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Aerial Censuses of Pinnipeds in The Queen Charlotte Islands, 1 July - 1 August, 1992

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**AERIAL CENSUSES OF PINNIPEDS IN
THE QUEEN CHARLOTTE ISLANDS,
1 JULY - 1 AUGUST, 1992**



by

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ABSTRACT

Olesiuk, P.F., D. Burles, G. Horonowitsch, and T.G. Smith. 1993. Aerial censuses of pinnipeds in the Queen Charlotte Islands, 1 July - 1 August, 1992. Can. Manuscr. Rep. Fish. Aquat. Sci. No. 2217: 27 p.

In this report we present the results of aerial censuses of Pacific harbour seals (*Phoca vitulina richardsi*) and Steller sea lions (*Eumetopias jubatus*) conducted in the Queen Charlotte Islands during 3 July - 1 August, 1992. The 1992 count of Steller sea lions for the entire Queen Charlotte Islands was 2,115 non-pups and 484 pups. Regression analyses indicate that the non-pup and pup populations have increased by about 55% and 65% since standardized aerial censuses were begun in 1971, which represents finite annual rates of increase of 2.1% and 2.4% respectively. Coverage of harbour seal censuses was limited to the east coast of Moresby Island due to persistent fog during morning tidal windows. A total of 1,456 seals were counted between Alliford Bay and Goodwin Point. Comparison with the number counted in the same area in the only previous census in 1986 indicates that the seal population had increased by about 70%, which represents a finite annual rate of increase of 9.3%. The recent increases in both species probably reflects the recovery of populations from management and commercial kills made prior to their being protected in 1970.

RÉSUMÉ

Olesiuk, P.F., D. Burles, G. Horonowitsch, et T.G. Smith. 1993. Recensement aerien de pinnipeds aux Iles de la Reine Charlotte, 1 juillet - 1 août, 1992. Rapp. manusc. can. sci. halieut. aquat. 2217: 27 p.

Nous presentons les resultats du recensement aerien de phoques communs du Pacifique (*Phoca vitulina richardsi*) et d'otaries de Steller (*Eumetopias jubatus*) aux Iles de la Reine Charlotte entre le 3 juillet et le 1 août, 1992. Le total d'otaries de Steller sur le territoire entier était 2,115 adults et juveniles et 484 nouveaux nées. L'analyse de régression nous indiquent un accroissement de 55% et 65% depuis 1971 de nouveaux nées et du reste de la population respectivement qui equivaut à une augmentation finie annuelle de 2.1% et 2.4%. Notre couverture du territoire pour les phoques communs a été limité à la côte ouest de l'île Moresby à cause du brouillard pendant les heures critiques. Un total de 1456 phoques a été compté entre la baie d'Alliford et le point Goodwin. Une comparaison avec le compte dans ce même endroit en 1986 indique une augmentation de 70% représentant un taux de croissance fini annuelle de 9.3%. Ces augmentations dans les deux espèces sont probablement dû à le rebondissement des populations après la terminaison des chasses commerciaux, et à le contrôle et protection complète commençant en 1970.

INTRODUCTION

Two species of pinniped reside year-round and breed in the coastal waters of British Columbia, including the Queen Charlotte Islands (Olesiuk and Bigg 1988). The Pacific harbour seal (*Phoca vitulina richardsi*) inhabits inshore waters from central Baja California northward to Bristol Bay, Alaska, and westward to the Aleutian and Pribilof Islands (Shaughnessy and Fay 1977; Bigg 1981). Although local movements associated with feeding, breeding and moulting have been reported (Fisher 1952; Brown and Mate 1983; Jefferies 1986; Olesiuk et al 1990a), the species is considered to be non-migratory (Bigg 1981). On land, harbour seals are gregarious and haul out in small groups on islands, reefs, sandbars and at the base of bluffs, primarily during daylight and at low tide (Olesiuk et al 1990b). Animals of both sexes and all ages generally consort at the same haulout sites (Wilson 1976). Unlike many other pinniped species, harbour seals do not congregate on rookeries to reproduce, but rather give birth and mate throughout their range. The pupping season varies with latitude (Temte et al 1991), and extends from mid June to mid August in southern B.C. and from mid May to mid July in northern B.C. (Olesiuk et al 1990b). Neonates are competent swimmers and typically enter the water within a few hours of birth (Bigg 1981).

The Steller sea lion (*Eumetopias jubatus*) ranges along the coastal rim of the North Pacific from northern California to the Bering Sea and Kurile Islands. The species utilizes three categories of haulouts (Bigg 1985): breeding rookeries where animals congregate to pup and mate during May-August; year-round haulouts which are used by non-breeding animals throughout the year; and winter haulouts which are used primarily during the non-breeding season. Males are the first to arrive on rookeries in May to claim and defend breeding territories. Females arrive on rookeries between early June and early July and give birth within a few days of their arrival. Neonates cannot swim and are therefore confined to the rookeries until they become competent swimmers at about a month of age (Sandegren 1970). During the breeding season, most juveniles and non-breeding adults are relegated to year-round haulouts along the exposed coast, although small numbers also occasionally occur at winter haulouts (Bigg 1985). In September when breeding has been completed animals disperse to feed and become widely distributed at numerous year-round and winter haulouts (Bigg 1985). Although animals tend to return to their natal rookeries to reproduce (Calkins and Pitcher 1983), they may venture over a thousand kilometres from them before reaching maturity or during the non-breeding season (Fisher 1981; LeBoeuf et al, in press).

The status of pinniped populations has most commonly been assessed using aerial censuses. The main advantages of this technique are that animals can be easily counted or photographed from the air even on irregular terrain, and aircraft make it possible to census large areas during the brief periods when peak numbers of animals are on land. In this report, we present the results of aerial censuses of Steller sea lions and Pacific harbour seals undertaken in the Queen Charlotte Islands during 1 July - 1 August, 1992. The censuses were conducted and funded jointly by the Department of Fisheries and Oceans and Canada Parks Service. We also compare the 1992 census counts with previous counts to assess population trends.

METHODS

Aerial censuses were conducted by 2-3 observers from a de Havilland Beaver or 185 Cessna aircraft on floats flown at an altitude of approximately 150 meters above sea level and an airspeed of 125 km·hr⁻¹. For harbour seals, which tend to be widely dispersed at numerous haulouts, the main shoreline was followed and all islands and reefs circumnavigated at a distance of about 100 meters. All known haulout sites were checked and we also searched, usually with the aid of 8X40 binoculars, for new haulouts and swimming animals. For sea lions, which tend to be concentrated at a few traditional sites, all known haulout sites were checked and the shoreline scanned while flying between adjacent haulouts.

Visual counts were made of swimming animals and small groups (<5-10) of animals on land. Larger groups were usually photographed with a hand held 35mm SLR camera equipped with a motor drive and 135-210mm zoom telephoto lens. When light conditions permitted, we preferred to use Kodachrome 200 ISO slide film, which in our experience provides greater resolution and contrast which is especially useful for discerning Steller sea lions pups. When there was insufficient light to maintain a shutter speed of 1/500th second or less, we switched to Extachrome 400 ISO slide film, which when necessary was exposed and subsequently push-processed at 800 ISO. Counts were subsequently made from projected transparencies by marking each animal on a white background. Counts of swimming animals, which never constituted more than 1% of the total count in an area, were added to the count for the nearest occupied haulout.

To facilitate comparisons with previous counts, censuses were conducted under standardized conditions when maximum numbers of animals would be expected to be hauled out on land. For harbour seal censuses, the two most important factors are tidal condition and date. Counts were conducted at low tides, during which haulout patterns tend to be synchronized throughout the population such that the majority of animals are on land at the same time (Olesiuk et al 1990b). Low tides in the morning (08:30 to 11:00 PDT) are preferred because haulout periods appear to be shorter in the afternoon, perhaps because seals become hyperthermic more rapidly at higher air temperatures (Watts 1992). Although suitable tides for censusing harbour seals occur throughout summer months (April-October), long-term trends can be confounded by seasonal fluctuations in the size of the population due to recruitment during the 10-week pupping season (Olesiuk et al 1990). These seasonal fluctuations were negated by adjusting all counts to post-pupping levels by applying corrections to account for pups born subsequent to the census. The corrections, which were derived based on the timing of births and the birth rate (see Olesiuk et al 1990 for details), range from 1.25 just prior to the pupping season to 1.00 at the end of the pupping season. In order to minimize the magnitude of these corrections, we prefer to conduct censuses toward the end of the pupping season, which in northern B.C. is 90% complete by 30 June (Olesiuk et al 1990b).

For sea lion censuses, the two most important factors are date and time-of-day. The date is especially important for counts of breeding animals and pups on rookeries which, as will be discussed later, provide the best index of the size of the breeding population. Throughout their range, the pupping season for Steller sea lions extends from mid May to early July. On average, only

about 7% of births have occurred prior to the end of May and 95% by the end of June (Bigg 1985). Moreover, pups are poor swimmers at birth and require about a month to become competent enough swimmers to leave the rookery (Sandegren 1970). Censuses are therefore conducted in very late June or very early July by which time most pups have been born, but before they begin to disperse from the rookeries. Since females give birth within a few days of their arrival on rookeries (Edie 1977), their peak numbers on rookeries coincides with that of pups. The other important factor was time-of-day. Since non-pups typically leave for foraging trips in the evening and return in the morning, we attempted to make counts between 10:00 and 18:00 hours when peak numbers are hauled out (Withrow 1982).

Censuses of Steller sea lions on the B.C. coast, including the Queen Charlotte Islands, have been conducted routinely (approximately every 5 years) since 1971 using essentially identical procedures. Temporal trends in abundance between 1971 and 1992 were assessed by regressing logarithmically transformed counts on time:

$$[1] \ln N_t = \ln N_0 + rt$$

such that:

$$[2] N_t = N_0 e^{rt}$$

where N_0 and N_t denote the number of animals counted in 1971 and year t respectively, and r the exponential or intrinsic rate of increase (Caughley and Birch 1971). The finite annual rate of increase, expressed as a percentage, was subsequently calculated as $100(1-e^{-r})$. For example, the finite annual rate of increase would be 10% for a population increased in size from 100 to 110 animals the following year.

The only previous harbour seal census in the Queen Charlotte Islands was conducted during 22-24 July, 1986. Changes in abundance between 1986 and 1992 were assessed by comparing the numbers of seals observed in 1992 with the number observed in the same area in 1986. Whenever replicate counts had been made for the same haulout site on the same date in the same year, the maximum count was used. Since it is unlikely that seals move from one haulout site to another during the same low tide cycle, daily changes in abundance at a particular site probably reflects the arrival of animals that had previously been swimming or the departure of animals that had previously been hauled out. For replicate counts made on different dates in the same year, the counts were averaged. Our observations elsewhere indicate that the distribution of harbour seals may shift among different haulout sites even on consecutive days, depending on factors such as the direction and strength of the wind or on the height of tides. Using the maximum count for each site censused on different dates could therefore inflate the estimate of the number of animals in an area.

RESULTS

Steller sea lions:

Steller sea lions in the Queen Charlotte Islands breed at one rookery situated at Cape St. James (Kerouard Islands), and are known to haul out at 4 year-round haulout sites and 14 winter haulout sites (Figure 1). During three flights on 1-3 July, 1992, all known sites were surveyed except for two winter haulouts: Langara Island and Rose Spit which were both fogbound. It is unlikely that substantial numbers of animals occurred at the two missed sites. During the 4 previous summer censuses conducted since 1971, animals have only been observed once at Rose Spit (1 animal was present) and twice at Langara Island (6 and 3 animals were present). Thus, no corrections were made to account for any animals that might have been present at the two missed sites.

No new Steller sea lion rookeries or haulout sites were discovered in 1992. Indeed, the rookery at Cape St. James has been known to exist since the first Steller sea lion census in B.C. was conducted in 1913 (Newcombe and Newcombe 1914), and only one new year-round haulout has been discovered (Anthony Island in 1987) since 1956 (Bigg 1985). Steller sea lions are probably more flexible in their utilization of winter sites depending on the local distribution and abundance of prey, but few censuses have been conducted during winter months.

All Steller sea lion counts were made during the 10:00 - 18:00 optimal census window except for Reef Island, which was surveyed at 09:35. Light conditions were good at most sites, including the rookery at Cape St. James, which allowed us to use the preferred Kodachrome film. We therefore judge the Steller sea lion census to be an excellent count.

The total 1992 Steller sea lion count was 2,115 non-pups and 484 pups (Table 1). Non-pups were present at the rookery at Cape St. James (867 animals) and at all 4 year-round haulouts (1,175 animals), which combined accounted for 96.5% of the total number observed. The remaining 3.5% of non-pups (73 animals) were counted at two winter sites. All of the 484 pups counted occurred at Cape St. James, which indicated they had not yet begun to disperse from the rookery.

The 1992 pup count was the highest of the 6 counts made since 1971 (Table 2). Since all pup counts since 1971 had been made on virtually the same date (1 July \pm 2 days), these counts are believed to represent long-term trends rather than differences in the timing of censuses. The finite annual rate of increase of pups during 1971-92 was estimated to be 2.1% and was statistically significant ($t=3.03$; $P<0.05$)(Figure 2). The regression indicates that total pup production at the Cape St. James rookery has increased by about 55% since 1971.

The 1992 non-pup count was the 2nd highest of 5 counts made since 1971; the highest count was obtained during the last previous census in 1987 (Table 2). The finite rate of increase of non-pups since 1971 was 2.4% per annum, which was not quite statistically significant ($t=2.19$; $P=0.116$)(Figure 2). Although not significant, the increase in non-pups is considered to be real as

it is very similar to the 2.2% rate observed for the entire province, which was statistically significant ($t = 3.25$; $P < 0.05$). We attribute our inability to discern significant trends in non-pup abundance in the Queen Charlotte Islands to two factors: 1) the non-pup regression analysis was less powerful (i.e. there was a higher probability of incorrectly concluding populations were stable when they were in fact increasing) than the pup regression analysis because there was one less count and hence one less degree of freedom; and 2) non-pup counts are inherently more variable than pup counts because the proportion of non-pups foraging at sea and hence missed may vary between censuses, whereas essentially all pups are confined to land during the census periods.

Harbour seals:

Harbour seal censuses were limited in scope due to persistent morning fog which precluded flying during several tidal census windows. A total of 3 successful flights were conducted, during which we focused on the east coast of Moresby Island (Table 3). The area between Alliford Bay on the north coast to Goodwin Point, excluding the coast of Burnaby Island, was surveyed at least once (Figure 3a and 3b). There was some overlap between each of flights, such that duplicate counts were made for about 38% and triplicate counts for about 5% of the population in the censused area.

During the 1992 census, harbour seals were observed at 39 haulout sites (Table 4). Seals were present at 14 of the 17 (82.4%) sites that had been occupied during the only previous census in 1986 census. Thirteen of the sites occupied in 1992 were new haulouts that were not known to exist before the census, and the general vicinity of the remaining 12 were known to exist prior to the census from an examination of seal hunter's logbooks from the 1960s.

The number of seals counted on all 3 census flights in 1992 was greater than that seen in the same areas in 1986 (Figure 4). Because both the 1986 and 1992 censuses had been conducted toward the end of the pupping season, the multipliers to correct for unborn pups were small (range 1.018 to 1.000). Finite rates of increase for the adjusted counts in each area, when amortized over the 6-year interval, ranged from 10.5% to 15.2% per annum (mean 12.1%) (Table 5).

The rate of increase for the entire area surveyed in 1992 was 9.3%, which is less than the rate of increase for any of the 3 areas censused on each flight. This can be explained by the fact that there was some overlap between each of the flights, and the rates of increase happened to be greatest in the areas of overlap. Since counts over smaller areas are more prone to being distorted by the inclusion or exclusion of one or two sites during the flight or by slight shifts in distribution of seals between nearby haulouts (i.e. border bias), we consider the total area counts to be the most reliable indicator of population trends in the Queen Charlotte Islands.

Although our comparison on the 1986 and 1992 counts are based on the exact same area and the two censuses were conducted under very similar conditions, we may nevertheless have overestimated the actual rate of population growth. During a census, there is always a possibility that haulout sites were missed and this possibility may have been greater in 1986 than 1992 for two

reasons. Firstly, the 1986 census provided us with better prior knowledge of the location of haulout sites for the 1992 census, and since all known haulout sites were specifically checked they were less likely to have been missed. Secondly, the size (number of animals) of haulout sites tended to be greater in 1992 than 1986 as a direct result of population growth and possibly also because animals are becoming more gregarious as they become accustomed to not being hunted, and the probability of missing a site is probably inversely related to its size. However, the bias introduced as a result of missing fewer sites during the 1992 census is probably small. Twenty-six of the 39 (67%) sites occupied in 1992 were known to have existed prior to the census based on the 1986 census or on seal hunter's logbooks. The remaining 13 (33%) new sites were relatively small and combined accounted for only 16.4% of the total 1992 count. Thus, even if all these 13 new sites had existed but were overlooked in the 1986 census, which is highly unlikely, the rate of increase would have been 6.1% rather than 9.3%. In other words, all of the new sites discovered in 1992 combined accounted for only about one-third of the total increase observed since 1986.

DISCUSSION

Aerial censuses provide only an index of absolute abundance. Even under optimal conditions some animals, particularly those at sea, are missed. For example, Steller sea lions commonly forage as far offshore as the edge of the continental shelf (Kajimura and Loughlin 1988), well outside the boundaries of our censuses. Time-depth recorders have shown that foraging harbour seals may spend more than 90% of their time submerged (Olesiuk, unpubl. data), so the vast majority of swimming animals would probably have been missed. Despite these limitations, the censuses probably provide an accurate indication of population trends. Because the censuses were conducted under rigorously standardized conditions, the proportion of animals missed in each census would presumably have been relatively constant.

The observed increase in the abundance of Steller sea lions in the Queen Charlotte Islands between 1971 and 1992 mirrors that observed throughout the province. Over the same period, counts of non-pups and pups for the B.C. coast increased at finite annual rates of 2.2% and 1.8% respectively (Olesiuk, Smith and Horonowitsch, unpubl. data). These increases probably represent the recovery of populations from management and commercial kills made before the species was protected in 1970. For example, an estimated 1,500 pups and 2,500 non-pups occurred at the Cape St. James rookery in July of 1956 and 1957, which was before any substantial kills had been made. During 1959-66, about 3,100 animals (mainly adult females) were taken from Cape St. James during a commercial harvest (Bigg 1984). Thus, although the size of the breeding colony at Cape St. James has grown by about 50% since being protected in 1970, it is still presently only about one-third its historic size.

Inferences can also be made from census counts as to the absolute abundance of animals. For Steller sea lions, two aspects of absolute abundance are of interest. One is the size of the breeding stock at Cape St. James, which reflects the importance of the Queen Charlotte Islands as

a breeding area. Pup counts are especially useful for estimating the size of breeding stocks. The pupping curve in Bigg (1985) indicates that pupping would have been about 97% complete when the rookery was censused on 3 July, 1992, which implies that total annual pup production would have been approximately 500. Based on life tables, the ratio of Steller pups:non-pups has been estimated to be about 3.5:1 (Calkins and Pitcher 1983). The total Cape St. James breeding stock would therefore be comprised of about 1,750 non-pups. However, because animals may disperse great distances from their natal rookeries, some of these animals would undoubtedly have emigrated to other areas. Indeed, animals tagged as pups on Cape St. James have subsequently been resighted as far north as Prince William Sound in Alaska and as far south as Tofino on the southwest coast of Vancouver Island (Fisher 1981). Conversely, immigrants belonging to other breeding stocks may frequent the Queen Charlotte Islands.

A second measure of absolute abundance is the total size of the population inhabiting the Queen Charlotte Islands during summer months, which reflects the importance of the Queen Charlotte Islands as a summer feeding area. This population would include not only a portion of the animals that breed at Cape St. James, but also immigrants that breed elsewhere. By applying life table analyses such as those outlined above to large geographic regions (sufficiently large such that the effects of immigration and emigration were probably minimal), Loughlin et al (1992) estimated that 75% of non-pups were counted in aerial censuses conducted during the breeding season. The Queen Charlotte Island non-pup count of 2,115 thus represents an actual non-pup population on the order of 2,800. This is about 1.6X the size of the Cape St. James breeding stock, which suggests there is a net influx of animals from other rookeries. The most plausible source of immigrants is the large rookery at Forrester Island in southeast Alaska, which is situated about 80 kilometres northwest of the Queen Charlotte Islands. Annual pup production on Forrester Island is currently about 2,300 (Bigg 1985), which translates into a non-pup population on the order of 8,000, and only about one-third of these occur on the rookery itself. We suspect that competition with the Forrester Island breeding stock may explain the slow rate of recovery of the Cape St. James breeding stock. The Forrester Island stock was either very small or did not exist prior to 1945 (Imler and Sarber 1947), but flourished during the 1950s and 60s as commercial and management kills depleted breeding populations throughout British Columbia (Bigg 1985).

The observed increase in the abundance of harbour seals on the east coast of Moresby Island between 1986 and 1992 also mirrors that observed elsewhere in the province. Olesiuk et al (1990b) concluded that populations throughout British Columbia have been increasing at an annual rate of about 12.5% since the early 1970s. Total abundance on the B.C. coast was estimated to have increased from 9,000-10,500 in 1973 to about 100,000 by 1992 (Olesiuk et al 1990b; Olesiuk, unpubl. data). These increases likely also represent the recovery of populations from management and commercial kills made before the species was protected in 1970. The main depletion probably occurred during an intense commercial harvest for pelts throughout B.C. during 1963-68, over which period about 6,000 seals were killed in the Queen Charlotte Islands (Olesiuk, unpubl. data).

An accurate estimate of the proportion of harbour seals actually counted during the censuses is not currently available. Using the bounded-count technique, which is known to be subject to small-sample biases (Robson and Whitlock 1964), Olesiuk et al (1990b) estimated that about 84% of harbour seals were counted during similar censuses in the Strait of Georgia. However, prelimi-

nary results from more recent studies into the haulout behaviour of harbour seals using time-depth recorders suggests that the proportion missed may actually be slightly greater. Assuming that 75% of animals were counted, the size of the harbour seal population in the area censused in 1992 (Alliford Bay to Goodwin Point excluding Burnably Island) is estimated to be about 1,940. This represents a mean density of about 2.7 seals per kilometre of shoreline. If it is assumed this density is representative of the entire Queen Charlotte Islands, which cannot be ascertained until censuses have been conducted to other regions, the total number of harbour seals currently inhabiting the Queen Charlotte Islands is provisionally estimated to be on the order of 10,000.

In summary, the 1992 censuses indicate that both Steller sea lion and Pacific harbour seal populations in the Queen Charlotte Islands have been recovering from management and commercial kills made prior to their being protected in 1970. Nevertheless, we recommend that aerial censuses be continued on a regular basis. In particular, coverage of harbour seal censuses needs to be expanded to other regions so that the validity of our total population estimates can be evaluated. Routine censuses should also be conducted for both species to monitor the status of populations, which can change abruptly. For example, Steller sea lion populations in Russian and Alaskan waters (with the exception of southeast Alaska) have inexplicably declined precipitously in recent years. Total abundance of Steller sea lions in the North Pacific is presently only about 39-48% of the levels observed in the 1950s, and the species is now considered to be threatened (Loughlin et al 1992). In 1988, harbour seal populations throughout much of Europe also experienced dramatic declines, in some regions by up to 50-60%, due to an epizootic of a distemper virus (Harwood 1990).

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Table 1. Steller sea lion counts for the Queen Charlotte Islands, 1-3 July, 1992. Sites are listed clockwise from Cape St. James. Codes for site type classifications are: R-rookery; Y-year-round haulout; W-major winter haulout (maximum \geq 100 animals); and w-minor winter haulout (maximum $<$ 100 animals). Parentheses indicate that the site was not censused.

Site Name:	Type:	Non-pups:	Pups:	Total:
Cape St. James	R	867	484	1,351
Anthony Island	Y	279	-	279
Negas Point	w	0	0	0
McLean Fraser Point	w	0	0	0
Wells Cove	w	0	0	0
S. Tasu Head	Y	80	-	80
N. Chads Point	w	0	0	0
Moresby Island	W	3	-	3
Marble Island	w	0	0	0
Cone Head	W	70	-	70
Hippa Island	W	0	0	0
Joseph Island	Y	327	-	327
Langara Island	W	(0)	(0)	(0)
Rose Spit	w	(0)	(0)	(0)
Sandspit	w	0	0	0
Skedans	W	0	0	0
Reef Island	Y	489	-	489
Ramsay Island	W	0	0	0
Scudder Point	w	0	0	0
TOTAL		2,115	484	2,599

Table 2. Comparison of the 1992 Steller sea lion count for the entire Queen Charlotte Islands with previous breeding-season censuses. In 1973, pups were counted at the Cape St. James rookery, but a complete non-pup count could not be obtained because all haulouts along the west coast were obscured by fog.

Date(s) of census: (Day/Month/Year)	<u>Queen Charlotte Islands</u>		
	Non-pups:	Pups:	Total:
01/07/92 - 03/07/92	2,115	484	2,599
01/07/87 - 02/07/87	2,123	369	2,492
30/06/82 - 30/06/82	1,265	404	1,669
29/06/77 - 29/06/77	1,548	303	1,851
03/07/73 - 03/07/73	-	272	-
30/06/71 - 30/06/71	1,335	337	1,672

Table 3. Summary of the harbour seal census flights attempted and conducted in 1992.

Date:	Time (PDT)		Area censused/comments:
	Start:	Finish:	
01/07/92	08:00	08:51	SW Graham Island; aborted due to fog.
02/07/92	-	-	No morning flying due to fog.
03/07/92	08:43	11:57	Good count; NE Moresby Island.
04/07/92	08:16	08:59	SE Moresby Island; aborted due to fog.
05/07/92	-	-	No morning flying due to fog.
30/07/92	06:55	08:35	Good count; NE Moresby Island.
01/08/92	08:05	10:30	Good count; SE Moresby Island.

Table 4. Comparison of 1992 and 1986 harbour seal counts for haulout sites on the east coast of Moresby. Sites are listed from north to south. The exact locations of the haulout sites are shown in Figures 3a and 3b.

Site Number and Name	1986	1992			Mean:
	22/07-23/07	03/07:	30/07:	01/08:	
417 Gillatt Island	0	15	-	-	15.0
296 Cumshewa Island	234	27	-	-	27.0
297 Kingui Island	77	156	-	-	156.0
418 Cumshewa Rocks	0	114	-	-	114.0
419 S Skedans Point Reef	0	19	-	-	19.0
298 Skedans Islands	15	59	-	-	59.0
420 Low Island	0	33	-	-	33.0
299 S Low Island	48	47	-	-	47.0
422 N Nelson Point	0	11	-	-	11.0
424 Sewell Inlet	0	16	-	-	16.0
421 Reef Island	0	51	-	-	51.0
423 SW Alfred Point	0	83	-	-	83.0
300 Proctor Rocks	13	13	-	-	13.0
425 Dwight Rock	0	51	-	-	51.0
432 Lost Islets	0	0	74	-	37.0
430 Flower Pot Island	0	0	30	-	15.0
302 Nob Rock	12	32	34	-	33.0
301 N Tanu Island	35	21	2	-	11.5
431 W Kunga Island	0	7	0	-	3.5
429 Tanu Pass Rock	0	14	0	-	7.0
433 Kul Rocks	0	0	23	-	11.5
303 SE Dog Island	35	71	88	-	79.5
308 N Shuttle Island	81	44	19	-	31.5
435 Tar Islands	0	37	47	76	53.3
428 E Shuttle Island Islets	0	85	51	-	68.0
427 Hoya Pass Rock	0	1	0	-	0.5
426 S Shuttle Island	0	22	0	-	11.0
434 Agglomerate/Kawas Islands	0	0	47	31	26.0
304 SE Murchison Island	33	14	-	0	7.0
307 Bischof Islands	14	-	0	0	0.0
436 W Ramsay Point Rock	0	22	-	79	50.5
305 SE Ramsay Island	30	75	-	0	37.5
306 Tatsung Rock	40	26	-	261	143.5
437 De la Beche Inlet	0	-	-	7	7.0
438 Hoskins Islets	0	-	-	16	16.0
309 SE Marco Island	41	-	-	37	37.0
310 W Wanderer Island	69	-	-	11	11.0
439 Skaat Harbour	0	-	-	68	68.0
312 E Copper Island	25	-	-	0	0.0
313 Joyce Rocks	67	-	-	0	0.0
TOTAL	869	1,166	415	586	1,460.8

Table 5. Comparison of the number of harbour seal counted on each of the flights conducted in 1992 with counts for the same area in 1986. Adjusted counts have been corrected for the estimated number of pups born subsequent to the census as described in Olesiuk et al. (1990b).

Census Date:	1992 Count		1986 Count		Annual Rate of Increase:
	Unadjusted:	Adjusted:	Unadjusted:	Adjusted:	
03/07/92	1,166	1,187.0	653	653.2	10.5%
30/07/92	415	415.0	177	177.2	15.2%
01/08/92	586	586.0	319	319.3	10.6%
TOTAL	1,461	1,481.3	873	873.4	9.2%

Figure 1. Map of the Queen Charlotte Islands showing the location of all known Steller sea lion breeding rookeries (★), year-round haulouts (●), major winter haulouts (○), and minor winter haulouts (◦).

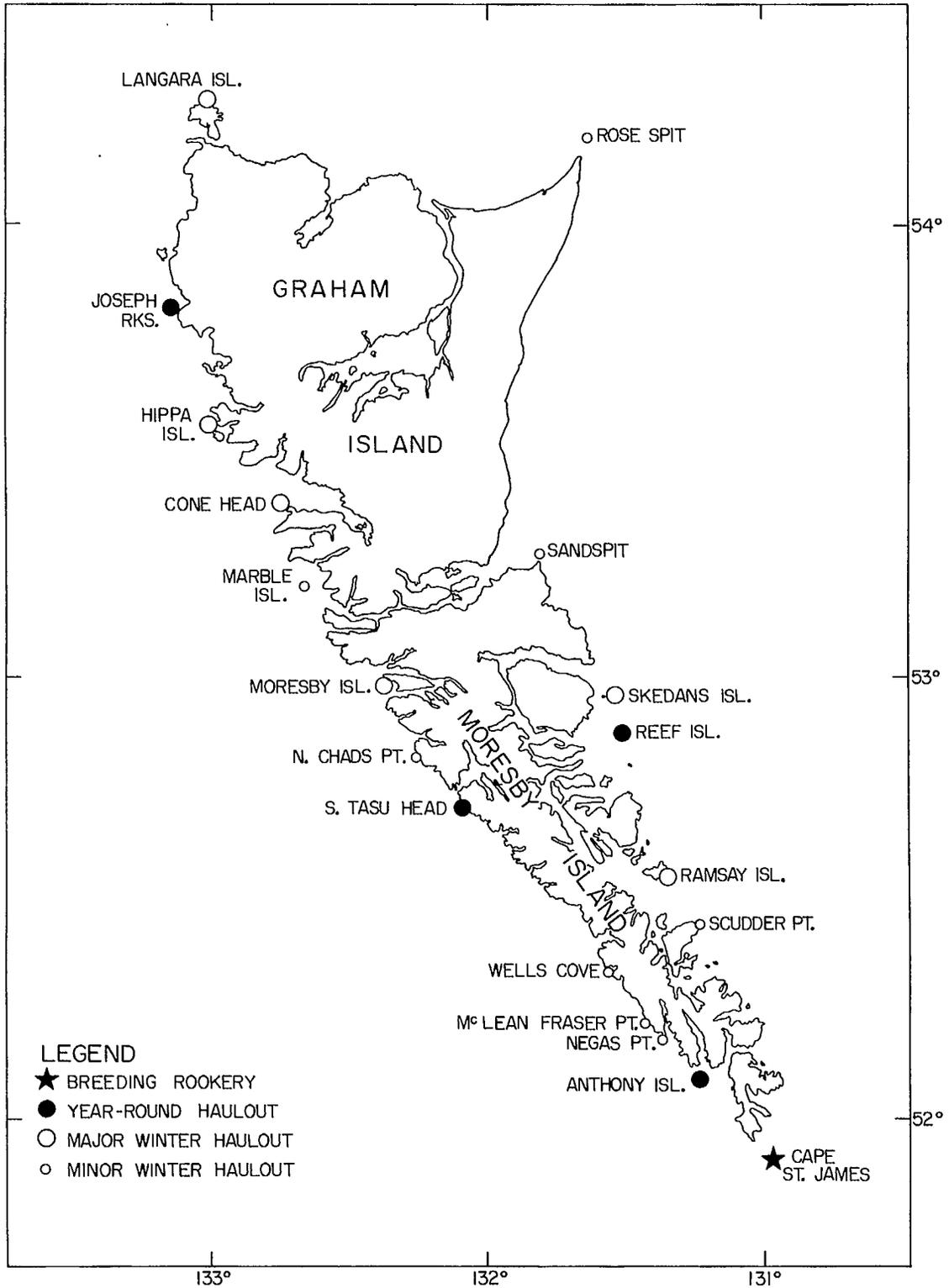


Figure 2. Trends in the abundance of Steller sea lions in the Queen Charlotte Islands, 1971-92. All censuses were conducted during 1 July \pm 2 days. Note that the number of animals is plotted on a logarithmic scale.

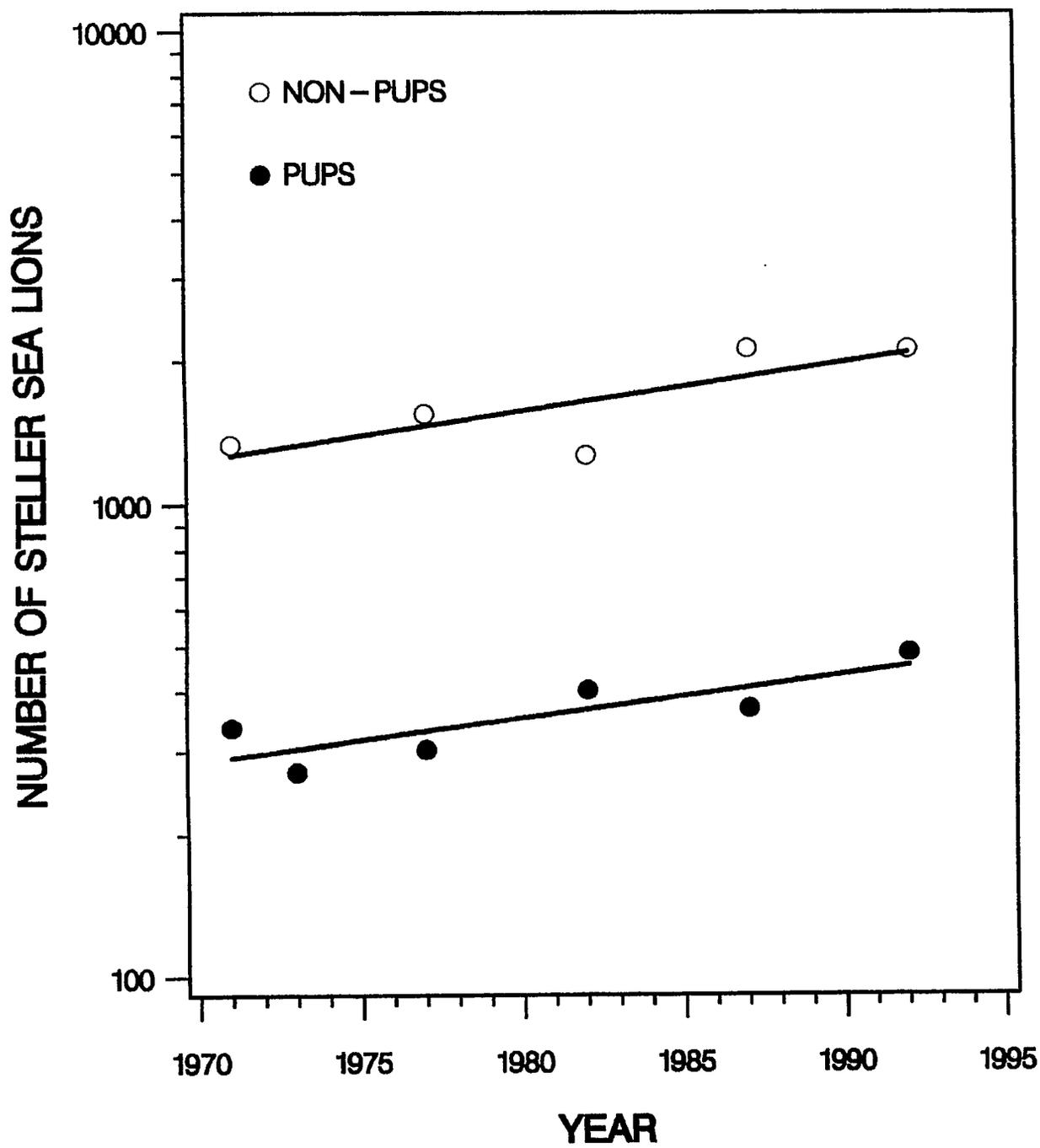


Figure 3a. Map of the northern portion of the east coast of Moresby Island showing the location of harbour seal haulouts (arrows) and the area covered during the 03/07/92 flight (which is continued onto Figure 3b). Haulout reference numbers correspond with those given in Table 4.

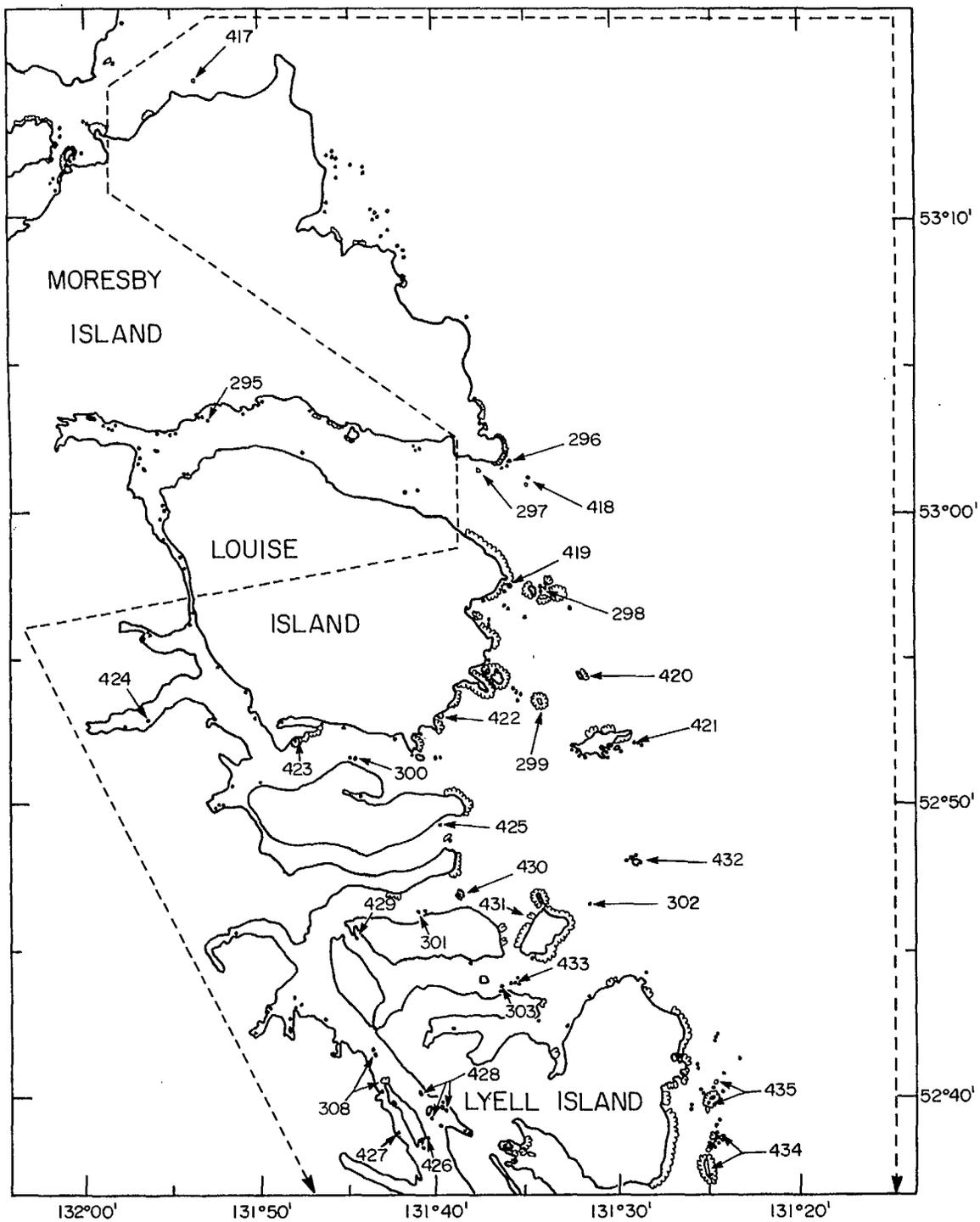


Figure 3b. Map of the southern portion of the east coast of Moresby Island showing the location of harbour seal haulouts (arrows) and areas covered during each census flight in 1992. Note that the area censused on 03/07/92 is continued from Figure 3a. Haulout reference numbers correspond with those given in Table 4.

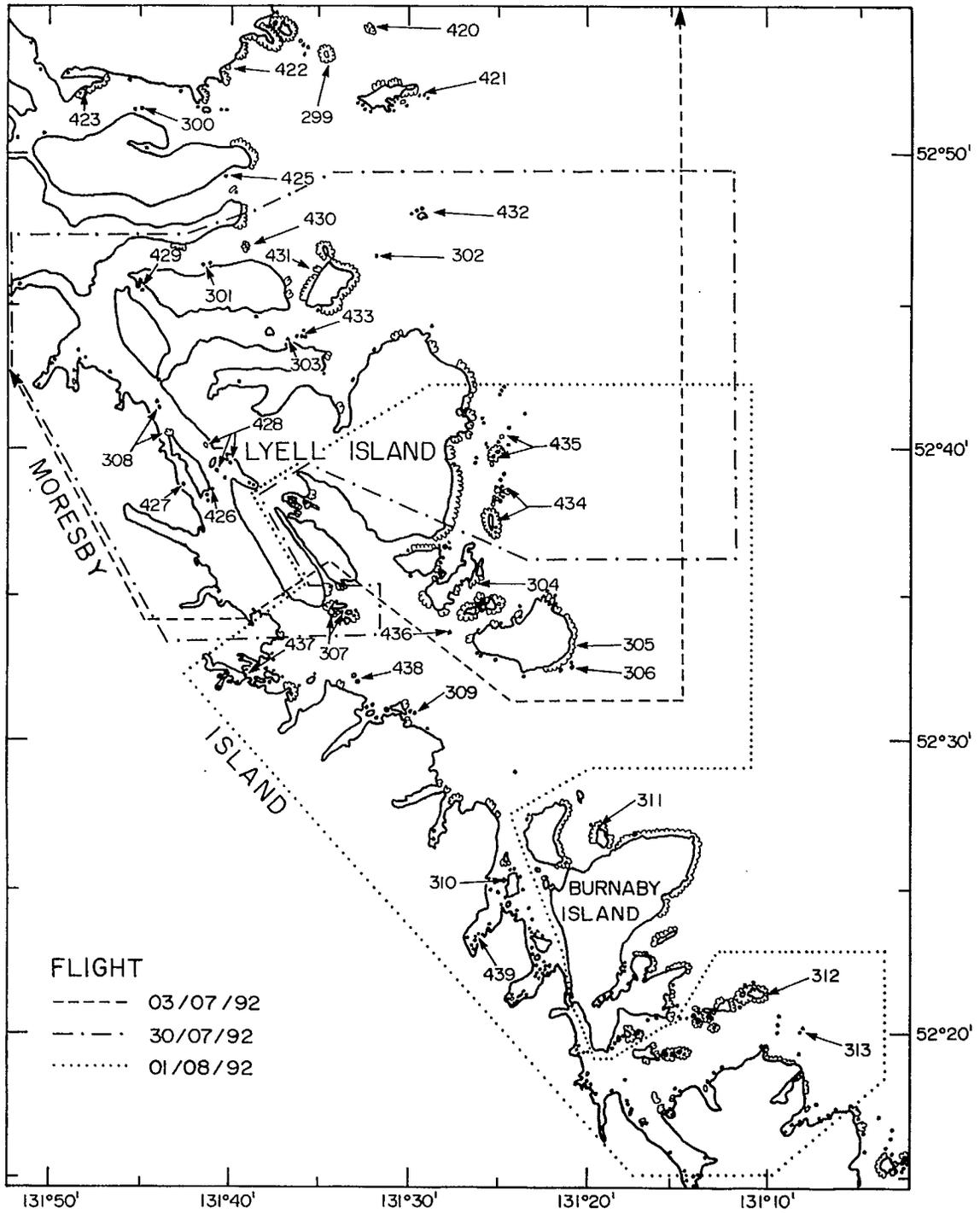


Figure 4. Comparison of harbour seal counts for the 3 areas censused on each flight in 1992 (thin lines) and for the total area censused in 1992 (thick line) with the numbers seen in the same areas in 1986. Note that the number of animals is plotted on a logarithmic scale.

