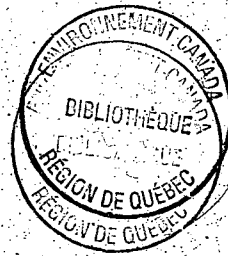


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**A BREEDING GROUND SURVEY OF ATLANTIC FLYWAY  
CANADA GEESE IN NORTHERN QUEBEC - COSTS ESTIMATES**

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**Daniel Bordage and Nathalie Plante  
Canadian Wildlife Service, Quebec region**

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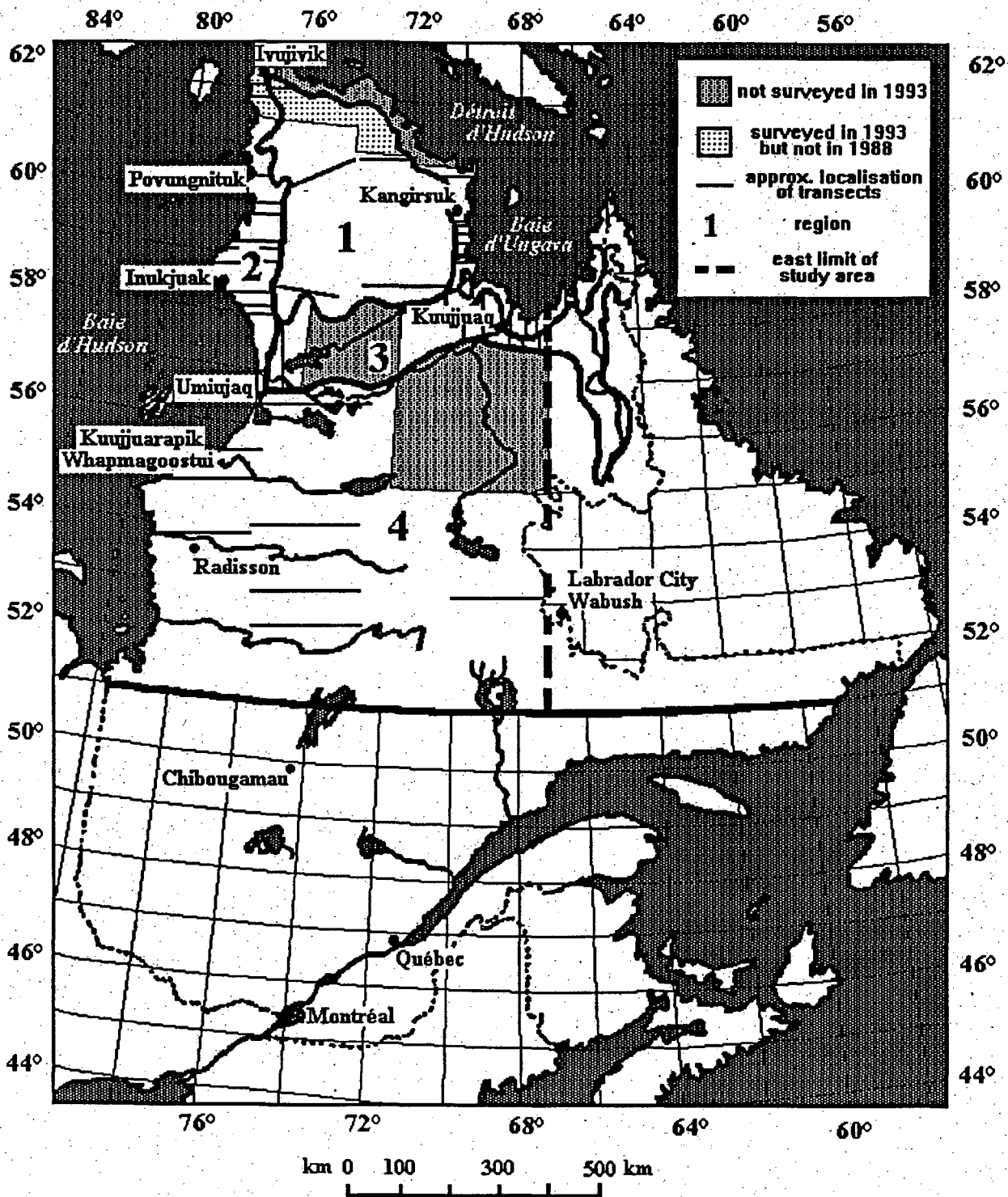
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Figure 1. Study area.



# A BREEDING GROUND SURVEY OF ATLANTIC FLYWAY CANADA GEESE IN NORTHERN QUEBEC - COSTS ESTIMATES

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CWS Quebec

This report provides costs projections for a breeding ground survey of Atlantic Flyway Canada Geese in Northern Quebec. The costs are based on methods described in the 1993 survey proposal (Francis 1993). Basically it consists of transects surveyed by two observers in a fixed wing aircraft flying at a ground speed of 160 km/h and at an altitude of 30 m. Both observers count geese along a 200 m wide strip resulting in an effective strip width of 400 m.

Costs estimates are based on a stratified random sampling of transect locations. The sample sizes in each of 4 strata (regions) are determined by optimum allocation with a cost per transect proportional to its length. Regions delimitations (fig. 1) basically follow landscape ecoregions of Quebec (Gilbert *et al.* 1985). Estimates of overall population size and variances within strata are based on 1993 survey data (Bordage and Plante 1994). Tables and figures on following pages show projected costs for different coverage and precision options. Note that the expected coefficients of variation in tables 1 and 2 are for the total population estimates; for a specific region, the coefficient could be much higher.

All cost estimates are in canadian funds. The overall cost used in the tables is based on \$8 per km (\$7.75 rounded up to \$8) of transect surveyed (ferry between transects included; transportation to the study area and salaries for the 2 observers not included; GST (7%) added to costs per km). Details of costs used are \$300 per hour (\$4.45 per km) for the airplane (twin engine), \$128 per hour (\$1.90 per km) for the fuel, and \$112 per person per day (\$1.40 per km) for accomodation and food (total of 3 pers.). The ratio of survey time on transect/total flight time = 0.41. Mean transects length in calculations are 160.6 km for the region 1; 52.2 km for region 2; 109.0 km for region 3; and, 194.7 km for region 4.

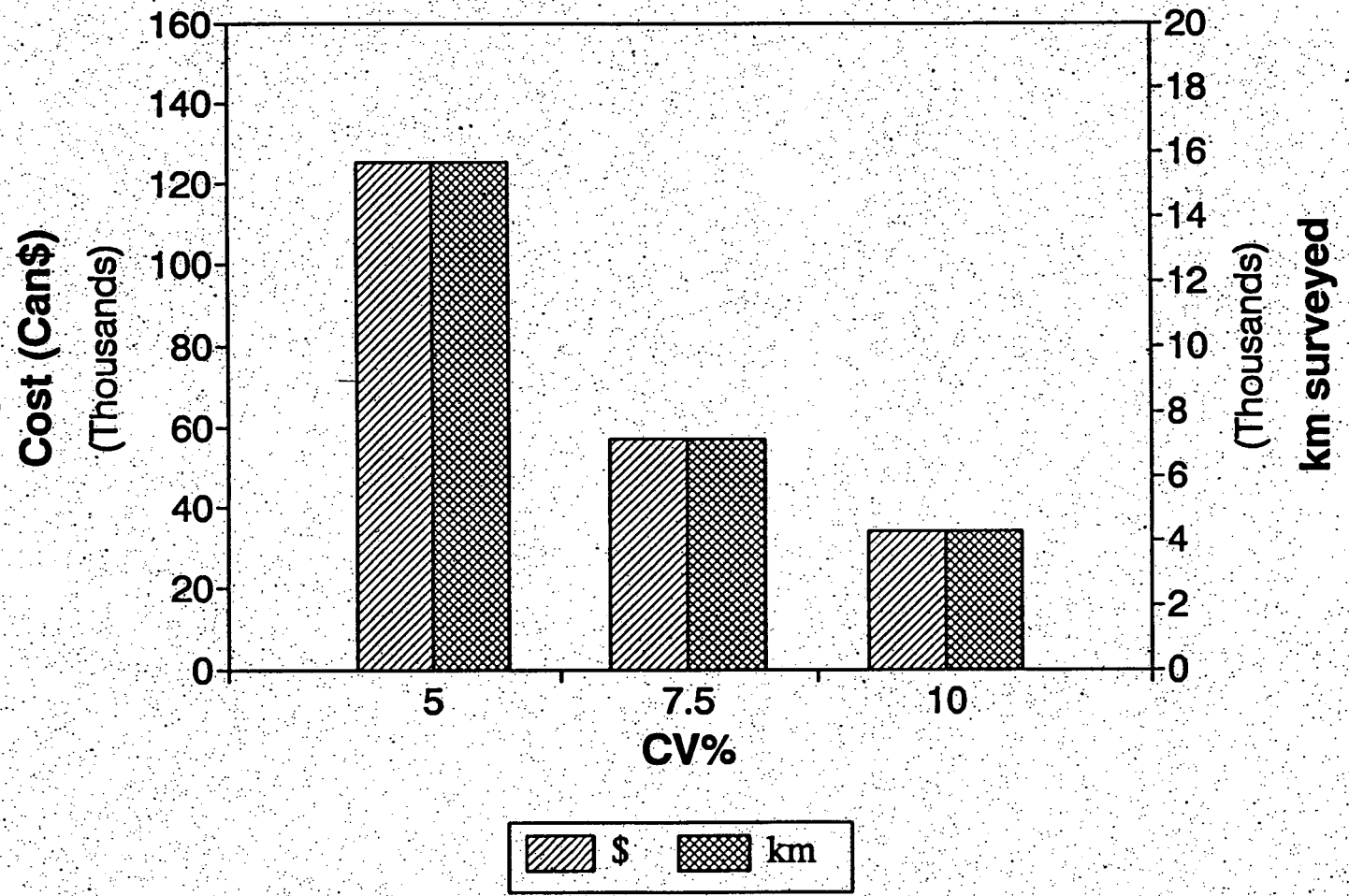
Part of the region 2 (Hudson Strait coastal zone) of the 1988 survey (Malecki and Trost 1990) was included in this report in region 1. This coastal zone consists essentially of cliffs and differs substantially from the flat landscape found in region 2 close to the Ungava Bay and the Hudson Bay. The resulting new regions areas are: region 1 = 154 200 km<sup>2</sup> (2 400 transects); region 2 = 41 800 km<sup>2</sup> (2 000 transects); region 3 = 63 200 km<sup>2</sup> (1 450 transects); region 4 = 508 100 km<sup>2</sup> (6 525 transects).

Table 1. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 1, 2, 3, and 4.

| CV% | REGION | SAMPLE SIZE (transects) |                   | COST (Can\$) |
|-----|--------|-------------------------|-------------------|--------------|
|     |        | number                  | total length (km) |              |
|     | 1      | 26                      | 4176              | 33408        |
|     | 2      | 79                      | 4128              | 33024        |
|     | 3      | 23                      | 2507              | 20056        |
|     | 4      | 25                      | 4867              | 38936        |
| 5   | TOTAL  | 153                     | 15678             | 125424       |
|     | 1      | 12                      | 1928              | 15424        |
|     | 2      | 36                      | 1881              | 15048        |
|     | 3      | 11                      | 1199              | 9592         |
|     | 4      | 11                      | 2141              | 17128        |
| 7.5 | TOTAL  | 70                      | 7149              | 57192        |
|     | 1      | 7                       | 1124              | 8992         |
|     | 2      | 21                      | 1097              | 8776         |
|     | 3      | 6                       | 654               | 5232         |
|     | 4      | 7                       | 1363              | 10904        |
| 10  | TOTAL  | 41                      | 4238              | 33904        |

Figure 2. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 1, 2, 3, and 4.

### AF Canada Goose breeding ground survey Projected costs for regions 1,2,3,4



280% ± 50% 10% 41.10%

Table 2. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 1, 2, and 3.

| CV% | REGION | SAMPLE SIZE (transects) |                   | COST (Can\$) |
|-----|--------|-------------------------|-------------------|--------------|
|     |        | number                  | total length (km) |              |
|     | 1      | 27                      | 4337              | 34696        |
|     | 2      | 83                      | 4337              | 34696        |
|     | 3      | 24                      | 2615              | 20920        |
| 5   | TOTAL  | 134                     | 11289             | 90312        |
|     | 1      | 19                      | 3052              | 24416        |
|     | 2      | 58                      | 3030              | 24240        |
|     | 3      | 17                      | 1853              | 14824        |
| 6   | TOTAL  | 94                      | 7935              | 63480        |
|     | 1      | 14                      | 2249              | 17992        |
|     | 2      | 43                      | 2247              | 17976        |
|     | 3      | 12                      | 1308              | 10464        |
| 7   | TOTAL  | 69                      | 5804              | 46432        |
|     | 1      | 11                      | 1767              | 14136        |
|     | 2      | 33                      | 1724              | 13792        |
|     | 3      | 10                      | 1090              | 8720         |
| 8   | TOTAL  | 54                      | 4581              | 36648        |
|     | 1      | 8                       | 1285              | 10280        |
|     | 2      | 26                      | 1358              | 10864        |
|     | 3      | 8                       | 872               | 6976         |
| 9   | TOTAL  | 42                      | 3515              | 28120        |
|     | 1      | 7                       | 1124              | 8992         |
|     | 2      | 21                      | 1097              | 8776         |
|     | 3      | 6                       | 654               | 5232         |
| 10  | TOTAL  | 34                      | 2875              | 23000        |

71.4R2  
F 10%

Figure 3. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 1, 2, and 3.

### AF Canada Goose breeding ground survey Projected costs for regions 1,2,3

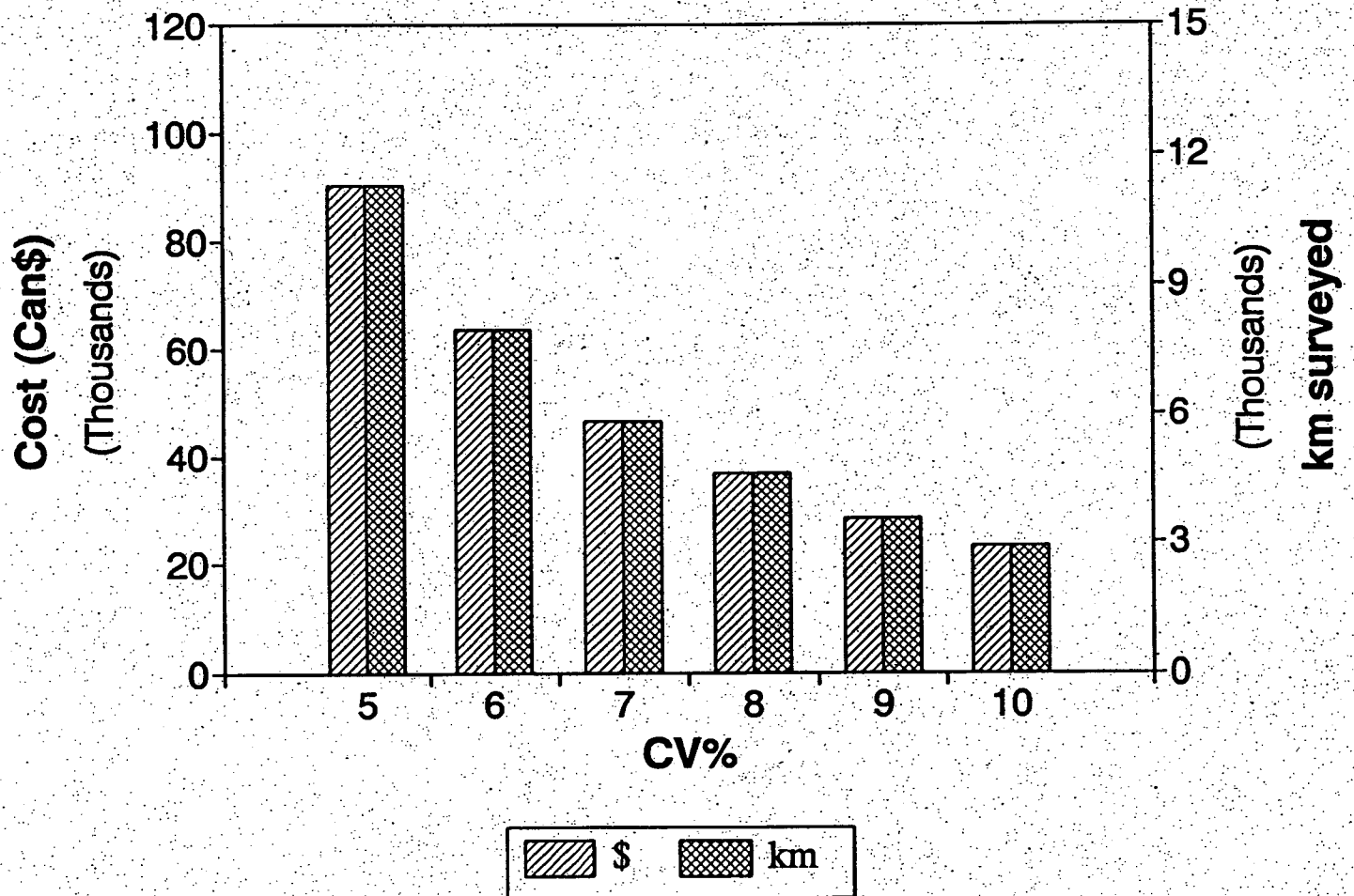


Table 3. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 2.

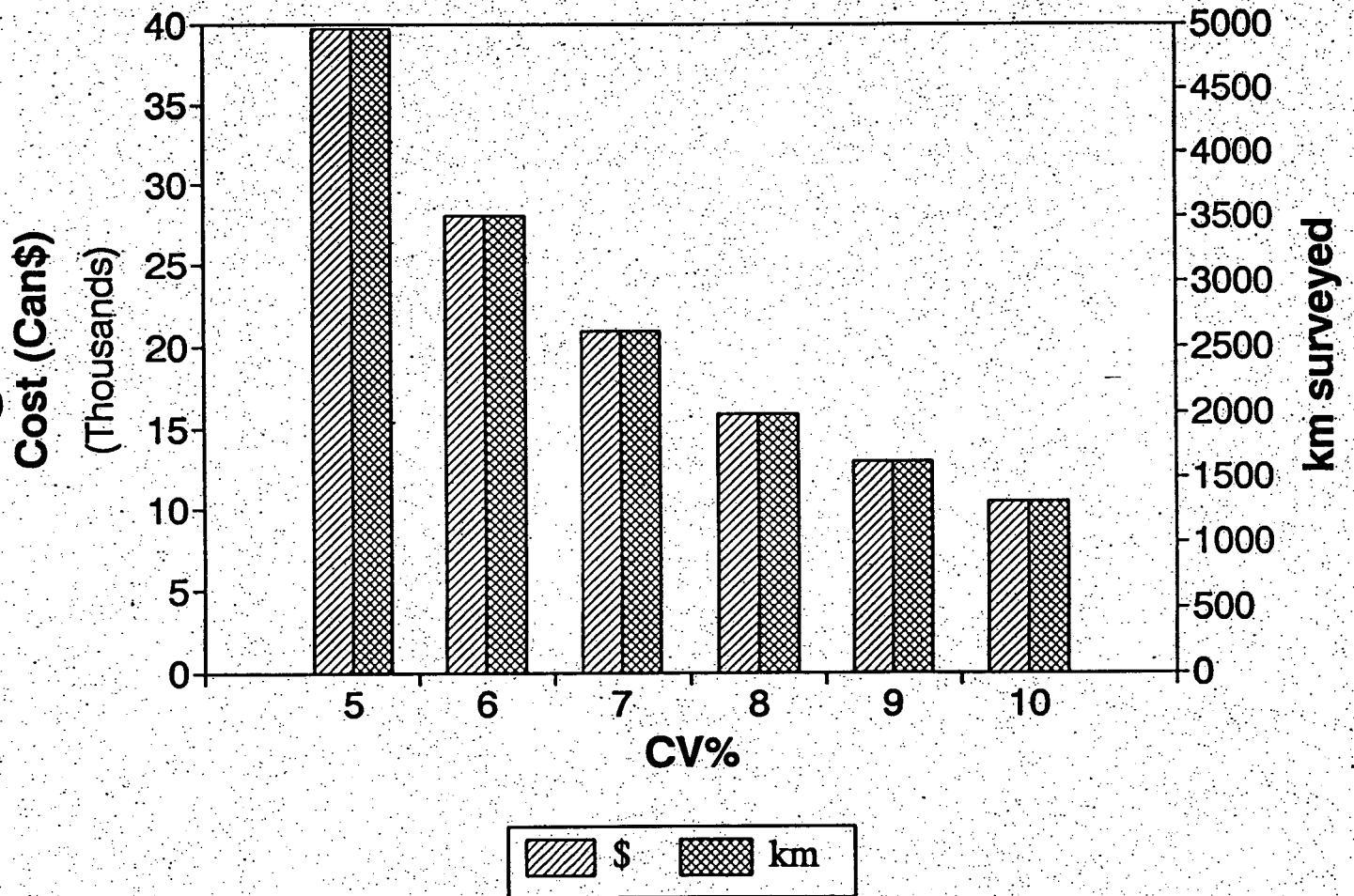
*M. HRS*

| CV% | SAMPLE SIZE (transects) |                   | COST<br>(Can\$) |
|-----|-------------------------|-------------------|-----------------|
|     | number                  | total length (km) |                 |
| 5   | 95                      | 4964              | 39712           |
| 6   | 67                      | 3501              | 28008           |
| 7   | 50                      | 2612              | 20896           |
| 8   | 38                      | 1985              | 15880           |
| 9   | 31                      | 1620              | 12960           |
| 10  | 25                      | 1306              | 10448           |



Figure 4. Projected costs for a breeding ground survey of AF Canada Geese in northern Quebec: region 2.

### AF Canada Goose breeding ground survey Projected costs for region 2



**LITERATURE CITED**

- Bordage, D. and N. Plante. 1993.** A breeding ground survey of Atlantic flyway Canada Geese in Northern Quebec - 1993. Report from the CWS, Quebec region. 19pp.
- Francis, C.M. 1993.** Breeding ground surveys of Atlantic Region Canada Geese, Spring 1993: Survey Proposal. Report from the CWS and USFWS. 6pp.
- Gilbert, G., R.G. Hélie et J.M. Mondoux. 1985.** Sensibilité de l'écosystème aux précipitations acides au Québec. Partie A: Écorégions et écodistricts du Québec. Environnement Canada, Direction générale des terres, série de la classification écologique du territoire n° 20: 86 pp.
- Malecki, R.A. and R.E. Trost. 1990.** A breeding ground survey of Atlantic flyway Canada Geese, *Branta canadensis*, in Northern Quebec. Can. Field Nat. 104(4): 575-578.