Conservation Assessment

for

Cryptomastix devia,
Puget Oregonian

Originally issued
as Management Recommendations

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TABLE OF CONTENTS

Preface:

Converting Survey and Manage Management Recommendations into Conservation Assessments

Much of the content in this document was included in previously transmitted Management Recommendations developed for use with Survey and Manage Standards and Guidelines. With the removal of those Standards and Guidelines, the Management Recommendations have been reconfigured into Conservation Assessments to fit Special Status/Sensitive Species Program (SSSSP) objectives and language. Changes include: the removal of terminology specific to Survey and Manage Standards and Guidelines, the addition of Oregon Natural Heritage Information Center ranks for the species, and the addition of USDA Forest Service and USDI Bureau of Land Management (BLM) Special Status/Sensitive Species status and policy. Habitat, range, and taxonomic information have also been updated to be current with data gathered since the Management Recommendations were initially issued. The framework of the original documents is maintained in order to expedite getting this information to field units. For this reason this document does not entirely conform to recently adopted standards for the Forest Service and BLM for Conservation Assessment development in Oregon and Washington.

Assumptions about site management

In the Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) to Remove or Modify the Survey and Manage Standards and Guidelines (USDI and USDIA 2004), assumptions were made as to how former Survey and Manage species would be managed under Agency Special Status/Sensitive Species policies. Under the assumptions in the FSEIS, the ROD stated "The assumption used in the final SEIS for managing known sites under the Special Status Species Programs was that sites needed to prevent a listing under the Endangered Species Act would be managed. For species currently included in Survey and Manage Categories A, B, and E (which require management of all known sites), it is anticipated that only in rare cases would a site not be needed to prevent a listing…. Authority to disturb special status species sites lies with the agency official who is responsible for authorizing the proposed habitat-disturbing activity." At the time of the signing of the ROD, this species was in Category A in the Survey and Manage Program.

Management Considerations

Within the following Conservation Assessment, under the "Managing in Species Habitat Areas" section, there is a discussion on "Management Considerations." "Management Considerations" are actions and mitigations that the deciding official can utilize as a means of providing for the continued persistence of the species' site. These considerations are not required and are intended as general information that field level personnel could utilize and apply to site-specific situations. Management of the species covered in this Conservation Assessment follows Forest Service 2670 Manual policy and BLM 6840 Manual direction. (Additional information, including species specific maps, is available on the Interagency Special Status and Sensitive Species website.)

EXECUTIVE SUMMARY

Species: *Cryptomastix devia* (Gould 1846), Puget Oregonian

Taxonomic Group: Mollusks (Phylum Mollusca: Class Gastropoda)

Management Status: Bureau Sensitive Species, OR and WA BLM; Forest Service Region 6 Sensitive Species. Oregon Natural Heritage Program ranks this as a List 1 species, "critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation", with Global ranking G2, State ranking S1. Washington Status is S2.

Range: *Cryptomastix devia* inhabits areas of the western Cascade Range and Puget Trough at low to moderate elevations from southern Vancouver Island, B.C., Canada through western Washington into northwestern Oregon, between The Dalles and Salem, south to Eugene, with the potential to extend to the Coast Range. There are more than 178 locations identified in the Interagency Database (as of Sept. 2004), with 141 of these occurring in the Cowlitz and Cispus River drainages of the Gifford Pinchot National Forest.

Specific Habitat: *Cryptomastix devia* inhabits moist, conifer forest habitats. Although often occurring within riparian areas, and possibly confined to the riparian zone in some dry landscapes or less densely forested areas, it is not generally a riparian obligate. *C. devia* is usually absent from riparian zones prone to regular or occasional flooding. It is associated with bigleaf maples growing among conifers (usually Douglas-fir, western hemlock and western redcedar), or in groves of maples and other hardwoods such as black cottonwood and red alder. This species is often found on or under hardwood logs or other woody material, maple leaf litter, or under the lowest fronds of swordfern plants (*Polystichum munitum*) that are growing near or under the maple crowns. Maples on flat or gentle slopes are more suitable habitat than steeper slopes, perhaps because they offer more stable environments. Large diameter, older bigleaf maples provide a deep leaf litter layer and are highly suitable habitat for this species, although they may also be found under smaller diameter maples, particularly when they occur in patches or are frequently interspersed within upland conifer stands. Young *C. devia* may be found among or under mosses, or in leaf litter or under swordfern fronds with adult animals.

Threats: Primary threats to this species are the loss of habitat due to forest management practices, conversion for agricultural, urbanization and other uses, and fire. Other threats may include vertebrate and invertebrate predators (i.e., predatory snails, and beetles), which can concentrate in isolated, small habitat patches where snails are vulnerable. In some forest stands, bigleaf maples can be suppressed by Douglas-fir and other conifers or lost as a result of selective thinning, leading to a long-term loss of habitat for the species. Harvest of special forest products (i.e., raking for mushrooms, firewood gathering, moss harvest from maple sites, collection of swordfern plants for ornamental transplant) are potential threats in limited habitats. Large numbers of invasive slugs have been documented in several *C. devia* sites on the Cowlitz Valley Ranger District, Gifford Pinchot National Forest, but the effects to this native snail have not been documented.

Management Considerations: There are three potential management approaches for *Cryptomastix devia* that may be considered, depending on the local distribution of the species in the area. The primary goal in each approach is to provide habitat sufficient for continued occupancy by the species; moderating fluctuations in temperature and humidity by maintaining shade, protecting key habitat features, and limiting adverse impacts of fire.

In Approach 1, known sites are managed individually, within individual Habitat Areas. In Approaches 2 and 3, known sites are managed collectively as a population, within one Habitat Area. Approaches 2 and 3 provide flexibility in management and allows some of the individual sites to be temporarily degraded, while successfully maintaining sufficient habitat to provide for continued occupation of the area by the species. In areas where this species is locally common any of the approaches could be considered.

- **Approach 1** could be used where the species is not locally common. A single site is managed within a small Species Habitat Area, with the goal of maintaining or restoring microsite conditions and the best habitat features at a site. Habitat management under this approach should be to maintain or benefit the species.

- **Approach 2** could be used when the species is considered locally common, and occurs in locally clustered sites which occupy a portion of the project area. Multiple sites are managed together within a larger Species Habitat Area, in which disturbance actions detrimental to the species can occur within limited areas.

- **Approach 3** could be used where the species is locally common and when it occurs throughout a proposed project area. An entire project or survey area is managed as a Species Habitat Area which then allows for a higher level of disturbance, while maintaining connectivity and habitat quality without the need to manage individual sites.

Data Gaps and Information Needs: The primary questions remaining about this species are:

- What stand characteristics (canopy cover, tree species, stand age, large woody debris, litter and duff, elevation, slope, aspect etc.) are required to support the species?
- What stand size is required to provide sufficient area of suitable habitat for populations to remain secure and viable?
- What is the dispersal ability of this species, particularly related to the patchy nature of its suitable, bigleaf maple habitat?
- What impacts, if any, are non-native mollusks having where they occur with *C. devia*?
- Clarification of the status, rarity and distribution of this species, particularly outside of the Cowlitz and Cispus river drainages on the Gifford Pinchot National Forest.

I. NATURAL HISTORY

A. Taxonomic/Nomenclatural History

This species was first described by Gould as *Helix devia* in 1846. The Genus name has been changed over time by various authors, as listed below. Considered a subgenus of the genus *Triodopsis* in 1940, *Cryptomastix* is now recognized as a full genus, based on reproductive anatomy and distribution.

Family: Polygyridae
Species: *Cryptomastix devia* (Gould, 1846)

Triodopsis (Cryptomastix) devia (Gould) in Pilsbry, 1940.
Polygyra devia Gld., Dall, 1905.
Mesodon devia Gld., Taylor 1891; W.G. Binney, 1878.
Odotropis devia Gld., J.G. Cooper, 1868.
Helix baskervillei Pfeiffer, 1850.
Helix devia Gould, 1846.

B. Species Description

1. Morphology

The largest *Cryptomastix*, the shell of *C. devia*, has a greater diameter (outer edge of aperture to opposite side of shell) of 18-25 mm. Color of the shell is yellowish horn to brown. Mature shells have a broadly reflected lip margin; immature shells lack the reflected lip margin and have short, moderately spaced, microscopic bristles on the shell (difficult to see with a 10x lens and readily lost from collected shells). The basal lip margin supports a long, low tooth-like lamella (fold), and there is a distinct parietal tooth in the aperture, although this tooth may be greatly reduced or even absent on some specimens.

Other Pacific Northwest shells of similar size do not have the apertural teeth. Two other *Cryptomastix* are found within the same range: *C. germana* is the smallest species of the genus (8 mm. diameter), and usually retains long, curved bristles on its shell as an adult. *C. hendersoni* is somewhat smaller than *C. devia* (to 18 mm. diameter), and usually lacks apertural teeth, although it sometimes has a very small parietal tooth.

Other species with which *C. devia* may be confused are:

(1) *Allogona townsendiana*, which is larger, and *A. ptycophora*, may be about the same size as *C. devia*. *Allogona* adult shells lack the parietal tooth, and shells of the immature are without the short, hooked bristles of immature *C. devia*.

(2) Immature *Monadenia fidelis* can be confused with immature *C. devia*. Immature *M. fidelis* is more angular at the periphery, lacks the short bristles of fresh immature *C. devia* shells, and the peripheral bands of *M. fidelis* are usually apparent, though not always obvious in small living snails (Pilsbry 1940). The young *M. fidelis* also have rather straight edged maleations on the dorsal surface of the whorls.

2. Reproductive Biology

Cryptomastix devia hatch from eggs and live for more than one year. However, specific details on life span and reproduction for this species were not found.

Like most Terrestrial gastropods, *Cryptomastix* are hermaphroditic, having both male and female organs. Although not confirmed specifically for *C. devia*, self-fertilization has been demonstrated in some species of gastropods, but cross-fertilization is the norm. Bayne (1973) discussed the complexities of the Pulmonate reproductive system, and studied mechanisms by which allosperms (sperm from another) exert dominance over autosperms (sperm from oneself) during fertilization. Thus, ". . . self-fertilization is normally avoided, but remains a possible alternative to cross-fertilization." The advantage is in normally avoiding potentially deleterious inbreeding, yet retaining the option to reproduce if a mate is not available.

3. Ecology

Nothing was found in literature sources on the ecology of *Cryptomastix devia*, but Pilsbry (1940) states of the Family Polygyridae, "Their food is chiefly the mycelia of fungi." He also says, "The young snails wander abroad more freely than adults, and are often found on plants where the adults are under cover." Although the natural foods of *C. devia* have not been specifically documented, one immature specimen was observed to eat lettuce, reluctantly, in captivity. While it is suspected that mycophagy is the primary life style of this species, it appears that at least the young may be partially herbivorous on green plants during certain seasons, and that other microorganisms associated with decaying leaf litter, such as molds, yeasts and bacteria, form the bulk of the diet. The species probably has a digestive efficiency rate in the high forties for assimilation of food materials, a low rate that allows viable spores and fragments of fungal hyphae to be excreted with the feces. Thus, they represent an important dispersal mechanism for fungal species throughout the year when this mollusk is active. The scraping action of the microscopic teeth of the species used to harvest microorganisms from leaf surfaces contributes to the breakdown of forest floor litter, and is an important part of the decomposition cycle.

C. Range, Known Sites

The known range of *C. devia* is in the western Cascade Range and Puget Trough at low to moderate elevations (from near sea level upwards through the Western Hemlock Series) from southern Vancouver Island, B.C., Canada through western Washington to between The Dalles and Salem, in Oregon.

There are currently 178 locations documented in the interagency database. The vast majority are from the Cowlitz Valley Ranger District on the Gifford Pinchot National Forest (Cowlitz and Cispus River watersheds), where the species is relatively common in stands containing bigleaf maple trees below approximately 2500 feet in elevation. Outside of this area, the species is rare, with one location on the Wenatchee N.F. (possibly misidentified), one on the Olympic N.F., three on the Salem BLM District, one in the Columbia Gorge National Scenic Area, and two on the Eugene BLM District (not verified).

Pilsbry (1940) gave locations at Vancouver Island, B.C., "Puget Sound, type locality", Seattle, King County; Carson, Skamania County; Freeport, Cowlitz County (Henderson 1929); and Nisqualie flats, Thurston/Pierce counties, Washington, and Hayden Island, Oregon, opposite Vancouver, Washington. Frest and Johannes (1993) reported locations from King, Clark, Skamania, and Thurston counties, Washington, and Multnomah County, Oregon. Branson (1980) reported it from Lake Chelan State Park, Chelan County, a record that needs to be confirmed. Other unidentified *Cryptomastix* have been found in that vicinity, but it is an unlikely habitat for *C. devia*.

Henderson (1936) says there are *Polygyra devia* (Gould) in the Hemphill-Hannibal collections at Stanford University from Kalama, Clark County, Clearwater, (Jefferson County, apparently), Freeport, Cowlitz County, and Seattle, King County, Washington; Portland, and Hayden Island, Multnomah County, Oregon. He also cites but questions the validity of a record from Yakima, Washington. Frest questions the validity of the Clearwater Co. record, considering it as being more likely an Idaho species from Clearwater, Idaho. If the Chelan County record is verified, it will be a range extension and confirmation of the species in the eastern Cascades of Washington.

D. Habitat Characteristics and Species Abundance

1. Habitat Characteristics

Records for *C. devia* indicate its habitat to be in mature to old growth, moist forest and riparian habitats, under logs, in leaf litter, around seeps and springs, and often associated with coarse woody debris and leaf litter and/or talus. It almost always occurs under or near bigleaf maple trees and may be found under sword ferns growing under those trees, or on the underside of bigleaf maple logs. Canopy cover over natural occupied habitats was usually greater than 70%, with rare exceptions on wetter sites. Juveniles of this snail may also be found under or among mosses such as grow on the trunks of old bigleaf maples. The deep layers of decaying leaves which accumulate under late seral trees form the optimal microhabitat for the species.

Frest and Johannes (1993) said the habitat is low to middle elevations; old growth and riparian associate; habitat includes leaf litter along streams, under logs, seeps, and springy areas. Dr. Baker found them at bases of east-facing slopes along the lake north of Seattle, near damp places with maples and sword ferns (Pilsbry 1940).

North of the Cispus River, Lewis County, Washington, they were found in mature and old growth forest, seldom in riparian habitat (Burke, 1996). This species is rarely found in riparian areas prone to regular or occasional flooding. Some sites were quite rocky, one overlaying a talus scree slope, while other sites contained almost no surface rock. The plant association was old-growth western hemlock/sword fern, but *C. devia*, *Monadenia fidelis*, and *Prophysaon dubium* appeared associated with bigleaf maple logs or leaf litter within that association. Most of the *C. devia* were found on the underside of bigleaf maple logs that were sound but with the bark loose and falling away. They were most often found on logs greater than 12 inches in diameter, but which were broken into smaller chunks. The larger logs in the area were too heavy to move for examination. Pieces as small as 3 feet long by 5-6 inches in cross-section were found with this snail on them. Other *C. devia* were found in forest floor litter often under sword ferns growing among or near the base of living mature big-leaf maples. Canopy cover in occupied forest sites was usually greater than 80% mixed conifer and hardwoods. Wetter sites with a greater component of bigleaf maple sometimes had more open canopies. Possibly additional water compensates for the reduced shading by moderating temperature fluctuations as well as maintaining humidity.

Flat or gentle slopes generally provide better habitat for this species than steep slopes, probably due to more stable environmental and soil conditions. Although large diameter, older bigleaf maple trees provide optimal suitable habitat for this species, patches of smaller diameter maples, or numerous individual maples interspersed in an upland conifer stand, can also contain relatively high densities of *C. devia*.

A draft Bayesian belief network model has been developed for *Cryptomastix devia* (Kogut et al. in prep.). This model attempts to predict habitat suitability for this species based on occurrence of bigleaf maple trees, leaf litter, coarse woody material, and other factors. This model has not been field verified (as of summer, 2004) but can provide some insights into possible habitat components and preferences associated with *C. devia*.

2. Species Abundance

Current knowledge of this species indicates that it is widespread across its range, but of quite spotty distribution. It is relatively common only in the Cowlitz and Cispus River drainages on the Gifford Pinchot N.F.; elsewhere it is quite rare and local. It is unknown if this is a result of a lack of survey effort in bigleaf maple habitats in other areas, or if the Cowlitz and Cispus drainages are, in fact, the center of this species current distribution and abundance.

Much of its former range is now urban or has been developed for agriculture. Ten of 42 records from prior to 1994 are from the metropolitan Seattle area, and it apparently still occurs there in a few protected forested parks, but most of those sites can be expected to have been developed for housing, business, industry, streets, and highways. It generally appears to be lacking from areas that were burned for site preparation after timber harvest.

Based on surveys conducted on the Cowlitz Valley Ranger District, this species occurs in low densities, with most documented locations consisting of one to three individual snails. Typically, one or two adult *C. devia* are located under or near a bigleaf maple tree during a 20 minute (average) search effort. Although relatively large, this species can easily be overlooked due to its cryptic brown coloration, which matches the leaf litter and decaying fern fronds where it usually is found. Therefore, estimates of abundance based on time-constrained surveys may be misleading.

II. CURRENT SPECIES SITUATION

A. Status History

The FEMAT analysis for *C. devia* determined that under the preferred management option insufficient habitat would remain to allow the species to stabilize well distributed across Federal lands; there would be 7% probability that it might remain viable but with gaps in its distribution; there would be a 50% probability that populations will remain viable in refugia; and 43% probability that it would be extirpated from federal lands. These ratings were based on "past actions" that have caused the species to decline due to forest management and urban area development (USDA, Forest Service, and USDI, Bureau of Land Management, 1994: J2-307).

Cryptomastix devia was considered to be a Category A species under Survey and Manage, based on the low number of occurrences, its low detection rate in suitable habitat and its small range. The Oregon Natural Heritage Program ranks this as a List 1 species, with Global ranking G2, State ranking S1 (critically imperiled globally and within the state because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation). In 2004, both Region 6

of the Forest Service and OR/WA BLM classified this species as a Sensitive Species.

B. Major Habitat and Viability Considerations

What is known of the habitat and ecology of this species has changed significantly since the Northwest Forest Plan (NFP) decision in 1994. Prior to the NFP, knowledge about the species was from few, generally poorly documented, observations. Literature sources (Pilsbry 1940; Branson 1977, 1980; Branson and Branson 1984; Frest and Johannes 1993, 1995, 1996) give general site information at best, but detailed records of specific plants or other microhabitat elements are primarily from personal knowledge (Burke, 1994). However, since the beginning of the NFP, biologists from several federal land management units took the initiative to conduct surveys and study habitat conditions of the species. As a result, we have learned more about the range and habitat of this species over the past ten years than the total that was known prior to that time.

Cryptomastix devia occurs in moist forest habitats, such as mid- to late-successional hemlock/sword fern associations, and it appears to be associated with hardwoods- particularly bigleaf maple- within these stands. Such stands have been reduced by timber harvest, and by conversion of forest land for agricultural and urban development. Hardwood components may also be lost during forest succession, especially if stands are thinned or otherwise managed to promote conifer growth at the expense of hardwoods. Precommercial thinning which selects against hardwoods may result in reduction or loss of the critical habitat components used by this species.

The number of population sites required to maintain species viability is unknown, however, it can be assumed that the likelihood of species viability increases with the number of populations, increasing opportunities for interaction between populations. Landscape management which maintains a distribution of populations and suitable habitat of sufficient quality, distribution, and abundance to allow the species populations to stabilize on federal lands is thought to be necessary for species persistence. The historic distribution pattern for this species is thought to be related to the coincident occurrence of hardwood forests, which were once widespread in the western Washington lowlands. The current distribution of this species is sparse and patchy; it is not generally abundant in known habitats relative to populations of other associated gastropods. For species with patchy distribution, concerns for viability increase as habitat areas decrease in number and size toward a critical threshold. The probability of catastrophic loss of local or limited habitats increases, the quality of remaining habitats may decrease (especially if management is directed toward maintaining minimum quality or quantities), potential for deleterious effects of inbreeding increases, and chance of population loss from predation, pathogens, or other causes increases as population size decreases.

C. Threats to the Species

Further loss of habitat to support the species across the landscape - Much of the formerly known range of *C. devia* has been developed for urbanization or agriculture. At the time of the FEMAT Analysis, *Cryptomastix devia* was known from only about 42 records from 24 localities, 6 in Oregon and 18 in Washington. Ten of the records were from what is now the metropolitan Seattle area. Currently, habitat disturbances and modifications such as timber management, fire, and development appear to be the greatest threats to this species. Herbicide spraying on private commercial forest lands to remove hardwoods has resulted in widespread loss of this habitat component across the landscape.

Reduction in quality of existing habitat/forest succession - Quality habitat is important to this

snail for maintaining a balanced biotic community to support them and for escaping predators. It appears to be closely associated with moist conifer forest plant associations supporting a hardwood component, such as bigleaf maple. There appears to be a need for hardwood leaf litter, mycorhiza, or other associated fungi or microbes. In some mid-seral stands (e.g. "Cispus burn" sites on the Gifford Pinchot N.F.), bigleaf maple trees can be overtopped and outcompeted by faster growing conifers such as Douglas-fir. Management of forest stands which selects against hardwoods also may result in a loss of this habitat component. The loss of bigleaf maple trees in these areas will reduce future habitat suitability for *C. devia*, and strategies to retain this maple habitat component should be explored.

Predation - Concern about predators increases as habitat quality or quantity decreases. Up to three species of *Haplotrema* and *Ancotrema* (predatory snails that feed on snails, slugs, and other invertebrates) occur in the same habitats and in greater numbers than *C. devia*. Ground beetles (*Scaphinotus* sp.), specifically adapted for preying on snails, are common in northwest forests (White 1983; Kozloff 1976), and other insects as well as reptiles, amphibians, birds, and mammals also prey on them. Hiding and escape cover is provided by forest floor litter, including deep leaf packs and fine and large woody debris. When habitat patches are limited in size and number, predators can easily focus hunting efforts and severely reduce *C. devia* populations. However, in good habitat with large numbers of hardwood patches, predators are a lesser threat to a population.

Competition from exotic slugs - Exotic slugs are increasing within the range of *C. devia*. To what extent these introduced species might compete with the native gastropods or buffer them from predation has not been demonstrated. Exotic species should be of concern because of the rapidity with which their populations increase. The mollusk fauna in most urban and suburban areas is now almost exclusively exotic species, and they are spreading into the forests, as documented in several cases in the Cowlitz and Cispus River drainages at sites containing *C. devia* populations.

High intensity fire - High intensity fire is particularly damaging to gastropod populations as it destroys both the snails and their habitats. Prescribed burning of slash piles can be a threat to *Cryptomastix devia* in bigleaf maple areas; there is at least one documented example of an escaped slash pile burn that resulted in the mortality of numerous *C. devia* adults at a bigleaf maple patch.

Inadvertent losses because of other management activity - For example, harvest of special forest products can be a threat in limited habitat areas. Raking the forest floor for mushrooms, or removal of hardwood logs for firewood could be particularly damaging, as well as harvest of swordfern plants for ornamental transplants. The harvest of moss mats from bigleaf maple trees should be strongly discouraged, as these provide potentially important habitats for juvenile snails.

D. Distribution Relative to Land Allocations

Approximately two thirds of documented sites for *C. devia* occur outside of reserves, in the Matrix allocation and within Adaptive Management Areas (AMAs) of the Olympic and the Gifford-Pinchot National Forests. Approximately one third of known sites occur within Late-Successional Reserves (LSR) and administratively withdrawn land allocations in the Upper and Lower Cispus, Upper and Clearfork Cowlitz Watersheds, in the Cowlitz Valley Ranger District of the Gifford Pinchot N.F. Many of the historic sites are in the area of Seattle and its suburbs and it apparently still occurs in a few parks where natural forest stands exist, but it is expected that most of those historic sites have been developed. Occurrence on private lands has not been

documented in recent years.

III. MANAGEMENT GOALS AND OBJECTIVES

A. Management Goals for the Taxon

Management for this species follows Forest Service Region 6 Sensitive Species (SS) policy, and/or Oregon and Washington BLM Special Status Species (SSS) policy.

For Oregon and Washington Bureau of Land Management administered lands, SSS policy details the need to manage for species conservation. For Region 6 of the Forest Service, Sensitive Species policy requires the agency to maintain viable populations of all native and desired non-native wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Management should also not create significant trends towards federal listing, for any identified Sensitive species.

IV. HABITAT MANAGEMENT

A. Lessons from History

Once extirpated from a site, populations of most gastropods are slow to recover. Fire is a natural disturbance factor which has occurred over many centuries. Even as a natural process, its effects can be harmful to existing populations. The effects of fire depends on several variables, including intensity, season and relationship to the life cycle of the species. Fire, especially intense fire events, can be very destructive to snails and slugs. Fire can kill the mollusks (if they are unprotected), and it can destroy logs and other woody debris that hold moisture and create microsites necessary for survival of these animals (Applegarth 1995). Sites that appear to be suitable habitat for many gastropods, but which have been burned in the past, support few if any species or individuals even after 50 years and longer. Some of the more abundant, larger species begin repopulating these sites from adjacent stands after suitable habitat for them is restored, which may take many years. The first species to reappear in western Washington stands are usually the *Haplotrema* and *Vepericola*. These species are the most abundant of the large snails in a variety of forest habitats. The time required for the abundance and diversity of the molluscan fauna to be restored to these sites is indicated by the much greater numbers of species and individuals found in old growth than in stands in which signs of fire (and other management in some cases) are still evident but not necessarily obvious. In these burned stands, the ecosystem is lacking the habitat components and functions provided by the mollusk fauna.

An intense burn leaves the biotic community under moist conifer stands with only a small fraction of its mollusk fauna for many years (possibly a century or more). In contrast to severely burned areas, stands in which numerous large logs were left, and which were not severely charred during the fire, have been found to retain a portion of their mollusk fauna after an undetermined number of years but within a time that evidence of the burn was still apparent at the site. Remaining logs at these types of sites are estimated to be greater than 1000 linear feet per acre, and greater than 20 inches average diameter (both dimensions estimated). Whether gastropods remained through the burn, protected by the abundant logs, or they were able to more rapidly disperse back into the stand because of the cover provided by the logs has not been determined. What is apparent is that an abundance of large logs is important to many forest snails and slugs. Zero to two or rarely three species may be expected in burned stands without abundant logs remaining; five to seven species may be expected to be found in stands similarly treated but with

the logs remaining; and in unburned stands 13 to 20 or more species may be found. In one of the prime habitat areas in the Lower Cispus Watershed, after the bigleaf maple logs were removed from along the road, *C. devia* became very difficult to find in the area where it was previously most abundant (Burke, 1996).

B. Identification of Species Habitat Areas

All known sites on federal lands administered by the Forest Service and/or BLM in Oregon and Washington are identified as areas where the information presented in this Conservation Assessment could be applied. A species habitat area is defined as the suitable habitat occupied by a known population plus the surrounding habitat needed to support the species.

Managing populations

Individual mollusks are mobile and may move from the location where they were discovered. In areas where a species has been found, additional individuals are likely to also be present in nearby areas and remain undetected. Management of a larger area occupied by a population of a species may be more effective for local species persistence than management of smaller areas around individual sites. While this approach may cause the loss of some individuals, where the species is locally common sufficient numbers of individuals remain for persistence of that population. Managing larger areas of occupied habitat rather than small areas around individual sites may result in a smaller but persistent population in the local area without risk to the regional species distribution.

The following criteria should be used when considering a larger scale/population based management approach:

1. The species should be well distributed in all or a significant portion of its range,

2. There should be adequate information about its habitat associations to allow biologists to prescribe management to maintain, conserve or improve its habitat, and

3. The species should be locally common within and adjacent to the project area.

The first two criteria for *Cryptomastix devia* are met. *Cryptomastix devia* occupies scattered localities within parts of the western Washington Cascades, Olympic Peninsula, southwestern Washington, eastern Washington Cascades, Willamette, and Deschutes Provinces. Within the central portion of its range, the Cowlitz Valley Ranger District on the GPNF, *C. devia* has been found regularly in localized but fairly well-distributed, abundant populations. Although there are geographic differences in habitat that are not well understood, there are sufficient observations to define habitat associations, and there are situations that evidence how this species should respond to management measures designed to maintain, conserve or improve its habitat.

To determine if the species is locally common within or adjacent to a project area, the following criteria can be applied:

1. There are at least two sites in the project or survey area, with a ratio of at least one site per 10 acres. This ratio establishes the presence of a minimum number of sites in a project area as evidence of a local population large enough to afford the loss of some individuals.

2. The species is known to occur in adjacent or nearby forest stands. This displays evidence that there are opportunities for recolonization from individuals outside of the managed area.

3. The species is known to occur in adjacent or nearby 6th field watersheds. This is evidence that the species is distributed across a broader landscape.

Managing at different scales

Management of habitat for this species can be approached at three different scales. These three management approaches are discussed briefly below and illustrated in Appendix 1.

Management activities to benefit the species in a small, local area are the focus of Approach 1. Approaches 2 and 3 allow habitat manipulation over larger areas, for a broader range of benefits, while providing for continued occupation of the area by the species. In areas where the species is not locally common, only Approach 1 is recommended. In areas where this species is locally common, any of the 3 Approaches could be considered. Also, there could be a combination of Habitat Area types within a single project. The chart in the following section summarizes a few of the distinguishing characteristics of the three Habitat Areas and Management Approaches.

Approach 1 is intended for use when **managing a single location**, or when the species is not considered "locally common". At this scale, an individual known site is managed within a single Species Habitat Area. Management within the Habitat Area should focus on maintaining or enhancing habitat for the species in a small area immediately surrounding a single site.

Under this approach, the size and quality of the Species Habitat Area should be sufficient to maintain favorable environmental conditions at the site location, conserve (or restore) the identified associated habitat features, and provide conditions that allow the species to survive at this site. The size and shape of the Species Habitat Area depends on site specific conditions and estimates of dispersal distances in similar-sized terrestrial mollusks and estimates of genetic neighborhood, or deme, size. Based on the size and moderate dispersal ability of this species, the area required to sustain a population of interacting individuals may range from a few acres up to 25 acres or more, depending on amount and condition of the habitat (ie. how many individuals it can sustain per acre), and the amount of surrounding habitat needed to maintain suitable environmental conditions. Site features (such as slope position, aspect, cover, moisture, topographic breaks, vegetation types, ecotones, habitat elements) and management operations (such as ownership boundaries, roads and logging requirements) can both be incorporated into the size and shape of the unit needed. Drier, more open stands, southerly or westerly aspects, upper slopes, etc., generally indicate the need for larger Species Habitat Areas. Consideration should also be given to daily and annual movement cycles of the animals. Several research articles provide information about maintaining site conditions and reducing edge effects and are listed in the reference section (Chen et.al., 1990, 1992, 1993, 1995, 1997; Song et. al., 1977; Dong et. al., 1998; Saunders et. al., 1998).

Approach 2 can be used where the species is **locally common and multiple known sites occur in locally clustered areas** within a project area, or there is an identifiable concentration of favorable habitat features and conditions that occurs together with those sites. At this scale, multiple sites are managed together in a larger area as a collective population. Management within the Species Habitat Area should focus on the continued occupation by the species by maintaining a relatively high quality of suitable habitat around selected sites and habitat features.

To use Approach 2, concentrations of known sites or habitat features such as old bigleaf maples and down logs are selected as "hot spots". All hot spots do not have to include known sites, and not all sites need to be included within a hot spot. (See illustrations in Appendix 1.) The number and distribution of these hot spots should reflect (but not necessarily match) the existing distribution of habitat elements and known sites within the project area. A polygon drawn around

these hot spots and the intervening habitat between them is then considered the Species Habitat Area. The hot spots can be relatively small (1 - 2 acres in size) but at least one hot spot should be identified for each 10 acres, and collectively make up 10- 20% of the Species Habitat Area. There can be one or several multi-site Habitat Areas within a survey area, and there may also be one or more single-site Habitat Areas for outlying sites within the same Survey Area. The Species Habitat Area should be large enough to generally maintain favorable habitat conditions at the hot spots. There should be enough distance between the hot spots and the Species Habitat Area edge that most of the original shading of the hot spots would be maintained.

Approach 3 can be used where the species is **locally common** and the distribution and numbers of sites and habitat features suggest that they are **likely to occur more or less throughout the survey or project area.** This Approach can also apply if there are multiple, small survey areas that are close together in a continuous area of potential habitat, and there is a possibility of managing them and the intervening land as a single multi-site Habitat Area. At this largest scale, Approach 3 manages an entire project or survey area as a single multi-site Species Habitat Area. All known sites in the project/survey area should be within the Species Habitat Area, and are managed as a collective population. Within the Species Habitat Area, habitat is managed to meet the minimum conditions necessary for the persistence of a population over a large area by focusing on overall habitat quality rather than site locations. The objective is to maintain primary habitat conditions and connectivity throughout the Habitat Area, while allowing other management to occur. Within the Habitat Area, "hot spots" are selected as described in Approach 2.

C. Management Within Species Habitat Areas

General considerations

For all three management approaches, consider the following:

- Maintain the favorable daily and seasonal temperature and moisture regimes of the microsites in which these gastropods occur (i.e., ground level microclimates and cover components):
    - Retain a sufficient amount of overstory crown cover and understory vegetation to shade the ground, provide humidity through evapotranspiration, and impede air movement that would tend to displace the cool moist air.
    - Encourage the maintenance and recruitment of woody debris and a layer of litter and duff. These components provide cool moist places in which the animals spend the days, hide from predators, deposit their eggs, and find food.

- When found within riparian reserves, consider increasing the width of occupied riparian reserves as potential management for this mollusk species.

- Attempt to maintain habitat contiguity by extending boundaries of Species Habitat Areas to meet other reserve areas such as Riparian Reserves, other Habitat Areas etc., to minimize fragmentation of populations.

COMPARISON OF THREE HABITAT AREAS AND MANAGEMENT STRATEGIES

Attribute	Approach 1	Approach 2	Approach 3
Local population	Does not need to be locally common	Must be locally common	Must be locally common
Distribution of sites	Can be isolated, single sites	Clusters of multiple sites	Sites scattered across a landscape
Distribution of suitable habitat	Can be isolated areas	Irregular, mosaic distribution	Relatively uniform
Description of Habitat Area	Area immediately around known site.	Polygon around cluster of several known sites & habitat features.	Entire survey area or project area.
Management Considerations within Habitat Area	Manage to maintain or enhance favorable microsite conditions and habitat features at site. Disturbance only to benefit species.	Manage for favorable habitat conditions and maintain microclimate at most sites and best habitat features. Limited disturbance. some thinning and other activities.	Manage for habitat connectivity and suitable conditions, and maintain microclimate at some individual sites and habitat features. Greater degree of disturbance than under Approach 2.
Fire management in Habitat Areas.	As possible, protect from fire. Prescribed fire for fuels management is discouraged.	As possible, protect from fire in low fire frequency areas. Manage fuels with mechanical means.	As possible, protect from fire in low fire frequency areas. Manage fuels with cool, patchy underburns rather than broadcast burning

Specific considerations
Within the Species Habitat Areas consider the following as a way of maintaining or enhancing habitat conditions for the species:

Approach 1: Focus on maintaining or enhancing habitat conditions for the species at known sites

- Minimize disturbance of the forest floor litter, duff, and woody debris.
- Maintain existing canopy closure within a large enough area to moderate fluctuations of temperature and humidity.
- Maintain hardwood trees and shrubs, including bigleaf maple trees (oldest preferred) and other hardwoods, to provide a constant supply of logs, leaves, and leaf mold.
- Manage for a diversity of hardwood and conifer tree species on the site. Place emphasis on the

species that the mollusk species is observed to be using in the area. The desired mix could be determined by the sites supporting the greatest populations of the mollusk species in the area.

- Maintain or enhance the naturally occurring diversity of plant species. This will increase the range of hosts for a variety of fungi species and make other food substrates available throughout the season. This also provides assurance that specific plant species, if found to be critical in the life cycle of this mollusk species, are not inadvertently lost.

- Maintain important cover and microhabitats by maintaining dead and downed woody debris (especially Class 2 - 4), including all size classes, in its natural abundance. Falling trees where insufficient numbers of logs occur may be done, but is not encouraged unless the resulting canopy cover provides sufficient shade to maintain cool, moist conditions.

- Avoid prescribed burning within the Species Habitat Area.

- As feasible, manage to control exotic snails and slugs, as well as noxious weeds and other exotic animal species.

- Avoid road construction, quarrying, and other major site disturbing activities within occupied rockslides and talus areas.

Approach 2: Focus on managing for habitat conditions sufficient to maintain connectivity within the polygon and between islands of high quality habitat in hot spots.

- Minimize disturbance within the "hot spots", applying Approach 1 considerations to these "hot spots" (except for size of the Habitat Area).

- Over the remainder of the Species Habitat Area, maintain a relatively high level of suitable habitat conditions to allow for continued occupation by the species.

    - Moderate fluctuations in temperature and humidity by limiting disturbance to ground cover, woody debris and shrub layer vegetation.

    - Avoid compaction by limiting use of machinery and heavy equipment

    - Manage to maintain crown cover at an average of 70%, or at a level sufficient to provide shade over most of the Habitat Area. Most natural stands in which *C. devia* has been found have had canopy cover greater than 70%. The few exceptions have been areas with high water tables. Maintain connectivity within the polygon and between hot spots by providing corridors of dense shade, which is most important during the hottest and driest time of the year. On average, maintain favorable temperature and humidity regimes by retaining more shaded areas than open areas. Mature trees provide shade and also radiate heat at a higher level above the ground. For this reason, the majority of canopy closure should come from the larger or more mature trees available.

    - Avoid broadcast burning for site preparation or slash disposal within Species Habitat Areas.

    - During site preparation or slash disposal, minimize ground disturbance and retain

large woody debris to the degree possible. Hand piling is much preferred to machine piling; place piles outside of the Habitat Area as much as feasible. Consider covering and burning piles in the same season to prevent mollusks from being attracted to the piles and killed, or leaving the piles unburned to provide additional habitat.

- Types of activities that may occur and meet the objectives of this approach include: skid trails, yarding corridors and falling and removal of trees. Pro-active habitat management is also encouraged, such as thinning to promote propagation or growth of hardwoods, or to enhance conifer growth in young thickets; fall an occasional tree to improve distribution of large woody debris.

Approach 3: Focus on managing overall habitat quality throughout the Habitat Area to maintain minimum conditions and connectivity necessary for the persistence of a population over a large area rather than managing individual sites. This approach may result in short-term reduction of overall habitat quality, but should maintain connecting corridors within the Habitat Area (especially between hot spots) and adequate protection of hot spots to ensure continued occupation by the species.

- Manage "hot spots" to emphasize habitat maintenance or enhancement. Minimize disturbance within the "hot spots", applying Approach 1 considerations to these areas (except for size of the Habitat Area).

- Over the remainder of the Species Habitat Area, retain and manage key habitat components. These components include conifer and hardwood trees, tree and shrub species used by associated fungal species, and large down woody material (including a source for future recruitment). Ensure that these components are shaded.

    - Moderate the fluctuations in temperature and humidity by limiting disturbance to ground cover, woody debris and shrub layer vegetation.

    - Avoid compaction by limiting use of machinery and heavy equipment

    - Maintain connectivity within the Species Habitat Area and between hot spots by providing corridors of shade, which is most important during the hottest and driest time of the year. Under Approach 3, external influences affect the internal habitats much less than they would in a situation where there is an abrupt edge where stand conditions change. An average of 50 to 60% canopy closure is likely sufficient to maintain favorable habitat for *C. devia* in the Species Habitat Area outside of the hot spots, if other habitat components are maintained (i.e., logs, litter and duff, word ferns and other ground vegetation). This level of average shading may be attained by averaging small openings with areas having more dense canopy. Mature trees provide shade and also radiate heat at a higher level above the ground. For this reason, the majority of canopy closure should come from the larger or more mature trees available.

    - During site preparation or slash disposal, minimize ground disturbance and retain large woody debris to the degree possible. Hand piling is much preferred to machine piling; place piles outside of the Habitat Area as much as feasible. Consider covering and burning piles in the same season to prevent mollusks from being attracted to the piles and killed, or leaving the piles unburned to provide additional habitat.

- Avoid broadcast burning for site preparation or slash disposal within Species Habitat Areas. Keep fire out of Habitat Areas in regions with a longer fire return interval (greater than 50 years). Areas with relatively short fire return intervals (less than 50 years) have a greater need for and opportunity to use prescribed burns to manage fire risk in and around Habitat Areas. When used, fire prescriptions should target cool, patchy under burns which leave a portion of the Habitat Area (approximately 30% minimum) unburned. Take into consideration the species life cycles and behaviors by avoiding the use of prescribed fires while the species is active on the ground surface. Attempt to keep fire out of the 'hot spots'.

- Types of activities that may occur and meet the objectives of this approach include: skid trails, yarding corridors and falling and removal of trees. Pro-active habitat management is also encouraged, such as thinning to promote propagation or growth of hardwoods, or to enhance conifer growth in young thickets; fall an occasional tree to improve distribution of large woody debris

D. Other Management Issues and Considerations

Exotic species of both plants and animals are entering habitats occupied by this species. If exotic species are found, measures to control them should be implemented if feasible. Measures to control exotic species should not be adverse to *Cryptomastix devia* and other native species.

V. RESEARCH, INVENTORY AND MONITORING OPPORTUNITIES

The objective of this section is to identify opportunities for additional information that could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. While the research, inventory, and monitoring information is not required, these recommendations should be addressed by a coordinating body at the Regional level.

A. Data Gaps and Information Needs

Additional data could help resolve several questions. These include;

- What is the specific range of this species?

- What is the range of habitat conditions tolerated the species? What is the range of conditions required for populations to remain secure and viable? Are habitats used by the species at the apparent center of its distribution in the Cowlitz and Cispus River drainages on the Gifford Pinchot N.F. consistent with those used elsewhere, particularly at the edges of its range and at more xeric sites?
    - How does this species disperse to other suitable habitat patches, and what limits its dispersal capability?
    - How large are local populations, and how does this affect long-term viability of occupied sites?

- What are the species biological attributes?
    - Plant associations;
    - Specific plant species required/used;
    - Specific foods;

- Amount of large woody debris desired;
- Optimum forest crown cover to maintain desired conditions;
- Other stand structure and components (e.g., small woody debris, litter, duff, water, etc.)?
- Distance moved in a lifetime?

- What are the species physical attributes?
  - Soil types, geology, trace elements;
  - Temperature, humidity.

B. Research Questions

- What stand characteristics (canopy cover, age, large woody debris, litter and duff, etc.) are required to support the required conditions?

- Can mid-seral, conifer forest habitat for this species be enhanced through commercial thinning or other practices (e.g. snag creation), specifically to maintain and stimulate growth of bigleaf maple trees for C. devia habitat? If so, which method(s) are the most effective?

- How do the required stand characteristics vary under different circumstances (elevation, slope, aspect, geographical location, etc.)?

- What is the response of the species to fire under various intensities and seasons?

- What stand size is required to provide sufficient area of suitable habitat?

- How long is required for recolonization of a site by species from adjacent populations? How does this recolonization occur, and what are its limits?

- What are the effects of herbicides and other chemicals used in forest management on mollusk species, particularly at roadside locations where *C. devia* sometimes occurs adjacent to noxious weed populations?

- What effects are non-native gastropods having, if any, where they occur with *C. devia* ?

C. Monitoring Needs and Recommendations

- Monitoring of known sites could track trends in populations (numbers, size and density), reproduction, quantity and quality of habitats.

- Monitoring could also help to determine impacts on habitats and populations from management activities, natural disturbances, and vegetative succession.

- For both surveys and monitoring, a standardized set of parameters should appear on the field forms, including standard definitions of all biological parameters.

- Where a species is rare, consider disturbing no more than 5% of its occupied habitat during surveys or monitoring.

- Record all environmental conditions where this species are found to better understand its

habitats and management needs.

- Monitor natural sites for conditions and trends of populations.
- Monitor managed sites for implementation and effectiveness of prescriptions.

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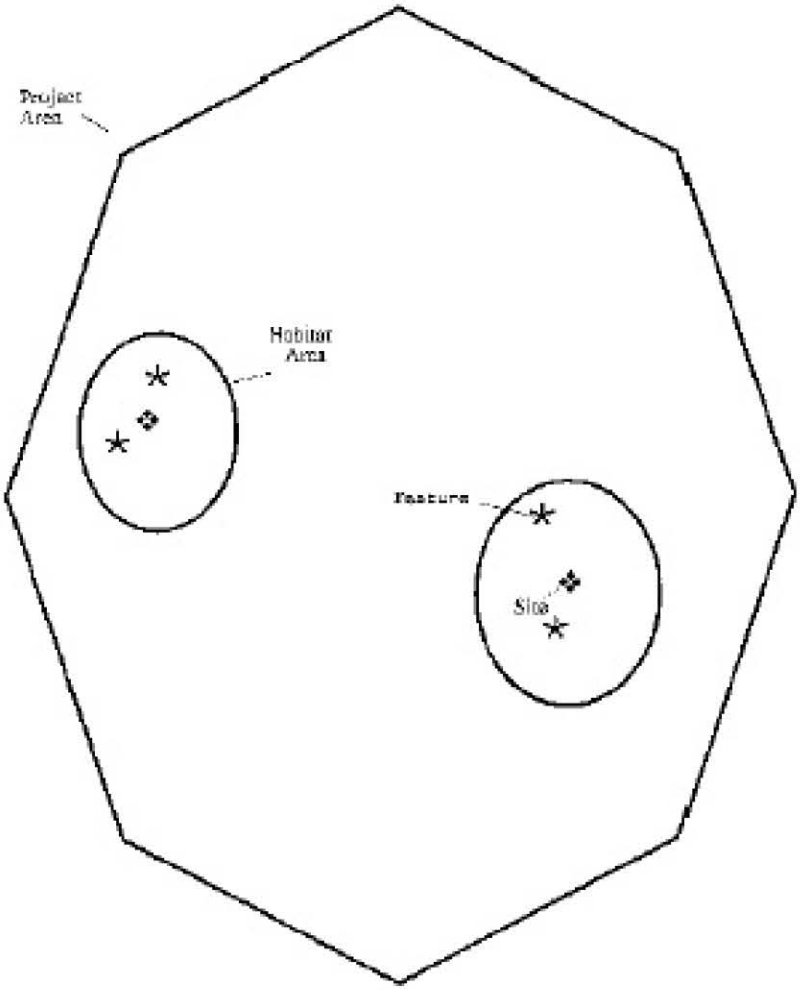
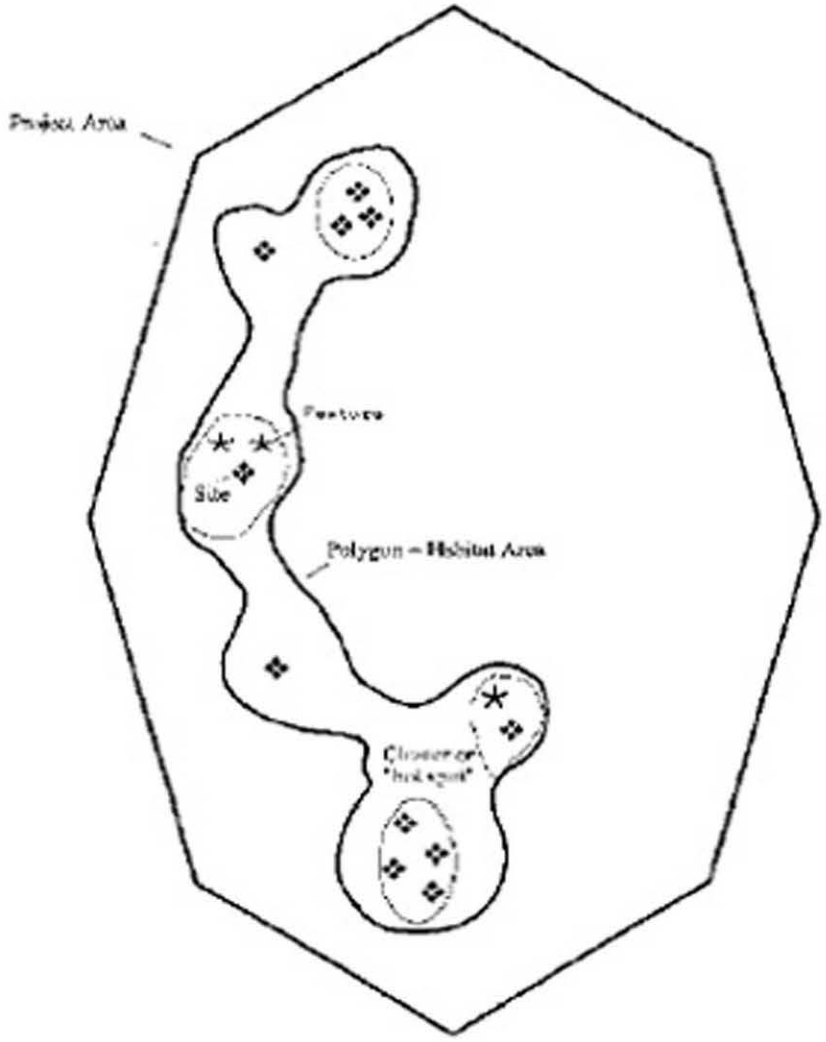
APPENDIX 1

Approach 1 is the option where the species is not locally common. This is the cautious approach where individual known sites are managed within designated Habitat Areas. No or very minimal disturbance is generally expected within the Habitat Area. Management within a Habitat Area should be to maintain, benefit and/or enhance the species.



Approach 2 is suggested where the species is locally common and multiple sites occur in loally clustered areas within a project area, or there is an identifiable concentration of key habitat features that occurs together with those sites. These multiple sites are managed as a collective population. The Species Habitat Area encompasses the population, but is less than the entire project area. Management should focus on the continue occupation by the species within the Habitat Area by maintaining suitable habitat and connectivity within and between high quality hot spots around sites.



Approach 3 is suggested where this species is locally common and the distribution of sites and key habitat features suggests that it is likely to occur throughout the project area. This approach defines the entire project area as the Species Habitat Area, and manages sites as a collective population by focussing on maintaining primary habitat conditions and connectivity throughout the Habitat Area while allowing some adverse modification to occur.