MOUNTAIN GOAT SURVEYS IN THE TATLATUI, SPATSIZI AND MT. EDZIZA PROVINCIAL PARK AREAS, BRITISH COLUMBIA JULY 1985

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ABSTRACT

Mountain goats were censused in all of Tatlatui Provincial Park, in four selected Wildlife Zones of Spatsizi Wilderness Park, and in Mt. Edziza Provincial Park and Recreation Area, during an intensive helicopter survey over a six day period in mid-July 1985. A total of 458 goats were observed and classified, including 127 in Tatlatui Park, 180 in the Spatsizi Zones and 151 in the Mt. Edziza survey areas. Those results are presented in relation to previous surveys and observations, and factors potentially affecting the counts are discussed. Data on incidental observations of other species including 227 Stone's Sheep and 230 caribou are also presented.

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1.0 INTRODUCTION

This is the final report on work conducted for the B.C. Ministry of Lands, Parks and Housing, Contract CONS1/8406, during summer 1985. Under the terms of that contract, intensive mountain goat surveys were undertaken in 11 specified wildlife zones in Spatsizi Plateau Wilderness Park and Tatlatui Provincial Park, and in the park and recreation area of Mount Edziza Provincial Park. The primary field work, consisting of 35.9 hours of helicopter surveys, was completed on 16 July, and an interim report summarizing preliminary findings was submitted on 18 July.

Following pages present detailed results and discussion of these helicopter surveys and a comparative survey by fixed-wing aircraft over a portion of the Spatsizi-Tatlatui study area.

2.0 OBJECTIVES

The primary objectives, as outlined by terms of reference in the contract, were to obtain total counts of mountain goats in the specified areas by helicopter observations of all suitable habitat in those areas, and to classify all goats seen to at least adult/kid categories. Contract terms also called for mapping of locations and more detailed goat sex and age composition counts whenever possible, and required that incidental sightings of other big game species be noted and mapped.

Spatsizi wildlife zones was provided by Bill Love, Ron Fleming and Bob Henderson of Love and Lee Outfitters. Keith Connors (Finlay River Outfitters) provided information for the Edozadelly and Brothers Zones, and Ray Collingwood (Collingwood Bros. Guide-Outfitters) for the Terraze and Cartmel Zones. Tom Britton, owner/pilot of Central Mountain Air Services Ltd., also shared some useful observations for various locations in the Tatlatui and Spatsizi areas. Unfortunately, none of the prospective contacts for the Mount Edziza Park area were available for interview during the pre-survey period.

Maps prepared during the interviews were used in-flight by the rear observer to keep the survey crew alerted to the presence of expected high potential areas, including mineral lick sites.

3.2 Helicopter Surveys

3.2.1 Flight Characteristics

A Bell 206 Jet Ranger helicopter (Okanagan Helicopters Ltd., Smithers, B.C.) equipped with "bubble" windows for rear observers, was employed for the bulk of the work reported here. Two observers, one front and one rear, were positioned on the port side of the aircraft, and the flight was generally directed in a counter-clockwise pattern around mountain blocks to orient that side next to most slopes to be observed. Occasionally, as dictated by terrain features, light conditions and/or wind, a clockwise pattern was required. Flight speed during surveys ranged from about 65 to 120 kph, depending upon terrain and cover characteristics, and averaged about 90 kph.

The forward observer served as the navigator, directing

the flight in a pattern judged most likely to fulfill objectives while mapping both flight path and observation locations. The navigator also kept a rough tally of observations as the work proceeded. As noted previously, the rear observer alerted the survey crew to high potential areas as determined in interviews. He also took primary responsibility for classification of animals to sex and age and recorded detailed information on that and other aspects of observations on a small tape recorder. The pilot (Tom Brooks, an experienced observer) assisted both in spotting and classifying animals. With the navigator, he surveyed terrain ahead of the aircraft and he was the primary spotter for opposite slopes and valley bottoms on the starboard side, i.e., usually away from the hillside being surveyed. As described in greater detail in Hatler and Hazelwood (1984), having a pilot who is a competent observer obviates the need for a second rear observer, thereby keeping the load lighter for better aircraft performance and safety.

Generally, a survey flight line proceeded horizontally along a contour selected locally, in flight, on the basis of professional judgement relating to "goat habitat". For rimrock areas at the edge of plateaus and relatively open slopes without cliffs, the best flight elevation seemed to be about 50-75 meters above ridgetop, and well out from the slope so that the rear observer, who has the greatest vertical observational range because of the bubble windows, has an unobstructed view downslope to about the 1500 meter level. A similar pattern proved sufficient for slopes with only a few scattered cliffs.

For slopes having series of bluffs and cliffs in tiers, it was usually necessary to fly two or more passes at different elevations. At such times it seemed most effective to begin

at a level along the scree slopes below the lowest level of cliffs. That contour was flown until the navigator observed a natural break, at which point the helicopter was directed up to the next locally appropriate level and the flight direction was reversed. This procedure was followed until that particular section of the slope had been covered. Working upward, from the lowest cliffs to the highest, is more demanding on machine and pilot, but seems to be biologically justified in that goats disturbed from below often move uphill, remaining visible, while those disturbed from above often take cover and may be missed.

Because the objective was to observe and count all goats present, some flexibility in flight characteristics was clearly required. For an unreplicated survey with no marked animals, the only measure of success available in the field under such an objective is an ad hoc feeling -- the observers merely searching a particular slope by the pattern that seems to be required until they are satisfied that the search is complete.

3.2.2 Classification of Mountain Goats

Once animals had been spotted, an attempt was made to classify each to sex and age. Total counts and counts of kids were usually attained from a higher elevation for larger groups (10+), and during the approach to classify smaller groups. An attempt was made to position the helicopter between the animals and their escape terrain, to prevent them from "clumping up" in caves and crevices. This was usually achieved by approaching from the escape terrain direction and heading the animals away and up the mountain slope. The best results were obtained when the helicopter could follow a group slowly and closely as they moved uphill.

Criteria for recognizing the individual sex and age classes and a review of literature on that subject were presented in detail by Hatler and Hazelwood (1984), following goat inventories in seven wildlife zones of Spatsizi Park. As described there, the most useful features for distinguishing the various classes were the extent of moult and relative body size. Horns are not conspicuous from the air and they were of little use in distinguishing sex, although they were occasionally helpful in establishing relative age, especially of younger animals.

The 1985 surveys were conducted less than 2 weeks earlier than those in 1984, 10-16 July versus 21-24 July, but there were significant differences in the stage of the moult cycle between the two years. The slightly earlier schedule in 1985 was based partly on an apprehension that the 1984 survey had been too late, allowing time for some adult females to moult to a stage where they might have been mistakenly identified in the non-parturient class. However, in retrospect, the 1984 timing was nearly ideal and that in 1985 was too early. As will be discussed in greater detail later, it is possible that those results reflect different winter and spring conditions and subsequent differential phenology rather than date of survey *per se*. The net result was that the animals were more difficult to classify in 1985. Appendix 1 lists criteria for distinguishing the various classes in 1984, and differences observed in 1985. In general, adult males, kids and yearlings were still easily recognized, but it was difficult to distinguish adult females from subadults of either sex, particularly in large groups. Consequently, the term "unclassified adults", appears more frequently in our 1985 results than in those for 1984. In most cases, the bulk of the animals in that class were

probably adult females.

3.3 Fixed-wing Comparison

In 1984 we found that during reconnaissance surveys by fixed-wing aircraft in two wildlife zones we made observations which increased survey totals for both zones, and that we actually found more animals with the fixed-wing than with the helicopter in one of them (Hatler and Hazelwood 1984). In our proposal for the 1985 contract, we offered an optional package which would provide another local comparison of fixed-wing and helicopter results over a part of the study area. The original intent was to apply up to 5 hours of fixed-wing time within a short time period of the helicopter work, but not necessarily in a preliminary (reconnaissance) fashion as in 1984.

Following the helicopter work it was decided to split the fixed-wing comparison into two periods. The first was to be as soon after the helicopter survey as possible, to provide a comparison similar to that in 1984, and the second in September to detect any changes in distribution which may have occurred over the summer. The late spring of 1985 and the large areas of vacant habitat observed during the surveys suggested that at least some animals might not yet have reached their summer-fall habitats at that time.

The first fixed-wing comparison flight was undertaken on 28 July, in a Cessna 180 piloted by Bob Henderson of Love and Lee Outfitters. The navigator and front observer was D. Hatler, while the rear observer was guide Bill Love. As with the 1984 reconnaissance flight, the general pattern was a high elevation (2100-2400 m) path following ridges so that observers could see both slopes and valley bottoms on one pass.

Breaks from that pattern, to more closely observe locations believed to have high potential, were made on several occasions. The flight covered known goat areas in the Thutade Zone, all of the Tatlatui and Kitchener Zones, and most of the Brothers Zone. Animals seen were counted, but no attempt was made to classify them.

The second fixed-wing survey, which will cover the same areas as the first, will be conducted in September, after this report has been submitted. Results for that flight will be submitted in a short addendum report.

4.0 RESULTS

4.1 General

Detailed flight reports for the helicopter surveys in all areas are assembled in chronological order in Appendices 2-4. Appendix 2 covers 10-14 July, during which time the southern Spatsizi and Tatlatui wildlife zones were surveyed. Appendix 3 presents results for 14-15 July in the Marion, Caribou Mountain, Cartmel and Brock Zones in the northern Spatsizi area, and Appendix 4 covers surveys in the Mount Edziza area, all on 15 and 16 July. Table 1 summarizes those results in terms of total numbers of the four ungulate species observed during the helicopter work in all three park areas. As shown, we tallied 438 mountain goats, 230 caribou, 227 sheep and 3 moose during the intensive 6 day survey period.

More detailed information on our sightings is provided in following pages. For mountain goats, a separate section complete with maps and tables, is given for each wildlife zone. Summary paragraphs include reference to results of previous surveys and/or incidental observations for those areas where they were available. Aspects of behavior,

including movements, are also noted where they seem pertinent to the subject of goat inventory. Separate sections are also provided for goat occurrence and composition summaries by survey blocks, and for comparison of the reconnaissance and helicopter results. Detailed data, including maps, for the incidental sightings of other species are also given, but with only minimal discussion.

4.2 Mountain Goat Observations: Numbers

4.2.1 Kitchener Wildlife Zone

As listed in Table 2 and depicted in Figure 1, only 20 goats were seen in this large unit. It appeared that habitat capability was much higher than that, since there were many apparently unoccupied areas having grassy slopes, escape terrain and mineral licks in close proximity. Bob Henderson, Ron Fleming and Bill Love (pers. comm.) noted that one group of 20 or more which used to occupy the ridge between Trygve and Kitchener Lakes has not been seen for two years; it is not known if they all died or simply moved away, but the latter seems less likely. The 20 seen included only 14 adults, of which only 1 was a male, and they were scattered widely throughout the zone, mostly on the park side of the height-of-land boundary. Possibly more animals move into the Kitchener Zone later in the summer.

Records from Parks Branch files (Smithers office) indicate that the highest past count in the zone was 34 on a partial survey by Hazelwood, K. Fujino and M. Warren in early August 1979. There have been two previous attempts at complete counts in the Kitchener Zone. During the period 22-24 July 1981, G. Jones and others did little better than our count, finding only 24 animals, although G. Jones and

Table 1. Total numbers of four ungulate species observed during mountain goat surveys in the Tatlatui, Spatsizi and Mount Edziza Provincial Park areas, British Columbia, July 1985.

Block[a]	Wildlife Zone	Mountain Goats	Stone's Sheep	Caribou	Moose
I	Kitchener	20	14	57	0
	Tatlatui	59	0	18	1
	Thutade	3	0	41	2
	Brothers	2	0	5	0
	Edozadelly b	0	0	19	0
	Terraze	107	5	34	0
ALL BLOCK I		191	19	174	3
II	Caribou Mtn.	9	0	0	0
	Marion	10	92	0	0
ALL BLOCK II		19	92	0	0
III	Cartmel	64	82	0	0
	Brock	20	0	0	0
ALL BLOCK III		84	82	0	0
IV	Edozadelly a	13	0	8	0
	Rognaas	0	0	44	0
ALL BLOCK IV		13	0	52	0
Edziza	Rec. Area	84	0	0	0
	N. Raspberry Pass	41	34	4	0
	S. Raspberry Pass	26	0	0	0
ALL EDZIZA		151	34	4	0
ALL AREAS		458	227	230	3

[a]Blocks of park wildlife zones as specified in Contract CONS1/8406.

K. Fujino counted 32 there on 23 September 1982. That higher count in the fall lends further credence to the speculation that local occurrence may be seasonal, peaking in late summer and/or fall.

4.2.2 Tatlatui Wildlife Zone

A total of 59 goats were tallied in this zone, and 15 were adult billies (Table 2). Most of the billies were on the west end of the area, near Hoy Lake and on cliffs facing south over Thutade Creek (Figure 1). Bob Henderson (pers. comm.) believes that many of those animals and possibly the nursery group found in the Hoy Lake area work out the ridges to the west, toward the upper Skeena, as the summer progresses. More than half of the goats observed (33/59 = 56%) were south of the height-of-land boundary, i.e., outside of the park. That included the largest nursery band found in the Tatlatui Park area, 26 animals at low elevation near a mineral lick pointed out earlier by Bill Love (pers. comm.). Both that group and the Hoy Lake nursery group (18) hid in escape cover before they could be closely observed and a high proportion of the adults were unclassified, although most were probably adult females.

The total for the Tatlatui Zone was higher than expected (B. Henderson, pers. comm.), thus possibly some of the animals observed on the July survey will move to other areas by fall. In two previous attempts at complete counts, G. Jones and others (Parks Branch files, Smithers) found 44 (22-24 July 1981) and 32 (23 September 1982). Interestingly, the sum of the Kitchener and Tatlatui counts in those two surveys was similar (24 at Kitchener and 44 at Tatlatui = 68 in 1981 and 32 + 32 = 64 in 1982). That result supports the possibility of summer movement between the two areas, although

Table 2. Sex and age composition[a] of mountain goats observedin the Kitchener, Tatlatui and Thutade Wildlife Zones, Tatlatui Provincial Park and Vicinity, British Columbia, July 1985.

Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Tatlatui										
Kitchener	13- 7	3	-	2	-	1	-	-	-	-
	13- 8	7	-	3	-	2	1	-	1	-
	13-11	2	-	1	-	1	-	-	-	-
	13-15	2	-	1	-	1	-	-	-	-
	13-16	1	1	-	-	-	-	-	-	-
	13-17	5	-	3	-	1	1	-	-	-
Totals:		20	1	10	0	6	2	0	1	0
Tatlatui	11- 3	2	2	-	-	-	-	-	-	-
	11- 6	18	-	-	11	6	-	-	-	1
	11- 7	1	1	-	-	-	-	-	-	-
	11- 8	1	1	-	-	-	-	-	-	-
	11- 9	4	4	-	-	-	-	-	-	-
	11-10	2	2	-	-	-	-	-	-	-
	11-11	3	3	-	-	-	-	-	-	-
	11-12	2	2	-	-	-	-	-	-	-
	11-14	25	-	-	12	8	3	-	-	2
	11-15	1	-	1	-	-	-	-	-	-
Totals:		59	15	1	23	14	3	0	0	3
Thutade	10- 4	1	-	1	-	-	-	-	-	-
	11- 7	1	-	1	-	-	-	-	-	-
	11- 8	1	-	1	-	-	-	-	-	-
Totals:		3	0	3	0	0	0	0	0	0

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

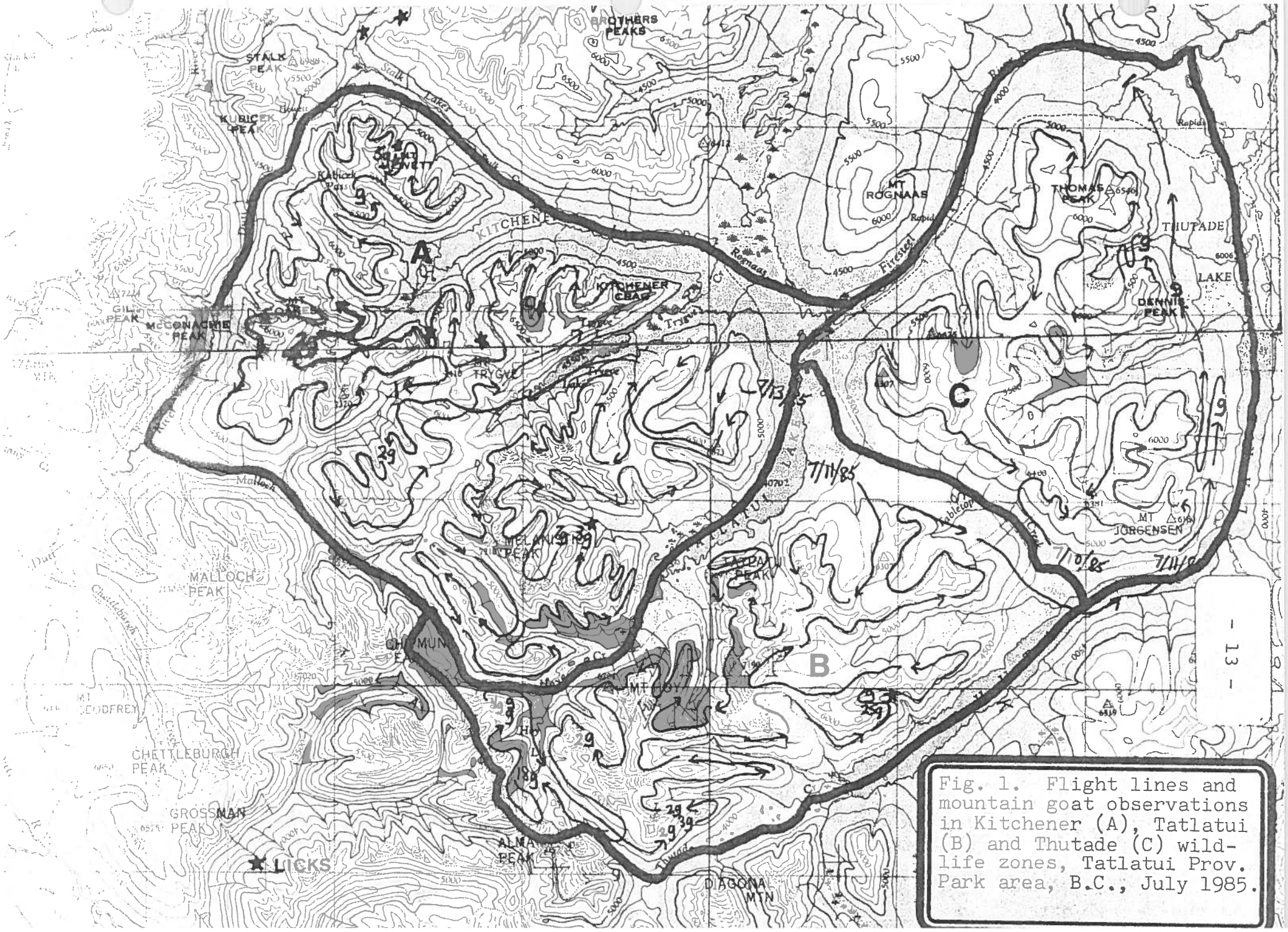

Fig. 1. Flight lines and mountain goat observations in Kitchener (A), Tatlatui (B) and Thutade (C) wildlife zones, Tatlatui Prov. Park area, B.C., July 1985.

it certainly does not prove it.

4.2.3 Thutade Wildlife Zone

This zone was first surveyed on the evening of 10 July, and only one goat was seen. Henderson, Fleming and Love (pers. comm.) confirmed that the usual locations for goats in that zone are on the cliffs, including those at low elevation, above the lake in the Mt. Jorgensen area, and the series of cliffs in the Dennis Peak area, and that they have seen up to 5-6 animals in both places in recent years, although not at the same time. We passed by both areas again, on the 11th, and found two more animals for a total of three in the zone, all single adult females. The Thutade Zone does not appear to be an important goat area, although the animals present there are of some interest in that they may be fairly isolated. Goats are rarely seen on the ridges just to the south of Tabletop Creek and no distinct trails across the wide Tabletop valley were evident. There are goat ranges east and south of Thutade Lake, and possibly movements to and from those areas occur on the ice, in winter.

4.2.4 Terraze Wildlife Zone

The largest goat total we found in any single zone in the Spatsizi-Tatlatui area was the 107 tallied in Terraze (Table 3). As shown in Figure 2, the largest number of groups was on the series of ridges south of Chapea Lake, and the largest group found in the entire Southern Spatsizi-Tatlatui area was 47 on Mt. Terraze itself. The total for that mountain, 51, was 10 fewer than were seen by Ray Collingwood (per. comm.) on about 21 July in 1984. No comparable counts for the rest of the zone were obtained in that year.

On the two previous attempted total counts of the

Terraze Zone (July 1981 and September 1982), substantially fewer goats were tallied than on our 1985 count (37 and 60, respectively -- Parks Branch files, Smithers). However, there are some higher counts than those from past observations in only portions of the area. For example, Osmond-Jones et. al. (1977) reported an observation of 92 animals on Mt. Terraze alone sometime in summer 1976.

Of the 107 goats seen in the Terraze Zone in 1985, all but 12 (89%) were within park boundaries. Table 2 provides separate listings and subtotals for areas east and west of the Duti River, on the thought that those to the east might have affinities more to Tatlatui Park while those to the west might be referable more to Spatsizi Park. The percentage split between the two areas was 40 and 60 for east and west, respectively.

4.2.5 Rognaas Zone

In about fall 1982, Ron Fleming (pers. comm.) observed two goats, which he believed were young billies, as they moved north along the spine of the Rognaas Unit from about Mt. Rognaas proper. No other goat observations are known from that Zone, and we saw none on this survey (Table 4, Figure 2).

4.2.6 Brothers Zone

Two adult billies, seen together near Brothers Peak, were the only goats observed in this Zone (Table 4, Figure 2). They were seen on 11 July, but a quick search of that area during a fuel ferry trip on the 13th failed to relocate them and it was believed they had moved on. K. Connors (pers. comm.) occasionally finds goats in that area, but indicated that occurrence is not consistent. A mineral lick on the

Table 3. Sex and age composition[a] of mountain goats observed in the Terraze Wildlife Zone, Spatsizi Plateau Wilderness Park, British Columbia, July 1985.

Park / Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Spatsizi										
Terraze										
East of Duti River	13- 1	1	1	-	-	-	-	-	-	-
	13- 4	2	-	1	-	1	-	-	-	-
	13- 5	1	1	-	-	-	-	-	-	-
	13- 7	5	-	3	-	2	-	-	-	-
	13- 8	8	-	5	-	3	-	-	-	-
	13- 9	13	-	4	3	4	2	-	-	-
	13-10	1	-	1	-	-	-	-	-	-
	13-11	6	-	3	-	1	1	-	-	1
	13-12	6	-	3	-	3	-	-	-	-
Subtotal:		43	2	20	3	14	3	0	0	1
West of Duti River	14-13	2	2	-	-	-	-	-	-	-
	14-14	4	-	2	-	1	-	-	1	-
	14-15	2	-	1	-	1	-	-	-	-
	14-17	1	1	-	-	-	-	-	-	-
	14-18	2	-	1	-	1	-	-	-	-
	14-19	2	2	-	-	-	-	-	-	-
	14-21	47	-	13	20	11	2	1	-	-
	14-22	4	-	2	-	1	1	-	-	-
Subtotal:		64	5	19	20	15	3	1	1	0
Terraze Totals:		107	7	39	23	29	6	1	1	1

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

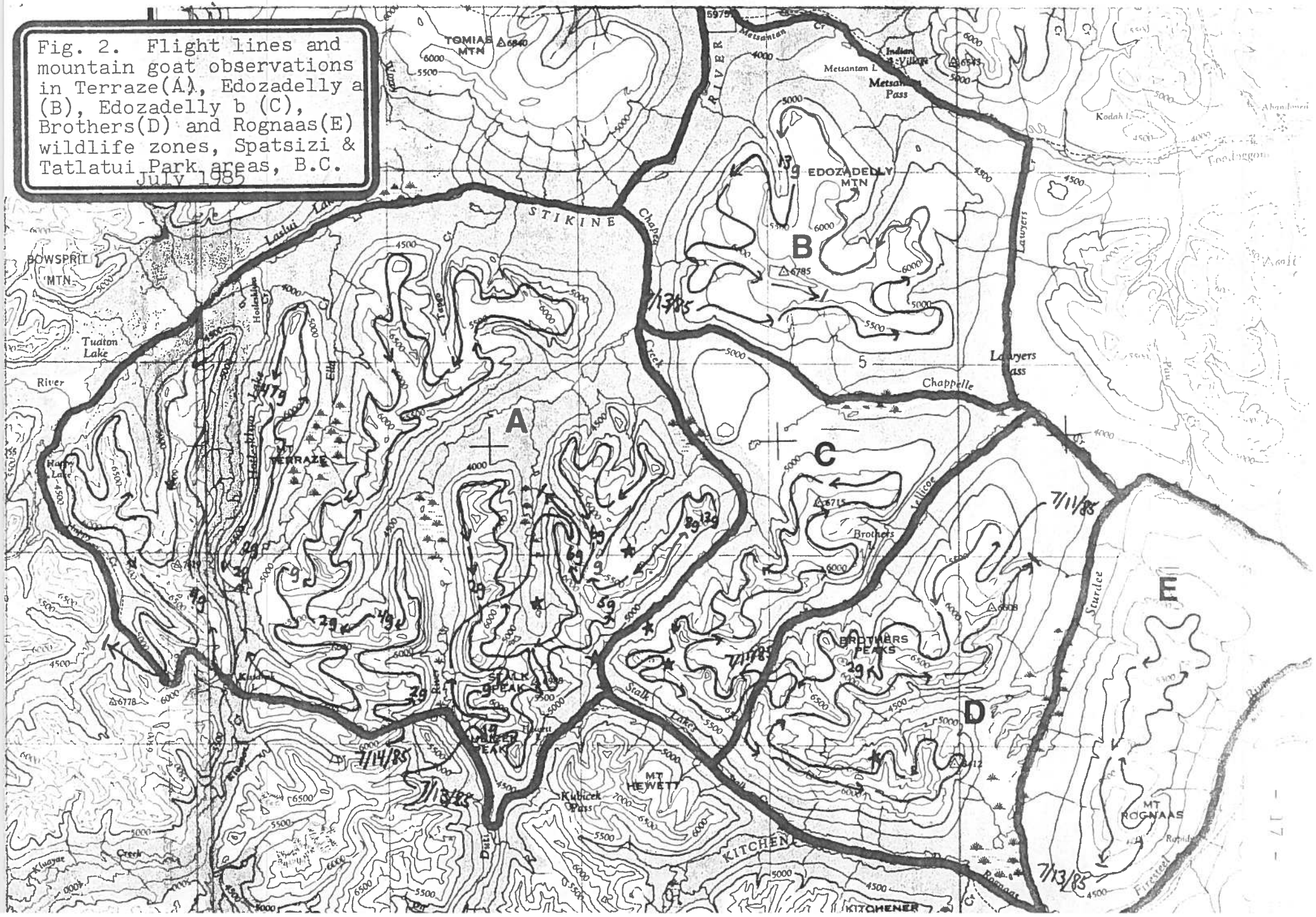

Fig. 2. Flight lines and mountain goat observations in Terraze(A), Edozadelly a (B), Edozadelly b (C), Brothers(D) and Rognaas(E) wildlife zones, Spatsizi & Tatlatui Park areas, B.C. July 1985

north side of the southernmost ridge was pointed out by Bill Love (pers. comm.), but that area was still snowbound at survey time.

As listed in Parks Branch files (Smithers), this zone and the Edozadelly b Zone were surveyed by Jones and others in attempted complete surveys of the Tatlatui area in July 1981 and in September 1982. The results for the two zones, listed together, included 26 goats (apparently all outside of park boundaries) in 1981 and 15 (all but one outside) in 1982. The total for the two zones in our 1985 survey was 2, the billies described above. It is possible that a local decline has occurred, but it seems more likely that the late spring and residual snow had simply resulted in retarding movements from elsewhere (probably the Terraze Zone).

4.2.7 Edozadelly b Zone

We saw no goats (Table 4, Figure 2), but Fleming and Love (pers. comm.) pointed out three mineral licks in the vicinity of the north end of Upper Stalk Lake and noted that they often see goats at those locations. Trails to those licks were evident, but it did not appear that animals other than caribou had yet used them in summer 1985. As noted in the Brothers section, above, there were still expanses of snow in those areas.

4.2.8 Edozadelly a Zone

The single sighting in this zone involved 13 goats essentially together on the east rim of the northernmost canyon (Figure 2). That constitutes the largest total found on this zone in any single count. The previous high was 11, seen on the opposite side of the same canyon on a caribou survey on

Table 4. Sex and age composition[a] of mountain goats observed in the Rognaas, Brothers and Edozadelly a and b Wildlife Zones, Tatlatui and Spatsizi Provincial Park areas, British Columbia, July 1985.

Park / Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Tatlatui										
Rognaas	No mountain goats observed.									
Brothers	11- 3	2	2	-	-	-	-	-	-	-
Totals:		2	2	0	0	0	0	0	0	0
Spatsizi										
Edozadelly b	No mountain goats observed.									
Edozadelly a	13- 1	13	1	6	-	3	2	1	-	-
Totals:		13	1	6	0	3	2	1	0	0

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

9 October 1984 (Jones 1984).

As listed in Table 4, the group of 13 included an adult male and a young male, which were together and were near but not in the group until the disturbance of the helicopter moved them all upslope. It appears that those animals constitute the entire population of the rather isolated Edozadelly a Zone.

4.2.9 Caribou Mountain Zone

This and the following zone were resurveyed in 1985, after what we thought were unrepresentative counts in the previous survey (Hatler and Hazelwood 1984). As described in that report, there are three known locations of goat occurrence in the Caribou Mountain Zone, of which the most regularly used appears to be the slopes and escarpment at the southwest end of Rainbow Mountain. Previous records available to us included "up to 8" reported by a pilot in 1975 (Carswell 1975), 7 animals on 15 September 1976 (Osmond-Jones et al. 1977), 9 seen on 13 July 1978 by Haber (1979), and 9 again in March 1983 (Jones 1983). Ray Collingwood (pers. comm.) reported that he has seen up to 13 animals in that location, and gave 9-13 as an "expected" range. In the 1984 surveys we covered that area thoroughly once and observed it in passing about twice a day for 4 days, and we saw no goats there, and only 1, a male, in the zone as a whole (Hatler and Hazelwood 1984).

As listed in Table 5, the count on the present survey was again 9, a result suggesting that the local population has changed little during at least the past decade. As was the case on Edozadelly Mountain (Section 4.2.8), all of the animals seen in the entire zone were in one location, a draw on the

Mink Creek side of the mountain (Figure 3). That included an adult billy about 200 m from the main group. All were moving uphill not far above the timber (1750 m) when first seen, and they may have been in the process of either crossing the Mink Creek Valley from the west or returning from some as yet unknown lowland mineral lick in the area.

4.2.10 Marion Zone

As described in Hatler and Hazelwood (1984), there are two primary areas of goat occurrence in the zone:

1) the Marion Creek bluffs, on which we have records of up to 15 animals (16 August 1976, Osmond-Jones et al. 1977). In recent years, the highest counts, made incidentally to caribou tracking flights have been 6 in October 1981 and 7+ in November 1982, but we saw only 2 there in July 1984 (Hatler and Hazelwood 1984).

2) the ridge above Hyland Post also harbours a few goats, especially the east end. Most records are in the 6-8 range, but Jones (1983) counted 19, all apparently along the east end of the ridge, in March 1983. Our counts in 1984 were 2 on the Marion Creek bluffs and 8 on Hyland Post Ridge. The total of 10 included 1 adult male and 3 kids.

In 1985, we again counted 10 goats in the Marion Zone, 4 at Marion Creek (seen both on the official survey on 14 July and on a caribou tracking flight on 26 July) and 6 on Hyland Post Ridge. The total included 4 yearlings, suggesting that at least one nanny-kid group was missed in 1984. There were no adult males or kids, thus if the count is accurate and the animals on the east end of the Spatsizi Plateau are as isolated

Table 5. Sex and age composition[a] of mountain goats observed in the Caribou Mountain and Marion Wildlife Zones, Spatsizi Plateau Wilderness Park, British Columbia, July 1985.

Park / Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Spatsizi										
Caribou Mountain	14-1	9	1	5	-	2	1	-	-	-
Total:		9	1	5	0	2	1	0	0	0
Marion	14- 1	6	-	3	-	-	2	-	1	-
	14-11	1	-	1	-	-	-	-	-	-
	14-12	3	-	1	-	-	2	-	-	-
Total:		10	0	5	0	0	4	0	1	0

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

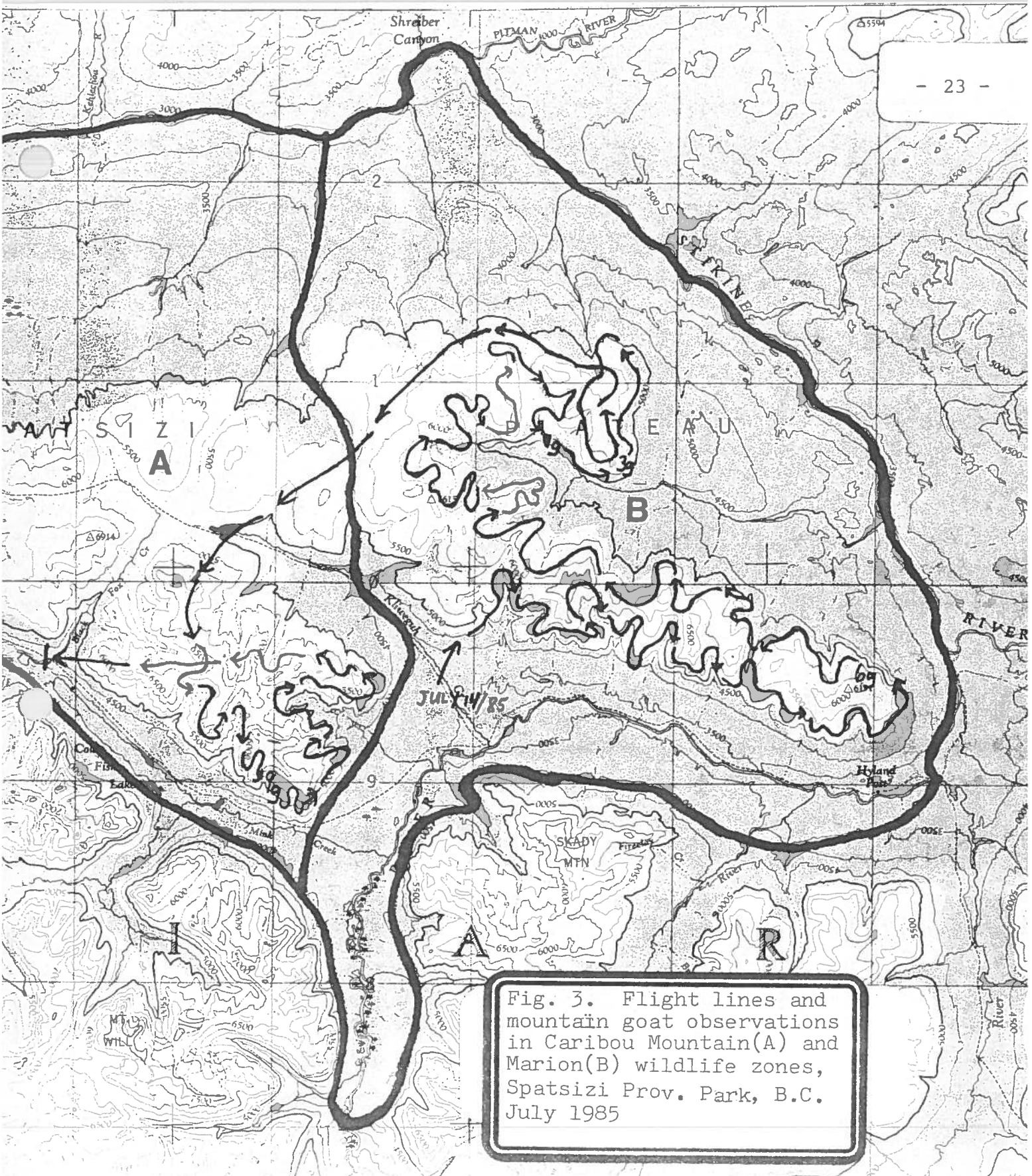

Fig. 3. Flight lines and mountain goat observations in Caribou Mountain(A) and Marion(B) wildlife zones, Spatsizi Prov. Park, B.C. July 1985

as they seem, the Marion group may be in trouble.

4.2.11 Cartmel Zone

A total of 64 goats were observed in the Cartmel Zone, with nursery groups clustered on the escarpments at the southwest end of the Cartmel Mountain block and billies scattered in ones and twos over the rest of the area (Table 6, Figure 4). As noted in the account for the Brock Zone (4.2.12), 15 of the goats seen there might actually be attributable to the Cartmel Zone in other seasons. Most previous surveys in the area have been either in winter, when goats are difficult to see or have covered only portions of the area, and throughout the 70's most counts were in the 20-35 range. Osmond-Jones et al. (1977) accounted for "at least 45" in that zone as a result of observations in 1976. The highest official count in the area appears to be that made by D. Blower and A. Stewart (Ministry of Environment, Victoria) on 23 September 1983. They attempted a complete survey of the zone and found 91 goats, but estimated that they had still missed 20% of those actually present. The rationale for that estimate is not known.

4.2.12 Mt. Brock Zone

Although it was not required in the contract, we knew that goats occur in that zone and that it remained the only unsurveyed unit in the Spatsizi Park area during our 1984 and 1985 surveys. Consequently, with fuel remaining after the Cartmel surveys we ran a quick partial survey of that area. The total of 20 animals we saw (Table 6, Figure 4) is apparently the highest recorded for the zone, although Hazelwood, W. MacGregor and D. Spalding reportedly saw 18 there in late September 1976 (Parks Branch files, Smithers).

Table 6. Sex and age composition[a] of mountain goats observed in the Cartmel and Brock Wildlife Zones, Spatsizi Plateau Wilderness Park, British Columbia, July 1985.

Park / Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Spatsizi										
Cartmel	15- 3	1	1	-	-	-	-	-	-	-
	15- 4	2	-	1	-	1	-	-	-	-
	15- 4a	1	1	-	-	-	-	-	-	-
	15- 5	5	-	3	-	1	-	1	-	-
	14- 7	7	-	4	-	2	1	-	-	-
	15- 8	13	-	8	-	3	2	-	-	-
	15- 9	1	1	-	-	-	-	-	-	-
	15-10	1	-	1	-	-	-	-	-	-
	15-11	1	1	-	-	-	-	-	-	-
	15-13	25	-	11	3	8	2	-	-	-
	15-14	1	1	-	-	-	-	-	-	-
	15-19	1	1	-	-	-	-	-	-	-
	15-24	2	2	-	-	-	-	-	-	-
	15-25	1	1	-	-	-	-	-	-	-
	15-26	2	-	1	-	1	-	-	-	-
Total:		64	9	30	3	16	5	1	0	0
Brock	15- 1	14	1	10	2	1	-	-	-	-
	15- 2	1	-	1	-	-	-	-	-	-
	15- 3	1	1	-	-	-	-	-	-	-
	15- 4	3	3	-	-	-	-	-	-	-
	15- 5	1	1	-	-	-	-	-	-	-
Total:		20	6	11	2	1	0	0	0	0

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

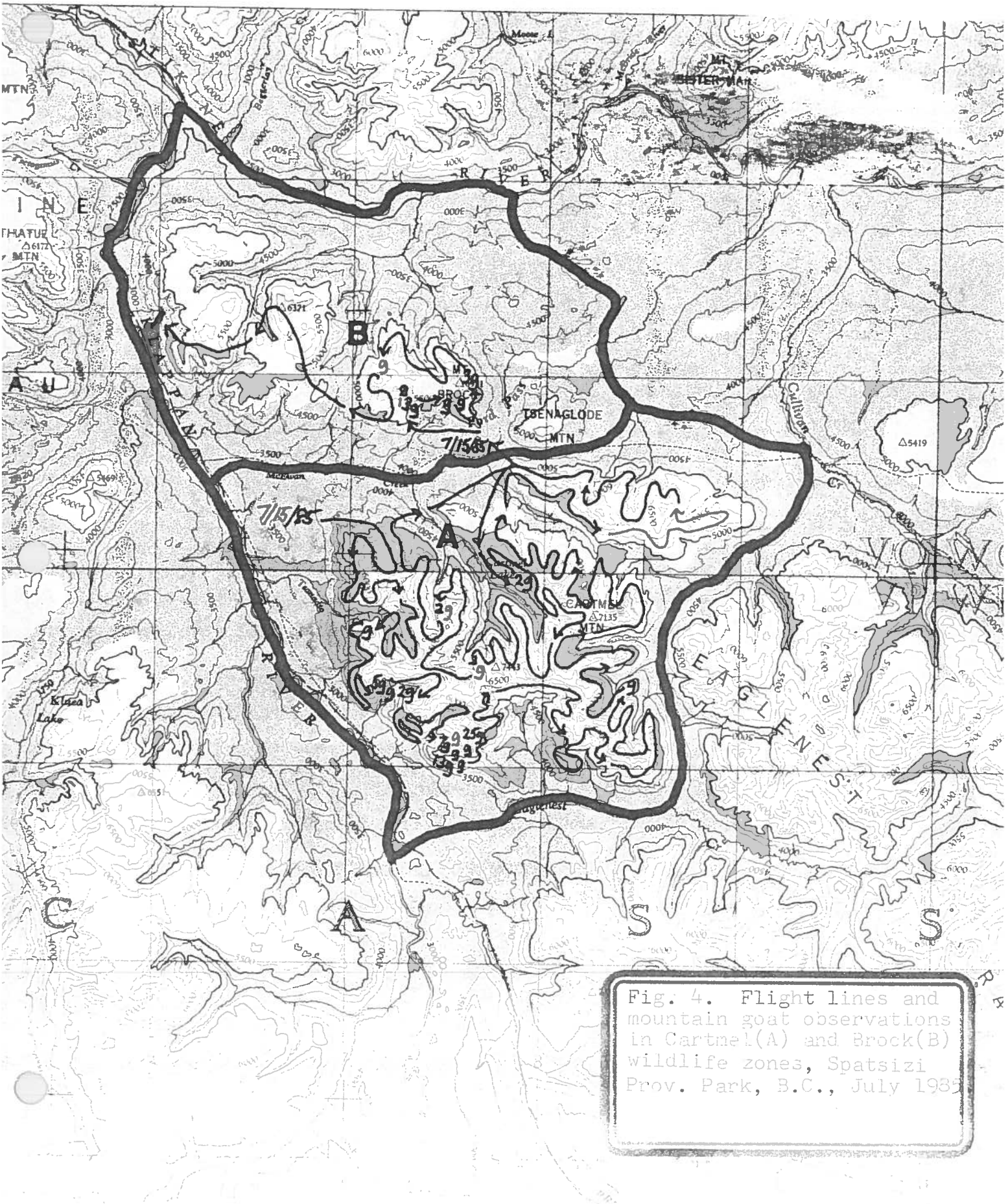

Fig. 4. Flight lines and mountain goat observations in Cartmel(A) and Brock(B) wildlife zones, Spatsizi Prov. Park, B.C., July 1985

In regard to the Brock occurrences, the linear mountain range on the northern edge of the Cartmel Zone has the nearest known goat range. Past incidental sightings in that area include 14 goats in late October 1980 and 8 in mid-March 1984 (Hatler files) and 12 in mid-July 1978 (Haber 1979). During the 1985 surveys we found no goats on the un-named mountain. It seems likely that most of those seen on Brock had come from the Cartmel Zone, and that may be a common seasonal occurrence, with the Brock Zone serving as a primary summer range in most or only some years. Hatler has occasionally seen 1 or 2 billies on Mt. Brock during winter caribou radio-tracking flights, but has never seen sign of goat groups there during that season. Thus up to 15+ of the animals seen there in July 1985 were probably in the Cartmel Zone in other seasons.

4.2.13 Mt. Edziza Provincial Park and Recreation Area

Our total count of 151 is just 1 animal higher than the previous high count of 150, made by Hazelwood in 1975. However, the area of coverage was much greater this time. The 1975 survey was limited to the park itself, which was covered more intensively than in 1985 because there were more snow-free areas then. The residual snowpack above 1675 m in July 1985 was extreme, especially on north-facing slopes and throughout the Spectrum Range. As listed in Table 7 and mapped in Figure 5, only 67 (44%) of the goats seen on the 1985 survey were within park boundaries. An additional 28 (19%) were within the Recreation Area, but 56 (the remaining 37%) were outside the boundaries of both, on the ridge north of Ball Creek at the southwest end of the survey area. That ridge, with an additional 12 animals inside the Recreation Area portion, was the most densely populated area of its size in all of the 1985 survey area.

The great difference in within park goat numbers on the 1975 and 1985 surveys requires some discussion. Local outfitter Bruce Creyke told Hatler in an informal discussion (pers. comm.) in about 1982 that he believed there had been heavy wolf predation in both goats and sheep in both the Edziza and Klappan Range (Todagin) areas. There is therefore a possibility that the observed difference is real, reflecting a declining population. However, it is also possible that the apparently deep snow and cold spring conditions previous to the 1985 surveys had affected animal distribution, keeping many at lower elevations in the Recreation Area, especially in areas to the west. The relative absence of sightings on the east side of the main Edziza massif is suggestive in that regard. It should also be noted that some of the goats we observed on the west were on exposed bluffs below timberline. There are many such areas flanking nearly every draw and canyon from the park's western boundary, and it would have been easy to miss animals in those areas, especially those seeking shade during the heat of the day. Daytime temperatures on the two survey days, 15 and 16 July, exceeded 25^{o}C.

We saw no goats in the canyons of the Klastline and Stikine Rivers, or along Mess Creek, during our surveys. The pilot, T. Brooks has flown that area on several occasions during monthly flights to check weather stations for B.C. Hydro dam feasibility studies. He reported (pers. comm.) that he had never seen goats along the Stikine between the mouth of the Klastline and the mouth of Mess Creek, although he had seen small numbers (no more than 3) in the Mess Creek canyon. In confirmation of those observations, in a map showing generalized regional abundance of mountain goats in the lower

Table 7 (continued)

Park / Wildlife Zone	Ident. No.[b]	Group Size	Adult Males	Adult Females	Uncl. Adults	Young	Yrlgs.	Subadults M	Subadults F	Subadults Uncl.
Mount Edziza										
Park (South of Raspberry Pass)	16-21	5	-	2	-	-	3	-	-	-
	16-22	7	-	5	-	1	1	-	-	-
	16-23	1	1	-	-	-	-	-	-	-
	16-24	4	-	4	-	-	-	-	-	-
	16-25	2	2	-	-	-	-	-	-	-
	16-26	2	-	1	-	1	-	-	-	-
	16-27	2	1	-	1	-	-	-	-	-
	16-37	3	1	1	-	1	-	-	-	-
Subtotal:		26	5	13	1	3	4	0	0	0
Recreation Area		84	9	37	15	17	6	0	0	0
North of Raspberry Pass		41	8	20	0	8	2	1	0	2
South of Raspberry Pass		26	5	13	1	3	4	0	0	0
Edziza Total		151	22	70	16	28	12	1	0	2

[a] See Appendix 1 for classification criteria.

[b] Ident. no. = date-observation number, e.g., 13-15 is 13 July, observation number 15 for the area in question, as listed in the flight transcript reports, Appendices 2-4.

Fig. 5. Flight lines and mountain goat observations in Mount Edziza Prov. Park and Recreation Area, B.C., July 1985

Stikine area, Foster and Rahs (1981) indicated no significant occurrence along the Stikine in that area, with a small area designated "uncommon" along Mess Creek. On a scale of high, moderate and low use by goats, they indicated moderate for a small area less than 1 km up both the Stikine and Klastline Rivers at their confluence.

4.2.14 Total Numbers: Summary

Foregoing sections present survey results on a zone or local area basis. Following are brief summaries in terms of groups of zones, as specified in the contract terms of reference:

Block 1 - Block 1 is composed of 6 zones, each of which contains a portion of Tatlatui Provincial Park and adjacent alpine areas outside the height-of-land boundaries. The total of 191 is higher than all past official counts in the area, but that is due largely to the large total (64) in the Spatsizi Park portion of the Terraze Zone. The July 1981 and September 1983 inventories, conducted by G. Jones and others (Parks Branch files) were attempted total counts for those zones, but they apparently did not include the west Terraze area. Subtracting our observations for that area, our comparable Tatlatui Park total is 127. That total is less than, but close to those of the two previous total surveys (1981 - 131, 1983 - 139), thus that order-of-magnitude appears to be a reasonable approximation to the summer population in the area.

Block 2 - The total of 19 for the Caribou Mountain and Marion Zones is 73% higher than the 11 observed in those two zones in 1984, but as indicated in the separate sections for each, is still less than expected on the basis of past observations.

Block 3 - The total of 64 in the Cartmel Zone is less than was seen on a recent fall survey (91 in late September 1982, see Section 4.2.11), but we have speculated that many of the 20 animals which we saw in the Brock Zone might have been in the Cartmel Zone in other seasons, thus making the current result comparable to that obtained in 1982.

Block 4 - Results for Edozadelly Mountain (13 animals) and Mt. Rognaas (0) were summarized and/or implied in the separate accounts for each. The apparently isolated population in the former appears to have been growing slowly over the past few years. There is no significant goat habitat on Mt. Rognaas, and occurrence there is rare, involving only transient animals.

Mt. Edziza Provincial Park and vicinity - As summarized in Section 4.2.13, the 151 animals tallied on our survey is 1 more than the previous high in the area, but only because a larger area was covered. The number seen in the area of comparable coverage, 67, is less than half that found on a survey a decade earlier.

4.3 Mountain Goat Observations: Sex and Age Composition

As described under methods (Section 3.2.2, Appendix 1), incomplete moult patterns made recognition of some classes of goats difficult during the 1985 surveys. We feel confident that adult males and kids were correctly identified and all were accounted for in all sightings. Yearlings were also relatively easy to identify, although in some large groups which reached escape terrain before we had a chance to closely observe all individuals, some yearlings might have been missed. As recorded in Appendices 2-4, that possibility is particularly applicable to observations No.'s 6 and 14 in the Tatlatui Zone,

No. 21 in the Terraze Zone, No. 13 in the Cartmel Zone and No. 47 in the Mount Edziza area. That is, the "Unclassified Adults" columns for those observations in Table 2, 3, 6 and 7 may have included some yearlings. However, as indicated in Section 3.2.2, most of the unclassified adults were probably subadults and adult females, which were difficult to distinguish from still unmoulted subadults of either sex.

Table 8 presents numbers and percentages of recognizable classes of goats among our observations, listed by wildlife zones or portions of zones, and summarized by appropriate groupings of those units. Following are general findings in comparison with results from our 1984 surveys in Spatsizi Park, the comparable Tatlatui Park survey in July 1981 and applicable generalizations from Chadwick (1983). Calculations of ratios on the basis of 100 adult females was impeded by the fact that in some areas many adult females were undistinguishable from unmoulted subadults, and the two classes were lumped together as "unclassified adults". Appendix 5 presents a rationale and procedure for estimating the base number of females from the unclassified adults columns of Table 8, and Table 9 lists pertinent ratios based on those estimations.

4.3.1 Adult Males

As listed in Table 8, this class does not include males known to have been subadults. The overall mean of 14% in the Spatsizi-Tatlatui area and 15% in the Edziza totals is somewhat higher than that obtained last year (11.5%). The highest incidence of adult males was in the Tatlatui Zone (25%), mostly in the Hoy Lake-Thutade Creek Headwaters area, and on Mt. Brock (30%). In terms of males per 100 adult females as listed in Table 9, the overall ratio (30.0) was only slightly higher than the mean (28.7) for 538 observations in Spatsizi Park

Table 8. Sex and age composition[a] of mountain goats observed during helicopter surveys in the Spatsizi, Tatlatui and Mount Edziza Provincial Park areas, British Columbia, July 1985.

Locations[b]	N	Adult Males No.(%)	Adult Fmles. No.(%)	Unclass. Adults No. (%)	Young No.(%)	Yearlings No. (%)	Subadults Males No.(%)	Subadults Fmles. No.(%)	Subadults Unclass. No.(%)
Block 1									
Kitchener	20	1(5)	10(50)	0 (0)	6(30)	2(10)	0(0)	1(5)	0(0)
Tatlatui	59	15(25)	1(2)	23 (39)	14(24)	3(5)	0(0)	0(0)	3(5)
Thutade	3	0(0)	3(100)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)
Terraze E	43	2(5)	20(47)	3 (7)	14(33)	3(7)	0(0)	0(0)	1(2)
Terraze W	64	5(8)	19(30)	20 (31)	15(23)	3(5)	1(2)	1(2)	0(0)
Brothers	2	2(100)	0(0)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)
Edozadelly b	0	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)
	191	25(13)	53(28)	46 (24)	49(26)	11(6)	1(1)	2(1)	4(2)
Block 4									
Edozadelly a	13	1(8)	6(46)	0 (0)	3(23)	2(15)	1(8)	0(0)	0(0)
Rognaas	0	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)
	13	1(8)	6(46)	0 (0)	3(23)	2(15)	1(8)	0(0)	0(0)
Block 2									
Caribou Mtn.	9	1(11)	5(56)	0 (0)	2(22)	1(11)	0(0)	0(0)	0(0)
Marion	10	0(0)	5(50)	0 (0)	0(0)	4(40)	0(0)	1(10)	0(0)
	19	1(5)	10(53)	0 (0)	2(11)	5(26)	0(0)	1(5)	0(0)
Block 3									
Cartmel	64	9(14)	30(47)	3 (5)	16(25)	5(8)	1(2)	0(0)	0(0)
Brock	20	6(30)	11(55)	2 (10)	1(5)	0(0)	0(0)	0(0)	0(0)
	84	15(18)	41(49)	5 (6)	17(20)	5(6)	1(1)	0(0)	0(0)
Edziza									
Rec. Area	84	9(11)	37(44)	15 (18)	17(20)	6(7)	0(0)	0(0)	0(0)
N. of Rasp.	41	8(20)	20(49)	0 (0)	8(20)	2(5)	1(2)	0(0)	2(5)
S. of Rasp.	26	5(19)	13(50)	1 (4)	3(12)	4(15)	0(0)	0(0)	0(0)
	151	22(15)	70(46)	16 (11)	28(19)	12(8)	1(1)	0(0)	2(1)

Table 8 (continued)

Location[b]	N	Adult Males No.(%)	Adult Fmles. No.(%)	Unclass. Adults No.(%)	Young No.(%)	Yearlings No.(%)	Subadults Males No.(%)	Subadults Fmles. No.(%)	Subadults Unclass. No.(%)
Blocks 1+4	204	26(13)	59(29)	46(23)	52(25)	13(6)	2(1)	2(1)	4(2)
Blocks 2+3	103	16(16)	51(50)	5(5)	19(18)	10(10)	1(1)	1(1)	0(0)
Blocks 1-4	307	42(14)	110(36)	51(17)	71(23)	23(7)	3(1)	3(1)	4(1)
Tatlatui Park[c]	127	20(16)	34(27)	26(20)	34(27)	8(6)	0(0)	1(1)	4(3)
All Areas	458	64(14)	180(39)	67(15)	99(22)	35(8)	4(1)	3(1)	6(1)

[a]Data given are numbers and per cent of total for each class in each area.

[b]Blocks refer to groupings of park wildlife zones as listed in the contract (B.C. Parks Branch, CONS1/8406); other locations are all or specified portions of wildlife zones and/or other park subdivisions.

[c]Total includes observations in all zones of Block 1, both inside and outside park boundaries, minus the Terraze sightings west of the Duti River.

during the 1984 surveys. We saw more males per 100 females in the Tatlatui and Brock Zones and in Edziza Park both north and south of Raspberry Pass than in any of the Spatsizi Zones surveyed in 1984. However, the Tatlatui Zone, with a figure of 75 males per 100 females, was the only area with a male ratio in the range (70 to 90) considered "typical" by Chadwick (1983). Despite the high ratio in the Tatlatui Zone, that for Tatlatui Park as a whole was just 38. That result illustrates the extreme sex segregation which occurs in some areas during the July survey period, and suggests one reason why local male ratios might be lower than expected.

4.3.2 Young-of-the-Year

Kids comprised an average of 22% of the goats seen in all areas (Table 8), a figure somewhat lower than the 25.7% recorded for Spatsizi Zones in 1985. Among individual zones, Terraze (east of Duti) with 33% and Kitchener with 30% had the highest percentages, and those were exactly equal to those recorded for the two zones with highest kid percentages in 1984. The highest composite total in 1985 was for the 6 zones and subzones comprising Tatlatui Park whose 27% kid percentage was slightly higher than the total for Spatsizi Park in 1984. The lowest composite percentages listed in Table 8 were for the northern Spatsizi area (Blocks 2 and 3, at 18%) and the Edziza area (19%). The low percentage in the latter area, especially south of Raspberry Pass within the Park, may reflect the results of the apparently heavy snowfall and late spring in that area.

Kid ratios per 100 females (Table 9) averaged considerably lower in 1985 than in 1984 (46 vs 63.9, respectively). That in Tatlatui Park (64) was equal to the previous year's Spatsizi results, but the average was brought down by very low ratios in northern Spatsizi (Blocks 2 and 3, 37 kids per

100 females) and the Edziza area (39). Again, the heavier snow winter and cold spring may have had some impact on goat production in 1985.

4.3.3 Yearlings

The overall percentage of yearlings among the 1985 sample (Table 8) was slightly less than that observed in 1984 (8 vs. 9, respectively). However, as indicated previously, at least a few of the animals in the unclassified adults category in 1985 may have been yearlings. The highest percentage was in the Marion Zone, where we saw 4 (40%) with 5 adult and 1 subadult female. However, for the larger samples in the zone composite areas, yearling occurrence ranged from 6-10%. Yearlings per 100 female ratios were also lower than in the previous year (16 vs. 23.2 for the total samples in 1985 and 1984, respectively). Unless there were more yearlings among the unclassified adults than we suspect, it appears that overwinter survival of the previous year's young was poorer in 1984-1985 than in 1983-1984.

4.3.4 Subadults

Subadult percentages in Table 8 and ratios per 100 females in Table 9 are also less than in 1984, but that result is certainly due largely to relegation of many of the subadults into the unclassified adults category. It is also possible that some of those which had notmoulted by survey time were incorrectly classified as adult females. In terms of percentage of total population, animals known to have been subadults constituted 3% of all goats classified (range 2-4% in the composite areas) and there were 6 per 100 females (range 2-9). If the 20-25% of unclassified adults not estimated to have been adult females (Appendix 5) were actually

all subadults, the (maximum) overall percentage of subadults among the observed total would be 10.3 and the number per 100 females would be 22.1. Both figures are near the maximum figures calculated for subadult occurrence in the 1984 Spatsizi sample (10.0 and 25.9, respectively; Hatler and Hazelwood 1984).

4.4 Fixed-wing Comparative Survey

Appendix 6 provides details of the fixed-wing survey on 28 July. Unlike the case in 1984, the Cessna survey did not find different or additional goats. The distribution of goats on the two 1985 flights, as depicted in Figure 6, suggests that all goats seen from the fixed-wing were also seen from the helicopter, and that in all cases except for a group of 26 at a mineral lick north of Thutade Lake, fewer animals were counted from the fixed-wing. In total, only 39 goats were seen from the Cessna in 4 zones in which 84 had been seen from the helicopter. Comparing the Tatlatui and Kitchener Zones, the only ones covered intensively on both surveys, the figures are 39 and 79.

Of the factors which may have contributed to the reduced count on the fixed-wing survey, three seem particularly likely:

1) The day was very hot and goats may have been taking cover in shade provided by ledges, crevices and/or lowland vegetation.

2) Some goats may have been crossing valleys to ranges elsewhere or visiting lowland mineral licks at survey time.

3) Coverage of the survey area by the relatively low power Cessna 180 was inefficient with the air conditions and load pertaining.

4.5 Observations of Other Species

As required in our contract, we mapped locations and obtained total counts of other large mammals observed during the surveys. Although it was not required, we also obtained data on sex and age composition whenever it did not conflict with our basic goat inventory objective. Appendix 7 constitutes a series of tables and figures presenting the above data for Stone's Sheep, caribou and moose. Table 10 summarizes the data for sheep and caribou. Sightings of other mammals, and birds were listed in the flight report transcripts (Appendices 2, 3 4, and 6) but they have not been compiled or summarized. Following paragraphs highlight our 1985 observations of large mammals other than goats.

Stone's Sheep - there were fewer sheep seen than expected in both the Cartmel Wildlife Zone and in the Edziza area. It appeared that nursery bands were the missing elements. Possibly they, like some of the goats, were occupying mineral licks outside of the main survey areas. There was again a good count in the Marion Zone (92), but that was only about two-thirds of the number (129) found there in 1984. Distribution there was far different, with the groups smaller and more scattered in 1985. The Tatlatui sheep total included only two rams, both small; discussions with Henderson *et al*. indicate that part of the local sheep population may reside outside of the park, to the west, but nobody seems to know exactly where. Lamb percentage among the 1985 sightings (16% for all areas) was exactly the same as among those classified in 1984.

Caribou - there was a significant concentration of caribou, in scattered groups of 5-14, on the rolling uplands between Tatlatui and Trygve Lakes. Survey results indicate

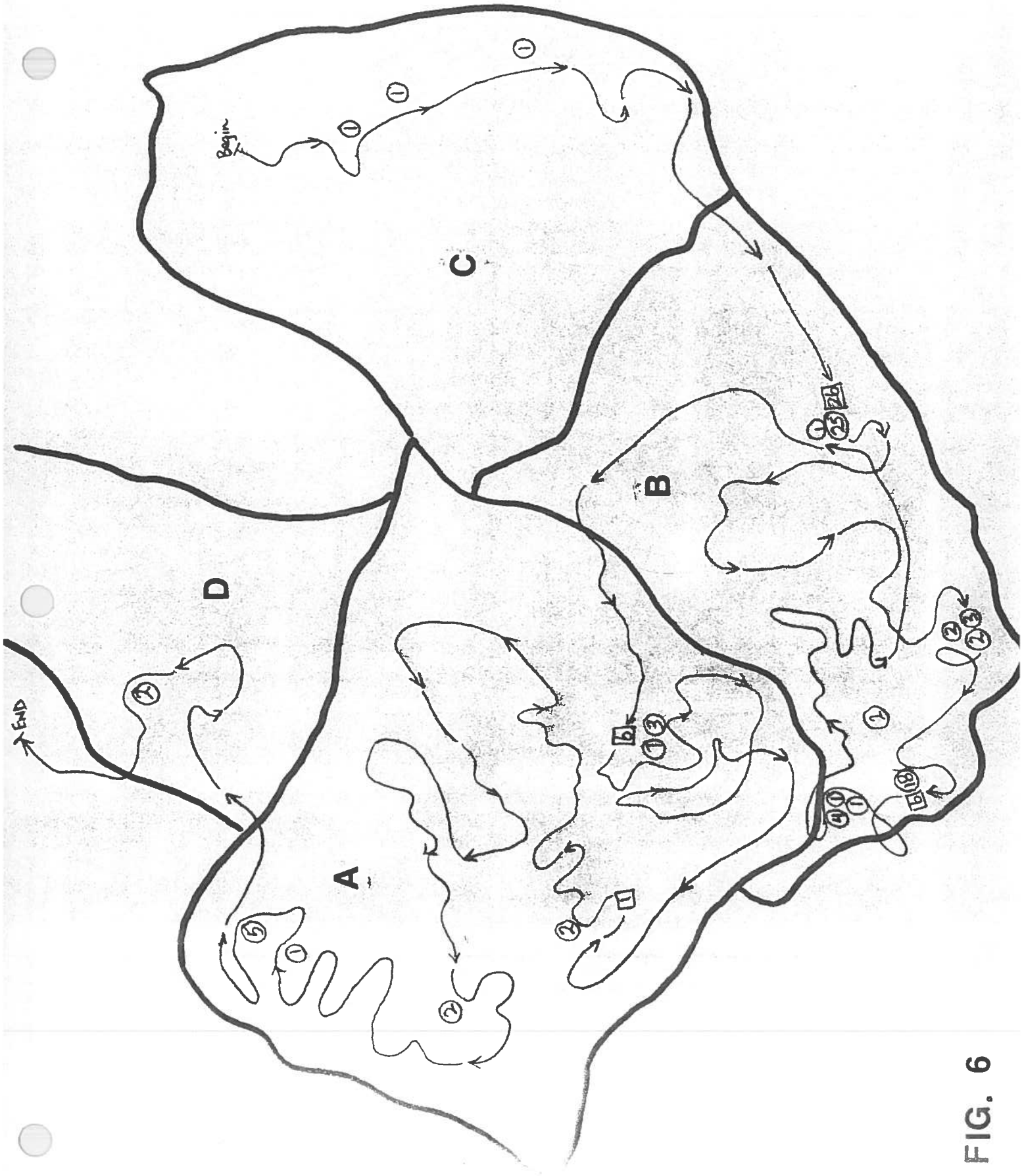

FIG. 6

Table 10. Summary of incidental Stone's sheep and caribou sightings during mountain goat surveys, Tatlatui Spatsizi and Mt. Edziza Provincial Park areas, British Columbia, July 1985. Only the helicopter results are listed.

Species / Park / Zone/Area	N	Adult Males No.	(%)	Other[a] Adults No.	(%)	Young No.	(%)
Stone's Sheep							
Tatlatui Park							
Kitchener	14	2	(14)	9	(65)	3	(21)
Terraze (E)	5	0	(0)	3	(60)	2	(40)
Park Total	19	2	(11)	12	(63)	5	(26)
Spatsizi Park							
Marion	92	14	(15)	59	(64)	19	(21)
Cartmel	82	33	(40)	40	(49)	9	(11)
Park Total	174	47	(27)	99	(57)	28	(16)
Edziza Area	34	14	(41)	17	(50)	3	(9)
All Area Total	227	63	(28)	128	(56)	36	(16)
Caribou							
Tatlatui Park							
Kitchener	57	3	(5)	35	(61)	19	(34)
Tatlatui	18	4	(22)	8	(44)	6	(34)
Thutade	41	6	(15)	25	(61)	10	(24)
Rognaas	44	1	(2)	28	(64)	15	(34)
Brothers	5	2	(40)	3	(60)	0	(0)
Edoz. b	19	0	(0)	13	(68)	6	(32)
Terraze (E)	16	0	(0)	9	(56)	7	(44)
Park Total	200	16	(7)	121	(61)	63	(32)
Spatsizi Park							
Terraze (W)	18	0	(0)	17	(94)	1	(6)
Edoz. a	8	0	(0)	7	(87)	1	(13)
Park Total	26	0	(0)	24	(92)	2	(8)
Edziza Area	4	2	(50)	2	(50)	0	(0)
All Area Total	230	18	(8)	147	(64)	65	(28)

[a]Females at least one year old and males too young to distinguish from females by horn or antler features.

that a large number of caribou of both sexes use the Tatlatui Park area in summer. Observed calf percentages were excellent, at 32% in the Tatlatui Park area and 28% overall. Two maternal bands containing 9 calves, one in the Thutade Zone and one on Mt. Rognaas, are the largest such July groupings Hatler has seen in 7 years of caribou observations in northern B.C. The overall caribou calf percentage observed during the 1984 goat surveys was 24.0%. On the fixed-wing survey 52 caribou were observed in the Tatlatui (8), Kitchener (27) and Brothers (17) Zones. There was some evidence of a movement north, especially into the Brothers Zone.

Moose - only three moose were seen during the helicopter surveys, a cow and calf near treeline in the Thutade Zone and an unclassified adult in a lowland meadow along Thutade Creek (Tatlatui Zone). In addition, on local fixed-wing flights during the survey period Bob Henderson (pers. comm.) saw 2 bulls and 2 cows near the outlet of Tatlatui Lake and a medium bull and 2 unclassified adults east of the Tatlatui camp (12th). All of those were in the Tatlatui Wildlife Zone.

Grizzly Bear - the only large carnivores we observed were a female grizzly with two yearling cubs in a lush meadow south of Armadillo Peak in Mt. Edziza Park (16 July). Henderson (pers. comm.) reported a small individual seen in the burn north of Thutade Lake on 12 July and Herb Green (pers. comm.) saw another bear that day in the valley at the east end of Trygve Lake.

5.0 DISCUSSION AND CONCLUSIONS

Hatler and Hazelwood (1984) discussed goat survey procedures and described some factors which may bear on the accuracy of counts. All that was written there applies also to the 1985 surveys. Following paragraphs are to establish a

perspective for interpretation of the 1985 results.

5.1 Conditions affecting visibility

Weather and light conditions during the helicopter surveys were good. All surveys on clear days were begun late enough in the morning and terminated early enough in the evening to prevent having to observe in the glare of low angle light. There were local storms in the Tatlatui and southern Spatsizi areas, but except on the 12th when we did no surveys, they were usually short. Their net effect was to keep temperatures down. Hot clear weather commenced on the 15th, possibly producing conditions for the Mt. Edziza area surveys which were sufficient to influence goat behavior. Our conclusion relative to the above points is that we do not believe we missed many goats which were occupying expected alpine habitats by simply failing to see them. The low counts in some zones of the Tatlatui and Spatsizi areas are believed to be accurate reflections of goat occurrence in the alpine survey areas on survey days. For example, we are convinced that we saw no goats in the Edozadelly b Zone because there were none there, and that we saw the only two that were occupying the Brothers Zone on 11 July.

Where normally used goat cliffs extend down below timberline, there is a greater chance for failing to see goats. That situation pertained in the Thutade Zone, particularly in the Mt. Jorgensen area, a few locations in the Marion and Cartmel Zones, and in many areas around the Mt. Edziza study area.

5.2 Phenological Effects

The 1984 surveys were conducted during the period 21-24 July. The 1983-84 winter had been unusually mild, with little snow, although the spring was unusually cold and in July

there was still a fair residual snowpack, especially in the Skeena Mountains (Hatler, Spatsizi caribou studies, report in preparation). The effects of winter conditions on goat biology and behavior in the Spatsizi area are not known, but if the animals normally use different summer and winter ranges, they may have moved less in that year because of the mild conditions or might have returned more slowly to summer ranges because of the cold spring. It is also possible that phenological retardation in alpine areas that year might have resulted in the slowing of other biological phenomena such as the goats' moult cycle.

Thel984-85 winter was more nearly normal in terms of snowfall, but the 1985 spring was again cold so that residual snowpack and retarded phenology were even more extreme than in the previous year. We got the strong impression that some known goat ranges had not yet been recolonized after the winter absence. In that category, especially, were the Edozadelly b and Brothers Zones, possibly portions of the Kitchener Zone, and certainly areas in the southern and eastern portions of the Edziza area.

As implied earlier, the stage of moult was behind what we expected, in relation to observations the previous year. That is, we do not believe that the animals would have attained the same level of moult by 21 July 1985 that they had on that date in 1984. There is therefore some justification for hypothesizing that the moult cycle is affected by alpine phenology. Those planning future surveys with the objective of obtaining population composition data should probably take that possibility into consideration.

5.3 Behavioral Factors

While it is no doubt true that goats exhibit diurnal activity patterns, it is apparent that those patterns may be

modified by a variety of factors, probably mostly climatic. From a practical standpoint, it is not possible to conduct an intensive survey over a large area within a short time period by surveying only during those brief periods when the animals are expected to be the most active. Indeed, it may be that "inactive" goats, i.e., those bedded down, are more likely to be in classical upland cliff habitat when bedded than when active. Further, bedded goats usually become active when an aircraft (especially a helicopter) approaches.

We believe that seasonal timing is a far more important consideration than is diurnal timing. In that regard we reiterate that July counts, if conducted at the right time in relation to the moult cycle, are probably the best for composition counts, but they may not give the best results in terms of total numbers. That may be especially true in years of late springs. As described in greater detail in Hatler and Hazelwood (1984), the two most important potential problems are:

1) The propensity for groups of goats to be using lowland mineral licks during the summer.
2) The possibility that groups of goats may be in the process of moving long distances to summer ranges, frequently crossing through habitats not normally searched (and often not searchable) during goat surveys.

Since goat groups may peak in size in early summer (pers. obs.) the consequence of missing just one such group may be a serious underestimation of numbers in any local area.

Nichols (1980 b) has discussed the implications of seasonal movements for management as well as inventory. In the

context of our B.C. Park studies, if the July distribution of goats differs significantly from that later in the summer/ fall period, then July counts may be of little value in planning fall-oriented management strategies on a wildlife zone basis.

5.4 Final Consideration of Numbers

As implied in several sections of this report, we do not believe that we counted all of the goats that were present in all of the areas we covered, or that the July 1985 distribution was completely representative. We do feel, however, that our results are the best that could be obtained with a single survey given present knowledge of goat distribution and behavior in relation to census timing and opportunity. In the absence of marked animals, or instructive evidence from the fixed-wing survey, we have no objective basis for estimating the proportion of animals we might have missed in our counts. We therefore recommend that the numbers presented in foregoing sections be considered the minimum baseline figures for those areas.

In terms of sex and age composition in the areas covered, we have described the problems we had in distinguishing between adult females and unmoulted subadults. However, we believe that our percentages for adult males, kids and yearlings are accurate for the animals observed. We cannot offer any evidence to support or refute the assumption that our sample represents the population. We consider it likely that the mature male component is under-represented because of the solitary and widespread distribution of that class during the season of our observations. It is also possible that other classes, e.g. yearlings or other subadults, may regularly occupy

habitats in which they would be less likely than members of other classes to be seen in a summer census. However, such facts can be determined only by numbers of replicate surveys or by detailed research involving marked animals. Considering the potential errors and interpretation problems associated with seasonal movements and use of special habitats such as mineral licks, we would also like to point out the need for pertinent research, probably using both radio telemetry and visual markers.

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