2004 NORTHERN GOSHAWK MONITORING OF CANFOR TFL 37, WOSS, BC

CANADIAN FOREST PRODUCTS LTD – ENGLEWOOD DIV.

Prepared By

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EXECUTIVE SUMMARY

The coastal subspecies of Northern Goshawk, the Queen Charlotte Goshawk (*Accipiter gentilis laingi),* is an uncommon forest raptor that is currently on the British Columbia "Red List" as a candidate species for Endangered or Threatened status. It is also classified as an Identified Wildlife Species under the BC Forest Practices Code, Identified Wildlife Management Strategy (IWMS). Federally, the Queen Charlotte Goshawk is listed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Population trends of Queen Charlotte Goshawk are uncertain. As of 2003, 40 nests in 12 goshawk territories had been found in Canfor's TFL 37, on north-central Vancouver Island. Canfor has committed to managing habitat for this species through an Adaptive Management Strategy involving approved Wildlife Habitat Areas, which vary from normal IWMS provisions. Ten goshawk WHAs were endorsed by government in March 2003

Between 11-18 May and 6-14 July 2004, goshawk surveys for breeding activity were conducted at all 12 previously known territories in TFL 37. All known nests were visited to determine the status of each nesting territory. Areas thought to have relatively high potential for nesting Queen Charlotte Goshawks, as predicted by a habitat model developed by MCA, were also surveyed for activity. Surveys followed Resource Inventory Standards Committee (RISC) standards for raptor surveys, and consisted mainly of call playback and nest search surveys.

A total of 227 call playbacks were completed during the survey period. Of the 192 call playbacks completed in known nest territories, 78% were completed in mature and old-growth forest stands and 22% were in second growth. Estimated hours surveyed in each known nest territory ranged from 1.5-17.0 hrs; total hours spent was approximately 156.5 hrs.

Four goshawk detections occurred during surveys. All initial detections occurred during the nestling period while conducting call playback and nest search surveys. Three detections occurred in mature and old-growth forest types and one detection occurred in second growth. All initial detections were incubating or brooding females on nests. Detection rates for call playbacks conducted in known and potential nesting territories in mature and old-growth forest areas were 1.70 detections/100 call stations (n = 176); in second growth 0.00 detections/100 call stations (n = 51); and overall detection rates for TFL 37 were 1.32 detections/100 call stations (n = 227).

Three of the 12 (25%) previously known goshawk nesting territories were active in 2004 (Kaipit, Sutton and Toad), all of which were in mature and old-growth forest stands. Occupancy rates in 2004 were approximately half the re-occupancy expected during an average year (54.6%). This is the same occupancy rate that occurred in 2003 (however, the occupied territories in 2003 were inactive (i.e., no nesting occurred)), which is the lowest occupancy rate recorded since monitoring began in 1995. One new goshawk territory was found in second growth (approximately 60 year old stand) at block CT-060.

Overall detection rates in TFL 37 were lower in 2004 compared to the long-term average (1994-2001) for call playback surveys completed in the TFL region. The long-term detection rate for the TFL region was approximately 1.73 detections/100 call stations, compared to 1.32 detections/100 call stations in 2004, or 76.3% of long-term detection rates.

The four active goshawks nests successfully fledged at least 9 young in 2004. Three of the nests (CT-060, Kaipit and Toad) fledged 2 young each, while Sutton fledged at least 3 young. Overall mean productivity for the 4 nests was 2.25 fledglings/nest. The productivity rate in 2004 was higher than

the mean long-term productivity rate (1994-2003) for known nesting territories in TFL 37, which was 1.37 young fledged/active nest.

Prey species detected across all habitat types in TFL 37 were higher in 2004 than the long-term average for the TFL area. Prey species detection rates in 2004 were 1.2 prey species/call station (n=227) compared to the long-term average (1995-2002) of 1.0 prey species/call station. Based on forest age class, prey detections were 112.5 detections/100 call stations in mature and old-growth areas, and 152.9 detections/100 call stations in second growth areas. Analyses of pellets collected from four goshawk nest territories in 2004 showed that the most common prey species were red squirrel (*Tamiasciurus hudsonicus*), Northern Flicker (*Colaptes auratus*) and Steller's Jay (*Cyanocitta stelleri*). Nevertheless, the relationship between prey detection rates and prey abundance is unclear and potentially unreliable. Aural detections of red squirrel are dependent on several factors including time of year, age and sex of the individual, whether there are other squirrels in the near vicinity, and the perceived threat of intruders.

In 2004, total precipitation levels (total rainfall and snowfall) in March were 88.4% of the 30-year mean (1971-2000), while total precipitation in March and April combined was 65.8% of the 30-year mean. Essentially, this meant that the spring period was drier than normal. Previous studies (Manning et al. 2004) in TFL 37 have demonstrated that there was a significant negative correlation between total precipitation levels in March and nest re-occupancy, and combined total precipitation levels for March and April and nest productivity. Precipitation levels in March 2004 would suggest that nest re-occupancy rates in 2004 should be higher than the long-term average; however, this was not the case. Active reoccupancy was higher than in 2003, when no goshawk territories were successfully occupied (i.e., no young were fledged in 2003) and spring precipitation levels were much higher than the 30-year mean. Combined total precipitation levels for March and April 2004 would suggest that in 2004, productivity rates should be higher than the long-term average of 1.37 young fledged/active nest for the TFL. This was the case; productivity in TFL 37 was 2.25 young fledged/active nest in 2004. It must be cautioned that spring precipitation levels are only one variable which may affect goshawk territory occupancy and the success of spring breeding (i.e., fledgling production). However, this perhaps simplistic indicator should be further quantified.

Recommendations for future work include:

1. Continue to survey existing goshawk territories, known nest sites, and potential new territories in TFL 37, as well as comparisons with two control areas (i.e., goshawk territories which are located in "benchmark" areas such as Strathcona Provincial Park).

2. **Subject to funding**, data collection on goshawk use of post-fledging areas (i.e., use and size of PFA, temporal movement beyond the PFA) should be conducted Nestling capture and use of radio telemetry will be required in order to assess PFA use. It is recommended that **this objective be pursued in 2006**, as part of the conclusion of the 5-year adaptive management monitoring cycle recommended by Manning et al. (2004).

3. The following procedures are recommended for **conducting goshawk nest surveys in 2005**:
    - check for nest activity in late April – early May at known goshawk territories, and play alarm calls during these surveys;
    - play juvenile begging calls in mid-late June to confirm nest activity and/or determine number of fledglings;

4. Continue to examine potential correlations and trends between climatic variables (monthly precipitation and temperature), and goshawk territory occupancy, nest establishment/success and nest productivity (i.e., number of young fledged).

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A. INTRODUCTION

Northern Goshawks (*Accipiter gentilis*) (hereafter referred to as "goshawk") are large forest raptors that breed in mature boreal and temperate forests across the Holarctic (Johnsgard 1990; Squires and Reynolds 1997). Goshawks are the largest of the three North American Accipiter hawks and prey mainly upon medium-sized mammals and birds. Goshawks have short rounded wings that allow for rapid acceleration and long tails that provide for quick maneuverability through forest stands. Although they are well-adapted for hunting within forests, they also hunt in open areas and non-forested habitats.

Two subspecies of goshawk occur in British Columbia: A. g. atricapillus and A. g. laingi. The former subspecies breeds throughout the mainland and interior of British Columbia (Campbell et al. 1990). The latter subspecies, or Queen Charlotte Goshawk, occurs only on coastal British Columbia (Campbell et al. 1990), mainly the Queen Charlotte Islands, Vancouver Island and other large coastal islands (McClaren 1997, 2001; Cooper and Chytyk 2001). Although Queen Charlotte Goshawk breeding has not been confirmed on the coastal mainland of British Columbia (Campbell et al. 1990), it is likely that the goshawks that breed on the north and central mainland coast are of this subspecies (Cooper and Chytyk 2001; McClaren 2003).

North American studies suggest that goshawks prefer to nest in mature and old growth forests that generally have closed canopies, sparse understories and larger trees (Crocker-Bedford and Chaney 1988; Reynolds et al. 1992; Squires and Reynolds 1997; Daw et al. 1998). Possible explanations for these preferred habitats include:

- large trees and open understories provide substantial flight corridors for goshawks and may improve the abundance of some key prey species such as jays, thrushes, grouse and squirrels;
- closed canopy forests provide a suitable nesting microclimate and deter nestling predation and nest site competition by other raptor species; and
- mature forests may increase the vulnerability of some prey species due to the ambush hunting techniques of the goshawk (Crocker-Bedford 1994).

Between 1994-2002, BC Ministry of Water, Land and Air Protection (formerly BC Ministry of Environment, Lands and Parks) conducted goshawk surveys around the Woss area, including Canadian Forest Products Ltd. (Canfor) Tree Farm Licence (TFL) 37 (Quayle et al. 1995; Ethier 1999; McClaren 1997, 1999, 2001 and 2003). In 2002, Canfor, Englewood Division, contracted Manning, Cooper and Associates to monitor known goshawk territories and survey new potential nesting territories in TFL 37 (Manning et al. 2003b) as part of their Queen Charlotte Goshawk Adaptive Management Strategy (Manning et al. 2004). Monitoring and surveying for goshawks continued in the TFL during 2003 (Manning et al. 2004) and 2004 by Manning, Cooper and Associates; the following report summarizes the results of these survey efforts in 2004.

A.1. Conservation Status

Nationally, the interior subspecies of goshawk is designated as "Not at Risk" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Duncan and Kirk 1995), while the coastal subspecies is designated as "Threatened" (Cooper and Chytyk 2001; COSEWIC 2004). Provincially, the interior subspecies is "Yellow-listed" (not considered at risk in British Columbia) while the coastal subspecies is "Red-listed" (a candidate for threatened or endangered status; BC CDC 2004).

In British Columbia, the coastal subspecies population is ranked as "S2B" and "SZN", i.e., imperiled provincially due to rarity and perceived threats to habitat (BC CDC 2004).

The Queen Charlotte Goshawk is an "Identified Wildlife Species" under the BC Forest and Range Practices Act *Identified Wildlife Management Strategy* (MWLAP 2004). This strategy contains specific management practices (General Wildlife Measures or GWMs) that outline allowable forest practices within Wildlife Habitat Areas (WHAs), which are designated conservation areas around goshawk nest sites.

Population trends for Queen Charlotte Goshawk are unknown for British Columbia. On Vancouver Island, recent surveys conducted by MWLAP and forestry companies and reports from the general public (1994-2002) on Vancouver Island have identified 66 goshawk breeding territories (McClaren 2003). Nine breeding territories were found on the Queen Charlotte Islands between 1995-2004 (Chytyk and Dhanwant 1999; G. Morigeau pers. comm.). Crude estimates for the breeding goshawk population in British Columbia is 300 pairs for Vancouver Island, 50 pairs for the Queen Charlotte Islands, and potentially another 75 pairs on the coastal mainland (Cooper and Chytyk 2001). In Canfor TFL 37, 41 nests in 12 different breeding territories were located between 1994-2003 (McClaren 2001, 2003; Manning et al. 2004).

A.2. Nesting Habitat

Although goshawks may breed in younger, more even-aged stands, they tend to choose breeding areas that have stands dominated by mature or old-growth trees, or suitable stand structure characteristics (e.g., relatively closed canopies, some large live trees and snags, coarse woody debris, etc.; Johnsgard 1990; Squires and Reynolds 1997; Kennedy 2003; McClaren 2003; Manning et al. 2003b). These stands do not necessarily need to be continuous, but substantial amounts seem to be preferred.

Goshawks are habitat generalists on large spatial scales, but have a complexity of habitat needs during the breeding season, the specifics of which vary among forest types and regions (Johnsgard 1990). High canopy closure (60-80%) is an important nesting habitat feature for goshawks across their range (Squires and Reynolds 1997; Daw et al. 1998; Kennedy 2003; McClaren 2003). Relatively closed canopies (60+%) provide protection from predators such as Red-tailed Hawks (*Buteo jamaicensis*), Great Horned Owls (*Bubo virginianus*), and corvids (Moore and Henny 1983; Crocker-Bedford and Chaney 1988; Crocker-Bedford 1990), provide thermal cover (Reynolds et al. 1992; Hall 1984), and promote more open spaces under the canopy that allow clear flight paths for striking prey (Squires and Reynolds 1997). Small forest openings, such as those created where a few trees have fallen, are often associated with goshawk nest sites (Reynolds et al. 1992; Chytyk and Dhanwant 1999).

Stands used for nesting vary in size and shape, depending on topography and availability of suitable stands. On Vancouver Island, goshawk nests are generally located on the bottom two-thirds of moderate slopes, at elevations below 900 m, and on all aspects (McClaren 2001, 2003). Of 131 goshawk nests found on Vancouver Island between 1994-2002, 55 (42.0%) were found in contiguous old-growth forests, 39 (29.8%) in contiguous second-growth forests, and 37 (28.2%) in fragmented old-growth forests (McClaren 2003). The youngest-aged stand that contained a nest was approximately 50 years old. On north-central Vancouver Island, six nest sites have been found in younger stands (50-93 years). These tended to have western hemlock (*Tsuga heterophylla*) as the leading tree species with a high site index (mean SI = 30.0), i.e., had high quality nutrient and moisture regimes that promote fast tree growth (Manning et al. 2002).

Northern Goshawk nests tend to be somewhat evenly spaced in suitable habitat throughout a landscape. Distance between nests tends to be larger the further north in the range (Squire and Reynolds 1997). Average inter-nest distances have ranged from 3.0 km in Arizona (Reynolds et al. 1992; Reynolds and Joy 1998), 5.6 km in Oregon (Reynolds and Wight 1978), 11 km on the Queen Charlotte Islands (Doyle 2003), to 20 km in the Kispiox Forest District of northern British Columbia (F. Doyle pers. comm.). Of 16 nesting territories clustered in an area near Woss, the mean nearest territory distance was 6.9 $\pm$ 0.7 km, with the two closest being approximately 3.3 km apart (McClaren 2003). The mean distance between alternate nests within goshawk nesting territories on Vancouver Island was 248.4 $\pm$ 27.2 m (n = 65). Approximately 50% of all alternate nests were located within 200 m of one another, while 90% were located within 500 m.

Northern Goshawk nest trees tend to be the largest, or one of the largest trees in the stand (Reynolds et al. 1992; Squires and Ruggiero 1996; Bosakowski et al. 1999). Larger trees are also preferred by Queen Charlotte Goshawk in British Columbia (Chytyk and Dhanwant 1999; McClaren 2001, 2003). On Vancouver Island, nest trees had a large mean dbh (70.7 $\pm$ 2.9 cm; n = 131) compared to available trees within the nest stand (McClaren 2003). Mean estimated tree height was 39.0 $\pm$ 1.6 m, while mean nest height was 19.4 $\pm$ 0.8 m. Larger trees provide structural support for nests including strong lateral branches, crotches, defects or mistletoe-like structures that platform nests can more easily be built on.

On Vancouver Island, most nest trees have been found in Douglas-fir (*Pseudotsuga menziesii*) (59%), western hemlock (30.5%) and red alder (*Alnus rubra*) (6.9%); however, Sitka spruce (*Picea sitchensis)*, amabilis fir (*Abies amabilis*), western redcedar (*Thuja plicata*) and western white pine (*Pinus monticola*) have also been used (McClaren 2001, 2003). Almost all nest trees were live (96.9%; n = 131) (McClaren 2003). In general, the variety of nest tree species selected by goshawks on Vancouver Island suggests that they may select for forest and nest tree structure, not nest tree species (McClaren 2001, 2003).

A.3. Foraging Habitat

Goshawks require relatively large foraging areas due to the relative scarcity of their prey and, consequently, they generally have large breeding season home ranges. Typically, goshawk prey species diversity decreases with increasing latitude (Johnsgard 1990); as a result, there may be a general trend of increased breeding season home range size with higher latitude.

Prey abundance and prey availability drive the use of foraging habitat, and prey availability is usually affected by vegetation structural attributes. Consequently, goshawks forage in areas that have adequate prey, sufficient cover to conceal the goshawk's approach to prey, sufficient openings in cover so that prey cannot easily escape and goshawk flight paths are not obstructed, and enough perches available for the goshawk's spot and attack hunting method (Beebe 1974; Reynolds and Meslow 1984; Beier and Drennan 1997).

Goshawks forage in all layers of a forest, from the ground up to the aerial zones above the canopy, but tend to concentrate efforts in the ground-shrub layer (Reynolds and Meslow 1984). The large body size and hunting strategies of goshawks precludes the use of young, densely stocked stands for foraging (Hayward and Escano 1989; Duncan and Kirk 1995; Squires and Ruggiero 1996). Therefore, early seral stages are less suitable as foraging habitat. Clearcuts may be used for foraging until trees reach a size where goshawks cannot easily penetrate stems or foliage.

Although edges, small open areas, and clearcuts (Bosakowski et al. 1999) can be used for foraging, and are regularly used by goshawks in interior British Columbia (Beebe 1974), the Queen Charlotte goshawk use unbroken forests more frequently for foraging, and have less association with edges and larger openings (Iverson et al. 1996).

B. STUDY AREA

The Lower and Upper Nimpkish Landscape Units are located in Canfor TFL 37 (Figure 1), within the Port McNeill Forest District (BC Ministry of Forests) and the Vancouver Island Region (BC Ministry of Water, Land and Air Protection). The Lower Nimpkish Landscape Unit is located immediately south of Port McNeill and encompasses Nimpkish Lake and the lower Nimpkish River north and west of Woss. The Upper Nimpkish Landscape Unit is located further upstream and southeast of the Lower Nimpkish. The Upper Nimpkish Landscape Unit encompasses the upper Nimpkish River, Woss Lake, Vernon Lake, and the Klaklakama Lakes.

Figure 1. Canfor's Coast Operations Tree Farm Licence (TFL) 37 [the Englewood Defined Forest Area (DFA)] on Vancouver Island (Deal et al. 2001)

B.1. Ecoregion Classification

The Lower and Upper Nimpkish Landscape Unit is located in the Northern Island Mountains (NIM) ecosection, of the Western Vancouver Island ecoregion and Coast and Mountains ecoprovince (Demarchi 1995).

B.2. Biogeoclimatic Ecosystem Classification (BEC)

The Lower and Upper Nimpkish Landscape Units contains three biogeoclimatic zones, Coastal Western Hemlock (CWH), Mountain Hemlock (MH) and Alpine Tundra (AT) (Meidinger and Pojar 1991), as follows:

Biogeoclimatic Zone:	Coastal Western Hemlock	CWH
Subzone Variant:	Very Dry Maritime	CWHxm2
Subzone Variant:	Submontane Very Wet Maritime	CWHvm1
Subzone Variant:	Montane Very Wet Maritime	CWHvm2
Biogeoclimatic Zone:	Mountain Hemlock	MH
Subzone Variant:	Windward Moist Maritime	MHmm1
Subzone Variant:	Moist Maritime Parkland	MHmmp
Biogeoclimatic Zone:	Alpine Tundra	AT

The relative proportion of BEC units within the Lower and Upper Nimpkish Landscape Unit is dominated by CWH ecosystems (82%) comprised of a mix of old/mature and immature coniferous forests, with MH (17%) and AT (1%) ecosystems making up a relatively small proportion of the total area.

C. METHODS

Goshawk surveys (nest monitoring and call playback surveys) were conducted in Canfor TFL 37 between 11-18 May and 6-14 July 2004 in accordance to Resource Inventory Standards Committee (RISC) standards for raptor surveys (RIC 2001).

C.1. Nest Monitoring

Twelve previously-known goshawk nesting territories in TFL 37 (McClaren 2001; Manning et al. 2003b; Manning et al. 2004) were revisited in May and July 2004. Nest territories were surveyed for the presence of adults and any evidence of breeding activity (i.e., fresh whitewash, recent prey remains or pellets, new greenery added to nest structures, presence of nestlings or fledglings, etc.). Known nesting territories were visited at least once in May to determine activity and, if no activity was found, were resurveyed up to two additional times during July. All known nest territories were visited at least twice, once in the nestling period and once in the fledgling period. Other potential nest territory areas were surveyed once, typically in the fledgling period. In total, each goshawk territory was surveyed up to four times.

Data collected on each adult observed included: sex (if known), behavior, presence of bands or radio telemetry devices, and any evidence of territoriality. Known nest trees were inspected for activity by searching the base of the tree for any fresh whitewash, prey remains or pellets. Nest structures were viewed through 40x spotting scopes for incubating or brooding females from elevated vantage points (where possible) that provided best views into the nest. Nests were observed for any signs of activity (e.g., new greenery added to the nest, white down on nest edges, or whitewash on or adjacent to the structure, etc.).

To determine activity status of known nesting territories, all known nest trees and alternate nest trees were visited during the survey period. If none of the known nest trees were active, call playback surveys and nest searches were conducted within the nest stand to determine occupancy. Generally, subsequent surveys were conducted at call stations located within a 500 m radius of known nest tree areas, however, in larger nest stands, surveys were conducted at >1 km radii.

A nesting territory was considered "unoccupied" if no goshawk was observed or detected in the nest stand during the survey period (Table 1). If an adult exhibiting territorial behavior was observed within the nesting stand, but there was no evidence of egg-laying or young fledging, then the territory was considered "occupied but inactive". If an active nest with fledglings was found, then the territory was considered "active". If evidence was found that egg-laying was probably initiated, but no fledglings were detected, then the territory was considered "active but failed".

Table 1: Goshawk nesting territory activity status definitions.

Activity Category	Definition*
Unoccupied	No goshawks were observed or detected in the nesting territory during the survey period.
Occupied but inactive	At least one adult goshawk was observed or detected in the nesting territory, but no evidence was found of egg-laying or young fledging.
Active	A nest with nestlings or evidence that egg-laying has occurred was found in the nesting territory.
Active and successful	Fledglings were observed or detected in the nesting territory.
Active but failed	An active nest was found in the nesting territory, but no fledglings were observed or detected.

*Definitions adapted from McClaren (2003).

C.2. Call Playback Surveys

Call playback surveys were conducted in accordance to standards and protocols described in RIC (2001). Call playback surveys were completed in all previously known nesting territories.

Forest cover maps were produced for each known nesting territory at a 1:10,000 scale that highlighted mature and old stands within each territory area. Crews concentrated survey effort in mature and old forest types by searching for new active nests within existing nesting territories. To guide survey efforts for locating new nesting territories, a 1:50,000 scale forest cover map was produced that highlighted potential goshawk nesting habitat. To maximize survey efficiency and effort, nesting habitat that was approximately 7 km from the nearest known nesting territory received the greatest survey effort. Mature and old-growth stands within these areas thought to have the greatest probability of containing goshawks were pre-selected by Canfor and MCA biologists for call playback surveys.

Surveys were conducted by crews of two personnel. Each crew consisted of at least one experienced goshawk surveyor. Call playbacks were completed along transects that followed pre-selected compass bearings and generally followed slope contours. Calls were broadcast at call stations spaced between 200-400 m along the transect. Distances between survey stations were dependent on topography and the size and shape of the habitat polygon. Subsequent transects in the same area were generally placed parallel and at 200-400 m distance from the original transect. To maximize survey coverage, call stations on subsequent transects were staggered between the call stations of the original, adjacent transect.

At each call station, surveyors first listened briefly for any spontaneous goshawk calls. If no goshawks were detected, goshawk call playbacks were broadcast. Three bouts of calls (10 seconds each) were played in three opposing directions, each separated by 30 seconds of silence. All calls were broadcast at a volume that was audible to surveyors within the forest for a distance of approximately 200 m. Surveyors used a portable CD player that was attached to a *Radio Shack* model 23-2037 powerhorn to broadcast recorded goshawk calls.

Adult goshawk alarm calls were used during the incubation and nestling period during the field session from 11-18 May. Goshawk alarm calls were recordings of an adult from Arizona (Cornell Laboratory of Ornithology 1992) and an adult from the Queen Charlotte Islands (YUNI Environmental Consulting 1998). Between 6-14 July, juvenile begging calls were broadcast at call stations because these generally elicit greater response rates during the fledgling period (Kennedy and Stahlecker 1993). Juvenile begging calls were recordings taken from Vancouver Island (A. Stewart, MWLAP; see YUNI Environmental Consulting 1998).

After call playbacks were broadcast, surveyors listened for approximately 5 minutes for any goshawk responses. If a goshawk (or any other raptor species) responded, no further calls were played at the call station. After a response, surveyors searched within a 300 m radius of the detection for any evidence of a nest structure by walking along parallel transects within visual distance of one another. Surveyors also searched the area for prey remains, pellets, plucking posts, or any other evidence of activity. If no nest was found, the response area was revisited later in the field season to further search for any evidence of nesting. Due to time and budget constraints, call stations that had no detections were generally visited only once during the field season.

All call playback data were recorded on RIC Animal Observation Forms: Raptor Call Playback (RIC 2001). For each raptor response the following information was collected: weather conditions; species; time of response; the UTM of the detection; the direction and distance to the response; whether the detection was visual or aural; and the sex and age of the bird, if possible. Mimic species that responded to call stations (e.g., Gray Jay (*Perisoreus canadensis*)) were also recorded, including their age and sex, if possible, and the type of their response, vocal or visual). All songbirds and potential mammalian prey species (e.g., Red Squirrel (*Tamiasciurus hudsonicus*)) that were detected within a variable radius of the call station centre were recorded as well as occurrence data for any Red- or Blue-listed wildlife species.

C.3. Nest Site Descriptions

Data for goshawk nest sites were collected in the format described on RIC Nest Site Description Forms (RIC 2001). The following data were collected at goshawk nest sites: date; time; observers; nest tree species, tree height, dbh and wildlife tree class; nest height, aspect, size and depth; canopy and shrub percent cover; structural stage; slope aspect and slope percent; elevation; micro and macro

mesoslope position; UTMs; tree composition within 20 m radius; a brief description of the nest stand habitat; a brief description of the nest structure; any evidence of recent nesting including the number of adults, eggs or young that were observed; and a goshawk nesting habitat suitability rating (6 level rating scheme; RIC 1998) within a 20 m radius of the nest tree and at the nest stand level.

Nest trees were flagged with yellow and white flagging tape and labeled. The locations of nest trees were plotted on 1:10,000 scale forest cover maps. UTMs for goshawk nests were collected with a Garmin GPS12 handheld GPS unit (accuracy is typically $\pm$10 m). Nest territories were lumped into two categories: 1) mature and old-growth forests (structural stage 6 and 7), and second growth forests (structural stage 5) for comparative analysis. See BC MELP and BC MOF (1998) for structural stage descriptions.

For analysis purposes, the two known nesting territories of Nimpkish Island and Vernon were lumped as a single nesting territory in 2004. Inter-territorial distance between Nimpkish Island and Vernon to the south is approximately 3.3 km, while the distance between Nimpkish Island and John nest territory to the north is approximately 4.0 km. A cluster of 16 goshawk nesting territories (including Nimpkish Island and Vernon) on northern Vancouver Island had a mean inter-territorial distance of 6.9 $\pm$ 0.7 km (McClaren 2003), suggesting that the 2 nesting territories of Nimpkish Island and Vernon are the same. Also, Nimpkish Island and Vernon nest territories have never been simultaneously active during the same year (McClaren 2003), suggesting that they may be alternate nest sites for the same nest territory.

C.4. Prey Species

Prey species were inventoried for presence/not detected by recording all potential prey species that occurred at each call station. All visual and aural detections of key bird prey species including all grouse, woodpecker, jay and thrush species as well as red squirrel (Squires and Reynolds 1997; McClaren 2003) that occurred at each call station were recorded.

Where present, prey remains were described and/or identified and the presence of pellets was noted at the base of the nest tree and surrounding nest area, during each nest visit. Prey remains were searched for at potential plucking post sites that were located near or adjacent to the nest tree. Prey remains were not collected; however, pellets were collected, stored in individual plastic bags and frozen for future analysis.

C.5. Weather Data Analysis

Monthly precipitation levels (total and mean) and mean temperature data for Campbell River (the nearest Environment Canada weather station to TFL 37 where meteorological data are regularly recorded) were collected.[1] Total precipitation levels for March and April 2004 were compared to 30-year long-term total precipitation means. Previous analyses have demonstrated a significant negative correlation between total precipitation levels in March and nest re-occupancy, and combined total precipitation levels for March and April and nest productivity (Manning et al. 2004).

[1] Campbell River is approximately 95 km southeast of TFL 37, so weather conditions recorded at Campbell River may not necessarily mirror those in the Woss area

E. RESULTS

D.1. Nest Territory Surveys

A total of 227 call playback stations were completed during the spring-summer survey period in 2004 (Table 2). Most (85%) survey stations were completed in known nest territories, while 15% were completed in other potential nest territory areas in mature and old-growth forests. Of the 192 call stations completed in known nest territories, 78% were completed in mature and old-growth forests and 22% in second growth forests.

Table 2: Goshawk survey effort in 2004 for Canfor TFL 37, Woss, BC.

	Survey Effort			
Nest Territory	**Number of Visits**	**Call Stations Completed**	**Hours Surveyed**	**Number of Goshawk Detections**
Mature and Old Growth Areas				
*Claude Elliot**	2	12	7.0	0
Croman	1	17	5.5	0
Hoomak	2	15	11.5	0
John	3	16	9.0	0
Kaipit	3	0	2.0	1
Klaklakama	3	23	17.0	0
Lukwa	3	17	17.0	0
*Nimpkish Island***	1	3	1.5	0
Rona	3	36	15.0	0
Surprise Creek	2	11	8.0	0
Sutton	2	7	6.0	1
Toad	3	4	4.5	1
Vernon	2	15	9.0	0
Sub Total	**30**	**176**	**113.0**	**3**
Second Growth Areas (approx. 50-60 year old stand age range)				
BC-196	1	0	0.5	0
BC-224	3	7	11.0	0
CT-060	5	0	8.5	1
Loon	2	19	10.5	0
Tlakwa	2	25	13.0	0
Sub Total	**13**	**51**	**43.5**	**1**
Total	**43**	**227**	**156.5**	**4**

* italicized territory areas are previously known goshawk territories.
** assumed to be a part of Vernon goshawk nest territory.

Estimated hours surveyed in each known nest territory ranged from 1.5-17.0 hrs, depending on the size of the area surveyed and whether or not there were any previous indications of occupancy. Total crew hours spent conducting goshawk surveys was approximately 156.5 hrs. See Appendix 3 for a summary of nest survey results for 2004.

D.2. Goshawk Detections

In total, four goshawk detections occurred during surveys (Table 3), all of which resulted in active nests being located. Three detections occurred in mature and old-growth forest types and one detection occurred in second growth. All initial detections were incubating or brooding females on nests. One new nest territory (CT-060) was initially found by Canfor forestry workers in early 2004, and was subsequently confirmed to be active on 7 April by an MCA biologist. The other three detections in previously known nest territories (Kaipit, Sutton and Toad) occurred while conducting call playback/nest search surveys during the nestling period surveys (11-18 May). None of the goshawks detections were a result of a direct response to call playbacks, but instead, were a result of surveyors finding nests while searching along call playback/nest search transect routes.

Table 3: Goshawk detections in 2004 for Canfor TFL 37, Woss, BC.

Nest Territory	Date	Forest Type	Detected By	Visual/Aural Detection	Sex
CT-060	7 April	Second Growth	Incidentally/ Forestry Workers	Visual	Female (Incubating)
Kaipit	14 May	Mature and Old Growth	Call Playback/ Nest Search	Visual	Female (Incubating)
Sutton	16 May	Mature and Old Growth	Call Playback/ Nest Search	Visual	Female (Incubating)
Toad	14 May	Mature and Old Growth	Call Playback/ Nest Search	Visual	Female (Incubating)

Detection rates surveys conducted in known and potential nesting territories in mature and old-growth forest areas were 1.70 detections/100 call stations (n = 176). Detection rates were 0.00 detections/100 call stations (n = 51) using call playbacks in second growth for known and potential nesting territories. Overall detection rates in 2004 for TFL 37, within known and potential nesting territories, were 1.32 detections/100 call stations (n = 227).

Three of the previously known 12 goshawk nesting territories were active in 2004 (Table 4). Four of the 12 known goshawk nesting territories had another species of raptor nesting within the goshawk nest stand or within close proximity of it. Hoomak and Vernon had active Sharp-shinned Hawk (*Accipiter striatus*) nest territories; Lukwa had an active Merlin (*Falco columbarius*) territory; John Road had an active Red-tailed Hawk nest territory.

Table 4: Goshawk nesting territory activity status in 2004 for Canfor TFL 37, Woss, BC.

Nest Territory	Activity Status	Comments
Mature and Old Growth Nest Territories		
*Claude Elliot**	Unoccupied	No goshawks detected.
Hoomak	Unoccupied	No goshawks detected. Active Sharp-shinned Hawk territory with young located within 100 m of goshawk nest stand.
John	Unoccupied	No goshawks detected. Active Red-tailed Hawk territory located approximately 150 m south of goshawk nest stand.
Kaipit	Active and successful	New nest discovered in an Fd approximately 60 m on a 195^{o} bearing from Nest #1. Two young fledged successfully.
Klaklakama	Unoccupied	No goshawks detected.
Lukwa	Unoccupied	No goshawks detected. Active Merlin territory located approximately 200 m south of goshawk nest stand.
*Nimpkish Island***	Unoccupied	No goshawks detected. Considered part of Vernon territory.
Rona	Unoccupied	No goshawks detected.
Sutton	Active and successful	Nest #1 re-occupied. Three, possibly four, young fledged successfully.
Toad	Active and successful	New nest discovered in an Fd approximately 110 m on a 160^{o} bearing from Nest #3. Two young fledged successfully.
Vernon	Unoccupied	No goshawks detected. Active Sharp-shinned Hawk territory located approximately 800 m southeast of goshawk nest stand.
Second Growth Nest Territories		
CT-060	Active and successful	Nest discovered by discovered by forestry crews in an Fd in early 2004. Two young fledged successfully.
Loon	Unoccupied	No goshawks detected.
Tlakwa	Unoccupied	No goshawks detected.

* italicized territory areas are previously known goshawk territories.
** assumed to be a part of Vernon goshawk nest territory.

D.3. Nest Site Descriptions

Four active goshawk nests were found in TFL 37, three of which were located in new nest trees (Table 5). All active nest trees were Douglas-fir that ranged widely in height (33-63 m) and diameter at breast height (dbh) (42-128 cm). Structural stage of the stands ranged from 5-7 (maturing to old-growth forest). The nest tree at CT-060 was located in a second growth Douglas-fir stand that was planted in 1954. The area had been pruned and thinned in 1980 and fertilized in 1981, which resulted in a stand with some mature forest characteristics (e.g., semi-closed crown canopy, fairly open intermediate and lower canopy layers, some canopy gaps and coarse woody debris on the ground). The nest tree was located approximately 85 m from Highway 19 (see Appendix 2 for UTMs of all nest trees). The nest tree at Sutton was previously known and was last active in 2002. The nest tree at Kaipit was approximately 60 m on a 195^{o} bearing from Kaipit nest #1. The nest tree at Toad was approximately 110 m on a 160^{o} bearing from Toad nest #3 and approximately 40 m from Toad Road, which is infrequently used by vehicle traffic.

Table 5: Active goshawk nest site descriptions in 2004 for Canfor TFL 37, Woss, BC.

Nest	Tree Species	Tree Height (m)	WLT Class	DBH (cm)	Nest Height (m)	Nest Aspect (°)	Canopy Closure (%)	Shrub Cover (%)	Struct. Stage	Aspect (°)	Elev. (m)	Slope (%)
CT-060	Fd	33	1	42	22	60	70	15	5	5	-	180
Kaipit #6	Fd	36	1	80	16	235	85	1	6	260	344	15
Sutton #1*	Fd	63	1	125	26	160	55	35	7	206	400	58
Toad #4	Fd	50	2	128	21	224	70	15	6	108	353	22

* previously known nest tree.

D.4. Nest Productivity

Four active goshawks nests in TFL 37 successfully fledged at least 9 young in 2004 (Table 6). Three of the nests (CT-060, Kaipit and Toad) fledged 2 young each, while Sutton fledged at least 3 young (begging calls from a 4th fledgling may have been heard by observers on 8 July). Overall mean productivity for the 4 nests was 2.25 fledglings/nest.

Table 6: Goshawk nest productivity in 2004 for Canfor TFL 37, Woss, BC.

Nest Territory	Number of Successful Fledglings
CT-060	2
Kaipit	2
Sutton	3+
Toad	2
Mean Productivity	**2.25**

The nesting season was at least 2 weeks earlier in 2004 compared to other recent years. An incubating female was observed as early as 7 April 2004 at CT-060, while during the first week of July, young had already fledged and were not observed returning to the nest after forays. The spring season in 2004 was noticeably warmer and drier than normal (see Table 9 sec. E5) and may have provided favorable conditions for early nesting.

D.5. Prey Species

Potential prey species individuals recorded during call playback surveys had detection rates of 121.6 prey species per 100 call stations (n=227) across the entire TFL (Table 7). Total potential prey species detection rates per 100 call stations varied between forest age classes, with 112.5 in mature and old-growth and 152.9 in second growth.

Table 7: Prey species detections per 100 call stations in 2004 for Canfor TFL 37, Woss, BC.

Prey Species*	Mature and Old Growth	Second growth	Overall Study Area
Thrush species	55.7	98.0	65.2
Jay species	26.7	27.5	26.9
Woodpecker species	15.3	9.8	14.1
Grouse species	7.4	7.8	7.5
Red Squirrel	7.4	9.8	7.9
Total Prey Species	**112.5**	**152.9**	**121.6**

* Thrush species: American Robin, Hermit Thrush, Swainson's Thrush and Varied Thrush
Jay species: Gray Jay and Steller's Jay
Woodpecker species: Hairy Woodpecker, Northern Flicker, Pileated Woodpecker and Red-breasted Sapsucker
Grouse species: Blue Grouse and Ruffed Grouse

Thrush species (American Robin (*Turdus migratorius*), Hermit Thrush (*Catharus guttatus*), Swainson's Thrush (*Catharus ustulatus*) and Varied Thrush (*Ixoreus naevius*)) were the most commonly detected prey species guild across the study area with 65.2 detections/100 call stations. Varied Thrush was the most frequently detected prey species in the study area, accounting for 30.4% of all detections and 46.5% of all thrush species detections. Hermit Thrush accounted for 21.0% of the remaining thrush species detections, followed by American Robin (19.6%) and Swainson's Thrush (12.9%).

Jays (Steller's Jay (*Cyanocitta stelleri*) and Gray Jay) were the second most commonly detected potential prey species with 26.9 detections/100 call stations. Gray Jay accounted for 52.4% of all jay detections and Steller's Jay for 47.6% of detections. The woodpecker guild (Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), Pileated Woodpecker (*Dryocopus pileatus*) and Red-breasted Sapsucker (*Sphyrapicus ruber*)) had 14.1 detections/100 call stations. Northern Flicker was the most commonly detected woodpecker species, at 34.0% of all woodpeckers detections, followed by Hairy Woodpecker (31.2%), Pileated Woodpecker (22.0%) and Red-breasted Sapsucker (12.8%).

Grouse species (Blue Grouse (*Dendragapus obscurus*) and Ruffed Grouse (*Bonasa umbellus*)) were detected less frequently, 7.5 detections/100 call stations. Blue Grouse accounted for most (88.0%) of the grouse detections. Red Squirrel had 7.9 detections/100 call stations throughout the study area. See Appendix 4 for a detailed summary of potential prey species detected during call playback surveys.

In general, prey remains were observed infrequently in unoccupied nesting territories and were mainly feather piles of the more conspicuous species (e.g., Steller's Jay, Hairy Woodpecker, Red-breasted Sapsuckers and thrush species). Pellets and prey remains collected at active nest trees contained a large variety of prey species, most commonly, thrush, jay, squirrel, Common Flicker and grouse. See Appendix 5 for a companion report on analysis of pellets.

D.6. Other Raptor Species Detections

Four other raptor detections of three species (Merlin, Red-tailed Hawk and Sharp-shinned Hawk) occurred during surveys in known goshawk nesting territories (Table 8).

Table 8: Other raptor species detections in 2004 for Canfor TFL 37, Woss, BC.

Species	Nest Territory	Date	UTM	Comments
Merlin	Lukwa	13 July	09/677189E/ 5569380N	Adult responded to goshawk call station approximately 150 m south of goshawk nest stand; bird acted territorially
Red-tailed Hawk	John	14 July	09/679092E/ 5554381N	2 juvenile birds observed approximately 150 m south of goshawk nest stand.
Sharp-shinned Hawk	Vernon	10 July	09/6844515E /5547542N	Adult responded to goshawk call station approximately 800 m southeast of goshawk nest stand; bird acted territorially
Sharp-shinned Hawk	Hoomak	9 July	09/676853E/ 5563637N	Juvenile begging calls heard <100 m south of goshawk Nest #1.

The Merlin territory in Lukwa was the first record of this species breeding in that goshawk territory. The Red-tailed Hawk territory has been present at John since at least 2002, when the goshawk nest territory was active and the Red-tailed Hawk was present simultaneously (Manning et al. 2003b). The Sharp-shinned Hawk territory at Vernon was also active in 2003 (Manning et al. 2004); goshawks and Sharp-shinned Hawks are known to nest simultaneously within the same nest stand (P. Levesque pers. comm.). The Sharp-shinned Hawk nest territory in Hoomak has been recorded there previously, with an active nest tree found approximately 300 m to the north of the goshawk nest site (E. McClaren, MWLAP pers. comm.).

F. DISCUSSION

E.1. Nest Territory Surveys

Occupancy rates (occupied by at least one goshawk) of known nesting territories on Vancouver Island between 1995-2002 averaged 54.6% annually (McClaren 2003). This suggests that on an average year, approximately 7 of the 12 known nesting territories in TFL 37 could be expected to be occupied. In 2004, only 3 of the 12 (25%) previously known nesting territories in TFL 37 (not including new territory CT-060) were occupied. This is the same occupancy rate that occurred in 2003 (goshawks were detected in 3 territories in 2003 but no breeding was detected; Manning et al. 2004), which is the lowest occupancy rate recorded since monitoring began in 1995 (McClaren 2003).

No formal monitoring of known goshawk nesting territories occurred in other areas of Vancouver Island in 2004, except for TimberWest's southern Vancouver Island tenure (E. McClaren pers. comm.). There are 33 known goshawk nests at 20 nest territories in TimberWest TFL 47, its private lands, and other licence areas (D. Lindsay, TimberWest, pers. comm.). Eleven nest territories were visited in 2004; 5 were active and successful, 2 were occupied but inactive, 3 were unoccupied, and 1 was taken over by a Red-tailed Hawk that successfully fledged 3 young. Most of the active nest areas were in second growth forest that were approximately 50-60 years old. Four new goshawk nest territories were found in 2004 on TimberWest's tenure. As on northern Vancouver Island, the nesting season on southern Vancouver Island appeared to be approximately 2 weeks earlier in 2004 compared to typical years.

E.2. Call Playback Surveys

Goshawk detections rates in known and potential nesting territories were higher in 2004 than in 2003, when similar goshawk survey effort was completed in TFL 37 (Manning et al. 2004). In 2004, detection rates for TFL 37 were 1.32 detections/100 call stations (n=227) compared to 0.75 detections/100 call stations (n=267) in 2003. During both years, survey effort was similar; call playback surveys were concentrated in known goshawk nesting territories as well as a smaller subset of potential goshawk nesting habitat located throughout the TFL.

Overall detection rates in TFL 37 were lower in 2004 compared to the long-term average (1994-2001) for call playback surveys completed in the TFL region (McClaren 2003). The long-term detection rate for the TFL region was approximately 1.73 detections/100 call stations, compared to 1.32 detections/100 call stations in 2004, or 76.3% of long-term detection rates. Due to the different survey designs (i.e., long-term surveys tend to be conducted in areas other than nest territory stands) used in long-term surveys (1994-2001;) and those conducted in 2004, it is difficult to draw any conclusions about relative trends in detection rates.

E.3. Nest Productivity

Three of the 12 known goshawk nesting territories in TFL 37 were active in 2004. Productivity for known nest territories was 2.33 young fledged/active nest in 2004. Productivity for all nest territories in TFL 37 (including CT-060) was 2.25 young fledged/active nest. The productivity rate in 2004 was higher than the mean long-term productivity rate (1994-2003) for known nesting territories in TFL 37, which was 1.37 young fledged/active nest (E. McClaren unpubl. data; Manning et al. 2004).

Productivity for other known goshawk nest areas on Vancouver Island was also higher than normal in 2004. Five active nests that were monitored on TimberWest's tenure on southern Vancouver Island had a mean productivity of 2.8 young fledged/active nest; two nests fledged 2 young, two nests fledged 3 young, and one nest fledged 4 young (D. Lindsay pers. comm.). The second growth nest territory in the Cowichan Lake area that had 4 young was the first documentation of 4 successful fledglings from one nest on Vancouver Island (E. McClaren pers. comm.).

E.4. Prey Species

For comparative analyses, known goshawk nest territories in mature second growth stands (structural stage 6) were lumped with known nest territories in old-growth stands (structural stage 7). Mature structural stage 6 forests typically have more stand characteristics and structural attributes in common with old-growth structural stage 7 forests than with maturing structural stage 5 forests (BC MELP and BC MOF 1998). Previously, structural stage 6 nest territories were lumped with structural stage 5 nest territories for analysis (McClaren 2003). As a result of these category changes, comparisons among years for prey species detections by forest type/structural stage are difficult. However, comparisons among years for overall detection rates across all habitat types combined are possible.

In 2004, prey species detected across all habitat types in TFL 37 were higher than the long-term average for the TFL area. Prey species detection rates in 2004 were 1.2 prey species/call station compared to the long-term average (1995-2002) of 1.0 prey species/call station (McClaren 2003). However, prey species detection rates should be interpreted cautiously, particularly among years. Detection rates assume that all prey species are equally detectable both visually and aurally, that stand structure and landscape features do not affect the frequency of detection among species, that surveys are conducted at the same period each year, that species are equally detectable across the entire survey period, and that there are no observer biases. All these assumptions are probably unlikely, and as a result, determining prey species trends may not be that useful (see Rosenstock et al. 2002; Thompson 2002; McClaren 2003 for further discussion).

Ethier (1999) suggested that red squirrel populations influenced goshawk breeding success on northern Vancouver Island. Analysis of pellets collected from active nests between 1994-1996 found that red squirrel was the most common prey item of goshawk (Ethier 1999). As a result, it was speculated, that during years in which there were poor cone crops, squirrel populations would decline, and subsequently goshawks would produce fewer young. Contrary to this hypothesis, analysis by Pelletier (2000) of survey data for Vancouver Island (1994-1999) suggested that red squirrel detection rates were significantly negatively correlated with goshawk territory re-occupancy, but not significantly correlated with nest productivity.

In TFL 37 in 2004, detection rates for red squirrel were high (7.9 detections/100 call stations across the entire TFL (n = 227). Red squirrel detections in 2004 were 2.5 times greater than the long-term detection rate of 3.11 detections/100 call stations for the TFL area for the years 1997-2001 (n = 1382) (E. McClaren unpubl. data). Unlike the findings of Pelletier (2000), the high red squirrel detection rates in 2004 appeared to be more positively correlated to the year's higher nest productivity rates (2.25 young fledged/active nest), rather than the year's low nest territory re-occupancy (25% of known nest territories re-occupied). As well, red squirrel remains were the most common prey item identified from goshawk pellets collected at four goshawk territories in 2004 (see Appendix 5). Nevertheless, the relationship between prey detection rates and prey abundance is unclear and potentially unreliable. Aural detections of red squirrel are dependent on several factors including time of year, age and sex of the individual, whether there are other squirrels in the near vicinity, and the perceived threat of intruders (Banfield 1974; Price et al. 1990; Gurnell et al. 2001).

E.5. Weather Conditions and Nesting Success

The effect of rainfall and cool weather, particularly during the incubation period, has been shown to negatively affect goshawk productivity in Europe (Kostrzewa and Kostrzewa 1990; Penteriani 1997). In central Italy, the percentage of unsuccessful goshawk pairs was correlated with rainfall levels during the pre-laying, laying, incubation and nestling period between April and May (Penteriani 1997). Cold, wet springs delayed goshawk breeding and prolonged rain-reduced reproductive success and food intake. Over a 10-year monitoring period in central Italy, nest productivity was most negatively affected during years when intense rainfall occurred during the incubation period. In western Washington, goshawk productivity in occupied territories declined by 94% following a strong La Niña event (1998-1999), which caused atypically high precipitation levels in winter and colder spring temperatures (Bloxton 2002). Abundance indices of key prey species declined following the La Niña winter, which was correlated with an expansion in goshawk home range size (presumably because of the need for goshawks to range and forage further in search of a declining prey base).

On Vancouver Island and the Queen Charlotte Islands, March and April tend to be the most active months for goshawk courtship, territory re-establishment, nest building and egg laying (Chytyk and Dhanwant 1999; Zeeman 2003). As a result, March and April are probably the two most critical months for assessing if individual health, sufficient food resources and conducive weather conditions exist to initiate nesting. In TFL 37 during 2003, goshawk nest re-occupancy was negatively correlated to total precipitation in March, while nest productivity was negatively correlated to total precipitation in March and April (Manning et al. 2004).

In 2004, total precipitation levels (total rainfall and snowfall) in March were 88.4% of the 30-year mean (1971-2000), while total precipitation in March and April combined was 65.8% of the 30-year mean (Table 9). Precipitation levels were taken from Campbell River, located approximately 95 km to the southeast of Woss. The near-normal (and slightly drier) precipitation levels in March 2004 could lead one to hypothesize that goshawk nest re-occupancy rates in 2004 should not be appreciably lower than the long-term average of 54.7% (E. McClaren unpubl. data) for the TFL. However, this was not the case, as nest re-occupancy in the TFL was 25% in 2004. Lower than average combined total precipitation levels for March and April 2004 could again allow one to hypothesize that 2004 productivity rates should be higher than the long-term average of 1.37 young fledged/active nest for the TFL (E. McClaren unpubl. data; Manning Cooper et al. 2004). This was the case; productivity in TFL 37 was 2.25 young fledged/active nest in 2004, compared to zero young fledged in 2003.

It must be cautioned that spring precipitation levels are only one variable which may affect goshawk territory occupancy and the success of spring breeding (i.e., fledgling production). However, this perhaps simplistic indicator should be further quantified. Such analyses should be predicated on certain limitations, including: i) precipitation levels from Campbell River may not be representative of precipitation levels in TFL 37; ii) there may be a 1-2 year lag effect between poor weather conditions in a certain year and lower prey densities or fledgling production during the following year; and iii) not all goshawk nesting territories in TFL 37 are known nor annually monitored to obtain absolute nest re-occupancy and productivity data.

Table 9: Selected monthly total precipitation level comparisons for Campbell River, BC.

Month	2004 Total Precipitation (mm)	1971-2000 Mean Total Precipitation (mm)	2004 as a % of 30-year Mean Total Precipitation
February	121.4	158.7	76.5 %
March	120.2	136.0	88.4 %
April	24.6	84.2	29.2 %
May	58.8	67.1	87.6 %
Average	**325.0**	**446.0**	**72.9 %**

G. RECOMMENDATIONS

1. **Continue to survey existing goshawk territories, known nest sites, and potential new territories in TFL 37**, as well as comparisons with two control areas (i.e., goshawk territories which are located in "benchmark" areas such as Strathcona Provincial Park). Information on territory occupancy and reoccupancy, and nest productivity (i.e. calculate mean number of fledglings/territory/year) will be collected over the 5-year monitoring period (2002-2006) and can be used as a measurable indicator of "goshawk habitat suitability". This information can then be used to evaluate or at least make inferences concerning the effectiveness of the management recommendations for goshawk conservation areas (i.e., WHA sizes) as recommended by Canfor (Manning et al. 2004), and can provide additional information for substantiation of the habitat variable weightings (e.g., stand age and structure, inter-territorial spacing, etc.) used in the predictive goshawk habitat model for TFL 37 (Manning et al. 2002).

2. **Subject to funding**, data collection on goshawk use of post-fledging areas (i.e., use and size of PFA, temporal movement beyond the PFA) should be conducted (see McClaren and Pendergast 2002). Nestling capture and use of radio telemetry will be required in order to assess PFA use. This information can again be used to evaluate the effectiveness of the management recommendations (e.g., WHA sizes) cited in the Canfor adaptive management strategy for goshawk conservation areas. It is recommended that **this objective be pursued in 2006**, as part of the conclusion of the 5-year adaptive management monitoring cycle recommended by Manning et al. (2004).

3. The following procedures are recommended for **conducting goshawk nest surveys in 2005**:

    - check for nest activity in late April – early May at known goshawk territories, and play alarm calls during these surveys;
    - play juvenile begging calls in mid-late June to confirm nest activity and/or determine number of fledglings;

4. Continue to **examine potential correlations and trends between climatic variables** (monthly precipitation and temperature), **and goshawk territory occupancy, nest establishment/success and nest productivity** (i.e., number of young fledged). In this context, weather data should be collected for the winter months (Dec.-January) as well as the early-late spring period (Feb.-May).

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APPENDIX 1: Weather, nest productivity and re-occupancy data for Northern Goshawk known nest territories, Canfor TFL 37, Woss, BC.

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Mean 1971-2000
Total Precipitation (rainfall and snowfall in mm)												
February	167.4	98.8	126.4	79.8	276.4	485.4	124.6	78.6	99.2	33.0	121.4	158.7
March	96.4	218.6	82.8	213.6	114.6	223.8	138.0	83.3	114.8	249.9	120.2	136.0
April	98.6	93.5	159.1	118.2	28.2	51.1	36.2	89.0	70.8	169.6	24.6	84.2
May	36.2	63.6	87.6	105.3	52.8	82.6	72.2	50.0	35.4	51.7	58.8	67.1
Mean Temperature (Celsius)												
February	1.9	4.1	2.8	3.7	5.2	3.2	3.3	2.7	3.3	3.8	4.2	3.0
March	6.0	5.3	4.7	4.3	6.3	4.4	5.4	5.2	3.1	5.5	6.2	4.8
April	9.5	8.3	8.2	7.5	8.2	7.4	8.0	7.4	7.9	7.9	9.6	7.7
May	12.5	13.9	9.9	12.9	13.0	9.8	10.3	10.7	10.4	10.8	12.8	11.2
Nest Productivity (fledglings per known nest territory)												
	2.0	0	1.16	1.0	2.0	1.50	2.43	1.20	2.40	0.0	2.25	
std err.			0.40	0.45	0.00	0.29	0.43	0.49	0.26	0.0	0.25	
n =	1	0	6	5	5	4	7	5	8	0	4	
Nest Re-occupancy (% of known nest territories re-occupied)												
	N/A	0	100.0	66.7	50.0	22.2	60.0	45.5	54.5	0.0	25.0	
n =	1	1	1	6	8	9	10	11	11	12	12	

Total precipitation and mean temperature data for Campbell River, BC weather station courtesy of Environment Canada (http://www.climate.weatheroffice.ec.gc.ca/climate_normals/stnselect_e.html).

Nest productivity and nest re-occupancy data for known goshawk nest territories in Canfor TFL 37 (1994-2002) courtesy of Erica McClaren, Acting Rare and Endangered Species Biologist. BC Ministry of Water, Land and Air Protection, Nanaimo, BC.

APPENDIX 2: Northern Goshawk nest tree data in 2004 for Canfor TFL 37, Woss, BC.

Nest	WLT #	Easting	Northing	Activity Status	Tree Species	Tree Height (m)	WLT Class	DBH (cm)	Nest Height (m)	Nest Aspect (°)	Canopy Closure (%)	Shrub Cover (%)	Struct. Stage	Aspect (°)	Elev. (m)	Slope (%)
Claude Elliot #1	2002-05	673232	5575153	Inactive	Fd	51	2	77	21	338	40	25	7	78	505	47
Claude Elliot #2	2002-06	673140	5575028	Inactive	Hw	35	2	56	20	354	45	35	7	52	565	32
CT-060	-	*674245*	*5566488*	*Active*	*Fd*	*33*	*1*	*42*	*22*	*60*	*70*	*15*	*5*	*5*	-	*180*
Hoomak #1	2002-07	676824	5563680	Inactive	Fd	51	2	93	22	18	45	40	7	358	294	8
Hoomak #2	2002-08	676650	5563610	Inactive	Fd	54	2	98	27	183	55	45	7	286	268	21
Hoomak #3	-	-	-	NL*	-	-	-	-	-	-	-	-	-	-	-	-
Hoomak #4	2002-35	676700	5563549	Inactive	Fd	63	1	152	23	348	65	35	7	244	-	25
John #1/#2	2002-13	679028	5554087	Inactive	Fd	67	1	129	28	130	45	70	7	78	426	90
John #1/#2	2002-13	679028	5554087	Inactive	Fd	67	1	129	31	216	45	70	7	78	426	90
John #3	2002-14	679002	5554278	Inactive	Fd	71	2	176	41	167	35	30	7	52	381	58
John #4	2002-36	679130	5554474	Inactive	Fd	76	1	183	33	70	60	25	7	60	275	20
Kaipit #1	2002-09	659193	5566775	Inactive	Fd	39	2	87	15	222	65	10	6	348	317	36
Kaipit #2	2002-10	659209	5566643	Inactive	Fd	38	2	53	22	287	70	2	6	180	290	65
Kaipit #3	2002-11	659181	5566654	Inactive	Fd	64	1	119	25	149	70	3	6	188	309	62
Kaipit #4	2002-12 (no plaque)	659163	5566638	Inactive	Fd	63	1	135	24	187	70	6	6	242	300	35
Kaipit #5	(no plaque)	659170	5566575	Inactive	Hw	34	1	52	17	290	75	8	6	334	318	24
Kaipit #6	-	*659181*	*5566719*	*Active*	*Fd*	*36*	*1*	*80*	*16*	*235*	*85*	*1*	*6*	*260*	*344*	*15*
Klaklakama #1	2002-22	680404	5559192	Inactive	Hw	50	1	88	39	178	65	35	6	103	492	70
Klaklakama #2	2002-20	680396	5559094	Inactive	Fd	43	2	102	23	63	65	60	6	90	495	78
Klaklakama #3	2002-21	680330	5559152	Inactive	Fd	52	1	102	17	93	65	20	6	98	521	90
Klaklakama #4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klaklakama #5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klaklakama #6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klaklakama #7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loon #1	2002-26	652425	5567665	Inactive	Fd	57	2	85	23	357	70	4	6	288	372	79
Loon #2	2002-27	652387	5567833	Inactive	Fd	21	4	38	21	N/A	50	8	6	283	365	89
Loon #3	2002-25	651652	5567788	Inactive	Fd	40	1	55	18	3	75	2	5	30	372	36
Lukwa #1	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	-	-

Lukwa #2	-	677108	5570398	Inactive	Hw	40	1	72	40	220	40	10	7	290	554	88
Lukwa #3	-	677023	5569736	Inactive	Hw	43	2	106	20	240	50	80	7	280	708	62
Nimpkish #1	2002-17 (no plaque)	681478	5550895	Inactive	Fd	65	1	112	32	134	65	60	7	999	210	0
Nimpkish #2	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	-	-
Nimpkish #3 *	2002-18 (no plaque)	681458	5550916	Inactive	Fd	75	1	205	30	164	60	70	7	999	210	0
Rona #1	2002-29	670378	5563228	Inactive	Fd	48	2	112	19	247	60	40	6	213	200	15
Rona #2	2002-30	670897	5563815	Inactive	Fd	50	2	121	19	146	65	8	6	212	205	15
Rona #3	2002-28	670592	5563144	Inactive	Hw	26	2	35	17	173	40	80	6	69	210	18
Sutton #1	2002-19	693846	5542354	Active	Fd	63	1	125	26	160	55	35	7	206	400	58
Sutton #2	-	693987	5542139	Inactive	Hw	23	1	74	16	115	70	50	7	163	-	11
Tlakawa #1	-	646421	5574118	Inactive	Fd	27	2	55	18	N/A	85	20	5	195	114	35
Tlakawa #2	-	646078	5574136	Inactive	Fd	-	-	-	-	-	-	-	-	-	113	-
Toad #1	2002-24	663468	5566267	Inactive	Fd	44	1	94	19	205	50	35	6	280	295	29
Toad #2	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	-	-
Toad #3	2002-23	664148	5565990	Inactive	Fd	69	1	127	23	66	70	40	6	38	395	36
Toad #4	-	*664109*	*5566063*	*Active*	*Fd*	*50*	*2*	*128*	*21*	*224*	*70*	*15*	*6*	*108*	*353*	*22*
Vernon #1	2002-16	683291	5548466	Inactive	Fd	57	1	96	28	201	65	45	6	251	435	100
Vernon #2	2002-15	683405	5548166	Inactive	Fd	58	1	99	35	210	60	30	7	228	431	72

Italicized nests are new nests found in 2004; * NL = not located; " - " = not recorded; * nest used by Common Raven;
John #1/2 = 2 nests in tree; Fd = Douglas-fir; Hw = western hemlock

APPENDIX 3: Northern Goshawk nest monitoring surveys summary in 2004 for Canfor TFL 37, Woss, BC.

Date	Surveyors	Birds Observed	Duration of Visit	# of Call Stations Completed	Status of Nests	Comments
BC-224						
7 April 2004	JC, JD	0	1.0 hr	0	No Activity	Nest 1 checked for activity. No goshawks detected.
15 April 2004	PL, PC	0	6.5 hr	0	No Activity	Nest 1 checked for activity. Nest search completed for alternate nests. No goshawks detected.
14 July 2004	MB, PC	0	3.5 hr	7	No Activity	Nest 1 checked for activity. No goshawks detected.
BC-196						
14 April 2004	JD, PL, PC	0	0.75 hr	0	No Activity	Nest that was previously assessed as an old Common Raven's nest was re-assessed and thought to be a mistletoe structure or an old abandoned raptor or raven nest.
Claude Elliott						
16 May 2004	TI, PC	0	3.0 hr	4	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.
8 July 2004	MM, SB	0	3.75 hr	8	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.
Croman						
13 July 2004	MM, CH	0	5.5 hr	17	No Activity	Blocks on Cain Road and in East and West Croman completed, including block that John Deal wanted surveyed. No goshawk detected.
CT-060						
7 April 2004	JC, JD	1 adult female	1.0 hr	0	Active	Adult female seen incubating on nest.
14 April 2004	PL, PC	1 adult female	5.5 hr	0	Active	Adult female seen incubating on nest. Nest

						search completed for alternate nests.
6 July 2004	MM, SB	2 fledglings	0.5 hr	0	Active	2 fledglings seen approx 25 m from the nest tree. No adults observed.
9 July 2004	TM, PM, MB, PC	2 fledglings	0.75 hr	0	Active	1 fledgling seen approx 75 m from the nest tree and another fledgling heard approx 75 m from the nest tree. No adults observed.
15 July 2004	MM, CH	1 fledgling	0.75 hr	0	Active	1 fledgling heard approx 90 m at a 220^{o} bearing from the nest tree. No adults observed.
Hoomak						
12 May 2004	TI, PC	0	5.5 hr	5	No Activity	Nests 1, 2 & 4 checked for activity. No goshawks detected.
9 July 2004	MM, CH	0	6.0 hr	10	No Activity	Nests 1, 2 & 4 checked for activity. No goshawks detected. A single Sharp-shinned Hawk heard giving begging calls and seen briefly approx 100 m south of NOGO Nest 1.
John						
18 May 2004	SB, MM	0	3.75 hr	4	No Activity	Nest 3 & 4 checked for activity. No goshawks detected.
6 July 2004	SB, MM	0	2.5 hr	5	No Activity	Nest 4 checked for activity. No goshawks detected.
14 July 2004	CH, MM	0	2.5 hr	7	No Activity	Active Red-tailed Hawk territory approximately 250 m northeast of Nest 1/2; 2+ juvenile birds seen and heard giving begging and cry calls while flying over stand. No goshawks detected.
Kaipit						
14 May 2004	TI, PC	0	0.5 hr	0	Active	New nest discovered in an Fd approximately 60 m on a 195^{o} bearing from Nest #1. UTM: 09/659181E/5566719N ($\pm$7 m accuracy). Female assumed to be incubating on the nest but was not observed due to inability to see into

						the nest.
6 June 2004	CH, PC	2 fledglings	0.75 hr	0	Active	2 fledglings seen approx 70 m from the nest tree feeding on a red squirrel carcass on the ground. No adults observed.
15 July 2004	MB, PC	1 fledgling	1.0 hr	0	Active	1 fledgling heard approx 200 m on a 70^{o} bearing from the nest tree. No adults observed.
Klaklakama						
13 May 2004	PL, MM, TI, PC	0	9.0 hr	9	No Activity	All known nests checked for activity. No goshawks detected.
10 July 2004	MB, PC	0	4.0 hr	6	No Activity	Nest 4 checked for activity – north side of territory checked. No goshawks detected.
11 July 2004	MB, PC	0	4.0 hr	8	No Activity	Nests 1-3 checked for activity – south side of territory and east of HR102 checked. No goshawks detected.
Loon						
14 May 2004	PL, MM	0	5.5 hr	5	No Activity	Nests 1, 2 & 3 checked for activity. No goshawks detected.
12 July 2004	MM, CH	0	5.0 hr	14	No Activity	Nest 3 checked for activity. No goshawks detected.
Lukwa						
15 May 2004	PL, MM	0	5.75 hr	5	No Activity	Nest 3 checked for activity. No goshawks detected.
7 July 2004	SB, MM, CH, PC	0	5.5 hr	6	No Activity	Nest 2 checked for activity – north side of territory checked. No goshawks detected.
13 July 2004	MB, PC	0	6.0 hr	6	No Activity	South side of territory checked. Active Merlin territory approximately 200 m south of Nest 1 – adult bird responded with multiple alarm calls and displayed strong territorial behaviour. No goshawks detected.
Nimpkish Island						
14 July 2004	MM, MB,	0	1.5 hr	3	No Activity	All known nests checked for activity. No

	PL					goshawks detected.
Rona						
12 May 2004	PL, MM	0	5.5 hr	7	No Activity	Nests 1, 2 & 3 checked for activity. No goshawks detected.
9 July 2004	TM, PM, MB, PC	0	5.0 hr	9	No Activity	Nests 1, 2 & 3 checked for activity. No goshawks detected.
11 July 2004	MM, CH	0	4.75 hr	20	No Activity	Rona road perimeter and airstrip surveyed. No goshawks detected.
Surprise Creek						
11 May 2004	TI, PC	0	5.0 hr	7	No Activity	Area requested by John Deal to be surveyed for goshawks. No goshawk detected.
8 July 2004	CH, PC	0	3.0 hr	4	No Activity	Area requested by John Deal and old stick nest checked for activity. No goshawk detected.
Sutton						
16 May 2004	PL, MM	1 adult female	5.0 hr	7	Active	Nest 1 checked for activity – adult female observed incubating on Nest 1.
8 July 2004	CH, PC	3+ fledglings	1.25 hr	0	Active	3 fledglings, possibly 4 fledglings, heard simultaneously approx 70 m from nest tree. No adults observed.
Tlakwa						
17 May 2004	SB, MM	0	6.0 hr	10	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.
12 July 2004	MB, PC	0	7.0 hr	15	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.
Toad						
14 May 2004	TI, PC	1 female	2.5 hr	4	Active	New nest discovered in a Fd approximately 110 m on a 160^{o} bearing from Nest #3. UTM: 09/664109E/5566063N ($\pm$6 m accuracy). Nest is approximately 40 m from road. Female seen incubating on nest.
6 July 2004	CH, PC	1+ fledglings	1.0 hr	0	Active	1 fledgling seen and another fledgling possibly

						heard approx 50 m from the nest tree.
15 July 2004	MM, CH	2 fledglings	1.0 hr	0	Active	1 fledgling seen 10 m from the nest tree and another fledgling heard approx 130 m at a 60^{o} bearing from the nest tree.
Vernon						
15 May 2004	TI, PC	0	4.5 hr	4	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.
10 July 2004	MM, CH	0	4.5 hr	11	No Activity	Nests 1 & 2 checked for activity. No goshawks detected.

Surveyors: CH=Carmen Holschuh; JC=John Cooper; JD=John Deal; MB=Morgan Black; MM=Michael Miller; PC=Paul Chytyk; PM=Phillip Manning; SB= Suzanne Beauchesne; TI=Tyler Innes; and TM=Todd Manning

APPENDIX 4: Potential prey species detected during call playback surveys in 2004 for Canfor TFL 37, Woss, BC.

	Total Prey Species Detections			Prey Species Detections per 100 call stations		
	Mature and Old Growth	Maturing Second Growth	Overall Study Area	Mature and Old Growth	Maturing Second Growth	Overall Study Area
Thrushes						
American Robin	14	15	29	8.0	29.4	12.8
Hermit Thrush	19	12	31	10.8	23.5	13.7
Swainson's Thrush	13	6	19	7.4	11.8	8.4
Varied Thrush	52	17	69	29.5	33.3	30.4
Subtotal	98	50	148	55.7	98.0	65.2
Jays						
Gray Jay	27	5	32	15.3	9.8	14.1
Steller's Jay	20	9	29	11.4	17.6	12.8
Subtotal	47	14	61	26.7	27.5	26.9
Woodpeckers						
Hairy Woodpecker	10	0	10	5.7	0.0	4.4
Northern Flicker	8	3	11	4.5	5.9	4.8
Pileated Woodpecker	5	2	7	2.8	3.9	3.1
Red-breasted Sapsucker	4	0	4	2.3	0.0	1.8
Subtotal	27	5	32	15.3	9.8	14.1
Grouse						
Blue Grouse	11	4	15	6.3	7.8	6.6
Ruffed Grouse	2	0	2	1.1	0.0	0.9
Subtotal	13	4	17	7.4	7.8	7.5
Mammals						
Red Squirrel	13	5	18	7.4	9.8	7.9
Total Prey Species	**198**	**78**	**276**	**112.5**	**152.9**	**121.6**

APPENDIX 5. Analysis of Northern Goshawk diets from TFL#37, north-central Vancouver Island, BC.

METHODS

During the nestling phase of the breeding cycle, regurgitated food pellets and (non-pelleted) prey remains were collected from four Northern Goshawk (*Accipiter gentilis laingi*) nests from May-July 2004 at Woss, BC (TFL # 37, see Table 1). Pellets and prey remains were frozen, *en masse*, in plastic bags on the day they were collected and remained frozen until analysis. Food remains were brought to the Royal British Columbia Museum, Victoria, where they were air-dried and autoclaved prior to being re-packaged into separate bags representing individual pellets or pellet fragments, and non-pelleted prey remains. A random sample of 5 bagged individual pellets was examined from each location. Non-pelleted prey remain were examined from the Kaipit and Sutton nest stands.

Pellets were examined under a dissection microscope under 2x and 4x power following the methods described by Marti (1987). Prey items were identified to the lowest taxon possible based on colour and size characteristics of hair or feathers. When possible, positive confirmation of a species was made after reference to museum specimens or to appropriate field guides.

Species/class composition in pellets was presented on the basis of frequency of occurrence (Marti 1987).

Diet samples were archived for potential future analysis to better differentiate amongst species using microscopic techniques (*see* Brom 1991, Moore et al. 1997).

RESULTS

The breakdown of prey items in the pellets are outlined in Table 2. Prey remains were identified separately.

Additional non-pelleted prey remains were identified at the Sutton and Kaipit nest stands. These items, such as large feathers and larger, intact bones, were excluded from the pellet analysis. In two samples from Sutton, one containing Northern Flicker (*Colaptes auratus*) and Steller's Jay (*Cyanocitta stelleri*) remains and another containing an avian long bone were identified. Grouse *spp.* were identified from appendicular girdles and femora and American Robin and Steller's Jays were identified from rectrices.

DISCUSSION

These results closely mirror those of Ethier (1999) who analyzed the diet of Northern Goshawks from Nimpkish Valley. In this present study, Red Squirrel (*Tamiasciurus hudsonicus*) and Northern Flicker accounted for greater than 60% and 40%, respectively while Steller's Jay was present in 20 to 60% of pellets examined.

This determination of the diet of Northern Goshawks based on the collection of prey remains and pellets may not include all prey consumed by this species. Inherent biases involved in this assessment of diet must be acknowledged. Joy *et al.* (1996) noted that potential biases are the omission of prey plucked away from nest sites, an over-representation of more colorful and conspicuous avian prey remains, under-representation of less conspicuous mammalian prey remains,

and the underestimation (because of limited remains) of taxa such as reptiles, amphibians, and arthropods.

The abundance of arthropod remains in these pellets is remarkable. It remains unclear if the insects were primarily consumed by young birds in the nest (P. Levesque, *pers. comm.*) or whether adult Goshawks had secondarily consumed these items following the ingestion of gut contents of their insectivorous prey.

The majority of feathers within this sample could not be identified beyond the level of class. As indicated above, prey remains within pellets may be identified to order, family or even species by examination microscopic techniques (*see* Brom 1991, Moore et al. 1997).

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Table 1: Numerical summary of pellets and prey remains collected from Northern Goshawk territories from TFL# 37, Vancouver Island, Summer 2004.

Nest Site	Date Collected	Pellets	Prey Remains
Sutton	08-Jul-04	13	1
Toad	06-Jul-04	37	0
CT-60	09-Jul-04	13	1
Kaipit	06-Jun-04	12	1

Table 2: Species composition of Northern Goshawk pellets collected on Northern Goshawk territories from TFL# 37, Vancouver Island, Summer 2004. Results are presented as a per cent occurrence in the total number of pellets examined per nest location.

Prey Item	Nest Stand			
	Sutton	Toad	CT-60	Kaipit
Red Squirrel	3/5 (60%)	4/5 (80%)	5/5 (100%)	5/5 (100%)
Insect	5/5 (100%)	5/5 (100%)	3/5 (60%)	3/5 (60%)
Steller's Jay	1/5 (20%)	2/5 (40%)	1/5 (20%)	3/5 (60%)
Northern Flicker	4/5 (80%)	4/5 (80%)	2/5 (40%)	4/5 (80%)
Unknown Avian	5/5 (100%)	5/5 (100%)	4/5 (80%)	4/5 (80%)

Report prepared by Michael J. Miller