O.D.C 156·2 (931·7)

SOUTHLAND CONSERVANCY

CHANGES IN THE DENSITY AND DISTRIBUTION OF WILD ANIMALS IN SOUTHERN STEWART ISLAND

M. J. CUDDIHY

SEPTEMBER 1982

CHANGES IN THE DENSITY AND DISTRIBUTION OF WILD ANIMALS IN SOUTHERN STEWART ISLAND

M.J. Cuddihy
New Zealand Forest Service

September 1982

Southland Conservancy
N.Z. Forest Service
Invercargill
ODC 156.2 (931.7)

1.0 INTRODUCTION

In November and December of 1979 a survey of the southern coastal and inland sectors of Stewart Island was undertaken by Southland Conservancy personnel of the New Zealand Forest Service.

The 1979 survey was a follow-up to one undertaken in December 1976 (Ross, 1977). The 1976 survey described the vegetation associations and wild animal densities and distributions for coastal southern Stewart Island from Big Glory Bay to Port Pegasus. In summary this survey found that:

(1) Extensive areas of coastline between Paterson Inlet and Lords River were suffering from coastal forest dieback. All stages were represented and it was considered that dieback was spreading southward. Possums were considered at that time to have a major involvement.

(2) Whitetailed deer densities to the north of the Kopeka River were very high and the forest understorey severely depleted. Forest regeneration in areas of natural mortality was being completely inhibited.

The survey report recommend that a research programme be undertaken to investigate the coastal forest dieback phenomenon, particularly the role of possums, and that research be undertaken to determine the most acceptable and efficient means by which to reduce possum and deer densities. At the time of the report the use of the poison 1080 on Stewart Island was banned. The report also recommended that encouragement be given to possum hunters and private and commercial deer hunters as a means of reducing wild animal densities.

The 1979 wild animal survey was one of the first steps in the research programme. Other important activities undertaken were the establishment of a representative sample of deer exclosure plots to assess the rate and mode of vegetation recovery when deer were excluded and the aerial photography of the south eastern coastline as a permanent record of the coastal dieback areas. The aerial photographic record could then be subsequently updated to assess any changes in the dieback zone.

The objectives of the 1979 survey were therefore to:

(1) Assess the density and distribution of wild animals within the coastal and inland sectors of southern Stewart Island. The inland sector was considered particularly important as the 1976 survey transects rarely penetrated inland more than one kilometre from the coast. Recolonisation by white tailed deer from the extensive inland areas was considered likely to play an important part in determining the mid to longer term effectiveness of any management programme within the coastal sector.

(2) Establish a robust baseline for assessing future wild animal trends as a consequence of research and management activities.

(3) Make comparisons with the 1976 survey so as to establish the effectiveness of existing management practices.

2.0 SURVEY METHODS

2.1 Red Deer (Cervus elaphus)

The 1976 survey did not distinguish red deer within the southern forests, Ross (1977). An earlier survey in 1975 of the northern half of the island (Williamson, 1976) found scattered pockets of red deer in low densities. Notable amongst these were the Freshwater catchment and the western coastline, particularly the Ruggedy Mountains. From local information it is known that red deer are present in the south-eastern sector. A low population was known to occur around the Toitoi flats and there are reports of infrequent sightings north to Big Glory Bay. During the course of this survey some faecal pellet groups were found which were evaluated as more like red deer than those of whitetailed.

However these occasions were rare. For the purposes of this report red deer will be considered no further.

2.2 Whitetailed Deer (Odocoileus virginianus)

The appended map shows the location of the survey transects used by this survey. The transects established in 1976 formed the base so that a pool of data would be available for the assessment of trends. Where possible these transects were extended to provide an inland sample. In addition further transects were established to specifically sample the inland zone, the Lords River catchment, the Toitoi flats and to ensure that a consistently high sampling intensity was achieved.

Sample points were located at 20 metre intervals along each transect through the use of a running line, Bell (1973).

At each sample point two separate assessment techniques were used. The Point-Distance technique was used to give an unbiased estimate of pellet group density. A 200 cm maximum search radius was used for r_p and r_n measurements. This technique is described by Batcheler (1973) and Spurr et al (1976) and will form the baseline for future trend comparisons. The Presence/Absence technique was the only method used on the 1976 survey and was therefore repeated to provide information for comparison purposes. The technique is described by Bell (1973). A 114 cm search radius was used.

2.3 Possum (Trichosurus vulpecula)

The Presence/Absence technique, previously described, was also used for the assessment of possums. The same technique was used in 1976.

2.4 Kiwi (Apteryx australis)

Ancillary to the survey an assessment was undertaken of the relative density and distribution of kiwis. The technique used was to record the presence or absence of at least one kiwi probe hole within the 200 cm search radius used for Point-Distance assessments.

2.5 Cat (Felix catus)

Additionally the survey collected information on the distribution of feral cats. The presence of cat scats within the Presence/Absence plots was recorded as were scats observed on the transect.

3.0 RESULTS

The survey results are summarised in Map 1 to 3, Tables 1 to 6 and Figures 1 to 6.

3.1 Whitetailed Deer

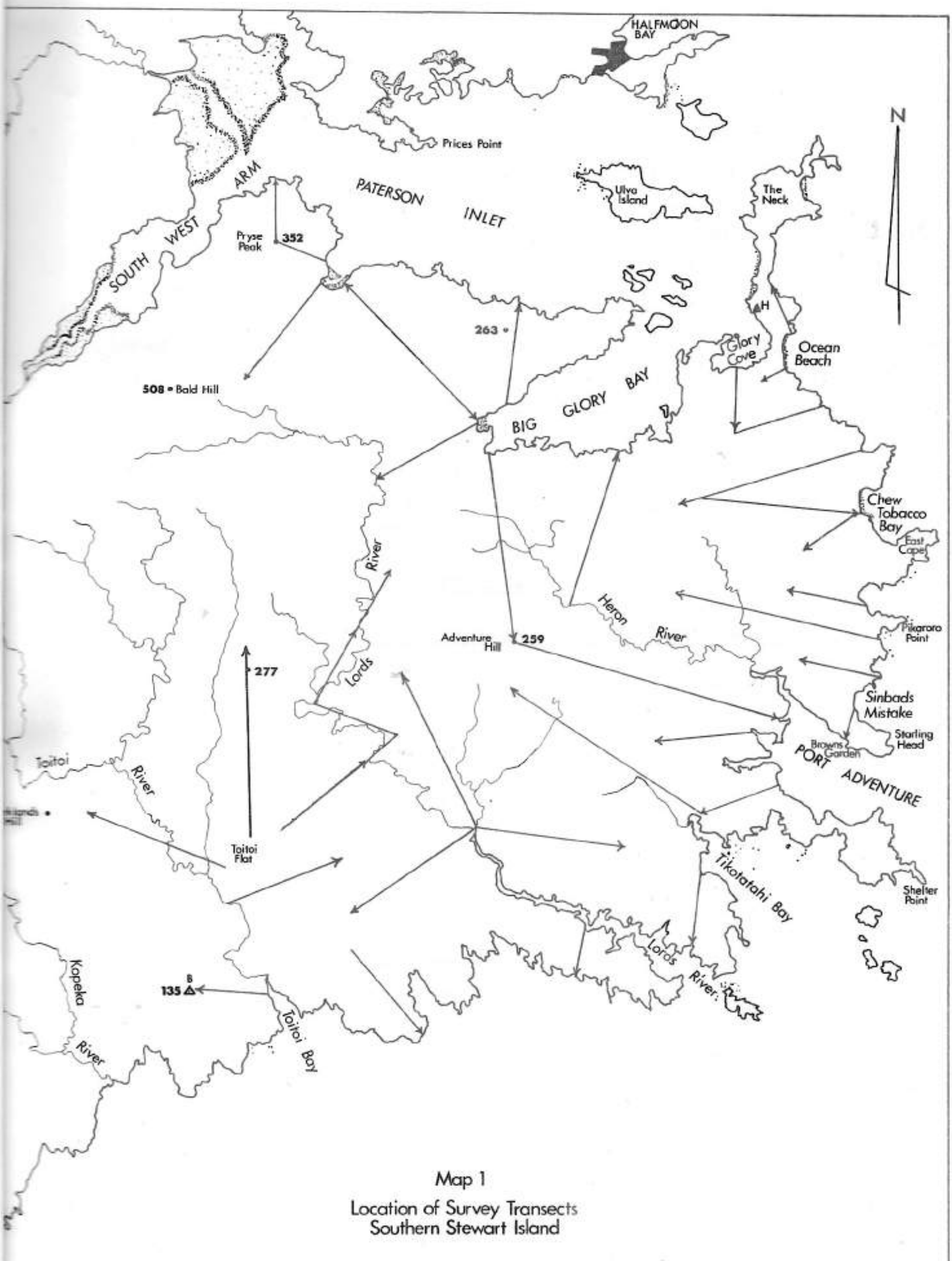
The mean pellet group density for the survey area as a whole is very high. A comparison with surveys in other areas is made in Table 1.

TABLE 1

COMPARISON OF DEER SURVEY RESULTS

Year	Survey Area (Animal)	Pellets Ha	Pellet Groups/Ha + 95% P.L.E.
1979	Southern Stewart Is. (whitetailed)	598	424 ± 27
1976	Southern Stewart Is. (whitetailed)	572	Not Done
1980	Northern Stewart Is. (whitetailed)	75	40.2 ± 4
1975	Northern Stewart Is. (whitetailed)	200	Not Done
1978	Eastern Mt Aspiring National Park (red)	52	12.5 ± 5.6
1980	Blue Mountains RHA (fallow)	320	194.2 ± 18.2
1975	" " "	372	229 ± 57
1980	Caples (fallow)	248	135 ± 75
1976	" "	685	470 ± 143
1976	Grebe Catchment (red)	256	150 ± 15
1978	Secretary Island (red)	36	2.4 ± 4
1981	Catseye Bay (red, wapiti)	118	94 ± 14
1980	" "	255	146 ± 18

Note: The above table makes no allowance for differences between deer species or differential decay rates.



Map 1

Location of Survey Transects
Southern Stewart Island

Scale: 1:126720

2 1 0 2 4 6 km

From this comparison it can be seen that mean whitetailed deer densities within the south eastern sector of Stewart Island are approximately nine times higher than the 1980 survey results for the northern half of the island. They are also in the order of twice that of two mainland areas where Recreational Hunting Areas (RHAs) have recently been established, the Blue Mountains and Caples/Greenstone valleys.

Ross (1977) demonstrated a distributional relationship between deer density and distance inland from the coastline. As a test of this relationship the Point-Distance data was stratified into 200 m isolines. Pellet group densities were computed and where no significant differences occurred between adjacent data blocks they were amalgamated. Table 2, Map 2 and Figure 1 present the results.

TABLE 2

WHITETAILED DEER DENSITY WITH DISTANCE FROM COASTLINE

Area	Pellet Groups/Ha	95% PLE
Survey Mean	424	27
Inland Zone	331	27
Glory Cove to Kopeka (0 - 2800 m inland)	580	60

From Glory Cove through to the Kopeka River from the coastal edge back inland to 2800 metres pellet group densities were uniformly higher than the mean. As Figure 1 shows localised high density areas around Adventure Hill and the mid Lords River catchment extend the high density zone even further inland at these locations. For the remainder of the survey area, further inland than 2800 m and the coastal catchments flowing north into Big Glory Bay and Paterson Inlet, pellet group densities were significantly lower than the mean.

3.1.1 Area

Pellet group densities were calculated for a number of geographical locations which were physically distinct, Figure 1 and Table 3.

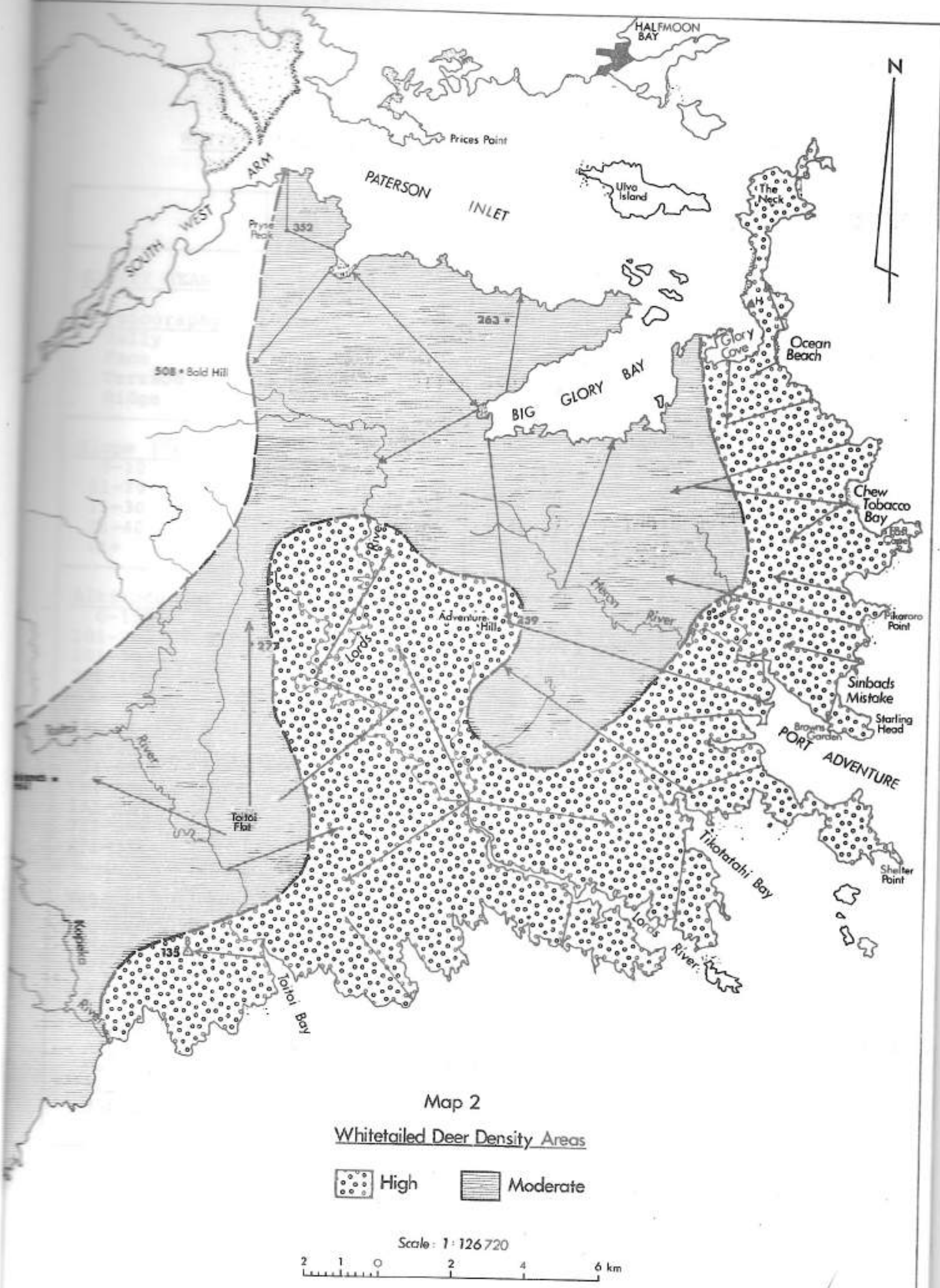
TABLE 3

WHITETAILED DEER DENSITY BY AREA

Area	Pellet Groups/Ha	95% PLE
Adventure Hill	545	183
Lords River (Inland)	500	173
Toitoi Flat	217	66

Adventure Hill lying some 7 km inland and midway between the Heron and Lords Rivers was the highest point covered by the survey. It rises up steeply to a high point of 259 m from the surrounding complex of low lying ridges and creeks. Pellet group densities were significantly higher than those of the inland zone, the survey mean, and approached those assessed for the high density coastal band. Likewise the transects sampling the mid section of the Lords River and closely aligned to the river itself recorded pellet group densities significantly higher than the mean.

The swamps of Toitoi flat, the manuka stands on the periphery of the swamp and the podocarp forests on the higher ground adjacent all recorded pellet group densities lower than the mean.



Map 2

Whitetailed Deer Density Areas

High Moderate

Scale: 1:126720

2 1 0 2 4 6 km

TABLE 4

WHITETAILED DEER AND POSSUM DENSITIES BY HABITAT

	Whitetailed Deer Pellet Groups/Ha	Possum Relative Density	Kiwis Relative Density
SURVEY MEAN	424	18.9	24.2
Physiography			
Gully	298	15.6	21.2
Face	468	21.7	23.4
Terrace	363	15.4	26.3
Ridge	268	16.4	30.0
Slope (°)			
0-10	413	18.4	26.6
11-20	473	20.5	21.1
21-30	363	19.1	17.5
31-40	407	16.3	24.9
41+	194	27.4	4.1
Altitude (m)			
0-100	483	18.3	23.4
101-200	269	20.1	23.9
201-300	349	19.7	36.9
301-400	58	19.1	42.7
Aspect (°)			
331-30	466	20.1	24.4
31-90	443	17.7	25.0
91-150	438	17.7	24.1
151-210	351	16.8	26.7
211-270	428	20.7	23.3
271-330	382	19.5	23.2
Vegetation Type			
Coastal Scrub	490	10.8	18.6
Hardwood	546	16.3	24.1
P1	439	18.3	21.1
P2	273	23.2	29.1
P3	156	21.0	29.3
Swamp	254	2.2	19.1
Alpine Scrub	372	3.0	30.7
Manuka	303	12.2	53.2
Cutover	272	14.5	48.6
Rata/Kamahi	532	24.4	19.6

3.1.2 Habitat

The survey data was then stratified into a range of habitat classes, Figure 2 and Table 4. Whitetailed deer showed no strong affinity for any particular physiography, slope, altitude or aspect class. They demonstrated a slight affinity for face sites and a disaffinity for slopes over 40^{o}. The altitudinal stratification reflects the influence of vegetation type and distance from the coastline. The 0-100 m class constituted 70% of the sample size and recorded densities higher than the mean. Densities were lower than the mean for all other classes.

With regard to vegetation type pellet group densities were highest within the coastal scrub, hardwood, rata/kamahi and P1 types.

Densities were significantly lower than the mean in the P2, P3, swamp, alpine scrub, manuka, and cutover types.

The vegetation types used are those of Ross (1977).

3.2 Possum

The mean relative density of possum pellets for the survey area is high. Table 5 presents the results of other surveys for comparison. It is highly significant that surveys of similar forest types in the north of the island and in the Catlins State Forest Park record much lower mean densities. When compared to the north of the island the high pellet densities in the south

TABLE 5

COMPARISON OF POSSUM SURVEY RESULTS

Year	Survey Area	Relative Density
1979	Southern Stewart Island	18.9
1976	" " "	12.9
1981	Northern Stewart Island	2.9
1975	" " "	7.5
1980*	Caples/Greenstone	5.1
1976	" "	11.6

*The forests of the Caples and Greenstone Valleys are dominated by beech species

may be attributable to difficulties of access, and hence a lower hunting pressure, and the extensive hinterland of low lying podocarp/hardwood forest acting as a reservoir of moderate to high densities.

To test the relationship between possum pellet densities and distance from the coastline the same procedure as described above for whitetailed deer was followed. Figure 3, Map 3 and Table 6 present the results.

TABLE 6

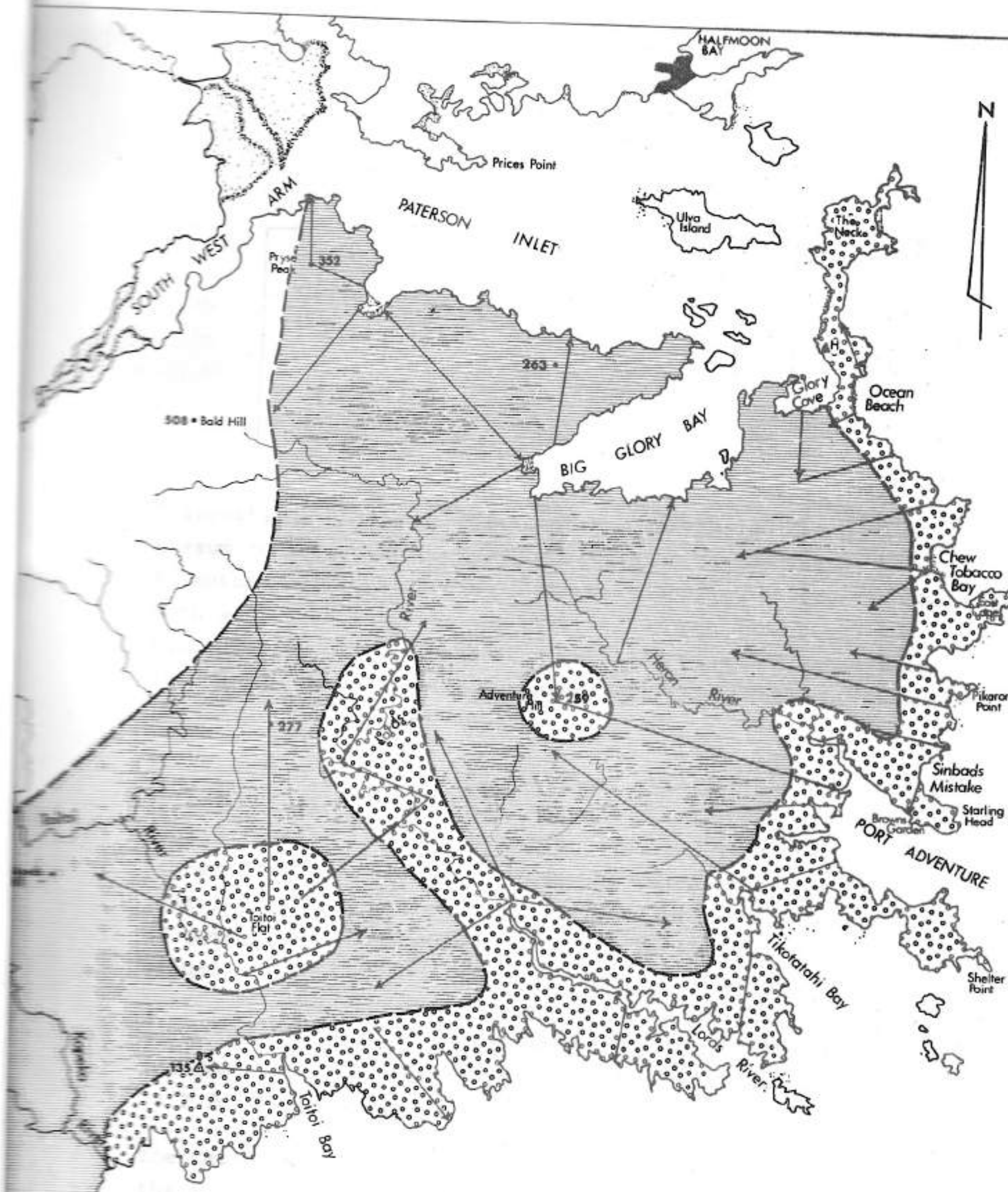
POSSUM DENSITY WITH DISTANCE FROM COASTLINE

	RELATIVE DENSITY
Survey mean	18.9
Paterson Inlet (mean)	16.2
Coastal (0-1200 m)	17.7
Inland (1201 m plus)	15.1
South Eastern Coastline	
0-1200 m	22.5
1201-2400 m	14.2
2401-3600 m	16.2
3601-4800 m	19.2

Pellet densities for the Paterson Inlet sector as a whole were below that of the survey mean. Stratification of the data indicated slightly higher densities in a coastal band of 1200 m width as compared with densities further inland. On the south eastern coastline from Glory Cove to Kopeka pellet densities within the 1200 m band were higher than the survey mean and significantly higher than the three succeeding inland bands, also of similar width.

3.2.1 Area

Pellet densities were then calculated for a number of geographical areas, Figure 3 and Table 7.



Map 3

Possum Density Areas

High Moderate

Scale: 1:126 720

TABLE 7

POSSUM DENSITY BY AREA

	Relative Density
Adventure Hill	30.4
Lords River (inland)	21.8
Toitoi Flats	26.4
Peninsula	26.9

Observations made at the time of the survey indicated that possum densities were exceptionally high on the flanks of Adventure Hill. Although it was only sampled by two transects both went to the top of the hill and enough data could be extracted to make a reasonable sample. Figure 3 shows that the pellet densities for Adventure Hill are 62% higher than the mean survey pellet density.

In a similar manner pellet densities were calculated for Toitoi, Lords River and for the peninsula like areas of headlands on the south east coast. Pellet densities were higher than the mean in all cases by 6% to 41%. For the Toitoi flat area possum densities were low within the areas of swamp, scrub and manuka country. It was on the higher ground within the surrounding P1, P2 and rata/kamahi forests that possum densities were much higher, exceeding the survey mean. The southernmost transect, Toitoi Bay to Trig B, also recorded heavy possum sign with a relative pellet density of 33.2 for the transect.

The rata/kamahi forests on the peninsula and headlands along the southern coastline were known previously to contain high possum densities. They were also the areas where coastal dieback was occurring. Data for these areas was extracted and pellet densities calculated. Although the pellet densities were found to be 44% higher than the survey mean they were not higher than those found for Adventure Hill and Toitoi. It is likely that some reductions had already been effected in the population by hunters before the survey.

3.2.2 Habitat

Figure 4 and Table 4 present the possum habitat results. Stratification of possum habitat showed no aspect or altitude preferences.

There is a strong affinity for the steeper slopes over 41°, but this relates to a small number of plots in the high possum density areas on Adventure Hill and Trig B. In contrast to other physiographical classes possums demonstrated a mild affinity for face sites.

With regard to vegetation type possum pellet densities were highest within the rata/kamahi forests. The P2 and P3 podocarp forest types also recorded pellet densities higher than the mean.

Vegetation types for which possums showed a significant disaffinity included coastal scrub, swamp, alpine scrub, manuka and the cutover forest type.

3.3 Kiwi

The assessment of the distribution and relative density of kiwis was not a formal part of this survey. It was undertaken because of the interest of the surveyors and because the simple assessments made could be easily accommodated within the survey procedure. No attempt has been made to translate the probe densities calculated to any estimate of kiwi numbers. There are likely to be a number of uninvestigated variables which influence the relative density and longevity of probe holes. The food source hunted and soil structure are two examples.

The results of the kiwi assessments are presented in Figure 5 and Table 4.

3.3.1 Habitat

Kiwis demonstrated no strong affinity for any particular aspect class. Relative densities were found to be significantly higher than the mean for slopes less than 10° and for ridge and terrace sites. Although it made up only 7% of the total survey sample kiwis were found to

show a strong affinity for altitudes between 200 m and 400 m. The locations of these high density areas were Trig U in the south, the centre high ground of the transect from big Glory Bay to Abrahams Bay and the upper flanks of Pryse Peak. As a general observation the high ground, over 200 m, on all transects originating from Paterson Inlet had above average kiwi densities.

With regard to vegetation type kiwis demonstrated a very strong affinity for the manuka and cutover forest types. The manuka stands were sampled predominantly around Toitoi flat, Toitoi Bay, and the terraces adjacent to the mid sections of the Heron and Lords Rivers. The cutover type was sampled by one transect at the head of Big Glory Bay. Other forest types that were also favoured included the P2 and P3 podocarp types and the alpine scrublands.

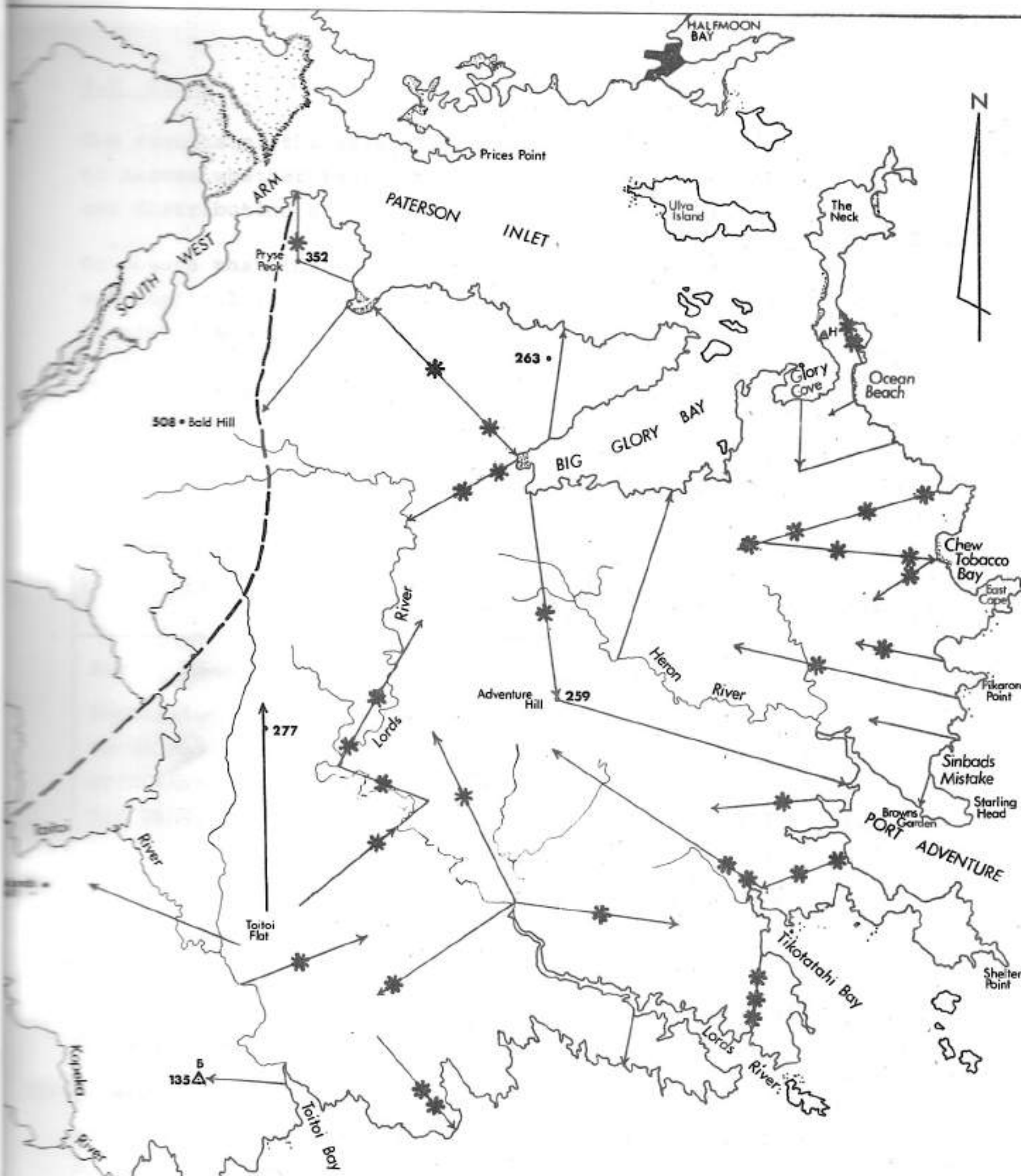
Because the manuka/cutover forest types made up only a small proportion of the total sample, approximately 6%, it will be suggested that in future surveys these types are more intensively sampled.

Finally the data was tested for any coastal/inland distributional patterns. None was found.

3.4 Cats

Ross (1977) commented on the sighting of three cats at Chew Tobacco Bay and from evidence found on the survey transects suggested that cats were distributed in low numbers between Big Glory and Port Adventure. No quantitative assessments were made by the 1976 survey.

The results of this survey confirm those observations in that cats were found to be scattered in low densities throughout the whole survey area. The relative density of scats as derived from the Presence/Absence data is 0.64. Cats showed no affinity for the coastal forests, with the highest proportion, 64%, being found within the inland P1 forest type. Map 4 shows the location of all cat scats observed either on the survey transect or on one of the pellet plots.



Map 4

Locations Where Cat Scats Were Found

Scale: 1:126 720

4.0 TREND

The results of the 1976 and 1979 surveys have been compared to assess whether there have been any changes in the density and distribution of possums and whitetailed deer.

To ensure that the comparison was being made for the same geographical area the 1979 transects have in some cases been truncated and in others omitted.

The results are presented in Figure 6 and Table 8.

TABLE 8

WHITETAILED AND POSSUM TRENDS

AREA	Whitetailed Deer (Relative Density)		Possums (Relative Density)	
	1976	1979	1976	1979
Survey Mean	26.4	21.9	12.9	18.7
Kopeka-Lords River	25.7	26.3	13.7	21.0
Lords River-Port Adventure	37.7	22.7	15.4	16.3
Port Adventure-Glory Cove	25.1	32.0	12.6	25.2
Big Glory	17.7	16.3	11.1	16.3
Heron	18.8	15.4	8.9	15.7

4.1 Whitetailed Deer

Overall there has been a reduction in the mean relative density of 17%.

Looking at the area in survey blocks*there has been no change within the Kopeka-Lords River block, but significant reductions of 8% to 18% have occurred within the Heron and Big Glory blocks. The Kopeka-Lords River block is the most remote and receives the lightest hunting pressure. The Big Glory block receives directly a moderate hunting pressure whilst the Heron block being somewhat isolated receives only light use. It is considered likely that the principal cause for a reduction in the Heron block is the movement of animals out into other adjacent blocks.

---

*The survey block boundaries as defined by the 1976 survey are the basis for comparison.

The Lords River - Port Adventure block was one which recorded a very high relative density in 1976. Since then there has been a 40% reduction, although compared with other survey areas the density still remains high. This section of Stewart Island has been a popular recreational hunting area and the reductions are considered mostly to be a result of this.

Initially the result for the Port Adventure-Glory Cove block seems anomalous. Whereas all other blocks recorded a stable or declining relative density this block recorded an increase of 27%. For this reason a closer analysis was undertaken. In the 1976 survey this block was sampled by five transects but in the 1979 survey the sampling intensity was increased to 11 transects. When a direct comparison is made of the five 1976 transects against the same transects in 1979 the relative density remains stable. The additional transects established in 1979 which sampled high density areas and thereby pulled up the overall mean relative density are a transect from Sinbads Mistake to Browns Garden, a transect sampling inland behind Chew Tobacco Bay, but most particularly from a transect originating at Ocean Beach and sampling the coastal hardwoods on the eastern side of the Trig H hill. This 1400 metre transect recorded the highest relative density of any on the 1979 survey, 42.7.

4.2 Possums

Possum densities within the blocks have increased from 6% to 100% with an overall increase of 44% for the area as a whole. This result is contrary to what could have been reasonably expected, especially when it is considered that the period between 1976 and 1979 was one of steadily increasing hunting pressure. It therefore seems likely that the 1976 survey under-estimated possum densities.

5.0 CONCLUSIONS

Whitetailed deer densities within the high density zone depicted in Map 2 are excessively high and prejudicial to the long term health of the existing vegetation associations.

At these densities the natural replacement cycle of these associations is likely to be inhibited. The non replacement of the coastal rata/kamahi forests where dieback has occurred stands as an example.

To attain a healthy balance between whitetailed deer densities and vegetation condition it is considered that deer densities recorded by the 1979 survey should be reduced by between 50% - 70%. Such a reduction would bring deer densities down to the levels pertaining in the northern forests (1976 survey) and would still provide sufficient animals to retain the interest of recreational hunters.

This survey found possum densities to be very high throughout with a number of geographical locations recording densities that were quite exceptional. Increased hunting pressure is required to bring down these densities and again an overall reduction of 50% - 70% is considered necessary.

6.0 RECOMMENDATIONS

(1) That whitetailed deer densities be reduced in those high density areas identified by this report. The first objective should be to achieve a balance between the density of deer and the maintenance of a healthy regenerating vegetative cover. From that point a further reduction may be required in areas where the preservation of natural values is important, such as in Scenic and Fauna and Flora Protection Reserves. In other areas where hunting is an important recreational use and one for which the land is to be managed it may be desired to maintain moderate animal densities.

(2) Again in those areas identified as containing unacceptably high possum densities a permanent reduction is required.

This can perhaps be best achieved by publicising those areas and encouraging commercial hunters into them.

(3) Because of the high whitetailed deer and possum densities recorded by this survey and the need for significant reductions this area will be resurveyed in November 1983.

REFERENCES

Batcheler, C.L. 1973 : Estimating Density and Dispersion from Truncated or Unrestricted Joint Point Distance. Nearest Neighbour Distances. Proceedings of the New Zealand Ecological Society 20: 131-147.

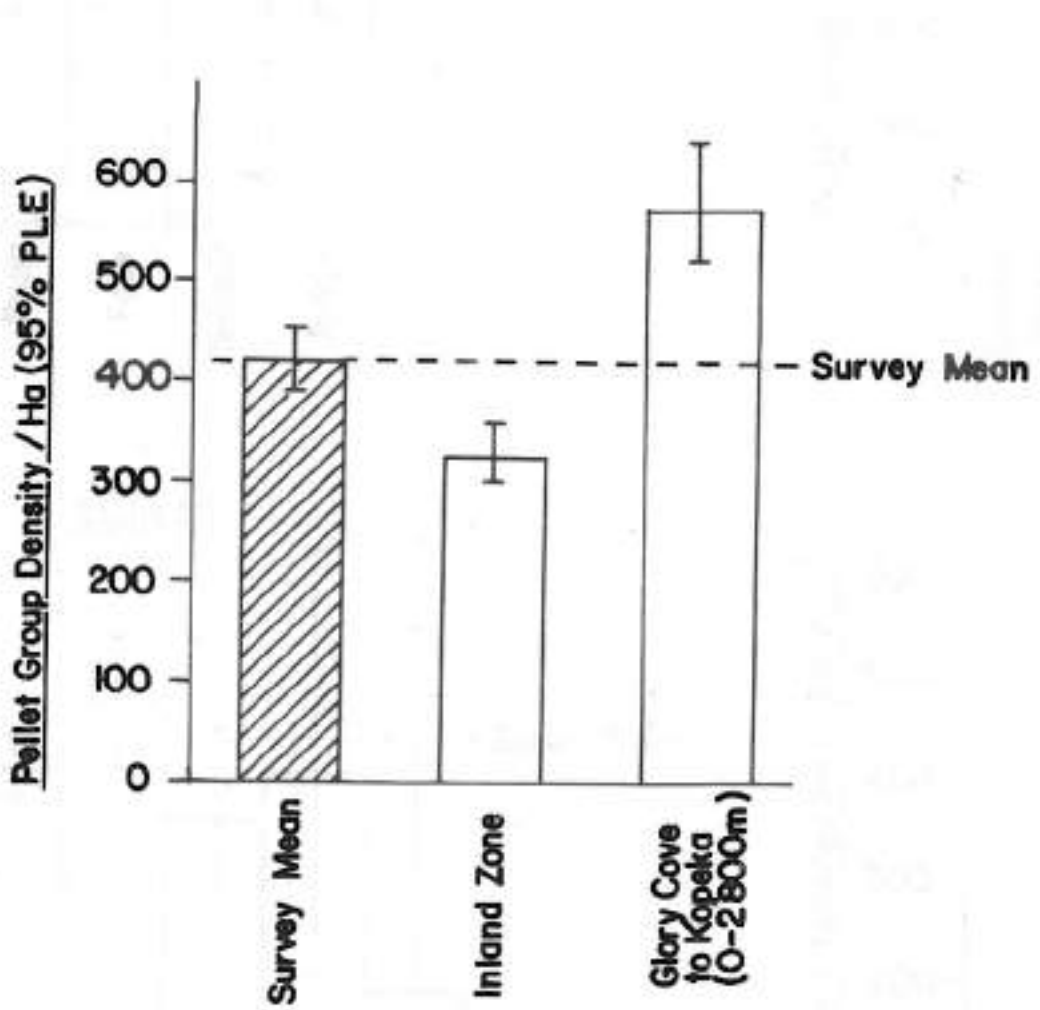
Bell, D.J. 1973 : The Mechanics and Analysis of Faecal Pellet Counts for Deer Census in New Zealand. New Zealand Forest Service, Forest Research Institute, Protection Forestry Report No. 124 (unpublished).

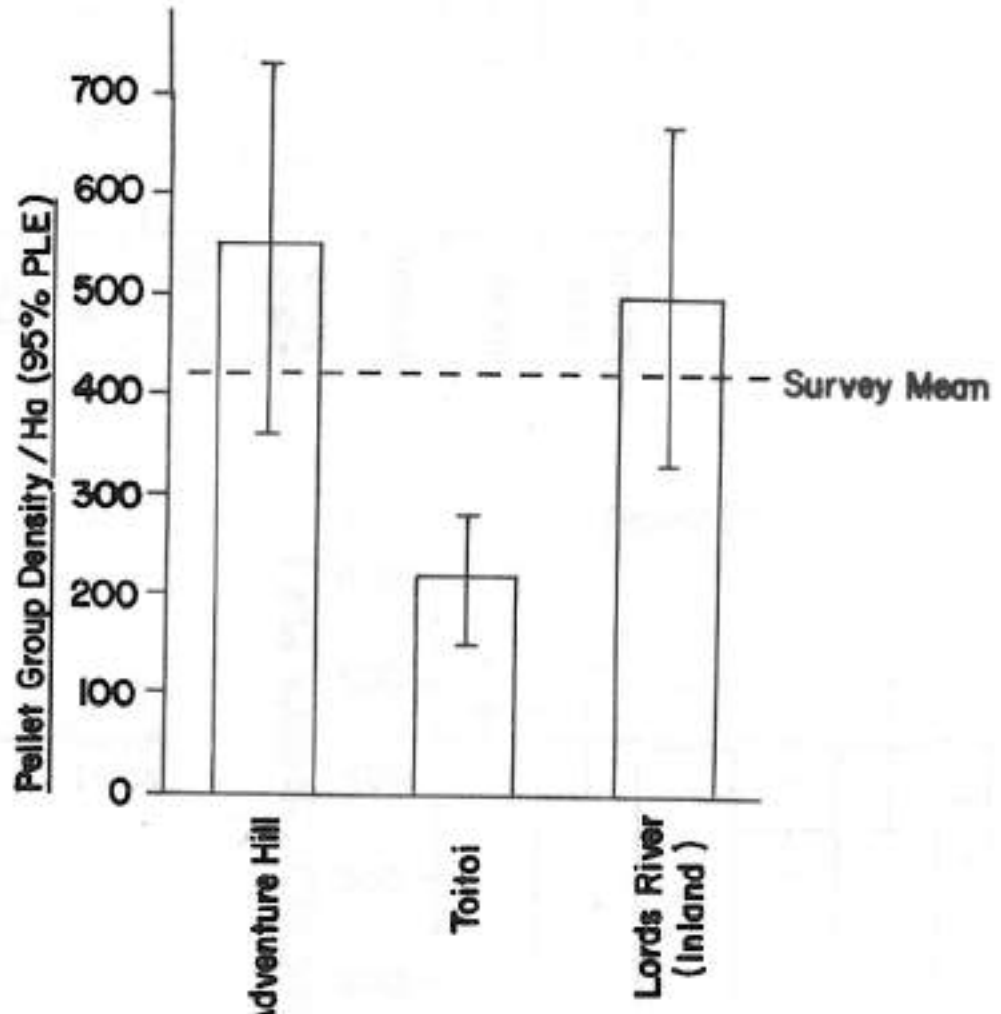
Ross, A.D. 1977 : Forests and the Influence of Deer and Opossums in Southern Stewart Island. New Zealand Forest Service, Southland Conservancy. (Unpublished report).

Spurr, E.B. Ross, W.D. and Batcheler, C.L. 1976 : A Computer Program in Fortran IV for Estimating Density from Point - Distance Nearest-Neighbour Distances. New Zealand Forest Service, Forest Research Institute Protection Forestry Report No. 137 (Unpublished).

Williamson, M.J. 1976 : Resource Survey of Northern Stewart Island, Part Two : Forests and Introduced Animals. New Zealand Forest Service, Southland Conservancy. (Unpublished report).

Fig.1 : Whitetailed Deer
Locality

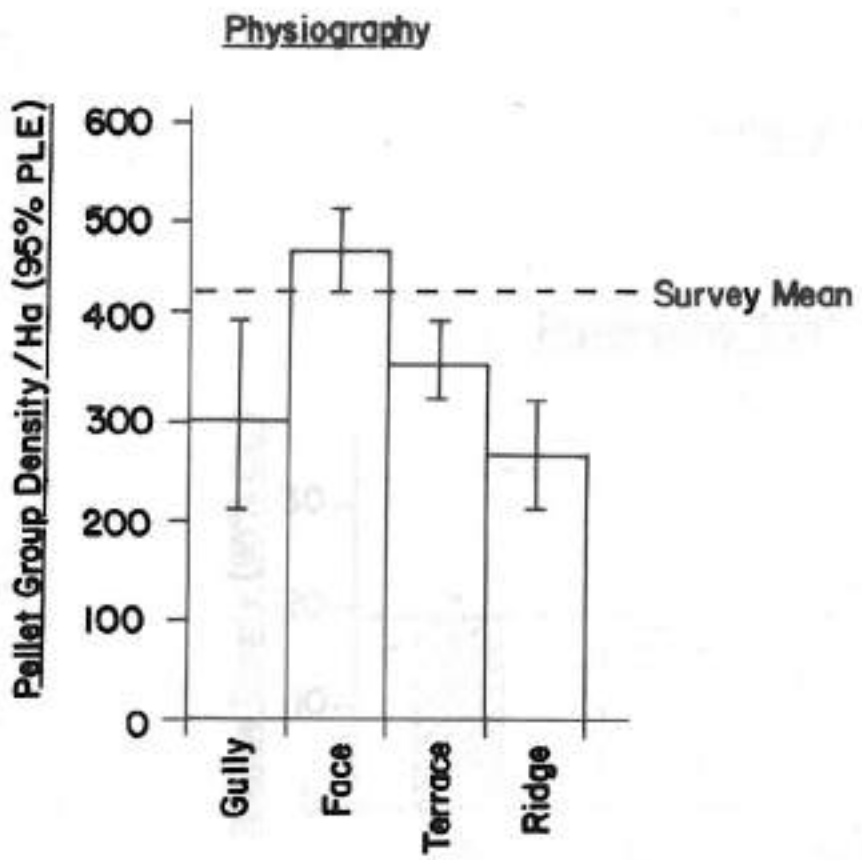


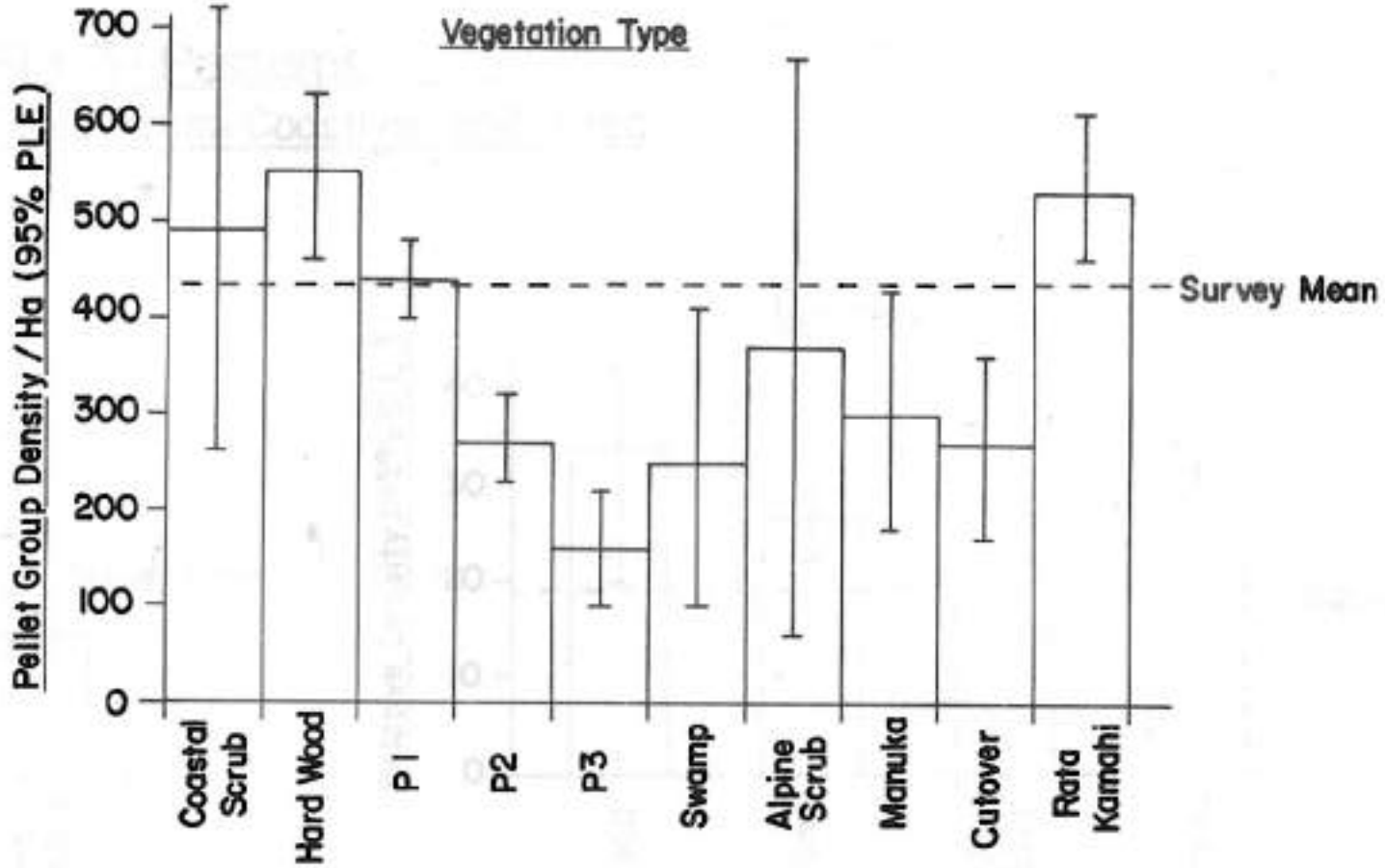


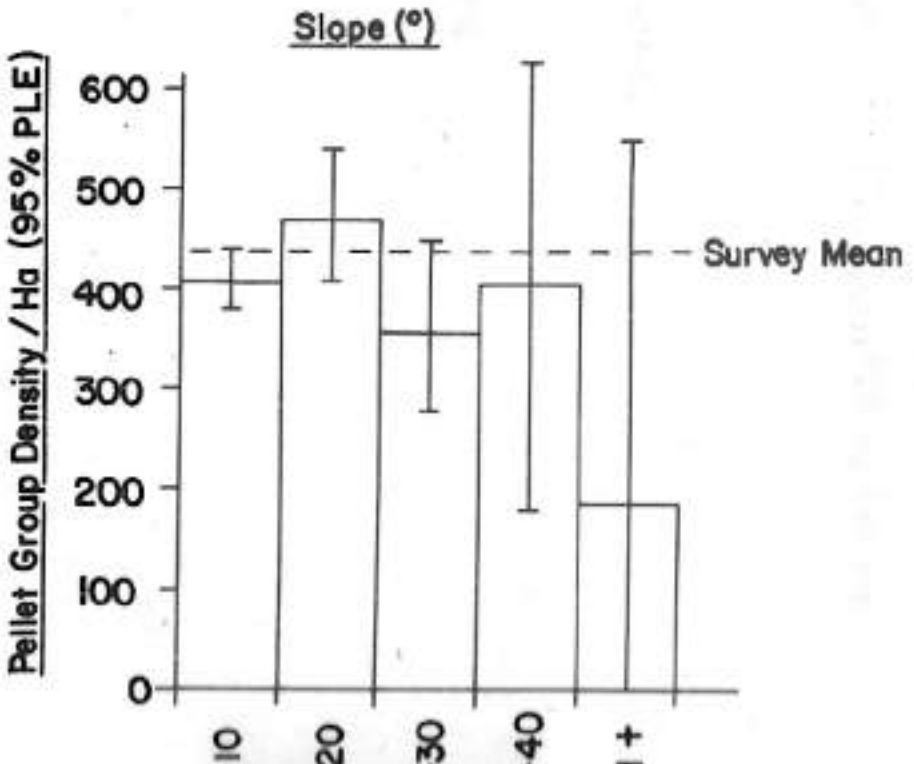
Density By Distance From Coastline and Area

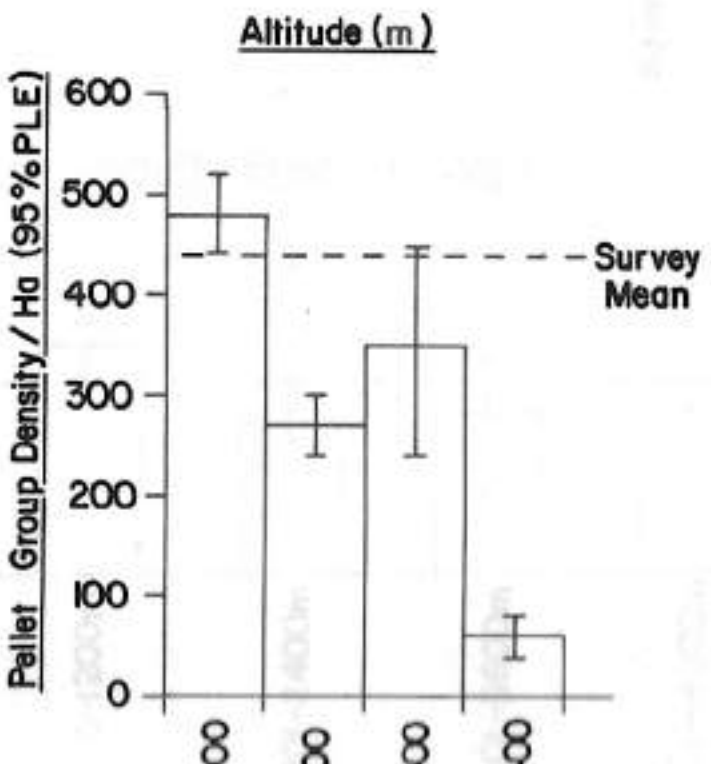
Fig. 2 Whitetailed Deer

Habitat









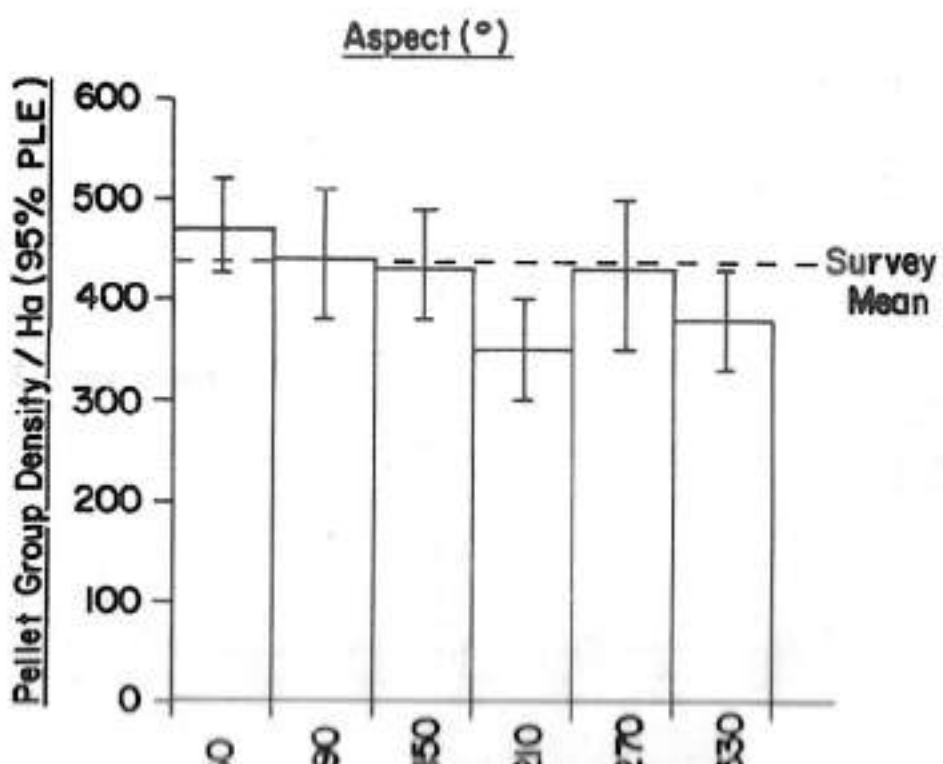


Fig. 6: Whitetailed Deer and Possums Trend