Management Recommendations for Washington's Priority Species

Volume I: Invertebrates

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INTRODUCTION

Fish and wildlife are public resources. Although the Washington Department of Fish and Wildlife is charged with protecting and perpetuating fish and wildlife species, the agency does not have authority over the habitat on which animals depend. Landowners, agencies, governments, and members of the public have a shared responsibility to protect and maintain these resources for present and future generations.

The department has developed management recommendations for Washington's *priority habitats and species* to provide planners, elected officials, landowners, and citizens with comprehensive information on important fish, wildlife, and habitat resources. These management recommendations are designed to assist in making land use decisions that incorporate the needs of fish and wildlife. Considering the needs of fish and wildlife can help prevent species from becoming increasingly threatened or extinct and may contribute to the recovery of species already imperiled.

Priority habitats are those habitat types with unique or significant value to many fish or wildlife species. *Priority species* are those fish and wildlife species requiring special efforts to ensure their perpetuation because of their low numbers, sensitivity to habitat alteration, tendency to form vulnerable aggregations, or because they are of commercial, recreational, or tribal importance. Descriptions of those habitats and species classified as priority are published annually in the Priority Habitats and Species (PHS) List.

Agency biologists develop management recommendations for Washington's *priority habitats and species* through a comprehensive review and synthesis of the best scientific information available. Sources include professional journals and publications, symposia, reference books, and personal communications with experts on specific habitats or species. Management recommendations are reviewed within the agency and by other resource experts and potential users of the information. The recommendations are revised when scientists learn more regarding a *priority habitat* or *priority species*.

Goals

Management recommendations for Washington's *priority habitats and species* are guidelines based on the best available scientific information and are designed to meet the following goals:

- Maintain or enhance the structural attributes and ecological functions of habitat needed to support healthy populations of fish and wildlife;
- Maintain or enhance populations of *priority species* within their present and/or historical range in order to prevent future declines;
- Restore species that have experienced significant declines.

Application

Management recommendations are generalized for statewide application. In many cases, a qualified biologist may be required to provide additional detail on specific projects.

In summary, management recommendations for Washington's *priority habitats and species*...

Are:	Are not:
Guidelines	Regulations
Generalized	Site specific
Updated with new information	Static
Based on fish and wildlife needs	Based on other land use objectives
To be used for all occurrences	To be used only for mapped occurrences

Format

Management recommendations for *priority species* are written in seven sections:

GENERAL RANGE AND WASHINGTON DISTRIBUTION	Summarizes information on the geographic extent of the species in Washington and throughout its range.
STATUS	Identifies the species' State and Federal status.
RATIONALE	Outlines the basis for classifying the species as priority.
HABITAT REQUIREMENTS	Delineates the species' known habitat associations.
LIMITING FACTORS	Specifies factors that may limit the species' distribution or abundance in Washington.
MANAGEMENT RECOMMENDATIONS	Provides management guidelines based on a synthesis of the best available scientific information.
KEY POINTS	Summarizes the most important elements of the species' biology and associated management recommendations.

Management recommendations for Washington's *priority habitats and species* are intended to be used in conjunction with mapped and digital data which display important fish, wildlife, and habitat occurrences statewide. Mapped data can be obtained by calling the PHS Data Request Line at (360) 902-2543. Questions and requests for additional PHS information may be directed to:

PHS Program Manager
WDFW Habitat Management Program
600 Capitol Way N, Olympia, WA 98501-1091

SPECIES STATUS DEFINITIONS

Federally Listed and Candidate Species

Federal Endangered - A species which is in danger of extinction throughout all or a significant portion of its range.

Federal Threatened - A species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Federal Candidate - A species for which sufficient information is available on status and threats to support a proposed listing rule. This includes only what were formerly identified as Category 1 Candidate Species.

State Listed and Candidate Species

State Endangered - Wildlife species native to the state of Washington that are seriously threatened with extinction throughout all or a significant part of their ranges within the state. Endangered species are legally designated in
WAC 232-12-014.

State Threatened - Wildlife species native to the state of Washington that are likely to become endangered within the foreseeable future throughout significant portions of their ranges within the state without cooperative management or the removal of threats. Threatened species are legally designated in WAC 232-12-011.

State Sensitive - Wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges within the state without cooperative management or the removal of threats. Sensitive species are legally designated in
WAC 232-12-011.

State Candidate - Fish and wildlife species that will be reviewed by the Department for possible listing as endangered, threatened or sensitive. A species will be considered for State Candidate designation if sufficient evidence suggests that its status may meet criteria defined for endangered, threatened or sensitive in
WAC 232-12-297. Currently listed State Threatened or State Sensitive species may also be designated as State Candidate species if evidence suggests that their status may meet criteria for a higher listing of State Endangered or State Threatened. State Candidate species will be managed by the Department, as needed, to ensure the long-term survival of populations in Washington (WDFW Policy POL-M-6001).

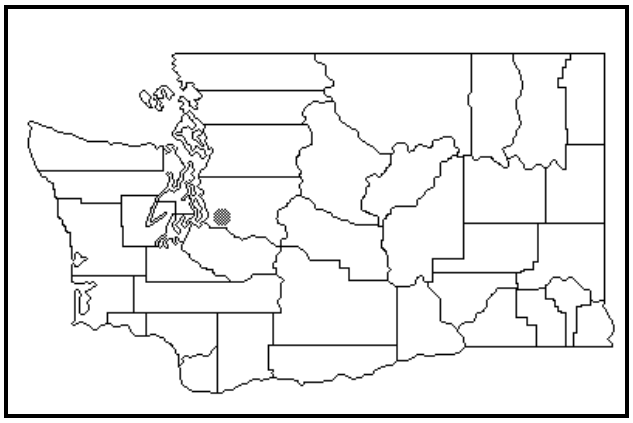
Management Recommendations for Washington's Priority Species

Volume I: Invertebrates

Beller's Ground Beetle
Agonum belleri

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The Beller's ground beetle inhabits lowland sphagnum bogs of Washington, Oregon, and southwestern British Columbia (Johnson 1979, 1986). While historically found in Snohomish and King counties, this beetle's confirmed population currently exists only in King County (Johnson 1979). The Beller's ground beetle no longer occurs at Chase Lake due to severe habitat alterations from peat mining and housing developments (U.S. Fish and Wildl. Ser. 1978).



Distribution of Beller's ground beetle, *Agonum belleri*, in Washington.

STATUS

The Beller's ground beetle is a State Candidate species.

RATIONALE

The distribution of Beller's ground beetle populations has decreased from historic record. The species is in jeopardy of extinction due to its limited distribution and a dependence on low elevation, eutrophic sphagnum bogs.

HABITAT REQUIREMENTS

Beller's ground beetles inhabit eutrophic sphagnum bogs associated with lakes below 1000 m (3300 ft.) elevation. Suitable bogs have very little surface drainage and tend to be acidic (Fitzgerald 1966, Johnson 1979). Johnson (1979) found Beller's ground beetles inhabiting the life zone immediately adjacent to open water at King's Lake bog. This area was characterized primarily as a free-floating band of Sphagnum spp. with some vascular plants including round-leaf sundew (*Drosera rotundifolia*), bog cranberry (*Vaccinium oxycoccos*), and cottongrass (*Eriphorum chamissonis*). Beller's ground beetles were not found in the surrounding dryer life zones of the bog. The beetles probably scavenge on plant and animal materials (Dawson 1965). In laboratory tests, Johnson (1979) maintained them on invertebrates, while Fitzgerald (1966) observed them eating conifer seeds.

LIMITING FACTORS

This beetle's distribution is limited by the availability of sphagnum bogs with living, floating sphagnum mats within the Puget Sound region.

MANAGEMENT RECOMMENDATIONS

Activities that might alter the condition of sphagnum bogs where Beller's ground beetles are known to occur should be prevented. These activities include peat mining, filling, draining or construction within bogs, removing or damaging endemic vegetation, and other perturbations. Changing the natural water level or flow rate within bogs should also be prevented. Sediment inflow from surrounding land-use activities may affect survival of Beller's ground beetles and should be avoided (Johnson 1986).

Ground beetles appear to be more susceptible to the effects of pesticides than other insect groups (Thiele 1977). If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts helpful when assessing pesticides and their alternatives.

Exotic fish could potentially prey upon beetle larvae and should not be introduced into wetlands where Beller's ground beetles occur.

REFERENCES

Dawson, N. 1965. A comparative study of the ecology of eight species of fenland Carabidae (Coleoptera). J. Animal Ecol. 34:299-314.

Fitzgerald, B. J. 1966. The microenvironment in a Pacific Northwest bog and its implications for establishment of conifer seedlings. Unpubl. M.S. Thesis, Univ. of Wash., Seattle.

Johnson, P. J. 1979. A report on a survey for Beller's ground beetle on the North Fork of the Snoqualmie River, King County, Washington. Unpubl. rep. #DACW67-79-M-1189, U.S. Army Corps of Eng., Seattle Dist.

))))). 1986. Letter on file with the Washington Department of Wildlife, Nongame Program, Olympia, WA.

United States Fish and Wildlife Service. 1978. Proposed endangered or threatened status and critical habitat for ten beetles. U.S. Fish and Wildl. Ser., Portland.

Thiele, H. U. 1977. Carabid beetles in their environments. Springer-Verlag. New York, NY.

Milner, '91

KEY POINTS

Habitat Requirements

- Beller's ground beetles inhabit sphagnum bogs associated with lakes below 1,000 m (3,300 ft.) elevation.

- Beller's ground beetles inhabit the life zone immediately adjacent to open water.

Management Recommendations

- Prevent activities that may alter the condition of sphagnum bogs (e.g. peat mining, filling, draining, construction, damage or removal of endemic vegetation).

- Maintain the natural water level or flow rate within sphagnum bogs.

- Prevent sediment inflow and the diversion of stormwater run-off from adjacent uplands.

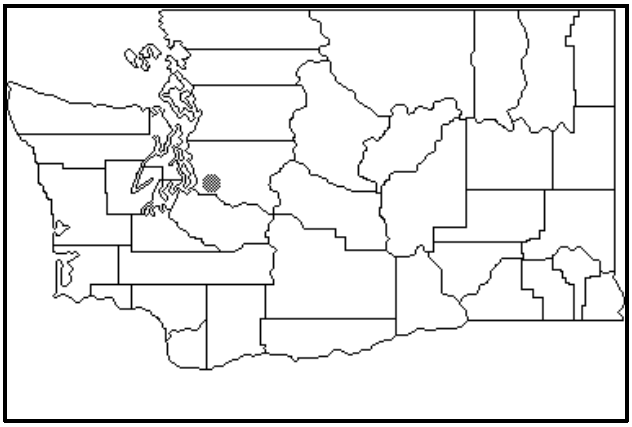
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

- Do not introduce non-native fish into lakes or wetlands associated with sphagnum bogs inhabited by this beetle.

Hatch's Click Beetle
Eanus hatchi

GENERAL RANGE AND WASHINGTON DISTRIBUTION

This beetle inhabits lowland sphagnum bogs of northwest Washington (Johnson 1979). It historically occurred in Snohomish and King counties, but is presently confirmed only in King County (Johnson 1984).



Distribution of Hatch's click beetle, *Eanus hatchi*, in Washington.

STATUS

The Hatch's click beetle is a State Candidate species.

RATIONALE

The distribution of Hatch's click beetle populations has decreased from historic record. Hatch's click beetles are in jeopardy of extinction due to their limited distribution and isolated populations.

HABITAT REQUIREMENTS

Hatch's click beetles inhabit eutrophic sphagnum bogs in or near lakes below 1,000 m (3,300 ft.). They have been collected in very low, floating mats of vegetation in pure sphagnum bogs (Lane 1938). Larvae have been found near bog margins, above the water line (Lane 1971). Adults probably feed on honey dew, pollen, nectar, and small soft insects. Larvae probably prey upon plants and small insects (P. Johnson, pers. comm.).

LIMITING FACTORS

This beetle's distribution is limited by the availability of sphagnum bogs with living, floating sphagnum mats, within the Puget Trough lowlands.

MANAGEMENT RECOMMENDATIONS

Activities that might alter the condition of sphagnum bogs where Hatch's click beetles are known to occur should be prevented. These activities include peat mining, filling, draining or construction within bogs, removing or damaging endemic vegetation, and other perturbations. Changing the natural water level or flow rate within bogs should also be prevented.

The use of insecticides or herbicides may negatively affect this species. If pesticide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

Stormwater run-off should not be diverted into sphagnum bogs.

Exotic fish could potentially prey upon beetle larvae and should not be introduced into wetlands occupied by Hatch's click beetles.

REFERENCES

Comstock, J. H. 1960. An introduction to entomology. Comstock Publishing Assoc., New York, NY.

Johnson, P. J. 1979. A report on a survey for Beller's ground beetle on the North Fork of the Snoqualmie River, King County, Washington. Unpubl. rep., #DACW 67-79-M-1189, U.S. Army Corps of Eng., Seattle Dist.

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Lane, M. C. 1938. A new species of the genus Eanus (Coleoptera Elateridae). Pan-Pacific Ent. 14(4): 188-189.

))))). 1971. *in*: M. H. Hatch, The beetles of the Pacific Northwest. Univ. of Wash. Publ. in Biol. 16:28-29.

Milner, '91

KEY POINTS

Habitat Requirements

- Hatch's click beetles inhabit sphagnum bogs associated with lakes below 1,000 m (3,300 ft.) elevation.

Management Recommendations

- Avoid activities that may alter the condition of sphagnum bogs (e.g. peat mining, filling, draining, construction, removing or damaging endemic vegetation).

- Avoid altering the natural water level or flow rate within sphagnum bogs, including the diversion of stormwater to such areas.

- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

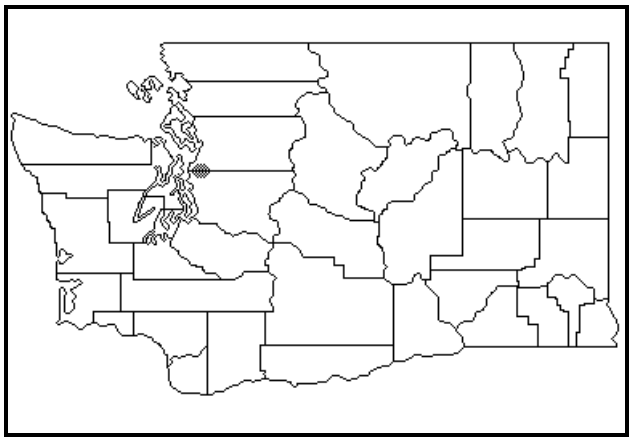
- Do not introduce exotic fish into lakes or wetlands associated with sphagnum bogs inhabited by this beetle.

This species was removed from the Priority Habitat and Species list in 2018

Long-horned Leaf Beetle
Donacia idola

GENERAL RANGE AND WASHINGTON DISTRIBUTION

This beetle inhabits lowland sphagnum bogs of Washington (Johnson 1979) and southwest British Columbia (Leech 1943, Hatch 1971). The long-horned leaf beetle is historically known only from Snohomish County.



Distribution of the long-horned leaf beetle, *Donacia idola*, in Washington.

STATUS

The long-horned leaf beetle is a State Candidate species.

RATIONALE

Long-horned leaf beetles are in jeopardy of extinction due to their limited distribution and isolated populations.

This species was removed from the Priority Habitat and Species list in 2018

HABITAT REQUIREMENTS

The long-horned leaf beetle inhabits eutrophic sphagnum bogs in or near lakes below 1,000 m (3,300 ft.). Long-horned leaf beetle larvae feed on submerged portions of aquatic plants. Adults feed on exposed portions of aquatic plants (White 1983), especially lilies and potamogeton.

LIMITING FACTORS

The availability of healthy sphagnum bogs in the Puget Trough lowlands limits the distribution of this beetle.

MANAGEMENT RECOMMENDATIONS

Activities that might alter the condition of sphagnum bogs should not occur where long-horned leaf beetles reside. These include peat mining, filling, draining, construction within the bogs, removing or damaging endemic vegetation, and other bog-altering activities. Changing the natural water level or flow rate within the bogs should also be prevented.

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts helpful when assessing pesticides and their alternatives.

Urban run-off waters may contain pesticides and other pollutants that could be harmful to adult or larval beetles. Therefore, stormwater run-off from surrounding developments should not be diverted into sphagnum bogs.

Exotic fish could potentially prey on beetle larvae and should not be introduced into wetlands occupied by long-horned leaf beetles.

REFERENCES

Hatch, M. H. 1971. The beetles of the Pacific Northwest. Univ. of Wash. Publ. in Biol. 16:28-29.

Johnson, P. J. 1979. A report on a survey for Beller's ground beetle on the North Fork of the Snoqualmie River, King County, Washington. Unpubl. rep. #DACW67-79-M-1189, U.S. Army Corps of Eng., Seattle Dist.

This species was removed from the Priority Habitat and Species list in 2018

Leech, H. B. 1943. Miscellaneous records of beetles in British Columbia. Proc. Ent. Cos. B.C. 40:26-27.

White, R. E. 1983. A field guide to the beetles of North America. Houghten Mifflin Co., Boston.

Milner, '91

KEY POINTS

This species was removed from the Priority Habitat and Species list in 2018

Habitat Requirements

- Long-horned leaf beetles inhabit sphagnum bogs below 1,000 m (3,000 ft.) elevation.

Management Recommendations

- Prevent activities that alter the condition of sphagnum bogs (e.g. peat mining, filling, draining, construction, removing or damaging endemic vegetation).

- Avoid altering the natural water level or flow rate within sphagnum bogs, including the diversion of stormwater.

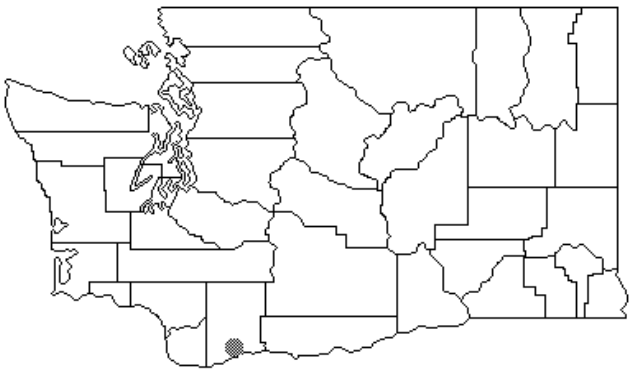
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts that can help evaluate pesticides and their alternatives.

- Do not introduce non-native fish into lakes or wetlands associated with sphagnum bogs inhabited by this beetle.

Golden Hairstreak Butterfly
Habrodais grunus herri

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The range of this species includes southern Washington, western Oregon, and northern California. The existence of golden hairstreak butterflies in Washington is currently confirmed in a single grove of golden chinquapin trees located in southern Skamania County (Pyle 1989).



Distribution of the Golden hairstreak butterfly, *Habrodais grunus herri*, in Washington.

STATUS

The golden hairstreak butterfly is a State Candidate species.

RATIONALE

Golden hairstreak butterflies are in jeopardy of extinction due to their limited distribution and their dependence on golden chinquapin (*Castanopsis chrysophylla*) stands.

HABITAT REQUIREMENTS

Golden hairstreak larvae are specialists that feed exclusively on the host plant golden chinquapin. The golden chinquapin is an evergreen member of the oak family, and Washington stands form the northernmost extension of its range (Kruckeberg 1980). Historic records of golden chinquapin are from at least four locations in Skamania County and a few sites near Hood Canal.

Adult golden hairstreaks feed on nectar during August (Neill and Hepburn 1976). Typical forage plants include herbaceous plants such as goldenrod (*Solidage spp.*), ox-eyed daisy (*Chrysanthemum leucanthemum*), and pearly everlasting (*Anaphalis margaritacea*) (R. Pyle, pers. comm.). Adults are always found in close proximity to golden chinquapin stands, and generally forage within 30 m (100 ft) of the trees (Pyle 1989).

LIMITING FACTORS

The availability of golden chinquapin limits the distribution of this butterfly.

MANAGEMENT RECOMMENDATIONS

Maintaining populations of this species depends upon protecting the larval food plant, golden chinquapin, and avoiding the use of insecticides near this host tree species.

Golden chinquapin is apparently shade intolerant and is generally found where conifer stands are either open or young (Kruckeberg 1980). However, some populations in the Hood Canal area appear somewhat shade tolerant (R. Lesher, pers. comm.). Forest practices should allow for natural regeneration of golden chinquapins.

Golden chinquapin will stump-sprout, thus stumps should not be removed. Cutting or yarding of other tree species in the vicinity of these groves should be done in a way that avoids damaging chinquapins. Careful selective cutting and pre-commercial thinning of conifers may benefit golden chinquapins by reducing shade. Clearcut logging and fire, however, could destroy the trees and should not occur where golden chinquapins are found. If clearcut logging is proposed near chinquapin stands, buffer areas around chinquapins should be established on a site-specific basis. To prevent golden chinquapins from being damaged by blowdown from buffer trees, buffer design should consider the topography, history of blowdown, and amount of root and butt rot present in the area.

Insecticides and herbicides should not be applied within 152 m (500 ft) of chinquapin groves (Pyle 1989). Aerial applications of herbicides and insecticides should not occur near golden chinquapins to minimize accidental contamination from overspray. If pesticide use is planned for areas where this species occurs, refer to Appendix A (page A-1), which lists contacts useful when assessing pesticides and their alternatives. Herbaceous forage plants used by adult butterflies should not be removed in or around golden chinquapin stands.

REFERENCES

Kruckeberg, A. R. 1980. Golden chinquapin (*Chrysolepis chrysophylla*) in Washington State: a species at the northern limit of its range. Northwest Sci. 54 (1): 9-16.

Neill, W. A., and D. J. Hepburn. 1976. Butterflies afield in the Pacific Northwest. Pacific Search Books, Seattle. 92 pp.

Pyle, R. M. 1989. Washington butterfly conservation status report and plan. Unpubl. rep., Wash. Dept. of Wildl., Nongame Prog., Olympia. 217pp.

PERSONAL COMMUNICATIONS

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Milner '93

KEY POINTS

Habitat Requirements

- Larvae feed only on golden chinquapin trees (*Castanopsis chrysophylla*).
- Adults feed on nectar of other plants, but are always found close to golden chinquapin stands.

Management Recommendations

- Do not cut or damage stands of golden chinquapin during timber harvesting.
- Allow natural regeneration of chinquapins.
- Thin and selectively cut conifers around golden chinquapin stands to reduce shade and create openings.
- Establish buffer areas if clearcut logging occurs near chinquapin stands.
- Do not apply insecticides or herbicides within 152 m (500 ft) of golden chinquapin stands.
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts useful when evaluating pesticides and their alternatives.

Puget Blue, *Plebejus icarioides blackmorei*
Valley Silverspot, *Speyeria zerene bremnerii*
Whulge Checkerspot, *Euphydryas editha taylori*
Mardon Skipper, *Polites mardon*

GENERAL RANGE AND WASHINGTON DISTRIBUTION

Puget Blue

The Washington distribution is considered this subspecies' general range. Small concentrations occur in the Tenino Prairies of western Washington.

Valley Silverspot

The Washington distribution includes declining concentrations in the San Juan Islands, Puget Trough, northeastern Olympics, Willapa Hills, and western Cascades. Formerly, this subspecies' overall range extended to the Willamette Valley in Oregon where it now appears to be extinct.

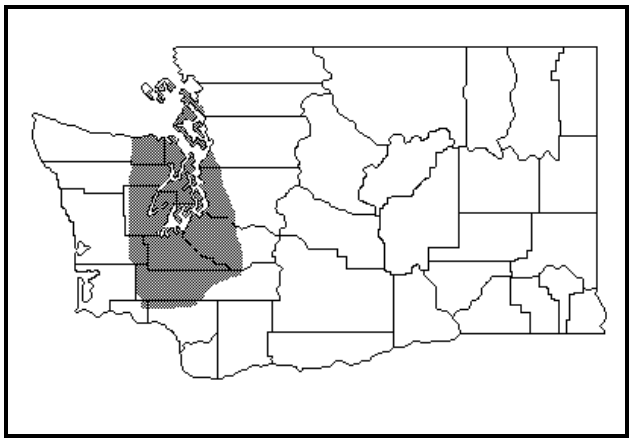
Whulge Checkerspot

The Washington distribution includes concentrations which occur in the Puget Trough, Straits of Juan de Fuca, and San Juan Islands. This subspecies' overall range extends to Oregon's Willamette Valley where whulge checkerspots are virtually extirpated.

Mardon Skipper

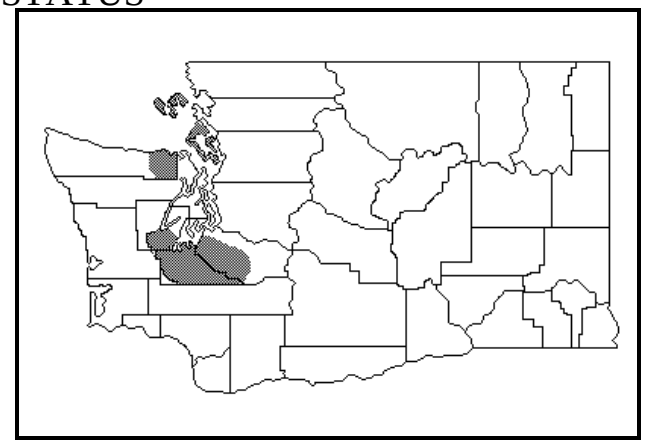
This species occurs in western Washington, southwestern Oregon, and northwestern California. The Washington distribution includes small concentrations which occur in the Tenino Prairies and south-central Cascades (Thurston, Yakima, and Klickitat counties).

Areas in Washington where the Puget blue butterfly, *Plebejus icarioides blackmorei*, occurs in suitable habitat. Map derived from WDFW data files

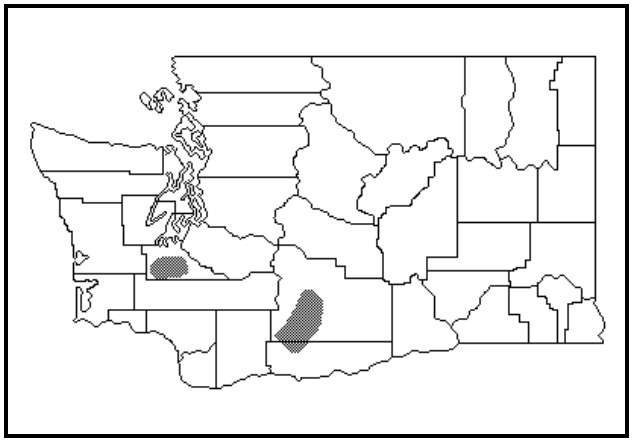


Areas in Washington where the valley silverspot butterfly, *Speyeria zerene bremnerii*, occurs in suitable habitat. Map derived from WDFW data files.

STATUS



Areas in Washington where the whulge checkerspot butterfly, *Euphydryas editha taylori*, occurs in suitable habitat. Map derived from WDFW data files.



Areas in Washington where the mardon skipper butterfly, *Polites mardon*, occurs in suitable habitat. Map derived from WDFW data files.

The Puget blue, valley silverspot, whulge checkerspot, and mardon skipper butterflies are State Candidate species.

RATIONALE

The Washington distributions of these four butterflies are very restricted. Puget blue butterflies are found in only 12 Washington locations and valley silverspots in 6. While locally bountiful, whulge checkerspot concentrations are declining. Mardon skippers are noted in less than 10 Washington locations. All four butterflies are considered vulnerable to a variety of threats.

HABITAT REQUIREMENTS

Puget Blue

Puget blue butterflies are colonial and not usually rare where they occur. Their habitat in Washington includes forest clearings with a presence of lupine (*Lupinus spp.*), Puget lowland prairies and their forest edges, powerline cuts, and unsprayed railroad rights-of-way. Known host plants for this Washington endemic include broadleaf lupine (*Lupinus latifolius*) and probably other lupine species.

Valley Silverspot

This highly localized and often abundant butterfly uses open prairies, arctic-alpine tundra, sub-alpine glades, and mid-elevation roadsides and clearings. The only known host plant is the western blue violet, *Viola adunca*.

Whulge Checkerspot

This locally prolific Pacific Northwest subspecies is associated with maritime prairies and shorelines along the Strait of Juan De Fuca, the post-glacial gravelly outwash and mounded prairies of the Puget Trough, and open island prairies with a dominance of original vegetation. Host plants include the native seaside plantain (*Plantago maritima macrocarpa*) and the non-native English plantain (*P. major lanceolata*).

Mardon Skipper

The mardon skipper is endemic to the Pacific Northwest. It primarily inhabits open grasslands on glacial outwash prairies, as well as openings and ridgetops within ponderosa pine (*Pinus ponderosa*) woodlands. Idaho fescue (*Festuca idahoensis*) is the suspected host plant.

LIMITING FACTORS

General

Many localized populations of butterflies have been lost and a great many more are in jeopardy. The most common causes of butterfly habitat loss and human-caused mortality are development, logging, grazing, impoundments, and the use of herbicides. Chemical or biological (e.g. *Bacillus thuringiensis*) insecticide use, including those applications targeting spruce budworm and gypsy moth, as well as drift from agricultural pesticides applications, undoubtedly affect non-target insect populations. Aerial use of herbicides in forestry, and roadside spraying for weeds eliminates many butterfly hostplants. Efforts to moderate the impact of these activities on natural habitats will benefit the diversity and abundance of our entire butterfly fauna.

Collecting has not been demonstrated to seriously impact butterfly populations in Washington. Conservationists do not usually consider butterfly populations to be susceptible to overcollecting due to the extraordinary reproductive capacity of these insects. Allegations of overcollecting have been made however, for some areas, and ecologically stressed, very local populations could conceivably be damaged in this way. Collecting should certainly be limited for the rarer butterflies (mardon skipper, valley silverspot, whulge checkerspot) of the easily accessible Tenino Prairies, and on the whole, collectors should practice restraint. Collecting remains essential to document occurrence and build research collections.

With care and appropriate application of funding and expertise, almost every subspecies and major population should be able to be maintained in reasonable numbers. Special efforts will have to be made, however, to preserve butterfly diversity in the most rapidly expanding urban and suburban zones.

Specific

Puget Blue--Land development, intensive fertilizing and grazing, agriculture, forest succession, and railroad right-of-way spraying threaten Puget blue butterflies.

Valley Silverspot--Development activities within habitats, grazing, fertilization and other agricultural practices, logging and associated reduction of floristic diversity, succession of prairies, and aerially applied herbicides within forestlands threaten valley silverspot butterflies.

Whulge Checkerspot--Development activities within habitats, grazing, fertilization and other agricultural practices, disturbance, and host plant community succession threaten this subspecies' perpetuation.

Mardon Skipper--Factors that degrade mardon skipper obligate grasslands limit this species. In addition, development, overgrazing and fertilization, herbicide application, the introduction of plants such as Scots broom, and natural succession within forest communities threaten mardon skipper butterflies.

MANAGEMENT RECOMMENDATIONS

General

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

Discontinue the use of fertilizers and limit grazing on habitats where these species still exist. The enlargement of Rocky Prairie Preserve and the long-term status of Rock Prairie Registry site are key to all four species.

Specific

Puget Blue--Maintain lupine stands and control succession by cutting and/or burning. Adults can and will disperse to nearby patches of lupine, as along Rocky Prairie railroad line. Therefore, the direct planting of lupines could be an effective measure. Spraying of the railroad at Rocky Prairie should be discontinued.

The Puget blue is restricted to a very limited number of lowland habitats under pressure from human expansion. Fortunately the best colony occurs on a Nature Conservancy Preserve, but additional habitat should be set aside and measures enhanced for survey and management.
Valley Silverspot--Forest practices within the Willapa Hills that diminish the use of chemicals would help to maintain this population. Control of plant community succession will be necessary on Tenino prairies.

The Olympic Mountains, Willapa Hills, and Puget Trough populations should be monitored separately and each protected individually. The San Juan population should be vigorously sought and protected if it still exists.

Whulge Checkerspot--Maintain grazing level at Rock Prairie. Light grazing may be necessary on other preserves.

Along with the valley silverspot and the mardon skipper, this is one of the most nearly autochthonous butterflies in Washington. All three fly in good numbers at Rock Prairie, near

Tenino, making this one of the most significant butterfly sites in the state. Light grazing therefore will likely need to be a component of its management, at least on the Rock Prairie site. The San Juan Island colonies, where native plantains are used, may not have this need. The sparse Dungeness populations are distinct in size and pattern from Puget Trough checkers. Each component should be conserved individually.

Mardon Skipper--Maintain stands of Idaho fescue and promote western blue violet (*Viola adunca*) as a nectar source. Incremental fire and mowing management techniques should be researched, as should further life history requisites of this species.

This butterfly was formerly considered to be Washington's only endemic butterfly species. The Washington distribution, disjunct between the Tenino Prairies and the southern Cascades, is puzzling. No records have been found between the two, but additional colonies should still be sought in intervening grasslands. This species is of great scientific and evolutionary interest.

RESEARCH NEEDS

Additional studies are necessary for a number of taxa and habitats. Some of the most important investigations include:

- A survey of the San Juan Islands in an attempt to detect several species that have not been recorded there in recent years.
- A full survey of western Washington grasslands and heath/shrublands with respect to the distribution, habitat, and management requirements of a guild of uncommon skipper butterflies.
- Surveys of existing nature reserves should be conducted in order to better document the representation of uncommon butterflies on existing protected lands.

SOURCE. Information for this management recommendations document was derived from:

Pyle, R. M. 1989. Washington butterfly conservation status report and plan. Wash. Dept. of Wildl., Nongame Prog., Olympia. 217pp.

Herbig '91/Whalen '93/Larsen '95

KEY POINTS

Habitat Requirements

Puget Blue

- This butterfly uses forest clearings with lupine (*Lupinus spp.*), Puget lowland prairies and their forest edges, powerline cuts, and unsprayed railroad rights of way.

- Known host plants include broadleaf lupine (*Lupinus latifolius*).

Valley Silverspot

- This butterfly uses open prairies, arctic-alpine tundra, subalpine glades, and mid-elevation roadsides and clearings.

- The western blue violet, *(Viola adunca*) is the only known host plant.

Whulge Checkerspot

- Habitats include maritime prairies, shorelines along the Strait of Juan de Fuca, and Puget Trough prairies that possess a dominance of original vegetation.

- Host plants include native seaside plantain (*Plantago maritima macrocarpa*), and non-native English plantain (*P. major lanceolata*).

Mardon Skipper

- This skipper inhabits open grasslands on glacial outwash prairies, as well as openings and ridgetops within ponderosa pine (*Pinus ponderosa*) woodlands.

- Idaho fescue (*Festuca idahoensis*) is a suspected host plant.

Management Recommendations

- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

- Discontinue the use of fertilizers and limit grazing on habitats where these species occur.

- The expansion of the area within Rocky Prairie Preserve and the long-term status of the Rocky Prairie Registry site are key to all four species.

Puget Blue

- Maintain lupine stands and control succession by cutting and/or burning.

- Planting native lupines may be beneficial.

- Discontinue spraying the railroad right-of way at Rocky Prairie.

Valley Silverspot

- Reduce the use of chemicals during forest practices within the Willapa Hills.

- Maintaining early plant community succession will be necessary on the Tenino prairies.

- Monitor Olympic Mountains, Willapa Hills, and Puget Trough populations individually. The San Juan population should be vigorously sought and protected, if it still exists.

Whulge Checkerspot

- Maintain current grazing level at Rocky Prairie. Light grazing may be necessary on other preserves.

Mardon Skipper

- Maintain stands of Idaho fescue and promote *Viola adunca* as a nectar source.

- Incremental fire and mowing management techniques should be researched, as should further life history requisites of this species.

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

Basin hairstreak, *Mitoura barryi*
Juniper hairstreak, *Mitoura siva ssp.*
Shepard's parnassian, *Parnassius clodius shepardi*
Yuma skipper, *Ochlodes yuma*

GENERAL RANGE AND WASHINGTON DISTRIBUTION

Basin Hairstreak

The range for this rare species is within the Pacific Northwest. The Washington distribution includes Asotin, Columbia, and Klickitat counties. There have been only three reported sightings as of 1989. Diligent examination of juniper stands may reveal more locations for this butterfly.

Juniper Hairstreak

The range is broadly defined as western North America, however, there are fewer than six stations known. The Washington distribution is in the Columbia Basin, and Franklin and Kittitas counties.

Shepard's Parnassian

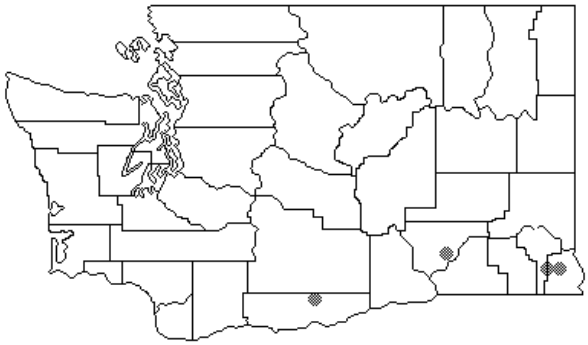
The range extends along the Snake River drainage from southeast Washington into western Idaho. Washington records are from Asotin, Garfield, and Whitman counties. In Idaho they were recorded in Latah and Nez Perce counties (Ferris and Brown 1981). One of the colonies at Wawawai was much reduced by the Snake River impoundment. Known colonies of this butterfly are very rare, but may not be uncommon within a population.

Yuma Skipper

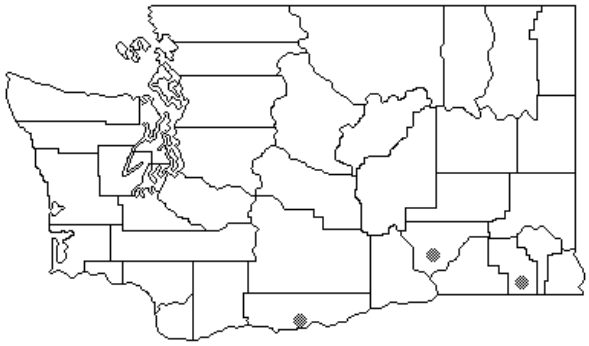
Yuma skippers range from central California east to western Colorado and south to northern

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

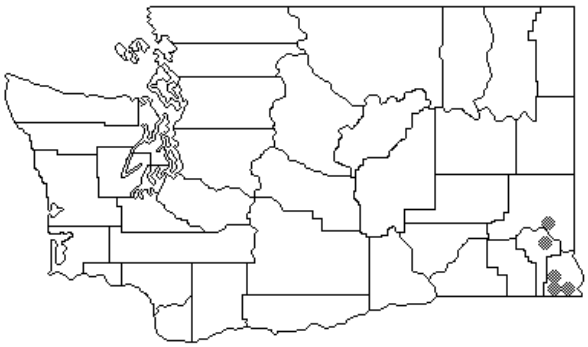
Arizona. There are isolated colonies in the Rocky Mountain region and in Washington that are thought to be relics from the late Pleistocene when a broader, more continuous distribution probably existed (Pyle 1981, Ferris & Brown 1981). In Washington they are found only in Grant County.



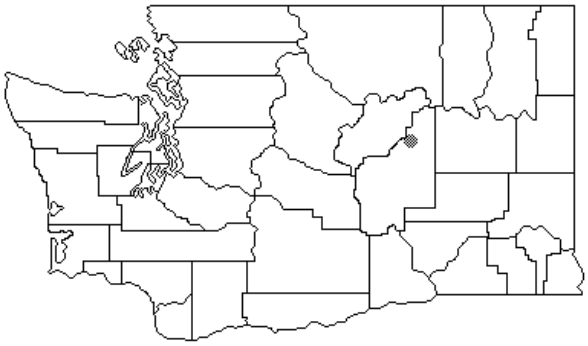
Washington locations where the basin hairstreak, *Mitoura barryi*, is known to occur in suitable habitat. Map derived from WDFW data files.



Washington locations where the juniper hairstreak, *Mitoura siva ssp*., is known to occur in suitable habitat. Map derived from WDFW data files.



Washington locations where the Shepard's parnassian, *Parnassius clodius shepardi,* is known to occur in suitable habitat. Map derived from WDFW data files.



Location in Washington where the Yuma skipper, *Ochlodes yuma,* is known to occur in suitable habitat. Map derived from WDFW data files.

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

STATUS

The basin hairstreak, juniper hairstreak, Shepard's parnassian, and Yuma skipper butterflies are State Candidate species. The taxonomy for basin hairstreak and juniper hairstreak is currently under revision -- these two taxa may be lumped into a single species.

RATIONALE

Basin hairstreak, juniper hairstreak, Shepard's parnassian, and Yuma skipper butterflies are rare species or subspecies with very limited Washington distributions. Highly specific habitat parameters and a sensitivity to an array of potential threats make these animals vulnerable.

HABITAT REQUIREMENTS

Basin Hairstreak

The habitat requirements of the basin hairstreak are not well known. Of the two sites in Washington where this butterfly has been found, one habitat consists of juniper groves within steppe, and the other of mostly open ridgetop with scattered juniper. Host plants are Rocky Mountain juniper (*Juniperus scopulorum*) and possibly other juniper species.

Juniper Hairstreak

As the name suggests this butterfly is found among junipers -- both in juniper/shrub-steppe composite, and in juniper covered hills and dunes. Host plants are Rocky Mountain juniper (*Juniperus scopulorum*) and western or Sierra juniper (*Juniperus occidentalis*). Presently it is difficult to distinguish this species from the basin hairstreak butterfly (*M. barryi*), except by genitalic dissection.

Shepard's Parnassian

This butterfly uses the moister parts of canyons. Host plants are the bleedingheart Dutchman's breeches (*Dicentra cucullaria*), and golden corydalis (*Corydalis aurea*).

Yuma Skipper

This species is found near dense hedges of the corn-like host plant, *Phragmites communis* which grows along edges of seeps, springs, riverbanks, sloughs, canals, and lakes (Scott 1986).

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

Adults take nectar from a variety of tall flowers (Ferris & Brown 1981). Eggs are laid on or near the host plant and the larvae live in rolled-leaf nests on the host plant. Leaves of the host plant are also eaten by the larval-stage animals (Scott 1986). Yuma skipper colonies are small and usually isolated from other colonies. These butterflies seldom move more than a few yards from the host plant (Pyle 1981, Scott 1986).

LIMITING FACTORS

General

Many localized populations of butterflies have been lost and a great many more are in jeopardy. The most common causes of butterfly habitat loss and human-caused mortality are development, logging, grazing, impoundments, and the use of herbicides. Chemical or biological (e.g. *Bacillus thuringiensis*) insecticide use, including those applications targeting spruce budworm and gypsy moth, as well as drift from agricultural pesticides applications, undoubtedly affect non-target insect populations. Aerial use of herbicides in forestry, and roadside spraying for weeds eliminates many butterfly hostplants. Efforts to moderate the impact of these activities on natural habitats will benefit the diversity and abundance of our entire butterfly fauna.

Collecting has not been demonstrated to seriously impact butterfly populations in Washington. Conservationists do not usually consider butterfly populations to be susceptible to overcollecting due to the extraordinary reproductive capacity of these insects. Allegations of overcollecting have been made however, for some areas, and ecologically stressed, very local populations could conceivably be damaged in this way. Collecting should certainly be limited for the rarer butterflies (mardon skipper, valley silverspot, whulge checkerspot) of the easily accessible Tenino Prairies, and on the whole, collectors should practice restraint. Collecting remains essential to document occurrence and build research collections.

With care and appropriate application of funding and expertise, almost every subspecies and major population should be able to be maintained in reasonable numbers. Special efforts will have to be made, however, to preserve butterfly diversity in the most rapidly expanding urban and suburban zones.

Specific

Basin Hairstreak and Juniper Hairstreak--The removal of junipers, livestock grazing on nectar plants, and the use of off-road vehicles in juniper woodlands contribute to the destruction and degradation of basin hairstreak and juniper hairstreak habitat.

Shepard's Parnassian--Interest in Shepard's parnassian butterflies has grown in recent years and

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

commercial overcollecting is known to have taken place. The availability of host food plants is limited by plant succession, invasive species, and climatic influences. It is believed by some that pesticide spray drift and overgrazing by livestock cause deleterious effects. Because these butterflies are found in canyons, impoundments also are a threat. This species once occurred on a bench of the Columbia River where junipers grew, but that bench is now inundated by the river. Another colony at Wawawai was much reduced by the Snake River impoundment.

Yuma Skipper--The Yuma Skipper is threatened by loss of suitable habitat around bodies of water. Tourism and development along *Phragmites* marshes are distinct contributors. Mosquito control by fogging should be planned in a way that avoids damage to these native insects.

MANAGEMENT RECOMMENDATIONS

General

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

Specific

Basin Hairstreak and Juniper Hairstreak--Juniper woodlands should be kept intact and not converted to rangelands or used for off-road recreational vehicles. Grazing should be limited, minimized, or halted to the degree necessary in order to retain nectar plants and to allow them to flower. Existing sites for these butterflies should be defined, registered, and protected.

The Juniper Hills Wilderness in Franklin County, specifically, should be managed to minimize off-road recreational vehicle use and juniper disturbance in order to protect the southern population of the juniper hairstreak butterfly.

Shepard's Parnassian--Existing sites for this species should be defined, registered, protected, and monitored. The plant communities within existing sites should be maintained so that succession will not occur. Further research is needed to determine what plants host these butterflies. Collecting may need to be limited.

Yuma Skipper--This recently discovered Washington species is found on state park lands and represents the dramatic disjuncture of a Great Basin extreme specialist. State park personnel should maintain a registry of habitat and should manage activities so that interference with this species does not occur. It should be one of the highest priorities for Washington butterfly conservation.

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

RESEARCH NEEDS

Additional studies are necessary for a number of taxa and habitats. Some of the most important further investigations to be undertaken include:

- A survey of the San Juan Islands in an attempt to detect several species that have not been recorded there in recent years.
- A full survey of western Washington grasslands and heath/shrublands with respect to the distribution, habitat, and management requirements of a guild of uncommon skipper butterflies.

Surveys of existing nature reserves should be conducted in order to better document the representation of uncommon butterflies on existing protected lands.

NOTE: Information for this Management Recommendations Document was derived from Pyle 1989, unless otherwise referenced.

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iener '91/Whalen '93/Larsen '95

KEY POINTS

Habitat Requirements

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

Basin Hairstreak and Juniper Hairstreak

- Basin hairstreak habitat is not well known. However, Rocky Mountain juniper (*Juniperus scopulorum*) is present in both locations where this species is found.
- Juniper hairstreaks are associated with Rocky Mountain juniper (*Juniperus scopulorum*) and western or Sierra juniper (*Juniperus occidentalis*) -- both in juniper/shrub-steppe composite, and in juniper covered hills and dunes.

Shepard's Parnassian

- The habitat consists of the moister parts of canyons.
- Host plants are the bleedingheart Dutchman's breeches (*Dicentra cucullaria*) and golden corydalis (*Corydalis aurea*).

Yuma Skipper

- The Yuma skipper requires the host plant, *Phragmites communis*, which grows along the edges of seeps, springs, riverbanks, sloughs, canals, and lakes.
- This species uses the host plant for egg deposition, larval nests, and as a larval food source.
- Adults take nectar from a variety of tall flowers.

Management Recommendations

- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

Basin Hairstreak and Juniper Hairstreak

- Keep juniper woodlands intact -- do not convert to rangelands or use for off-road recreational vehicles.
- Grazing should be limited, minimized, or halted to retain nectar plants and to allow them to flower.
- The Juniper Hills Wilderness Area in Franklin County should be managed to minimize off-road recreational vehicle use and juniper disturbance.

Basin hairstreak and Shepard's Parnassian were both removed from the Priority Habitat and Species list

Shepard's Parnassian

- Existing sites for this species should be defined, registered, protected, and monitored.
- Maintain plant communities within existing sites -- do not permit succession to advance.
- Collecting may need to be limited.

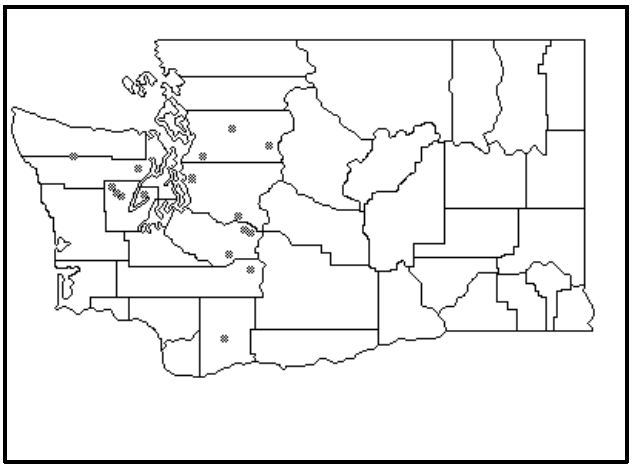
Yuma Skipper

- This species should be one of the highest priorities for Washington butterfly conservation.
- Maintain a registry of habitats and manage activities so that interference with this species does not occur on State lands.

Johnson's (mistletoe) hairstreak
Mitoura johnsoni

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The general range of the Johnson's (mistletoe) hairstreak includes British Columbia, western Washington, Oregon, and California (Howe 1975, Dornfeld 1980, Scott 1987). Washington locations where this butterfly has been documented include the Staircase area and Olympic National Park in Mason County, and Longmire and Mt. Rainier National Park in Pierce County. Other sites exist in various lowland old-growth forest remnants within Jefferson, King, Lewis, Skamania, and Snohomish counties (Shields 1965, Pyle 1989, R. Pyle, pers. comm.). Though there are few documented occurrences recorded, this butterfly was probably found throughout much of western Washington prior to 1900 (Pyle 1989, J. Pelham, pers. comm.). D. McCorkle (pers. comm.) suspects this butterfly is probably not uncommon in western Washington's remaining western hemlock stands that contain dwarf mistletoe.



Washington locations where *Mitoura johnsoni* has been recorded in suitable habitat. Map derived from WDFW data files, Pyle pers. comm.

STATUS

The Johnson's (mistletoe) hairstreak butterfly is a State Candidate species.

RATIONALE

This butterfly species may be vulnerable to decline throughout its range in Washington due to habitat loss (Pyle 1989).

HABITAT REQUIREMENTS

This butterfly depends on lowland coniferous forests that contain dwarf mistletoes of the genus *Arceuthobium*. These mistletoes occur mainly on western hemlock (*Tsuga heterophylla*) and occasionally on true firs (*Abies* spp.) (Scott 1987, Pojar and MacKinnon 1994, D. McCorkle, pers. comm.). Peak conditions for this butterfly exist in old-growth and late successional second-growth, lowland forests. Younger forests that contain dwarf mistletoe may also have the potential to support populations of the Johnson's (mistletoe) hairstreak (D. McCorkle, pers. comm.).

LIMITING FACTORS

Conifer forests containing mistletoe of the genus *Arceuthobium* are necessary for the Johnson's (mistletoe) hairstreak (D. McCorkle, pers. comm.). Forest monoculture, insecticide use, the logging of old-growth, and mistletoe suppression threaten this butterfly's existence (Pyle 1989), as does applying herbicides to flowering plants that are nectar sources (D. McCorkle, pers. comm.). The application of *Bacillus thuringiensis* Berliner var. *kurstak*i (BTK), used for gypsy moth and spruce budworm suppression, is also hazardous to populations of the Johnson's (mistletoe) hairstreak (Miller 1992, J. Pelham, pers. comm., R. Pyle, pers. comm.).

MANAGEMENT RECOMMENDATIONS

The protection of remaining lowland, late-successional and old-growth forests from clearcut logging is important to the survival of the Johnson's (mistletoe) hairstreak (Pyle 1989). Maintain forests composed of varied age-classes and conifer species. Practice non-chemical pest management that avoids the suppression of mistletoe. Do not apply herbicides to flowering plants that are nectar sources for Johnson's (mistletoe) hairstreak (D. McCorkle, pers. comm.). Avoid the use of BTK in forests where this butterfly occurs. Evaluate the possibility of reintroducing Johnson's (mistletoe) hairstreak in forested areas that provide suitable habitat (Pyle 1989).

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists

contacts that may be helpful when assessing pesticides and their alternatives.

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Nordstrom '95

KEY POINTS

Habitat Requirements

- Lowland, mature, coniferous forests that contain western hemlock are necessary for this butterfly.
- Flowering plants are used as a nectar source by Johnson's (mistletoe) hairstreak.
- Host plants for the Johnson's (mistletoe) hairstreak are mistletoes in the genus *Arceuthobium*, which occur on western hemlock (*Tsuga heterophylla*) and true fir (*Abies spp.)* trees.

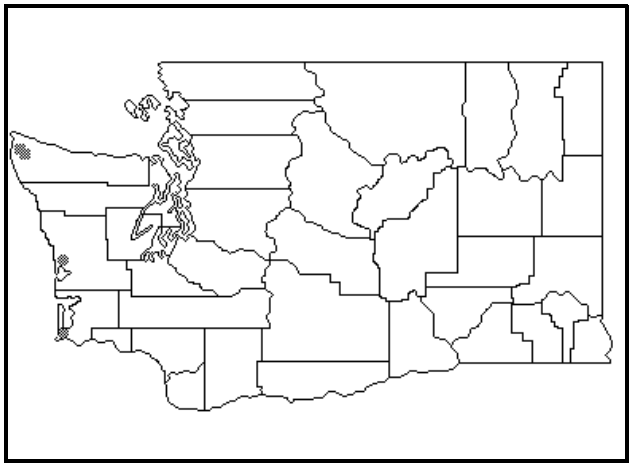
Management Recommendations

- Protect late successional and old-growth lowland forests containing western hemlock from clearcut logging.
- Practice non-chemical pest management in forests.
- Avoid applying herbicides to flowering plants used as nectar sources by *M. johnsoni.*
- Avoid the suppression of mistletoe in forests.
- Avoid using *Bacillus thuringiensis* Berliner var. *kurstak*i (BTK) in forests where this butterfly occurs.
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts useful when evaluating pesticides and their alternatives.
- Consider reintroducing the Johnson's (mistletoe) hairstreak in areas with suitable habitat.

Makah (Queen Charlotte) copper
Lycaena mariposa charlottensis

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The range of the Makah (Queen Charlotte) copper extends from the Queen Charlotte Islands south along the coasts of British Columbia and Washington (Pyle 1989). Washington populations are very restricted and local. Key sites include Ahlstrom's Prairie in Clallam County, and North Bay Bog in Gray's Harbor County. This species was noted once on the Long Beach Peninsula in 1918.



Washington locations where *Lycaena mariposa charlottensis* has been recorded in suitable habitat. Map derived from WDFW data files.

STATUS

The Makah (Queen Charlotte) copper butterfly is a State Candidate species.

RATIONALE

This butterfly species, a relict from a former sea-level era (J. Shepard, pers. comm. to R. Pyle 1989), is one of Washington's most jeopardized. It depends on coastal bogs and peatlands, many of which have been converted to commercial cranberry production (Pyle 1989).

HABITAT REQUIREMENTS

The Makah (Queen Charlotte) copper inhabits successional coastal bogs and peatlands that are subject to maritime climate. Stunted spruce and pine trees are often present in these bogs. The host plant of this butterfly is the native bog cranberry, *Vaccinium oxycoccos* (Pyle 1989).

LIMITING FACTORS

This butterfly species requires open bogs and peatlands with native vegetation. Threats include natural succession, bog drainage and conversion to commercial cranberry bogs, and water table changes. The application of pesticides, herbicides, and the microbial pest control agent *Bacillus thuringiensis* Berliner var. *kurstak*i (BTK), also threaten the Makah (Queen Charlotte) copper (Pyle 1989, Miller 1992, J. Pelham, pers. comm.).

MANAGEMENT RECOMMENDATIONS

Maintain open bog conditions on Ahlstrom's Prairie by suppressing spruce and hemlock encroachment. Burning may be appropriate on some sites, since Ahlstrom's Prairie was kept open by Native American and homesteader fires (Pyle 1976). Continue and expand protection of North Bay Bog, and protect the Long Beach Penninsula population if it is found. Avoid the application of insecticides, herbicides and BTK in areas where there are known colonies of the Makah (Queen Charlotte) copper (Pyle 1989, J. Pelham, pers. comm.). Review Appendix A (page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

RESEARCH NEEDS

Continue the search for the Long Beach population of the Makah (Queen Charlotte) copper. Additional colonies should be sought in remnant prairie/bog situations near the coast, such as the Sooes River Delta, and the Clearwater and Carlisle Bog Natural Area Preserves (Pyle 1989).

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Canada

Nordstrom '95

KEY POINTS

Habitat Requirements

- The Makah (Queen Charlotte) copper requires coastal bogs and peatlands that are subject to maritime climate and that contain native vegetation.

- The host plant of this butterfly is the bog cranberry, *Vaccinium oxycoccos*.

Management Recommendations

- Maintain open bog conditions on Ahlstrom's Prairie by suppressing spruce and hemlock encroachment.

- Burning may be appropriate on some sites to prevent encroachment.

- Continue protection and expansion of North Bay Bog.

- Protect any population of this butterfly that is found on the Long Beach Penninsula.

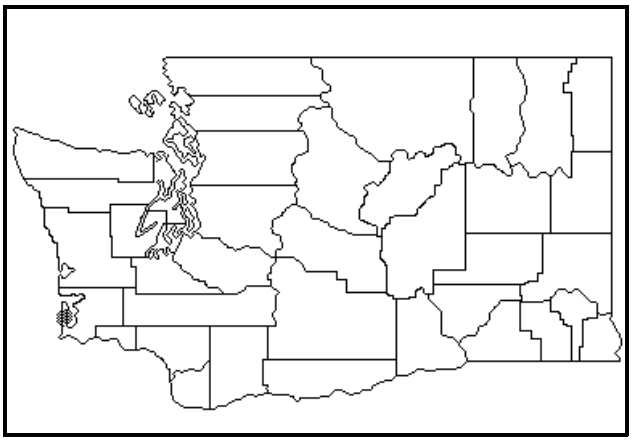
- Do not use insecticides, herbicides, or the microbial pest control agent *Bacillus thuringiensis* Berliner var. *kurstak*i (BTK), in the vicinity of known colonies of Makah (Queen Charlotte) coppers.

- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

Oregon Silverspot Butterfly
Speyeria zerene hippolyta

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The Oregon silverspot butterfly was historically found along the coastal zone of southern Washington and central and northern Oregon. Currently, one small population occurs in Washington on the Long Beach Peninsula in Pacific County.



Distribution of the Oregon silverspot butterfly, *Speyeria zerene hippolyta*, in Washington.

STATUS

The Oregon silverspot is a State Endangered and Federal Threatened species.

RATIONALE

The Oregon silverspot butterfly is in jeopardy of extinction due to limited distribution, low numbers, and loss of habitat supporting the western blue violet (*Viola adunca*).

HABITAT REQUIREMENTS

Oregon silverspot butterflies are found in coastal salt-spray meadows and open-field habitats that support the larval host plant, the western blue violet (*Viola adunca*). Moderate grass cover found in these open habitats provides shelter for the larvae from wind, rain, and sun (Stine 1982).

Adult butterflies feed in meadows, on nectar-producing herbaceous plants such as aster, tansy ragwort, goldenrod, thistle, and pearly everlasting (R. Pyle, pers. comm.). Open areas used by these butterflies are typically surrounded by a fringe of brush or conifer trees which provide necessary shelter for adults (Stine 1982).

In Washington, the Oregon silverspot breeds in stabilized sand dune communities where violets persist. Adults presumably rest and feed in nearby open forest glades (Pyle 1985).

LIMITING FACTORS

Availability of salt-spray meadow habitat that supports the western blue violet, and nearby forest fringe shelter belts.

MANAGEMENT RECOMMENDATIONS

Maintaining populations of Oregon silverspot butterflies depends upon protecting and restoring the habitat of the larval food plant, western blue violet, and protecting the forest glade habitat used by adults. Western blue violets grow best in exposed areas free of surrounding vegetation. However, mature violets apparently can survive for long periods of time in heavily shaded areas (Hammond 1987). Butterfly habitat in Oregon is recovering after six years of habitat restoration efforts (Hammond 1989).

In Washington, virtually all of the habitat where the Oregon silverspot and western blue violets have been found are threatened by the presence of heavy grass thatch or woody plant invasion, which deter violet growth. These sites are also threatened by residential, commercial, and recreational development (Pyle 1985).

Development should not occur in areas that may support the Oregon silverspot butterfly. These areas include forest stands that offer shelter to adult butterflies and the dune communities where larvae feed. Shore pine succession should be reduced in meadow violet habitat by removing

young trees and other woody vegetation. Selected older hind dune areas on the Long Beach Peninsula should be mowed two or three times a year for at least three successive years. Mowing should occur in April and June (to remove bracken fern), and in November. Once violets are re-established, mowing may only need to be done on a three-year rotation, once in early spring and once in late fall. Also, the mowing regimen should be staggered so that all habitat areas are not mowed in the same year (P. Hammond, pers. comm.). These treatment areas should be monitored to avoid erosion.

Landowners can promote violet growth by leaving their lawns and vacant lots natural (i.e., no fertilizers or herbicides) and by mowing only a few times a year (K. Sayce, pers. comm.). Small openings or strips, 9-12 m (30-40 ft.) wide, should be created in forest shelter areas to promote nectar plants (P. Hammond, pers. comm.). Camping, off-road vehicle use, and other recreational activities that damage western blue violet habitat, should be restricted in dune areas. Oregon silverspot butterflies should not be collected in Washington.

The use of insecticides and herbicides may negatively affect this species. Insecticides should not be applied in open areas or adjacent forested areas where butterflies occur (Stine 1982). Herbicides that would harm western blue violets should not be applied to areas where these violets grow. If pesticide use is planned for areas where this species occurs, review Appendix A (page A-1) for contacts useful when assessing pesticides, herbicides and their alternatives.

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Rodrick '91

KEY POINTS

Habitat Requirements

- Larval habitat consists of dune meadows with western blue violets (*Viola adunca*).
- Adult habitat consists of spruce-shore pine stands with grassy openings.

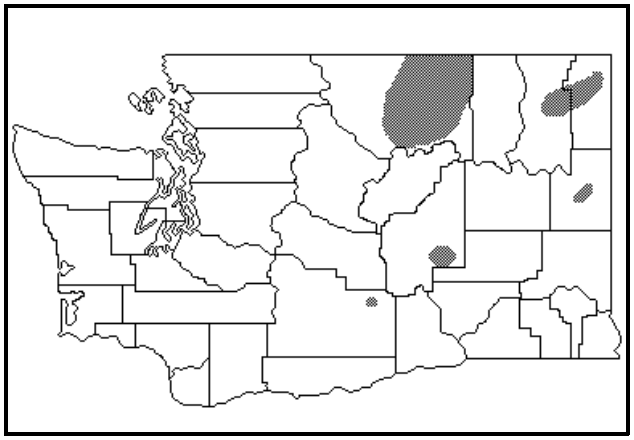
Management Recommendations

- Restore dune meadows, mow two to three times per year for three years.
- Maintain dune meadows, mow on a three-year cycle.
- Leave lawns and vacant lots natural and mow infrequently.
- Create openings or strips, 30-40 ft. wide in forest shelter areas.
- Avoid using insecticides, herbicides, and fertilizers that would harm this butterfly or its habitat.
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

Silver-bordered bog fritillary
Boloria selene atrocostalis

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The silver-bordered bog fritillary can be found in areas from Alaska to Newfoundland, and in Washington, Oregon, New Mexico, Illinois, and North Carolina (Pyle 1990). In Washington, this butterfly occurs east of the Cascade Mountains in the Columbia Basin, and in Okanogan and Pend Oreille counties. Though numerous where it occurs, the distribution of this species is disjunct, with fewer than 20 sites known.



Areas in Washington where the silver-bordered bog fritillary, *Boloria selene atrocostalis*, occurs in suitable habitat.

STATUS

The silver-bordered bog fritillary is a State Candidate species.

RATIONALE

The silver-bordered bog fritillary is an extremely colonial butterfly with disjunct populations. This butterfly is strongly associated with boggy meadows and true bogs, with northern bog violet (*Viola nephrophylla*) as a key host plant (Pyle 1974, 1990). This butterfly's dependence on specific wetlands or wetland types makes it vulnerable to population declines.

HABITAT REQUIREMENTS

The silver-bordered bog fritillary inhabits boggy meadows and true bogs which support violets (*Viola spp*.) (Pyle 1974), usually located within low- to mid-elevation forests. Several colonies occur in wetlands located within xeric steppe habitat.

Violets, most importantly the northern bog violet (*Viola nephrophylla*), are the only known larval host plants of the silver-bordered bog fritillary in Washington. Adults collect nectar from a variety of other flowering plants (Pyle 1974).

LIMITING FACTORS

General

Many localized populations of butterflies have been lost and a great many more are in jeopardy. The most common causes of butterfly habitat loss and human-caused mortality are development, logging, grazing, impoundments, and the use of herbicides. Chemical or biological (e.g. *Bacillus thuringiensis*) insecticide use, including those applications targeting spruce budworm and gypsy moth, as well as drift from agricultural pesticides applications, undoubtedly affect non-target insect populations. Aerial use of herbicides in forestry, and roadside spraying for weeds eliminates many butterfly hostplants. Efforts to moderate the impact of these activities on natural habitats will benefit the diversity and abundance of our entire butterfly fauna.

Collecting has not been demonstrated to seriously impact butterfly populations in Washington. Conservationists do not usually consider butterfly populations to be susceptible to overcollecting due to the extraordinary reproductive capacity of these insects. Allegations of overcollecting have been made however, for some areas, and ecologically stressed, very local populations could conceivably be damaged in this way. Collecting should certainly be limited for the rarer butterflies (mardon skipper, valley silverspot, whulge checkerspot) of the easily accessible Tenino Prairies, and on the whole, collectors should practice restraint. Collecting remains essential to document occurrence and build research collections.

With care and appropriate application of funding and expertise, almost every subspecies and major population should be able to be maintained in reasonable numbers. Special efforts will have to be made, however, to preserve butterfly diversity in the most rapidly expanding urban and suburban zones.

Specific

The availability of boggy meadows and true bog habitat with adequate populations of violets restricts the distribution of the silver-bordered bog fritillary. Natural succession within these plant communities jeopardizes habitat components necessary for this butterfly. Human activities that alter the water-table or reduce floristic diversity, such as land development, wetland drainage, intensive fertilizing and grazing, and pesticide application, also threaten this butterfly's existence.

MANAGEMENT RECOMMENDATIONS

Activities which result in wetland drainage or water-table alteration should be avoided.

Succession of bog vegetation (i.e., violets) to willow on protected sites may eventually become a problem requiring management.

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

Pesticide applications in areas located near known habitat should be monitored to ensure that populations of the butterfly are not adversely impacted. When possible, avoid pesticide use in adjacent habitat from early May through August. Adults may be feeding in drier, adjacent habitat during this time (Pyle 1974).

A complete site survey and protection profile should be performed for land-use activities that may impact silver-bordered bog fritillary populations and habitat. For example, plans to extract water from the aquifer near the Moxee Bog Nature Conservancy Preserve in Yakima County, a key site for protection of this species, should be monitored. The Potholes National Wildlife Refuge population and other sites may need registry or other protection.

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Demers '94/Larsen '95

KEY POINTS

Habitat Requirements

- This butterfly inhabits boggy meadows and true bogs.
- Violets (*Viola spp*.), particularly the northern bog violet (*Viola nephrophylla*), are the only known larval host plants.

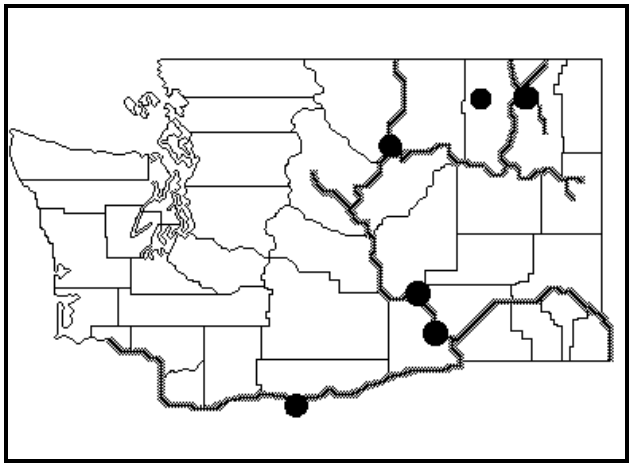
Management Recommendations

- Maintain hydrology of wetland and bog habitat by avoiding activities which result in drainage or water-table alteration.
- Monitor willow succession within silver-bordered bog fritillary habitat and manage to ensure continued existence of violets.
- Avoid using insecticides and herbicides that may negatively impact this butterfly or the northern bog violet, in silver-bordered bog fritillary habitat.
- Avoid pesticide use in adjacent areas from early May through August.
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts useful when evaluating pesticides and their alternatives.
- Increase efforts to locate sites occupied by the silver-bordered bog fritillary.

California Floater
Anodonta californiensis

GENERAL RANGE AND WASHINGTON DISTRIBUTION

The California floater is endemic to the Pacific drainage from British Columbia, Canada to Chihuahua, Mexico. Within the United States, it has been recorded in Washington, Idaho, western Wyoming, Oregon, California, Nevada, Utah, and Arizona (Burch 1973, Frest 1992, U.S.F.W.S. 1990). While declining throughout much of its former range, the species current distribution is not well known. This species may be nearing extinction in some of the more southern states, including parts of California (Taylor 1981).



Distribution of the California floater, *Anodonta californiensis*, in Washington. River systems with which this species has been associated are in bold.

In Washington, the California floater is known to occur in the Columbia River system and in a few other lakes and rivers in eastern Washington. Historic eastern Washington locations included the Snake, Wenatchee (may be extirpated), and Okanogan rivers, and Hangman Creek (formerly Latah Creek) near Spokane (Henderson 1929, Ingram 1948). The only sites from which there are recent records of

live California floaters include portions of the Columbia and Okanogan rivers, Curlew Lake (Frest and Johannes 1993), and several ponds adjacent to the Columbia River downstream from the Hanford reactor sites (Pauley and Nakatani 1968).

In western Washington, the California floater has been reported from Seattle (a doubtful record), and the Columbia River counties of Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat. There are no recent western Washington records of live California floaters (Frest and Johannes 1993).

STATUS

The California floater is a State Candidate species.

RATIONALE

The California floater is declining or extinct over much of its range due to habitat alteration and pollution. Within the Columbia River system in Washington, this clam may still be fairly widespread, although in patchy and diminished occurrence. The Columbia River is composed of nearly continuous impoundments with severe annual fluctuations of water levels. These fluctuations expose large areas of California floater habitat to alternating drying and deep flooding. The dumping of industrial wastes into rivers, as well as oil and chemical spills, are threats to the California floater and to other aquatic organisms crucial to the clam's survival.

HABITAT REQUIREMENTS

The California floater lives, feeds, respires, and reproduces in clean fresh water. These clams feed by filtering planktonic organisms (Frest 1992) which also require clean, well oxygenated water. When *A. californiensis* reproduces, eggs are fertilized by sperm brought through the brood pouch along with respiratory currents of water. The eggs are continually bathed by these currents while incubating in the brood pouch formed by the gills. Thus, both sperm and eggs are exposed to any pollutants in the water. Deriving oxygen, nutrients, and a means of reproduction from the water in which it lives, the California floater readily accumulates pollutants.

The larval stage of this clam is parasitic, adhering to a host fish while metamorphosing into a juvenile clam. An aquatic system must be able to support a healthy population of host fish in order for the California floater to be present. While several fish species are acceptable hosts, it is not clear which ones are best or whether only certain species are acceptable. Hypothetically, fish species native to the range of the clam should be expected to make the best hosts as those are the ones with which the clams have co-evolved.

Bequaert and Miller (1973) stress that specific host fish are required, and postulate that the disappearance of specific host fish from the clam's habitat in Arizona is one reason why *A. californiensis* is now near extinction in that state. Until the importance of particular fish species to the survival of the California floater is better understood, healthy populations of native fish within the range of the California floater should be maintained.

When metamorphosis is complete, juvenile clams must fall from the host fish where they can attach to gravel or rocks in clean flowing, well-aerated waters. These riffle areas, with rocky or gravel substrate, are essential for early development, especially when immediately upstream from the quiet, soft bottom habitat of mature clams (T. Burke, pers. obs.).

After growing for some time, young clams are washed downstream and settle in sandy or soft, muddy bottoms in the slower waters of lakes and large rivers where they mature (Isely 1911, Lefevre and Curtis 1912). Frest (1992) observed, "The California floater is most commonly reported from rivers or river lakes in relatively stable, oxygenated mud, sand, or fine gravel beds, often located in pools just downstream from rapids. Another favorite habitat for this species is in fine-sediment bars fringing the mouths of large tributaries to rivers."

Adult clams, as well as young clams in the final stages of maturation, live partially buried in soft mud or sand bottoms. Submerged alluvium surrounding the mouths of tributary streams or below riffle areas may support juvenile clams and seem to be especially important (T. Burke, pers. obs.). Since *A. californiensis* is unable to move rapidly across or through benthic materials, this clam requires a relatively stable substrate so it is not buried and/or suffocated by shifting sediments.

LIMITING FACTORS

There are several factors contributing to the California floater's decline that also restrict its recovery. Threats include sediment, debris, siltation, or bedload movement, all of which can smother or crush juvenile clams. Rapid outwash and accumulations of sediment can also cover and kill adults. Fluctuating water levels and pollution are threats to this and other aquatic species, as are changes in water temperature and dissolved gases caused by the impoundment of previously lotic environments.

A decreasing area of stable, unpolluted habitat appears to be the most limiting factor for this species. Fluctuating reservoir levels and oil and chemical contamination of its habitat are likely the greatest threats to this clam in the Pacific Northwest. Elsewhere, water diversion and dredging, ground water pumping, the lowering of the water table through agricultural development, and increased flooding due to overgrazing or logging, are destroying California floater habitat and are potential threats in Washington as well (Taylor 1981, USFWS 1990).

Access to host fish has been limited in some areas. Any factor that reduces the densities of suitable host fish populations (e.g., degradation of habitat quality or quantity, blockage of anadromous or other migrations, over-harvest of host fish species, or competition from exotic species) reduce the opportunity for attachment and survival (Hulen 1988). Blockage of fish movement in streams also limits access for reintroduction of *Anodonta* to those waters, and may eliminate use of essential riffle areas by newly metamorphosed juveniles (Taylor 1981, USFWS 1990).

Predation may become an important factor to the survival of this species as populations become more limited (Morejohn 1969). Competition from invading species of exotic mollusks (i.e., *Corbicula* spp.) should also be expected to become more severe as habitat decreases and the apparently more adaptable exotic species increase (USFWS 1990).

Parasites and diseases may affect these clams as well. California floater populations that become more localized may become weakened from competition and pollution. Natural and introduced pathogens could also threaten remnant segments of the population (Pauley and Becker 1968).

MANAGEMENT RECOMMENDATIONS

Baseline data are needed to adequately monitor, manage, and mitigate for losses of the California floater and/or its habitat. Surveys are needed to determine where these clams occur, as well as to monitor known colonies and associated habitats. Changes in populations, as well as habitat quality or quantity, need to be monitored so that trends affecting the survival of the species will be noticed, and so information is available for environmental assessments and/or evaluations of applications for construction or management permits. Maintain records for cumulative effects analyses and propose status changes as appropriate.

The use of insecticides and herbicides may negatively affect this species. If pesticide use is planned for areas where this species occurs, review Appendix A (page A-1) for contacts useful when assessing pesticides and their alternatives.

Water pollution levels should be monitored in cooperation with responsible agencies. Other phenomenon affecting habitat quality that need study include the effects of impoundments on this species and its reactions to associated fluctuations in water levels, temperature, and water quality. The California floater and associated species should be considered in resource management decisions, especially in areas of rivers and reservoirs which still provide suitable habitat. This species should be considered when projects are planned which might cause erosion, siltation or bedload movement in streams, fish blockage, deleterious effects on native fish populations, or those projects which might introduce non-native aquatic organisms.

- Coordinate with state and federal agencies responsible for monitoring pollutants and regulating effluent and contaminant levels (i.e. pesticides, fertilizers, potential oil or chemical spills, etc.) in California floater habitat. Agencies responsible for this monitoring may include the Washington Department of Ecology (WDOE), and the U.S. Environmental Protection Agency (EPA).

- Monitor the effects of water level fluctuations in reservoirs where California floaters actually or potentially occur. Coordinate with state and federal agencies responsible for the regulation and management of acceptable water level fluctuations. Locate areas where *Anodonta* can survive within reservoirs (e.g., shallows of upper reaches, mouths of major tributaries, etc.) and determine appropriate protection or management strategies for habitat associated with this species. Agencies responsible for the effects of water fluctuations within reservoirs may include WDOE, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Bonneville Power Administration (BPA).

- Avoid soil-disturbing activities that cause mass wasting in areas where there is *Anodonta* habitat, such as soft-bottomed slack-water regions and riffles immediately upstream from them. Activities that would bury a colony of adult clams or that would cover or remove rock or gravel from an area that provides habitat for young clams, should not occur.

- Avoid blocking fish movement in streams occupied by *A. californiensis* and between occupied lakes and influent streams.

- Strive to maintain native fish populations. Discourage the introduction of non-native fish, mollusks and other aquatic organisms in California floater habitat. Efforts to prevent the spread of introduced aquatic species should be vigorously pursued.

- Adhere to or surpass riparian and water quality protection regulations for tributaries that influence California floater habitat. Measures taken to protect other native species and resources will benefit this species as well.

RESEARCH NEEDS

Areas of potential habitat for this species should be surveyed and all occurrences of *A. californiensis* mapped. A database on population and habitat parameters needs to be developed.

Research the possibility of reintroducing the California floater into unoccupied, suitable habitat.

Effects of impoundments on this species and their reactions to associated water-level fluctuations, temperature, and water quality need to be studied.

The significance of host fish species is not well understood. It needs to be determined whether the California floater larva prefer native over non-native fish species.

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U.S. Fish and Wildlife Service (8/30/90) Memorandum Re: 90-day Petition Finding for the California Floater.

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GENERAL REFERENCES

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Burke '95

KEY POINTS

Habitat Requirements

- Clean, well-oxygenated water is necessary for all life stages of the California floater, as well as a healthy population of planktonic organisms on which this clam feeds.
- Larval-stage clams need a healthy population of host fish on which to adhere.
- Newly metamorphosed clams require gravel beds with clean, well-aerated water.
- Adult clams require lakes or slow moving rivers with soft sand or mud substrate.

Management Recommendations

- Monitor effects of water level fluctuations in reservoirs behind dams. Locate areas where *Anodonta* can survive within the reservoirs (e.g., shallows of upper reaches, mouths of tributaries, etc.) and strive for strict protection or management of those habitats.
- Avoid major soil disturbing activities that might bury areas of *Anodonta* habitat (soft bottomed slack-water areas, of riffles immediately upstream from such areas). Activities that would bury a colony of adult clams, or which would cover or remove rock or gravel from a riffle area that is habitat for young clams, should not occur.
- Avoid fish blockage in streams occupied by *A. californiensis* and between occupied lakes and the streams that flow into them.
- Strive to maintain native fish populations. Discourage introductions of non-native aquatic species, especially fish and mollusks.
- Avoid polluting waters occupied by *A. californiensis*. Coordinate with Washington State Department of Ecology (WDOE), and the U.S. Environmental Protection Agency (EPA) to regulate potentially harmful effluents or other sources of contaminants (e.g., pesticides, fertilizers, potential oil or chemical spills, etc.).
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.

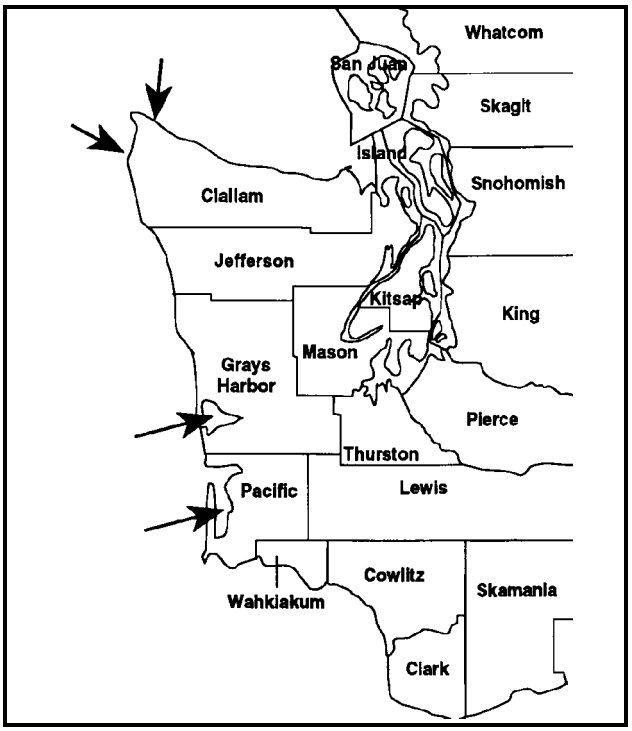
- Survey areas of potential habitat for this species. Map species occurrence and develop a database on population and habitat parameters. Monitor known colonies, and record changes in habitat quantity and quality, as well as any unresolved or unmitigated adverse impacts to these colonies or their habitats. Maintain a database for cumulative effects assessments.

Newcomb's Littorine Snail was removed from the Priority Habitat and Species list

Newcomb's Littorine Snail
Algamorda subrotundata

GENERAL RANGE AND WASHINGTON DISTRIBUTION

Newcomb's littorine snail has been reported from Neah Bay, Mukkaw Bay, Grays Harbor, and Willapa Bay, Washington; Coos Bay and Siletz Bay, Oregon; and Humboldt Bay, California (Dugan 1963, MacDonald 1969, Kozloff 1973). The current known distribution is on the shores of Grays Harbor, Willapa Bay, Coos Bay, and Humboldt Bay (Keen 1970, USFWS 1977, Taylor 1981).



Washington locations where Newcomb's littorine snail, *Algamorda subrotundata*, has been reported.

STATUS

Newcomb's littorine snail is a State Candidate species.

RATIONALE

Newcomb's Littorine Snail was removed from the Priority Habitat and Species list

Newcomb's littorine snail habitat in Oregon and California has been threatened by development and pollution, and may be similarly threatened in Washington. The invasion and spread of cordgrass, *Spartina spp.*, is a potential threat to this snail's habitat throughout its range. The current distribution and status of Newcomb's littorine snail is uncertain, and its biology and ecology are incompletely understood. Its current range is apparently more extensive and secure in Washington than in Oregon or California -- the only other states in which it is found. The species is currently known from only two or three Washington areas and is now more localized in most of those areas than in the past.

HABITAT REQUIREMENTS

This snail inhabits a narrow strip of land on glasswort (*Salicornia virginica*) salt marshes at the edges of bays and estuaries where fresh and ocean waters mix (Hinde 1954). It resides above the mean high tide where it is inundated occasionally but infrequently (Hinde 1954, MacDonald 1969, Taylor 1981). Talmadge (1962) reported that *L. newcombiana*, "...is neither a freshwater, nor a true marine gastropod." Though tolerant of both fresh and salt water, the snail will climb out of either when immersed, and will drown if forced to remain submerged.

MacDonald (1969) found it more abundant in less brackish environments. It lives on the stems of *Salicornia*, and possibly some other marsh plants. It also lives on the substrate beneath vegetation, where it remains moist and protected from the sun and wind. It feeds on microscopic and macroscopic algae and the vascular plants on and under which it lives.

LIMITING FACTORS

Habitat loss and pollution are the greatest threats to this species. Populations and habitats are destroyed as suitable salt marshes are developed or used as dumps for fill, spoils, or waste. By 1961, the population in Humboldt Bay was nearly extirpated due to habitat loss caused by the dumping and burning of sawdust (Keen 1970). The notice of review (U.S. Fish and Wildl. Serv. 1/12/77) concluded:

> ...although, recovering after closure of several of the sawmills, habitat around Humboldt Bay is still threatened by filling and dumping; in Coos Bay, Oregon, it is threatened by log storage on the mud flats, filling and dredging, and the effluent of treated sawdust chips which goes into the Bay; in Grays Harbor, Washington, it is potentially threatened by oil spill, pulp mill waste, and municipal waste.

Newcomb's Littorine Snail was removed from the Priority Habitat and Species list

Another threat to the saltmarsh habitat of this species is the invasion and spread of cordgrass (*Spartina spp.)* This large introduced grass is of concern due to its ability to displace native plants, degrade wildlife habitat, and alter the geomorphology of estuaries. This exotic plant is out-competing and destroying several native biotic communities. The ability of *Spartina* to convert *Salicornia* salt marshes may be the greatest threat to Newcomb's littorine snails. Political implications as well as the high cost of control, however, make it questionable whether the advance of *Spartina* can be checked or reversed.

MANAGEMENT RECOMMENDATIONS

General

The overall objectives for management of Newcomb's littorine snail should be to prevent it from becoming endangered and to maintain it as a functioning component of the salt marsh ecosystem. This habitat is within a distinct and unique ecosystem which also supports other species of plants and animals associated with similar limited habitat. The large local populations of the combined flora and fauna of these communities, "may play an important role in the cycling of nutrients and detritus ... and thus indirectly affect offshore communities." (MacDonald, 1969). The greatest challenge is to protect its habitat from further destruction and to restore it wherever opportunities are presented.

Activities that should be monitored and assessed for impacts on Newcomb's littorine snails and associated habitat include construction, industrial and municipal uses, recreation, the storage and transport of toxic substances, forest practices, and agriculture.

The use of insecticides or herbicides may negatively affect this species. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A (Page A-1) which lists contacts that may be helpful when assessing pesticides and their alternatives.

Specific

To ensure that sufficient habitat is maintained:

- Survey potential habitats including those that are to be affected by any proposed development or activities.
- Map all Newcomb's littorine snail occurrences.
- Include maintenance of this snail species and its habitat as a requirement in shoreline management or development permits. For permit approval consider whether or not:

- an affected colony is a significant portion of the state's population;
- a significant portion of that colony would be adversely affected;
- the remainder of the habitat of that colony will be secure from cumulative and/or latent effects;
- sufficient habitat will remain to ensure that the population within the state will not become endangered;
- successful mitigation of adverse effects is possible, feasible, and ensured.

- Keep a record of how habitat alterations affect colonies of this species.
- Avoid introducing exotic plants and animals into areas inhabited by Newcomb's littorine snail.
- Closely monitor agricultural activities such as grazing, irrigation, and the application of pesticides and fertilizers.
- Avoid using chemicals where salt marsh habitats might be affected.
- Avoid placing fill on habitats.
- Avoid using treated woods, unless shown to have no impact on Newcomb's littorine snail or its habitat.
- Avoid all-terrain and off-road vehicle activities that may compact, rut, or otherwise alter the soil, moisture, or vegetative regime of salt marsh habitats.
- Assess Forest Practices permit applications for impacts to Newcomb's littorine snail and its habitat. Condition permits to avoid or mitigate anticipated adverse impacts.

Toxic Substances and Spills:

- If a spill jeopardizes a significant portion of the state's Newcomb's littorine snail population, collect individuals from threatened areas, along with enough vegetation and substrate to support them. These animals can then be moved to the nearest unoccupied (or underpopulated) area of safe, suitable habitat, or temporarily maintained in captivity until they can be returned to restored habitat.
- Assess the potential effects of alternative cleanup methods vs. allowing natural dissipation

of the spill, and alternative methods to dilute or neutralize the contaminant, with protection of the priority species of the site in mind.

- Monitor the site to track the rate of recovery, improve knowledge of impacts from spills and cleanup methods.

RESEARCH NEEDS

Coordinate comprehensive population and species range surveys and mapping exercises with the states of Oregon and California. Track population changes throughout the range of the species. Questions on the life history, biology, and ecology of Newcomb's littorine snails include:

- Do foods differ with latitude? What is the ecology of the food organisms?

- How, where, and when do Newcomb's littorine snails reproduce? Are there any special conditions necessary to successfully breed, or for the young to develop to maturity?

- The ecology of the *Salicornia* salt marshes on which these snails live, including natural succession of these ecosystems, needs to be studied. Hinde (1954) and Dotty (1946) studied tide and other factors that influence the distribution of marine algae and seed plants in the zone of tidal influence. How do these relate to Newcomb's littorine snail habitat? Do they vary with latitude? What are the natural rates of sedimentation, and how are they affected by land-use activities?

- How much of the habitat of Newcomb's littorine snail has been affected by the invasion and spread of *Spartina*? What are the potential impacts from this invader? What are the impacts of control activities (i.e., herbicide application or mowing).

- What other animal and plant species are unique to or strongly associated with these ecosystems.

- Is livestock attracted to *Salicornia* salt marshes? If so:

    - What level of trampling can the snails endure?

    - How much grazing or trampling can the vegetation of the site tolerate before cover or composition is unacceptably altered?

    - Are the wet soils compacted by trampling to significantly alter the moisture of the site?

- What are the effects of animal wastes on the snails or vegetation of the site?
- Is livestock use sufficient to evoke concern for the above?

- What effects do wood preservatives, pesticides, and other contaminants have on Newcomb's littorine snails and other site organisms?
- Questions on other habitat parameters that need to be answered prior to attempting site mitigation through development of new habitat include:
  - What is the range of brackishness in which this snail species lives, reproduces, and develops?
  - What composition, distribution, and density of plant species make up the necessary cover?
  - Is the aspect of the site, or degree to which it is open to or sheltered from the sea, important in maintaining temperature, wave action, wetting spray, etc?

Newcomb's Littorine Snail was removed from the Priority Habitat and Species list

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Burke, '9

Newcomb's Littorine Snail was removed from the Priority Habitat and Species list

KEY POINTS

Habitat Requirements

- Newcomb's littorine snail inhabits a narrow strip of land on glasswort (*Salicornia virginica*) salt marshes at the edge of bays and estuaries.
- This snail lives on the stems of *Salicornia*, and possibly some other marsh plants, and on the substrate beneath the vegetation.

Management Recommendations

- Habitat loss and pollution are the greatest threats to this species. Conversion of habitat through development for other uses; the dumping of fill, spoils, or waste; and the invasion and spread of cordgrass, *(Spartina* spp.) also threatens this species.
- Survey and map all Newcomb's littorine snail occurrences.
- Consider this species in shoreline management or development permits.
- Monitor the effects of habitat changes on colonies of this species, including grazing and irrigation; insecticide, herbicide, and fertilizer application. Avoid using chemicals where salt marsh habitats might be affected.
- If insecticide or herbicide use is planned for areas where this species occurs, refer to Appendix A (page A-1) for contacts helpful when evaluating pesticides and their alternatives.
- Avoid placing fill on habitats; avoid use of treated woods unless shown to have no impact.
- Avoid off-road vehicle activities that may compact, rut, or otherwise alter the soil, moisture, or vegetative regime on salt marsh habitats.
- If a spill jeopardizes a significant portion of the state's Newcomb's littorine snail population, collect individuals from threatened areas, along with enough vegetation and substrate to support them. These animals can then be moved to the nearest unoccupied (or underpopulated) area of safe, suitable habitat, or temporarily maintained in captivity until they can be returned to restored habitat.
- Assess the potential effects of toxic spill cleanup methods and their alternatives, on

Newcomb's littorine snails.

- Assess Forest Practices permit applications for impacts to the Newcomb's littorine snail and its habitat.

- Avoid introducing exotic plants and animals into areas inhabited by Newcomb's littorine snails.

APPENDIX A: CONTACTS USEFUL WHEN EVALUATING PESTICIDES AND THEIR ALTERNATIVES

Government Organizations

United States Environmental Protection Agency

Provides information, brochures, and technical help on pesticide application.

Region 10 Public Affairs Office, Seattle 1-800-424-4372

Washington State Department of Agriculture

Pesticide Management

General Information . . . . . (360) 902-2010
Assistant Director . . . . . (360) 902-2011

Compliance

Enforces state and federal pesticide laws; investigates complaints of pesticide misuse.

Manager . . . . . (360) 902-2036
Olympia Compliance . . . . . (360) 902-2040
Mount Vernon Compliance . . . . . (360) 428-1091
Spokane Compliance . . . . . (509) 625-5229
Walla Walla Compliance . . . . . (509) 527-4130
Wenatchee Compliance . . . . . (509) 664-3171
Yakima Compliance . . . . . (509) 575-2746

Registration and Licensing

Registers pesticides sold and used in Washington.

Manager . . . . . (360) 902-2026
Pesticide Registration - Olympia . . . . . (360) 902-2030
Pesticide Registration - Yakima . . . . . (509) 575-2746

Program Development

Licenses pesticide application equipment and pesticide dealers; commercial, public, and private pesticide applications; and operators and consultants. Conducts waste pesticide disposal program; responsible for public outreach and education.

Manager . . . . . (360) 902-2051
Pesticide Licensing and Recertification . . . . . (360) 902-2020
Waste Pesticide Collection . . . . . (360) 902-2050
Farmworker Ed. and Pest. Licensing - Yakima . . . . . (509) 575-2746

Washington Department of Ecology, Regional Contacts

DOE provides information and permits on applying pesticides directly or indirectly to open bodies of water.

Eastern Region, Spokane . . . . . (509) 456-2873
Central Region, Yakima . . . . . (509) 457-7207
Northwest Region, Bellevue . . . . . (206) 649-7070
Southwest Region, Olympia . . . . . (360) 407-6292

Washington Department of Fish and Wildlife

Regional Contacts

Your regional program manager will direct your questions to a biologist. The department can provide information on what priority habitats and species are known to be in your area, and the life requisites of priority species.

Region 1, Spokane . . . . . (509) 456-4082
Region 2, Ephrata . . . . . (509) 754-4624
Region 3, Yakima . . . . . (509) 575-2740
Region 4, Mill Creek . . . . . (206) 775-1311
Region 5, Vancouver . . . . . (360) 696-6211
Region 6, Montesano . . . . . (360) 249-6522

Habitat Research and Information Services

Mapped information and management recommendations for Washington's priority habitats and species can be obtained by calling (360) 902-2543.

Washington Poison Control Center . . . . . (800) 732-6985

Provides information on who to contact in case of exposure to or spill of pesticides or other toxic substances.

Non-Government Organizations

Agricultural Support Groups

Tilth Producers . . . . . (206) 527-9216
Chapter of Washington Tilth
P.O. Box 85056
Seattle, WA 98145-1056

Provides a directory of organic growers, food and farm suppliers, and resources, called the Washington Tilth Directory. Can help place farmers wishing to reduce pesticide use in touch with those who have already done so.

Northwest Coalition for Alternatives to Pesticides . . . . . (503) 344-5044
P.O. Box 1393
Eugene, OR 97440

Provides information on a network of farmers practicing sustainable agriculture.

Palouse-Clearwater Environmental Institute . . . . . (208) 882-1444
P.O. Box 8596
112 W. 4th, Suite 1
Moscow, ID 83843

Coordinates farm/consumer improvement clubs in eastern Washington and is the western coordinator of the Campaign for Sustainable Agriculture.

Alternative Energy Resources Organization . . . . . (406) 443-7272
25 S. Ewing Suite 214
Helena, MT 59601

Coordinates a network of farm improvement clubs and produces a list of organic growers in Montana. Has information on growing grains in the Palouse region.

Financial Support for Farmers Shifting to Sustainable Agriculture

Cascadia Revolving Loan Fund . . . . . (206) 447-9226
157 Yesler Way, Suite 414
Seattle, WA 98104

A non-profit organization that lends money to small businesses.

Sustainable Agriculture Research and Education
Western Region SARE/ACE Program
ASTE Bldg. UMC 2310, Utah State University,
Logan, UT 84322-2310

A federal grant program for farmer-directed, on-farm research. The grants are called Farmer/Rancher Research Grants.

The Organic Farming Research Foundation . . . . . (408) 426-6606
P.O. Box 440
Santa Cruz, CA 98061

Provides funding for organic farming methodology research.

Insectaries

Northwest Biocontrol Insectary/Quarantine Insectary . . . . (509) 335-5504
Terry Miller

Can provide limited technical advice on using beneficial insects as biological control agents.

Integrated Pest Management and Non-Chemical Alternatives

Bio-Integral Resource Center) . . . . . (510) 524-2567
P.O. Box 7414
Berkeley, CA 94707

Publishes "Common Sense Pest Control Quarterly", and "The IPM Practitioner Monitoring the Field of Pest Management."

Integrated Fertility Management . . . . . (800) 332-3179
333 Ohme Gardens Rd.
Wenatchee, WA 98801

Provides information on organic farming, biological pest control, and soil amendments. Also provides a network with which growers can contact each other.

Northwest Coalition for Alternatives to Pesticides . . . . . (503) 344-5044

Located in Oregon, provides information regarding integrated pest management, a list of private consultants, as well as other sources and contacts.

Washington Toxics Coalition . . . . . (206) 632-1545

Has an information file on many topics involving chemical pesticides, including effects on the environment and on human health, as well as alternatives to household and garden chemicals.

National Organizations

Appropriate Technology Transfer for Rural Areas . (800) 346-9140
P.O. Box 3657
Fayetteville, AK 72702

Information service on sustainable agriculture. Not ideal for questions that are regionally specific, but good for crop production questions.

Chemical Referral Center . . . . . (800) 262-8200

This center, which is sponsored by the Chemical Manufacturers Association, will refer the caller to the manufacturer of the chemical in question, and provide telephone numbers of other hotlines.

National Agricultural Library . . . . . (301) 504-6559
Alternative Farming Systems Information Center
10301 Baltimore Blvd.
Beltsville, MD 20705-2351

Provides bibliographies on topics such as cover crops, living mulches, compost, etc. Will do individual searches on national agricultural databases for free. This organization's strong point is specific, technical information.

National Pesticide Telecommunication Network . . . . . (800) 858-PEST (7378)

Provides 24-hour information on pesticide products, poisoning, cleanup and disposal, enforcement contacts, certification and training programs, and pesticide laws.

Safety, Storage, Handling, and Disposal

Washington Toxics Coalition . . . . . (206) 632-1545

Has an information file on many topics involving chemical pesticides, including effects on the environment and on human health.

Local Solid Waste/Recycling Centers

Your county or municipal solid waste center may be of assistance when disposing of pesticides and herbicides.

WASHINGTON STATE UNIVSERSITY COOPERATIVE EXTENSION SERVICE
COUNTY AGENTS

County	Address	City	Phone #
Adams	210 W. Broadway	Ritzville 99169	(509) 659-0090 Ext. 214
Asotin	125 Second St.	Asotin 99402-0009	(509) 243-2018
Benton	1121 Dudly Ave.	Prosser 99350	(509) 786-5609
Benton	5600-E W Canal Pl.	Kennewick 99336	(509) 735-3551
Chelan	400 Washington St.	Wenatchee 98801	(509) 664-5540
Clallam	223 East 4th St.	Port Angeles 98362	(360) 417-2279
Clark	11104 NE 149th St.	Bush Prairie 98606	(360) 254-8436
Columbia	202 S. 2nd St.	Dayton 99328	(509) 382-4741
Cowlitz	207 4th Ave N	Kelso 98626	(360) 577-3014
Douglas	PO Box 550	Waterville 98858	(509) 745-8531
Ferry	350 E. Delaware	Republic 99166	(509) 775-5235
Franklin	Courthouse	Pasco 99301	(509) 545-3511
Garfield	PO Box 190	Pomeroy 99347	(509) 843-3701
Grant	1st and C St.	Ephrata 98823	(509) 754-2011 Ext. 412
Grays Harbor	100 Broadway W.	Montesano 98563	(360) 249-4332
Island	501 N Center	Coupeville 98239	(360) 679-7327
Jefferson	201 W. Patison	Port Hadlock 98339	(360) 379-5610
King	612 Smith Tower	Seattle 98104	(206) 296-3900
Kitsap	614 Division	Port Orchard 98366	(360) 876-7157
Kittitas	Courthouse - Rm 217	Ellensburg 98926	(509) 962-7507
Klickitat	228 W Main, Rm 210	Goldendale 98620	(509) 773-5817
Lewis	360 NW North St.	Chehalis 98532	(360) 740-1212

County	Address	City	Phone #
Lincoln	PO Box 399	Davenport 99122	(509) 725-4171
Mason	11840 Hwy 101 N	Shelton 98584	(360) 427-9670 Ext. 395
Okanogan	PO Box 391	Okanogan 98840	(509) 422-7245
Okanogan	Lake Roosevelt, 708 Crest Drive	Coulee Dam 99116	(509) 633-9196
Pacific	PO Box 88	South Bend 98586	(360) 875-9331
Pend Oreille	418 South Scott	Newport 99156	(509) 447-2401
Pierce	3049 S 36th, Ste.300	Tacoma 98409	(206) 591-7180
San Juan	315 Court St.	Friday Harbor 98250	(360) 378-4414
Skagit	220 E College Way, Ste. 180	Mount Vernon 98273	(360) 428-4270
Skamania	PO Box 790	Stevenson 98648	(509) 427-9427
Snohomish	600 128th St. SE	Everett 98208	(206) 338-2400
Spokane	222 N Havana	Spokane 99202	(509) 533-2048
Stevens	230 Williams Lake Rd.	Colville 99114	(509) 684-2588
Thurston	921 Lakeridge Dr. SW, rm 216	Olympia 98501	(360) 786-5445
Wahkiakum	68 Main St.	Cathlamet 98612	(360) 795-3278
Walla Walla	317 W Rose St.	Walla Walla 99362	(509) 527-3260
Whatcom	11 N Forest St, Ste 201	Bellingham 98225	(360) 676-6736
Whitman	310 N Main, rm 209	Colfax 99111	(509) 397-6290
Yakima	128 N 2nd, St, Rm 233	Yakima 98901	(509) 575-4218

INDEX TO SPECIES BY STANDARD NAME