# ANNEX C

# BIOLOGICAL RESOURCES[1]

**Table of Contents**



## 1.0 Introduction

The effect of noise (i.e. subsonic noise and sonic booms) on animals varies due to the animals' hearing ability, and varies considerably among animal species. Each species has adapted, physically and behaviourally, to fill an ecological role within a community; an animal's hearing ability often reflects this role. Animals rely on hearing to avoid predators, to obtain food, and to communicate with members of their own species and other members of the community.

Animal species differ greatly in their response to noise of various characteristics (i.e. intensity and frequency) and duration. Individual animal response to a given noise event (or series of events) can vary widely because of a variety of factors, including the time of day and year, the physical condition of the animal, the physical environment (such as whether the animal is restrained or not), the experience of the individual animal, and whether or not other physical stressors are present (e.g., lack of food, heavy snow and/ or extreme weather conditions).

[1] **Prepared by Dr. Vijay Singh**

Behavioural experiments have demonstrated that loud noise be it natural (thunder and lightening) or man-made (such as, gun shots, low-flying aircraft, or passing trains) is mildly aversive to animals, as it causes apparent physiological effects (e.g. muscular flinch, and vasoconstriction, etc). However, in general, noise is not aversive enough to effectively condition the response of the animal over the long term. This may explain the failure of most acoustic harassment devices to deter wildlife, such as deer from a favoured area.

The Department of National Defence completed the EIS for Low-Level Training Area in Goose Bay, and subsequent to that the Allied forces have flown aircraft as low as 1,000 ft AGL at subsonic speed for almost a decade (~5,000 sorties annually). In the EIS (DND, 1994), a number of Valued Ecosystem Components (VEC) were identified and ranked on the basis of their importance (Table C 1); and impacts due to aircraft noise and visual stimuli were assessed (Table C2). The DND designed its monitoring and mitigation program for the LLTA based on the recommendations emerging from the EIS. It should be noted, that DND's monitoring and mitigation program was quite successful, and no adverse effects on sensitive wildlife species had been observed; and it has been well documented by the effects research conducted by the Institute for Environmental Monitoring and Research (IEMR). As of April 2006, the environmental monitoring responsibility has been transferred to the IEMR; whereas, the DND still maintains the responsibility to mitigate any of the environmental effects that may result due to military training activities in the Goose Bay area.

Table C1. Importance Rating for Valued Ecosystem Components[2]

| VEC | Local Status (4,3,2) | Species Status (4,3,1) | Position in Food Web (4,3,2) | Socio-economic Importance (7,6,5,4,3,2) | Scientific Importance (5,4,3,2,1) | Migratory Species (4,2) | Total | Rank |
|---|---|---|---|---|---|---|---|---|
| George River Caribou Herd | 2 | 1 | 3 | 7 | 5 | 4 | 22 | 1 |
| Peregrine Falcon | 4 | 4 | 4 | 2 | 4 | 4 | 22 | 1 |
| Harlequin Duck | 4 | 4 | 3 | 2 | 5 | 4 | 22 | 1 |
| River Valleys | 4 | 4 | 4 | 5 | 5 | - | 22 | 1 |
| Gyrfalcon | 4 | 4 | 4 | - | 5 | 4 | 21 | 2 |
| Red Wine Caribou Herd | 4 | 4 | 3 | 4 | 5 | - | 20 | 3 |
| Golden Eagle | 4 | 3 | 4 | - | 5 | 4 | 20 | 3 |
| Freshwater and Diadromous Fish | 2 | 3 | 3 | 6 | 3 | 2 | 19 | 4 |
| Bald Eagle | 3 | 3 | 4 | - | 4 | 4 | 18 | 5 |
| Canada Goose | 2 | 1 | 3 | 5 | 3 | 4 | 18 | 5 |
| Ptarmigan/Grouse | 2 | 1 | 3 | 7 | 3 | 2 | 18 | 5 |
| Wolf | 3 | 3 | 4 | 3 | 4 | - | 17 | 6 |
| Marten | 3 | 1 | 4 | 7 | 2 | - | 17 | 6 |
| Lynx | 3 | 1 | 4 | 4 | 5 | - | 17 | 6 |
| Osprey | 2 | 3 | 4 | - | 4 | 4 | 17 | 6 |
| Hares (Snowshoe, Arctic) | 2 | 1 | 3 | 5 | 5 | - | 16 | 7 |
| Ducks | 2 | 1 | 3 | 5 | 3 | 2 | 16 | 7 |
| Moose | 3 | 1 | 3 | 5 | 3 | - | 15 | 8 |
| Wolverine | 3 | 4 | 3 | 2 | 3 | - | 15 | 8 |
| Owls | 3 | 3 | 4 | - | 3 | 2 | 15 | 8 |
| Loons | 3 | 3 | 4 | - | 3 | 2 | 15 | 8 |
| Porcupine | 4 | 1 | 3 | 5 | 1 | - | 14 | 9 |
| Black Bear | 3 | 1 | 3 | 4 | 2 | - | 13 | 10 |
| Small Mammals | 2 | 1 | 3 | 2 | 5 | - | 13 | 10 |
| Mink | 3 | 1 | 4 | 3 | 1 | - | 12 | 11 |
| Beaver | 2 | 1 | 3 | 5 | 1 | - | 12 | 11 |
| Passerine Birds | 2 | 1 | 3 | 2 | 2 | 2 | 12 | 11 |
| Vegetation | 2 | 1 | 2 | 4 | 3 | - | 12 | 11 |

[2] EIS (DND, 1994) Table 9.7

Table C2. Impact Assessment of Aircraft Noise and Visual Stimuli on Valued Ecosystem Components[3].

| VEC | Impact Rating[(1)] | Type of Effect[(1)] | Duration[(1)] | Uncertainty[(1)] |
|---|---|---|---|---|
| Migratory caribou | Major | Direct | Long-term | Low |
| Resident caribou | Moderate | Direct | Long-term | Moderate |
| Moose | Minor | Direct | Moderate | Moderate |
| Black bear | Minor | Indirect | Long-term | High |
| Wolf | Moderate | Indirect | Long-term | High |
| Marten | Minor-Moderate | Direct | Moderate | High |
| Wolverine | Negligible | - | - | Moderate |
| Mink | Negligible | - | - | Moderate |
| Otter | Minor | Direct | Moderate | High |
| Coloured fox | Negligible | - | - | Moderate |
| Arctic fox | Negligible | - | - | Low |
| Lynx | Minor | Direct | Moderate | High |
| Beaver | Negligible | - | - | Moderate |
| Muskrat | Negligible | - | - | Moderate |
| Arctic hare | Negligible | - | - | Low |
| Snowshoe hare | Negligible | - | - | Moderate |
| Small mammals | Negligible | - | - - | Moderate |
| Porcupine | Negligible | - | - | Moderate |
| Seals | Negligible | - | | Low |
| Peregrine falcon | Major | Direct | Long-term | Moderate |
| Gyrfalcon | Major | Direct | Long-term | Moderate |
| Golden eagle | Major | Direct | Long-term | Moderate |
| Bald eagle | Moderate | Direct | Long-term | Moderate |
| Osprey | Minor | Direct | Long-term | Moderate |
| Owls | Negligible | - | - | High |
| Canada goose | Minor | Direct | Moderate | Moderate |
| Ducks | Moderate | Direct | Moderate | Moderate |
| Harlequin duck | Major | Direct | Long-term | High |
| Loons | Negligible | - | - | Moderate |
| Ptarmigan | Minor | Direct | Moderate | High |
| Grouse | Negligible | - | - | Moderate |
| Passerine birds | Negligible | - | - | Moderate |
| Fish | Negligible | - | - | Moderate |

## 2.0 Noise Environment

For the subsonic low-level training activity, the DND's mitigation program is based on the principle of avoidance, and it is designed to minimize noise impact on sensitive wildlife species by providing spatial separation (i.e. vertical and/ or lateral), and temporal separation (during sensitive periods). However, the noise generated from these aircraft at altitude above 1,000 ft has been considered to be an acceptable level of noise disturbance for many of the wildlife species that are present in 5 Wing Goose Bay Air Ranges (EIS, DND 1994). Figure C1 shows the distribution of environmental closures that were in place during the month of July 2003. It should be pointed out that most of the Red Wine Caribou are outside the CYA 732 Air Range, and there are only a few closures for human occupancy areas and raptors.

[3] EIS (DND, 1994), Table 11.17

DND and IEMR, along with its partners, have conducted a number of wildlife monitoring programs/ studies in the field. These organizations have observed some startle reaction in many of the wildlife species due to subsonic jet aircraft noise; however, to date no population level effects have been observed. In these studies, it has been determined that the slow-moving aircraft (such as helicopter and propeller driven aircraft) may have greater impact on the wildlife because of the greater visual component, as compared to the low-flying jets. The reactions of osprey and waterfowl to sonic booms were observed in July 2004 during the field trails in Labrador. It should be pointed out the species of concern may change over time, and the monitoring program would be update accordingly.

Subsonic noise from an aircraft is generated because of the engine and airframe, whereas sonic boom noise is due to sudden onset and release of atmospheric pressure. Since a supersonic aircraft is flying faster than sound can travel, the noise that is heard on the ground due to the sonic boom is usually 2-60 seconds after the aircraft has passed overhead. Consequently there is no warning to wildlife, such as the build-up of the noise that is common with the approach of slower moving subsonic aircraft. Therefore, when a sonic boom reaches the ground the startle reaction due to the sudden noise will typically be present.

As stated earlier, only the Labrador portion of the Air Range CYA 732 would be used for training purpose. From the activity proposed (this Environmental Assessment), it is expected that the impact on the wildlife population would be insignificant. This is because most of the supersonic activities take place above 15,000 ft; further, DND will limit the minimum altitude at or above 5,000 ft AGL. Moreover, supersonic activity is likely to shift to higher altitudes with the deployment of modern aircraft.

The Department of National Defence contracted Wyle Laboratories to conduct BooMap analysis under various training scenarios (see Appendix 1, Annex B, which contains the associated manoeuvre ellipses). The analysis has been carried out using two distinct scenarios[4]: (a) Conventional Night Strike, and (b) Ongoing Training. It is pointed out that the frequency of sonic booms reaching the ground and the resulting cumulative noise level is proportional to the number of supersonic flights in a given airspace (i.e. within the manoeuvre ellipse).

Under the *Conventional Night Strike* scenario, which is an intensive two-week training period, 0.25 booms per day (or one boom every four days) can be expected in the centre of the training ellipse. Due to the weather and available daylight window of opportunity, this type of exercise can only to take place once or twice in a training season, and the cumulative noise (CNDL level) will be slightly above 45 dB in the centre of the manoeuvre ellipse, and lower towards the edge. Due to the nature of the training and resources requirements to conduct such training, only one or two training events are possible in a year. The noise impact on the ground would be akin to what is commonly felt during the rainy season.

[4] Note: DND contracted the Wyle Laboratories for analysis using two separate scenarios; however, at this stage, due to lack of interest from the Allies, it expects that only Conventional Night Strike may be possible.

On the other hand, for the *Ongoing Training* scenario, the DND predicts that even in the worst-case situation (~1,250 sorties flown in Air Range CYA 732, as a single manoeuvre ellipse), sonic booms may be heard about 4 times a month; the frequency of booms towards the edge of the Air Range would be lower. Average peak overpressures should normally be less than 1 psf; only 2 % of sonic booms are likely to exceed 4 psf. With this level of supersonic activity, the cumulative noise (CNDL level) will be slightly above 45 dB in the centre of the manoeuvre ellipse, and lower towards the edge. *In any case, the noise level is not enough to cause significant population level impact on wildlife species present in the Air Range CYA 732.*

## 2.0 Caribou

### 2.1 George River Caribou Herd

The George River caribou herd routinely migrates across the northern portion of the Quebec - Labrador Peninsula. (DND deployed 20 satellite collars in order to monitor the herd's movement through the training area.) Calving occurs to the north of the LLTA, or CYA 731/732. In 2003, the herd size was estimated to be about 450,000 animals, and DND deployed 20 satellite collars to monitor the herd. The period from pre-calving through post-calving is most sensitive to noise disturbance from military activity. The portion of the LLTA that has had historical migration routes has the lightest subsonic low-level aircraft activity (generally less than two flights per week). Given the low aircraft activity and the brief period that the herd may be exposed (usually April/ May and August/ September), the potential risk of population level impact was considered to be very low.

Initially for low-level subsonic mitigation activities, DND created "core area closures", which were protective (no fly) areas around collared animals (for flights below 1,000 ft AGL), that varied in radius from 10-15 miles, depending on the seasonal sensitivity. While this approach was generally effective, it assumed that the collared animals were cantered in each group, and that each group represented a large number of animals. It also assumed that the closed area was sufficient to accommodate movements of the group between reporting cycles. Subsequently, in consultation with the IEMR, these closure restrictions were lifted for this herd. However, with the approval of this new undertaking if necessary, a core area closure will be applied that effectively removes the north western portion of Air Range CYA 732 from active flying during herd migration through the area.

### 2.2 Red Wine Mountain Caribou Herd

The Red Wine Mountain caribou herd (RMCH) is a small woodland (sedentary or non-migratory) herd. With reconfiguration in 1996, the entire range of the herd fell within the training area. Given the proximity to the airfield, the RMCH occupy a potentially high-use area for flying activity that, without mitigation, could result in significant disturbance. A 2001 survey by DND showed that he RMCH herd has been in continuous decline and currently has about 97 animals. The RWM caribou has been assigned a "threatened" status by COSEWIC. This status is consistent with the status assigned under the Provincial Endangered Species Act.

Unlike the George River herd, the Red Wine animals do not embark on extensive migrations or form large aggregations. Low-level subsonic mitigation is designed around a radio-telemetry monitoring programme with an enhanced sample of 15 transmitters deployed on the herd, establishing a "core-use" area based on these collars. Considering the limited movement of woodland caribou and the large core area closure normally applied, the application of the core concept resulted in a closure of about 7-8000 $km^2$ throughout most of the flying training season. Although the known range of RMCH is outside the proposed area (i.e., CYA 732) for supersonic training activity; if necessary, the current mitigation activities will continue with this undertaking, including “core area closures”.

DND is a member of the Labrador Woodland Caribou Recovery Team established by the provincial government as a result of the COSEWIC “threatened” designation of woodland caribou herds. DND/ IEMR will support the efforts of Labrador Woodland Caribou Recovery Team to assist in the recovery of this species.

### 2.3 Lac Joseph Caribou Herd

The Lac Joseph Caribou herd (LJCH) is a “threatened” woodland herd that partially resides below the Goose Bay Air Ranges. Given the location of the herd, the small numbers of this herd that reside below the LLTA (CYA 731) and the relative lack of military activity in that portion of the training area (less than 2 flights per week), little monitoring had been conducted. Instead, DND relied largely on block closures of the western portion of the LLTA to effect mitigation.

The Province of Newfoundland and Labrador is proposing to establish a nature preserve for the Lac Joseph Caribou herd. While the designated area is west of the LLTA, a small portion overlaps the LLTA. As the plans for this preserve evolve, DND will work with the Province to ensure mitigation measures are appropriate.

### 2.4 Other Woodland Caribou

Other woodland caribou were also located in the southern portion of the LLTA, and one animal in a group of four was equipped with a satellite collar. It is still uncertain whether these animals are of the Joir River herd, or are dispersed remnants of the Mealy Mountain/ Lac Joseph Caribou Herd. Regardless of their herd affiliation, they are designated as threatened because they are defined as woodland caribou. IEMR will maintain this monitoring programme using satellite telemetry and apply the same mitigation standard that is applied to the Lac Joseph Herd collar groups.

## 3.0 Birds

### 3.1 Raptorial Birds

The Raptorial Bird monitoring component includes cliff-nesting (Golden Eagles, Peregrine Falcons and Gyrfalcons), and woodland (Bald Eagles, Osprey) raptors. DND has

conducted an annual raptor monitoring programme since 1990 and has gathered a substantial database, including detailed distribution, habitat use and recruitment data.

In the LLTA (CYA 731), cliff areas with suitable nesting or perching habitat are limited; these areas will continue to be monitored for cliff-nesting raptors. It is not anticipated that Gyrfalcons or Peregrine falcons will be found, as there is no historical use below the training area. Likewise, based on historical data, 1-2 active Golden Eagle nests may be active. Active nest sites will be confirmed, and a 2.5-mile protection area will be assigned to each active nest for the nesting period.

Bald Eagles comprise a small stable population, consisting of about 6-8 active nests dispersed throughout the area below the LLTA. DND will establish protection areas of 2.5-miles around all known active nest sites at the beginning of the nest initiation period and maintain these closures until the sites are confirmed to be inactive.

Ospreys have been the main focus of the programme, due to their large population and dispersion across the training area. Based on the results of recent population, recruitment and behavioural studies, the Osprey population appears healthy, and expanding. Subsonic military flying activity does not appear to cause negative population effect. In a workshop sponsored by the IEMR to examine the DND's monitoring programme, which included the associated resource managers and species experts, it was agreed that the commitment to protection of individual nests could be terminated and the level of effort dedicated to Osprey monitoring was to be significantly reduced. To ensure that longer-term effects do not go unrecognized, DND has turned over the osprey-monitoring component to the IEMR. The IEMR will continue to monitor Osprey using a sample of approximately thirty "disturbed" nests in the highest aircraft activity area and thirty "non-disturbed" nests on the adjacent Eagle Plateau, using the same monitoring protocol as in previous seasons.

### 3.2 Waterfowl

Waterfowl are distributed in very low densities throughout the training area. They had previously been considered sensitive to disturbance during their moulting, staging and nesting periods. However, recent monitoring and disturbance research by DND, in cooperation with the Canadian Wildlife Services (CWS) and other studies, suggests that sensitivity during the nesting period is less significant than initially perceived in the EIS. CWS has identified all high-use areas, which will be protected for the sensitivity period (i.e. the spring staging period).

During the supersonic field trials it was shown, waterfowl behaviour changed significantly for a short time immediately after the sonic boom, which is why the birds left the area momentarily. However, given the number of sonic booms reaching the ground and their expected frequency, no significant impact on the waterfowl population is expected. It should be pointed out, that the similar behaviour of waterfowl would be observed following a thunderstorm.

### 3.3 Eastern Harlequin Ducks

Harlequin ducks have received special consideration in light of their status as an endangered species. Most of the known prime habitat for the Harlequin duck is now outside the LLTA. Over the past few seasons, and with the cooperation of CWS, IEMR, the Voisey's Bay Nickel Company, the Lower Churchill Hydro Projects and the Department of Work Services and Transportation, DND has compiled an inventory describing the areas of use and occupancy periods for these ducks within the LLTA.

Harlequin Ducks have recently been downgraded to a "Species of Special Concern" in the recently released Provincial Endangered Species Act because of a clearer picture of the population, distribution, nesting and migration patterns. The changed status of the Harlequin triggered a review of the mitigation requirement. In consultation with CWS and IEMR, DND has removed all the closures for Harlequin Ducks. The IEMR has implemented an annual monitoring survey program for thee years; the first survey was conducted in 2005.

### 3.4 Barrow's Goldeneye

Barrows Goldeneye has been designated as vulnerable species by the province of Newfoundland and Labrador. Even though the main locale of this duck is Quebec, there may be some moulting and wintering areas in Newfoundland and Labrador. Barrow's Goldeneye has not been observed below the 5 Wing Air Ranges, and if the species is discovered below the Air Ranges, appropriate mitigation measures will be adopted.

### 3.5 Passerine Birds

In the EIS (DND, 1994), it was noted that the population status and distribution of passerine birds (as a group) in Labrador is not well known; however, some inferences were drawn considering the habitats that different species prefer. It was also noted that these species may be prevalent in the southern portion of the LLTA (CYA 731), and consequently no specific monitoring or mitigation measures were implemented for passerine birds while the low-level training program was active in the Goose Bay area (see Table C1 and C2). Furthermore, based on the expected frequency of low-level subsonic flights at a specific location, it was determined to have no significant effect on the passerine birds. The proposed supersonic activity would be confined to the CYA 732, the northern portions of Labrador, where the habitat is less likely to be suitable for the passerine birds. Consequently, with the expected number of booms reaching the ground during supersonic training, no significant impact is expected on the passerine birds. However, if during the monitoring activities of the IEMR significant number of birds is discovered, then the DND will adopt appropriate mitigation measures.

## 4.0 Moose Wintering Yards

The 1994 EIS predicted that military flying training would result in a minor impact on Moose during the late winter period. The EIS further identified high, moderate and low habitat capability for this period, which was verified by DND. However, the distribution and population was less than expected in the EIS. Mitigation measures for moose are based on the avoidance criteria of 5 moose per square kilometre over a 10 square kilometre area.

During the winter of 2000, IEMR, DND and the applicable resource managers conducted an aerial transect survey of the entire southern portion of the LLTA (CYA 731) to collect distribution data on moose and caribou. The transects indicated that all high-density areas have been captured in our inventory for protection. Areas identified as high capability late winter habitat will be protected.

**5.0 Nocturnal Species**

Nocturnal species received little attention during the preparation of the EIS (DND 1994), as there was little night flying activity and little literature available. As a result, there are no avoidance measures focused on nocturnal species. The current night flying activity level is well below the approved level, and is expected to remain below the approved level for some years ahead. Notwithstanding, DND is reviewing the literature for this group of species to assess the current understanding of potential aircraft impact on nocturnal wildlife habits, with a view to establishing new criteria if necessary. DND will collaborate on this study with the province of Quebec, Newfoundland and Labrador, and the Institute for Environmental Monitoring and Research.

**6.0 Avoidance Criteria**

Wildlife avoidance criteria are the standard applied when establishing protection areas for sensitive locations. The criteria were initially developed in the early phase of the mitigation program during the preparation of the EIS (DND, 1994). At the time, the impact of low-level jet over flight was poorly understood; consequently, the avoidance criteria were based largely on perception and the adaptation of existing aeronautical restrictions. Since then, the scientific knowledge base has improved considerably. This is largely due to studies/ monitoring activities conducted by DND. For its part, the IEMR has conducted research focused specifically on the effects of military flight activity. To date, with the current avoidance criteria, results of most studies on this subject clearly indicate that the actual impact on the environment due to over flight is minimal. At present, the avoidance involves spatial separation (vertical and/ or horizontal). At present, vertical separation of 1,000 ft is considered to be a sufficient level of protection for sensitive species. Also, horizontal separation (closure size) allows jet aircraft to fly low-level (< 1,000 ft) and provide sufficient horizontal offset from noise disturbance for the protection of the sensitive species. The avoidance criteria for low-level subsonic flight training are outlined in the FMTGB Mitigation Orders and are available on line, or they can be obtained from the Principal Contact person for this EA.

With this new supersonic flight training activity in the 5 Wing Goose Bay Air Range CYA 732, the Department of National Defence will continue to maintain current avoidance criteria (in terms of noise dosage levels for low-level subsonic aircraft activity only) for the protection of sensitive wildlife species. The DND predicts that with the proposed 'Supersonic Flight Training' activity, the cumulative noise levels resulting from ambient noise and occasional sonic booms reaching the ground would not necessarily increase the noise dosage so as to warrant special protection for wildlife species (in accordance with the data presented in Appendix 1 of Annex B). IEMR will conduct field-monitoring activities to validate these predictions.

The Department of National Defence has proposed an Adaptive Management Strategy for environmental monitoring and mitigation (see section 1.6 and 4.3 of the Registration document), whereby detrimental effects due to supersonic training should be discovered. Further, if there were any ill effects discovered during any of the IEMR monitoring and effects research, DND would take appropriate action. These actions may include dividing the Air Range into sections, thereby limiting supersonic flight activity in certain parts of the training airspace (see Appendix 1 in Annex B). The frequency of sonic booms reaching the ground and the resulting cumulative noise level is proportional to the number of supersonic flights over a defined area. The division of airspace into sections would help protect the sensitive species from sonic boom impact because this airspace division would force supersonic training dispersement across a larger area. Furthermore, as new fighter aircraft are brought into service, their supersonic noise levels will be reviewed and closure areas may be imposed if these new aircraft produce supersonic noise levels that exceed those allowed under the EIS (DND, 1994).

## 7.0 Conclusions

DND would like to approve supersonic flight activity for the Labrador portion of Air Range CYA 732 at 5,000 ft AGL and above. This is the minimum floor level for the training activity; however, most of the activity would occur above 15,000 ft AGL. Due to this proposed 'Supersonic Flight Training' activity, some startle reactions in the wildlife species is expected. It is believed this level of disturbance would not cause population-level impact on wildlife species that are present in the area. This proposed level of supersonic flight activity will not increase the noise levels significantly under the Air Range. Consequently, DND does not foresee a requirement for range closures because, currently, there does not appear to be evidence suggesting that harm would come to known sensitive species.

Once the supersonic flight training activity is approved for the Labrador portion of the CYA 732, the environmental monitoring and effects research program, to be conducted by the Institute for Environmental Monitoring and Research (IEMR), and DND's Environmental Mitigation program should be able to detect any population-level disturbances. Following this, if the adverse effects are observed in any of the wildlife species, the DND will implement appropriate mitigation measures, where necessary.

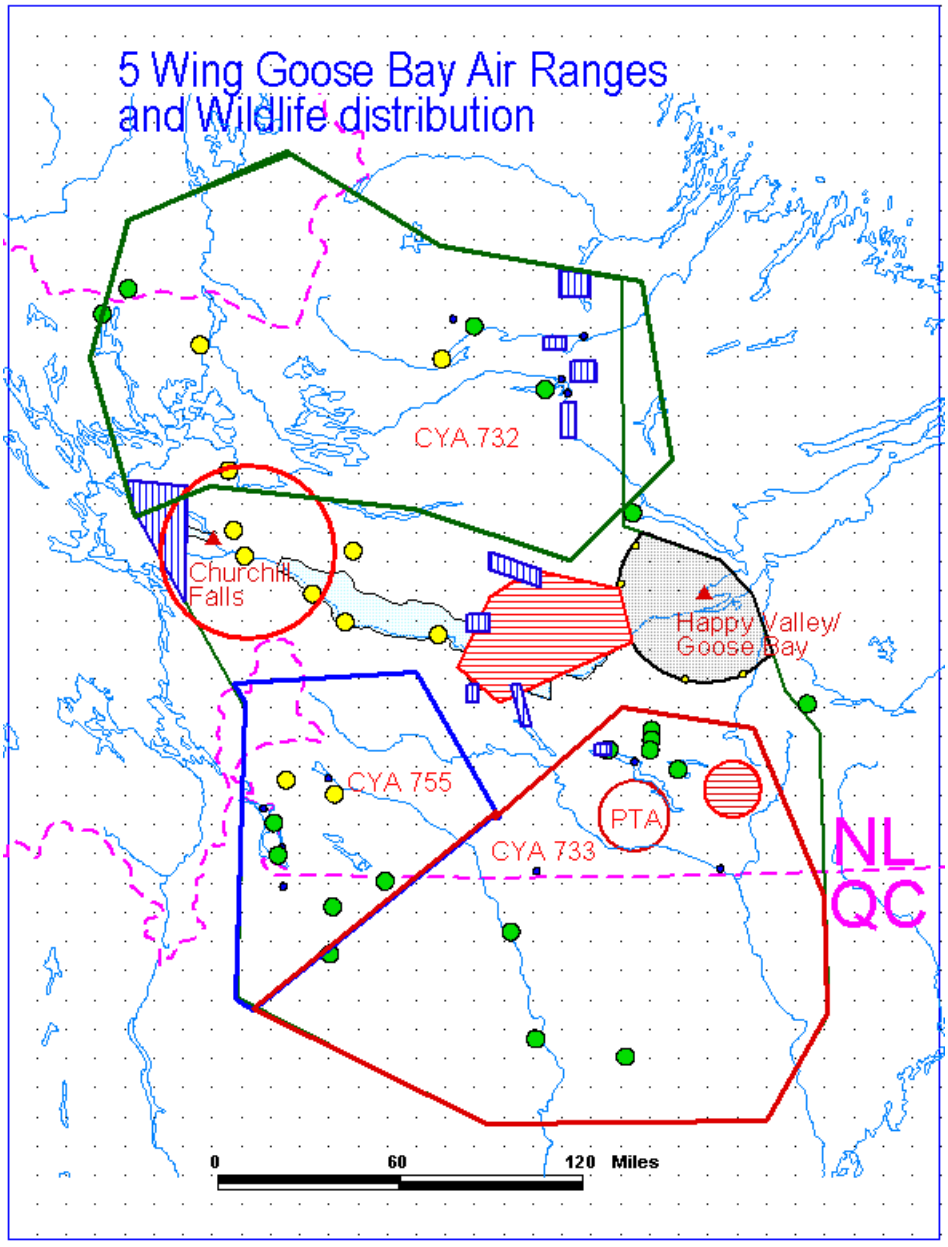


Figure C1. July 2003: Closures for wildlife species below the 5 Wing Goose Bay Air Ranges. The areas are marked as follows.

- Red stripe areas are the Red Wine Caribou closures.
- Blue stripe areas are the Harlequin duck closures.
- Green circles are 2.5 miles in radius and represent areas of human occupancy.
- Yellow circles are 2.5 miles in radius and represent raptor closures.
- Blue circles are 1 mile in radius and represent waterfowl locations.