
# WILDLIFE INTERPRETATIONS
# for
# TERRESTRIAL ECOSYSTEM MAPPING
# for the
# CLAYOQUOT SOUND AREA

## INTERIM DOCUMENT

## YEAR THREE

***for:***

**MINISTRY OF FORESTS**
**PORT ALBERNI FOREST DISTRICT**

***by:***

**MADRONE CONSULTANTS LTD.**
**1081 Canada Avenue, Duncan, BC V9L 1V2**

**March 1999**

# ACKNOWLEDGMENTS

This project is very much a team effort. The initial wildlife work built on earlier field sampling conducted in the Clayoquot Sound area by Gillian Radcliffe, David Aldcroft, and Margo Jarvis (for Interfor Forest Products), in 1994 and 1995. Early species accounts and ratings for this current project combined this information with further literature review and input from species specialists. Linda Veach, Derrick Marven, Tania Tripp, and Sally Leigh-Spencer conducted subsequent fieldwork in conjunction with the Terrestrial Ecosystem Mapping, over the period of this project (1996-1999). Gillian Radcliffe has provided periodic review of all aspects of the wildlife work. Species accounts and ratings and area descriptions for wildlife have been developed by Linda Veach, Gillian Radcliffe, and Tania Tripp. Julie Williams assisted with building databases.

We would like to thank the many biologists who have provided input and helpful discussion along the way, over the preceding three years. Tony Hamilton for black bear information, Trudi Chatwin and Alan Burger for marbled murrelets, Kim Brunt for information on deer and, especially, elk. Many other biologists, including the Madrone vegetation and bioterrain crews, have also provided helpful discussions or information over the years of this project; it is all appreciated.

## TABLE OF CONTENTS

**List of Appendices**

## List of Tables

## List of Figures

## PREFACE

This wildlife report compliments *Terrestrial Ecosystem Mapping for the Clayoquot Sound Area, Year Three*, by Madrone Consultants Ltd. 1999. The wildlife information contained here is intended to be read with the vegetation information in the TEM document.

This report concludes the third year of an inventory project, initiated in 1996, which has the objectives of producing ecosystem mapping for all of the Clayoquot Sound area and of providing wildlife habitat interpretations for black-tailed deer, Roosevelt elk, black bear, bald eagle, and marbled murrelet. At this stage the inventory is incomplete with a number of areas still to be mapped and assessed. As such, this is still an interim product. Constructive review comments and suggestions for future improvement are welcomed.

# 1.0 INTRODUCTION

Project wildlife species selected for the Clayoquot Sound study are black bear (*Ursus americanus*), black-tailed deer (*Odocoileus hemionus columbianus*), Roosevelt elk (*Cervus elaphus roosevelti*), Bald Eagle (*Haliaeetus leucocephalus*), and Marbled Murrelet (*Brachyramphus marmoratus*). Wildlife interpretations, including species-habitat models and watershed specific interpretations, have been developed for these species. Although effort in the report has concentrated on the five project species, a list of wildlife species observed during fieldwork is also included as Appendix II.

This report is part of a Multi-year Inventory Study conducted by Madrone Consultants Ltd. on behalf of the Ministry of Forests. The project was funded by Forest Renewal B.C. as part of the Forest Renewal Plan (FRP) announced April 14, 1994, by the Government of British Columbia. It is part of the Integrated Terrain Stability, Terrestrial Ecosystem, Hydroriparian, and Landslide Inventory at Clayoquot Sound, British Columbia.

Appendix I contains the Rare Vertebrate Tracking List for the Port Alberni Section of the Southern Vancouver Island Forest District generated by the Conservation Data Centre (CDC) on November 1, 1998. This list identifies the red and blue-listed wildlife species for this region of British Columbia.

## 1.1 Methodology

### *1.1.1 Provincial Standards*

At the inception of this multi-year project, species-habitat model structure was based on *Standards for Wildlife Habitat Capability and Suitability Ratings in British Columbia - Review Draft* (RIC, 1996). Under the terms of the multi-year contract, these 1996 standards can be applied to all wildlife ratings from 1996 to 1999. However, since the 1996 draft document, there have been some significant improvements to the still-evolving wildlife standards.

In the interests of producing better products to a more current standard, Madrone has therefore upgraded many aspects of the wildlife interpretations. Thus, while budgetary constraints (with budgets based on 1996 standards) have not permitted a complete upgrade, we have brought various portions of the work up to more recent standards. Consequently, Species-Habitat model structure has been updated to standards found in *Standards for Wildlife Habitat Capability and Suitability Ratings in British Columbia - Review Draft* (RIC, 1997a). Species accounts have also been upgraded to more closely reflect the standards found in *Procedures for Wildlife Capability and Suitability Mapping* (RIC, 1997b). In addition, to facilitate the ease of use of digital products, the presentation of the final habitat ratings table (found in Appendix III) follows the more recent 1997-1998 format standards. However, the content follows 1996 standards (i.e. aspects have not been differentially rated, security values not separated from feeding values). Due to limitations of the contract/budget, species-habitat models were not fully updated to reflect the RIC (1998) standards.

Each species-habitat model is composed of a species account and habitat ratings. Species accounts and summaries of habitat ratings for the project species are presented in Section 7.0 of this report. A complete list of the final habitat ratings is also included as Appendix III.

### *1.1.2 Species Accounts*

A species account provides background information about the selected species biology and identifies the habitat requirements for each life requisite and associated season of use (RIC, 1997b). Preliminary species accounts were drafted prior to fieldwork and assisted in identifying habitat features and characteristics of interest to collect information on during the field program.

### *1.1.3 Habitat Ratings*

Habitat ratings were assigned to each of the ecosystem units (or habitats) mapped in the Clayoquot Sound Year 1, 2 and 3 study areas. Habitat ratings are values assigned to each map unit to express the capability[1] or suitability[2] of that unit to support a wildlife species for a particular life requisite and season. They relate the habitat requirements described in the species accounts to the relevant ecosystem attributes. They do not take into account non-habitat features, such as the adjacency of other habitats in the surrounding landscape, the proximity of roads, or the location of water bodies.

Suitability habitat ratings have been developed for the ecosystems mapped as part of the Year Three (1998) fieldwork, included in this interim report. In addition, capability ratings were added for structural stages of units not yet sampled. Originally, this process was to be incorporated upon completion of mapping the entire area, to avoid too much guesswork. However, as funding to complete the project is currently in doubt, ratings for the un-sampled stages have been added at this time, to provide a more complete product.

Life requisites and seasons that are rated for each of the project species are identified in the species accounts. Each combination of ecosystem unit and structural stage was individually assessed for its ability to meet the species-habitat requirements for the rated life requisites and seasons for the project species. Values were further refined by additional field observation and data collection. Assumptions about the species habitat requirements were developed for each species and were used in assigning the ratings. Information used in developing the final habitat ratings includes the ecosystem-expanded legend, species accounts, Year 1 and 2 ratings tables, and wildlife data collected in the field.

### *1.1.4 Fieldwork*

Detailed field sampling in 1996, 1997, and 1998 was designed by the project ecologists with input from the wildlife biologists. During fieldwork, sampling was modified on a daily basis in discussion with all participants, including the wildlife biologists (see section 3.2 for more information on the field program). Every effort was made, within the time and budgetary constraints of the project, to ensure as much wildlife information as possible was collected, as well as covering the range of ecosystem/structural stages and checking for potential wildlife travel routes and areas of high importance.

### *1.1.5 Data Collected*

Habitat assessment forms were completed for wildlife at the full ecosystem plots, and they were also used to record information (for selected species) at ground inspection plots. Some of the aerial and ground based visual plots also had some wildlife information recorded. In addition, each plot was searched for evidence of wildlife use, and any significant observations between plots were recorded. Wildlife data was sorted by subzone/variant and ecosystem for subsequent use in refining the habitat ratings. Additional habitat attribute data

[1] Capability is defined as "*the ability of the habitat, under optimal natural (seral) conditions, to provide the life requisites of a species, irrespective of its current habitat condition"* (RIC, 1998).

[2] Suitability is defined as "*the ability of the habitat, in its current condition, to provide the life requisites of a species*" (RIC, 1998).

was collected for this project, including information on wildlife trees and coarse woody debris. Supplementary information was also collected to add further detail on such aspects as arboreal lichen loading and epiphyte coverage which we felt may assist in wildlife interpretations. Notes on phenology, additional adjacency information, or any other features of interest were also made.

### *1.1.6 Final Species-Habitat Models*

The species accounts were developed using biological and habitat information published in the literature, personal knowledge, and discussions with species experts. They were refined using additional data collected in the field. In addition to cited references within individual species accounts, the information sources used in developing the interpretations include Radcliffe and Ryan (1997), Barton and Radcliffe (1996), Madrone Consultants Ltd. (1994), Teversham and Redelback (1996), and Radcliffe (ed.) (1991). Local knowledge has also been incorporated into the interpretations wherever possible.

### *1.1.7 Digital Map Products*

Once the wildlife ratings tables were revised and edited following fieldwork and review, the digital databases were linked via look-up tables to the ecosystem ArcView map files, so that wildlife values could be displayed in ArcView. These digital rating tables are provided as a deliverable for the project. However, a wide range of possible options exists for displaying and analyzing the data, and the client is encouraged to explore ways of improving upon the first iterations that are discussed in the wildlife interpretations found in section 7.0 of this report.

## 1.2 Reliability and Data Limitations

The habitat ratings developed for this project should be regarded as an approximation only. At this point in time, reliability of the ratings for the study area is probably moderate, at best, for most species. Factors contributing to the uncertainties that exist are:

- Fieldwork for 1996, 1997, and 1998 was conducted during the late summer and early fall. Ratings for other seasons are made without the benefit of field observations at those times. Numerous assumptions and educated guesses are thus involved in generating the ratings. We have no actual data to indicate, for example, exactly when spring green-up occurs, or what the typical late winter snow conditions are like, at any given site.
- Some of the vegetation units/structural stages had little or no description in the existing literature, prior to this project. Our knowledge of these units/stages is thus based on very limited plot data. Habitat ratings are therefore in turn based on a very limited data set; plots may not have been completed for all structural stages of a given ecosystem unit, for example. Many structural stage variations or variations due to modifiers, such as aspect or slope, are effectively not described. The vegetation assumed for these un-described stages is thus an educated guess, and wildlife habitat assessments are consequently less reliable than for sites with substantial prior documentation.
- In the field, habitat ratings for any given unit were often quite variable, reflecting site-specific differences, and possibly individual differences between field biologists. Although we try to control for the latter with regular in-house correlation, inevitably there are some differences in how individuals perceive - and rate - the environment.
- Between-site variability cannot readily be controlled for. As there is often only a single plot for a given unit, this leads to the situation where the field results may be atypical and may not truly represent more normal conditions for a given unit. The final wildlife habitat ratings have been modified to reflect actual field ratings. Thus, until there is a substantial database for every plot/structural stage/ modifier combination, these ratings may be

misleading when field data does not reflect the expectations and assumptions made about the habitat attributes of a given unit.

- Some ecosystem units are very variable, which leads to greater uncertainty in reliability of habitat ratings. For example, mesic (01) ecosystems in the CWHvm1 and vm2 (as previously discussed in section 3.5) occur in either a nutrient poor salal phase or in a richer, normal phase. Often, wildlife values are very different in these two phases. For example, large trees suitable for Marbled Murrelet nesting are often found in rich, mesic sites, yet poor mesic sites often have smaller trees, much less suitable for nesting. As these two phases have not been differentiated in the mapping process, this leads to a difficulty in assigning ratings based on typical conditions.
- Winter ratings assume average winter conditions, but values can vary substantially from these during mild or severe winters.
- Factors such as site modifiers, habitat adjacency, proximity, distance to water and amount of edge have largely not been taken into account at this time. These are important factors for further consideration.

## 1.3 Introduction References

Barton, K. and G. Radcliffe. 1996. *Ecosystem Mapping and Wildlife Interpretations for Cachalot Drainage.* Report and Mapping for International Forest Products Ltd., West Coast Operations, Madrone Consultants Ltd., Duncan, B.C.

Madrone Consultants Ltd. 1994. *Expanded Legend for Strathcona Park: Biophysical Habitat Mapping.* A report to accompany mapping at 1:20 000 completed for British Columbia Parks, Ministry of Environment, Lands and Parks, Victoria, B.C.

Madrone Consultants Ltd. 1997. *Year One Terrain Inventory: Clayoquot Sound*. Madrone Consultants Ltd., Duncan B.C.

Radcliffe, G. (ed.). 1991. *Clayoquot Sound: Life Support Services and Natural Diversity.* A report prepared under contract to Strategy for Sustainable Development of Clayoquot Sound. Madrone Consultants, Duncan, B.C.

Radcliffe, G. and M. Ryan. 1997. *Ecosystem mapping and wildlife interpretations for the Chapman-Gray study area.* January 1997 Revised Report. Madrone Consultants Ltd., Duncan, B.C.

Resources Inventory Committee. 1998. *British Columbia Wildlife Habitat Rating Standards.* Review Draft, April, 1998. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997a. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, May 18, 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997b. *Procedures for Wildlife Habitat Capability and Suitability Mapping.* Partial Draft, August 1, 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1996. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, August 28, 1996. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Teversham, J. and M. Jarvis Redelback. 1996. *Ecosystem Mapping and Wildlife Interpretations for TFL 54 in the Clayoquot Sound Area.* May 1996 Draft. Report for International Forest Products Ltd., West Coast Operations Madrone Consultants, Ltd., Duncan, B.C.


# SPECIES-HABITAT MODELS

## 2.0 SPECIES-HABITAT MODEL FOR BLACK BEAR

A species account is provided below followed by suitability ratings tables.

| | |
|---|---|
| Common Name: | **Black Bear** |
| Scientific Name: | *Ursus americanus* |
| Species Code: | M-URAM |
| B.C. Status: | Yellow-listed (*U. americanus emmonsii* subspecies, not found within the study area, is Blue-listed) (B.C. MOELP, 1996) |
| Identified Wildlife Status: | None |
| COSEWIC Status: | Not applicable |

### 2.1 Distribution

***Provincial Range***: Black bears are found throughout British Columbia and are present in all ecoprovinces and most biogeoclimatic zones of the province (RIC, 1997a). Populations within the province are thought to be stable with an estimated 120,000 animals (Forbes and Tompa, in prep. in RIC, 1997a). There are five subspecies of black bears found within B.C.; a brief summary may be found in RIC (1997a).

***Clayoquot Sound Population***: The subspecies *Ursus americanus vancouveri* is found throughout Vancouver Island (RIC, 1997a) and is common throughout Clayoquot Sound, occurring in all of the BEC variants present within the Years One, Two and Three study areas (see Table 1). On a provincial basis, the Clayoquot Sound region is considered to have a "plentiful" relative abundance of black bears (over 1 bear per 8 $km^2$) (Fish, Wildlife and Habitat Protection Department, 1994).

**Table 1. Expected Black Bear Occurrence within the Clayoquot Years One, Two and Three Project BEC Variants, WIM Ecosection**

| BEC Variants | CWHvm1&CWHvm2 | CWHvh1 | MHmm1& MHmmp1 |
|---|---|---|---|
| Black Bear | • | • | • |

Legend:
• = occurs in the variant

***Elevational Range***: Within the study area, black bears occur at all elevations ranging from sea level to 1,500 m.

### 2.2 Key Life Requisites and Habitat Attributes

***General Habitat***: During the growing season, forage availability is the main factor influencing habitat selection in black bears. Black bears have a diverse diet and exhibit seasonal diet preferences. Other factors influencing habitat use from spring through fall include availability of:

- Good security cover near feeding areas.
- Bedding sites.
- Escape cover including trees for cubs and sows to climb if threatened.

***Growing Season***: The spring diet of bears generally consists of early growth stages of succulent vegetation. During spring, black bears will forage in wetlands, wet meadows, clearcuts, lake shores and river estuaries (RIC, 1997a), and in moist, open forest and deciduous stands with a lush herbaceous understorey. Beachfronts, estuaries, and open riparian areas are important feeding areas in early spring in the Clayoquot Sound region (T. Hamilton, *pers.*

*comm.*). Warm aspect avalanche chutes, slides, and perhaps clearcuts are also important spring feeding areas due to early green up. Grass communities are heavily utilized in spring and can be found in some disturbed areas such as skid trails and along logging roads.

Important spring foods include rushes, sedges, grasses, and forbs, including fern fiddleheads (especially Lady fern), wall lettuce, fireweed (newly emergent), skunk cabbage, cow parsnip, and angelica. On the coast, bears will also feed on clams along beaches and forage in the intertidal zone for barnacles and seaweed (T. Hamilton, *pers. comm.*). Bears also frequent ungulate wintering and calving grounds and will prey on ungulate calves.

In summer, black bears utilize early clearcuts (generally 5 to 15 years old) and forests with good berry crops. Initially, early berry crops, such as salmonberry, are very important. Most other berry species are utilized as their berries become available including red huckleberry, raspberry, blueberry, currants, black twinberry, elderberry, devil's club, highbush-cranberry, red-osier dogwood, and salal. Insects, especially wasps and ants, are also important summer food items. Bears will continue to utilize a variety of herbs throughout the summer including skunk cabbage. Riparian areas remain important throughout the growing season.

On the coast, black bears concentrate along major salmon spawning rivers and streams in the late summer and fall, with salmon becoming a very significant food source in some areas. Good security cover in feeding areas adjacent to rivers becomes important at this time. Berry crops remain an important food source with huckleberries (*Vaccinium* spp.) and salal being the most heavily utilized. Prior to denning, forbs such as skunk cabbage will also be used after the salmon stocks have declined (RIC, 1997a).

***Hibernating (Denning)***: Winter habitat use is probably determined by den site availability. In coastal British Columbia, black bears have been found to exclusively use wooden rather than rock structures for denning (Davis, 1996). Denning bears in the Nimpkish Valley, Vancouver Island, have been found to utilize old-growth associated structures comprising live or dead large standing hollow trees, stumps, logs, and root boles with a mean diameter of 143 cm (Davis, 1996). Western redcedar and yellow-cedar seem to be the most important denning tree species (Davis, 1996), and black bears appear to select for specific denning structures rather than stand type. They will also den among second growth provided old-growth structures remain (T. Hamilton, *pers. comm*.). However, once these structures decay, replacements will not be present until second growth obtains old-growth characteristics. One to three cubs are born in the den between late December and January (Alt, 1983), therefore, security and thermal values of the den are very important. Selection of good den sites may be critical for reproductive success.

***Security Habitat***: Escape trees adjacent to foraging areas are required for females with cubs. Trees of approximately 60 cm to 70 cm minimum DBH are needed to serve as effective escape trees (T. Hamilton, *pers. comm.*). In addition to providing safety for cubs, trees may also provide bedding sites for females (T. Hamilton, *pers. comm.*). Females with cubs usually forage within 100 m of forested cover (Herrero, 1978). Dense shrubs also provide good cover and bedding areas for black bears (Jonkel, 1978).

## 2.3 Seasons of Use

**Table 2. Seasons of Use Summary for Black Bear.**

| Season | Code | Habitat Use | Months[a] | Comments[b] |
|---|---|---|---|---|
| Early Spring | EP | Living | late March-April | Emergence from dens is quite variable. Males emerge first, beginning around March 15th, although the 1st week of April is more likely. Females will emerge until May if they have cubs, yet most are emerging by the 3rd week of April. |
| Spring | **P** | Living | April-May | |
| Summer | **S** | Living | June-August | |
| Fall | **F** | Living | September-October | Fall period will continue until initiation of denning. |
| Winter | **W** | Hibernating | November-March (Period of denning) | Denning dates for Vancouver Island are quite variable; females may begin denning as early as the 3rd week of October, while some males may not den until the end of December, if there are late salmon runs. |

[a]Months for the seasons spring through winter for the Coast and Mountains Ecoprovince are taken from RIC (1997b; Appendix B).
[b]Dates for denning of black bears are based on personal communications with T. Hamilton and are based on those from the Nimpkish black bear study.

## 2.4 Rating Scheme and Seasons

***6-class, 5-season***

A 6-class rating scheme of high (1), moderately high (2), moderate (3), low (4), very low (5), and nil (6) is employed due to the detailed level of knowledge on habitat use of black bears (RIC, 1997b). The ratings scheme is defined in Table 3.

**Table 3. Relative Quality Classes (from RIC, 1997b).**

| Code | Quality relative to the best in B.C. | Suitability/Capability |
|---|---|---|
| 1 | Equivalent (75%-100% of best) | High |
| 2 | Slightly less (50%-75% of best) | Moderately high |
| 3 | Moderately less (25%-50% of best) | Moderate |
| 4 | Substantially less (5%-25% of best) | Low |
| 5 | Much less (0%-5% of best) | Very low |
| 6 | Habitat or attribute is absent | Nil |

Ecosystem units are rated for five seasons as defined above. Early spring (EP), spring (P), summer (S), and fall (F) are rated for general living with an emphasis on food values, and winter (W) is rated for hibernating (i.e., denning) habitat.

## 2.5 Ratings Assumptions

General seasonal habitat ratings are presented in Tables 4, 5, 6, and 7. Interpretations were developed primarily on the basis of availability and timing of preferred food species in the growing season and for quality of denning habitat in the winter season. Additional information was obtained from published and unpublished literature supplemented with personal knowledge, communications, and field data. Further study is needed to validate and refine these ratings. The following assumptions have been made:

| Season | Assumptions |
|---|---|
| Early spring, Spring, Summer and Fall - Feeding | **Structural Stage:**<br>• In most site series, structural stages 2 to 3 should provide abundant forage and have good spring and summer values. Burns and clearcuts should provide moderate to high summer forage due to high fruit production.<br>• Structural stage 3 stands in most site series are rated fairly high in fall, as fruit production is quite good.<br>• Stage 4 stands generally have poor year round foraging value as these stands are typically dense and most forage has been shaded out.<br>• Generally, once forest cover is established, food availability increases with the age of the stand. Therefore, mature and old growth forests are rated as highest value, with young forests having lower foraging values.<br>• Older forested stands should have higher production than young stands due to more forest openings.<br>**Vegetation Characteristics:**<br>• Food values of the units are emphasized throughout the growing season. Units with high proportions of key seasonal food species (presence, percent cover) are rated high for the appropriate seasons.<br>• Units with preferred species of herbs and berry-producing shrubs are rated as having high value, as they are extremely important foraging sites in the summer.<br>• Units in the fall season are rated as having high value if they have a good proportion of salal and *Vaccinium* spp. as these are key food items at this time, although berry production is hard to assess.<br>• Riparian communities have high value if they provide good security habitat for bears feeding on salmon.<br>• Moist forests with skunk cabbage are important feeding areas, especially important in the spring after emerging from hibernation.<br>**Other:**<br>• Water and minerals are not limiting for black bears.<br>• Bears will congregate at salmon spawning areas during the fall for feeding.<br>• Warm aspect units, especially avalanche tracks and meadows, have increased value in early spring See adjustments section.<br>• Intertidal habitat are assumed to have feeding values in the form of clams, barnacles and seaweed. |

**Habitat Ratings Assumptions for Black bear (continued).**

| Season | Assumptions |
|---|---|
| Early spring, Spring, Summer and Fall - Security/Thermal | **Structural Stage:**<br>• Mature and old growth coniferous forests provide thermal cover.<br>• Mixed conifer/deciduous mature forests provide important security habitat. Shrub cover >50% and canopy closure >66% also provide good cover.<br>**Vegetation Characteristics:**<br>• Larger trees (>40cm dbh), within 100m of feeding areas are required for security habitat.<br>• Riparian areas and other ecosystems with preferred grasses and herbs are rated high as these areas should provide abundant, new succulent forage during the spring.<br>**Site:**<br>• Low elevation, warm aspect units offer better thermal site value. |
| Hibernation - Security/Thermal | **Structural Stage:**<br>• Black bears use large trees and their related structures for denning (Davis, 1996). Therefore, as they will not provide suitable denning trees, structural stages 1-4 are given a rating of nil value and structural stage 5 is given a low value. It is assumed that no old-growth legacies (e.g., stumps) are present.<br>• Mature forest (stage 6) is generally rated a little lower than stage 7, yet more productive, moist, mature forest may also provide high value denning habitat.<br>• Old-growth forest (stage 7) has the highest denning value, as it should provide large, decadent trees.<br>• Second-growth forest with a remnant old-growth component can have some high values for denning if suitable old-growth structures remain.<br>**Vegetation Characteristics:**<br>• Stands that contain mature or old growth yellow-cedar or western redcedar are rated highest for the winter as they often contain trees with the preferred attributes for denning. |

Ratings in the year one and two ratings tables have been refined, based on the year three field verification plots and observations (see Tables 4 to 7). These revisions are identified in bold. Shaded values indicate that these ratings have been developed without site information (as they have not been sampled in the year one, two or three mapped watersheds). However, they have been provided at this stage in order to ensure that the project is as complete as possible for future reference.

## 2.6 Habitat Ratings Tables

### Table 4. Summary of Black Bear Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Maritime Subzone - Submontane and Montane Variants (CWHvm1 and vm2)

***CWH vm1 and vm2: Forested Site Series***

| | Structural Stage | 3 | | | | | 4 | | | | | 5 | | | | | 6 | | | | | 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W |
| **Unit** | **Site Series** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **AB** | 01 HwBa - Blueberry | 4 | 4 | 3 | 2 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | **4** | **4** | 5 | 4 | 4 | **3** | **3** | 3 | 4 | 4 | 2 | 2 | 2 |
| **LC** | 02 HwPl - *Cladina* | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | **5** |
| **HS** | 03 HwCw - Salal | 5 | 4 | 2 | **1** | 6 | 4 | 4 | **4** | 3 | 6 | 4 | 4 | 3 | 2 | **5** | 4 | 4 | 3 | 2 | 3 | 4 | 4 | 3 | 2 | 1 |
| **RS** | 04 CwHw - Swordfern | 4 | 3 | 3 | **3** | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | **3** | **3** | 4 | **2** |
| **AF** | 05 BaCw - Foamflower | 3 | 3 | 2 | 4 | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 3 | 4 | **5** | 4 | 4 | 2 | 4 | **3** | 4 | 3 | 2 | 4 | 1 |
| **HD** | 06 HwBa - Deer fern | 4 | 3 | 2 | 4 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 4 | 4 | 4 | **5** | 4 | 4 | 3 | 3 | **4** | 4 | 4 | 3 | 3 | 1 |
| **AS** | 07 BaCw - Salmonberry | 2 | 1 | 1 | 1 | 6 | 4 | 4 | 4 | 4 | 6 | 3 | 3 | 3 | 3 | **5** | 2 | 1 | 1 | 1 | **3** | 2 | 1 | 1 | 1 | **1** |
| **SS** | 09 (vm1) Ss - Salmonberry | 1 | 1 | 1 | 2 | 6 | 4 | 4 | 4 | 4 | 6 | 4 | 3 | 3 | 3 | **5** | 1 | 1 | 1 | 2 | **3** | 1 | 1 | 1 | 2 | **2** |
| **CW** | 11 (vm1) Act - Red-osier dogwood or (vm2) Act - Willow | 1 | 1 | 1 | **2** | 6 | 2 | 2 | 2 | 2 | 6 | 2 | 2 | 2 | 2 | **5** | x | x | x | x | X | x | x | x | x | x |
| **YG** | 12 (vm1) & 09 (vm2) CwYc - Goldthread | 4 | 4 | **3** | 2 | 6 | 4 | 4 | 3 | 3 | 6 | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 |
| **LS** | 13 (vm1) & 10 (vm2) Pl - *Sphagnum* | 5 | 5 | 3 | 4 | 6 | 5 | 5 | 5 | 4 | 6 | 5 | 5 | 5 | 4 | 6 | 5 | **3** | 3 | 4 | 6 | 5 | **3** | 3 | 4 | **5** |
| **RC** | 14 (vm1) & 11 (vm2) CwSs - Skunk cabbage | 2 | 1 | 1 | 2 | 6 | 3 | 2 | 2 | 3 | 6 | 3 | 2 | 2 | 3 | 4 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |

***CWH vm1 and vm2: Deciduous, Shrub, and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | | 3 | | | | | 4 | | | | | 5 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W |
| **Ecosystem Unit** | | | | | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | x | 2 | 1 | 1 | 3 | 6 | 4 | 3 | 2 | 3 | 6 | 4 | 3 | 2 | 3 | 6 |
| **DS** | Dunegrass - Silverweed | 2 | 3 | 4 | 5 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 1 | 1 | 4 | 5 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **IF** | Indian hellebore - Fern slide track | 3 | 1 | 1 | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | x | 3 | 3 | **2** | **3** | 6 | x | x | x | x | x | x | x | x | x | x |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | x | 2 | 1 | 1 | 3 | 6 | x | x | x | x | x | x | x | x | x | x |
| **SC** | *Sphagnum* - Cotton-grass | 1 | 2 | 4 | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **SG** | Sphagnum - Deer cabbage | 3 | 2 | **3** | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - Sphagnum | 3 | 3 | 3 | 4 | 6 | 3 | 3 | 3 | 4 | 6 | x | x | x | x | x | x | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 3 | 1 | 1 | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **WS** | Willow - Salmonberry | x | x | x | x | x | 2 | 2 | 3 | 3 | 6 | x | x | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem; **Bold** indicates a refinement in rating from year 2 tables.

## Table 5. Summary of Black Bear Seasonal Habitat Ratings For Clayoquot Sound: Coastal Western Hemlock Very Wet Hypermaritime Subzone - Southern Variant (CWHvh1)

### *CWHvh1: Forested Site Series*

| | Structural Stage | 3 | | | | | 4 | | | | | 5 | | | | | 6 | | | | | 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | | | | | | |
| **HS** | 01 CwHw - Salal | 4 | 3 | 2 | 2 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 4 | 5 | **5** | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 1 |
| **LR** | 02 PlYc - *Rhacomitrium* | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | **5** |
| **RS** | 03 CwHw - Salal | 5 | 4 | **1** | **1** | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 4 | 3 | 3 | **5** | 5 | 4 | **1** | **1** | **3** | 5 | 4 | **1** | 1 | **2** |
| **RF** | 05 CwSs - Sword fern | 4 | 4 | 3 | 3 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 3 | 4 | 5 | 5 | 4 | 3 | 4 | **1** |
| **SF** | 06 CwSs - Foamflower | 5 | 4 | 4 | 3 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | **5** | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | **1** |
| **SD** | 07 CwSs - Devil's club | **3** | 2 | 2 | 2 | 6 | 5 | 4 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | **5** | 2 | 2 | 2 | **3** | 3 | 2 | 2 | 2 | **3** | **1** |
| **SL** | 08 Ss - Lily-of-the-valley | 2 | **1** | **1** | 4 | 6 | 2 | 2 | 2 | 4 | 6 | 3 | 2 | 2 | 3 | 5 | 3 | 1 | 1 | **2** | 3 | **2** | 1 | 1 | **2** | 2 |
| **AL** | 10 Dr - Lily-of-the-valley | 5 | **4** | **3** | 5 | 6 | 5 | **4** | **3** | 5 | 6 | 5 | 4 | 2 | 3 | 6 | x | x | x | x | x | x | x | x | x | x |
| **YG** | 11 CwYc - Goldthread | **4** | 2 | 2 | 2 | 6 | 5 | 4 | 4 | 4 | 6 | 4 | 3 | 3 | 3 | 5 | **4** | 2 | 3 | 2 | 4 | **4** | 2 | 3 | 2 | 3 |
| **LS** | 12 PlYc - *Sphagnum* | 3 | 3 | 3 | 3 | 6 | 3 | 3 | 4 | 4 | 6 | 3 | 3 | 4 | 4 | 6 | 3 | 3 | 4 | 4 | 5 | 3 | 3 | 4 | 4 | 6 |
| **RC** | 13 CwSs - Skunk cabbage | 1 | 1 | 1 | 1 | 6 | 3 | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 3 | **5** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **SS** | 14 Ss - Salal | 5 | 5 | **2** | **2** | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | **2** | **2** | 5 | 5 | 5 | **2** | **2** | **4** |
| **SK** | 15 Ss - *Kindbergia* | 4 | 4 | 3 | 2 | 6 | 5 | 5 | 5 | 4 | 6 | 5 | 5 | 5 | 4 | 6 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | **2** | **2** | **2** |
| **SW** | 17 Ss - Sword fern | 4 | 4 | 3 | 3 | 6 | 5 | 4 | 3 | 4 | 6 | 5 | 4 | 3 | 4 | 6 | 4 | **3** | 3 | **3** | **4** | 4 | **3** | 3 | **3** | **2** |

### *CWHvh1: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

| | Structural Stage | 2 | | | | | 3 | | | | | 4 | | | | | 5 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W |
| Ecosystem Unit | | | | | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | x | 2 | 1 | 1 | 3 | 6 | 4 | 3 | 2 | 3 | 6 | 4 | 3 | 2 | 3 | 6 |
| **BS** | Bulrush - Sitka burnet marsh | 2 | 2 | 4 | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **CM** | Rocky Mountain cow-lily - Marsh cinquefoil marsh | 4 | **3** | 4 | 4 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **DS** | Dune grass - Silverweed | 2 | 3 | 4 | 5 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 1 | 1 | 4 | 5 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | x | 3 | 3 | **2** | **3** | 6 | x | x | x | x | x | x | x | x | x | x |
| **SB** | Sedge - Buckbean | 1 | 1 | 3 | 3 | 6 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - *Sphagnum* moss | 3 | 3 | 3 | 4 | 6 | 3 | 3 | 3 | 4 | 6 | x | x | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem; **Bold** indicates a refinement in rating from year 2 tables.

## Table 6. Summary of Black Bear Seasonal Habitat Ratings For Clayoquot Sound: Coastal Western Hemlock Zone (CWH), Non-forested Units

***CWH: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| Ecosystem Unit | | Season | EP | P | S | F | W |
|---|---|---|---|---|---|---|---|
| **BE** | Beach | (1) | 2 | 3 | 4 | 4 | 6 |
| **CB** | Cobble beach | (1) | **3** | **3** | **3** | **3** | 6 |
| **CG** | Cultivated garden | (3) | 3 | 3 | 3 | 4 | 6 |
| **CL** | Cliff | (1) | 6 | 6 | 6 | 6 | 6 |
| **ES** | Exposed soil | (1) | 6 | 6 | 6 | 6 | 6 |
| **GB** | Gravel bar | (1) | 5 | 5 | 5 | 5 | 6 |
| **GP** | Gravel pit | (1) | 6 | 6 | 6 | 6 | 6 |
| **LA** | Lake | | 6 | 6 | 6 | 6 | 6 |
| **MU** | Mudflats | (1) | 3 | 3 | 5 | 5 | 6 |
| **OW** | Shallow water | | **5** | **5** | **5** | **5** | 6 |
| **PO** | Pond | | **5** | **5** | **5** | **5** | 6 |
| **RI** | River | | **5** | **5** | **5** | **5** | 6 |
| **RO** | Rock outcrop | (1) | 5 | 5 | 5 | 5 | 6 |
| **RP** | Road surface | | 5 | 5 | 5 | 5 | 6 |
| **RR** | Rural | | 5 | 5 | 5 | 5 | 6 |
| **SO** | Salt water | | **5** | **5** | **5** | **5** | 6 |
| **TA** | Talus slope | (1) | 5 | 5 | 5 | 5 | 6 |
| **WP** | Wave cut platform | (1) | 6 | 6 | 6 | 6 | 6 |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil;
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter;
**Bold** indicates a change in rating from year 2 tables.

## Table 7. Summary of Black Bear Seasonal Habitat Ratings For Clayoquot Sound: Mountain Hemlock Moist Maritime - Windward Variant (MHmm1) and Parkland Subzone (MHmmp)

***MH mm1 and mmp: Forested Site Series***

| | Structural Stage | 3 | | | | | 4 | | | | | 5 | | | | | 6 | | | | | 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W | EP | P | S | F | W |
| **Unit** | **Site Series** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **MB** | 01 HmBa - Blueberry (includes 04) | 5 | 5 | 3 | 3 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 3 | 3 | 5 | 5 | 5 | 3 | 3 | 2 |
| **MM** | 02 HmBa - Mountain-heather | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 4 | **3** | 5 | 6 | 5 | 4 | **3** | 3 |
| **MO** | 03 HmBa - Oak fern | 5 | 3 | 3 | 3 | 6 | 5 | 3 | 3 | 3 | 6 | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 2 | 2 | **5** | 5 | 3 | 2 | 2 | **3** |
| **MT** | 05 BaHm - Twistedstalk | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 2 | 2 | 5 | 5 | 3 | 2 | 2 | **3** |

***MH mm1 and mmp: Shrub and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | | 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | EP | P | S | F | W | EP | P | S | F | W |
| **Ecosystem Unit** | | | | | | | | | | | |
| **IF** | Indian hellebore - Fern slide track | 6 | 1 | 1 | 4 | 6 | x | x | x | x | x |
| **LD** | Arctic lupine - Alpine daisy meadow | 6 | 3 | 1 | 3 | 6 | x | x | x | x | x |
| **MH** | Mountain-heather meadow | 6 | 5 | 3 | 4 | 6 | 6 | 5 | 3 | 4 | 6 |
| **MK** | Montane krummholz | x | x | x | x | x | 6 | 6 | 5 | 5 | 6 |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | x | 5 | 5 | 2 | 2 | 6 |
| **SC** | Sphagnum - Cotton-grass | 4 | 3 | 3 | 4 | 6 | x | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 4 | 3 | 1 | 3 | 6 | x | x | x | x | x |

***MH mm1 and mmp: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| | Season | | EP | P | S | F | W |
|---|---|---|---|---|---|---|---|
| **Ecosystem Unit** | | | | | | | |
| **CL** | Cliff | (1) | 6 | 6 | 6 | 6 | 6 |
| **ES** | Exposed soil | (1) | 6 | 5 | 5 | 5 | 6 |
| **GB** | Gravel Bar | (1) | 6 | 5 | 5 | 5 | 6 |
| **LA** | Lake | | 6 | 6 | 6 | 6 | 6 |
| **OW** | Shallow water | | 6 | 6 | 6 | 6 | 6 |
| **PS** | Permanent snow | | 6 | 6 | 6 | 6 | 6 |
| **RO** | Rock outcrop | (1) | 5 | 5 | 5 | 5 | 6 |
| **TA** | Talus slope | (1) | 5 | 5 | 5 | 5 | 6 |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem; **Bold** indicates a refinement in rating from year 2 tables.

## 2.7 Rating Adjustments

**Elevation:**

***CWHvm1 and CWHvm2***
At present we have insufficient information to distinguish between the vm1 and the vm2, in terms of assumptions, although there is likely to be a gradation of habitat values with increasing elevation. For example, fall berry crops may be better in the vm2, on average, than in the vm1. Spring feeding values are likely, on average, to be best on warm slopes in the lower vm2 and upper vm1. However, differences may not be sufficient to warrant ratings changes.

***MHmm1 and MHmmp***
Similarly, we have not at this stage separated the MHmm1 habitats from the same units in the MHmmp, in terms of different assumptions.

**Aspect:**
Adjustments (e.g. warm versus cool aspect slopes), where applicable typically increase or decrease the suitability value of a site by a single class. Preliminary adjustments to habitat ratings based on aspect differences are suggested below. Further refinement of aspect ratings should be possible as more information becomes available from studies in the area.

Aspects can be expected to influence bear habitat values as follows:

- In all subzones and variants, sparsely or unvegetated units (CL, ES, RO, TA) may support some plants early in spring when on warm aspects, and so receive some use. However, as vegetation cover – and food – is so low, changes are unlikely to affect ratings by a full step. Aspect is generally not relevant for the other sparsely or non-vegetated units.

- No changes in structural stages 4 and 5, all units, any season.

- Structural stage 3 will experience greatest aspect influence on spring vegetation.

- Structural stages 6 and 7 will generally experience more influence from aspect than stages 4 and 5 (which usually have more dense, closed canopies).

- Shading effects of canopy in 6 and 7 will mute aspect influence to varying degrees, especially in the mature stage 6 stands versus the more open old growth stage 7.

- We have little information on the influence of aspect on berry crops. This needs further research. Warm aspect units at higher elevations appear to produce good berry crops. However, at lower elevations, are cooler aspects, which may prolong the berry season until later in fall, actually more important to bears as the season progresses?

***Aspect Adjustments: CWHvh***
Xeric ecosystems (LR) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of

vegetation is low, the habitat ratings for feeding in any season are unlikely to change by as much as one step.

Submesic sites (RS) get dense shrubs in early seral stages (stage 3) but herbs may not increase significantly. Feeding values are therefore unlikely to change enough in spring to warrant an increase in rating. Values in late summer and fall for berries may be influenced by aspect. However, at the lower elevations of the CWHvh, berry crops may be as good or better on cool aspect stage 3 and 7 sites than on warm. No adjustments are proposed at this stage.

Mesic (HS) and moister forests (RF, SF, SD, SW) values will increase in spring (+1) in structural stage 3. Some spring value increase in stages 6 and 7 can be expected, but aspect is unlikely to increase spring ratings by as much as one in these later stages. Spring feeding values on cool slopes are lower than on warm, but the general habitat ratings should still apply. Summer and fall feeding values are likely to alter in structural stages 3 and possibly 7; less in stage 6. However, at the lower elevations of the CWHvh, berry crops may be as good or better on cool aspect stage 3 and 7 sites than on warm. No adjustments are proposed at this stage.

The wetter forested units (SL, AL, YG, LS, RC, SK) do not occur on very sloping sites, and are not rated for aspect differences.

Deciduous units (AW), on warm slopes will have enhanced spring feeding values (+1), in all structural stages. Summer values may also be best on warm slopes but differences are probably not sufficient to warrant a rating change. Other deciduous, shrubby or herbaceous units (BS, CM, DS, GS, PD, SB, SM) do not occur on sufficient slopes to require aspect adjustments.

***Aspect adjustments: CWHvm1 and vm2***

Xeric ecosystems (LC) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of vegetation is always low, the habitat ratings for feeding in any season are unlikely to change by as much as one step.

Submesic sites (HS) get dense shrubs in early seral stages but herbs may not increase significantly. Feeding values are therefore unlikely to change enough in spring to warrant an increase in rating. Values in late summer and fall for berries may be influenced by aspect. At the lower elevations berry crops may be as good or better on cool aspect stage 3 and 7 sites than on warm; at higher elevations, crops may be better on warmer aspects. No adjustments are proposed at this stage.

Dry, rich (RS), mesic (AB) and moister forests (AF, HD, AS): increased spring values (+1) should occur in structural stage 3. Some spring value increase in stages 6 and 7 can be expected, but aspect might not increase spring ratings by as much as one in these stages. Summer and fall feeding values are likely to alter by up to 1 in structural stage 3 and possibly 7. However, the combined influence of aspect with elevation is unknown. Berry crops are possibly best on warm aspects in the upper vm2, but the effect could be the opposite at low elevations in the vm1. No summer or fall ratings adjustments are proposed at this stage.

The wetter forested units (CW, YG, LS, RC) are not normally on sloping sites, and are not rated for aspect differences.

Mountain Hemlock zone units mapped in the CWHvm2 will have the same adjustments as the same ecosystem units in the MH zone (see below).

Herbaceous (IF) units are occasionally on slopes sufficient to warrant aspect modifiers. Although so far only mapped on either gentle slopes or cool aspects, it may well occur on warm aspects in some of the watersheds not yet mapped. In this case enhanced feeding in spring (+1) on the warm aspects can be expected. Summer values may also be better on warm slopes, but probably not enough to warrant a rating adjustment.

All structural stages of deciduous units (AW), on warm slopes will have enhanced spring feeding values (+1). Shrub units (SA) on warm slopes will also have enhanced spring values (+1). These units may also be slightly better in summer and fall at the higher elevations. The remaining deciduous, shrubby or herbaceous units (DS, GS, PD, SC, SM, WS and normally VS) do not occur on sufficient slope to warrant aspect modifiers.

***Aspect Adjustments: MHmm1 and MHmmp***

Xeric ecosystems (MM) are on rocky sites. Influence of aspect is unlikely to greatly affect the heather dominated understorey in all structural stages, so habitat ratings for feeding are unlikely to change much in response to aspect. Late summer and fall berries may be a little better on the warm aspects at these high elevations, in all structural stages, but the increase is probably insufficient to warrant a rating change of one step.

Dry rich (MO), mesic (MB) and moister forests (MT): late spring and summer values will increase (+1) in structural stage 3. Some late spring value increase in stages 6 and 7 can also be expected, but may be insufficient to warrant a change of one step. Summer and fall feeding values may increase on warm aspects (+1) in structural stages 3 and 7.

Herbaceous (IF, LD) or shrubby/herbaceous units (SA) on warm slopes will have enhanced summer feeding values; S +1. The SA unit may also have better summer and fall values; S, F +1. Additional herbaceous units (SC, VS) are not on sufficient slopes to warrant rating adjustments.

The low shrub MH and MK units may have slightly better summer and fall values on warm aspects. However, berry-producing shrubs are not usually sufficiently dense to warrant adjustments of one step.

**Other Adjustments:**

***CWHvm1 and vm2: Salal Phase of the mesic (AB) site series***

Ratings for the mesic (01) unit in the CWHvm1 and vm2 assume average conditions. The salal phase of the AB (01) site series has not been mapped. However, it may have lower spring feeding values (-1) for bears and possibly higher late summer and fall feeding values due to the very dense salal. Denning values may be slightly lower than on average sites, but large trees can still occur, so the differences may not warrant a reduction in rating.

***Site Index***

Incorporation of VRI information into the species model may help refine some of the ratings. For example site index may assist in further identifying the best potential denning habitats.

**Human Disturbance:**

Habitats adjacent to areas of human disturbance will have decreased value (e.g. roads and settlements). This could be incorporated by reducing values of habitats within 100 metres (or 200 metres, 500 metres etc.) on either side of a main road, for example. However, more explicit information on black bear habitat use/human avoidance is needed before incorporating this into the model.

## 2.8 References

Alt. G. L. *Timing of Parturition of Black Bears (Ursus Americanus) in Northeastern Pennsylvania*. J. Mammal. 64: 305-307.

B.C. Ministry of Environment, Lands and Parks. 1996. *Vertebrate Red and Blue Lists.* Wildlife Branch, Victoria, B.C.

Davis, H. 1996. *Characteristics and Selection of Winter Dens by Black Bears in Coastal British Columbia.* Masters Thesis. University of British Columbia.

Fish, Wildlife and Habitat Protection Department. 1994. *Wildlife Distribution Mapping, Big Game Series.* Ministry of Environment, Lands and Parks, Victoria, B.C. 16 maps, 1:2,000 000.

Forbes, R. D. and F. S. Tompa. In prep. *Provincial Black Bear Species Statement*. B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. Draft.

Jonkel, C. 1978. *Black, Brown (Grizzly) and Polar Bears*. pp. 227-248 in J. L. Schmidt and D. L. Gilbert (eds.) Big Game of North America: Ecology and Management. Stackpole Books.

Hamilton, T. Personal communication 1997. *Large Carnivore Specialist*. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

Herrero, S. 1978. *A Comparison of Some Features of the Evolution, Ecology and Behaviour of Black and Grizzly/Brown Bears.* Carnivore 1:7-17.

Resources Inventory Committee. 1997a. *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Large Terrestrial Carnivores - Black Bears and Grizzly Bears.* Draft - June 1997. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997b. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, May 18, 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

## 3.0 SPECIES-HABITAT MODEL FOR BLACK-TAILED DEER

A species account is provided below followed by suitability ratings tables.

| | |
|---|---|
| Common Name: | **Black-tailed Deer** |
| Scientific Name: | *Odocoileus hemionus columbianus* |
| Species Code: | M-ODHC |
| B.C. Status: | Yellow-listed |
| Identified Wildlife Status: | None |
| COSEWIC Status: | Not applicable |

### 3.1 Distribution

***Provincial Range***: The black-tailed deer, *Odocoileus hemionus columbianus*, is one of three subspecies of mule deer recognized in British Columbia. While the mule deer is common throughout most of the province (except in the northwestern and north central regions), the coastal subspecies occurs on the coast north to Rivers Inlet and on Vancouver Island (Banfield, 1974). Mule deer densities are highest along the coast, including the Queen Charlottes and Vancouver Island.

***Clayoquot Sound Population***: Black-tailed deer are fairly common and range throughout the project area. They are found in all of the BEC variants present within the Clayoquot Sound Years One, Two and Three study areas (see Table 8). On a provincial basis, black-tailed deer have a moderate relative abundance (1 deer per 0.2-2 $km^2$) within Clayoquot Sound (Fish, Wildlife and Habitat Protection Department, 1994).

**Table 8. Expected Black-tailed Deer Occurrence within the Clayoquot Years One, Two and Three Project BEC Variants, WIM Ecosection.**

| BEC Variants | CWHvm1&CWHvm2 | CWHvh1 | MHmm1& MHmmp1 |
|---|---|---|---|
| Black-tailed Deer | • | • | • |

Legend:
- = occurs in the variant

***Elevational Range***: Within the study area, black-tailed deer can occur at all elevations, from sea level to 1,500 m.

### 3.2 Key Life Requisites and Habitat Attributes

***General Habitat***: Black-tailed deer have small home ranges and tend to be relatively sedentary. They generally migrate between seasonal habitats within a watershed, typically moving from good, higher elevation, summer habitats to winter habitats consisting of low elevation, south facing, warm aspect slopes or floodplain areas where snowpacks are very low (Nyberg and Janz, 1990). In severe winters, warm aspect, old-growth, coniferous forests provide very important winter range (Harestad *et al.,* 1982). Where a suitable habitat mix of young to old forest areas occur, black-tailed deer may also be non-migratory, remaining in very small home ranges (McNay and Davies, 1985).

Adjacency of early spring range to winter range is critical. Steep south-facing slopes are often the first areas to green up in early spring (Luttmerding *et al.,* 1990). Herbaceous open areas and floodplain forests may also be important spring areas. Early and intermediate seral stages after burning or logging often provide abundant foods and are good spring and summer habitats, providing sufficient security cover is available. Deer may migrate to higher elevations in late summer and fall to take advantage of newer growth resulting from delayed

phenology (Nyberg and Janz, 1990). Open forests and natural openings also provide high quality forage throughout the growing season. Deer are rarely found in dense woods.

***Feeding***: Black-tailed deer have a diverse diet including a variety of grasses, forbs, shrubs, trees, sedges, agricultural crops, mushrooms, and lichens, depending on season (Petticrew and Jackson, 1980). Key winter forage species within the coastal region include western redcedar, Douglas-fir, red huckleberry, salal, deer fern, and arboreal lichens (Nyberg and Janz, 1990). In severe winters when snow depth precludes use of other forage species, arboreal lichens (especially *Alectoria*, *Bryoria,* and *Usnea* species), western Redcedar, and Douglas-fir compose the main diet. In spring, important forage species include fireweed, pearly everlasting, bunchberry, *Rubus*, *Vaccinium*, willow species, and many herbs and grasses (Nyberg and Janz, 1990). Key summer species utilized are fireweed, pearly everlasting, salal, and *Rubus* and V*accinium* species (Nyberg and Janz, 1990). Table 9 summarizes the important forage species for black-tailed deer.

***Security Habitat***: Interspersion of food and cover is very important in determining deer habitat quality. Optimal habitat consists of open areas closely interspersed with forests. Minimum security cover for deer has been defined as vegetation capable of concealing 90% of a deer from view at a distance of 60 m or less (Thomas *et al.,* 1979). The stand's density and diameter of trees and the density of understorey vegetation determine its value as security cover (Nyberg and Janz, 1990). Tree boles and foliage provides the best cover, yet short, dense vegetation and CWD can provide adequate screening for deer in some areas (Nyberg and Janz, 1990). In flat terrain, small trees 1 m to 2 m in height can provide effective cover (Armeleder and Dawson, 1992). In more uneven terrain, topographic features such as swales or dips can often provide sufficient hiding cover for deer (Nyberg and Janz, 1990). Bluffs or ridges that offer an unimpeded view of the surrounding terrain may also have value as security habitat (Nyberg and Janz, 1990).

Security cover reduces deer energy expenditure by reducing the need and the distance to flee (Armeleder and Dawson, 1992; Armeleder *et al.,* 1986). Deer will typically remain within 200 m of security cover (Nyberg and Janz, 1990).

### Table 9. Important Forage Plants for Black-tailed Deer in Southern British Columbia

(Taken from Nyberg and Janz (1990). The most important or preferred species are printed in bold type.)

| | Winter forage | Spring forage | Summer forage |
|---|---|---|---|
| TREES: | **Douglas-fir**<br>western hemlock<br>**western redcedar** | bigleaf maple<br>**Douglas-fir** | red alder |
| SHRUBS: | Alaskan blueberry<br>five-leaved bramble<br>kinnikinnick<br>oval-leaved blueberry<br>**red huckleberry**<br>rose spp.<br>**salal**<br>saskatoon<br>twinflower<br>vine maple<br>willow spp. | ***Rubus* spp.**<br>(salmonberry, blackberry, thimbleberry, raspberry, bramble)<br>salal<br>**willow spp.** | **salal**<br>willow spp. |
| FERNS: | **deer fern** | **bracken** | |
| HERBS: | bunchberry<br>grass spp. | bunchberry<br>**fireweed**<br>grass spp.<br>hairy cat's-ear<br>horsetail<br>**pearly everlasting** | **fireweed**<br>grass spp.<br>hairy cat's-ear<br>**pearly everlasting** |
| ARBOREAL LICHENS: | ***Alectoria***<br>***Bryoria***<br>*Lobaria oregana*<br>***Usnea* spp.** | | |

## 8.3 Seasons of Use

### Table 10. Seasons of Use Summary for Black-tailed Deer

| Season | Code | Habitat Use | Months* | Comments |
|---|---|---|---|---|
| Spring | **P** | Living | April-May | |
| Summer | **S** | Living | June-August | Birthing: first half of June (Nyberg and Janz, 1990). |
| Fall | **F** | Living | September-October | |
| Winter | **W** | Living | November-March | Rut: mid-November to early December (Nyberg and Janz, 1990). |

* *Seasons defined per the Chart of Seasons by Ecoprovince (RIC, 1997; Appendix B).

## 3.4 Rating Scheme and Seasons

***6-class, 4 season***

A 6-class rating scheme of high (1), moderately high (2), moderate (3), low (4), very low (5), and nil (6) is employed due to the detailed level of knowledge on habitat use of black-tailed deer (RIC, 1997). The used ratings scheme is defined in Table 3. Units are rated for general habitat values for living for four seasons: Spring (P), Summer (S), Fall (F), and Winter (W), as defined in the "Seasons of Use" section.

## 3.5 Ratings Assumptions

General seasonal habitat ratings are presented in Tables 11, 12, 13, and 14. In developing habitat interpretations, assumptions were based on information found in published literature cited above and unpublished literature including Radcliffe and Ryan (1997), supplemented with personal knowledge and field data. Further study is needed to validate and refine these ratings. The following assumptions have been made:

| Season | Assumptions |
|---|---|
| Spring, Summer and Fall - Feeding | **Structural Stage:**<br>• Clearcuts should provide moderate to high summer forage, yet deer will likely not forage in the middle of large clearcuts due to lack of adjacent cover.<br>• Structural stages 2 and 3 should provide abundant forage and have good spring and summer values for deer. Stage 3 units were rated more strongly towards feeding values than security values.<br>• Stage 4 stands generally have poor year round foraging value.<br>• Generally, food availability increases with the age of the stand. Therefore, old-growth forests are rated as highest value, with mature forests having slightly less value, and young forests moderate foraging values.<br>**Vegetation Characteristics:**<br>Riparian stands should provide good habitat throughout the growing season |
| Spring, Summer and Fall - Security/Thermal | **Structural Stage:**<br>• Stage 4 stands contain pole-saplings that should provide good security and thermal cover and increase the value of more open feeding areas adjacent to them.<br>• Structural stages 5 to 7 should generally provide adequate thermal and security cover for black-tailed deer during spring through fall. |
| Winter - Feeding (winter ratings assume average winter conditions) | **Structural Stage:**<br>• Structural stages 1 to 4 have minimal winter values. In the low elevation subzones, they may be available to deer, but during more severe winters, snow may preclude access to these stands.<br>• Stage 4 forests generally have poor year round foraging value as these stands are typically dense and forage has been shaded out.<br>• Stage 5 forests generally have little forage available to function as good winter range, but where adjacent to better feeding units, they may be sufficient to function as winter range in the warmer subzones in most years. In severe winters however, these stands will not provide adequate winter range.<br>• Mature stands (stage 6) tend to provide more forage in severe winters as shrub layers are well developed and, particularly, as arboreal lichens also tend to be much more abundant.<br>• Old-growth forests (stage 7) provide the best food availability in winter.<br>**Site:**<br>• The MHmm subzone generally will have deep snowpacks in the winter, and units are therefore usually inaccessible to deer in winter and early spring. They may have some value in mild winters, yet are generally rated nil value in winter and nil or very low value in spring. |

**Habitat Ratings Assumptions for Black-tailed deer (continued).**

| Season | Assumptions |
|---|---|
| Winter - Security/Thermal | **Structural Stage:**<br>• Stage 4 forests may provide limited thermal and security cover , depending on adjacent habitat.<br>• Young forests of structural stage 5 often have some good values for thermal cover, depending on forage availability, subzone and snowpack.<br>• Stage 6 provides good thermal cover and snow interception, and this combination of good canopy closure and reasonable food availability may provide some of the best winter range conditions in the area.<br>• Because of the uneven canopy with many gaps in stands of stage 7, thermal cover is often not as good as in a mature stand. There is a great deal of variability, however, and patchy, uneven aged stands on steep slopes can provide some of the best winter ranges for deer during severe conditions.<br>**Vegetation Characteristics:**<br>• Mountain Hemlock (MH) zone is poor deer habitat in winter and early spring because of excessive snowpack.<br>**Site:**<br>• Warm aspect slopes are best.<br>• The MHmm subzone generally will have deep snowpacks in the winter, and units are therefore usually inaccessible to deer in winter and early spring. They may have some value in mild winters, and are generally rated as very low in winter and spring.<br>• The CWHvm1 is better than the vm2 due to lower snowpacks. |

Ratings in the year one and two ratings tables have been refined, based on the year three field verification plots and observations (see Tables 11 to 14). These revisions are identified in bold. Shaded values indicate that these ratings have been developed without site information (as they have not occurred in the year one, two or three mapped watersheds). However, they have been provided at this stage in order to ensure that the project is complete as possible for future reference.

## 3.6 Habitat Ratings Tables

### Table 11. Summary of Black-tailed Deer Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Maritime Subzone - Submontane and Montane Variants (CWHvm1 and vm2)

**CWH vm1 and vm2: Forested Site Series**

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **AB** | 01 HwBa - Blueberry | 3 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | **3** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| **LC** | 02 HwPl - *Cladina* | **3** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | **3** | 4 | 4 | 4 | **3** | 4 | 4 | 4 | **3** |
| **HS** | 03 HwCw - Salal | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| **RS** | 04 CwHw - Swordfern | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 5 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 2 |
| **AF** | 05 BaCw - Foamflower | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 4 | 4 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| **HD** | 06 HwBa - Deer fern | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 |
| **AS** | 07 BaCw - Salmonberry | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| **SS** | 09 (vm1) Ss - Salmonberry | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| **CW** | 11 (vm1) Act - Red-osier dogwood or Act - Willow | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 | x | x | x | x | x | x | x | x |
| **YG** | 12 (vm1) & 09 (vm2) CwYc - Goldthread | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **LS** | 13 (vm1) & 10 (vm2) Pl - *Shagnum* | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 |
| **RC** | 14 (vm1) & 11 (vm2) CwSs - Skunk cabbage | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 |

***CWH vm1 and vm2: Deciduous, Shrub, and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | 3 | | | | 4 | | | | 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | 2 | 2 | 3 | **5** | 2 | 2 | 3 | 6 | 2 | 2 | 3 | 5 |
| **DS** | Dunegrass - Silverweed | 2 | 2 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 3 | 3 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **IF** | Indian hellebore - Fern slide track | 3 | 2 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | 3 | 2 | 4 | **5** | x | x | x | x | x | x | x | x |
| **SC** | *Sphagnum* - Cotton-grass | 3 | 3 | 4 | **5** | x | x | x | x | x | x | x | x | x | x | x | x |
| **SG** | Sphagnum - Deer cabbage | 4 | 4 | 4 | **5** | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - Sphagnum | 3 | 4 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 3 | 2 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **WS** | Willow - Salmonberry | x | x | x | x | 2 | 3 | 4 | 5 | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables: 1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; Shaded cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3 EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; x indicates structural stages not applicable** for the **ecosystem; Bold indicates a refinement in rating from year 2 tables.**

## Table 12. Summary of Black-tailed deer Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock, Very Wet Hypermaritime Subzone – Southern Variant (CWHvh1)

### *CWHvh1: Forested Site Series*

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **HS** | 01 CwHw - Salal | 3 | 2 | 3 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 2 |
| **LR** | 02 PlYc - *Rhacomitrium* | 4 | 4 | 4 | **4** | 5 | 5 | 5 | 5 | 4 | 4 | 4 | **4** | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 |
| **RS** | 03 CwHw - Salal | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 2 |
| **RF** | 05 CwSs - Sword fern | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |
| **SF** | 06 CwSs - Foamflower | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 |
| **SD** | 07 CwSs - Devil's club | 3 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **SL** | 08 Ss - Lily-of-the-valley | 3 | 3 | 3 | 5 | **4** | **4** | **4** | **4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **AL** | 10 Dr - Lily-of-the-valley | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **YG** | 11 CwYc - Goldthread | 4 | 3 | 3 | 5 | 4 | 3 | 3 | 5 | 4 | 3 | 3 | 5 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 4 |
| **LS** | 12 PlYc - *Sphagnum* | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| **RC** | 13 CwSs - Skunk cabbage | 2 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 5 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| **SS** | 14 Ss - Salal | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 |
| **SK** | 15 Ss - *Kindbergia* | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 |
| **SW** | 17 Ss - Sword fern | 4 | 3 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

### *CWHvh1: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

| | Structural Stage | 2 | | | | 3 | | | | 4 | | | | 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | 2 | 2 | 3 | **5** | 2 | 2 | 3 | **5** | 2 | 2 | 3 | **5** |
| **BS** | Bulrush - Sitka burnet marsh | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **CM** | Rocky Mountain cow-lily - Marsh cinquefoil marsh | 5 | 5 | 5 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **DS** | Dune grass - Silverweed | 2 | 2 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 2 | 2 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **SB** | Sedge - Buckbean | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - *Sphagnum* moss | 3 | 4 | 4 | 5 | 3 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem; **Bold** indicates a refinement in rating from year 2 tables.

## Table 13. Summary of Black-tailed Deer Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock (CWH)

***CWH: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| Ecosystem Unit | | Season | P | S | F | W |
|---|---|---|---|---|---|---|
| **BE** | Beach | (1) | 3 | 3 | 5 | 5 |
| **CB** | Cobble beach | (1) | 5 | 5 | 5 | 5 |
| **CG** | Cultivated garden | (3) | 2 | 1 | 2 | 4 |
| **CL** | Cliff | (1) | 6 | 6 | 6 | 6 |
| **ES** | Exposed soil* | (1) | 6 | 6 | 6 | 6 |
| **GB** | Gravel bar | (1) | 4 | 4 | 5 | 5 |
| **GP** | Gravel pit | (1) | 6 | 6 | 6 | 6 |
| **LA** | Lake | | 6 | 6 | 6 | 6 |
| **MU** | Mudflats | (1) | 5 | 5 | 5 | 5 |
| **OW** | Shallow water | | 6 | 6 | 6 | 6 |
| **PO** | Pond | | 6 | 6 | 6 | 6 |
| **RI** | River | | 6 | 6 | 6 | 6 |
| **RO** | Rock outcrop | (1) | 3 | 5 | 5 | 3 |
| **RP** | Road surface | | 5 | 5 | 5 | 5 |
| **RR** | Rural | | 4 | 4 | 4 | 5 |
| **SO** | Salt water | | 6 | 6 | 6 | 6 |
| **TA** | Talus slope | (1) | 5 | 5 | 5 | 5 |
| **WP** | Wave cut platform | (1) | 6 | 6 | 6 | 6 |

*This unit will have higher foraging values in hydroseeded areas.

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil
P = Spring, S = Summer, F = Fall, W = Winter

## Table 14. Summary of Black-tailed Deer Seasonal Habitat Ratings for Clayoquot Sound: Mountain Hemlock Moist Maritime - Windward Variant (MHmm1) and Parkland Subzone (MHmmp)

***MHmm1 and MHmmp: Forested Site Series***

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **MB** | 01 HmBa - Blueberry (includes 04) | 5 | 3 | 4 | 6 | 5 | 4 | 4 | 6 | 5 | 3 | 4 | 6 | 5 | 3 | 4 | 6 | 5 | 3 | 4 | 6 |
| **MM** | 02 HmBa - Mountain-heather | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 3 | 6 |
| **MO** | 03 HmBa - Oak fern | 5 | 2 | 2 | 6 | 5 | 4 | 4 | 6 | 5 | 3 | 3 | 6 | 5 | 3 | 3 | 6 | 5 | 3 | 3 | 6 |
| **MT** | 05 BaHm - Twistedstalk | 5 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 | 5 | 3 | 3 | 6 | 5 | 3 | 3 | 6 |

***MHmm1 and MHmmp: Shrub and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | 3 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | |
| **IF** | Indian hellebore - Fern slide track | 6 | 2 | 4 | 6 | x | x | x | x |
| **LD** | Arctic lupine - Alpine daisy meadow | 6 | 2 | 3 | 6 | x | x | x | x |
| **MH** | Mountain-heather meadow | 6 | 3 | 4 | 6 | 6 | 3 | 4 | 6 |
| **MK** | Montane krummholz | x | x | x | x | 6 | 5 | 5 | 6 |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | 6 | 3 | 3 | 6 |
| **SC** | Sphagnum - Cotton-grass | 5 | 2 | 3 | 6 | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 5 | 2 | 3 | 6 | x | x | x | x |

***MHmm1 and MHmmp: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| | Season | | P | S | F | W |
|---|---|---|---|---|---|---|
| Ecosystem Unit | | | | | | |
| CL | Cliff | (1) | 6 | 6 | 6 | 6 |
| ES | Exposed soil | (1) | 6 | 6 | 6 | 6 |
| GB | Gravel bar | (1) | 6 | 4 | 5 | 6 |
| LA | Lake | | 6 | 6 | 6 | 6 |
| OW | Shallow water | | 6 | 6 | 6 | 6 |
| PS | Permanent snow | | 6 | 6 | 6 | 6 |
| RO | Rock outcrop | (1) | 5 | 5 | 5 | 6 |
| TA | Talus slope | (1) | 5 | 5 | 5 | 6 |

**Legend for Habitat Ratings Tables:**

1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3

P = Spring, S = Summer, F = Fall, W = Winter; **x i**ndicates structural stages not applicable for the ecosystem

## 3.7 Rating Adjustments

**Elevation:**

***CWHvm1 and CWHvm2***
At present we have insufficient information to distinguish between the vm1 and the vm2, in terms of assumptions, although there is likely to be a gradation of habitat values with increasing elevation. Winter habitat values are likely to be best on warm slopes in the lower vm2 and the vm1. Summer values may be a little better at the higher elevations of the vm2, than in the vm1. However, differences may not be sufficient to warrant ratings changes between the two variants.

***MHmm1 and MHmmp***
Similarly, we have not at this stage separated the MHmm1 habitats from the same units in the MHmmp, in terms of different assumptions.

**Aspect:**
Adjustments (e.g. warm versus cool aspect slopes), where applicable typically increase or decrease the suitability value of a site by a single class. Preliminary adjustments to habitat ratings based on aspect differences are suggested below. Further refinement of aspect ratings should be possible as more information becomes available from studies in the area.

Aspects can be expected to influence deer habitat values as follows:

- In all subzones and variants, sparsely or unvegetated units (CL, ES, RO, TA) may support some plants early in spring when on warm aspects, and so receive some use for feeding, especially around the edges. However, as vegetation cover – and food – is so low, changes are unlikely to affect feeding values by a full step. These sites however may be important on warm aspects for absorbing solar radiation in late winter and early spring, so values are increased on warm aspects (+1). Aspect is generally not relevant for the other sparsely or non-vegetated units.

- No significant understorey changes in structural stages 4 and 5, all units, any season, so feeding values will be unaffected. However, these stages may have better thermal values for deer on warm aspects in winter.

- Structural stage 3 will experience greatest aspect influence on spring vegetation.

- Structural stages 6 and 7 will generally experience more influence from aspect than stages 4 and 5 (which usually have more dense, closed canopies)

- Shading effects of canopy in 6 and 7 will mute aspect influence to varying degrees, especially in the mature stage 6 stands versus the more open old growth stage 7.

***Aspect Adjustments: CWHvh***
Xeric ecosystems (LR) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of vegetation is low, and herbs are very sparse, the ratings for feeding are unlikely to change by as much as one step. Thermal values do change as the sites are used for absorbing solar

heat on sunny days in winter and spring. Overall values for winter and spring should increase (+1).

Submesic sites (RS) get dense shrubs in early seral stages (stage 3). Feeding values (on shrubs) therefore may be better in winter and spring on warm aspects (+1). Older forests (stages 6 and 7) on warm slopes are likely to be better in winter (+1).

Mesic (HS) and moister forests (RF, SF, SD, SW) have improved values on warm aspects in spring (+1) in structural stage 3. Some spring value increase in stages 6 and 7 can also be expected, due to good shrub and herb density and diversity, but aspect is unlikely to increase spring ratings by as much as one in these stages. Spring feeding values on cool slopes are lower than on warm, but the general habitat ratings should still apply. Summer feeding values are unlikely to change enough to warrant a rating change. Fall values may be a little higher on warm than cool slopes but again differences are unlikely to warrant a rating change. On warm aspects, structural stages 4 and 5 should provide better thermal qualities, while stages 6 and 7 likely provide better winter feeding opportunities. All these stages therefore may need to be adjusted (+1) for winter values.

The wetter forested units (SL, AL, YG, LS, RC, SK) do not occur on very sloping sites, and are not rated for aspect differences.

Deciduous units (AW), on warm slopes will have enhanced spring feeding values (+1), in all structural stages. Summer values may also be best on warm aspects, but the general rating should still apply. Other deciduous, shrubby or herbaceous units (BS, CM, DS, GS, PD, SB, SM) do not occur on sufficient slopes to require aspect adjustments.

***Aspect adjustments: CWHvm1 and vm2***

Xeric ecosystems (LC) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of vegetation is low, the habitat ratings for feeding are unlikely to change by as much as one step in any season. Thermal values do change as the sites are used for absorbing solar heat on sunny days in winter and spring, so overall values improve (+1).

Submesic sites (HS) get dense shrubs in early seral stages although herbs may not increase significantly. Feeding values in structural stage 3 are thus likely to increase winter on warm aspects, but thermal values will be low. Use will depend on accessibility of the sites and the adjacency of suitable thermal cover (see adjacency, below). At this stage no overall rating increase is proposed. Values of older forests (stages 6 and 7) are likely to increase on warm aspect in winter (+1).

Dry, rich (RS), mesic (AB) and moister forest (AF, HD, AS) feeding values increase in spring on warm aspects (+1) in structural stage 3. Similarly, some spring value increase in stages 6 and 7 can be expected, but aspect might not increase spring ratings by as much as one in these stages. Summer and fall feeding values are unlikely to increase enough on warm slopes to warrant a rating change. Winter values may be better on warm aspects, in stages 4 and 5 (for thermal qualities) and 6 and 7 (for feeding). However, values may not be sufficient to increase winter ratings by one step, other than perhaps in the mesic (AB) ecosystem.

The wetter forested units (CW, YG, LS, RC) are not normally on sloping sites, and are not rated for aspect differences.

Mountain Hemlock zone units mapped in the CWHvm2 will have the same adjustments as the same ecosystem units in the MH zone (see below).

Herbaceous (IF) units are occasionally on slopes sufficient to warrant aspect modifiers. Although so far only mapped on either gentle slopes or cool aspects, it may well occur on warm aspects in some of the watersheds not yet mapped. In this case enhanced feeding in spring (+1) on the warm aspects can be expected. Summer values may also be better on warm slopes, but probably not enough to warrant a rating adjustment.

All structural stages of deciduous units (AW), on warm slopes will have enhanced spring feeding values (+1). Shrub units (SA) on warm slopes will also have enhanced spring values (+1). These SA units may also be slightly better in summer and fall at the higher elevations (+1). The remaining deciduous, shrubby or herbaceous units (DS, GS, PD, SC, SM, WS and normally VS) do not occur on sufficient slope to warrant aspect modifiers.

***Aspect Adjustments: MHmm1 and MHmmp***

Xeric ecosystems (MM) are on rocky sites. Influence of aspect on the heather dominated understorey in all structural stages in summer and fall is unlikely to be great, and habitat ratings for feeding are unlikely to change much in response to aspect.

Dry rich (MO), mesic (MB) and moister forests (MT) on warm slopes are likely to have better values in late spring (+1) in structural stage 3. Some late spring value increase in stages 6 and 7 can also be expected, but may be insufficient to warrant a change of one step. Summer and fall feeding values for deer may increase on warm aspects (+1) in structural stages 3, 6, and 7.

Herbaceous (IF, LD) or shrubby/herbaceous units (SA) on warm slopes will have enhanced late spring and summer feeding values (+1). The SA unit may also have better fall values (+1). Additional herbaceous units (SC, VS) are not on sufficient slopes to warrant rating adjustments.

The low shrub MH and MK units may have better summer and fall values on warm aspects (+1).

**Other Adjustments:**

***CWHvm1 and vm2: Salal Phase of the mesic (AB) site series***

Ratings for the mesic (01) unit in the CWHvm1 and vm2 assume average conditions. The salal phase of the AB (01) site series has not been mapped. However, in structural stages 3 and possibly 7, it may have better winter values on warm aspects due to the food provided by dense salal.

***Adjacency***

Habitat maps depicted are rated on an individual polygon basis. At this stage the broader landscape perspective is not reflected in ecosystem ratings. More detailed analysis needs to be undertaken on the spatial relationships between different ecosystem units and structural stages, as this has a very substantial effect on overall deer habitat values.

***Site Index***

Incorporation of VRI information into the species model may help refine some of the ratings. For example canopy closure may assist in further identifying the best potential winter habitats.

## 3.8 References

Armeleder, H. M. and R. J. Dawson. 1992. *Logging on Mule Deer Winter Range: An Integrated Management Approach.* Forestry Chronicle 68:132-137.

Armeleder, H. M., R. J. Dawson and R. N. Thomson. 1986. *Handbook for Timber and Mule Deer Management Co-Ordination on Winter Ranges in the Cariboo Forest Region.* Land Management Handbook No. 13. B.C. Ministry of Forests, Victoria, B.C.

Fish, Wildlife and Habitat Protection Department. 1994. *Wildlife Distribution Mapping, Big Game Series.* 16 maps, 1:2,000,000.Ministry of Environment, Lands and Parks, Victoria, B.C.

Harestad, A. S., J. A. Rochelle, and F. L. Bunnell. 1982. *Old-Growth Forests and Black-Tailed Deer on Vancouver Island.* Trans. N. Am. Wildl. Nat. Resour. Conf. 47: 343-352.

Luttmerding, H. A., D.A. Demarchi, E. C. Lea, D. V. Meidinger, and T. Vold. (Eds.) 1990. *Describing Ecosystems in the Field, 2nd Ed.* MOE Manual 11. B.C. Ministry of Environment and B.C. Ministry of Forests, Victoria, B.C.

McNay, R. D., and R. Davies. 1985. *Interactions Between Black-Tailed Deer and Intensive Forest Management: A Problem Analysis.* For. Res. IWIFR-22. B.C. Ministry of Environment, Victoria, B.C..

Nyberg, J. B. and D. W. Janz, technical eds. 1990. *Deer and Elk Habitats in Coastal Forests of Southern British Columbia.* Ministry of Forests, Special Report Series 5, Research Branch, Victoria, B.C.

Petticrew, P. S., and L. Jackson. 1980. *Preliminary Deer Management Plan for British Columbia.* B.C. Min. Environment, Fish and Wildlife Branch., Victoria, B.C.

Thomas, J. W., H. Black, R. J. Scherzinger, and R. J. Pedersen. 1979*. Deer and Elk*. In Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington. J. W. Thomas (tech. editor). U. S. Dept. Agric. For. Ser., Agric. Handb. 553. pp 104-127.

Radcliffe, G. and M. Ryan. 1997. *Ecosystem Mapping and Wildlife Interpretations for the Chapman-Gray Study Area, Sechelt*. Report for International Forest Products Ltd., Sechelt, B.C.

Resources Inventory Committee. 1997. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, May 18, 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

## 4.0 SPECIES-HABITAT MODEL FOR ROOSEVELT ELK

A species account is provided below, followed by suitability ratings tables.

| | |
|---|---|
| Common Name: | **Roosevelt Elk** |
| Scientific Name: | *Cervus elaphus roosevelti* |
| Species Code: | M-CEEL |
| B.C. Status: | Blue-listed (B.C. MOELP, 1996, B.C. CDC, 1997) |
| Identified Wildlife Status: | None |
| COSEWIC Status: | Not applicable |

### 4.1 Distribution

***Provincial Range***: Roosevelt Elk (*Cervus elaphus roosevelti*) is one of two subspecies of elk that occur in British Columbia. It is confined to Vancouver Island and parts of the Sunshine Coast (RIC, 1997c). In 1996, the Roosevelt elk population for Vancouver Island was estimated at approximately 3,200 animals (Brunt, cited in Ross, 1996). The other subspecies of elk, Rocky Mountain elk (*Cervus elaphus nelsoni*), occurs on the mainland and achieves higher densities, especially in the East Kootenay and Muskwa/Kechika areas (RIC, 1997b).

***Clayoquot Sound Population***: Roosevelt elk occur in varying intensities within the watersheds of Clayoquot Sound, with the Ursus, Bedwell and Moyeha River watersheds having the highest recorded elk use (Ross, 1996). The majority of the area has very infrequent elk occurrence, with only occasional sightings and/or sign recorded throughout most of the region (Ross, 1996). On a provincial basis, elk have a low relative abundance of one animal per 10 $km^2$ to 250 $km^2$ within this area (Fish, Wildlife and Habitat Protection Department, 1994). Roosevelt elk habitat is present within all of the BEC variants located within the Clayoquot Sound Years One, Two and Three study areas (see Table 15), so elk could potentially occur in all BEC units.

**Table 15. Expected Roosevelt Elk Occurrence within the Clayoquot Year One, Two and Three Project BEC Variants, WIM Ecosection**

| BEC Variants | CWHvm1&CWHvm2 | CWHvh1 | MHmm1& MHmmp1 |
|---|---|---|---|
| Roosevelt elk | • | • | • |

Legend:
- • = occurs in the variant

***Elevational Range***: Within the study area, Roosevelt elk can occur from sea level to 1,500 m.

### 4.2 Key Life Requisites and Habitat Attributes

***General Habitat***: Most Roosevelt elk on Vancouver Island are migratory, usually frequenting high elevation summer ranges and retreating down to river valleys in the fall. Non-migrating populations also exist in certain low elevation habitats where all seasonal habitat requirements can be met (Nyberg and Janz, 1990). Key yearlong feeding habitats include open conifer stands, deciduous-dominated stands, and non-forested units including marshy meadows, wetlands, seepage sites, and estuaries (Nyberg and Janz, 1990). Riparian areas adjacent to lakes, streams, and floodplains of major river valleys also have very high value (Nyberg and Janz, 1990). In summer, vegetated slides become important foraging areas.

Suitable winter range for elk on Vancouver Island is generally found in "low elevation river valleys and the lower part of watersheds" (Ross, 1996). During mild winters or in the low snowpack zone, elk use wetlands, clearcuts, and open forests to forage, generally in rich, moist sites (Nyberg and Janz, 1990). When snow conditions preclude feeding in more open areas (snow depth >30 cm or snow crusted), elk will move into densely canopied forests or onto moderately steep southerly slopes with rock outcrops where snow packs are lower (Nyberg and Janz, 1990). Snow depths of more than 60 cm reduce mobility, forcing elk to move to lower elevation forested habitats (RIC, 1997c). In winter and spring, borders of south aspect rock outcrops are high value due to warming effects and early vegetation green up. Ideal landforms range from floodplain areas with adjacent river breaks to steep avalanche tracks with >100% slope (Luttmerding *et al.,* 1990).

***Feeding***: (Feeding account synthesized from Nyberg and Janz, 1990). The diet of Roosevelt elk consists primarily of grasses, ferns, shrubs, forbs, and conifers in varying seasonal proportions. During spring, the diet consists mainly of shrubs, ferns, and grasses. Deer fern is a very important forage species at this time, in addition to salmonberry, bunchberry, sword fern, grasses and sedges, and young skunk cabbage. In summer, shrubs and herbs are more heavily used, including salmonberry, red elderberry, and bunchberry with ferns and moderate amounts of grasses and sedges also taken. In fall, deer fern is a significant food, and more conifers are consumed. During mild winters, important forage species include grasses, sedges, deer fern, twinflower, willows, devil's club, salal, dull Oregon-grape, red huckleberry, and oval-leaved blueberry. Under heavy snow conditions when many species of plants are not accessible, elk will shift to include more browse in their diet. Western hemlock and western redcedar are consumed at this time in addition to other available forage. Table 16 summarizes the important forage species for Roosevelt elk.

***Security Habitat***: Good interspersion of feeding areas and cover is important to elk. Optimal habitat consists of open areas interspersed with patches of trees or dense shrubs. In summer, elk will bed wherever they are finished feeding, but always in close proximity to cover (Collins and Urness, 1983). Minimum security cover for elk has been defined as vegetation capable of concealing 90% of a standing elk from view at a distance of 61 m or less (Thomas *et al.,* 1979). The stand's density and diameter of trees and the density of understorey vegetation, determine its value as security cover; topographical features may also enhance security cover for elk (Nyberg and Janz, 1990; Thomas *et al*., 1979). Roosevelt elk will generally not forage farther than 200 m from security cover, preferring the edges between open foraging areas and densely forested cover (Nyberg and Janz, 1990).

### Table 16. Important Forage Plants for Roosevelt Elk on Vancouver Island

(Taken from Nyberg and Janz (1990). The most important or preferred species are printed in bold type.)

| | Winter forage | Spring forage | Summer forage |
|---|---|---|---|
| **TREES:** | amabilis fir<br>Douglas-fir<br>**western hemlock**<br>western redcedar | **amabilis fir**<br>Douglas-fir<br>**western hemlock** | **amabilis fir**<br>western hemlock<br>western redcedar |
| **SHRUBS:** | devil's club<br>**dull Oregon-grape**<br>**Pacific ninebark**<br>**red elderberry**<br>*Rubus* spp.<br>(salmonberry, blackberry, thimbleberry, raspberry, bramble)<br>salal<br>twinflower<br>***Vaccinium* spp.**<br>(blueberry, huckleberry, cranberry)<br>**willow spp.** | devil's club<br>hardhack<br>Pacific ninebark<br>**salmonberry** | **bunchberry**<br>devil's club<br>dull Oregon-grape<br>Pacific ninebark<br>red elderberry<br>**salmonberry**<br>**twinflower** |
| **FERNS:** | **deer fern**<br>lady fern<br>**sword fern** | **deer fern**<br>**sword fern** | **deer fern**<br>lady fern<br>**sword fern** |
| **HERBS:** | **grass spp.**<br>**sedge spp.**<br>skunk cabbage | bunchberry<br>**grass spp.**<br>**sedge spp.**<br>skunk cabbage | **grass spp.**<br>**sedge spp.**<br>skunk cabbage<br>wall lettuce |

## 4.3 Seasons of Use

### Table 17. Seasons of Use Summary for Roosevelt Elk

| Season | Code | Habitat Use | Months* | Comments |
|---|---|---|---|---|
| Spring | **P** | Living | April-May | |
| Summer | **S** | Living | June-August | Birthing: late May, early June (Nyberg and Janz, 1990). |
| Fall | **F** | Living | September-October | |
| Winter | **W** | Living | November-March | |

*Seasons defined per the Chart of Seasons by Ecoprovince (RIC, 1997a; Appendix B).

## 4.4 Rating Scheme and Seasons

***6-class, 4 season***

A 6-class rating scheme of high (1), moderately high (2), moderate (3), low (4), very low (5), and nil (6) is employed due to the detailed level of knowledge on habitat use of Roosevelt elk (RIC, 1997a). The used ratings scheme is defined in Table 3. Ecosystem units are rated for general habitat values for living for four seasons: Spring (P), Summer (S), Fall (F), and Winter (W), as defined in the "Seasons of Use" section.

## 4.5 Ratings Assumptions

General seasonal habitat ratings are presented in Tables 18, 19, 20, and 21. In developing habitat interpretations, assumptions were based on information found in published and

unpublished literature supplemented with personal knowledge and field data. Further study is needed to validate and refine these ratings. The following assumptions have been made:

| Season | Assumptions |
|---|---|
| Spring, Summer and Fall - Feeding | **Structural Stage:**<br>• Clearcuts should provide moderate summer forage, yet elk will likely not forage in the middle of large clearcuts due to the lack of adjacent cover.<br>• Structural stages 2 to 3 should provide abundant forage and have good spring and summer values for elk if adjacent to cover.<br>• Structural stage 4 forests generally have poor year round foraging value as these stands are typically dense, and forage has been shaded out.<br>• Generally, food availability increases with the age of the stand. Therefore, old-growth forests are rated as highest value, with mature forests having slightly less value, and young forests moderate foraging values.<br>**Vegetation Characteristics:**<br>• Open sites such as wetlands, riparian forest, deciduous-dominated stands, and vegetated slides around rock outcrops are favoured spring sites and are therefore rated highly.<br>**Other:**<br>• High elevation sites are favoured feeding areas in summer due to delayed phenology.<br>• Wetlands, riparian areas, open deciduous stands, and clearcuts are also significant in the summer. |
| Spring, Summer and Fall - Security/Thermal | **Structural Stage:**<br>• Structural stages 5 to 7 should all provide adequate security cover for Roosevelt elk during spring through fall.<br>• Stage 4 forests should provide adequate thermal and security cover and increase the value of more open feeding areas adjacent to them. |
| Winter - Feeding<br>(winter ratings assume average winter conditions) | **Structural Stage:**<br>• If they are accessible, open wetlands and cutblocks are likely important winter feeding areas.<br>• Structural stages 1 to 4 have low winter values. When snow accumulations are low, they may be available to elk, but during more severe winters, snow will preclude access to these sites.<br>• Structural stage 4 forests generally have poor year round foraging value as these stands are typically dense, and forage has been shaded out.<br>**Vegetation Characteristics:**<br>• Dense, mature conifer stands with a high western hemlock and western redcedar component will likely become very important in severe winters when snow depths preclude use of most other habitats.<br>• The MHmm subzone has deep snowpacks in the winter, and units are therefore usually inaccessible to elk in winter and early spring. They may have some value in mild winters, yet are generally rated as of nil value in winter and spring<br>**Other:**<br>• Low-lying areas with reduced snow depth along floodplains become important for foraging in mild winters.<br>• Warm aspect, generally south-facing slopes are important winter range for elk under heavy snow conditions. |
| Winter - Security/Thermal | **Structural Stage:**<br>• Stage 4 forests should provide adequate thermal and security cover and increase the value of more open feeding areas adjacent to them.<br>**Site:**<br>• Warm aspects and rock outcrops provide high thermal value. |

Ratings in the year one and two ratings tables have been refined, based on the year three field verification plots and observations (see Tables 18 to 21). These revisions are identified in bold. Shaded values indicate that these ratings have been developed without site information (as they have not been sampled in the year one, two or three mapped watersheds). However, they have been provided at this stage in order to ensure that the project is as complete as possible for future reference.

## 4.6 Habitat Ratings Tables

### Table 18. Summary of Roosevelt Elk Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Maritime Subzone - Submontane and Montane Variants (CWHvm1 and vm2)

**CWHvm1 and vm2: Forested Site Series**

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **AB** | 01 HwBa - Blueberry | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | **4** | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 |
| **LC** | 02 HwPl - *Cladina* | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| **HS** | 03 HwCw - Salal | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 |
| **RS** | 04 CwHw - Swordfern | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **AF** | 05 BaCw - Foamflower | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **HD** | 06 HwBa - Deer fern | 2 | 2 | 2 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 3 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 2 | 4 |
| **AS** | 07 BaCw - Salmonberry | 2 | 2 | 2 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 4 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| **SS** | 09 (vm1) Ss - Salmonberry | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 5 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **CW** | 11 (vm1) Act - Red-osier dogwood or Act - Willow | 1 | 1 | 2 | 5 | 1 | 1 | 2 | 5 | 2 | 2 | 2 | 5 | x | x | x | x | x | x | x | x |
| **YG** | 12 (vm1) & 09 (vm2) CwYc - Goldthread | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 |
| **LS** | 13 (vm1) & 10 (vm2) Pl - *Shagnum* | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 | **3** | **3** | **3** | 5 | **3** | **3** | **3** | 5 | **3** | **3** | **3** | 5 |
| **RC** | 14 (vm1) & 11 (vm2) CwSs - Skunk cabbage | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |

***CWHvm1 and vm2: Deciduous, Shrub, and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | 3 | | | | 4 | | | | 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | 3 | 2 | 3 | 5 | 2 | 2 | 2 | 4 | 2 | 2 | 2 | 4 |
| **DS** | Dunegrass - Silverweed | 3 | 3 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 2 | 2 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **IF** | Indian hellebore - Fern slide track | 1 | 1 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | 2 | 2 | 2 | 5 | x | x | x | x | x | x | x | x |
| **SC** | *Sphagnum* - Cotton-grass | 1 | 1 | 2 | 3 | x | x | x | x | x | x | x | x | x | x | x | x |
| **SG** | Sphagnum - Deer cabbage | **2** | **2** | **2** | **4** | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - Sphagnum | 2 | **2** | **2** | **4** | x | x | x | x | x | x | x | x | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 1 | 1 | **2** | **4** | x | x | x | x | x | x | x | x | x | x | x | x |
| **WS** | Willow - Salmonberry | x | x | x | x | 2 | 2 | 3 | 5 | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables: 1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; Shaded cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3 EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; x indicates structural stages not applicable for the ecosystem; Bold indicates a refinement in rating from year 2 tables.**

## Table 19. Summary of Roosevelt Elk Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock, Very Wet Hypermaritime Subzone – Southern Variant (CWHvh1)

### *CWHvh1: Forested Site Series*

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **HS** | 01 CwHw - Salal | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| **LR** | 02 PlYc - *Rhacomitrium* | 5 | 5 | 5 | **5** | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 |
| **RS** | 03 CwHw - Salal | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 3 |
| **RF** | 05 CwSs - Sword fern | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |
| **SF** | 06 CwSs - Foamflower | 2 | 2 | 2 | 5 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| **SD** | 07 CwSs - Devil's club | 2 | 2 | 2 | 4 | 5 | 4 | 4 | 5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **SL** | 08 Ss - Lily-of-the-valley | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| **AL** | 10 Dr - Lily-of-the-valley | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **YG** | 11 CwYc - Goldthread | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **LS** | 12 PlYc - *Sphagnum* | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| **RC** | 13 CwSs - Skunk cabbage | 1 | 2 | 2 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| **SS** | 14 Ss - Salal | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| **SK** | 15 Ss - *Kindbergia* | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 |
| **SW** | 17 Ss - Sword fern | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

### *CWHvh1: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

| | Structural Stage | 2 | | | | 3 | | | | 4 | | | | 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | | | | | | | | | |
| **AW** | Red alder - Fern | x | x | x | x | 3 | 2 | 3 | 5 | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |
| **BS** | Bulrush - Sitka burnet marsh | 2 | 3 | 3 | 4 | x | x | x | x | x | x | x | x | x | x | x | x |
| **CM** | Rocky Mountain cow-lily - Marsh cinquefoil marsh | 3 | 3 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **DS** | Dune grass - Silverweed | 3 | 3 | 4 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **GS** | Tufted hairgrass - Silverweed | 2 | 2 | 3 | 5 | x | x | x | x | x | x | x | x | x | x | x | x |
| **PD** | Pacific crab apple - Red-osier dogwood | x | x | x | x | 4 | 4 | 4 | 5 | x | x | x | x | x | x | x | x |
| **SB** | Sedge - Buckbean | 2 | 2 | 3 | 4 | x | x | x | x | x | x | x | x | x | x | x | x |
| **SM** | Sweet gale - *Sphagnum* moss | 2 | 3 | 3 | 5 | 2 | 3 | 3 | 5 | x | x | x | x | x | x | x | x |

**Legend for Habitat Ratings Tables:**

1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3

EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem; **Bold** indicates a refinement in rating from year 2 tables.

## Table 20. Summary of Roosevelt Elk Seasonal Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock (CWH)

***CWH: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| Ecosystem Unit | | Season | P | S | F | W |
|---|---|---|---|---|---|---|
| **BE** | Beach | (1) | 5 | 5 | 5 | 5 |
| **CB** | Cobble beach | (1) | 6 | 6 | 6 | 6 |
| **CG** | Cultivated garden | (3) | 2 | 1 | 1 | 3 |
| **CL** | Cliff | (1) | 6 | 6 | 6 | 6 |
| **ES** | Exposed soil* | (1) | 6 | 6 | 6 | 6 |
| **GB** | Gravel bar | (1) | 4 | 4 | 5 | 5 |
| **GP** | Gravel pit | (1) | 6 | 6 | 6 | 6 |
| **LA** | Lake | | 6 | 6 | 6 | 6 |
| **MU** | Mudflats | (1) | 6 | 6 | 6 | 6 |
| **OW** | Shallow open water | | 6 | 6 | 6 | 6 |
| **PO** | Pond | | 6 | 6 | 6 | 6 |
| **RI** | River | | 6 | 6 | 6 | 6 |
| **RO** | Rock outcrop | (1) | 3 | 5 | 5 | 3 |
| **RP** | Road surface | | 5 | 5 | 5 | 5 |
| **RR** | Rural | | 5 | 5 | 5 | **5** |
| **SO** | Salt water | | 6 | 6 | 6 | 6 |
| **TA** | Talus slope | (1) | 6 | 6 | 6 | 6 |
| **WP** | Wave cut platform | (1) | 6 | 6 | 6 | 6 |

*This unit will have higher foraging values in hydroseeded areas.

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil
P = Spring, S = Summer, F = Fall, W = Winter
**Bold** indicates a refinement in rating from Year 2.

## Table 21. Summary of Roosevelt Elk Seasonal Habitat Ratings for Clayoquot Sound: Mountain Hemlock Moist Maritime - Windward Variant (MHmm1) and Parkland Subzone (MHmmp).

***MHmm1 and MHmmp: Forested Site Series***

| | Structural Stage | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W | P | S | F | W |
| Unit | Site Series | | | | | | | | | | | | | | | | | | | | |
| **MB** | 01 HmBa - Blueberry (includes 04) | 6 | 3 | 3 | 6 | 6 | 4 | 4 | 6 | 6 | 4 | 4 | 6 | 6 | 3 | 3 | 6 | 6 | 3 | 3 | 6 |
| **MM** | 02 HmBa - Mountain-heather | 6 | 4 | 5 | 6 | 6 | 5 | 5 | 6 | 6 | 5 | 5 | 6 | 6 | 4 | 5 | 6 | 6 | 4 | 5 | 6 |
| **MO** | 03 HmBa - Oak fern | 6 | 2 | 3 | 6 | 6 | 3 | 3 | 6 | 6 | **2** | **3** | 6 | 6 | 3 | 4 | 6 | 6 | 2 | 3 | 6 |
| **MT** | 05 BaHm - Twistedstalk | 6 | 2 | 3 | 6 | 6 | 2 | 3 | 6 | 6 | 2 | 3 | 6 | 6 | 5 | 3 | 6 | 6 | 2 | 3 | 6 |

***MHmm1 and MHmmp: Shrub and Herb Dominated Ecosystem Units***

| | Structural Stage | 2 | | | | 3 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Season | P | S | F | W | P | S | F | W |
| Ecosystem Unit | | | | | | | | | |
| **IF** | Indian hellebore - Fern slide track | 6 | 1 | 3 | 6 | x | x | x | x |
| **LD** | Arctic lupine - Alpine daisy meadow | 6 | 1 | 3 | 6 | x | x | x | x |
| **MH** | Mountain-heather meadow | 6 | 4 | 4 | 6 | 6 | 4 | 4 | 6 |
| **MK** | Montane krummholz | x | x | x | x | 6 | 5 | 5 | 6 |
| **SA** | Salmonberry - Sitka alder | x | x | x | x | 6 | 1 | 1 | 6 |
| **SC** | Sphagnum - Cotton-grass | 6 | 1 | 3 | 6 | x | x | x | x |
| **VS** | Sitka valerian - Sedge meadow | 6 | 1 | 3 | 6 | x | x | x | x |

***MHmm1 and MHmmp: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

| | | Season | P | S | F | W |
|---|---|---|---|---|---|---|
| Ecosystem Unit | | | | | | |
| **CL** | Cliff | (1) | 6 | 6 | 6 | 6 |
| **ES** | Exposed soil | (1) | 6 | 6 | 6 | 6 |
| **GB** | Gravel Bar | (1) | 6 | 4 | 5 | 6 |
| **LA** | Lake | | 6 | 6 | 6 | 6 |
| **OW** | Shallow water | | 6 | 6 | 6 | 6 |
| **PS** | Permanent snow | | 6 | 6 | 6 | 6 |
| **RO** | Rock outcrop | (1) | 6 | 5 | 5 | 6 |
| **TA** | Talus slope | (1) | 6 | 5 | 5 | 6 |

**Legend for Habitat Ratings Tables:**
1 = High, 2 = Moderately High, 3 = Moderate, 4 = Low, 5 = Very Low, 6 = Nil; **Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
EP = Early Spring, P = Spring, S = Summer, F = Fall, W = Winter; **x** indicates structural stages not applicable for the ecosystem

## 4.7 Rating Adjustments

**Elevation:**

***CWHvm1 and CWHvm2***
At present we have insufficient information to distinguish between the vm1 and the vm2, in terms of assumptions, although there is likely to be a gradation of habitat values with increasing elevation. Winter habitat values are likely to be best on warm slopes in the lower vm2 and the vm1. Summer values may be a little better at the higher elevations of the vm2, than in the vm1. However, differences may not be sufficient to warrant ratings changes between the two variants.

***MHmm1 and MHmmp***
Similarly, we have not at this stage separated the MHmm1 habitats from the same units in the MHmmp, in terms of different assumptions.

**Aspect:**
Adjustments (e.g. warm versus cool aspect slopes), where applicable typically increase or decrease the suitability value of a site by a single class. Preliminary adjustments to habitat ratings based on aspect differences are suggested below. Further refinement of aspect ratings should be possible as more information becomes available from studies in the area.

Aspects can be expected to influence elk habitat values as follows:

- In all subzones and variants, sparsely or unvegetated units (CL, ES, TA and especially RO) may support some plants early in spring when on warm aspects, and so receive some use for feeding, especially around the edges. However, as vegetation cover – and food – is so low, changes are unlikely to affect feeding values by a full step. These sites however may be important on warm aspects for absorbing solar radiation in late winter and early spring, so winter and spring values are increased (+1) for this reason. Aspect is generally not relevant for the other sparsely or non-vegetated units.

- No significant understorey changes in structural stages 4 and 5, all units, any season, so feeding values will be unaffected. However, these stages may have better thermal values for elk on warm aspects in winter.

- Structural stage 3 will experience greatest aspect influence on spring vegetation.

- Structural stages 6 and 7 will generally experience more influence from aspect than stages 4 and 5 (which usually have more dense, closed canopies)

***Aspect Adjustments: CWHvh***
Xeric ecosystems (LR) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of vegetation is low, and herbs are very sparse, the ratings for feeding are unlikely to change by as much as one step. Thermal values do change as the sites are used for absorbing solar heat on sunny days in winter and spring. Overall values for winter and spring are therefore increased (+1), probably in all structural stages, on warm aspects.

Submesic sites (RS) get dense shrubs in early seral stages (stage 3). Feeding values (on shrubs) therefore may be better in winter and spring on warm aspects (+1). Older forests (stages 6 and 7) are also likely to be better in winter (+1).

Mesic (HS) and moister forests (RF, SF, SD, SW) have better values on warm aspects in spring (+1) in structural stage 3. Some spring value increase in stages 6 and 7 can be expected, due to good shrub and herb density and diversity, but might not increase spring ratings by as much as one in these stages. Spring feeding values on cool slopes are lower than on warm, but the general habitat ratings should still apply. Summer feeding values are unlikely to be better on warm slopes. Late fall values may be a little higher on warm than cool slopes but differences are unlikely to warrant a rating change. Winter values are likely to be better on warm aspects in stages 6 and 7 (+1). Stages 4 and 5 may also be better in winter on warm aspects, although differences are probably seldom enough to warrant a rating change.

The wetter forested units (SL, AL, YG, LS, RC, SK) do not occur on very sloping sites, and are not rated for aspect differences.

Deciduous units (AW), on warm slopes will have enhanced spring and summer feeding values (+1), in all structural stages. Other deciduous, shrubby or herbaceous units (BS, CM, DS, GS, PD, SB, SM) do not occur on sufficient slopes to require aspect adjustments.

***Aspect adjustments: CWHvm1 and vm2***

Xeric ecosystems (LC) are on rocky sites, often on warm aspects. Influence of aspect on vegetation understorey in all structural stages may be strong, but as percentage cover of vegetation is low, the habitat ratings for feeding are unlikely to change by as much as one step in any season. Thermal values do change as the sites are used for absorbing solar heat on sunny days in winter and spring. Overall values for winter and spring are therefore increased (+1).

Submesic sites (HS) get dense shrubs in early seral stages although herbs may not increase significantly. Feeding values in structural stage 3 are thus likely to increase in winter on warm aspects, but thermal values will be low. Use will depend on accessibility of the sites and the adjacency of suitable thermal cover (see adjacency, below). At this stage no overall rating increase is proposed. Values of older forests (stages 6 and 7) are likely to increase on warm aspect in winter and spring (+1).

Dry, rich (RS), mesic (AB) and moister forests (AF, HD, AS) have better spring values on warm slopes (+1) in structural stage 3. Spring value increase in stages 6 and 7 can also be expected (+1). Summer and fall feeding values may be better in structural stages 3, 6 and 7 in the three moister sites (+1).

The wetter forested units (CW, YG, LS, RC) are not normally on sloping sites, and are not rated for aspect differences.

Mountain Hemlock zone units mapped in the CWHvm2 will have the same adjustments as the same ecosystem units in the MH zone (see below).

Herbaceous (IF) units are occasionally on slopes sufficient to warrant aspect modifiers. Although so far only mapped on either gentle slopes or cool aspects, it may well occur on

warm aspects in some of the watersheds not yet mapped. In this case enhanced feeding in spring and summer (+1) on the warm aspects can be expected.

All structural stages of deciduous units (AW), on warm slopes will have enhanced spring, summer and fall feeding values (+1). Shrub units (SA) on warm slopes will also have enhanced values in spring, summer and fall (+1). The remaining deciduous, shrubby or herbaceous units (DS, GS, PD, SC, SM, WS and normally VS) do not occur on sufficient slope to warrant aspect modifiers.

***Aspect Adjustments: MHmm1 and MHmmp***

Xeric ecosystems (MM) are on rocky sites. Influence of aspect on the heather dominated understorey in all structural stages in summer and fall is unlikely to be great, and habitat ratings for feeding are unlikely to change much in response to aspect.

Dry rich (MO), mesic (MB) and moister forests (MT) may have better values on warm sites by late spring (+1) in structural stage 3. Some late spring value increase in stages 6 and 7 can also be expected (+1). Summer and fall feeding values for elk may increase on warm aspects (+1) in structural stages 3, 6 and 7.

Herbaceous (IF, LD) or shrubby/herbaceous units (SA) on warm slopes will have enhanced late spring, summer and fall feeding values (+1). Additional herbaceous units (SC, VS) are not on sufficient slopes to warrant rating adjustments.

The low shrub MH and MK units may have slightly better summer and fall values on warm aspects, but increases are probably insufficient to warrant a rating change.

**Other Adjustments:**

***CWHvm1 and vm2: Salal Phase of the mesic (AB) site series***

Ratings for the mesic (01) unit in the CWHvm1 and vm2 assume average conditions. The salal phase of the AB (01) site series has not been mapped. Aspect differences in understorey are unlikely to affect seasonal values for elk sufficiently to warrant a rating change.

***Adjacency***

Habitat maps depicted are rated on an individual polygon basis. At this stage the broader landscape perspective is not reflected in ecosystem ratings. More detailed analysis needs to be undertaken on the spatial relationships between different ecosystem units and structural stages, e.g. the proximity of warm rock outcrops to forests with high food availability and thermal cover. The interspersion of different habitat types across the landscape has a very substantial effect on overall elk habitat values.

***Site Index***

Incorporation of VRI information into the species model may help refine some of the ratings. For example canopy closure may assist in further identifying the best potential winter habitats.

## 4.8 References

B.C. Conservation Data Centre. 1997. *Rare Vertebrate Animal Tracking List (Sorted Phylogenetically Within Each Taxonomic Group).* March 10, 1997.

B.C. Ministry of Environment, Lands and Parks. 1996. *Vertebrate Red and Blue Lists*. Wildlife Branch, Victoria, B.C.

Collins, W. B., and P. J. Urness. 1983. *Feeding Behaviour and Habitat Selection of Mule Deer and Elk on Northern Utah Summer Range*. J. Wildl. Manage. 47(3):646-663.

Fish, Wildlife and Habitat Protection Department. 1994. *Wildlife Distribution Mapping, Big Game Series.* 16 maps, 1:2,000,000. Ministry of Environment, Lands and Parks, Victoria, B.C..

Luttmerding, H. A., D. A. Demarchi, E. C. Lea, D. V. Meidinger, and T. Vold. (Eds.) 1990. *Describing Ecosystems in the Field, 2nd Ed.* MOE Manual 11. B.C. Min. Environment, Lands and Parks and B.C. Ministry of Forests, Victoria, B.C.

Nyberg, J. B. and D. W. Janz, technical eds. 1990. *Deer and Elk Habitats in Coastal Forests of Southern British Columbia.* Ministry of Forests, Special Report Series 5, Research Branch, Victoria, B.C.

Resources Inventory Committee. 1997a. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, May 18, 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997b. *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Ground Based Census Techniques for Selected Cervids - Moose, Elk, Mule/Black-tailed Deer, White-tailed Deer, and Fallow Deer*. Draft - March 1997. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997c. *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Aerial-based Inventory Techniques for Selected Ungulates - Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer, and Caribou*. Version 1.1 - January 1997. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

Ross, S. 1996. *Roosevelt Elk Inventory Project in Clayoquot Sound.* Unpubl. WILCON, Wildlife Consulting Ltd. Report to Ministry of Environment, Lands and Parks, Vancouver Island Regional Office, Nanaimo, B.C.

Thomas, J. W., H. Black, R. J. Scherzinger, and R. J. Pedersen. 1979. *Deer and Elk*. In Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington. J. W. Thomas (tech. editor). U. S. Dept. Agric. For. Ser., Agric. Handb. 553. Chap.8. pp 104-127. - def'n of security cover.

## 5.0 SPECIES-HABITAT MODEL FOR BALD EAGLE

A species account is provided below, followed by suitability ratings tables.

| | |
|---|---|
| Common Name: | **Bald Eagle** |
| Scientific Name: | *Haliaeetus leucocephalus* |
| Species Code: | B-BAEA |
| B.C. Status: | Yellow-listed |
| Identified Wildlife Status: | None |
| COSEWIC Status: | Designated as not at risk in Canada, following a review in 1984 (COSEWIC, 1997). |

### 5.1 Distribution

***Provincial Range***: An estimated 21,000 Bald Eagles nest within British Columbia, occurring over the entire province with the exception of the alpine and sub-alpine zones. An estimated 20,000 to 30,000 Bald Eagles winter within the province with over 90% of these birds wintering on the coast (Blood and Anweiler, 1994).

***Clayoquot Sound Population***: The Bald Eagle is a common year-round resident within Clayoquot Sound (Stevens, 1995), and nesting is abundant, particularly along the coastline. This area provides important nesting and wintering habitat.

The relative provincial importance of the Coast and Mountains ecoprovince has been estimated in terms of providing Bald Eagle habitat. Within this ecoprovince, the CWH biogeoclimatic zone received a rank of high importance for both nesting and wintering and is thought to support over 75% of the nesting Bald Eagles within the province (Blood and Anweiler, 1994). The MH biogeoclimatic zone received a rank of no importance for both uses (Blood and Anweiler, 1994). Bald eagles occur within all of the BEC variants present within the Clayoquot Sound Years One, Two and Three study areas (see Table 22) but are unlikely to nest regularly within the MH zone.

**Table 22. Expected Bald Eagle Occurrence within the Clayoquot Year One, Two and Three Project BEC Variants, WIM Ecosection.**

| **BEC Variants** | CWHvm1&CWHvm2 | CWHvh1 | MHmm1& MHmmp1 |
|---|---|---|---|
| Bald Eagle | • | • | • |

Legend:
- = occurs in the variant

***Elevational Range***: Bald Eagles may nest up to 1,370 m elevation (Campbell *et al.,* 1990), although they generally nest at low elevations (Blood and Anweiler, 1994).

## 5.2 Key Life Requisites and Habitat Attributes

***Reproduction (Breeding Habitat)***: Bald Eagles are primarily associated with aquatic habitats and large trees. On the British Columbia coast, the best habitat for nesting occurs "along the seacoast, especially near estuaries and broad intertidal zones, island and reef complexes, seabird colonies, and sites with strong tidal currents" (Blood and Anweiler, 1994). They will also nest along large rivers and around lakes, usually within 200 m of water (Gerrard *et al.,* 1975). They rarely nest farther than a few hundred metres from shore in wilderness areas; however, in areas of human disturbance, eagles will nest farther away from water, up to distances of approximately 1.6 km from permanent water (Blood and Anweiler, 1994; Anthony *et al.,* 1982; Anthony and Isaacs, 1989). Generally, Bald Eagles select areas for nesting with suitable forest structure, low human disturbance, and high diversity or accessibility to prey species (Livingstone *et al.,* 1990).

Nesting may occur in a variety of stand types, including coniferous, deciduous, or mixed stands (Blood and Anweiler, 1994). Tree structure may be more important than tree species in determining Bald Eagle nest site selection (Gerrard *et al.,* 1975; Anthony *et al.,* 1982). Large, usually old-growth, prominent trees, live or dead, are needed to support their massive nests. Along the British Columbia coast, most nesting occurs in coniferous trees. Within the CWH, Sitka spruce is the most used nest tree, but western redcedar, western hemlock, Douglas- fir, and cottonwood are also used (Blood and Anweiler, 1994).

***Feeding***: Bald Eagles are opportunistic feeders, having a diverse diet including mainly fish (including spawning salmon, herring, eulachons), birds (mostly waterfowl and seabirds), and carrion. Intertidal invertebrates are also used along the coast. Bald Eagles will congregate in large numbers to take advantage of locally or seasonally abundant foods (Blood and Anweiler, 1994).

## 5.3 Seasons of Use

***Reproductive Season***: Within British Columbia, the Bald Eagle breeding season extends from mid-February to the end of August (Campbell *et al.,* 1990). On the south coast of B.C., egg-laying begins in mid-February with the majority occurring in early March (Blood and Anweiler, 1994). One to three chicks hatch (average clutch size of 2) after an estimated 33 to 40 day incubation period and remain in the nest for an average of 10 to 11 weeks (Blood and Anweiler, 1994). Young may fledge from late June to late August, depending on location (Blood and Anweiler, 1994).

For this project, the reproducing season for the Bald Eagle was estimated as mid-February to August.

## 5.4 Rating Scheme and Seasons

***4-class, 1 season***

A 4-class rating scheme of high (H), moderate (M), low (L), and nil (N) is employed as suggested by Resources Inventory Committee (1997) due to the intermediate level of knowledge on habitat use of Bald Eagles. The used ratings scheme is defined in Table 23.

**Table 23. Relative Quality Classes (from RIC, 1997).**

| Code | Quality relative to the best in B.C. | Suitability/Capability |
|---|---|---|
| H | Equivalent (75% to 100% of best) | High |
| M | Slightly-moderately less (25% to 75% of best) | Moderate |
| L | Substantially less (5% to 25% of best) | Low |
| N | Much less (0% to 5% of best) | Nil |

Ecosystem units identified within Clayoquot Sound are rated for ability to satisfy nesting habitat requirements during the reproducing season as defined in the “Seasons of Use” section. Food values were not taken into account when developing ratings for ecosystem units due to the largely aquatic food habits of the Bald Eagle.

This model was not intended to assess the quality of fall and winter habitat.

## 5.5 Ratings Assumptions

Nesting habitat ratings for the reproducing season are presented in Tables 24, 25, and 26. Bald Eagle nesting habitat may not be strongly linked to ecosystem units; however, some site series may more reliably provide suitable trees and stand characteristics favourable for nesting. In developing the following habitat interpretations, assumptions were based on information found in published and unpublished literature, supplemented with personal knowledge and field data. Further study is needed to validate and refine these ratings.

The following assumptions have been made:

| Season | Assumptions |
|---|---|
| Reproductive Season – Security Habitat for Nesting | **Elevation:**<br>? **Higher elevations are of lower overall value than lower elevations; the MH zone is therefore rated lower than CWH subzones.**<br><br>**Structural Stage:**<br>• Structural stages 1 to 5 have no nesting value as trees are not large enough to support the weight and structure of Bald Eagle nests. Second-growth forest with a remnant old-growth component can have some value for nesting if suitable old-growth nest trees remain. However, the ratings assume that these attributes are absent in the younger structural stage stands.<br>• Mature and old-growth structural stages (6 to 7) provide the most suitable nest trees. Stage 7 has higher value than stage 6 due to presence of more prominent trees, more trees with broken tops, and a more open forest structure. Due to their large wing span, Bald Eagles are more or less restricted to using the largest trees along the forest edge or dominant trees protruding above the canopy (Blood and Anweiler, 1994). Trees that extend above the canopy level are important to provide not only a suitable structure for nests but also prominent perching sites from which to watch for prey or intruders (Livingstone *et al.,* 1990).<br><br>**Vegetation Characteristics:**<br>• Within the CWH on the westcoast, Sitka spruce is the most important nest tree, although western redcedar, western hemlock, and Douglas-fir are also used (Blood and Anweiler, 1994). Therefore, units with high components of these tree species in the later structural stages are assigned higher nesting values.<br><br>**Site:**<br>• Large diameter trees are generally required for nesting. Trees with a DBH of less than 76 cm are rarely used (Blood and Anweiler, 1994). More productive, moist units therefore receive higher ratings as these units are more likely to produce suitable large trees.<br>• Proximity of nest trees to water and prey base is very important. Therefore, coastal and floodplain ecosystems are rated higher due to their location along major water bodies. Nesting values of all ecosystems will decrease with distance from the water body. Ecosystems will likely have minimal nesting values unless they are within approximately 1.6 km of a water body or wetland. |

Ratings in the year one and two ratings tables have been refined, based on the year three field verification plots and observations (see Tables 24, 25 and 26). These revisions are identified in bold. Shaded values indicate that these ratings have been developed without site information (as they have not occurred in the year one, two or three mapped watersheds). However, they have been provided at this stage in order to ensure that the project is complete as possible for future reference.

## 5.6 Habitat Ratings Tables

**Table 24. Summary of Bald Eagle Reproductive Season Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Zone, Very Wet Maritime Subzone - Submontane and Montane Variants (CWHvm1 and vm2).**

***CWHvm1 and vm2: Forested Site Series***

| Unit | Site Series | Structural Stage 3 RE | 4 RE | 5 RE | 6 RE | 7 RE |
|---|---|---|---|---|---|---|
| **AB** | 01 HwBa - Blueberry | N | N | N | M | H |
| **LC** | 02 HwPl - *Cladina* | N | N | N | M | M |
| **HS** | 03 HwCw - Salal | N | N | N | M | M |
| **RS** | 04 CwHw - Sword fern | N | N | N | H | H |
| **AF** | 05 BaCw - Foamflower | N | N | N | H | H |
| **HD** | 06 HwBa - Deer fern | N | N | N | M | M |
| **AS** | 07 BaCw - Salmonberry | N | N | N | H | H |
| **SS** | 09 (vm1) Ss - Salmonberry | N | N | N | H | H |
| **CW** | 11 (vm1) Act - Red-osier dogwood or Act - Willow | N | N | N | x | x |
| **YG** | 12 (vm1) & 09 (vm2) CwYc - Goldthread | N | N | N | **N** | L |
| **LS** | 13 (vm1) & 10 (vm2) Pl - *Shagnum* | N | N | N | L | L |
| **RC** | 14 (vm1) & 11 (vm2) CwSs - Skunk cabbage | N | N | N | **L** | M |

**Legend for Habitat Ratings Tables:**
H = High, M = Moderate, L = Low, N = Nil RE = Reproducing Season
**Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
**x** indicates structural stages not applicable for the ecosystem
**Bold** indicates a refinement in rating from Year 2.

### *CWHvm1 and vm2: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

No nesting values are contained within these ecosystem units for Bald Eagles during their reproductive season.

**Table 25. Summary of Bald Eagle Reproductive Season Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Hypermaritime Subzone - Southern Variant (CWHvh1).**

***CWHvh1: Forested Site Series***

| Unit | Site Series | Structural Stage 3 RE | 4 RE | 5 RE | 6 RE | 7 RE |
|---|---|---|---|---|---|---|
| **HS** | 01 CwHw - Salal | N | N | N | L | M |
| **LR** | 02 PlYc - *Rhacomitrium* | N | N | N | L | L |
| **RS** | 03 CwHw - Salal | N | N | N | M | M |
| **RF** | 05 CwSs - Sword fern | N | N | N | M | H |
| **SF** | 06 CwSs - Foamflower | N | N | N | **M** | H |
| **SD** | 07 CwSs - Devil's club | N | N | N | **M** | H |
| **SL** | 08 Ss - Lily-of-the-valley | N | N | N | **M** | H |
| **AL** | 10 Dr - Lily-of-the-valley | N | N | N | x | x |
| **YG** | 11 CwYc - Goldthread | N | N | N | L | L |
| **LS** | 12 PlYc - *Sphagnum* | N | N | N | L | L |
| **RC** | 13 CwSs - Skunk cabbage | N | N | N | L | L |
| **SS** | 14 Ss - Salal | N | N | N | L | M |
| **SK** | 15 Ss - *Kindbergia* | N | N | N | M | H |
| **SW** | 17 Ss - Sword fern | N | N | N | M | H |

**Legend for Habitat Ratings Tables:**
H = High, M = Moderate, L = Low, N = Nil RE = Reproducing Season
**Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
**x** indicates structural stages not applicable for the ecosystem
**Bold** indicates a refinement in rating from Year 2.

### *CWHvh1: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

There are no nesting values contained within these ecosystem units for Bald Eagles during their reproductive season.

### *CWH: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units*

There are no nesting values contained within these ecosystem units for Bald Eagles during their reproductive season.

**Table 26. Summary of Bald Eagle Reproductive Season Habitat Ratings for Clayoquot Sound: Mountain Hemlock Moist Maritime - Windward Variant (MHmm1) and Parkland Subzone (MHmmp).**

***MH mm1 and mmp: Forested Site Series***

| Unit | Site Series | Structural Stage 3 RE | 4 RE | 5 RE | 6 RE | 7 RE |
|---|---|---|---|---|---|---|
| **MB** | 01 HmBa - Blueberry (includes 04) | N | N | N | N | L |
| **MM** | 02 HmBa - Mountain-heather | N | N | N | N | L |
| **MO** | 03 HmBa - Oak fern | N | N | N | L | L |
| **MT** | 05 BaHm - Twistedstalk | N | N | N | L | L |

**Legend for Habitat Ratings Tables:**
H = High, M = Moderate, L = Low, N = Nil RE = Reproducing Season

***MH mm1 and mmp: Shrub and Herb Dominated Ecosystem Units***

There are no nesting values contained within these ecosystem units for Bald Eagles during their reproductive season.

***MH mm1 and mmp: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

There are no nesting values contained within these ecosystem units for Bald Eagles during their reproductive season.

## 5.7 Rating Adjustments

***Adjacency:***
Highest value nesting habitats occur in close proximity to good feeding sources, i.e. the ocean, and fish bearing lakes and rivers. As the distance from the feeding source increases, the value of potential nesting habitat is reduced. Distance boundaries need to be placed around all feeding sources and areas outside of these "buffers" should receive reduced habitat ratings.

***Site Index:***
Incorporation of VRI information into the species model may help refine some of the ratings. For example site index may assist in further identifying the highest productivity sites, with the best potential for large nest trees.

***Human Disturbance:***
The impacts of human disturbance on Bald Eagles are still being debated and are of major concern in many areas (Blood and Anweiler, 1994). They should be considered in future through adjustments to the species model. However, at the present time, disturbance effects are likely to be relatively low due to the wilderness nature of Clayoquot Sound.

## 5.8 References

Anthony, R. G., R. L. Knight, G. T. Allen, B. R. McClelland, and J. I. Hodges. 1982. *Habitat Use by Nesting and Roosting Bald Eagles in the Pacific Northwest.* Trans. N. Am. Wildl. Nat. Resour. Conf. 47:332-342.

Anthony, R. G., and F. B. Isaacs. 1989. *Characteristics of Bald Eagle Nest Sites in Oregon*. J. Wildl. Manage. 52(1):148-159.

Blood, D. A. and G. G. Anweiler. 1994. *Status of the Bald Eagle in British Columbia.* Wildlife Working Report No. WR-62. Prepared for the Wildlife Branch of the Ministry of Environment, Lands and Parks, Victoria, B.C.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall. 1990. *The Birds of British Columbia. Vol.II. Nonpasserines. Diurnal Birds of Prey Through Woodpeckers.* Royal B.C. Mus., Victoria, B.C.

COSEWIC. 1997. Can*adian Species at Risk, April 1997*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.

Gerrard, J. M., P. N. Gerrard, W. J. Mather and D. W. A. Whitfield. 1975. *Factors Influencing Nest Site Selection of Bald Eagles in Northern Saskatchewan and Manitoba.* Blue Jay 33:169-176.

Hodges, J. I. 1984. *Bald Eagle Breeding Population Survey of Coastal British Columbia*. J. Wildl. Manage. 48(3):993-998.

Livingstone, S. A., C. S. Todd, W. B. Krohn, and R. B. Owen. 1990. *Habitat Models for Nesting Bald Eagles in Maine.* J. Wildl. Manage. 54(4):644-653.

Peterson, A. 1986. *Habitat Suitability Index Models: Bald Eagle (Breeding Season).* U. S. Fish Wildl. Serv. Biol. Rep. 82(10.126).

Resources Inventory Committee. 1997. *Standards for Wildlife Habitat Capability/Suitability Ratings in British Columbia*. Review Draft, May 18 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Stevens, V. 1995. *Wildlife Diversity in British Columbia: Distribution and Habitat Use of Amphibians, Reptiles, Birds, and Mammals in Biogeoclimatic Zones*. Work Pap. 04/1995. Res. Br., B.C. Min. For., Wildl. Br., B.C. Min. Environment, Lands and Parks., Victoria, B.C.

## 6.0 SPECIES-HABITAT MODEL FOR MARBLED MURRELET

A species account is provided below, followed by suitability ratings tables.

| | |
|---|---|
| Common Name: | **Marbled Murrelet** |
| Scientific Name: | *Brachyramphus marmoratus* |
| Species Code: | B-MAMU |
| B.C. Status: | Red-listed (B.C. MOELP, 1996; B.C. CDC, 1997) |
| Identified Wildlife Status: | Yes (B.C. MOELP, 1997) |
| COSEWIC Status: | Designated as threatened in Canada, following a review by Rodway (1990) (COSEWIC, 1997). |

### 6.1 Distribution

***Provincial Range***: The Marbled Murrelet is considered to be a common, yearlong, salt-water resident along the coast of British Columbia (Stevens, 1995), although densities vary widely between and within years (B.C. MOELP, 1997). Marbled Murrelets are found throughout most parts of the inshore coastline of British Columbia (Burger, 1995b). The breeding population within the province is roughly estimated to be about 45,000 to 50,000 birds (Rodway *et al.,* 1992, cited in Burger, 1997) with the largest breeding concentrations found "on the east coast of Moresby Island (Queen Charlotte Islands), certain inlets on the mainland coast, and off southwest Vancouver Island from Clayoquot Sound to Port San Juan" (Burger, 1997).

***Clayoquot Sound Population***: Clayoquot Sound supports large populations of breeding Marbled Murrelets (McLaughin, 1995; Burger *et al.,* 1997) and has one of the highest densities of breeding birds in B.C. (Burger, 1995b). There is evidence of population decline in this area (40% over 10 years) with reduction of old-growth nesting habitat; logging is suggested as a cause of this decline (Kelson *et al.,* 1995, cited in Burger *et al.,* 1997). The Clayoquot Sound population was estimated to be about 6,000 to 8,000 birds in 1996 (Burger *et al.,* 1997).

Most nesting within B.C. occurs in the CWH biogeoclimatic zone; although, nests and some areas of fairly high activity have also been found in the MH zone (Burger, 1995a). No nests have been found in the AT zone (Burger, 1995a). Marbled Murrelets should occur within all of the BEC variants present within the Clayoquot Sound Years One, Two and Three study areas (see Table 27).

**Table 27. Expected Marbled Murrelet Occurrence within the Clayoquot Years One, Two and Three Project BEC Variants, WIM Ecosection**

| BEC Variants | CWHvm1&CWHvm2 | CWHvh1 | MHmm1& MHmmp1 |
|---|---|---|---|
| Marbled Murrelet | • | • | • |

Legend:
- = occurs in the variant

***Elevational Range***: Marbled Murrelets have been found to nest as high as 1,000 m (Burger, 1995a). However, most murrelet nesting activity recorded to date has been at the lower elevations in the CWH subzones and variants. The absence of large trees at higher elevations is likely the main factor in prohibiting nesting (Burger, 1995a).

## 6.2 Key Life Requisites and Habitat Attributes

***Reproduction (Breeding Habitat)***: Nesting habitat appears to be a main limiting factor in maintaining Marbled Murrelet populations (RIC, 1996). Although a pelagic sea bird, this species nests almost exclusively on large branches high in the canopy of dominant conifers (Hamer and Nelson, 1995a; RIC, 1996) and is considered to be old-growth dependent for breeding habitat within British Columbia. Marbled Murrelets nest primarily in old-growth coniferous stands located on valley bottoms and the lower two-thirds of forested slopes with moderate gradients (Hamer and Nelson, 1995a). Large diameter, old-growth trees with large boughs covered with moss and other epiphytes are required to create potential nesting platforms (RIC, 1996; Hamer and Nelson, 1995a). Nesting stands generally have multi-layered canopies with openings in the canopy for access and well spaced trees allowing three dimensional corridors of space for flight routes (RIC, 1996; Hamer and Nelson, 1995a). Marbled Murrelets may nest up to 85 km inland from salt water but probably nest more frequently within 30 km (RIC, 1996).

***Feeding***: Marbled Murrelets customarily forage within 0.5 km from shore, usually in relatively shallow waters less than 30 m deep (Sealy, 1975), where they consume mainly small schooling fish and large zooplankton (Kaiser *et al.,* 1994; Burkett, 1995). Major prey species include sand lance (*Ammodytes hexapterus*), anchovies (*Engraulis mordax*), herring (*Clupea harengus*), osmerids and seaperch (*Cymatogaster*) with euphausiids (*Thysanoessa, Euphausia*), mysids, and amphipods being the most common invertebrate prey (Burkett, 1995). Fish form the most important component of the diet during the breeding season (Burkett, 1995). During rearing, both adult birds often return to the nest several times daily to feed the chick single small fish (Nelson and Hamer, 1995).

## 6.3 Seasons of Use

***Reproductive Season***: The Marbled Murrelet breeding season is extended, occurring from mid-April through late September (Rodway *et al.,* 1992 *cited in* Burger, 1997). Hamer and Nelson (1995b) proposed the length of the breeding season to be approximately 118 days in B.C. with the incubation period from May 2 to July 4 and the nestling period from June 1 to August 30. Marbled Murrelets only lay one egg per year and probably do not breed until they are three or more years old (Kaiser *et al.,* 1994). Chicks hatch after an estimated 27 to 30 day incubation period and remain in the nest for 27 to 40 days (Nelson and Hamer, 1995).

For this project, the reproducing season for the Marbled Murrelet was estimated as May to August.

## 6.4 Rating Scheme and Seasons

***4-class, 1 season***

A 4-class rating scheme of high (H), moderate (M), low (L), and nil (N) is employed as suggested by Resources Inventory Committee (1997) due to the intermediate level of knowledge on habitat use of Marbled Murrelets. The used ratings scheme is defined in Table 23.

Ecosystem units identified within Clayoquot Sound are rated for ability to satisfy nesting requirements during the reproducing season as defined in the “Seasons of Use” section. Food values were not taken into account when developing ratings for ecosystem units as terrestrial habitats are not used for foraging.

## 6.5 Ratings Assumptions

Nesting habitat ratings for the reproducing season are presented in Tables 28, 29, and 30. Little is known of the habitat requirements of Marbled Murrelets, and strong site-series associations have not been determined. In developing habitat interpretations, assumptions were based on information found in published literature cited above and unpublished literature including Radcliffe and Ryan (1997) supplemented with personal knowledge and field data. Further study is needed to validate and refine these ratings. The following assumptions have been made:

| Season | Assumptions |
|---|---|
| Reproductive Season – Security Habitat for Nesting | **Elevation:**<br>? **Higher elevations are of lower overall value than lower elevations; the MH zone is therefore rated lower than CWH subzones.**<br><br>**Structural Stage:**<br>• Structural stages 1 to 5 have no nesting value due to the absence of potential nesting platforms. Even the more productive units are unlikely to provide trees that satisfy the nesting requirements for large limbs and abundant epiphytes.<br>• Younger forest with a residual old-growth component may have some value for nesting.<br>• Structural stage 7 is assumed to provide the most suitable nesting habitat. Stage 7 stands have the largest stature trees (providing more potential nesting platforms) and more open forest structures generating access and flyways.<br>• Stage 6 is generally less valuable and is therefore rated a little lower than stage 7, yet more productive, moist, mature forest should also provide high value nesting habitat.<br>**Vegetation Characteristics:**<br>• Stand closure is often low (50%) in stands used for nesting, suggesting use of canopy opening for access to nests (Hamer and Nelson, 1995a).<br>• The most important nest tree species within British Columbia are likely Sitka spruce and western hemlock. Units with a high component of these tree species, if in combination with other suitable stand characteristics, receive high nesting ratings.<br>• Douglas fir and western redcedar may also be used (Hamer and Nelson, 1995a).<br>**Other:**<br>• Based on work in the U.S., it has been suggested that mistletoe infestations can lead to tree limb deformities that may provide suitable nest sites in some younger stands. However, there appears to e no firm evidence for this to date.<br>• Decadence, unusual limb deformations, tree damage, and dwarf mistletoe blooms, all common in old growth and mature stands, also appear to create nest platforms (Hamer and Nelson, 1995a) adding to the value of older stands.<br>• Large diameter trees (mean diameter >200 cm) with well developed epiphytic mosses are generally required for nesting (Hamer and Nelson, 1995a). All nests have been found in old growth or mature trees greater than 81 cm DBH (Ralph *et al.,* 1995a).<br>• More productive, moist units receive higher ratings, as these units are more likely to produce suitable large trees.<br>• Marbled Murrelets generally nest at low elevations from valley bottom to mid slope (RIC, 1996). The general absence of large trees at higher elevations is likely a main factor in prohibiting nesting (Burger, 1995a). Therefore, higher elevation MH units that occur in crest and upper slope positions are down-rated.<br>• Generally, Marbled Murrelets were not assumed to nest directly adjacent to the ocean coastline. Although large, suitable nest trees may be present, these sites are down-rated to low value as they afford poor protection from winds/violent storms and exposure to higher predation along the coast. These units may have higher value in sheltered bays and inlets where more protection is afforded. |

Ratings in the year one and two ratings tables have been refined, based on the year three field verification plots and observations (see Tables 28, 29 and 30). These revisions are identified in bold. Shaded values indicate that these ratings have been developed without site information (as they have not been sampled in the year one, two or three mapped

watersheds). However, they have been provided at this stage in order to ensure that the project is as complete as possible for future reference.

## 6.6 Habitat Ratings Tables

**Table 28. Summary of Marbled Murrelet Reproductive Season Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Maritime Subzone – Submontane and Montane Variants (CWHvm1 and vm2).**

***CWHvm1 and vm2: Forested Site Series***

| Structural Stage | | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Season | | RE | RE | RE | RE | RE |
| **Unit** | **Site Series** | | | | | |
| **AB** | 01 HwBa - Blueberry | N | N | N | M | M |
| **LC** | 02 HwPl - *Cladina* | N | N | N | N | N |
| **HS** | 03 HwCw - Salal | N | N | N | L | L |
| **RS** | 04 CwHw - Sword fern | N | N | N | **M** | H |
| **AF** | 05 BaCw - Foamflower | N | N | N | **M** | H |
| **HD** | 06 HwBa - Deer fern | N | N | N | M | M |
| **AS** | 07 BaCw - Salmonberry | N | N | N | **M** | H |
| **SS** | 09 (vm1) Ss - Salmonberry | N | N | N | **M** | H |
| **CW** | 11 (vm1) Act - Red-osier dogwood or Act - Willow | N | N | N | x | x |
| **YG** | 12 (vm1) & 09 (vm2) CwYc - Goldthread | N | N | N | **N** | L |
| **LS** | 13 (vm1) & 10 (vm2) Pl - *Shagnum* | N | N | N | N | N |
| **RC** | 14 (vm1) & 11 (vm2) CwSs - Skunk cabbage | N | N | N | L | M |

***CWHvm1 and vm2: Deciduous, Shrub, and Herb Dominated Ecosystem Units***

There are no nesting values contained within these ecosystem units for Marbled Murrelets during their reproductive season.

**Table 29. Summary of Marbled Murrelet Reproductive Season Habitat Ratings for Clayoquot Sound: Coastal Western Hemlock Very Wet Hypermaritime Subzone - Southern Variant (CWHvh1).**

***CWHvh1: Forested Site Series***

| Unit | Site Series | Structural Stage / Season | 3 RE | 4 RE | 5 RE | 6 RE | 7 RE |
|---|---|---|---|---|---|---|---|
| **HS** | 01 CwHw - Salal | | N | N | N | M | M |
| **LR** | 02 PlYc - *Rhacomitrium* | | N | N | N | N | N |
| **RS** | 03 CwHw - Salal | | N | N | N | L | M |
| **RF** | 05 CwSs - Sword fern | | N | N | N | M | H |
| **SF** | 06 CwSs - Foamflower | | N | N | N | **M** | H |
| **SD** | 07 CwSs - Devil's club | | N | N | N | **M** | H |
| **SL** | 08 Ss - Lily-of-the-valley | | N | N | N | **M** | H |
| **AL** | 10 Dr - Lily-of-the-valley | | N | N | N | x | x |
| **YG** | 11 CwYc - Goldthread | | N | N | N | L | L |
| **LS** | 12 PlYc - *Sphagnum* | | N | N | N | N | N |
| **RC** | 13 CwSs - Skunk cabbage | | N | N | N | M | M |
| **SS** | 14 Ss - Salal | | N | N | N | L | L |
| **SK** | 15 Ss - *Kindbergia* | | N | N | N | L | L |
| **SW** | 17 Ss - Sword fern | | N | N | N | L | L |

**Legend for Habitat Ratings Tables:**
H = High, M = Moderate, L = Low, N = Nil RE = Reproducing Season
**Shaded** cells indicate which ecosystem units have not been mapped during Year 1, 2 or 3
**x** indicates structural stages not applicable for the ecosystem
**Bold** indicates a refinement in rating from Year 2 tables.

### *CWHvh1: Deciduous, Shrub, and Herb Dominated Ecosystem Units*

There are no nesting values contained within these ecosystem units for Marbled Murrelets during their reproductive season.

### *CWH: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units*

There are no nesting values contained within these ecosystem units for Marbled Murrelets during their reproductive season.

**Table 30. Summary of Marbled Murrelet Reproductive Season Habitat Ratings for Clayoquot Sound: Mountain Hemlock Moist Maritime - Windward Variant (MHmm1) and Parkland Subzone (MHmmp).**

***MH mm1 and mmp: Forested Site Series***

| Unit | Site Series | Structural Stage / Season | 3 RE | 4 RE | 5 RE | 6 RE | 7 RE |
|---|---|---|---|---|---|---|---|
| **MB** | 01 HmBa - Blueberry (includes 04) | | N | N | N | L | L |
| **MM** | 02 HmBa - Mountain-heather | | N | N | N | N | L |
| **MO** | 03 HmBa - Oak fern | | N | N | N | L | M |
| **MT** | 05 BaHm - Twistedstalk | | N | N | N | **L** | M |

**Legend for Habitat Ratings Tables:**
H = High, M = Moderate, L = Low, N = Nil RE = Reproducing Season
Bold indicates a refinement in rating from the Year 2 tables.

***MH mm1 and mmp: Shrub and Herb Dominated Ecosystem Units***

There are no nesting values contained within these ecosystem units for Marbled Murrelets during their reproductive season.

***MH mm1 and mmp: Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units***

There are no nesting values contained within these ecosystem units for Marbled Murrelets during their reproductive season.

## 6.7 Rating Adjustments

***CWHvm1 and vm2: Salal Phase of the mesic (AB) site series***
Ratings for the mesic (01) unit in the CWHvm1 and vm2 assume average conditions. The salal phase of the AB (01) site series has not been mapped. However, this phase may have smaller trees, on average, than the typical sites. Nesting potential in stages 6 and 7 may therefore be lower (up to -1).

***Site Index:***
Incorporation of VRI information into the species model may help refine some of the ratings. For example site index may assist in further identifying the best potential denning habitats.

## 6.8 References

B.C. Conservation Data Centre. 1997. *Rare Vertebrate Animal Tracking List (Sorted Phylogenetically Within Each Taxonomic Group).* March 10, 1997.

B.C. Ministry of Environment, Lands and Parks. 1997. Draft. *Managing Identified Wildlife Guidebook*. B.C. Ministry of Environment, Lands and Parks, B.C. Ministry of Forests, Victoria B.C.

B.C. Ministry of Environment, Lands and Parks. 1996. *Vertebrate Red and Blue Lists*. Wildlife Branch, Victoria, B.C.

Burger, A. E. 1995a. *Inland Habitat Associations of Marbled Murrelets in British Columbia*. Pages 151-161 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Burger, A. E. 1995b. *Marine Distribution, Abundance, and Habitats of Marbled Murrelets in British Columbia.* Pages 295-312 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Burger, A. E. 1997. *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Marbled Murrelets in Marine and Terrestrial Habitats.* Version 1.1. Resources Inventory Committee, Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C.

Burger, A. E., B. A. Beasley, and T. A. Chatwin, eds. 1997. *Clayoquot Sound Marbled Murrelet Inventory for 1996.* Unpubl. Report to Ministry of Environment, Lands and Parks, Vancouver Island Regional Office, Nanaimo, B.C.

Burkett, E. E. 1995. *Marbled Murrelet Food Habits and Prey Ecology.* Pages 223-246 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

COSEWIC. 1997. Can*adian Species at Risk, April 1997*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.

Hamer, T. E. and S. K. Nelson. 1995a. *Characteristics of Marbled Murrelet Nest Trees and Nesting Stands.* Pages 69-82 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Hamer, T. E. and S. K. Nelson. 1995b. *Nesting Chronology of the Marbled Murrelet*. Pages 49-56 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Kaiser, G. W., H. J. Barclay, A. W. Burger, D. Kangasniemi, D. J. Lindsay, W. T. Munro, W. R. Pollard, R. Redhead, J. Rice, and D. Seip. 1994. *National Recovery Plan for the Marbled Murrelet.* Rep. No. 8. Recovery of Nationally Endangered Wildlife Committee, Ottawa, Ontario.

Kelson, J. D., I. A. Manley, and H. R. Carter. 1995. *Decline of the Marbled Murrelet in Clayoquot Sound, British Columbia: 1982-1993.* Northwestern Naturalist 76:90-98.

McLaughlin, R. T. 1995. *Summer 1995 Marbled Murrelet Surveys – Kennedy/Estevan Division.* Unpubl. Report, MacMillan Bloedel Ltd., Nanaimo, B.C.

Nelson, S. K., and T. E. Hamer. 1995. *Nesting Biology and Behaviour of the Marbled Murrelet.* Pages 57-67 in C. J. Ralph, G L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Radcliffe, G. and M. Ryan. 1997. *Ecosystem Mapping and Wildlife Interpretations for the Chapman–Grey Study Area, Sechelt.* Report for International Forest Products Ltd., Sechelt, B.C.

Ralph, C. J., G .L. Hunt, M. G. Raphael, and J.F. Platt. 1995. *Ecology and Conservation of the Marbled Murrelet in North America: An Overview.* Pages 3-22 in C. J. Ralph, G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt, technical eds. Ecology and conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture.

Resources Inventory Committee. 1996. *Marbled Murrelet Resource Inventory Workbook.* Ministry of Environment, Lands and Parks, Victoria, B.C.

Resources Inventory Committee. 1997. *Standards for wildlife habitat capability/suitability ratings in British Columbia*. Review Draft, May 28 1997. Wildlife Interpretations Subcommittee, Wildlife Branch, Ministry of Environment Lands and Parks, Victoria, B.C.

Rodway, M. S. 1990. *Status report on the Marbled Murrelet in Canada.* Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Rodway, M. S., H. R. Carter, S. G. Sealy, and R. W. Campbell. 1992. *Status of the Marbled Murrelet in British Columbia.* Pp. 17-41 in Status and conservation of the Marbled Murrelet in North America (H. R. Carter and M. L. Morrison, eds.). Proc. Western Foundation Vert. Zool. 5.

Sealy, S. G. 1975. *Feeding Ecology of Ancient and Marbled Murrelets near Langara Island, British Columbia.* Can. J. Zool. 53:418-433.

Stevens, V. 1995. *Wildlife Diversity in British Columbia: Distribution and Habitat Use of Amphibians, Reptiles, Birds, and Mammals in Biogeoclimatic Zones*. Work Pap. 04/1995. Res. Br., B.C. Min. For., Wildl. Br., B.C. Min. Environment, Lands and Parks., Victoria, B.C.

## 7.0 SPECIFIC AREA DESCRIPTIONS

The following is a summary of wildlife values within each study area for the project species. Physical descriptions and a summary of ecosystems mapped in each area are provided in the associated TEM report (Madrone Consultants Ltd. 1999). Some of the general area description content from the TEM report is repeated here for ease of reference.

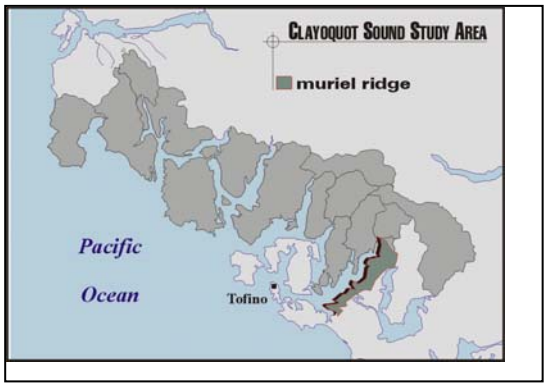
For each of the project wildlife species, key habitat values within the Clayoquot study areas are briefly identified. These summaries were made through reviewing the ArcView map files for the study areas by species, season, and life requisite. The maps were coloured on the basis of the first ecosystem label only (largest decile), and no further refinements have been attempted at this stage. Far more detailed and thorough analyses are possible; maps could be colored up by second and third ecosystem components, by some composite ratings through averaging or differential weightings being applied, and so on. However, for simplicity we have restricted this brief analysis and overview to the first ecosystem component only. As a first pass, this analysis identifies some of the general trends and values that stand out, and this section focuses simply on identifying those. Where appropriate, reduced wildlife maps showing the general distribution of habitat values are provided in the report.

Relevant observations on the key project species are noted within the study area summaries. However, many other species were directly or indirectly recorded during fieldwork, and these are listed in Appendix II. Where applicable, a short section outlining any observations of red and blue listed species within each study area is included for each area.


# YEAR THREE STUDY AREAS

MADRONE
ECOLOGY & EARTH SCIENCES

# MURIEL RIDGE STUDY AREA



## 7.1 Muriel Ridge Study Area

### *7.1.1 Location and Extent*

Muriel Ridge study area lies along the eastern side of Tofino Inlet extending from sea level up to the ridgetop at a maximum elevation just over 1100 m. The total area is approximately 3,627 hectares. It is comprised of watershed numbers: 348, 349X, 351X, 354, 356X, 358X, 360, 363X, and 380X.

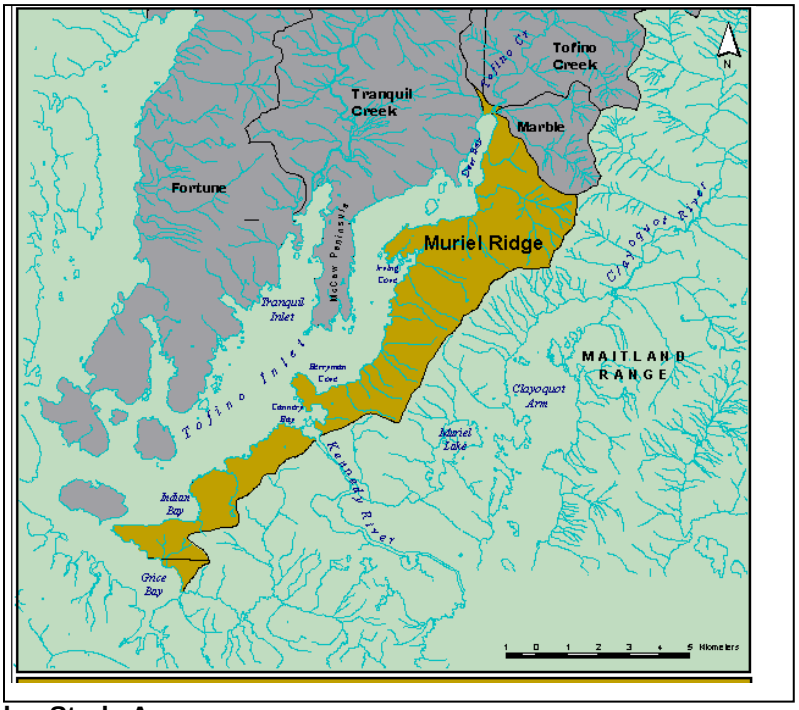



**Figure 1: Muriel Ridge Study Area**

### *7.1.2 Topography and Drainage*

Slopes of the northern half of this watershed are generally west facing and are steep, becoming gentler near the coastline. Creeks draining the northern slopes generally flow east in undefined valleys. The southern half of the study area is hummocky with generally gentle slopes, although some slopes have local short steep sections. Creeks here flow in various directions. Northwest flowing creeks include one that drains a small lake to the east of Indian Bay and one that flows directly into Indian Bay. Several other small creeks flow southwest into Grice Bay. The mouth of Kennedy River lies to the couth of Cannery Bay.

### *7.1.3 Biogeoclimatic zones:*

There are two biogeoclimatic zones within the Muriel Ridge study area: The Coastal Western Hemlock (CWH) Zone and the Mountain Hemlock (MH)Zone. The CWH is represented by the vh1, vm1, and vm2 variants. The CWH vh1 occurs below 200 m along the shoreline. As the vh1 boundary approaches Tofino Creek estuary it becomes a narrow strip just above sea level. The southern portion of the study area is primarily in the vh1. The CWH vm1 and vm2 variants occur above 200 m and form much of the middle and northern portion of the study area. The MH Zone is represented by the MHmm1 variant

which occurs above 800 m and is continuous along the ridge tops of the eastern boundary. Two very small pockets of parkland (MHmmp1) subzone occur above 1200 m.

### *7.1.4 Ecosystems*

A complete list of ecosystems that have been mapped in the area appears in the ecosystem inventory report and accompanying maps (Madrone Consultants Ltd., 1999).

The most extensively logged area in the study area is in the central portion along the ridge from the divide to halfway down the slopes, and in the more southerly section down to sea level. The northern area near Tofino Creek has all been clearcut, while the most southerly portion of the study area has experienced very little logging.

In the CWHvh1 variant the only two small floodplain ecosystems (SL) that occur within the study area are logged units located along the northern boundary in the Tofino Creek estuary. Although one small floodplain is included in a complex polygon label on the southern most tip of the study area, the polygon actually extends outside this study area where the floodplain occurs

The rich, moist ecosystems (SD) occurs where moisture is abundant and drainage is not impeded. These ecosystems are most common adjacent to creeks and on fluvial fans.

Poorly drained bog forests (YG) are quite common throughout the vh where the terrain is hummocky. Several bog woodland forests (LS) are scattered throughout the vh where water movement is impeded and organic deposits have accumulated. Three small wet, but richer forests (RC) occur where water movement is less impeded. Two of these sites are located near the mouth of Kennedy River and one site is located south of Irving Cove.

Several herbaceous wetland types occur within the vh. As well as the treeless bogs (SM) associated with bog forests (YG), a richer wetland (CM) occurs along the outer edges of a small lake (LA) east of Indian Bay.

One tall shrub dominated wetland (PD) occurs in Kennedy Cove. This area, originally a cultivated orchard, is now dominated by dense willows, Pacific crab apple, red osier dogwood, and sedges. The moisture regime is very wet, as small side creeks run through the area. One other site similar to this within Clayoquot Sound is located on the Hesquiat Peninsula. Although the species are slightly different, the expected climax of both sites is most likely the same.

The richer mesic ecosystem (SF) is quite rare within the area and is found on lower colluvial slopes, on level areas adjacent to the wetter SD sites, and on fluvial fans.

The most common ecosystem occurring within the vh is mesic forest (HS). This unit occurs on shallow to deep soils, on hummocky terrain, and on steep to gentle slopes.

Poorer submesic forests (RS) are common in the vh and generally occur above or adjacent to mesic (HS) forests where soils are shallow. The very dry pine ecosystem (LR) often occurs in complexes with these submesic ecosystems and rock outcrops (RO) where soils are very shallow and drainage is rapid.

Herbaceous ecosystems (DS and GS) are scattered along the coastline and are usually adjacent to beaches (BE) or mudflats (MU). They frequently occur on fluvial fans.

In the CWHvm1 one floodplain site (SS) is located on the Tofino Creek estuary. This site has been logged.

Moist, nutrient rich forests (AS) are common adjacent to creeks, where soils are deep and moisture is abundant, while moist, nutrient poor ecosystems (HD) occur on steep north and northwest facing seepage slopes.

Bog forests (YG) are scattered throughout the vm where slopes are gentle to flat and hummocky. These ecosystems generally occur in complexes with the mesic (AB) or drier (HS) ecosystems. Several bog woodland forests (LS) are located within the vm and are also complexed with bog forests (YG). Two small treeless bogs (SG) are located along the eastern boundary of the study area.

Rich mesic forests (AF) are usually found on colluvial and fluvial fans and on lower slopes of creek valleys, where soils are deep. This generally occurs in the western portion of the study area.

Mesic forests (AB) are the most commonly occurring ecosystem in the vm1 and vm2. They occur on all aspects from the upper elevations of the vm to sea level. Soils are generally deep, but many mesic forests are located on shallow soils, especially at higher elevations.

Submesic forests (HS and LC) usually occur in complexes with rock outcroppings (RO). They are found on the upper slopes and in areas where terrain is hummocky and soils are thin.

Three small shrub dominated avalanche track ecosystems (SA) are found at the heads of valleys in the CWHvm2.

The MH zone in the Muriel Ridge study area is limited to the ridges along the northeastern boundary. Most of the zone is very steep and access is difficult. Both the mm1 and mmp1 subzones are represented.

Mesic forest (MB) is the most common ecosystem found in the MH zone. Soils are generally deep, but these units are also often found on shallow and very shallow soil. One small rich mesic site (MO) is mapped.

Submesic parkland (MM) and rock (RO) occur near and along ridgetops where soils are very shallow and conditions xeric.

### *7.1.4 Wildlife Interpretations*

#### *Black Bear*

Overall, early spring feeding values are low to very low throughout the area (see Figure 2), and food availability is expected to be limiting for bears in the Muriel Ridge area at this time of year. Only a handful of small, widely scattered, polygons are rated as high value for this time. A small area where some of the better spring habitats are concentrated occurs at the extreme northern end, around the Tofino Creek estuary at Deer Bay. This area includes several moderately high (DS units) and one high value polygon (SS3); more will occur in the immediately adjacent map area to the north and west. Several GS2b units that occur further south along the shoreline of Tofino Inlet are also of high value in early spring. Most of the better early spring habitats are concentrated in the southern part of the study area, where additional moderate value habitats are also more widely available, in the low elevation CWHvh1 near Indian Bay. Moderately high value sites including AS3, AS7 and SD7 units.

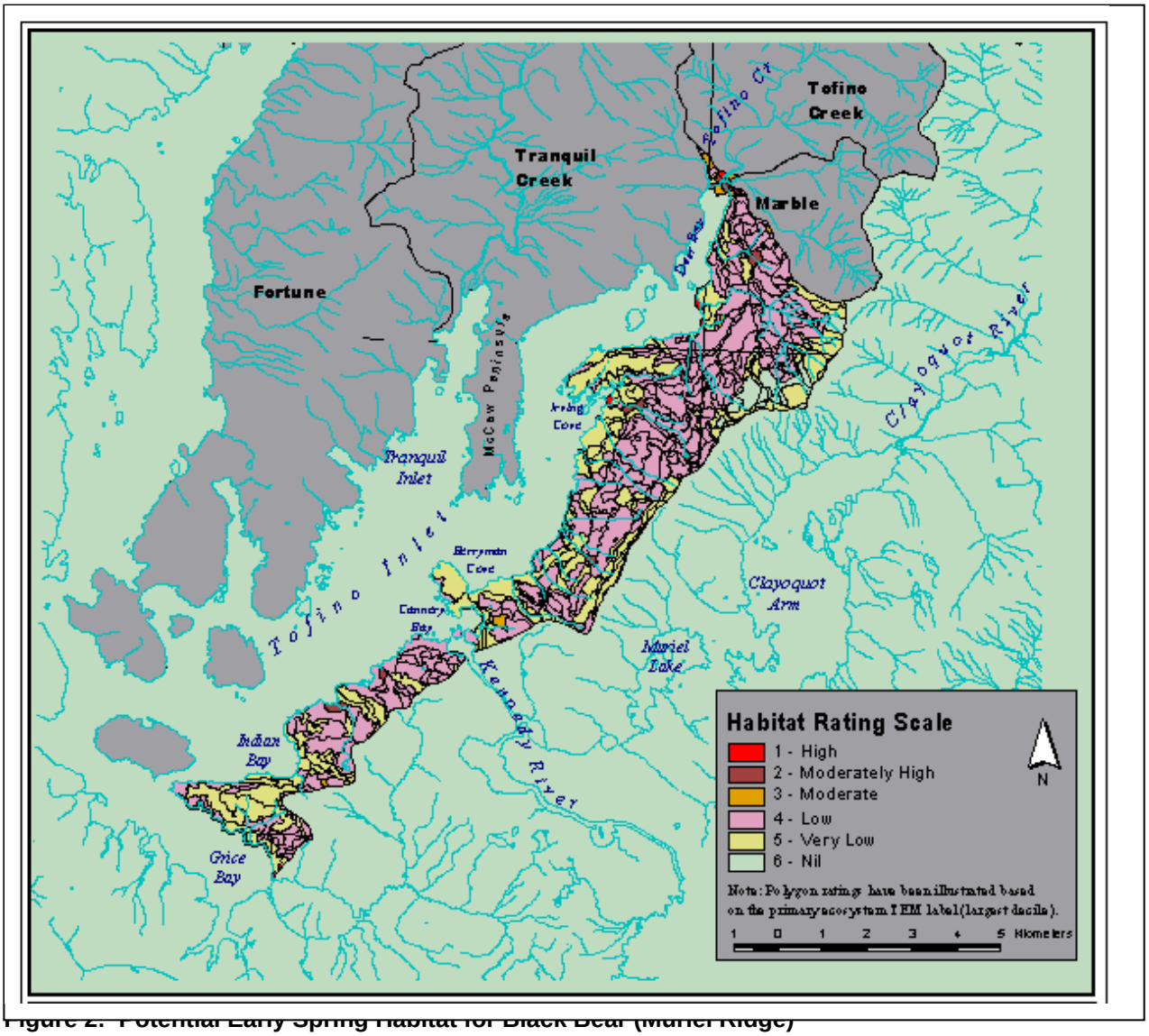



**Figure 2. Potential Early Spring Habitat for Black Bear (Muriel Ridge)**

Suitable feeding habitats become more available as spring progresses, and many of the moderate value early spring habitats increase in value. However, later in spring values are still concentrated in the southern vh1 subzone area and in the vh1 in the north, near Deer Bay.

Food is unlikely to be limiting during the summer season, when moderate to moderately high value habitat is widely available throughout the vh and vm subzones of the study area.

Values rate highest for this area in the fall, when berry production is expected to be high in the numerous structural stage 3 mesic units, as well as in mature and old growth stands. The majority of the area supports moderately high to high fall values. During fieldwork, the structural stage three HS units were noted as having good berry production for feeding.

The habitat ratings review (in ArcView 3.1) indicates that hibernation/denning values in the area are fairly high, with numerous HS7 units (at high suitability) and AB7 and AS7 (at moderately high suitability) (see Figure 3). This was verified during fieldwork, as large cedars (greater than 1m dbh) were often noted as present in the area. These have high

potential to provide denning sites. A possible den was recorded in the vh1 subzone at plot G3J65, in an HS7 unit. In addition to high hibernating values, the site was rated as having high value for security during spring, summer and fall. Tree sizes ranging from 30cm to +2m dbh, and a cluster of two large cedars and a hemlock tree provided multiple root and tree holes which appeared to afford suitable denning sites. One opening was used and there were two old bear scats present near the tree.

Ratings in the field correlated quite well with the preliminary values assigned, with many high and moderately high values assigned to specific sites for spring, summer, fall and hibernation life requisites. Evidence of bear use was noted at many plots as well, further supporting the established ratings.

No bears were seen in the study area itself, but moderate to high levels of bear use were evident in the form of trails and scat. Some trails were so well worn that semi-permanent foot impressions had been formed in the ground. Tracks, trails, scat (especially along the main road through Muriel Ridge) and digging sign were also observed (e.g. G3J85 and G3J84, both HS units). One bear was seen near the study area (part of Kennedy Flats study area) on the West Main road.

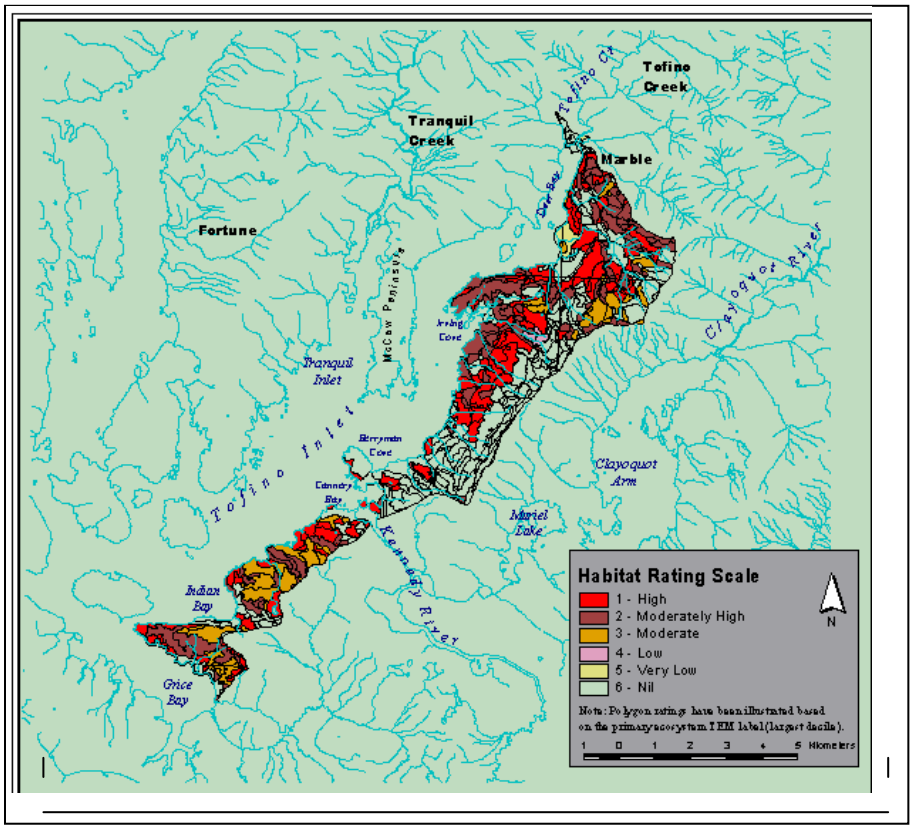



**Figure 3: Potential Denning Habitat for Black Bear (Muriel Ridge)**

### *Black-tailed Deer*

Deer values are moderate to high overall for the area, with many sites containing high value security and thermal habitat. The numerous young structural stages also provide good feeding throughout the year in the lower elevations where little to no snow pack occurs.

Moderate to good spring feeding habitat is present throughout the northeast portion of the study area (AB3, HS7, AB6 and AB7 in the CWHvm1). The best spring foraging habitat occurs in the vm1, with young and mature forest stands providing ample feeding opportunities on herbaceous vegetation. The HD3 and AF7 units in the CWHvm2 are rated moderately high for spring feeding suitability. The GS2b unit in the vh1 subzone is also rated moderately high in spring. However, these sites are limited – located intermittently along the shoreline. No polygons were rated high for spring feeding.

Moderate to moderately high summer feeding potential is present throughout the area as well. Feeding is limited in the mesic HS forests. Better summer feeding values occur in the SD3 where fireweed, vacciniums, salmonberry, deer fern, thimbleberry, sword fern, bracken fern, and evergreen huckleberry are present. AB3 units in the vm1 and vm2 are rated moderately high, providing some of the better habitats for summer feeding on the island. At the higher elevations of the MHmm1 and mmp, some moderately high value feeding habitats occur, although overall summer values are still lower than in the CWH zone. In general, the best summer habitats within the study area are concentrated within the northern and central portions of the study area, where logging has been extensive.

Fall feeding values are also quite high throughout the area and are not thought to be a limiting factor. The extensive AB3 and HD3 units within the vm1 and vm2 are of moderately high feeding value at this time. Adjacent forested units provide security and thermal cover.

Suitable winter range is quite widely available within the vh1 and vm1 subzones of Muriel Ridge (see Figure 4). The best thermal values occur in units AS7 in the vh1, and SD7, and HS7, rated moderately high value. Most of the better winter range is on the lower, west facing slopes in the northern half of the study area. Some is also concentrated near the southern tip in the CWHvh1. Rock outcrop patches occur throughout the lower elevations of the study area. On warm aspects these provide deer with an opportunity to warm in the sun, as well as providing good visibility of surroundings, important for security from predators. As such, the presence of these outcrops may increase the value of adjacent forest cover in winter and spring. At sites such as these, fall and winter pellets, as well as well-used trails were present (e.g. 3J69—vh1 LR3b). Well-worn trails were also noted in RS7 units of the vh1 (e.g. G3J72). Overall, observed deer sign indicated that use of the area was moderate.

Although security and feeding values are often rated of moderate to high value in the young structural stage units (i.e. stage 3 and 4), deer mobility in some of these units may be significantly impeded by dense shrubs, dense small trees, steep sections, and/or abundant coarse woody debris in the form of stumps and logs. Therefore, some areas may not be utilized to their full potential by deer.

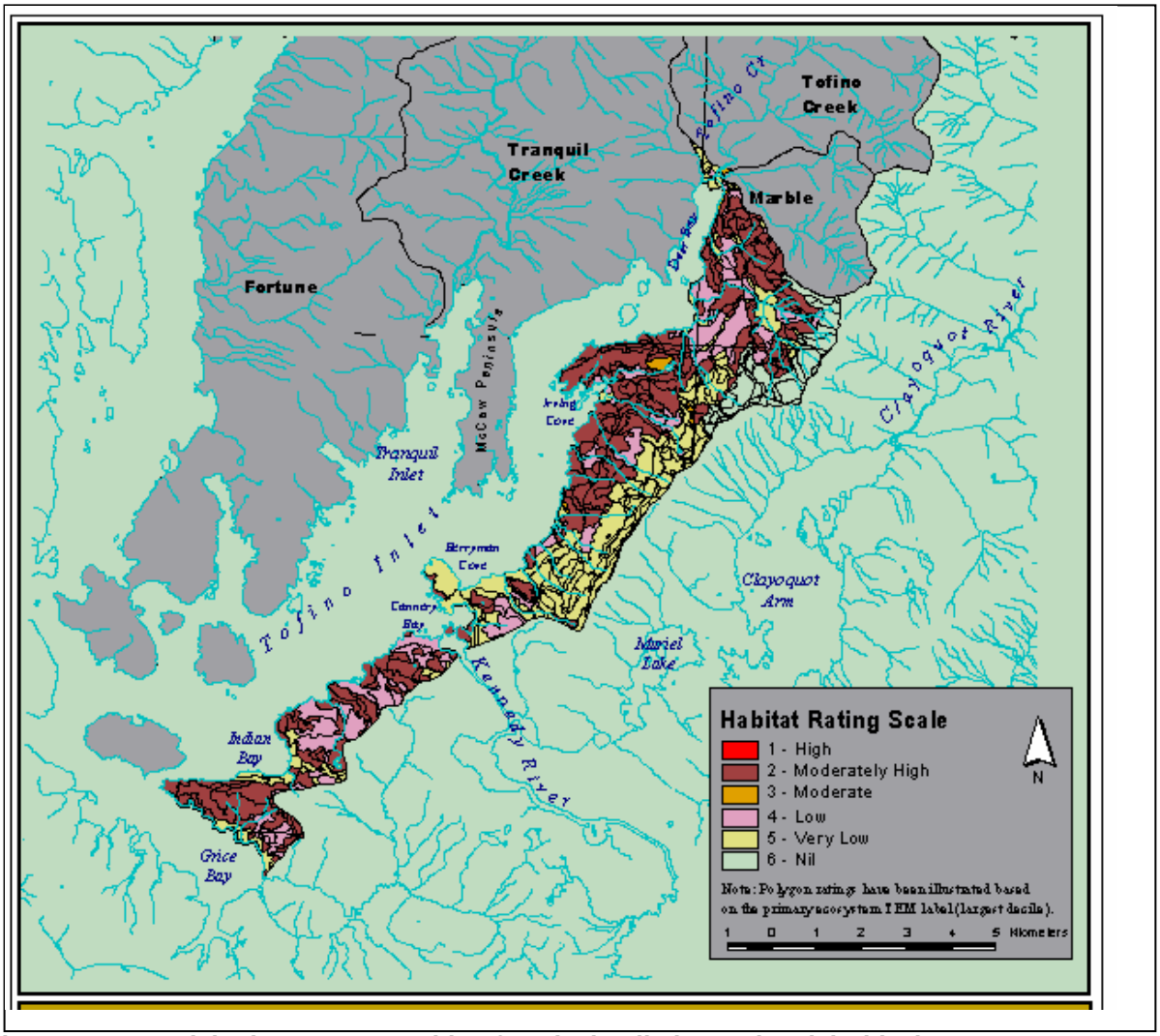



**Figure 4: Potential Winter Range Habitat for Black-tailed Deer (Muriel Ridge)**

### *Roosevelt Elk*

Although some moderately high and high value ecosystems are scattered throughout the Muriel Ridge study area, the overall, spring, summer, and fall season values for elk are low to moderate. No sign of elk was observed during fieldwork, even in potentially the best habitats, and elk are not thought to occur within the study area at this time. However, the following discussion briefly evaluates current habitat suitability. It should be noted that floodplain ecosystems, which provide important year round habitat for elk, are for the most part absent within the Muriel Ridge area.

Spring habitat for elk is limited in the area, with an overall suitability of low to moderate (see Figure 5). However, there are a few scattered sites that rate the highest value habitat for this season. Moderate spring feeding habitats are more widespread, especially in the southwestern part of this watershed, in the vh1 subzone. These are mainly YG7 units. A few polygons of SD7 are also present and are rated moderately high for this season. The upper elevation MHmm1 zone is rated of no value for feeding and security habitat in the spring as it is assumed that the area is neither productive nor accessible to elk (due to later snowpacks) at this time.

Summer values are generally moderate throughout the area, with a few isolated polygons of high potential for feeding and security (the same polygons rated high for spring are also rated high for the summer and fall). Moderately high rated habitat is also present, but is very limited in extent. It comprises HD3, SD7 in vm1, GS2b and SD7, SL7 and RC3 in the vh1. Summer feeding is good in the SD3 sites (e.g. G3J70), with a wide variety of herbaceous plants present.

Moderate to moderately high value fall habitats are quite widely available, with a concentration of the better values in the northern half of the area. Values in fall appear to be generally a little better than for the other seasons.

The MHmm1 is rated of nil value for elk in the winter. At this time elk will favour the warmer units of the lower elevation riparian areas and flatlands, where feeding and security habitat is available all year. However, there are very few polygons rated high for the winter (mainly AS7 in the vm1). The vh1 subzone contains more extensive moderate winter range habitat, interspersed with some polygons rated moderately high. However, the vm1 subzone in the east central portion of the study area consists of predominately young structural stage forests of very low thermal/security value in the winter to elk. Overall, winter habitat availability may be a limiting factor for elk in this area (see Figure 6). However, many of the sites visited were located on warm aspect slopes, and had ideal thermal cover with mature forest stands, dense shrubs and adjacent to rock outcrops. These sites would be expected to receive considerable winter use. However, no elk sign was observed during fieldwork.

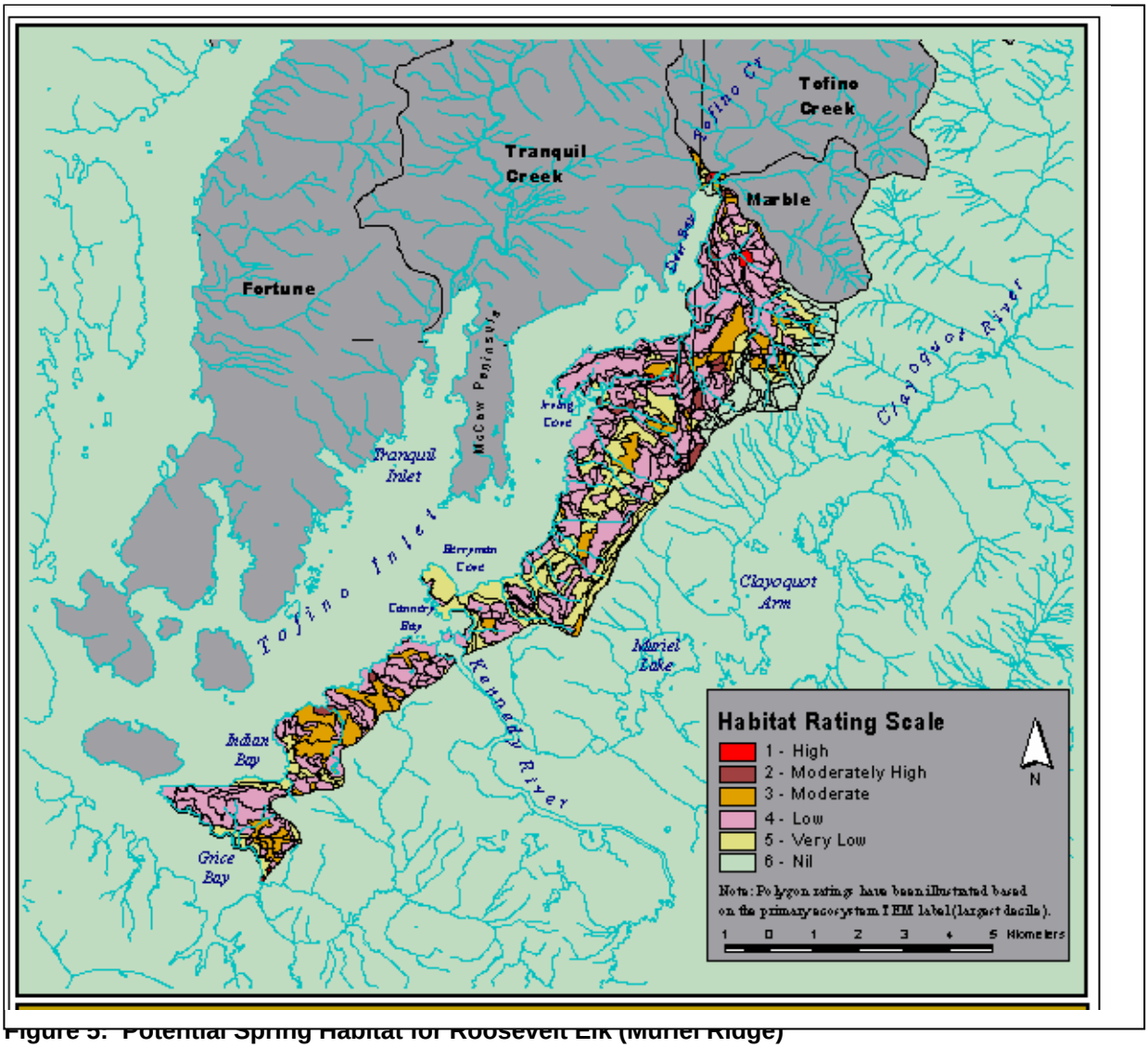



Figure 5. Potential Spring Habitat for Roosevelt Elk (Muriel Ridge)

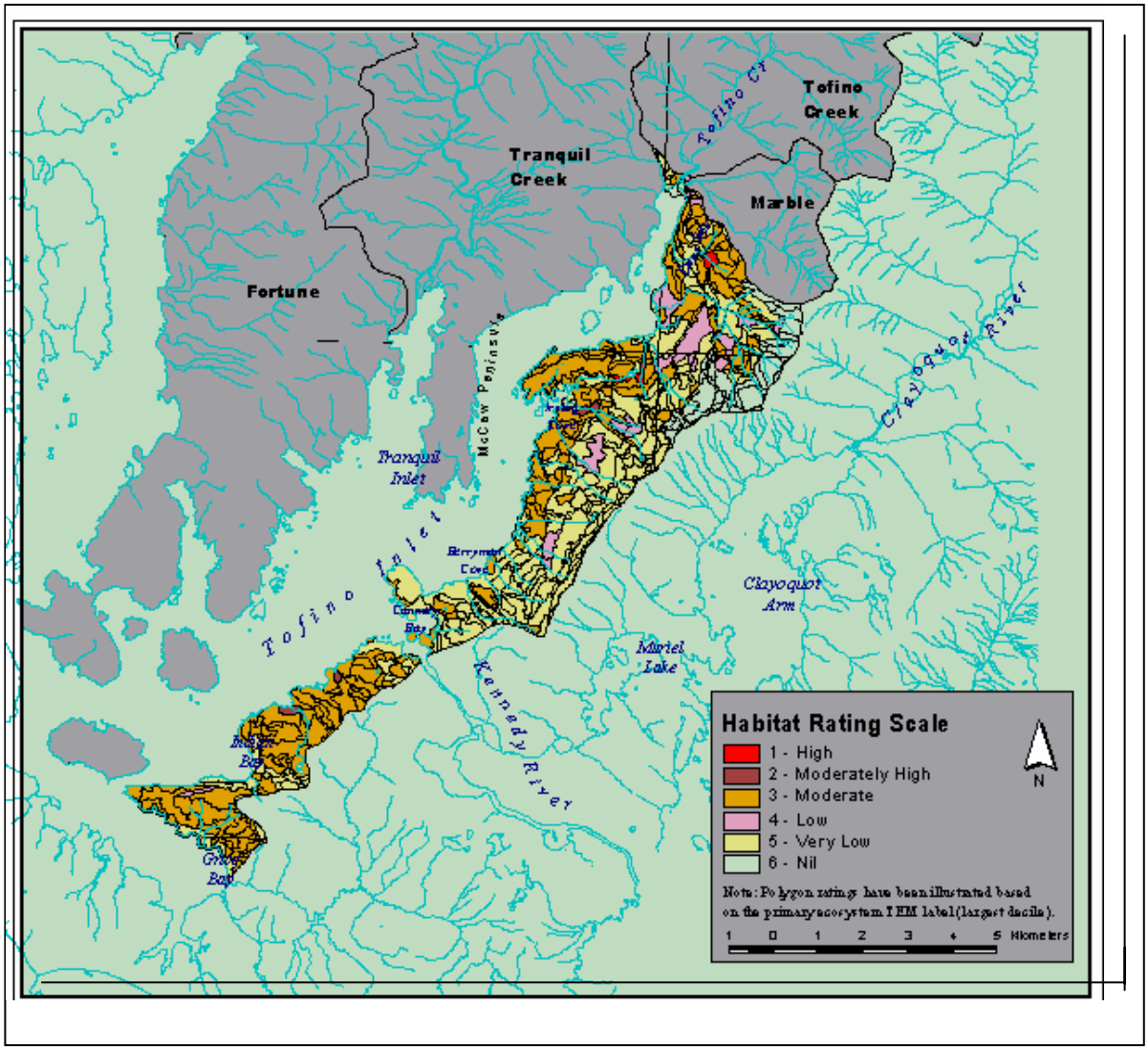



**Figure 6: Potential Winter Range Habitat for Roosevelt Elk (Muriel Ridge)**

### *Bald Eagle*

Our initial interpretations indicate that high value nesting habitat is located primarily in areas of old-growth mesic (AB) forests common throughout the CWHvm in the northern part of this study area. High value nesting habitats are also found in scattered areas of old-growth AF and AS units within the vm and within old-growth SD units of the vh. Past logging has been fairly extensive within this study area, especially throughout the central region, and has reduced potential nesting habitats (see Figure 7). However, within the CWHvh along the coast, fairly extensive areas of old-growth mesic (HS) and submesic (RS) forests remain and should provide moderate nesting values. These are likely the most important Bald Eagle nesting habitats in Muriel Ridge.

During fieldwork, plots in HS7 along the Tofino inlet confirmed moderate nesting value within this ecosystem unit. In addition, this unit also had good all-year perching habitat (plots G3J79, G3J84 and G3J65 were all rated as moderate value). Snags (although few) and large diameter cedar trees (some greater than 2 m dbh, with an average of 70-80 cm dbh) were often present in these stands.

Feeding values are high for Bald Eagles in this general area, due to the close proximity of the ocean and inlets. High eagle use of most habitat types adjacent to the Tofino inlet is expected during salmon spawning. For example, the alders of 20cm dbh at plot G3J60 in the CWHvm1 (LS3b) will serve as good perching sites to view fish from.

No evidence of Bald Eagle use was observed during fieldwork, but very limited time was spent along the coast in this area.

It should be noted that distance buffers need to be placed along oceanfront and the larger river/estuary and lake areas (in all watersheds) to further delineate suitable nesting habitats. Adjustments to the habitat ratings outside of these zones should then be made, reducing habitat values as the distance from feeding sources increases.

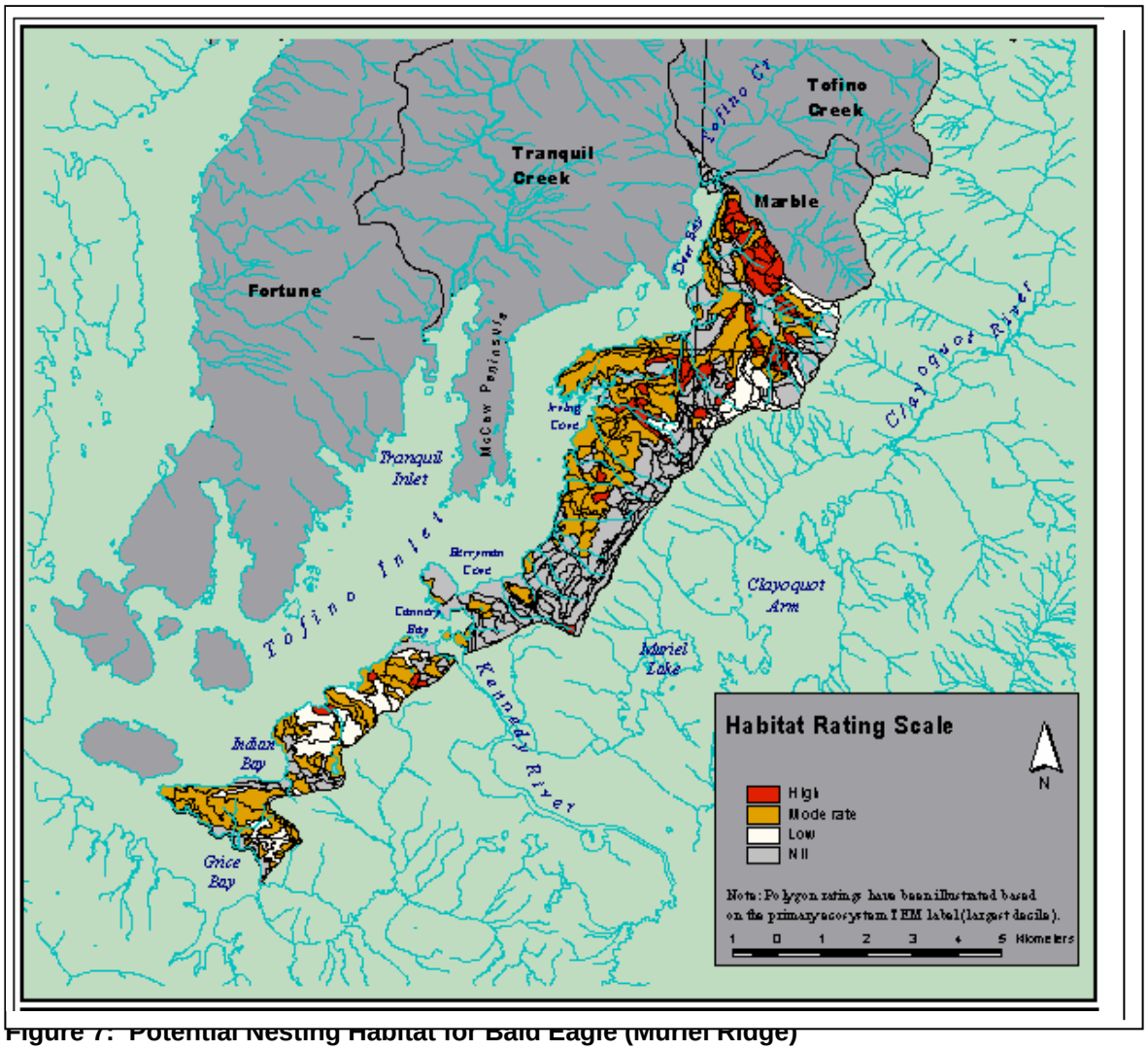



Figure 7: Potential Nesting Habitat for Bald Eagle (Muriel Ridge)

### *Marbled Murrelet*

Overall, the Muriel Ridge study area appears to have moderate to low Marbled Murrelet nesting value with only a few high value habitats present (see Figure 8). A few high value polygons of rich moist old-growth forest (SD7 units in the vh1 and AS7 units in the vm) are scattered along creeks and on fluvial fans throughout the CWH. A small number of rich mesic AF7 units (rated H) also occur in the CWHvm in the western part of the study area.

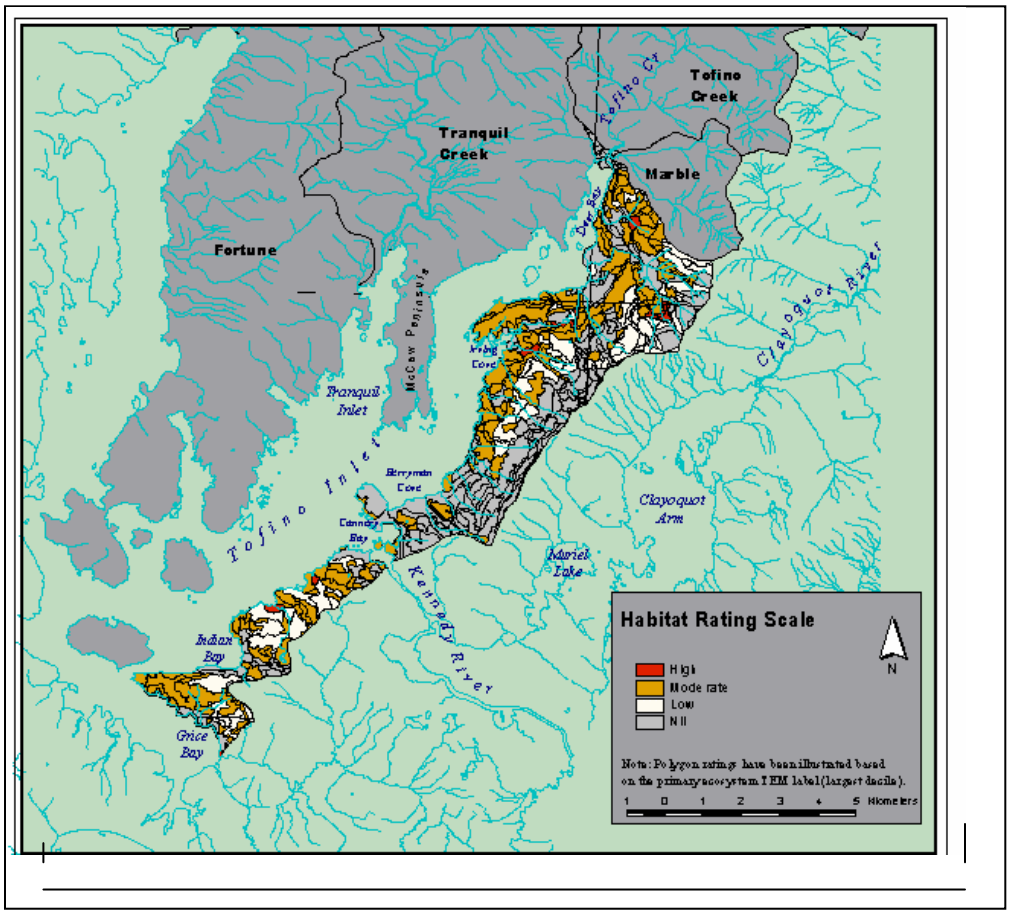



**Figure 8: Potential Nesting Habitat for Marbled Murrelet (Muriel Ridge)**

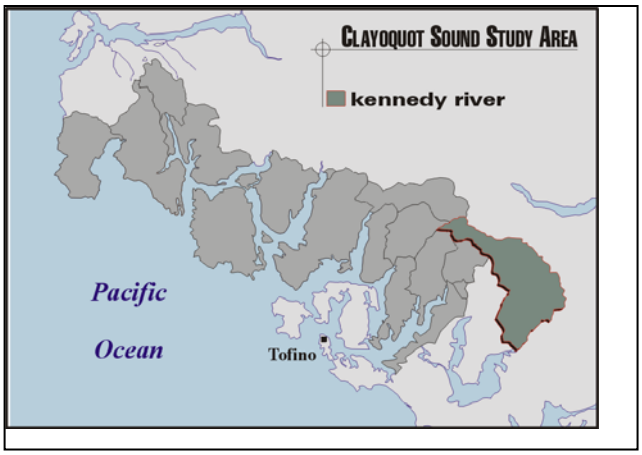
Areas of moderate nesting value are more widespread, occurring throughout the eastern and lower parts of the study area in old-growth HS and RS forests in the CWHvh and in old-growth AB and HD units in the CWHvm. During fieldwork, plots in HS stage 7 units verified these ecosystems had moderate nesting value, with good epiphyte cover and large trees (plots G3J65 and G3J84). Habitat suitability is greatly reduced in the central portion of the study area where past logging has resulted in extensive areas of structural stage 3 and 4.

### *Non-focal Wildlife Observations (Red and Blue Listed Species)*

No red or blue listed species were observed during fieldwork within this area. However, inventory of red and blue listed species was not the intent or focus of this project. Please refer to Appendix II for a list of all wildlife species detected during fieldwork.

MADRONE
ECOLOGY & EARTH SCIENCES

# KENNEDY RIVER STUDY AREA



## 7.2 Kennedy River Study Area

### *7.2.1 Location and Extent*

The Kennedy River watershed lies on the eastern edge of the Clayoquot study area. It extends from sea level to an elevation of approximately 1500 m. Clayoquot Arm, Clayoquot River, and Tofino Creek lie to the west, while Kennedy Lake lies to the south. The total area is approximately 20,347 hectares. It is comprised of watershed numbers: 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 306, 307, and 309.

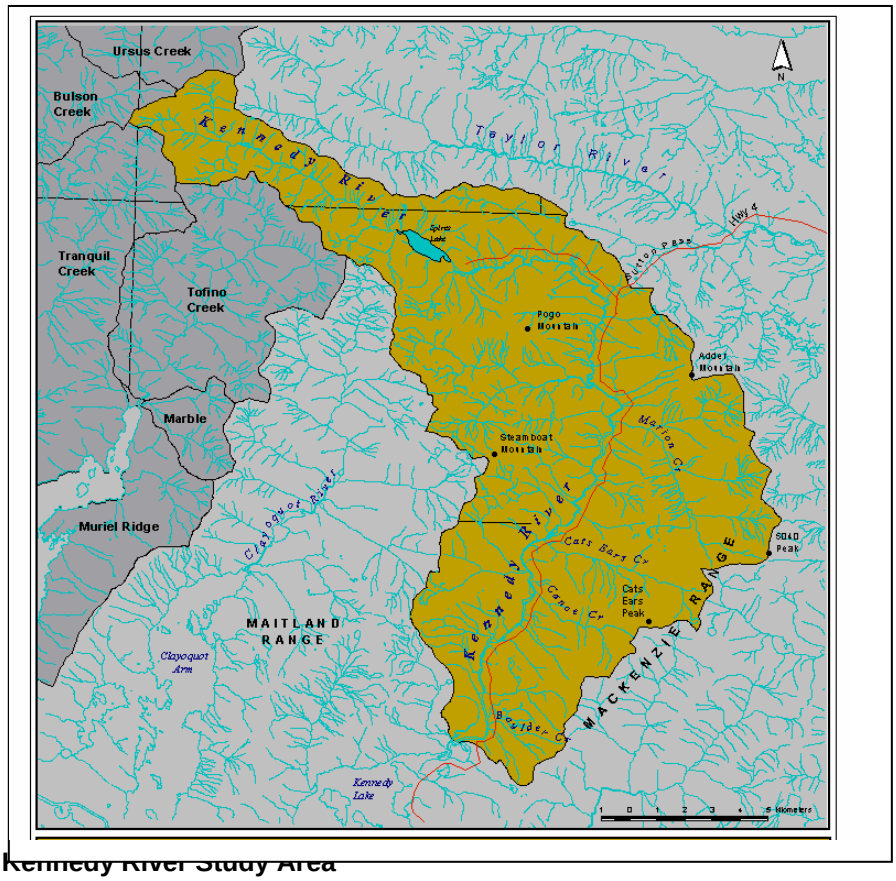



**Figure 9: Kennedy River Study Area**

### *7.2.2 Topography and Drainage*

Kennedy River is the largest watershed in the Clayoquot Sound study area. The river flows in a predominately southwesterly direction from its headwaters to Sutton Pass, where it changes course abruptly to flow in a southerly direction to Kennedy Lake. Slopes are steep and rugged in the upper valley with generally north and south aspects.

South of Sutton Pass, the valley slopes are steep and rugged above the wide floodplain but sections of more gentle, hummocky terrain are found northwest of Adder mountain, between Boulder Creek and Canoe Creek, on the upper slopes west of Marion Creek, and on the west side of the river in the southern portion of the study area. Tributary creeks generally flow in an east or west direction into Kennedy River. The main exception to this is Marion Creek that flows north to join the river. The main valley slopes are generally east and west facing, while tributary valleys' sides have north and south aspects.

The broad floodplain of Kennedy River extends to its upper reaches. Cat's Ear Creek and Marion Creek also have small pockets of floodplain.

One large lake, Spire Lake, occurs in the northern section of the river valley. This lake was formed by a large slope failure that blocked the river. Small lakes are scattered throughout the hummocky terrain in the subalpine. Several of these occur on Clayoquot Plateau. A large lake is located south of Adder Mountain.

### *7.2.3 Biogeoclimatic zones*

There are two biogeoclimatic zones within the Kennedy River study area; the Coastal Western Hemlock (CWH) Zone, and the Mountain Hemlock (MH) Zone. The CWH is represented by the vm1 and vm2 variants and occurs between sea level and 800 m. The MH Zone is represented by the MHmm1 variant, which occurs above 800 m and the mmp1 subzone (parkland) which generally occurs above 1200 m to 1300 m. This zone is continuous along the ridgetops, except in several areas, where elevations drop below 800 m.

### *7.2.4 Ecosystems*

A complete list of ecosystems that have been mapped in the area appears in the ecosystem inventory report and accompanying maps.

Logging is extensive along the floodplain of Kennedy River as far as Spire Lake, beyond which no logging has taken place. In many areas logging extends from floodplain up the valley sides and along major creeks such as Marion Creek and Cat's Ear Creek.

In the CWH, floodplain ecosystems occur along most of Kennedy River. They are also found along Marion Creek, Cat's Ear Creek, and some of the smaller tributaries feeding into Kennedy River. The majority of the high bench sites (SS), once conifer stands, are now herbaceous, shrubby, or very young forests, because of logging. Some patches of old conifer stands are scattered along the river and some of the tributaries. Other more frequently flooded ecosystems (CW) are rare within the study area and are generally found adjacent to gravel bars (GB) on the main river and some tributaries. These shrub dominated units are small and usually mapped in complexes with gravel bars (GB).

Moist, nutrient rich forests (AS) are common adjacent to Kennedy River and tributaries where soils are deep and moisture is abundant. Many of these ecosystems have been logged and are herbaceous or shrubby.

The moist, but nutrient poor, ecosystems (HD) occur on steep north and northwest facing seepage slopes. These forests are scattered throughout the watershed but are most common in the mid portion of the study area.

Bog forests (YG) are common throughout the vm where slopes are gentle to flat and hummocky. These ecosystems generally occur in complexes with the mesic (AB) or drier (HS) ecosystems. Several bog woodland forests (LS) are located within the vm, one of which is mapped in a complex with a treeless bog (SM). The wet but richer skunk cabbage forests (RC) are also mapped within the study area. These forests are infrequent, and several that are located close to Kennedy River have been logged.

The most common wetland mapped in the study area is the sedge dominated fen (SC), which is found where water movement is continuous. Another bog type, sedge dominated wetland (SG), is found near the headwaters of Kennedy River. The rarely mapped crab-apple and red-osier dogwood dominated shrubby wetland (PD) is mapped in several areas near the mouth of the Kennedy River.

Rich mesic forests (AF) are present throughout the study area. They are usually found on colluvial and fluvial fans, on lower slopes of valleys, where soils are deep.

Mesic forests (AB) are the most commonly occurring ecosystem within the vm. They occur on all aspects and elevations. Soils are generally deep, but many of these forests are located on shallow soils, especially at higher elevations.

The subxeric, nutrient rich forests (RS), found rarely in Clayoquot sound, are mapped in several areas in the vm1 in the Kennedy River watershed. One old forest is located on the north facing slope above Cat's Ear Creek and one mature forest is located above the Kennedy River near Sutton Pass. Several logged sites and mature forests are mapped on the western slopes of Kennedy River opposite the mouth of Cat's Ear Creek.

Subxeric forests (HS) are usually found on the upper slopes and in areas where the terrain is hummocky and soils are thin. They are often found in complexes with mesic forests (AB), wet forests (YG) and xeric pine forests (LC). When complexed with dry forests (LC), rock outcrops (RO) are often present.

Shrub dominated avalanche track ecosystems (SA) are found at the heads of valleys in the CWHvm, while herbaceous sites (IF), rarely mapped in Clayoquot Sound, are mapped at the toe of two avalanche tracks.

Several recent slides or slope failures (ES) have occurred in the vm. One very large slope failure is present along the upper reaches of Kennedy River, where the accumulated rock has resulted in the formation of Spire Lake. Older slope failures, vegetated by red alder (AW), are scattered but infrequent.

Two ecosystems that occur in the MH were mapped within the CWH. The moist ecosystem (MT) was field sampled in the CWHvm1 and vm2 on the lower north facing slopes and on some level areas in the upper reaches of Kennedy River. The high percentage of copper bush and mountain hemlock on these sites is similar to those sites found in the MH. In the same area, the xeric site series MM was also sampled and mapped. These units were found primarily on the hummocky terrain on the south side of the river. In this particular area, field sampling crews noted a higher percent cover of mountain hemlock than is usual for the CWH, and it was present on zonal sites (although not high percent cover) down to an elevation of 500 m. Copperbush also was noted to have an unusually high percent cover in the CWH, particularly on poorer sites, where it is often dense.

The MH zone in the Kennedy River watershed is found on most upper slopes. Many of these slopes are extremely steep and rocky, making sampling difficult.

The wet, rich forests (MT) are scattered through the MH. This unit includes three ecosystems: MT (05), MD(06), and YH (07). In this study, these ecosystems occur close together and cannot be separated by air photo interpretation. The subhygric unit, MT, occurs on steep seepage slopes, while the hygric units, MD and YH occur on lower receiving slopes just below MT. All units occur on deep soils.

Wetlands are rare in the MH in this watershed. Four pockets of fen type units (SC) are mapped.

Mesic forests (MB) are the most common ecosystem found in this zone and occur on all aspects and slopes.

Soils are generally deep, but these units are also often found on shallow and very shallow soil.

Rich mesic forests (MO) are scattered throughout, where soils are deep. They are often on colluvial fans and lower slopes near the headwaters of tributaries. Several sites are located on slopes adjacent to small lakes.

Subxeric parkland (MM) and rock (RO) occur near and along ridgetops where soils are very shallow. Terrain is often hummocky.

Krummholtz vegetation (MK) occurs above 1200 m in the MHmmp1 where wind and severe climatic conditions maintain the conifer vegetation in a shrubby form. Mountain heather meadows (MH) occur at these high elevations and are usually in complexes with rock outcrops (RO). Limestone bedrock occurs on Steamboat Mountain and adjacent ridges of Clayoquot Plateau. The ridgetops are sparsely vegetated with scattered herbs and pockets of heath (MH) and krummholtz (MK).

Avalanche track vegetation occurs near the headwaters of creeks. Most avalanche tracks consist of shrubby vegetation (SA), but one slide track at the headwaters of Kennedy River is dominated by herbaceous vegetation (IF) near the toe. This ecosystem has only been recognized in this study area.

Two other new herbaceous ecosystems have been identified. Lush meadows (VS) occur on fluvial fans in the MH zone. These gently sloping fans have a continuous water movement where Indian hellebore, sedges and other moisture loving herbs flourish. Another meadow type with somewhat similar species occurs on steep colluvial slopes at high elevations where snow pack lasts late into the year. These meadows are also lush with flowering herbs and vary in species content, depending on moisture availability.

### *7.2.5 Wildlife Interpretations*

#### *Black Bear*

Overall, early spring feeding habitat is limiting in the area, with low to very low habitat values prevailing (see Figure 10). However, some moderately high and high rated units are present within the CWHvm subzone and include SA (shrubby vegetated slide tracks), forested units AS 3, 6 & 7. The sedge dominated fen units (SC) are also rated high value, and some are located north of Spire Lake. At field plot 3H31, SC habitat was confirmed to be of high suitability for feeding in the spring and summer, with rushes, sedges, Sitka burnet, heather, cottongrass, some skunk cabbage, and small open water holes present. Feeding sign was observed in the plot with dug up skunk cabbage and sedge, and a high number of bear tracks.

Floodplain unit (SS) also rates high for this season as well as for summer and fall for feeding and security habitat. These units are located along the Kennedy River drainage and are often present as complexes of stage 3 and 6 or as pure stage 7 stands, but are small in size and limited in the study area.

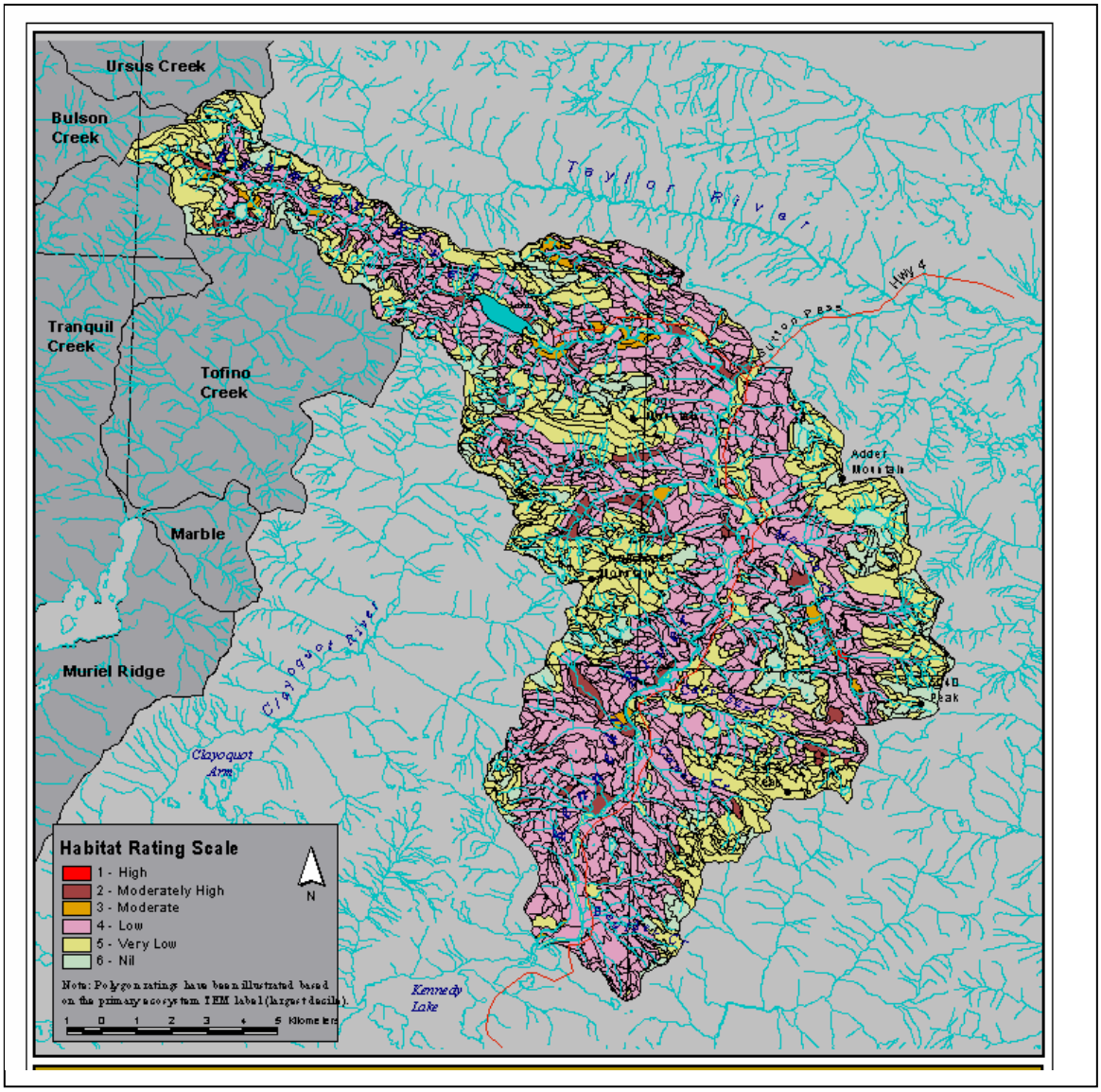



**Figure 10: Potential Early Spring Habitat for Black Bear (Kennedy River)**

Spring habitat is also limited in the area. As in the early spring, the best habitat is located along the riparian zones and floodplain units of Kennedy River and its tributaries. Marion Creek has moderate to high rated habitats along most of it, in the form of AS, SS and AF units. These moist, highly productive sites are important yearlong for feeding and security. During fieldwork, swamp forest (RC) stage 7 units were also noted as having good spring suitability, with extensive patches of skunk cabbage, *Vaccinium* spp., salmonberry, deer fern and grasses available for feeding (e.g. G3J62). The slide track (SA) units of the upper reaches of the tributaries increase in value in the spring to high. Evidence of use was frequently recorded during transects through this habitat type (scat, trails, and feeding sign).

Appropriate summer feeding and security habitat are common throughout the area and are therefore probably not limiting for bear use of the area during this season. Habitat distribution maps (reviewed in ArcView 3.1) indicate that the best summer habitat is present

along the river and creek valley bottoms (AS, SS and AF units) as in the spring. However, moderately high value habitat is plentiful at all elevations, subzones and variants.

The mesic stands of the vh and vm subzones (AB6 and 7, and HS6 and 7) provide ample moderately high values for the summer and fall. Feeding values were rated highest for the summer and fall, when salal berries would be present. Generally, HS7 units in the vm1 contain many salal bushes with berries for summer and fall feeding. This was especially evident and noted at warm aspect sites during fieldwork (e.g. G3J95). However, fieldwork was conducted in late summer and early fall. It is possible that cool aspect slopes supporting good berry crops become increasingly important to bears as fall progresses. At site G3J100 in the vm1, AB7 was confirmed to be of high (1) suitability for P, S and F for security habitat.

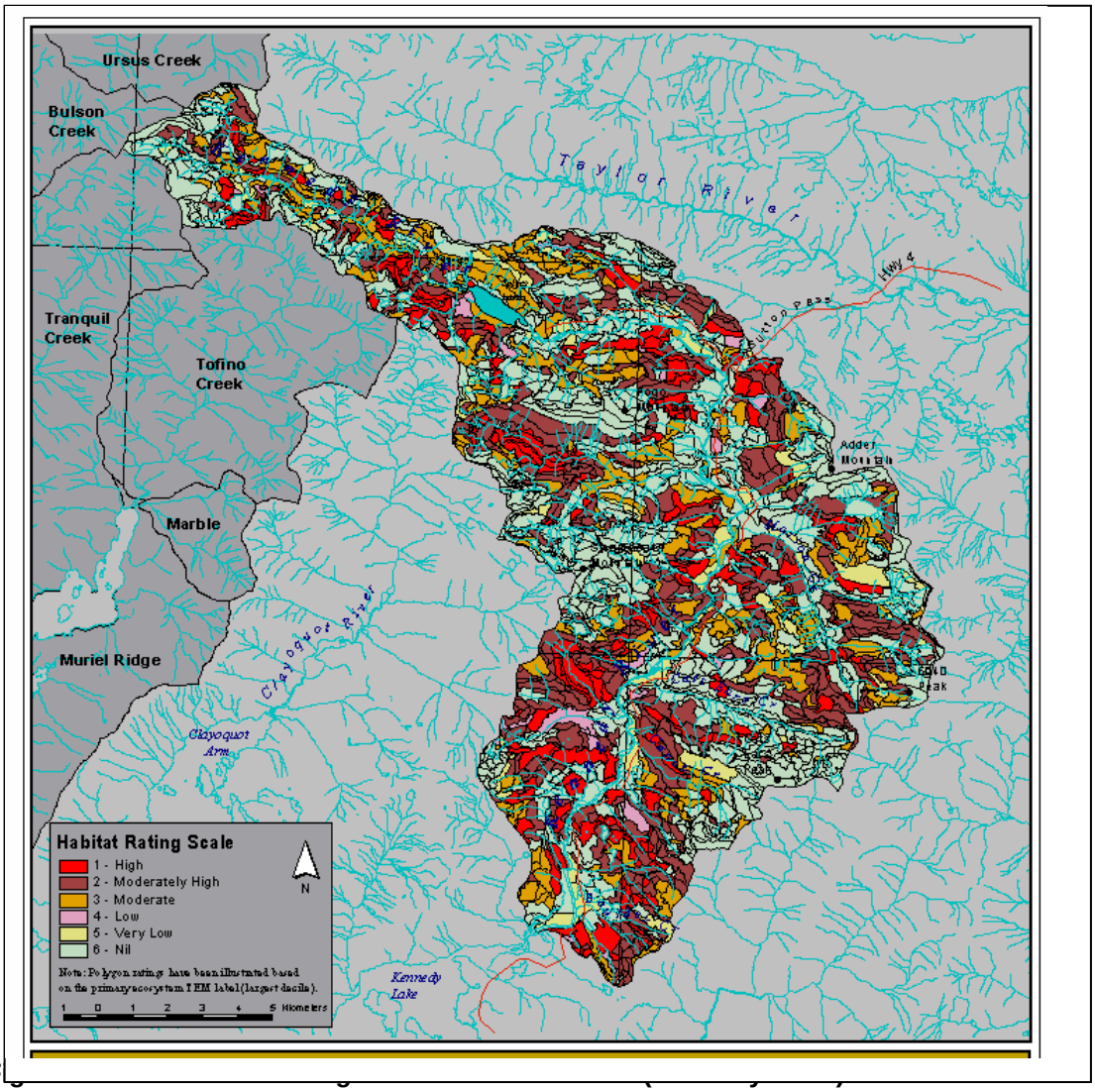
Security habitat adjacent to riparian zones becomes of increasing importance in the fall, during salmon runs, for visual cover from other animals during feeding. Such habitat is present along much of Kennedy River. Gravel bars (GB) are also utilized during the spawning season to feed on the salmon. Evidence of this use was observed in the field, with fresh bear scat located on gravel bars. At the time of fieldwork, the salmon were just starting to spawn and bear scat still consisted mainly of salal berries.

Moderate to high suitability denning habitat is available in the Kennedy River drainage (see Figure 11). The HS and AF stage 7 stands in the vm are of high potential for use by bears in the winter for hibernation. AB7 was confirmed to be of moderately high denning value in the field at site G3J100 in the vm1. One well used possible denning site (observation during transect, near V3T31) was found in a hemlock tree approximately +1.5m dbh, located in an AF stage 7 stand in the vm2. The entrance to the tree was located approximately 2.5 metres off the ground and had claw marks up the tree to a well-sheltered hollow.

Evidence of use for the summer and fall was especially high in the upper elevation MH zone. A number of small lakes are located in this zone in the area and were noted as of high use by bears and deer. Bear scat containing berries, and others consisting mainly of grass, were present. At V3J63 (a wetland site SM) an extremely well traveled bear trail was noted, with well worn individual foot placement impressions. The trail led from wetland to wetland through the forest and shrubby sites. In the wetland areas, skunk cabbage had been dug up and claw marks were visible in the mud. At site G3H15 in the mmp1, an Arctic lupine – Subalpine daisy (LD) unit was noted of moderately high suitability for spring and summer feeding for bear. At this site adult summer scat was present that indicated feeding on *Vaccinium deliciosum*, with numerous undigested berries and leaves of this species.

Bears were seen on four occasions from the helicopter: one in the MHmm1 subzone (V3B180 - terrain plot), 1 adult was seen foraging on salal berries and travelling through a mesic clearcut (V3H-61 in the vm1), two bears were seen from the helicopter in mature, upper elevation mm1 forest (V3H-65), another was seen walking across rocks by the river at plot G3J-23 in the vm1.

Human and bear interactions are likely to occur frequently in the fall along the highway, which runs north to south through the centre of the study area along Kennedy River, as bears try to access the spawning salmon. One bear mortality was found in the ditch of the highway (approximately 100m from the river) (site G3J101 in the vm1, map unit AB7).


Ursus Creek
Bulson Creek
Tranquil Creek
Tofino Creek
Marble
Muriel Ridge
Taylor River
Hwy 4
Clayoquot River
Clayoquot Arm
Kennedy Lake
Habitat Rating Scale
1 - High
2 - Moderately High
3 - Moderate
4 - Low
5 - Very Low
6 - Nil
N
Note: Polygon ratings have been illustrated based on the primary ecosystem FHM label (largest decile).
0 1 2 3 4 5 Kilometers

**F**

### *Black-tailed Deer*

Overall, the Kennedy River area has moderate spring values for deer, mainly in the numerous AB, and HS stage 3, 6 and 7 stands of the CWHvm subzone. Moderately high habitat is limited, occurring in dispersed AF and AS stage 3, 6 and 7 stands. The SS floodplain units of stage 7 are rated moderately high to high for feeding during the spring, as rich herbs and shrubs are present. These sites are limited in extent in the study area. The MH zone has very low to nil values for deer in the spring due to snowpack and delayed phenology of vegetation in the higher elevations. In the summer and early fall, when lush herbaceous vegetation is at its prime, some of these same sites will increase in value for feeding.

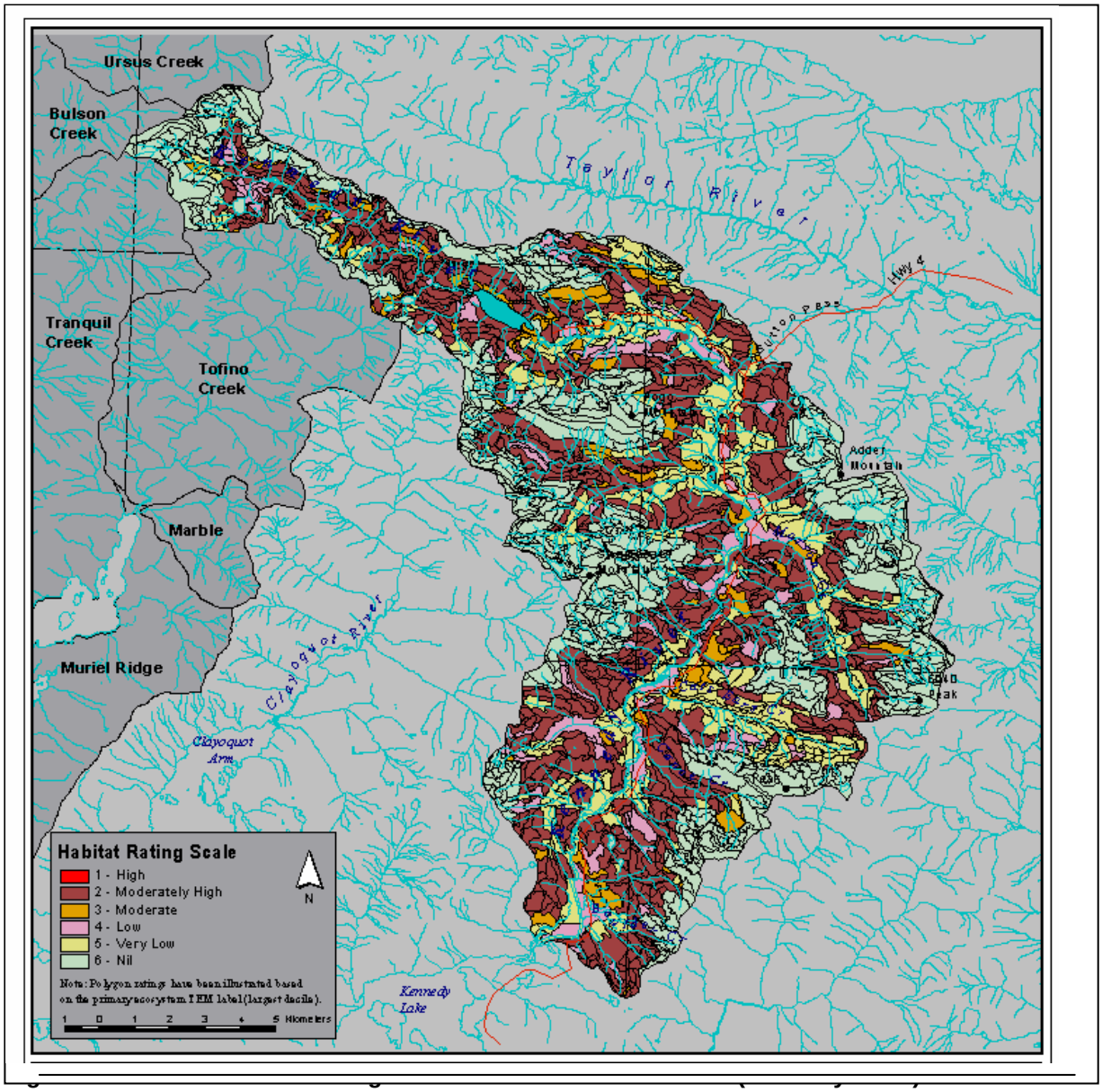
Moderate to moderately high summer habitat is widespread as mesic units of the vm subzone (e.g. AB stage 3 rated moderately high and AB stage 7 of moderate suitability) and is likely not limiting for deer use in the area. The herbaceous meadows in the higher elevation MH subzone sites also contain excellent feeding values for deer during the summer and early fall. Browse (probably deer) was noted on lupine, arnica and others. Feeding values were especially high in the wet meadow units with heavy browse recorded on the lush herbaceous vegetation. During work in this area a doe was seen from the helicopter, in mature, upper elevation forest (MHmm1) near site V3LV-1.

Overall, fall habitat is moderate, with moderately high rated polygons (e.g. AB3) dispersed throughout.

Winter habitat is predominately of moderately high (2) suitability in the lower elevation subzones, and of limited suitability in the higher elevation MH subzones due to snowpack (see Figure 12). AB and HS6 and 7 units provide important winter range habitat requirements for deer in the study area. These units are most suitable where located on warm aspect slopes to maximize thermal benefits. Winter range values are also highest in the vm1, where temperatures are warmer and therefore snowpack is lower than at higher elevations.

Values are quite high for all seasons along the southern end of the study area in the vm1 flatlands, where Kennedy River empties into Kennedy Lake. In this southern area, the rare shrubby crabapple and red-osier dogwood unit (PD) has been mapped. These sites were rated high for deer use, and values were confirmed in the field at plots E3H111 and 101, where high evidence of use was noted. The crab-apple trees had been debarked around many of their bases, well-worn trails and fresh and old pellets were present. Adjacent to this site was a buckbean/pond site, which also was receiving high use by deer, with numerous buckbean plants browsed along the edge of the pond (a back channel of Kennedy River). In addition to sign, a deer was seen from the helicopter before landing at an adjacent site. The mixture of sedge meadows (SD), shallow open water/buckbean (OW/BS), crabapple (PD) and floodplain (SS) units in this area make it of high suitability for deer throughout the growing season.

Evidence of use was considered to be moderate to high for deer in this study area. Game trails were present through many of the mature forest stands (e.g. AB7, YG7) as well as the wetlands (e.g. SC2b). Browse was noted on many plant species (noted numerous times on deer cabbage), and scat was often present at TEM plots. Evidence of use appeared quite high in the mmp subzone, as expected during the time of year that fieldwork was completed (late summer, early fall).


Ursus Creek
Bulson Creek
Tranquil Creek
Tofino Creek
Marble
Muriel Ridge
Taylor River
Hwy 4
Adder Mountain
Clayoquot River
Clayoquot Arm
Kennedy Lake
Habitat Rating Scale
1 - High
2 - Moderately High
3 - Moderate
4 - Low
5 - Very Low
6 - Nil
N
Note: Polygon ratings have been illustrated based on the primary ecosystem TEM label (largest decile).
1 0 1 2 3 4 5 Kilometers

### *Roosevelt Elk*

Spring habitat for elk is limited in this study area, with predominately low to very low values interspersed with some moderately high and high sites (see Figure 13). Very few high rated polygons are present, but some do occur along the floodplains of the Kennedy River and tributaries such as Marion Creek. AS stage 7 units are also of high value in the spring and are present to a limited extent within the vm subzone. At site 3H31 in the vm1, SC stage 2b was rated 2 for spring suitability for elk, as these wetlands contain a mixture of important food species such as rushes, sedges, and Sitka burnet.

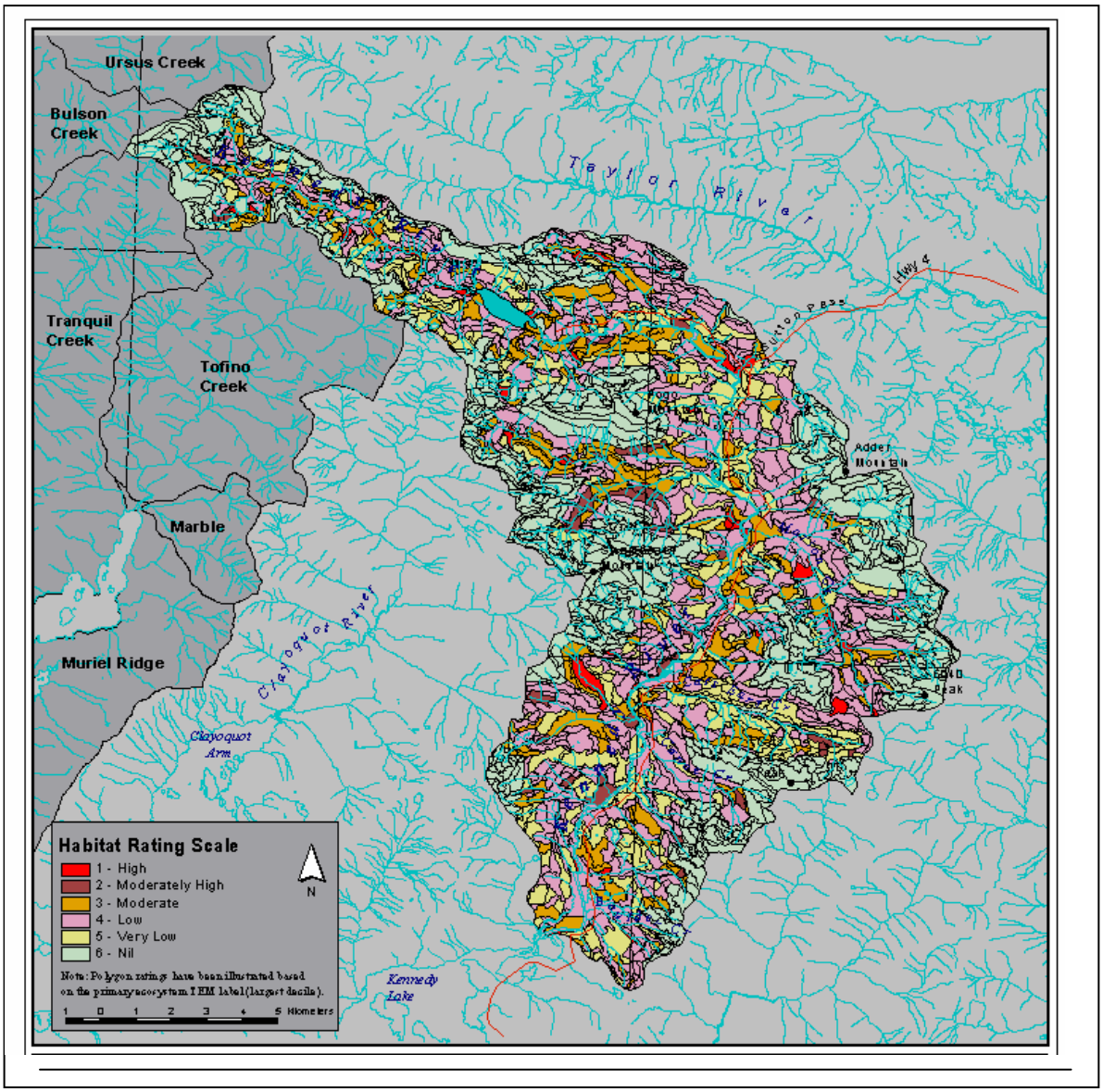



**Figure 13: Potential Spring Habitat for Roosevelt Elk (Kennedy River)**

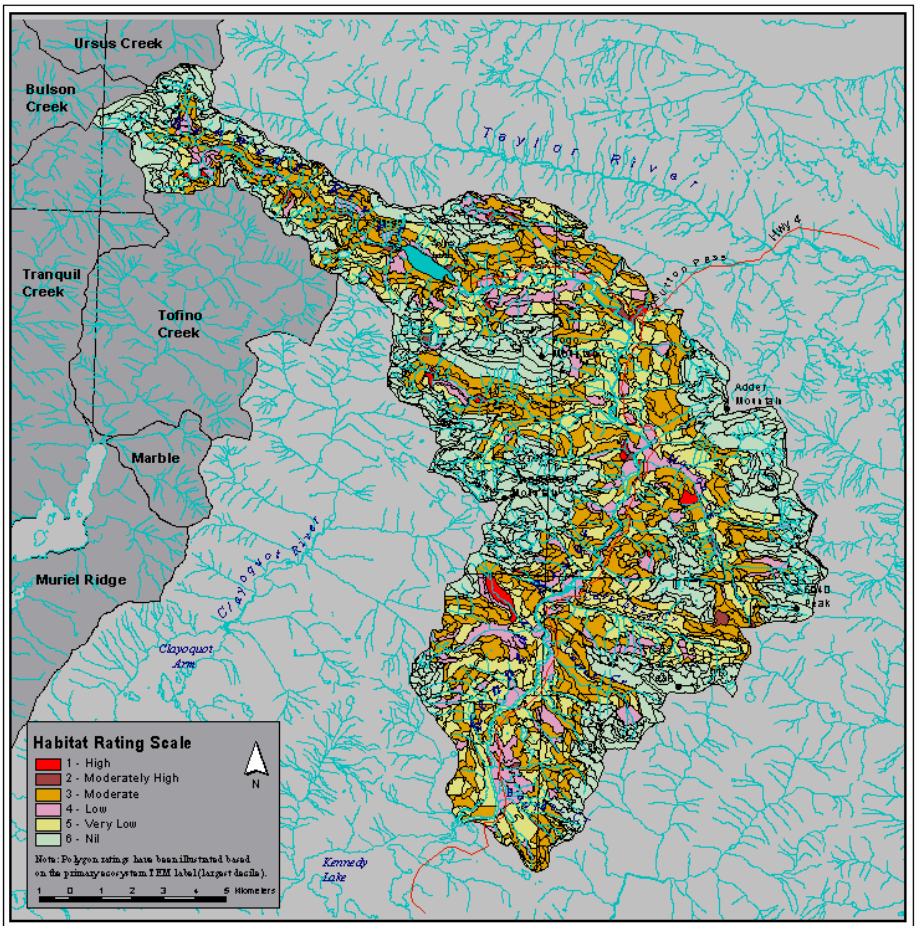
Moderate summer habitat is abundant, with occasional sites of high suitability. The vegetated slide unit (SA) stage 3 in the mm1, and the AS and SS forested units of stage 6 and 7 in the vm1 are rated high for summer suitability for feeding and security habitat. The floodplain units (SS) was confirmed to be of moderately high to high suitability for elk throughout the year (e.g. G3H110 vm1 SS3 and G3J110 vm1 SS7) with important forage of rich herbs and shrubs (e.g. salmonberry, fireweed, thimbleberry).

In the fall, habitat is predominately moderate as with the summertime. Values vary little between the summer and fall seasons for elk habitat. The willows and alders of CW stage 3 units provide good forage for elk during the fall and winter (e.g. G3J106 vm1).

During the winter, the area consists mainly of low to moderate elk habitat (see Figure 14). The units rated highest in the area for elk during the winter include the AS 6 and 7 in the vm1. One fairly continuous length of this unit, that is located along Kennedy River north of Spire Lake, along with SS stage 6, is very suitable winter range for elk.

Moderate value mesic AB 6 and 7 stage forested units are available throughout the vm subzone. Where these units are located in complexes or adjacent to warm aspect rock outcrops, their value will generally increase (typically by one rating).

No elk sign was observed during fieldwork in this watershed.




**Figu**

### *Bald Eagle*

Moderate to high nesting habitat for eagles is widely distributed in the Kennedy River study area (see Figure 15). However, much of the area is located in the MH zone, which is of low to no value during the majority of the year. As well, although suitable nesting trees do occur, they are not located in proximity to feeding sources (a limiting life requisite for this area) and would have little likelihood of use. In reality, it should be noted that distance buffers need to be placed along the larger river and lake areas to further delineate suitable nesting habitats. Adjustments to the habitat ratings outside of these zones should then be made, reducing habitat values as the distance from feeding sources increases.

The southern end of the area is considered to have the best nesting habitat suitability in the area, as it is located adjacent to prime feeding sources (Kennedy River and Lake), especially during salmon spawning in the fall. Two nests were observed in this portion of the study area. Both were in large spruce trees in SS units. Both sites had been logged and are now occupied by deciduous stands, within which the isolated spruce nest trees remain. One of the nests was located on the alluvial flats of Kennedy River, where it exits Kennedy Lake (seen from E3H111). The nest was inspected from a helicopter, to determine activity status, which was confirmed to be inactive (i.e. plants were growing out of the nest base). The other nest was located upstream, and appeared to have been used more recently, with less vegetative growth on the nest base. Nests were not found in any other sampling plots, nor during transects between plots.

Many other large trees and snags potentially ideal for nesting were located along the river. These large trees will also be utilized in the fall, by eagles perching to rest, preen, or hunt during the spawning season. However, the majority of the study area is too far removed from good eagle feeding habitats to provide the best nesting sites. For example while the AB6 and 7 units are rated moderate for nesting, sites are often located a fair distance from the nearest feeding sources. Consequently, when placed in the context of the surroundings, the suitability of many of the sites is in reality is very low to nil. This needs to be accommodated in our model and maps through the addition of distance buffers.

Eagle sign was observed during fall fieldwork along the river on a gravel bar with alders and willows present. Whitewash and eagle feathers (primary and breast) were located under one of the larger alder tree branches (G3J106). Eagles were also observed flying along the river.

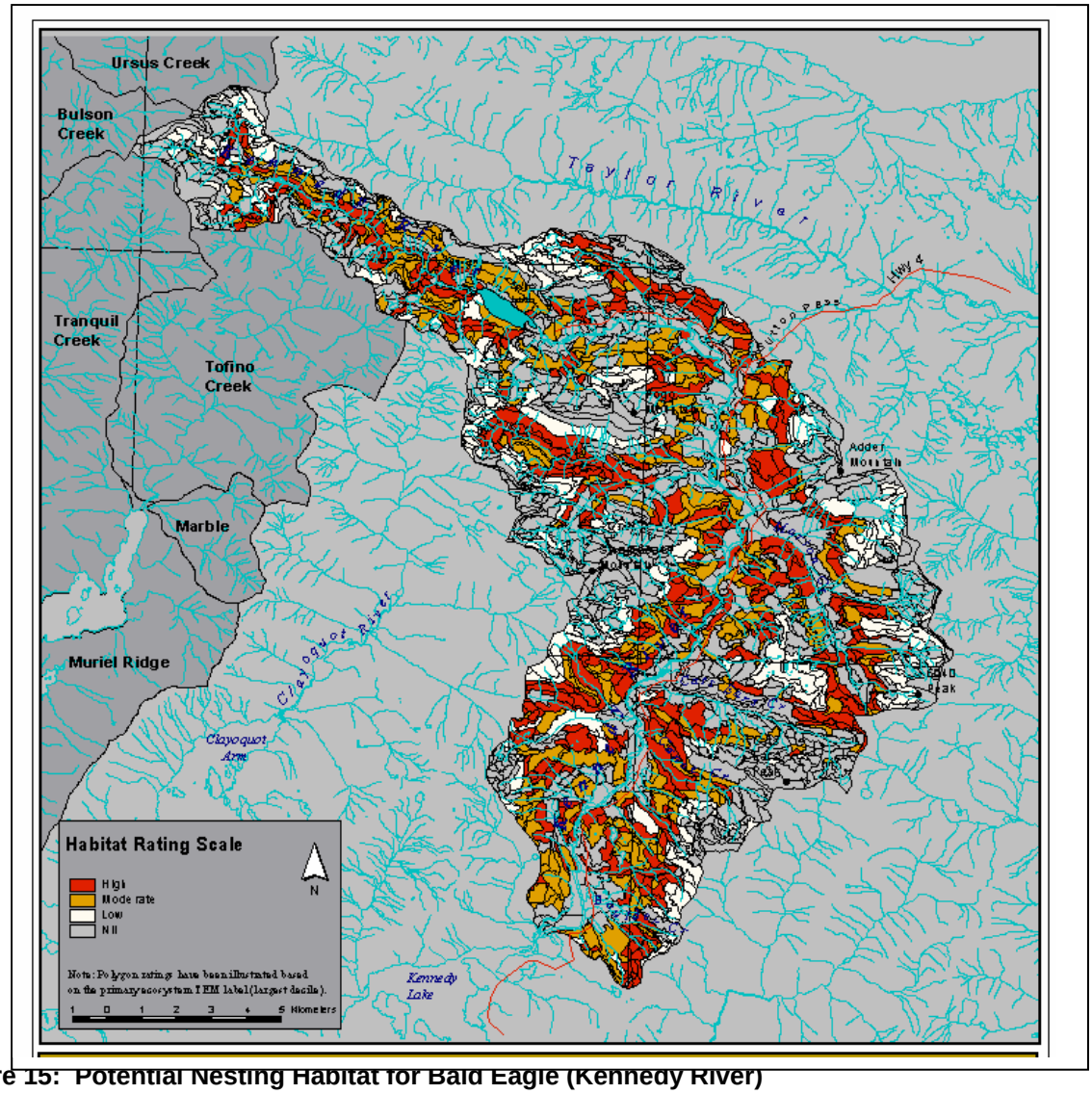



**Figure 15: Potential Nesting Habitat for Bald Eagle (Kennedy River)**

### *Marbled Murrelet*

Marbled Murrelet habitat appears to be plentiful throughout much of the study area (see Figure 16). There are many sites along the valley bottoms of the watershed and along Kennedy River itself that still contain old growth stands with large cedar and hemlock trees. The YG stage 7 unit was rated of good nesting potential in the field (3J44 in the vm2 YG7). At site G3J110 in the vm1 subzone, an SS stage 7 site was rated moderately high for nesting and contained some of the largest cedar trees of any sites visited (ave dbh of 1.5 with some trees to 3m dbh). Another SS stage 7 stand was rated moderately high for nesting in the vm1 at site G3J110. At site G3J091 and G3J91, also in the vm1, AB stage 7 stands were rated moderately high for nesting. Good epiphyte cover was present on the Western hemlock branches, with decent platforms noted (polygon was a mix of AB and AF). AB stage 6 stands were also rated moderately high for nesting at site E3J087.

Very high quality habitat was confirmed during fieldwork (e.g. V3T31 in AF7 stand with cedar trees over 2m dbh). High value murrelet habitat was also noted at terrain plot V3P71 along upper Kennedy River, west of Spire/Snag Lake. MELP radar count surveys were conducted in the Kennedy River drainage in 1998. Marbled Murrelets were recorded in the area, using the river as a travel corridor into the area and up to the Taylor River in the Port Alberni area (Natalie Denis pers. comm. – radar survey crew 1998).

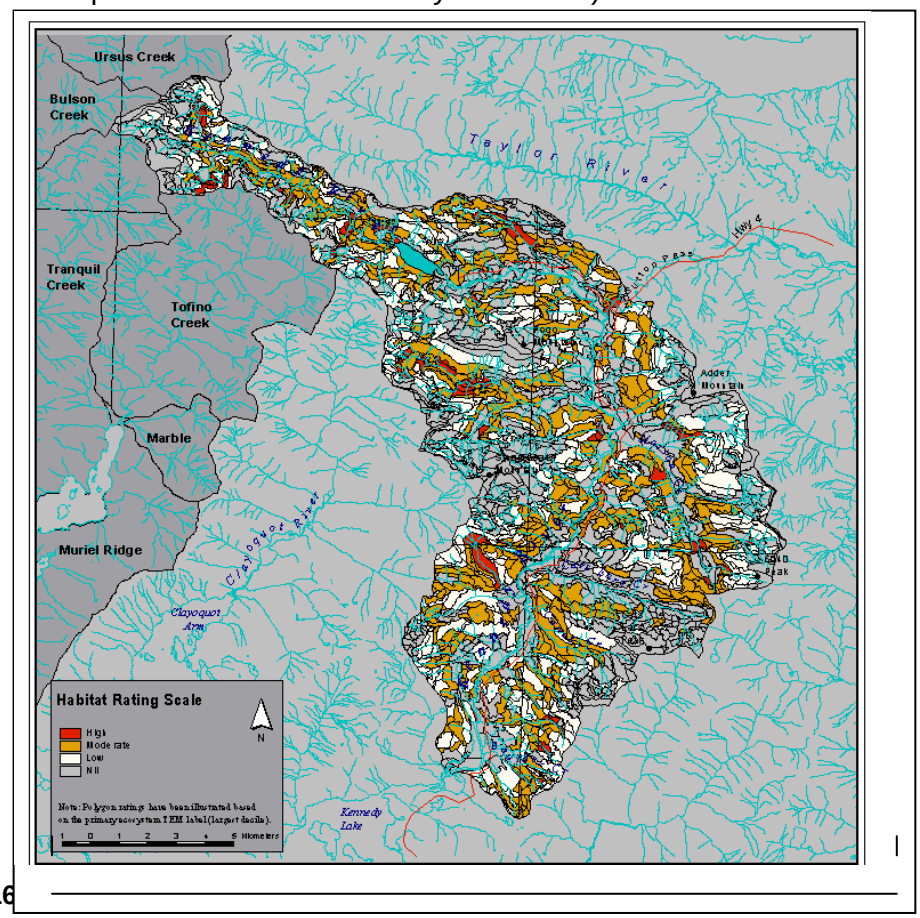



**Figure 16**

### *Non-focal Wildlife Observations (Red and Blue Listed Species)*

A Peregrine Falcon (red-listed) was seen at V3M82 during the terrain field verification program. It was observed eating a small bird, while perched on top of a snag located at the north end of Spire Lake. Good nesting cliff habitat was noted as being present nearby—the upper reaches of Kennedy River, northeast of Spire Lake. Clearly, Peregrine Falcons do utilize portions of this watershed, and there is potential for nesting as well.


# APPENDICES


# Appendix I

## Conservation Data Centre Rare Vertebrate Tracking List for the Port Alberni Section of the Southern Vancouver Island Forest District

| SCIENTIFIC NAME | COMMON NAME | GLOBAL RANK | PROVINCIAL RANK | PROVINCIAL LIST |
|---|---|---|---|---|
| **BIRDS** | | | | |
| ACCIPITER GENTILIS LAING SUBSPECIES | NORTHERN GOSHAWK, LAINGI | G5T2 | S2B,SZN | RED |
| ARDEA HERODIAS | GREAT BLUE HERON | G5 | S3B,SZN | BLUE |
| ASIO FLAMMEUS | SHORT-EARED OWL | G5 | S2N,S3B | BLUE |
| BOTAURUS LENTIGINOSUS | AMERICAN BITTERN | G4 | S3B,SZN | BLUE |
| BRACHYRAMPHUS MARMORATUS | MARBLED MURRELET | G3G4 | S2B,SZN | RED |
| BRANTA BERNICLA | BRANT | G5 | S3N | YELLOW |
| BUTORIDES VIRESCENS | GREEN HERON | G5 | S3S4B,SZN | BLUE |
| CERORHINCA MONOCERATA | RHINOCEROS AUKLET | G5 | S4B,SZN | YELLOW |
| FALCO PEREGRINUS PEALEI SUBSPECIES | PEREGRINE FALCON, PEALEI | G4T3 | S3B,SZN | BLUE |
| FRATERCULA CIRRHATA | TUFTED PUFFIN | G5 | S3B,SZN | BLUE |
| GLAUCIDIUM GNOMA SWARTHI | VANCOUVER ISLAND PYGMY-OWL | G5T3Q | S3 | BLUE |
| HALIAEETUS LEUCOCEPHALUS | BALD EAGLE | G4 | S4 | YELLOW |
| HISTRIONICUS HISTRIONICUS | HARLEQUIN DUCK | G4 | S3N,S4B | YELLOW |
| LAGOPUS LEUCURUS SAXATILIS SAXATILIS SUBSPECIES | WHITE-TAILED PTARMIGAN, | G5T3 | S3 | BLUE |
| MELANITTA PERSPICILLATA | SURF SCOTER | G5 | S3B,SZN | BLUE |
| OTUS KENNICOTTII SATURATUS SUBSPECIES | WESTERN SCREECH-OWL, SATURATUS | G? | S3 | BLUE |
| PHALACROCORAX AURITUS | DOUBLE-CRESTED CORMORANT | G5 | S2S3B,SZN | BLUE |
| PHALACROCORAX PENICILLATUS | BRANDT'S CORMORANT | G5 | S1B,S4N | RED |
| PINICOLA ENUCLEATOR CARLOTTAE SUBSPECIES | PINE GROSBEAK, CARLOTTAE | G5T3T4 | S3S4B,SZN | BLUE |
| POOECETES GRAMINEUS AFFINIS SUBSPECIES | VESPER SPARROW, AFFINIS | G5T3 | S1B | RED |
| PROGNE SUBIS | PURPLE MARTIN | G5 | S2B | RED |
| PTYCHORAMPHUS ALEUTICUS | CASSIN'S AUKLET | G4 | S3B,SZN | BLUE |
| TYTO ALBA | BARN OWL | G5 | S3 | BLUE |
| URIA AALGE | COMMON MURRE | G5 | S2B,SZN | RED |
| **FRESHWATER FISH** | | | | |
| GASTEROSTEUS SP 2 | ENOS LAKE LIMNETIC STICKLEBACK | G1 | S1 | RED |
| GASTEROSTEUS SP 3 | ENOS LAKE BENTHIC STICKLEBACK | G1 | S1 | RED |

| SCIENTIFIC NAME | COMMON NAME | GLOBAL RANK | PROVINCIAL RANK | PROVINCIAL LIST |
|---|---|---|---|---|
| **MAMMALS** | | | | |
| BALAENOPTERA ACUTOROSTRATA | MINKE WHALE | G5 | S3N | N/A |
| CERVUS ELAPHUS ROOSEVELTI | ROOSEVELT ELK | G5T4 | S2S3 | BLUE |
| CORYNORHINUS TOWNSENDII | TOWNSEND'S BIG-EARED BAT | G4 | S2S3 | BLUE |
| ENHYDRA LUTRIS | SEA OTTER | G4 | S2 | RED |
| ESCHRICHTIUS ROBUSTUS | GRAY WHALE | G3G4 | S2N | N/A |
| EUMETOPIAS JUBATUS | NORTHERN SEA LION | G3 | S2B,S3N | RED |
| GULO GULO VANCOUVERENSIS | WOLVERINE, VANCOUVERENSIS | G4T1 | S1 | RED |
| SUBSPECIES | | | | |
| MARMOTA VANCOUVERENSIS | VANCOUVER ISLAND MARMOT | G1G2 | S1 | RED |
| MEGAPTERA NOVAEANGLIAE | HUMPBACK WHALE | G3 | S1N | N/A |
| MUSTELA ERMINEA ANGUINAE | VANCOUVER ISLAND ERMINE | G5T3 | S3 | BLUE |
| MYOTIS KEENI | KEEN'S LONG-EARED MYOTIS | G2G3 | S1S3 | RED |
| ORCINUS ORCA RESIDENT ECOTYPE | ORCA, RESIDENT ECOTYPE | G4G5T3Q | S3 | BLUE |
| ORCINUS ORCA TRANSIENT ECOTYPE | ORCA TRANSIENT ECOTYPE | G4G5T4Q | S3 | BLUE |
| ORCINUS ORCA OFFSHORE ECOTYPE | ORCA OFFSHORE ECOTYPE | G4G5TUQ | S3 | BLUE |
| SOREX PALUSTRIS BROOKSI | VANCOUVER ISLAND WATER SHREW | G5T2 | S2 | RED |
| **REPTILES** | | | | |
| CHRYSEMYS PICTA | PAINTED TURTLE | G5 | S3S4 | BLUE |
| DERMOCHELYS CORIACEA | LEATHERBACK | G3 | S1S2N | N/A |

**41 TAXA LISTED**


# Appendix II

## Wildlife Species Observed During Fieldwork in the Clayoquot Year Three Study Areas

## Appendix II: Wildlife Species Observed During Fieldwork in the Clayoquot Year Three Study Areas

(The list of both common and scientific names and their sequence follows Cannings and Harcombe, 1990)

| Species Code | Common Name | Scientific Name | B.C. Status |
|---|---|---|---|
| ***AMPHIBIANS*** | | | |
| A-PLVE | Red-backed Salamander | *Plethodon vehiculum* | Yellow |
| A-AMGR | Northwestern Salamander | *Ambystoma gracile* | Yellow |
| A-HYRE | Pacific Treefrog | *Hyla regilla* | Yellow |
| A-RAAU | Red-legged Frog | *Rana aurora* | Yellow |
| A-BUBO | Western Toad | *Bufo boreas* | Yellow |
| ***REPTILES*** | | | |
| R-EUSK | Western Skink | *Eumeces skiltonianus* | Yellow |
| R-GECO | Northern Alligator Lizard | *Gerrhonotus coeruleus* | Yellow |
| R-THEL | Western Garter Snake | *Thamnophis elegans* | Yellow |
| R-USNA | Garter Snake | *Thamnophis spp.* | Yellow |
| ***BIRDS*** | | | |
| *Diurnal Birds of Prey* | | | |
| B-BAEA | Bald Eagle | *Haliaeetus leucocephalus* | Yellow |
| B-NOHA | Northern Harrier | *Circus cyaneus* | Yellow |
| B-SSHA | Sharp-shinned Hawk | *Accipiter striatus* | Yellow |
| B-RTHA | Red-tailed Hawk | *Buteo jamaicensis* | Yellow |
| B-AMKE | American Kestrel | *Falco sparverius* | Yellow |
| B-PEFA | Peregrine Falcon | *Falco peregrinus* | *Red |
| *Upland Game Birds* | | | |
| B-BLGR | Blue Grouse | *Dendragapus obscurus* | Yellow |
| B-RUGR | Ruffed Grouse | *Bonasa umbellus* | Yellow |
| B-UPTA | Unidentified ptarmigan | *Lagopus spp.* | Yellow |
| *Shorebirds, Gulls, Awks and Allies* | | | |
| B-GWGU | Glaucous-winged Gull | *Larus glaucescens* | Yellow |
| *Pigeons* | | | |
| B-BTPI | Band-tailed Pigeon | *Columba fasciata* | Yellow |
| *Owls* | | | |
| B-NSWO | Northern Saw-whet Owl | *Aegolius acadicus* | Yellow |
| B-WSOW | Western Screech Owl | *Otus kennicottii* | Yellow |
| *Kingfishers* | | | |
| B-BEKI | Belted Kingfisher | *Ceryle alcyon* | Yellow |
| *Woodpeckers* | | | |
| B-RBSA | Red-breasted Sapsucker | *Sphyrapicus ruber* | Yellow |
| B-HAWO | Hairy Woodpecker | *Picoides villosus* | Yellow |
| B-NOFL | Northern Flicker | *Colaptes auratus* | Yellow |
| B-UWOO | Unidentified Woodpecker | | Yellow |
| B-PIWO | Pileated Woodpecker | *Dryocopus pileatus* | Yellow |

| | Species Code | Common Name | Scientific Name | B.C. Status |
|---|---|---|---|---|
| *Passerine birds* | | | | |
| | B-GRJA | Gray Jay | *Perisoreus canadensis* | Yellow |
| | B-STJA | Steller's Jay | *Cyanocitta stelleri* | Yellow |
| | B-NOCR | Northwestern Crow | *Corvus caurinus* | Yellow |
| | B-CORA | Common Raven | *Corvus corax* | Yellow |
| | B-CBCH | Chestnut-backed Chickadee | *Parus rufescens* | Yellow |
| | B-RBNU | Red-breasted Nuthatch | *Sitta canadensis* | Yellow |
| | B-BRCR | Brown Creeper | *Certhia americana* | Yellow |
| | B-WIWR | Winter Wren | *Troglodytes troglodytes* | Yellow |
| | B-AMDI | American Dipper | *Cinclus mexicanus* | Yellow |
| | B-GCKI | Golden-crowned Kinglet | *Regulus satrapa* | Yellow |
| | B-RCKI | Ruby-crowned Kinglet | *Regulus calendula* | Yellow |
| | B-HETH | Hermit Thrush | *Catharus guttatus* | Yellow |
| | B-AMRO | American Robin | *Turdus migratorius* | Yellow |
| | B-VATH | Varied Thrush | *Ixoreus naevius* | Yellow |
| | B-WETA | Western Tanager | *Piranga ludoviciana* | Yellow |
| | B-SPTO | Spotted Towhee | *Pipilo erythrophthalmus* | Yellow |
| | B-FOSP | Fox Sparrow | *Passerella iliaca* | Yellow |
| | B-SOSP | Song Sparrow | *Melospiza melodia* | Yellow |
| | B-GCSP | Golden-crowned Sparrow | *Zonotrichia atricapilla* | Yellow |
| | B-DEJU | Dark-eyed Junco | *Junco hyemalis* | Yellow |
| | B-PISI | Pine Siskin | *Carduelis pinus* | Yellow |
| ***MAMMALS*** | | | | |
| | M-TAHU | Red Squirrel | *Tamiasciurus hudsonicus* | Yellow |
| | M-CALU | Gray Wolf | *Canis lupus* | Yellow |
| | M-LOCA | River Otter | *Lontra canadensis* | Yellow |
| | M-MAAM | Marten | *Martes americana* | Yellow |
| | M-URAM | Black Bear | *Ursus americanus* | Yellow |
| | M-ODHC | Black-tailed Deer | *Odocoileus hemionus columbianus* | Yellow |

Yellow status is assigned to any indigenous species or subspecies (taxa) which is not at risk in B.C. The CDC tracks some Yellow listed taxa which are vulnerable during times of seasonal concentration (e.g., breeding colonies).

*Associated rank refers to breeding occurrences, which was not the case with this observation – bird was seen feeding on prey (small bird) on top of a snag.

Reference:

Cannings, R.A. and A.P. Harcombe (eds.) 1990. The Vertebrates of British Columbia: Scientific and English Names. Royal British Columbia Museum Heritage Record No. 20; Wildlife Report No. R24. Ministry of Municipal Affairs, Recreation and Culture and Ministry of Enviroment. Victoria, B.C., 116 pp.


# Appendix III

## Final Habitat Ratings Tables

## Appendix III: Final Habitat Ratings Tables

This appendix provides habitat ratings for each mapped ecosystem within the Clayoquot Year Three study areas. Suitability ratings are provided for each of the rated seasons for the five project species. Definitions for the codes used in the final ratings table are provided in Table A1.

### Table A1: Legend for Wildlife Capability and Suitability Ratings

Species Codes

| | |
|---|---|
| BBAEA | Bald Eagle |
| BMAMU | Marbled Murrelet |
| MURAM | black bear |
| MODHC | black-tailed deer |
| MCEEL | Roosevelt elk |

Life Requisites

| | |
|---|---|
| HI | hibernating |
| RE | reproducing (eggs) |

(where no life requisite is given, living is the default)

Seasons

| | |
|---|---|
| PE | early spring |
| P | spring |
| S | summer |
| F | fall |
| W | winter |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vh | 1 | | HS | 3 | | | N | N | 4 | 3 | 2 | 2 | 6 | 3 | 2 | 3 | 4 | 4 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | HS | 3 | b | | N | N | 4 | 3 | 2 | 2 | 6 | 3 | 2 | 3 | 4 | 4 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | HS | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | HS | 5 | | | N | N | 5 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | HS | 6 | | | L | M | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 2 | 4 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | HS | 7 | | | M | M | 4 | 4 | 3 | 3 | 1 | 4 | 3 | 4 | 2 | 4 | 4 | 4 | 3 |
| WIM | CWH | vh | 1 | | LR | 3 | a | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | LR | 3 | b | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | LR | 4 | | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | LR | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 |
| WIM | CWH | vh | 1 | | LR | 6 | | | L | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 |
| WIM | CWH | vh | 1 | | LR | 7 | | | L | N | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 |
| WIM | CWH | vh | 1 | | RS | 3 | | | N | N | 5 | 4 | 1 | 1 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | RS | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | RS | 5 | | | N | N | 5 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 |
| WIM | CWH | vh | 1 | | RS | 6 | | | M | L | 5 | 4 | 1 | 1 | 3 | 4 | 3 | 4 | 2 | 4 | 4 | 4 | 3 |
| WIM | CWH | vh | 1 | | RS | 7 | | | M | M | 5 | 4 | 1 | 1 | 2 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 3 |
| WIM | CWH | vh | 1 | | RF | 3 | | | N | N | 4 | 4 | 3 | 3 | 6 | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | RF | 4 | | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | RF | 5 | | | N | N | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 |
| WIM | CWH | vh | 1 | | RF | 6 | | | M | M | 5 | 4 | 3 | 4 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |
| WIM | CWH | vh | 1 | | RF | 7 | | | H | H | 5 | 4 | 3 | 4 | 1 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |
| WIM | CWH | vh | 1 | | SF | 3 | | | N | N | 5 | 4 | 4 | 3 | 6 | 4 | 3 | 4 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vh | 1 | | SF | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 |
| WIM | CWH | vh | 1 | | SF | 5 | | | N | N | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | SF | 6 | | | M | M | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| WIM | CWH | vh | 1 | | SF | 7 | | | H | H | 4 | 4 | 4 | 3 | 1 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| WIM | CWH | vh | 1 | | SD | 3 | | | N | N | 3 | 2 | 2 | 2 | 6 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 4 |
| WIM | CWH | vh | 1 | | SD | 4 | | | N | N | 5 | 4 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SD | 5 | | | N | N | 4 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| WIM | CWH | vh | 1 | | SD | 6 | | | M | M | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| WIM | CWH | vh | 1 | | SD | 7 | | | H | H | 2 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| WIM | CWH | vh | 1 | | SL | 3 | | | N | N | 2 | 1 | 1 | 4 | 6 | 3 | 3 | 3 | 5 | 2 | 2 | 2 | 3 |
| WIM | CWH | vh | 1 | | SL | 4 | | | N | N | 2 | 2 | 2 | 4 | 6 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 3 |
| WIM | CWH | vh | 1 | | SL | 5 | | | N | N | 3 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| WIM | CWH | vh | 1 | | SL | 6 | | | M | M | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| WIM | CWH | vh | 1 | | SL | 7 | | | H | H | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 |
| WIM | CWH | vh | 1 | | AL | 3 | | | N | N | 5 | 4 | 3 | 5 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | AL | 4 | | | N | N | 5 | 4 | 3 | 5 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | AL | 5 | | | N | N | 5 | 4 | 2 | 3 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | YG | 3 | | | N | N | 4 | 2 | 2 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | YG | 3 | b | | N | N | 4 | 2 | 2 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | YG | 4 | | | N | N | 5 | 4 | 4 | 4 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | YG | 5 | | | N | N | 4 | 3 | 3 | 3 | 5 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 3 |
| WIM | CWH | vh | 1 | | YG | 6 | | | L | L | 4 | 2 | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| WIM | CWH | vh | 1 | | YG | 7 | | | L | L | 4 | 2 | 3 | 2 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| WIM | CWH | vh | 1 | | LS | 3 | b | | N | N | 3 | 3 | 3 | 3 | 6 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | LS | 4 | | | N | N | 3 | 3 | 4 | 4 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | LS | 5 | | | N | N | 3 | 3 | 4 | 4 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vh | 1 | | LS | 6 | | | L | N | 3 | 3 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | LS | 7 | | | L | N | 3 | 3 | 4 | 4 | 6 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | RC | 3 | | | N | N | 1 | 1 | 1 | 1 | 6 | 2 | 3 | 3 | 5 | 1 | 2 | 2 | 4 |
| WIM | CWH | vh | 1 | | RC | 4 | | | N | N | 3 | 3 | 3 | 3 | 6 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | RC | 5 | | | N | N | 3 | 3 | 3 | 3 | 5 | 3 | 4 | 4 | 5 | 2 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | RC | 6 | | | L | M | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 2 | 2 | 1 |
| WIM | CWH | vh | 1 | | RC | 7 | | | L | M | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 2 | 2 | 1 |
| WIM | CWH | vh | 1 | | SS | 3 | | | N | N | 5 | 5 | 2 | 2 | 6 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 |
| WIM | CWH | vh | 1 | | SS | 4 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SS | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SS | 6 | | | M | L | 5 | 5 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SS | 7 | | | H | L | 5 | 5 | 2 | 2 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SK | 3 | | | N | N | 4 | 4 | 3 | 2 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SK | 4 | | | N | N | 5 | 5 | 5 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SK | 5 | | | N | N | 5 | 5 | 5 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SK | 6 | | | M | L | 4 | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SK | 7 | | | H | L | 4 | 4 | 2 | 2 | 2 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SW | 3 | | | N | N | 4 | 4 | 3 | 3 | 6 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SW | 4 | | | N | N | 5 | 4 | 3 | 4 | 6 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SW | 5 | | | N | N | 5 | 4 | 3 | 4 | 6 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | SW | 6 | | | M | L | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | SW | 7 | | | H | L | 4 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vh | 1 | | AW | 3 | | | N | N | 2 | 1 | 1 | 3 | 6 | 2 | 2 | 3 | 5 | 3 | 2 | 3 | 5 |
| WIM | CWH | vh | 1 | | AW | 4 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | AW | 5 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | BS | 2 | b | | N | N | 2 | 2 | 4 | 4 | 6 | 4 | 4 | 4 | 5 | 2 | 3 | 3 | 4 |
| WIM | CWH | vh | 1 | | CM | 2 | c | | N | N | 4 | 3 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | DS | 2 | b | | N | N | 2 | 3 | 4 | 5 | 6 | 2 | 2 | 4 | 5 | 3 | 3 | 4 | 5 |
| WIM | CWH | vh | 1 | | GS | 2 | b | | N | N | 1 | 1 | 4 | 5 | 6 | 2 | 2 | 3 | 5 | 2 | 2 | 3 | 5 |
| WIM | CWH | vh | 1 | | PD | 3 | b | | N | N | 3 | 3 | 2 | 3 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vh | 1 | | SB | 2 | a | | N | N | 1 | 1 | 3 | 3 | 6 | 4 | 4 | 4 | 5 | 2 | 2 | 3 | 4 |
| WIM | CWH | vh | 1 | | SB | 2 | b | | N | N | 1 | 1 | 3 | 3 | 6 | 4 | 4 | 4 | 5 | 2 | 2 | 3 | 4 |
| WIM | CWH | vh | 1 | | SM | 2 | b | | N | N | 3 | 3 | 3 | 4 | 6 | 3 | 4 | 4 | 5 | 2 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | SM | 3 | a | | N | N | 3 | 3 | 3 | 4 | 6 | 3 | 4 | 4 | 5 | 2 | 3 | 3 | 5 |
| WIM | CWH | vh | 1 | | BE | 1 | | | N | N | 2 | 3 | 4 | 4 | 6 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | CB | 1 | | | N | N | 3 | 3 | 3 | 3 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | CG | 3 | | | N | N | 3 | 3 | 3 | 4 | 6 | 2 | 1 | 2 | 4 | 2 | 1 | 1 | 3 |
| WIM | CWH | vh | 1 | | ES | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | GB | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 |
| WIM | CWH | vh | 1 | | GP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | LA | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | MU | 1 | | | N | N | 3 | 3 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | OW | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | RI | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vh | 1 | | RO | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 3 | 5 | 5 | 3 | 3 | 5 | 5 | 3 |
| WIM | CWH | vh | 1 | | RP | | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | RR | | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vh | 1 | | SO | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vh | 1 | | WP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | AB | 3 | | | N | N | 4 | 4 | 3 | 2 | 6 | 3 | 2 | 2 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | AB | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | AB | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | AB | 6 | | | M | M | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | AB | 7 | | | H | M | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | LC | 3 | a | | N | N | 4 | 4 | 4 | 4 | 6 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | LC | 3 | b | | N | N | 4 | 4 | 4 | 4 | 6 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | LC | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | LC | 5 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | LC | 6 | | | M | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | LC | 7 | | | M | N | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | HS | 3 | | | N | N | 5 | 4 | 2 | 2 | 6 | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | HS | 3 | b | | N | N | 5 | 4 | 2 | 2 | 6 | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | HS | 4 | | | N | N | 4 | 4 | 4 | 3 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | HS | 5 | | | N | N | 4 | 4 | 3 | 2 | 5 | 3 | 3 | 3 | 4 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | HS | 6 | | | M | L | 4 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | HS | 7 | | | M | L | 4 | 4 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | RS | 3 | | | N | N | 4 | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | RS | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | RS | 5 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | RS | 6 | | | H | M | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | RS | 7 | | | H | H | 4 | 3 | 3 | 4 | 2 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | AF | 3 | | | N | N | 3 | 3 | 2 | 4 | 6 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | AF | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | AF | 5 | | | N | N | 4 | 4 | 3 | 4 | 5 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 1 | | AF | 6 | | | H | M | 4 | 4 | 2 | 4 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | AF | 7 | | | H | H | 4 | 3 | 2 | 4 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | HD | 3 | | | N | N | 4 | 3 | 2 | 4 | 6 | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vm | 1 | | HD | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 |
| WIM | CWH | vm | 1 | | HD | 5 | | | N | N | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 3 | 4 |
| WIM | CWH | vm | 1 | | HD | 6 | | | M | M | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 4 |
| WIM | CWH | vm | 1 | | HD | 7 | | | M | M | 4 | 4 | 3 | 3 | 1 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 4 |
| WIM | CWH | vm | 1 | | AS | 3 | | | N | N | 2 | 1 | 1 | 1 | 6 | 2 | 2 | 3 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 1 | | AS | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | AS | 5 | | | N | N | 3 | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 1 | | AS | 6 | | | H | M | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 |
| WIM | CWH | vm | 1 | | AS | 7 | | | H | H | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 |
| WIM | CWH | vm | 1 | | SS | 3 | | | N | N | 1 | 1 | 1 | 2 | 6 | 2 | 2 | 3 | 5 | 1 | 1 | 1 | 3 |
| WIM | CWH | vm | 1 | | SS | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | SS | 5 | | | N | N | 4 | 3 | 3 | 3 | 5 | 4 | 3 | 3 | 4 | 3 | 2 | 3 | 3 |
| WIM | CWH | vm | 1 | | SS | 6 | | | H | M | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 |
| WIM | CWH | vm | 1 | | SS | 7 | | | H | H | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 |
| WIM | CWH | vm | 1 | | CW | 3 | | | N | N | 1 | 1 | 1 | 2 | 6 | 2 | 2 | 2 | 5 | 1 | 1 | 2 | 5 |
| WIM | CWH | vm | 1 | | CW | 4 | | | N | N | 2 | 2 | 2 | 2 | 6 | 2 | 2 | 2 | 5 | 1 | 1 | 2 | 5 |
| WIM | CWH | vm | 1 | | CW | 5 | | | N | N | 2 | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vm | 1 | | YG | 3 | | | N | N | 4 | 4 | 3 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | YG | 3 | b | | N | N | 4 | 4 | 3 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vm | 1 | | YG | 4 | | | N | N | 4 | 4 | 3 | 3 | 6 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | YG | 5 | | | N | N | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | YG | 6 | | | L | N | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 1 | | YG | 7 | | | L | L | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 1 | | LS | 3 | a | | N | N | 5 | 5 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | LS | 3 | b | | N | N | 5 | 5 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | LS | 4 | | | N | N | 5 | 5 | 5 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | LS | 5 | | | N | N | 5 | 5 | 5 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | LS | 6 | | | L | N | 5 | 3 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | LS | 7 | | | L | N | 5 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 1 | | RC | 3 | | | N | N | 2 | 1 | 1 | 2 | 6 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 1 | | RC | 4 | | | N | N | 3 | 2 | 2 | 3 | 6 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | RC | 5 | | | N | N | 3 | 2 | 2 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 |
| WIM | CWH | vm | 1 | | RC | 6 | | | L | L | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 1 | | RC | 7 | | | M | M | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 1 | | AW | 3 | | | N | N | 2 | 1 | 1 | 3 | 6 | 2 | 2 | 3 | 5 | 3 | 2 | 3 | 5 |
| WIM | CWH | vm | 1 | | AW | 4 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 6 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 1 | | AW | 5 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 1 | | DS | 2 | b | | N | N | 2 | 3 | 4 | 5 | 6 | 2 | 2 | 4 | 5 | 3 | 3 | 4 | 5 |
| WIM | CWH | vm | 1 | | GS | 2 | b | | N | N | 1 | 1 | 4 | 5 | 6 | 3 | 3 | 3 | 5 | 2 | 2 | 3 | 5 |
| WIM | CWH | vm | 1 | | IF | 2 | a | | N | N | 3 | 1 | 1 | 4 | 6 | 3 | 2 | 4 | 5 | 1 | 1 | 3 | 5 |
| WIM | CWH | vm | 1 | | PD | 3 | b | | N | N | 3 | 3 | 2 | 3 | 6 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 1 | | SA | 3 | | | N | N | 2 | 1 | 1 | 3 | 6 | 3 | 2 | 4 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vm | 1 | | SC | 2 | b | | N | N | 1 | 2 | 4 | 4 | 6 | 3 | 3 | 4 | 5 | 1 | 1 | 2 | 3 |
| WIM | CWH | vm | 1 | | SG | 2 | b | | N | N | 3 | 2 | 3 | 4 | 6 | 4 | 4 | 4 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 1 | | SM | 2 | b | | N | N | 3 | 3 | 3 | 4 | 6 | 3 | 4 | 4 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 1 | | SM | 3 | a | | N | N | 3 | 3 | 3 | 4 | 6 | 3 | 4 | 4 | 5 | 2 | 3 | 3 | 4 |
| WIM | CWH | vm | 1 | | VS | 2 | | | N | N | 3 | 1 | 1 | 4 | 6 | 3 | 2 | 3 | 5 | 1 | 1 | 2 | 4 |
| WIM | CWH | vm | 1 | | WS | 3 | | | N | N | 2 | 2 | 3 | 3 | 6 | 2 | 3 | 4 | 5 | 2 | 2 | 3 | 5 |
| WIM | CWH | vm | 1 | | BE | 1 | | | N | N | 2 | 3 | 4 | 4 | 6 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | CB | 1 | | | N | N | 3 | 3 | 3 | 3 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | CG | 3 | | | N | N | 3 | 3 | 3 | 4 | 6 | 2 | 1 | 2 | 4 | 2 | 1 | 1 | 3 |
| WIM | CWH | vm | 1 | | CL | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | ES | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | GB | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 |
| WIM | CWH | vm | 1 | | GP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | LA | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | MU | 1 | | | N | N | 3 | 3 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | OW | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | PO | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | RI | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | RO | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 3 | 5 | 5 | 3 | 3 | 5 | 5 | 3 |
| WIM | CWH | vm | 1 | | RP | | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | RR | | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 1 | | SO | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | TA | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | UR | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 1 | | WP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vm | 2 | | AB | 3 | | | N | N | 4 | 4 | 3 | 2 | 6 | 3 | 2 | 2 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | AB | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | AB | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | AB | 6 | | | M | M | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | AB | 7 | | | H | M | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | LC | 3 | a | | N | N | 4 | 4 | 4 | 4 | 6 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | LC | 3 | b | | N | N | 4 | 4 | 4 | 4 | 6 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | LC | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | LC | 5 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | LC | 6 | | | M | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | LC | 7 | | | M | N | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | HS | 3 | | | N | N | 5 | 4 | 2 | 2 | 6 | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | HS | 3 | b | | N | N | 5 | 4 | 2 | 2 | 6 | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | HS | 4 | | | N | N | 4 | 4 | 4 | 3 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | HS | 5 | | | N | N | 4 | 4 | 3 | 2 | 5 | 3 | 3 | 3 | 4 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | HS | 6 | | | M | L | 4 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | HS | 7 | | | M | L | 4 | 4 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | RS | 3 | | | N | N | 4 | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | RS | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | RS | 5 | | | N | N | 4 | 4 | 4 | 4 | 6 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | RS | 6 | | | H | M | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | RS | 7 | | | H | H | 4 | 3 | 3 | 4 | 2 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | AF | 3 | | | N | N | 3 | 3 | 2 | 4 | 6 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | AF | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | AF | 5 | | | N | N | 4 | 4 | 3 | 4 | 5 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIM | CWH | vm | 2 | | AF | 6 | | | H | M | 4 | 4 | 2 | 4 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | AF | 7 | | | H | H | 4 | 3 | 2 | 4 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | HD | 3 | | | N | N | 4 | 3 | 2 | 4 | 6 | 2 | 2 | 2 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vm | 2 | | HD | 4 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 |
| WIM | CWH | vm | 2 | | HD | 5 | | | N | N | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 3 | 4 |
| WIM | CWH | vm | 2 | | HD | 6 | | | M | M | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 4 |
| WIM | CWH | vm | 2 | | HD | 7 | | | M | M | 4 | 4 | 3 | 3 | 1 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 4 |
| WIM | CWH | vm | 2 | | AS | 3 | | | N | N | 2 | 1 | 1 | 1 | 6 | 2 | 2 | 3 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 2 | | AS | 4 | | | N | N | 4 | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | AS | 5 | | | N | N | 3 | 3 | 3 | 3 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 2 | | AS | 6 | | | H | M | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 |
| WIM | CWH | vm | 2 | | AS | 7 | | | H | H | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 |
| WIM | CWH | vm | 2 | | YG | 3 | | | N | N | 4 | 4 | 3 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | YG | 3 | b | | N | N | 4 | 4 | 3 | 2 | 6 | 4 | 3 | 3 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | YG | 4 | | | N | N | 4 | 4 | 3 | 3 | 6 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | YG | 5 | | | N | N | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | YG | 6 | | | L | N | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 2 | | YG | 7 | | | L | L | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 |
| WIM | CWH | vm | 2 | | LS | 3 | a | | N | N | 5 | 5 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | LS | 3 | b | | N | N | 5 | 5 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 |
| WIM | CWH | vm | 2 | | LS | 4 | | | N | N | 5 | 5 | 5 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | LS | 5 | | | N | N | 5 | 5 | 5 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | LS | 6 | | | L | N | 5 | 3 | 3 | 4 | 6 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | CWH | vm | 2 | | LS | 7 | | | L | N | 5 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 5 | 3 | 3 | 3 | 5 |
| WIM | CWH | vm | 2 | | RC | 3 | | | N | N | 2 | 1 | 1 | 2 | 6 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 2 | | RC | 4 | | | N | N | 3 | 2 | 2 | 3 | 6 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | RC | 5 | | | N | N | 3 | 2 | 2 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 |
| WIM | CWH | vm | 2 | | RC | 6 | | | L | L | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 2 | | RC | 7 | | | M | M | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 1 | 2 | 2 | 2 |
| WIM | CWH | vm | 2 | | AW | 3 | | | N | N | 2 | 1 | 1 | 3 | 6 | 2 | 2 | 3 | 5 | 3 | 2 | 3 | 5 |
| WIM | CWH | vm | 2 | | AW | 4 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 6 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 2 | | AW | 5 | | | N | N | 4 | 3 | 2 | 3 | 6 | 2 | 2 | 3 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 2 | | MM | 3 | a | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 |
| WIM | CWH | vm | 2 | | MM | 3 | b | | N | N | 5 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 |
| WIM | CWH | vm | 2 | | MM | 7 | | | L | L | 5 | 5 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 5 | 4 |
| WIM | CWH | vm | 2 | | MT | 7 | | | L | M | 3 | 2 | 2 | 2 | 5 | 4 | 3 | 3 | 4 | 4 | 2 | 3 | 4 |
| WIM | CWH | vm | 2 | | IF | 2 | a | | N | N | 3 | 1 | 1 | 4 | 6 | 3 | 2 | 4 | 5 | 1 | 1 | 3 | 5 |
| WIM | CWH | vm | 2 | | SA | 3 | | | N | N | 2 | 1 | 1 | 3 | 6 | 3 | 2 | 4 | 5 | 2 | 2 | 2 | 5 |
| WIM | CWH | vm | 2 | | SC | 2 | b | | N | N | 1 | 2 | 4 | 4 | 6 | 3 | 3 | 4 | 5 | 1 | 1 | 2 | 3 |
| WIM | CWH | vm | 2 | | SG | 2 | b | | N | N | 3 | 2 | 3 | 4 | 6 | 4 | 4 | 4 | 5 | 2 | 2 | 2 | 4 |
| WIM | CWH | vm | 2 | | VS | 2 | | | N | N | 3 | 1 | 1 | 4 | 6 | 3 | 2 | 3 | 5 | 1 | 1 | 2 | 4 |
| WIM | CWH | vm | 2 | | WS | 3 | | | N | N | 2 | 2 | 3 | 3 | 6 | 2 | 3 | 4 | 5 | 2 | 2 | 3 | 5 |
| WIM | CWH | vm | 2 | | CG | 3 | | | N | N | 3 | 3 | 3 | 4 | 6 | 2 | 1 | 2 | 4 | 2 | 1 | 1 | 3 |
| WIM | CWH | vm | 2 | | CL | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | ES | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | GB | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 |
| WIM | CWH | vm | 2 | | GP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | LA | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | OW | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | PO | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | RI | | | | N | N | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | RO | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 3 | 5 | 5 | 3 | 3 | 5 | 5 | 3 |
| WIM | CWH | vm | 2 | | RP | | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | RR | | | | N | N | 5 | 5 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| WIM | CWH | vm | 2 | | TA | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| WIM | CWH | vm | 2 | | WP | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mm | 1 | | MB | 3 | | | N | N | 5 | 5 | 2 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MB | 3 | a | | N | N | 5 | 5 | 3 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MB | 3 | b | | N | N | 5 | 5 | 3 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MB | 4 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mm | 1 | | MB | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 3 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mm | 1 | | MB | 6 | | | N | L | 5 | 5 | 3 | 3 | 5 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MB | 7 | | | L | L | 5 | 5 | 3 | 3 | 2 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MM | 3 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 3 | a | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 3 | b | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 4 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 5 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 6 | | | N | N | 6 | 5 | 4 | 3 | 5 | 5 | 4 | 4 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mm | 1 | | MM | 7 | | | L | L | 6 | 5 | 4 | 3 | 3 | 5 | 4 | 3 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mm | 1 | | MO | 3 | | | N | N | 5 | 3 | 3 | 3 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | MH | mm | 1 | | MO | 4 | | | N | N | 5 | 3 | 3 | 3 | 6 | 5 | 4 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mm | 1 | | MO | 5 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 3 | 6 | 6 | 3 | 4 | 6 |
| WIM | MH | mm | 1 | | MO | 6 | | | L | L | 5 | 3 | 2 | 2 | 5 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MO | 7 | | | L | M | 5 | 3 | 2 | 2 | 3 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 3 | a | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 3 | b | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 4 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 5 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 6 | | | L | L | 5 | 3 | 2 | 2 | 5 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | MT | 7 | | | L | M | 5 | 3 | 2 | 2 | 3 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mm | 1 | | IF | 2 | a | | N | N | 6 | 1 | 1 | 4 | 6 | 6 | 2 | 4 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mm | 1 | | LD | 2 | a | | N | N | 6 | 3 | 1 | 3 | 6 | 6 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mm | 1 | | SA | 3 | | | N | N | 5 | 5 | 2 | 2 | 6 | 6 | 3 | 3 | 6 | 6 | 1 | 1 | 6 |
| WIM | MH | mm | 1 | | SC | 2 | | | N | N | 4 | 3 | 3 | 4 | 6 | 5 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mm | 1 | | SC | 2 | b | | N | N | 4 | 3 | 3 | 4 | 6 | 5 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mm | 1 | | VS | 2 | a | | N | N | 4 | 3 | 1 | 3 | 6 | 5 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mm | 1 | | CL | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mm | 1 | | ES | 1 | | | N | N | 6 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mm | 1 | | GB | 1 | | | N | N | 6 | 5 | 5 | 5 | 6 | 6 | 4 | 5 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mm | 1 | | LA | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mm | 1 | | OW | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mm | 1 | | RO | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | RO | 1 | a | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | TA | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mm | 1 | | TA | 1 | a | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | MB | 3 | | | N | N | 5 | 5 | 2 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MB | 3 | a | | N | N | 5 | 5 | 3 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MB | 3 | b | | N | N | 5 | 5 | 3 | 3 | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MB | 4 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mmp | 1 | | MB | 5 | | | N | N | 5 | 5 | 4 | 4 | 6 | 5 | 3 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mmp | 1 | | MB | 6 | | | N | L | 5 | 5 | 3 | 3 | 5 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MB | 7 | | | L | L | 5 | 5 | 3 | 3 | 2 | 5 | 3 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MM | 3 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 3 | a | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 3 | b | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 4 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 5 | | | N | N | 6 | 5 | 4 | 4 | 6 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 6 | | | N | N | 6 | 5 | 4 | 3 | 5 | 5 | 4 | 4 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mmp | 1 | | MM | 7 | | | L | L | 6 | 5 | 4 | 3 | 3 | 5 | 4 | 3 | 6 | 6 | 4 | 5 | 6 |
| WIM | MH | mmp | 1 | | MO | 3 | | | N | N | 5 | 3 | 3 | 3 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MO | 4 | | | N | N | 5 | 3 | 3 | 3 | 6 | 5 | 4 | 4 | 6 | 6 | 3 | 3 | 6 |
| WIM | MH | mmp | 1 | | MO | 5 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 3 | 6 | 6 | 3 | 4 | 6 |
| WIM | MH | mmp | 1 | | MO | 6 | | | L | L | 5 | 3 | 2 | 2 | 5 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MO | 7 | | | L | M | 5 | 3 | 2 | 2 | 3 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MT | 3 | a | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MT | 3 | b | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MT | 4 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 2 | 2 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MT | 5 | | | N | N | 5 | 3 | 2 | 2 | 6 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |

| ECO_SEC | BGC_ZONE | BGC_SUBZON | BGC_VRT | BGC_PHASE | SITE_S | STRCT_S | STRCT_M | SERAL | BBAEA_RE | BMAMU_RE | MURAM_PE | MURAM_P | MURAM_S | MURAM_F | MURAM_HI | MODHC_P | MODHC_S | MODHC_F | MOCHC_W | MCEEL_P | MCEEL_S | MCEEL_F | MCEEL_W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIM | MH | mmp | 1 | | MT | 6 | | | L | L | 5 | 3 | 2 | 2 | 5 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | MT | 7 | | | L | M | 5 | 3 | 2 | 2 | 3 | 5 | 3 | 3 | 6 | 6 | 2 | 3 | 6 |
| WIM | MH | mmp | 1 | | LD | 2 | a | | N | N | 6 | 3 | 1 | 3 | 6 | 6 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mmp | 1 | | MH | 2 | d | | N | N | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mmp | 1 | | MH | 3 | a | | N | N | 6 | 5 | 3 | 4 | 6 | 6 | 3 | 4 | 6 | 6 | 4 | 4 | 6 |
| WIM | MH | mmp | 1 | | MK | 3 | a | | N | N | 6 | 6 | 5 | 5 | 6 | 6 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | SA | 3 | | | N | N | 5 | 5 | 2 | 2 | 6 | 6 | 3 | 3 | 6 | 6 | 1 | 1 | 6 |
| WIM | MH | mmp | 1 | | SC | 2 | | | N | N | 4 | 3 | 3 | 4 | 6 | 5 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mmp | 1 | | SC | 2 | b | | N | N | 4 | 3 | 3 | 4 | 6 | 5 | 2 | 3 | 6 | 6 | 1 | 3 | 6 |
| WIM | MH | mmp | 1 | | CL | 1 | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mmp | 1 | | ES | 1 | | | N | N | 6 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mmp | 1 | | LA | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mmp | 1 | | OW | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mmp | 1 | | PS | | | | N | N | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| WIM | MH | mmp | 1 | | RO | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | RO | 1 | a | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | TA | 1 | | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |
| WIM | MH | mmp | 1 | | TA | 1 | a | | N | N | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 6 |