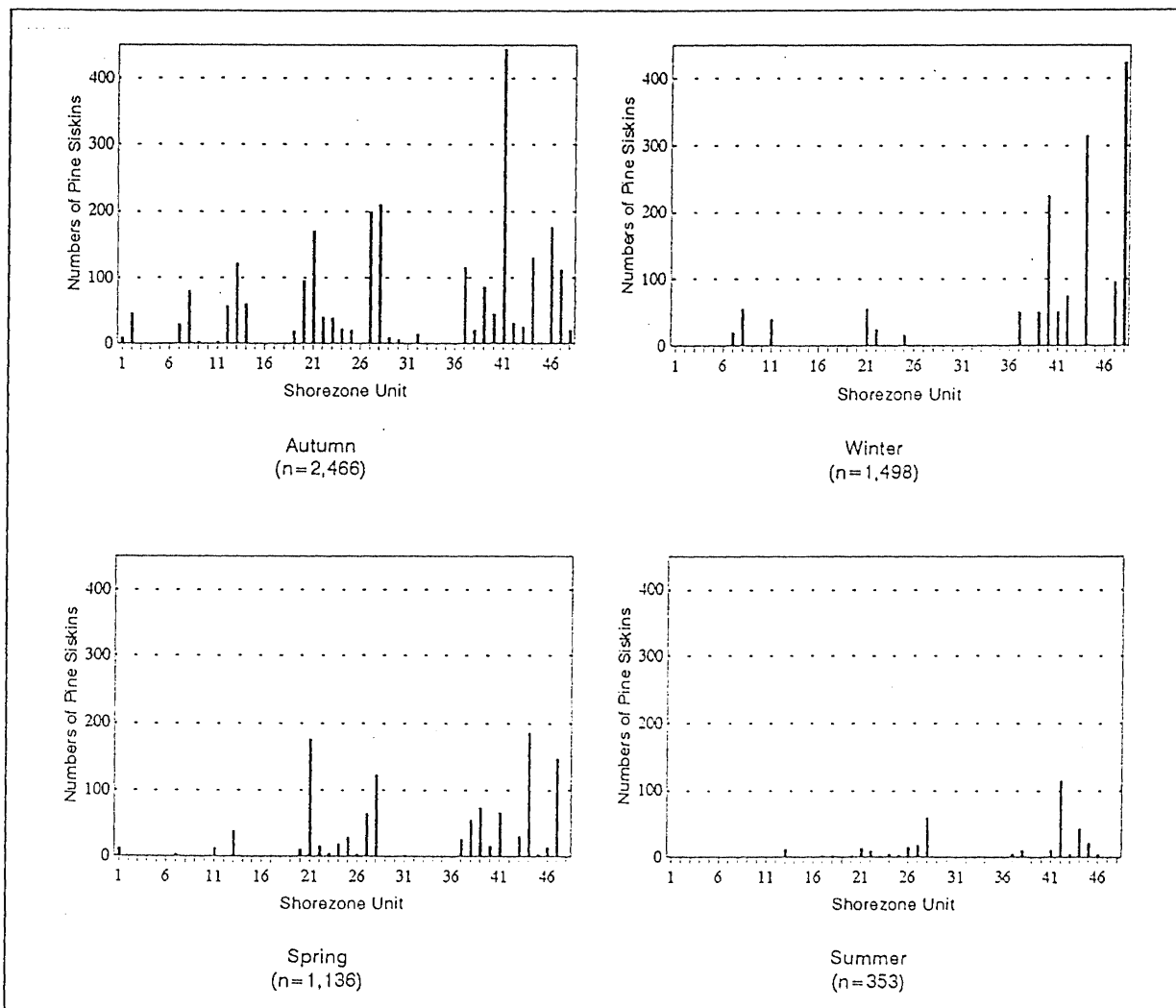


Figure 107. Seasonal variations in the distribution of Pine Siskins in the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981.

The House Finch, with a total of 836 birds seen, ranked second in abundance among the finches. The frequency of occurrence remained high (above 80%) throughout the year. The highest seasonal tally was for autumn (36% of bird-use days). Within in each season, survey counts fluctuated from zero to 30, 40 or more birds without showing any obvious cycle; the peak of 60 birds on 11

October 1980 included 30 birds seen near the base of Goose Spit (unit 5). The House Finch used all but 2 of the locations surveyed from units 1 to 38 and all but 2 of the locations from units 39 to 46. The largest amount of use was recorded from Deep Bay (36% at unit 46, Figure 12) and from units 5 and 13.

A total of 504 American Goldfinches was recorded. The earliest arrival was 25 April (1980) and the latest departure was 3 October (1981). Most of the birds were seen in the summer (61% of bird-use days) when the frequency of occurrence was 100%. The peak of 77 birds on 8 August 1981 included 57 birds in the area of Beacon Creek, Union Point and Hart Creek (units 27 and 28). Goldfinches were viewed at 36 locations; the highest use occurred near Deep Bay (16% at unit 45; Figure 12) where 25 birds were seen on 10 May 1981 and 25 birds on the 13 June. Use was also high near Fanny Bay (unit 39, 14%) and just north of Union Point (unit 28, 11%).

A total of 137 Purple Finches was recorded over the study period, most of them in spring (84% of bird-use days). Less than 10 birds were tallied in each of the other seasons. The peak was 29 birds seen on 25 April 1981. Almost half the Purple Finches were recorded near Metcalf Bay (unit 47; Figure 11); the remainder of the sightings were of small numbers at 23 other locations around the study area.

A total of 40 Evening Grosbeaks were recorded, most of them from unit 13 on the north shore of Comox Harbour: 14 birds on 31 January 1981, 2 birds on 7 February 1981, 3 birds on 28 February 1981, 4 birds on 11 April 1981, and 9 birds on 4 July at unit 13. Small numbers of Evening Grosbeaks were also seen at other locations: 3 birds on 11 April 1981 (unit 25), 1 bird on 25 April 1981 (unit 11), and 4 birds on 5 September 1981 (unit 1).

Eleven Pine Grosbeaks were recorded on 6 December 1980 near Metcalf Bay (unit 47).

Two Rosy Finches were recorded on 25 October 1980 near the mouth of the Courtenay River (unit 19).

Weaver Finches: Although the House Sparrow is known to be well established in many areas on Vancouver Island, only 2 birds were seen in this study. They occurred on 25 April 1981 in the vicinity of McNaughton and Chef Creeks (unit 44).

Conclusions

Comparative Significance of the Baynes Sound - Comox Harbour Area

The numbers of water birds wintering in the Baynes Sound - Comox Harbour area, the Fraser River estuary and 4 other estuaries on the Strait of Georgia are shown in Table 4. For comparative purposes, Table 4 only includes peak numbers that occurred during the period from 1 November to 31 March even though some records of higher peak numbers on Baynes Sound - Comox Harbour can be found in the annotated species list (see Species Composition section above).

Species	Squamish ^b	Campbell ^c	Little Qualicum ^d	Nanoose/ Bonell ^e	Nanaimo ^f	Fraser ^a	Baynes/ Comox ^m
RTLO	12	0	10	0	0	140	22
PALO	0	0	55	1	0	197	1005
COLO	15	2	34	7	30	119	134
HOGH	109	61	14	13	59	293	206
RNGR	23	1	8	6	21	227	87 ^p
WEGR	772	50	510	700	900	1067	10356
DCCO	70	0	3	1	1	336	98
GBHE	13	11	4	7	48	251	57 ^p
TUSW	0	0	1	0	15	125	2
TRUS	5	2	70	9	1	150	179
SNGO	0	0	100	1	0	40000	39
BRAN	0	0	2600	0	0	0	3373 ^p
CAGO	7	0	30	1	9	1000	195
GWTE	79	2	150	14	23	50000	130
MALL	188	85	811	100	182	50000	2001
NOPI	113	0	4	32	343	35000	673
GADW	0	0	2	2	0	132	0 ^p
AMWI	93	4	544	680	453	62000	2254
CANV	2	0	0	0	1	753	48
GRSC	38	4	189	161	45	3003	2265
LESC	0	0	0	0	0	248	138 ^p
BLSC	0	3	307	20	12	493	960
SUSC	9	1	385	94	187	1534	1820
WWSC	0	350	182	242	210	477	2436
COGO	229	61	300	69	122	450	458
BAGO	58	0	0	11	42	87	205
BUFF	113	179	150	24	183	1143	672
COME	129	16	300	7	153	177	644
RBME	56	8	16	42	74	249	812
RUDU	0	0	2	0	0	3838	1
AMCO	0	2	1	10	2	760	103
BBPL	0	0	0	0	0	727	63 ^p
KILL	6	3	23	15	7	411	48 ^p
DUNL	0	0	132	0	190 ^g	109000	2020
BOGU	0	0	3000	0	0	1053	165 ^p
MEGU	0	40	250	255	0	7243	1256
THGU	0	62	960	720	0	924	257
GWGU	1118 ^h	1142 ⁱ	1500	230	4160 ^j	30000	6250
MAMU	14	0	0	10	3	107	17 ^p
NOCR	296	222	130	360	424	ND ^k	1003
Total	3564	2311	12640	3835	7910	403864	42452

Table 4. Maximum number of individuals of selected species seen on some estuaries of the Strait of Georgia from 1 November to 31 March (modified from Butler et al. 1989). Notes are explained on the following page. For species names, see Appendix IV.

Notes for Table 4:

- a Maximum from Ladner Christmas Bird count or aerial survey reported in Butler and Campbell (1987). For the purpose of comparison, Butler has excluded Boundary Bay and White Rock data from the data of the Fraser River estuary.
- b Data from Appendix 2.2 in Trethewey (1985).
- c Data from Trethewey (unpublished).
- d Data from Dawe (1976, 1980, unpublished) and Eamer (1985).
- e Data from Dawe and Lang (1980) and Eamer (1985).
- f Data from Environment Canada (1973).
- g Unidentified shorebirds were probably Dunlin.
- h Trethewey (1985) reported 1118 gulls that were probably Glaucous-winged Gulls.
- i Trethewey (unpublished) reported 1142 gulls at Campbell River estuary that were probably Glaucous-winged Gulls.
- k ND = no data, but probably occur in numbers < 100.
- m Data from Baynes Sound - Comox Harbour area (including the Courtenay River estuary) for the period 1 November 1980 to 31 March 1981.
- p A significantly higher maximum number was recorded from April to October in the 1980-1981 study on Baynes Sound; see the annotated species list.

The maximum one-day count for loons and grebes was far higher in the Baynes Sound - Comox Harbour area than in any other estuary in Table 4, including the Fraser; the large numbers of Pacific Loons and Western Grebes seen in the Baynes Sound - Comox Harbour study area account for this difference. However, Butler et al. (1989) noted that the numbers of divers (loons, grebes, cormorants and alcids) might have been underestimated for the Fraser because deep waters there were not well surveyed.

The peak number of Double-crested Cormorants was highest on the Fraser; Baynes Sound - Comox Harbour was second and the Squamish estuary ranked a close third. The numbers of Brandt's Cormorants were also higher on the Fraser. However the Baynes Sound - Comox Harbour area recorded a higher maximum number of Pelagic Cormorants; 263 birds as compared with 81 birds on the Fraser estuary reported by Butler and Campbell (1987).

The number of herons on the Baynes Sound - Comox Harbour area ranked second after the Fraser. This would have been true even if the summertime peak of 136 Great Blue Herons on the Baynes Sound study area had been used for comparison.

Tundra Swans were more numerous on the Fraser but Trumpeter Swans were more numerous in the Baynes Sound - Comox Harbour area.

Although Snow Geese are very abundant on the Fraser, few were seen in the Baynes Sound - Comox Harbour area. The reverse is true of Brant which are more numerous in the Baynes Sound - Comox Harbour area. The latest date for the comparison figures is 31 March, a time when the numbers of Brant are still increasing. Had the cutoff date been chosen as 30 April, the maximum one-day count of Brant in the Baynes Sound - Comox Harbour area would have been even higher (5291 birds).

Higher numbers of Canada Geese use the Fraser estuary; the Baynes Sound - Comox Harbour area ranked second.

The numbers of wintering dabbling ducks on the Baynes Sound - Comox Harbour area ranked second, ahead of the other 5 Strait of Georgia estuaries reported in Table 4 but several orders of magnitude below the numbers on the Fraser. For the Green-winged Teal, Baynes Sound - Comox Harbour ranked third after the estuaries of the Fraser and the Little Qualicum.

For many species of diving ducks, the Baynes Sound - Comox Harbour area has recorded maxima that are higher than any other estuary on the Strait of Georgia, including the Fraser. This is true for 3 species of scoters, 2 species of goldeneyes and 2 species of mergansers, as shown in Table 4. This ranking also applies to the Harlequin Duck; 387 birds were seen on a survey of the Baynes Sound - Comox Harbour study area (22 November 1980) whereas the maximum for the Fraser was 136 birds.

The one-day count of 3230 Oldsquaw on the Little Qualicum estuary on 22 March 1979 (Dawe and Buechert 1995) was much higher than the maximum reported by Butler and Campbell (1987) for the Fraser (498 birds, CBC Ladner 1980). The Baynes Sound - Comox Harbour area ranks second, slightly ahead of the Fraser, based on a record of 650 Oldsquaw on Baynes Sound on 7 February 1979 (Campbell et al. 1990).

The Fraser River estuary had larger numbers of scaup, Canvasbacks and Bufflehead and much larger numbers of Ruddy Ducks than the Baynes Sound - Comox Harbour area. However, when all the species are tallied, the Baynes Sound - Comox Harbour area supports almost as many diving ducks in winter as the Fraser River estuary, and far more than any other area on the Strait of Georgia.

Baynes Sound - Comox Harbour also ranked second to the Fraser in peak numbers of wintering coots, Black-bellied Plovers and Killdeer. These 3 species had counts in October that were higher than those presented in Table 4 but they were excluded because of the time restrictions placed on data used for this comparison. Nevertheless, the ranking of the various estuaries with regard to these 3 species was not affected by this definition.

A peak of 109,000 Dunlin on the Fraser estuary (Fry 1980) is not comparable with any other estuary on the Strait of Georgia. Baynes Sound - Comox Harbour ranked second, 2 orders of magnitude below the Fraser, but nevertheless, the peak number (2020 birds) reported in this study is far above any of the other estuaries considered in Table 4.

In contrast, Baynes Sound supports the largest numbers of Black Turnstones in the province; 3093 were reported on one day and 3000 of these birds were at one roost on log booms north of Union Point. The all-time high Christmas bird count for North America is 3560 Black Turnstones reported on the Comox count of 1982. The Fraser estuary numbers are minor by comparison; maximum counts of less than 100 birds are reported (Butler and Campbell 1987).

For wintering gulls as defined in Table 4, the Baynes Sound - Comox Harbour area ranked second or third behind the Fraser or the Little Qualicum in the maximum numbers reported for the Bonaparte's, Mew, Thayer's and

Glaucous-winged. Factors that likely affect the counts include the spacial and temporal relationships between the bird surveys and herring spawns, gull migrations, garbage dump management and commercial and recreational fishing activity. For example, Bonaparte's Gulls are most numerous in the Baynes Sound - Comox Harbour study area during the peaks of migration which were both omitted from Table 4 for the purpose of comparison: 1301 birds on 25 April 1981 and 1356 birds on 5 September 1981.

Baynes Sound - Comox Harbour is an important staging and wintering area for a wide variety of migratory bird species as well as home to a number of resident species. Comparisons between this study and other records indicate that the Baynes Sound - Comox Harbour area is second only to the Fraser in its importance as migratory waterbird habitat within the Strait of Georgia.

In fact, the Baynes Sound - Comox Harbour area is a wetland of international significance as defined by the Convention on Wetlands of International Importance (the Ramsar Convention). The definition includes any wetland that regularly supports 10,000 ducks, geese and swans; the total of maximum one-day counts for each species during the 1980-1981 study period indicate that the Baynes Sound - Comox Harbour area regularly supports a minimum of almost 22,000 waterfowl at some stage of their life cycle. Another criterion identifies any wetland as having an international significance if it regularly supports at least 1% of the individuals in a population of one species or subspecies. This study shows that at least 9 species (Table 5) have numbers in the Baynes Sound - Comox harbour area that exceed these thresholds.

Species	Maximum One-day Count on Baynes Sound - Comox Harbour, 1980-1981	Global Threshold ^a
Pacific Loon	1005	500
Western Grebe	10358	1200
Great Blue Heron (northwest coastal i.e. <i>fannini</i> subspecies) ^b	136	50 pairs
Trumpeter Swan (Pacific population)	179	160
Brant (Pacific flyway i.e. <i>nigricans</i> subspecies) ^c	5291 staging ^c	1270 wintering
Black Turnstone	3093	800
Mew Gull	1256	500
Thayer's Gull	257 ^d	250
Glaucous-winged Gull	6250	5000

Table 5. Species with numbers on the Baynes Sound - Comox Harbour study area, 11 October 1980 through 10 October 1981, that surpassed the global thresholds for congregatory species.

Notes for Table 5:

- a Based on 1% of the total number in a population as estimated in the preliminary list of Congregatory Species Thresholds, Canadian IBA (Important Bird Areas) Criteria (Wilcox in preparation).
- b The west coast population of the Great Blue Heron (known as the *fannini* subspecies) is included in the list of nationally threatened species as well as in the list of congregatory species.
- c The total Pacific flyway population of Brant is approximately 140,000 birds; 3.8% of this population might be feeding and resting on Baynes Sound at one time which makes this staging area globally important and sensitive to a single perturbation such as a petrochemical spill on the water.
- d This is a minimum figure; actual numbers are likely higher (see Thayer's Gull in the Species Composition section above).

Bird Use and Recreational Activities

The Comox Strathcona Regional District predicts substantial population growth and residential development in the study area. The greatest threat to birds in the Baynes Sound - Comox Harbour area is the destruction or degradation of habitat by urban development. Coastal wetlands are especially vulnerable. Canada has made international and statutory obligations to protect birds. Opportunities for securing habitat that is essential for maintaining bird populations in this area are outlined by Fry (in preparation). Although the number of legal tools for achieving these goals has been increasing in recent years, each bit of habitat that is lost represents a lost opportunity.

Urbanization, if it occurs, will also affect habitat located far from the houses and shops. People increasingly seek outdoor recreation in areas that have, until recently, been used mainly by birds and other wildlife. Although much of the use will be non-consumptive, the disturbance of birds by people, vehicles and domestic animals should be considered in any decisions about land use and public access.

A number of remarks were made by the surveyors about the effects of hunting on the observed activities of birds in the study area (Appendix II). This kind of ongoing feedback will assist wildlife managers to balance the timing and location of hunting with the needs of waterfowl and other users of the resource.

Management Recommendations

1) Baynes Sound and Comox Harbour generally function as a single estuary in terms of water exchange rates, salinity and temperature gradients as well as in other ways (Morris et al. 1979). The cumulative effects of ongoing, small alterations to the system may eventually surpass the effects caused by any single large development. Careful, comprehensive planning for the region must take place if the amount of habitat loss that will inevitably accompany the

predicted increases in human population and human activity is to be minimized. This is particularly true of developments that are likely to have a direct impact on wildlife habitat.

However, even if everyone reduces to a minimum their impact on the landscape and its ability to support wildlife, the cumulative impacts will continue to increase as the human population of the area grows. If the migratory birds resource and other wildlife values present today are considered an important part of the quality of life of the area, regional and municipal planners must move to a steady-state, rather than growth dependent, model of land use within the Baynes Sound - Comox Harbour area (see e.g. Regional District of Nanaimo 1997, page 18). Legislatively, the Growth Strategies Act and the Municipal Act would allow the regional districts and municipalities to move towards a steady-state through Regional Growth Management Plans and Official Community Plans that ensure the conservation of their community wildlife values.

2) In the Baynes Sound - Comox Harbour area, every effort must be made to secure or in some way protect the remaining migratory bird habitat from degradation due to the impacts of developments that are incompatible with the large numbers of birds dependent on this internationally important system. Special status for the migratory bird habitat within the entire Baynes Sound - Comox Harbour area is needed. This could take the form of a provincial Wildlife Management Area, such as was done when the provincial Ministry of Environment created the Parksville - Qualicum Beach Wildlife Management Area for Brant and the other migratory birds that use that 17 km stretch of coastline.

3) Conservation groups, land trusts, and wildlife management agencies have placed a high priority on the purchase of wild lands or the acquisition of conservation covenants on properties adjacent to the foreshore of the Baynes Sound - Comox Harbour area. These management tools must continue to be used in this internationally important bird area.

4) This study highlights the importance of Baynes Sound and Comox Harbour to the migratory birds of the Pacific Flyway. Productive discussions on how to maintain these resource values requires that information about the significance of Baynes Sound reaches a broad range of people including political representatives, municipal advisors and planners, media, commercial interests, those involved in environmental reviews, and especially, the general public. Efforts to inform these stakeholders could also be made by other organizations concerned about the future of the migratory birds dependent on Baynes Sound. Activities involving community television programs, pamphlets, and the follow-up of the recommendations in reports such as this are but a few examples.

Future Studies

Some baseline surveys of human activities within the study area (Morris et al. 1979) were done before the year these bird surveys began. *Bird Use of Baynes Sound - Comox Harbour, 1980-1981* is intended to prepare the way for future studies that will compare changes in bird use against this baseline, using more recent catalogues of wildlife habitat and human activity such as the

Sensitive Ecosystems Inventory of Eastern Vancouver Island and the Gulf Islands under preparation by the Canadian Wildlife Service of Environment Canada and the provincial Ministry of the Environment, Lands and Parks (P. Ward, pers. comm.).

It is difficult to draw conclusions about the effects of human impacts from the spatial differences in bird use that were observed in this study because of the inherent differences in the productivity of sites and the way that different forms of development may affect a site. For example, the presence of log booming provided an important roost for wintering Black Turnstones thereby boosting the bird counts in that area but at the same time this activity may have created a number of less obvious effects.

In another example, from Union Bay south almost to the Buckley Bay ferry terminal, the foreshore has been modified by coal handling, boat ramps, the adjacent highway and houses, the use of rip-rap in many areas, and more. Human activity is high. Dabbling ducks, geese, swans and even the ubiquitous herons make less than average use of the area, whereas the deeper water species, such as diving ducks, are present (Appendix VI) and most occur in numbers similar to those in other parts of the Baynes Sound coastline (Figures 20, 22, 27, 50, 52 and 55). This suggests that the numbers of shallow-water birds may be low because of human modification of this stretch of coastline.

Measurements of the changes to one particular area or habitat over time would likely provide a much clearer correlation between bird use and the changes wrought by human activity. Therefore, a high priority should be given to repeating the surveys of bird use in the Baynes Sound and Comox Harbour area or at least in those parts of the study area where changes to habitat have occurred since 1981.

Approximately half of the shellfish production of the province comes from the Baynes Sound - Comox Harbour area. High quality marine water, free from coliform bacterial contamination, is essential to shellfish aquaculture. Shellfish production and migratory bird use of the sound are not necessarily incompatible if integrated management techniques are used that recognize the value of both resources. Securing the wildlife habitat would help protect the shellfish resource as well, but detailed information about the relationships between the shellfish industry and wild bird populations is needed to clarify potential conflicts that might be real or simply perceptual.

Since estuaries and wetlands are dependant on the inflow of water and the presence of a high water table, it would be useful to monitor the watersheds that affect the wetlands around Baynes Sound and Comox Harbour with particular attention to streambed condition, stream flow and water quality. Existing and proposed industrial use of groundwater by the aquaculture industry has the potential to affect groundwater and surface stream flows in the Fanny Bay area (Braybrook et al. 1995) which in turn could have an impact on use by birds, fish and other wildlife (Dawe et al. 1995). This is also an issue that will likely arise in other parts of the study area.

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Appendices

Appendix I. Bird surveys on Baynes Sound - Comox Harbour study area 11 October 1980 through 10 October 1981. For each shorezone unit (szu), the number of surveys performed in each month is shown and then totalled for each season (ST, shaded columns) and for the entire year of study (YT).* Note the year of study begins and ends mid-autumn.

szu	AUTUMN *					WINTER				SPRING				SUMMER				YT
	Sep 81	Oct 81	Oct 80	Nov 80	ST	Dec 80	Jan 81	Feb 81	ST	Mar 81	Apr 81	May 81	ST	Jun 81	Jul 81	Aug 81	ST	
1	2	2	3	5	12	1	4	3	8	4	2	4	10	1	2	2	5	35
2	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
3	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
4	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
5	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
6	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
7	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
8	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
9	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
10	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
11	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
12	2	2	3	5	12	1	4	3	8	4	3	4	11	1	2	2	5	36
13	4	2	3	4	13	1	4	4	9	4	3	4	11	3	3	3	9	42
14	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
15	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
16	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
17	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
18	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
19	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
20	4	2	3	5	14	1	4	4	9	4	3	4	11	3	3	3	9	43
21	4	2	3	5	14	1	4	4	9	4	3	4	11	4	4	4	12	45
22	4	2	3	5	14	1	4	4	9	4	3	4	11	4	4	4	12	46
23	4	2	3	5	14	1	4	4	9	4	3	4	11	4	4	4	12	46
24	4	2	3	5	14	1	4	4	9	4	3	4	11	4	4	4	12	45

szu	AUTUMN *					WINTER				SPRING				SUMMER				YT
	Sep 81	Oct 81	Oct 80	Nov 80	ST	Dec 80	Jan 81	Feb 81	ST	Mar 81	Apr 81	May 81	ST	Jun 81	Jul 81	Aug 81	ST	
25	4	2	2	5	13	1	4	4	9	4	3	4	11	4	3	4	11	44
26	4	2			6					2	3	4	9	4	3	4	11	26
27	4	2	3	5	14	1	4	4	9	4	3	4	11	4	3	4	11	45
28	4	2	3	5	14	1	4	4	9	4	3	4	11	4	3	4	11	45
29	4	1	3	4	12	1	4	2	7	2	2		4		1		1	24
30	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
31	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
32	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
33	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
34	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
35	4	1	3	4	12	1	4	4	9	3	3		6		1		1	28
36	4	1	3	4	12	1	4	4	9	3	3		6		1		1	27
37	3	2	3	3	11	1	4	4	9	4	3	3	10	3	2	2	7	37
38	3	2	3	3	11	1	4	4	9	4	3	3	10	3	2	2	7	37
39	3	2	3	3	11	1	4	4	9	4	3	3	10	3	2	2	7	37
40	3	2	3	3	11	1	4	4	9	4	3	3	10	3	2	2	7	37
41	3	2	3	3	11	1	4	4	9	4	3	3	10	3	2	2	7	39
42	4	2	2	5	13	1	4	4	9	4	3	4	11	3	2	3	8	41
43	3	2	2	5	12	1	4	4	9	4	3	4	11	4	2	3	9	41
44	4	2	1	4	11	1	4	4	9	4	3	4	11	4	2	3	9	40
45	4	2	2	5	13	1	4	4	9	4	3	4	11	4	2	3	9	42
46	4	2	2	5	13	1	4	4	9	4	3	4	11	4	2	3	9	42
47			2	5	7	2	4	3	9	4	3	1	8					24
48			2	5	7	2	4	3	9	2	2		4					20

Appendix II. *List of surveyors and their initials, survey dates, and sundry remarks for the Baynes Sound - Comox Harbour study area.*

Surveyors	Initials	Surveyors	Initials
Jean Allan	JA	Brian Mahoney	BM
June Belsom	JB	Diana Maloff	DMa
Sid Belsom	SB	Ruth Masters	RM
Tonia Billie	TB	Anika Meyers	AM
G. Brandie	GB	Doris Miller	DMi
Phil. Capes	PC	June Miller	JM
Joan Cartwright	JC	M. Miller	MMr
Vi Chungranes	VC	Maureen Mills	MMs
Mac Deddle	MD	Keith Morton	KM
Steve Ellis	SE	Norma Morton	NM
Erma Fitzpatrick	EF	Myrtle O'Neill	MO
Michael Fitzpatrick	MF	Wilma Patterson	WP
Walter Fitzpatrick	WF	Maureen Pegler	MP
Dulcie Hamilton	DH	Ann Perkins	AP
Willie Haras	WH	Adele Routledge	AR
Allan Hendriks	AH	Dave Routledge	DR
Gus Hendriks	GH	Nini Smith	NS
Keith Henn	KH	Pat Smith	PS
Eric Hyde	EH	Lilian Stewart	LS
Jim Lunam	JL	Howard Telosky	HT
Georgina McCuig	GMc	Ruth Towers	RT
Isobel McLeish	IMc	Olga Whipps	OW

Remarks - Autumn 1980

11 October 1980

Area II
DM, PS, MMs

* This was the first day of duck hunting season. There were numerous hunters out, with constant shooting heard. Ducks scary and in flight, mostly absent in river estuary. We did not have maps to start so units not true on the report, only numbers seen in each observation.

18 October 1980

Area II
WP, PS, MMs

* poor visibility (only 6 units surveyed)
(This is a reworked count of original data. To conform with the 8 subunits in this area). This subunit (i.e. unit 20) counted by Area III observers for this date only.

Areas III & IV

* 16.4 km of shoreline

WH, MD

Area V

* low cloud & fog causing poor visibility

SB, JM

Area VII

* visibility poor, Cook Creek estuary (unit 44) cancelled, cut off by tide

PC, LS

25 October 1980

Area II
DM, PS, MMs

* Ducks spooky and in flight for large part in all places. Hunters still shooting sporadically.

1 November 1980

Area II
DM, MMs

* Some shotgun shots in distance. Birds very restless. Also seen: 1 muskrat... (unit 18) and 5 seals... in river (unit 19).

Areas III & IV

* heavy showers developing to steady rain;

PC, DH, WH

slight chop (on the water and) low fog

Area V

* dull, steady rain, birds probably scattered by overnight storm

SB, JM

Area VII

* Rain was so hard that it was difficult to keep lenses clear after noon. (unit 44) ...at Cook Creek was not done.

LS, VC, JL

8 November 1980

Area II
DM, PS, MMs

* Cloudy conditions made identification difficult at times. 3 seals in... (unit 16).

Area III

* 2 otters (seen at unit 28)

PC, DH, SE, WH

Area V

* Heavy rain from... (units 36 to 31)

SB, JM

Area VII

* Hunting drives the dabblers out to sea a bit

JL, VC, LS

15 November 1980

Area II
WH, MD, SE

* (This is a reworking of the original data to fit the 8 subunits in this area.) Unit 13 not done this date.

Area VII

* Goldeneye getting more plentiful

JL, VC, LS

22 November 1980

Area II * Gunfire from hunters heard in distance. Birds very
DM, PS, MMs nervous and easy to flight. Lots of birds in distance, hard to
distinguish. One Cattle Egret seen... (unit 18) two days
previous to count. 250 unidentified gulls in park on grass.

Areas III & IV * 26 seals

PC, DH, GB

Area VII * Trumpeter Swans and Whistling Swan for first time -
JL, LS, IMc many Barrows Goldeneye; also Common Mergansers

29 November 1980

Area II * Snow overnight; 4 to 6 in. (10 to 15 cm)

DM, PS, MMs

Area III & IV * Perhaps first snowfall of the season partly accounts for
PC, DH, KH low numbers - Except the 3000 Black Turnstones on logs at
Glover's Booming Ground.

Area VII * 2" snow fell thru night. 3 flights of Canada Geese in...
JL, VC, LS (unit 44).

Remarks - Winter 1980-1981

6 December 1980

Area II * Cancelled due to deep snow.

13 December 1980

Area II * Cloudy and dull. Heavy mist at times.

DM, PS, MMs Apart from the count, on Dec 9, when it was clear and very
warm 54⁰, we counted 13 bald headed eagles (Bald Eagles)
spiralling upward over the centre of Courtenay... 8:30 AM.

Area III & IV * Black Turnstones while not unusual such large
PC, RT, DH concentrations as seen on Nov. 29 & Dec. 13 seem to be
unheard of in this area. 1 seal (unit 21); 15 seals (unit 22)
(unit 42) ...between mouth of Rosewall Creek and Waterloo
Area VII Creek largely spoiled due to 3 hunters immed. preceeding us
JL, VC, LS, WH & firing several shots from the waterfront

10 January 1981

Area I * cloudy - fog fairly dense over water - sunny afternoon

NM, KM

Area II * cloudy and poor light; (unit 17) ...had 3
DM, PS, MMs hunters and dogs on island; lots of shots. Few birds in this
area. Fog obscured outer parts of... (units 13 and 14)

Area III & IV * 1 seal (unit 21); 72 seals (unit 22);

PC, DH, RT, KE 1 river otter (unit 28)

Area VI fog (at units 40 and 41)

MO, JC, GH, BM

Area VII * again - Hunters at Mud Bay do disturb the area; Black
JL, VC, LS -bellied Plovers for the first time.

17 January 1981

Area II

* overcast - rain

DH, JC, PS, MMr

Area V

* cloudy, raining, visibility poor

SB, JM

Area VII

* Dabbling ducks skittish due to hunters. The 600 Western Grebes on... (unit 42) ...were not seen by adjacent observers. light rain to some fog to clearing.

VC, JL, LS

24 January 1981

Area I

* Clear, Sunny - bright glare made I.D. difficult at times.

NM, KM, AR, DR, JC

Area II

* Last day for hunters. Birds absent from... (unit 17) as hunters on island. 30 (unidentified) ducks scared up by hunter (near unit 18).

DM, PS, MMs

Area III

* Please note Areas 3 and 4 now reported separately & started in the south & going north.

PC, RT, IMc

Area IV

* Please note Areas III & IV now reporting separately travelling from South to North.

PC, RT, IMc

Area V

* glare from water made positive identification almost impossible, especially at... (unit 36)

SB, JM

Area VII

* Hunting still depletes... (unit 42) - season will be closed 'till Brant opens. Western Grebes - 2000 (units 43, 42)

JL, VC, AM

31 January 1981

Area I

* High population increase in mergansers - very concentrated and active - difficult to separate Common from Red-breasted for accurate count of each species

NM, KM

Area II

* We were surprised to see no swans in the estuary today, although we saw 5 feeding just out of... (unit 18) under the hill. Junco was singing high in a tree. On Friday January 30, 1981... on Croteau Beach (i.e. unit 7) there were approx 150 ducks...many ducks were dozing on shore... 25 mallards were evidently pairing... frenzied bathing...and then pursuing in the water. 2 pairs of mallards out further were ceremoniously dip-dipping their beaks in the water, and then copulating. 3 or 4 widgeon only were doing the bath bit..the mild weather may be the reason.

Dm, PS, MMs

Area IV

* Visibility poor

PC, JC, RT

Area III

* Visibility poor

PC, RT, JC

Area VII

* More dabbling ducks - Hunting season over.

JL, AM, DR, AR

Saw Townsend warbler at... (unit 46) at 3 P.M. Good view from 2 o'clock by all observers

7 February 1981

Area II

* First gr. wing teal or pied grebes (Pied-billed) seen on our route since start of count. At low tide the ducks had moved far out of counting range in area... (unit 20), except for some puddles (puddle ducks).

DM, PS, MMs

A great number of Trumpeter Swans used... (unit 20) and off Millard Cr. in... (Area III)... Have the swans left the water in favour of the fields because of guns or warmer than usual

weather?... 15 swans feeding (up Courtenay River) at the base of hill, right next to silage tanks of dairy farm. There were at least 100 mallards & widgeon, & a further 100 crows there also. There are 3 other known farms in which large numbers of swans are feeding, much to the farmers' consternation.

Area IV
PC, RT

* The large concentration of shorebirds at Glover's Booming Ground consisted of a mixture of Black Turnstone, Dunlin, Black-bellied Plover, Sanderling & Yellowlegs. It was impossible to count individuals as they were continually flitting about. But the majority were Black Turnstone, followed by Dunlin, Black-bellied Plover, Sanderling & a few Yellowlegs. This appears to be a favourite spot for shorebirds at high tide.

Area VII
WH, JL

* again - more Dabbling ducks because of Hunting season finished. Still tremendous nos. of Western Grebes.

Area VIII

WF,

JA, EF, MF, NS

* In over 60 years of birding I have never seen anything comparable to the *explosion* of Bald Eagles on this date. The entire south half of Denman Island was covered; every tree top had one or more eagles. I received several phonecalls telling me that people were seeing *hundreds* of eagles. I counted personally over 250 eagles near my home on Metcalf Bay (unit 47).

14 February 1981

Area II
DM, MMs

* Report from weekend count of Tr. Swans was 500 in fields all around Courtenay & Comox. They are not using the salt water to rest. Also... mallards, A. Widgeon, & Pintail, using pools on potato fields back of... (unit 18).

Area III
PC, IMc

* One hawk observed at... (unit 21)...; though lighting was good identification not positive but from distinct dark band across upper breast it appeared to be a Swainson's. As bird did not take flight underwing pattern not visible... Since the booming has been discontinued at the former Crown Zellerbach ground (unit 22) the bird life there has been increasing. It is recommended that very careful consideration be given this when future development is proposed.

Area IV
PC, IMc
Area VII
LS, JL, VC

* Of particular interest 1 Ruddy Duck male at... (unit 28)

* - Herring running - mergansers - Arctic loons (i.e. Pacific Loons) in great numbers - also Gl.w (Glaucous-winged) & Herring gulls - many sea lions.

21 February 1981

Area II
DM, JC, MMs

* Approx 200 widgeon & few mallards flying & feeding near farm under hill... (unit 18).

Area IV
PC, DH

* Unidentified shorebirds were a mix of Black Turnstone, Dunlin & Black-bellied Plover. (unit 28)

Area VII
LS, JL, VC

* visibility diffic due to roughness of water. An attempt made to separate THAYERS from Herring gulls.

Area VIII
WF

* (wind) 25-30 MPH; No report for 14 Feb. weekend

28 February 1981

Area VII
JL, LS, WH

* 4 Violet-green Swallows seen at... (unit 45) at Deep Bay.

Remarks - Spring 1981

7 March 1981

- Area I * (water) calm - becoming choppy - then rough.
NM, KM (wind) calm - increasing to 35 M.P.H.
- Area II * No swans in counting area but ... approx 200 Tr. Swans
DM, PS, MMs feeding in field near Comox-Powell River Ferry on March 5 and 6.
- Area III * rain squalls; whitecaps; gusty - up to approx. 30 knots.
PC, IMc The old Crown Zellerbach booming ground provides a good loafing area for Common Merganser.
- Area IV * Gulls were more numerous than usual, probably due to the
PC, IMc herring run.
At 9 A.M. there were no shorebirds at... (unit 28). In order to confirm our observations & the possibility of tide conditions having a bearing on their appearance at this site, we returned at 5:30 P.M. At that time there were approximately 5000 birds, stretched out in some sections 2 & 3 deep, over the entire length of the boom logs. The flock consisted of Dunlin, Black-bellied Plover, Black Turnstone, Sanderlings & some not identifiable. Half tide at 9 AM. High tide at 6:30 PM. The pattern that is evolving seems to indicate that the birds use this site for loafing at high tide.
- Area VII * First appearance of Black Brant off Deep Bay. Rough
JL, LS, DR, AR water prevented good sightings well off shore, which usually produce our Arctic Loons (i.e. Pacific Loons) & masses of Western Grebes. Pigeon Guillemot - almost complete summer plumage. Pelagic Cormorants getting white patch in flanks.

14 March 1981

- Area I * (water) calm - becoming rough by 1:00 PM
NM, KM (wind) calm to 20-25 M.P.H.
- Area II * 4 Rock Doves were seen in the water in... (unit 17)
JC, PS, MMs
- Area III * 30 seals on boom logs (unit 22)
PC, AM
- Area IV * By 11 A.M. wind speed 25 knots, water rough with
PC, AM whitecaps making identification rather difficult
- Area VII * No trumpeter swans for first time - rough weather made
SB, JL distant ducks unidentifiable

21 March 1981

- Area I * The sudden increase in Mew Gulls was due to the herring
KM, NM spawn below Willemar Bluffs. Diving ducks have shifted to feed over Comox Bar - rough water makes accuracy difficult out there.
- Area II * Tho' the tide was out far... (unit 19), we
DM, PS, MMs could count green winged teal & other dabbling ducks in existing pools. Turkey Vulture (was) very high overhead.
- Area III * scattered showers; whitecaps; (winds) 25 knots
PC, IMc 4 Mallard hybrids were observed at north end of Royston waterfront.

- Area IV
PC, IMc
- Area V
JC, DR, AR
- Area VI
GH, MO, OW, DH
- Area VII
RM, VC, WH
- 28 March 1981
- Area I
NM, KM
- Area II
DM, PS, MMs
- Area III
PC, IMc
- Area VI
JC, OW, MO, GH
- Area VII
LS, JL, DR, AR
- 4 April 1981
- Area I
KM, NM, SE
- Area II
DM, PS, MMs
- Area III
PC, IMc
- Area IV
PC, IMc
- Area VI
MO, JC
- Area VII
LS, JS, VC, WH
- 11 April 1981
- Area II
DM, MMs
- Area VI
MO, JC
- Area VII
LS, JL, WH, VC
- Area VIII
WF, JA
- There was rather a long gap between... (units 27 & 25), this section all owned privately but we now have permission to view from Lynn Maur Resort so have added unit 4A (i.e. unit 26).
- sky overcast; water very choppy; winds 15 - 25 knots
- * (water) very choppy; (wind) approx. 25 km
- * very choppy, (winds) 20-25 KM/HRS
- * Diving ducks literally *peppered* over Comox Bar - estimated numbers difficult - sea rough.
- * The ducks in... (unit 13) were gone this Sat. We were especially lacking scoters.
- * intermittent showers; whitecaps; (winds) 25-30 knots
- 4 Mallard hybrids seen again at north end of Royston waterfront.
- * (water) rough; (wind) 20 or 25
- * Yellow-rumped Warbler & Rufous Hummingbird for first time. Horned Grebes breeding plumage starting - as also Red-necked Grebe - first Bonaparte's (Gulls)
- * (at unit 1) - sea too rough for viewing anything
- * Cloudy and dull sky; very choppy water; 30 m.p.h wind (48 kph); impossible to count on water in... (unit 13). 200 (unspecified) dabbling ducks following the tide line.
- * Poor visibility - difficult to see birds on choppy sea
- * Cold wind, poor visibility - difficult to see birds in choppy sea
- * (water) rough; (wind) 20 or 25
- * overcast w slight drizzle all day, fogging binoculars & telescopes; (water) rough; (winds) to 20 knots; Difficult to identify ducks at a distance - thus many unidentified. 1 Gadwall seen for first time; Oldsquaws not seen for 2 weeks in a row; European Widgeon (i.e. Eurasian Wigeon) - 3rd & 4th week in row.
- * We heard White Crowned Sparrows for the first time (this year).
- * (units 37 to 40: water) rough; (wind) 20 or 25
- * Total brant may be overemphasized as they fly from one place to another - however it is fairly accurate. Oldsquaws reappeared - many unident ducks
- * cloudy - rain & snow flurries

17 April 1981

Area VIII

WF, EF

* overcast - rain & snow flurries (unit 47)
(winds) to 30K

25 April 1981

Area III & IV

PC, RT

Area VII

JL, AM, VC

* Shimmering haze made for poor visibility in the water.
Shimmering haze in water made viewing difficult
* Savannah sp. for first time - returning warblers &
swallows putting count up - ducks diminish in numbers.
Species count up - individ down.

10 May 1981

Area II

DM, PS, MMs

* (units 14 and 15) had many birds... possibly 150...
surprisingly many Arctic Loons. Then a pleasure boat entered
the channel & scared them off before we got our count. This
happens frequently with the boat traffic. Canada Goose
goslings (seen from unit 18)

16 May 1981

Area II

DM, PS, MMs

Area VII

JL, LS

* 6 Canada Goose goslings (seen from unit 18)
26 Mallard ducklings (seen from unit 19)
* Pelagic (birds) count very reduced - no Buffleheads,
Goldeneye or oldsquaws - no brant or Green winged teal -
only 10 scaup - Mallards Nest: 9 eggs in Mud Bay marsh

23 May 1981

Area II

DM, MMs

* A barge towed up through units... (units 14
to 19) during our count; cut off our total birds. Also 2 groups
of dog trainers in... (unit 18) to cut our count. 17 Common
Merganser chicks (unit 17)

Area III

PC, RT

Area VII

JL, VC

* Com. Merganser 20 adult plus 9 young (unit 22)

* Western meadowlark..., (Swainson's) Thrush & Western
(Wood-Pee-wee) for first time. Still fewer pelagic birds.

30 May 1981

Area II

DM, MMs

* The tide was the lowest we had seen yet in... (unit
13)... many mallards, and more kept flying in to feed on the
exposed shoreline. We were surprised to note 1 whimbrel still
in... (unit 15). Surprise again at 27 Canada Geese feeding on
shoreline out in... (unit 19). (Young Canada Geese were seen
again at unit 18). The 3 winter wrens... (unit 13) were all
young... no tail feathers whatsoever. They were all learning to
sing.

We found... a large racoon very high (in a tree surrounded by
vocalizing crows, unit 20)... working his way back and forth
on different branches, no doubt checking for crows' nests.
The one coot... (was) feeding around a clump... in a clearing
in the heavy grasses, in a pool of water at low tide.
6 young Canada Geese (unit 18)

42 Common Merganser chicks (units 15 and 16).

Area VII

VC, JL, DMi

* Pelagic (birds) count getting even less than last week -
no grebes.

Remarks - Summer 1981

6 June 1981

Area II
DM, PS, MMs

* ... the Sandhill Crane (was) hunting for insects in the a field and the female Hooded Merganser (was) resting on a log. 33 Common Merganser young (near unit 17).

13 June 1981

Area II
PS, MMs

* 1 T. Swan immature on dyke in slough (unit 18);
6 Canada Goose goslings; 20 Mallard ducklings
38 Common Merganser ducklings

Area III & IV
JC, IMc
Area VII
LS, JL

* Heat haze off rocks on beach made sightings hard.
8 ducklings Common Merg. (unit 22)
* MUD BAY - (unit 42) - not done as car broke down - pelagic birds away down - no grebes.

20 June 1981

Area II
PS, MMs

* 1 T. Swan immature still in slough (unit 18) alone, (seems) in good condition;
6 Canada Goose goslings; 6 Mallard ducklings
106 Common Merganser ducklings: 2 groups of 25 birds, 2 groups of 15 birds, 2 groups of 9 birds, 1 group of 8 birds

27 June 1981

Area II
PS, MMs
Area III
RT, IMc
Area VII
VC, JL

* 22 Mallard ducklings;
59 Common Merganser ducklings; 4 (American) Coot downies
* Common Mergansers 2 adults, 6 babies

* 1 lone Lesser Scaup & Bufflehead.

4 July 1981

Area II
DM, PS, MMs

* Haze on water in... (unit 20) made recognition difficult. 6 Can. (Goose) goslings;
12 Mallard ducklings; 46 Common Merganser ducklings;
* Heat haze from rocky beach made sightings difficult.
1 mink (unit 28)

Area III & IV
IMc, RT

11 July 1981

Area II
DM, MMs

* 14 Mallard ducklings;
9 Common Merganser ducklings;
8 Red-breasted Merganser ducklings

18 July 1981

Area I
KM, NM
Area II
DM, PS, MMs

* Common Mergansers consisted entirely of females with broods
* Field trials in... (unit 18) made count impossible.
6 Mallard ducklings; 18 Common Merganser ducklings
* 3 otters (unit 35)

Area V
PC, IMc
Area VII
VC, JL

* (male) Northern Oriole seen for first time

25 July 1981
 Area III * 60 seals (unit 22)
 PC, RT

1 August 1981
 Area II * one young Blue Heron in... (unit 13)
 DM, MMs

22 August 1981
 Area III * 34 seals (unit 22)
 PC, RT
 Area IV * 3 seals (unit 28)
 PC, RT
 Area VII * Terns seen for first time. Red-necked Grebes in
 VC, JL abundance. Cedar Waxwing nest in... (unit 43).

Remarks - Autumn 1981

5 September 1981
 Area VII * at Deep Bay Parasitic Jaeger & Skua seen... harassing
 JL, VC terns and gulls

12 September 1981
 Area IV * Overcast - sunny periods - haze
 IMc, RT
 Area V * Reflection of sun on choppy water made observation
 JB, SB difficult especially at... (unit 36).
 Area VII * still many Red-necked Grebes - Parasitic Jaeger as well
 VC, JL

19 September 1981
 Area VII * First appearance of Surfbird;
 VC, JL Surf & Black Scoters coming back in numbers.

3 October 1981

10 October 1981
 Area II * Hunters.
 PS, MMs, WH Light was very poor so unable to substantiate this (record)
 was European (Eurasian) Widgeon.
 Area III * On Oct. 6 a flight of 50 Snow Geese were observed from
 PC, IMc Dyke (Area II) & from Goose Spit (Area I).
 Area VII Opening of hunting season... 'till 26 Jan 82. - Dabblers
 JL, LS, VC pushed out to sea & Pied-billed Grebes also. Thus ends a most
 interesting learning experience for us all - we are encouraged
 to keep it up... at least... monthly.

Appendix III.

Key to Baynes Sound marine vegetation maps (Figures 5 to 12) including methods, descriptions and references.

1. INTRODUCTION

This map is one of two maps of the Baynes Sound area indicating the general distribution of marine vegetation. It is part of a series of natural resource maps that were prepared in order to provide input into the development of a foreshore plan of the area.

Marine vegetation constitutes a vital component of coastal ecosystems and may be used directly, for example as a food source by waterbird species, or indirectly through the detrital food chain where decaying vegetative matter supports a number of invertebrates which in turn provide a food base for other species (eg., juvenile salmonids). In addition, marine vegetation serves as habitat for a wide variety of animals and may also act as wave and current barriers and help stabilize bottom substrates.

2. METHODS

Marine vegetation mapped here includes both vascular vegetation such as eelgrass and tidal marsh species and non-vascular seaweeds. The seaweeds are sub-grouped into green algae, brown algae, rockweed and red algae. Microscopic vegetation (phytoplankton and periphyton), although very important to marine and estuarine ecosystems, is not included here due to the difficulties of inventory and presentation in map format.

Distribution of vegetation was determined from large scale color (1:10,000) and false color infra-red (1:6,000) aerial photographs, and from Haegle (1981), followed by site specific ground truthing.



GREEN ALGAE



RED ALGAE



ROCKWEED (FUCUS)



EELGRASS (ZOSTERA)



BROWN ALGAE



MARSH

4. ON-SITE SYMBOLS



Ferry Terminal



Marina Wharf



Boat Ramp



Breakwater



Log Boom

5. CREDITS

Supervised by M.H.Wayne
Mapped by M.H.Wayne, S.M.Thomson and D.E.Smith
Map drafted by R.P. Collins
Base map prepared by D.M.Richards and Cartography
Surveys and Resource Mapping Branch
Ministry of Environment

Special thanks to the Sierra Club of Canada

3. VEGETATION TYPES

There are nearly 500 species of seaweeds present within British Columbia. The distribution of plants along a shore is affected by substrate, exposure (wave action), elevation and competition. The types of vegetation common to Baynes Sound are outlined below:

Green Algae: Species within this subgroup are usually found from the middle intertidal to the upper subtidal zone attached to pebbles, cobbles, boulders, shells, and bedrock. Sea lettuce (*Ulva* sp.) and sea confetti (*Enteromorpha* spp.) are the most abundant green algae found in Baynes Sound. Sea confetti in particular is tolerant of a wide range of light intensity, temperature, salinity, and pollution and often occurs in areas of upland seepage, especially from septic tanks.

Brown Algae: Within Baynes Sound the most abundant brown algae is Jap-weed (*Sargassum muticum*) which forms dense populations in warm bays and tide pools from the lower intertidal to upper subtidal zones. Although Jap-weed contains two commercially important extracts (tannin and algin), there is very little demand for this species at present.

Rockweed: Although it is a brown algae, rockweed (*Fucus distichus*) is treated separately for mapping purposes as it occurs in very dense bands in the middle and lower intertidal zone, generally marking the uppermost elevations of seaweed populations. Growing on large pebbles as well as cobbles, boulders, and bedrock, rockweed provides habitat for numerous small bottom-dwelling organisms.

Red Algae: This sub-group is generally distributed below the rockweed band from the mid to lower intertidal to the upper sub-tidal zone. *Rhodomela larix* was the most prominent genus occurring within Baynes Sound often forming a dense monotypic mat on rocks within shallow pools in the intertidal zone. The presence of *Rhodomela* is often indicative of upland seepage. Two other genera of red algae found in Baynes Sound are *Gigartina* (Turkish towel) and *Gelidium*. These occur with other algal species on rock substrates in the lower intertidal and upper subtidal zones. The former is valued for its carrageenan content while the latter is valued as a source of agar. Quantities of *Gigartina* and *Gelidium* growing within Baynes Sound however are not sufficient to warrant commercial harvest.

Eelgrass (Zostera): The extensive root and rhizome systems of these vascular plants provide firm anchors in fine substrates (mud/sand). Eelgrass (*Zostera* spp.) occurs in the lower intertidal and subtidal zones, (+ 1m to -7m tidal levels), often forming a continuous cover in well protected bays. Eelgrass is a perennial which forms an important nursery area for fish and invertebrates. It is very important as a substrate for herring spawn and as a food source for some waterbird species, particularly brant.

Marsh: Marshes are generally located in the upper intertidal zone from the mean tide level to the backshore. Marshes within the study area are commonly broad wetland areas occupied by salt-tolerant vascular plants. Seashore salt grass, Arctic rush, Lyngbye's sedge, sea-side arrow-grass, sea milk-wort and saltwort are common marsh species. Marshes are highly productive and are very important components of detritus based food-webs serving as sources of nutrients and as habitats for a wide range of vertebrate and invertebrate species.

6. REFERENCES AND SOURCES OF FURTHER INFORMATION

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Photography used: 1978 A31202, #176-215; A31209, #1-3; 1979 Denman Island Flight 12,13,14 NW:7321-7359;7403-7414

Appendix IV. Baynes Sound - Comox Harbour bird check-list.

Species Code	Species Name	Scientific Name
RTLO	Red-throated Loon	<i>Gavia stellata</i>
PALO	Pacific Loon	<i>Gavia pacifica</i>
COLO	Common Loon	<i>Gavia immer</i>
YBLO	Yellow-billed Loon	<i>Gavia adamsii</i>
PBGR	Pied-billed Grebe	<i>Podilymbus podiceps</i>
HOCR	Horned Grebe	<i>Podiceps auritus</i>
RNGR	Red-necked Grebe	<i>Podiceps grisegena</i>
EAGR	Eared Grebe	<i>Podiceps nigricollis</i>
WEGR	Western Grebe	<i>Aechmophorus occidentalis</i>
DCCO	Double-crested Cormorant	<i>Phalacrocorax auritus</i>
BRCO	Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>
PECO	Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>
GBHE	Great Blue Heron	<i>Ardea herodias</i>
TUSW	Tundra Swan	<i>Cygnus columbianus</i>
TRUS	Trumpeter Swan	<i>Cygnus buccinator</i>
GWFG	Greater White-fronted Goose	<i>Anser albifrons</i>
SNGO	Snow Goose	<i>Chen caerulescens</i>
BRAN	Brant	<i>Branta bernicla</i>
CAGO	Canada Goose	<i>Branta canadensis</i>
GWTE	Green-winged Teal	<i>Anas crecca</i>
MALL	Mallard	<i>Anas platyrhynchos</i>
NOPI	Northern Pintail	<i>Anas acuta</i>
BWTE	Blue-winged Teal	<i>Anas discors</i>
CITE	Cinnamon Teal	<i>Anas cyanoptera</i>
NOSL	Northern Shoveler	<i>Anas clypeata</i>
GADW	Gadwall	<i>Anas strepera</i>
EUWI	Eurasian Wigeon	<i>Anas penelope</i>
AMWI	American Wigeon	<i>Anas americana</i>
CANV	Canvasback	<i>Aythya valisineria</i>
RNDU	Ring-necked Duck	<i>Aythya collaris</i>
GRSC	Greater Scaup	<i>Aythya marila</i>
LESC	Lesser Scaup	<i>Aythya affinis</i>
HADU	Harlequin Duck	<i>Histrionicus histrionicus</i>
OLDS	Oldsquaw	<i>Clangula hyemalis</i>
BLSC	Black Scoter	<i>Melanitta nigra</i>
SUSC	Surf Scoter	<i>Melanitta perspicillata</i>
WWSC	White-winged Scoter	<i>Melanitta fusca</i>
COGO	Common Goldeneye	<i>Bucephala clangula</i>
BAGO	Barrow's Goldeneye	<i>Bucephala islandica</i>
BUFF	Bufflehead	<i>Bucephala albeola</i>
HOME	Hooded Merganser	<i>Lophodytes cucullatus</i>
COME	Common Merganser	<i>Mergus merganser</i>
RBME	Red-breasted Merganser	<i>Mergus serrator</i>
RUDU	Ruddy Duck	<i>Oxyura jamaicensis</i>

Baynes Sound bird check-list (continued).

Species Code	Species Name	Scientific Name
TUVU	Turkey Vulture	<i>Cathartes aura</i>
OSPR	Osprey	<i>Pandion haliaetus</i>
BAEA	Bald Eagle	<i>Haliaeetus leucocephalus</i>
NOHA	Northern Harrier	<i>Circu cyaneus</i>
SSHA	Sharp-shinned Hawk	<i>Accipiter stiiatus</i>
COHA	Cooper's Hawk	<i>Accipter cooperii</i>
NOGO	Northern Goshawk	<i>Accipiter gentilis</i>
SWHA	Swainson's Hawk	<i>Buteo swainsoni</i>
RTHA	Red-tailed Hawk	<i>Buteo jamaicensis</i>
GOEA	Golden Eagle	<i>Aquila chrysaetos</i>
AMKE	American Kestrel	<i>Falco sparverius</i>
MERL	Merlin	<i>Falco columbarius</i>
PEFA	Peregrine Falcon	<i>Falco peregrinus</i>
RNPH	Ring-necked Pheasant	<i>Phasianus colchicus</i>
RUGR	Ruffed Grouse	<i>Bonasa umbellus</i>
CAQU	California Quail	<i>Callipepla claifornica</i>
AMCO	American Coot	<i>Fulica americana</i>
SACR	Sandhill Crane	<i>Grus canadensis</i>
BBPL	Black-bellied Plover	<i>Pluvialis squatarola</i>
LGPL	Lesser Golden-Plover	<i>Pluvialis dominica</i>
SEPL	Semipalmated Plover	<i>Charadrius semipalmatus</i>
KILL	Killdeer	<i>Charadrius vociferus</i>
BLOY	Black Oystercatcher	<i>Haematopus bachmani</i>
GRYE	Greater Yellowlegs	<i>Tringa melanoleuca</i>
LEYL	Lesser Yellowlegs	<i>Tinga flavipes</i>
SPSA	Spotted Sandpiper	<i>Actitis macularia</i>
WHIM	Whimbrel	<i>Numenius phaeopus</i>
RUTU	Ruddy Turnstone	<i>Arenaria interpres</i>
BLTU	Black Turnstone	<i>Arenaria melanocephala</i>
SURF	Surfbird	<i>Aphriza virgata</i>
SAND	Sanderling	<i>Calidris alba</i>
WESA	Western Sandpiper	<i>Calidris mauri</i>
LESA	Least Sandpiper	<i>Calidris minutilla</i>
DUNL	Dunlin	<i>Calidris alpina</i>
SBDO	Short-billed Dowitcher	<i>Limnodromus griseus</i>
LBDO	Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
COSN	Common Snipe	<i>Gallinago gallinago</i>
PAJA	Parasitic Jaeger	<i>Stercorarius parasiticus</i>
SPSK	South Polar Skua	<i>Catharacta maccormicki</i>
FRGU	Franklin's Gull	<i>Larus pipixcan</i>
BOGU	Bonaparte's Gull	<i>Larus philadelphia</i>
MEGU	Mew Gull	<i>Larus canus</i>
RBGU	Ring-billed Gull	<i>Larus delawarensis</i>
CAGU	California Gull	<i>Larus californicus</i>
HEGU	Herring Gull	<i>Larus argentatus</i>
THGU	Thayer's Gull	<i>Larus thayeri</i>

Baynes Sound bird check-list (continued).

Species Code	Species Name	Scientific Name
WEGU	Western Gull	<i>Larus occidentalis</i>
GWGU	Glaucous-winged Gull	<i>Larus glaucescens</i>
GLGU	Glaucous Gull	<i>Larus hyperboreus</i>
COTE	Common Tern	<i>Sterna hirundo</i>
COMU	Common Murre	<i>Uria aalga</i>
PIGU	Pigeon Guillemot	<i>Cephus columba</i>
MAMU	Marbled Murrelet	<i>Brachyramphus marmoratus</i>
RODO	Rock Dove	<i>Columba livia</i>
BTPI	Band-tailed Pigeon	<i>Columba fasciata</i>
MODO	Mourning Dove	<i>Zenaida macroura</i>
BLSW	Black Swift	<i>Cypseloides niger</i>
VASW	Vaux's Swift	<i>Chautura vauxi</i>
RUHU	Rufous Hummingbird	<i>Selasphorus rufous</i>
BEKI	Belted Kingfisher	<i>Ceryle alcyon</i>
RBSA	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>
DOWO	Downy Woodpecker	<i>Picoides pubescens</i>
HAWO	Hairy Woodpecker	<i>Picoides villosus</i>
NOFL	Northern Flicker	<i>Colaptes auratus</i>
PIWO	Pileated Woodpecker	<i>Dryocopus pileatus</i>
OSFL	Olive-sided Flycatcher	<i>Contopus borealis</i>
WWPE	Western Wood-Pee-wee	<i>Contopus sordidulus</i>
WIFL	Willow Flycatcher	<i>Empidonax traillii</i>
HAFL	Hammond's Flycatcher	<i>Empidonax hammondi</i>
PSFL	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>
TRSW	Tree Swallow	<i>Tachycineta bicolor</i>
VGSW	Violet-green Swallow	<i>Tachycineta thalassina</i>
NRWS	Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
CLSW	Cliff Swallow	<i>Hirundo pyrrhonota</i>
BASW	Barn Swallow	<i>Hirundo rustica</i>
STJA	Steller's Jay	<i>Cyanocitta stelleri</i>
NOCR	Northwestern Crow	<i>Corvus caurinus</i>
CORA	Common Raven	<i>Corvus corax</i>
CBCH	Chestnut-backed Chickadee	<i>Parus rufescens</i>
BUSH	Bushtit	<i>Psaltiriparus minimus</i>
RBNU	Red-breasted Nuthatch	<i>Sitta canadensis</i>
BRCR	Brown Creeper	<i>Certhia americana</i>
BEWR	Bewick's Wren	<i>Thryomanes bewickii</i>
HOWR	House Wren	<i>Troglodytes aedon</i>
WIWR	Winter Wren	<i>Troglodytes troglodytes</i>
AMDI	American Dipper	<i>Cinclus mexicanus</i>
GCKI	Golden-crowned Kinglet	<i>Regulus satrapa</i>
RCKI	Ruby-crowned Kinglet	<i>Regulus calendula</i>
SWTH	Swainson's Thrush	<i>Catharus ustulatus</i>
HETH	Hermit Thrush	<i>Catharus guttatus</i>
AMRO	American Robin	<i>Turdus migratorius</i>
VATH	Varied Thrush	<i>Ixoreus naevius</i>

Baynes Sound bird check-list (continued).

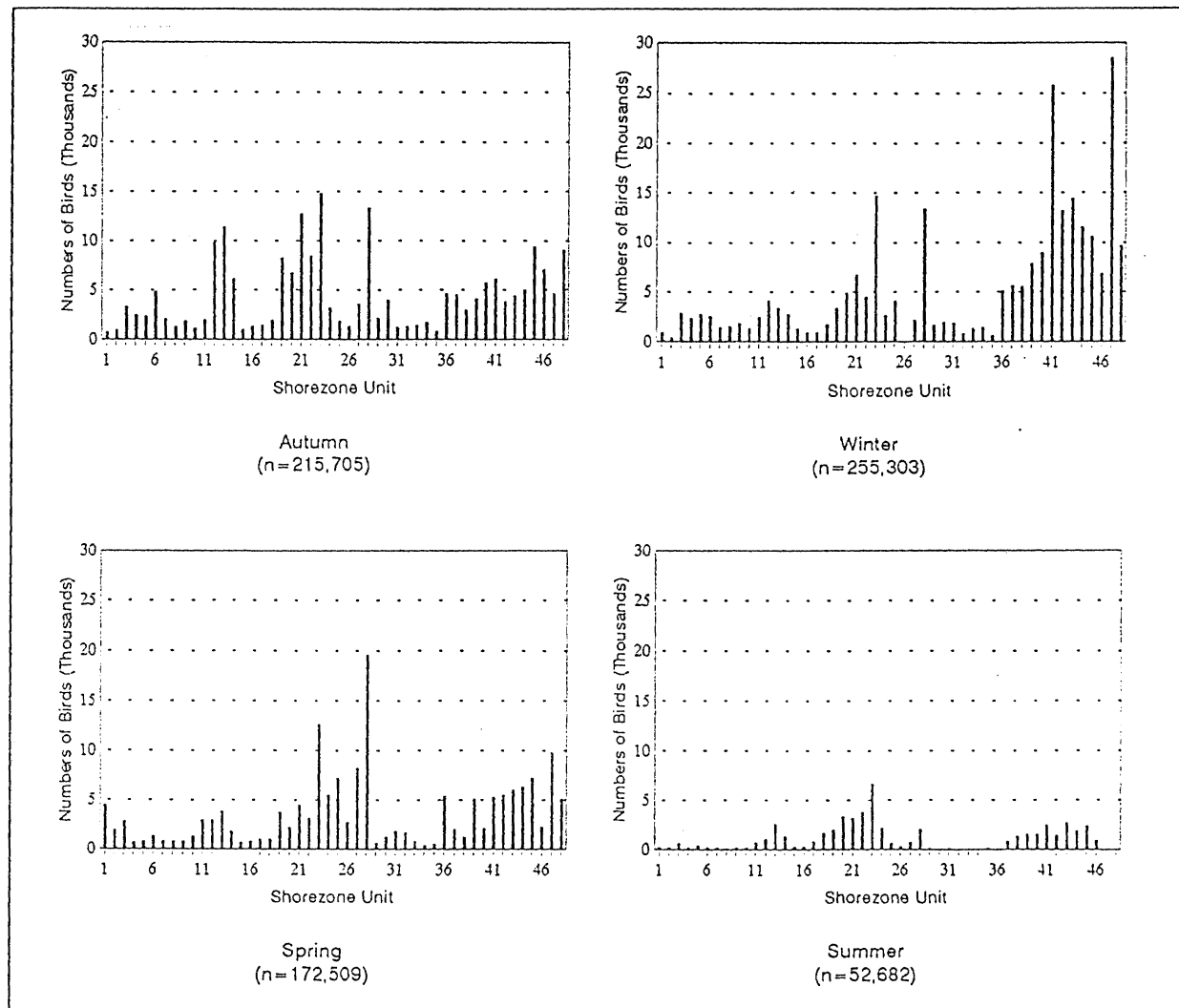
Species Code	Species Name	Scientific Name
AMPI	American Pipit	<i>Anthus spinoletta</i>
CEWA	Cedar Waxwing	<i>Bombycilla cedrorum</i>
NOSH	Northern Shrike	<i>Lanius excubitor</i>
EUST	European Starling	<i>Sturnus vulgarus</i>
SOVI	Solitary Vireo	<i>Vireo solitarius</i>
WAVI	Warbling Vireo	<i>Vireo gilvus</i>
HUVI	Hutton's Vireo	<i>Vireo huttoni</i>
REVI	Red-eyed Vireo	<i>Vireo olivaceus</i>
OCWA	Orange-crowned Warbler	<i>Vermivora celata</i>
YEWA	Yellow Warbler	<i>Dendroica petechia</i>
YRWA	Yellow-rumped Warbler	<i>Dendroica coronata</i>
BTGW	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>
TOWA	Townsend's Warbler	<i>Dendroica townsendi</i>
MGWA	MacGillivray's Warbler	<i>Oporornis tolmiei</i>
COYE	Common Yellowthroat	<i>Geothlypis trichas</i>
WIWA	Wilson's Warbler	<i>Wilsonia pusilla</i>
WETA	Western Tanager	<i>Piranga ludoviciana</i>
RSTO	Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
ATSP	American Tree Sparrow	<i>Spizella arborea</i>
CHSP	Chipping Sparrow	<i>Spizella passerina</i>
SAVS	Savannah Sparrow	<i>Passerculus sandwichensis</i>
FOSP	Fox Sparrow	<i>Passerella iliaca</i>
SOSP	Song Sparrow	<i>Melospiza melodia</i>
WTSP	White-throated Sparrow	<i>Zonotrichia albicollis</i>
GCSP	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
WCSP	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
DEJU	Dark-eyed Junco	<i>Junco hyemalis</i>
RWBL	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
WEME	Western Meadowlark	<i>Sturnella neglecta</i>
BRBL	Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
BHCO	Brown-headed Cowbird	<i>Molothrus ater</i>
NOOR	Northern Oriole	<i>Icterus galbula</i>
ROFI	Rosy Finch	<i>Leucosticte arctoa</i>
PIGR	Pine Grosbeak	<i>Pinicola enucleator</i>
PUFI	Purple Finch	<i>Carpodacus purpureus</i>
HOFI	House Finch	<i>Carpodacus mexicanus</i>
PISI	Pine Siskin	<i>Carduelis pinus</i>
AMGO	American Goldfinch	<i>Carduelis tristis</i>
EVGR	Evening Grosbeak	<i>Coccothraustes vespertinus</i>
HOSP	House Sparrow	<i>Passer domesticus</i>

Appendix IV (continued)

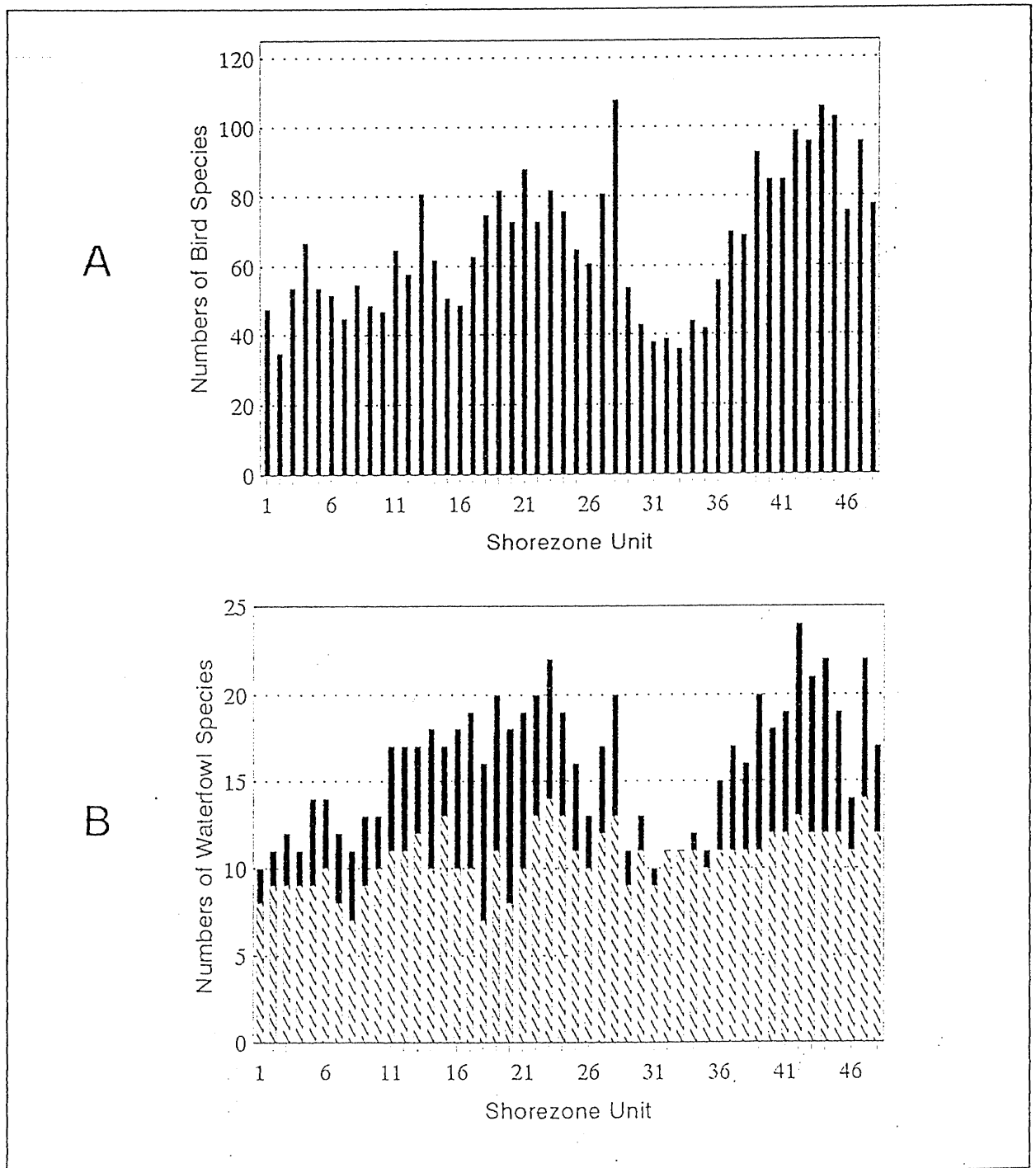
Codes Used to Record Species Group Totals or Birds Not Identified to Species

Code	Meaning
#LOO	total of all loons
LOON	birds identified simply as loons
#GRE	total of all grebes
GREB	birds identified simply as grebes
#COR	total of all cormorants
CORM	birds identified simply as cormorants
#HER	total of all herons
#SWA	total of all swans
#GEE	total of all geese
#DAB	total of all dabbling ducks
DABL	birds identified simply as dabbling ducks
#DIV	total of all diving ducks
DIVE	birds identified simply as diving ducks
DUCK	birds identified simply as ducks
#RAP	total of all raptors
HAWK	birds identified simply as hawks
#RAI	total of all rails and cranes
#SHO	total of all shorebirds
SHOR	birds identified simply as shorebirds
YELL	birds identified simply as yellowlegs
PEEP	birds identified as "peep" sandpipers eg: Western, Least, etc
DOWI	birds identified simply as dowitchers
#GUL	total of all gulls
GULL	birds identified simply as gulls
#ALC	total of all alcids
HUMM	birds identified simply as hummingbirds
#WOO	total of all woodpeckers
#PAS	total of all passerines
FLYC	birds identified simply as flycatchers
SWAL	birds identified simply as swallows
WREN	birds identified simply as wrens
VIRE	birds identified simply as vireos
WARB	birds identified simply as warblers
SPAR	birds identified simply as sparrows
#TOT	total of all birds

Appendix V. Seasonal variations in the distribution of all birds combined on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981. The Methods and Limitations section should be consulted when interpreting this chart.



Appendix VI. Bird species diversity by shorezone unit for all birds (A) and for waterfowl (B; the numbers of diving duck species are shown in diagonal pattern) on the Baynes Sound - Comox Harbour study area, 11 October 1980 to 10 October 1981. The Methods and Limitations section should be consulted when interpreting these charts.



Appendix VII.

Baynes Sound - Comox Harbour bird surveys: Seasonal bird numbers, 11 October 1980 to 10 October 1981 (See enclosed 3.5 inch computer diskette with data in ASCII format).

Note: In this Appendix, the mean has been calculated as the total number of birds of species-x counted over the season, divided by the total number of counts where species-x occurred. Counts of zero have not been included in the total number of counts nor are they included as minimum values. Thus the last 6 columns in the Appendix summarize the species occurrence on the study area. For example, the probability of seeing a Brandt's Cormorant in autumn on the Baynes Sound - Comox Harbour study area is about 63%. If you see the species, you are likely to see an average of about 5 birds and more than 16 would be exceptional. Appendix I should be consulted to help differentiate between a low count that represents *fewer birds present* in the study area on a particular date and a low count that indicates *fewer shorezone units surveyed* on that date.

Appendix VIII

Baynes Sound - Comox Harbour study area birds surveys: Seasonal bird use by habitat, 11 October 1980 to 10 October 1981 (See enclosed 3.5 inch computer diskette with data in ASCII format).

Note: In this Appendix, the mean has been calculated as the total number of birds of species-x counted over the season, divided by the total number of counts where species-x occurred. Counts of zero have not been included in the total number of counts nor are they included as minimum values. Thus the last 6 columns in the Appendix summarize the species occurrence on the study area. For example, the probability of seeing a Common Loon in autumn at shorezone unit 48 on the Baynes Sound - Comox Harbour study area is about 88%. If you see the species, you are likely to see an average of about 5 birds and more than 12 would be exceptional. Appendix I should be consulted to help differentiate between a zero that represents *no birds* on a particular survey and a zero that indicates *no data* because no survey was performed on that date and location.

