State Wildlife Action Plan Update

Appendix A-5

Species of Greatest Conservation Need

Fact Sheets

INVERTEBRATES

Conservation Status and Concern

Biology and Life History

Distribution and Abundance

Habitat Needs

Stressors

Conservation Actions Needed

Washington Department of Fish and Wildlife
2015

Appendix A-5

SGCN Invertebrates – Fact Sheets

Table of Contents

What is Included in Appendix A-5 5

MILLIPEDE 6
LESCHI'S MILLIPEDE (*Leschius mcallisteri*) 6

MAYFLIES 8
MAYFLIES (Ephemeroptera) 8
[unnamed] (*Cinygmula gartrelli*) 8
[unnamed] (*Paraleptophlebia falcula*) 8
[unnamed] (*Paraleptophlebia jenseni*) 8
[unnamed] (*Siphlonurus autumnalis*) 8

DRAGONFLIES and DAMSELFLIES 11
Family Gomphidae: CLUBTAIL DRAGONFLIES 11
Columbia Clubtail (*Gomphus lynnae*) 11
Pacific Clubtail (*Gomphus kurilis*) 11
White-belted Ringtail (*Erpetogomphus compositus*) 11
SUBARCTIC BLUET (*Coenagrion interrogatum*) 14

STONEFLIES 16
STONEFLIES (Plecoptera) 16
Sasquatch Snowfly (*Bolshecapnia sasquatchi*) 16
Northern Forestfly (*Lednia borealis*) 16
Wenatchee Forestfly (*Malenka wenatchee*) 16
Pacific Needlefly *(Megaleuctra complicata)* 16
Cascades Needlefly *(Megaleuctra kincaidi)* 16
Yosemite Springfly *(Megarcys yosemite)* 16
Talol Springfly *(Pictetiella lechleitneri)* 16
Rainier Roachfly *(Soliperla fenderi)* 16

BEETLES 21
HATCH'S CLICK BEETLE (*Eanus hatchi*) 21
Family Carabidae: GROUND AND TIGER BEETLES 23
Mann's Mollusk-eating Ground Beetle (*Scaphinotus mannii*) 23
Beller's Ground Beetle (*Agonum belleri*) 23
Columbia River Tiger Beetle (*Cicindela columbica*) 23
Siuslaw Sand Tiger Beetle (*Cicindela hirticollis siuslawensis*) 23

CADDISFLIES 28

CADDISFLIES (Trichoptera) 28
[unnamed] (*Allomyia acanthis*) 28
[unnamed] (*Goereilla baumanni*) 28
[unnamed] *(Limnephilus flavastellus)* 28
[unnamed] *(Psychoglypha browni)* 28
[unnamed] *(Rhyacophila pichaca)* 28
[unnamed] *(Rhyacophila vetina)* 28

MOTHS 32
Genus *Copablepharon* 32
Sand Verbena Moth (*Copablepharon fuscum*) 32
[unnamed] *(Copablepharon columbia)* 32
[unnamed] *(Copablepharon mutans)* 32
[unnamed] *(Copablepharon viridisparsa hopfingeri)* 32

BUTTERFLIES 35
GREAT ARCTIC *(Oeneis nevadensis gigas)* 35
ISLAND MARBLE (*Euchloe ausonides insulanus*) 37
MONARCH BUTTERFLY (*Danaus plexippus*) 39
TAYLOR'S CHECKERSPOT (*Euphydryas editha taylori*) 41
Family Lycaenidae: GOSSAMER WING BUTTERFLIES 44
Makah Copper (*Lycaena mariposa charlottensis*) 44
Golden Hairstreak (*Habrodais grunus herri*) 44
Johnson's Hairstreak (*Callophrys johnsoni*) 44
Juniper Hairstreak (*Callophrys gryneus* Columbia Basin segregate) 44
Hoary Elfin (*Callophrys polios* Puget Trough segregate) 44
Puget (Blackmore's) Blue (*Icaricia icarioides blackmorei*) 44
Straits Acmon Blue (*Icaricia acmon sp.*) 44
Subfamily Heliconiinae: FRITILLARY BUTTERFLIES 52
Puget Sound Fritillary (*Speyeria cybele pugetensis*) 52
Valley Silverspot (*Speyeria zerene bremnerii*) 52
Oregon Silverspot (Speyeria zerene hippolyta) 52
Meadow Fritillary (*Boloria bellona toddi*) 52
Silver-bordered Fritillary (*Boloria selene atrocostalis*) 52
Family Hesperiidae: SKIPPER BUTTERFLIES 59
Propertius Duskywing (*Erynnis propertius*) western Washington populations only 59
Oregon Branded Skipper (*Hesperia colorado* Salish Sea segregate) 59
Mardon Skipper (*Polites mardon*) 59
Sonora Skipper (*Polites sonora siris*) 59
Yuma Skipper (*Ochlodes yuma*) 59

BUMBLE BEES 66
Genus *Bombus*: BUMBLE BEES 66
Western Bumble Bee (*Bombus occidentalis*) 66
Morrison's Bumble Bee (*Bombus morrisoni*) 66
Suckley Cuckoo Bumble Bee (*Bombus suckleyi*) 66

MOLLUSKS 70

Family Oreohelicidae: MOUNTAINSNAILS 70
Chelan Mountainsnail (*Oreohelix sp. 1)* 70
Hoder's Mountainsnail (*Oreohelix n. sp.*)..... 70
Mad River Mountainsnail (*Oreohelix n. sp*.)..... 70
Ranne's Mountainsnail (*Oreohelix n. sp*.)..... 70
Limestone Point Mountainsnail (*Oreohelix sp. 18* or *O. idahoensis baileyi)*..... 70
Family Polygyridae: FORESTSNAILS, DUSKYSNAILS, OREGONIANS, AND HESPERIANS..... 74
Dry land forestsnail (*Allogona ptychophora solida*)..... 74
Washington Duskysnail (*Amnicola sp. 2*) 74
Columbia Oregonian (*Cryptomastix hendersoni*)..... 74
Puget Oregonian (*Cryptomastix devia*) 74
Poplar Oregonian (*Cryptomastix populi*)..... 74
Mission Creek Oregonian (*Cryptomastix magnidentata*) 74
[unnamed Oregonian] (*Cryptomastix mullani hemphilli*) 74
Dalles Hesperian (*Vespericola depressa*) 74
Family Vertiginidae..... 81
Hoko Vertigo (*Nearctula new sp*. or *Vertigo new sp*.)..... 81
Pacific Vertigo (*Vertigo andrusiana*) 81
Idaho Vertigo (*Vertigo idahoensis*)..... 81
OTHER TERRESTRIAL SNAILS 84
Oregon Megomphix (*Megomphix hemphilli*)..... 84
Dalles Sideband (*Monadenia fidelis minor*) 84
Crowned Tightcoil (*Pristiloma pilsbryi*) 84
Nimapuna Tigersnail (*Anguispira nimapuna new spp*.) 84
Families: Lymnaeidae and Hydrobiidae 88
Shortface Lanx *or* Giant Columbia River Limpet (*Fisherola nuttalli*) 88
Masked Duskysnail (*Lyogyrus sp. 2*)..... 88
Olympia Pebblesnail (*Fluminicola virens*)..... 88
Salmon River Pebblesnail (*Fluminicola gustafsoni*)..... 88
Ashy Pebblesnail (*Fluminicola fuscus*)..... 88
Family Pleuroceridae (Genus *Juga*): FRESHWATER AQUATIC SNAILS..... 93
Barren Juga (*Juga hemphilli hemphilli*) 93
Dalles Juga (*Juga hemphilli dallesensis*) 93
Brown Juga (*Juga sp. 3*)..... 93
Three-band Juga (*Juga sp. 7*)..... 93
One-band Juga (*Juga sp. 8*) 93
SLUGS..... 97
TAILDROPPER SLUGS..... 97
Bluegray Taildropper (*Prophysaon coeruleum*)..... 97
Spotted Taildropper (*Prophysaon vanattae pardalis*)..... 97
FRESHWATER BIVALVES 100
Families Unionidae and Margaritiferidae: FRESHWATER MUSSELS 100
California Floater (*Anodonta californiensis*)..... 100
Winged Floater (*Anodonta nuttaliana*)..... 100
Western Ridged Mussel (*Gonidea angulata*) 100
Western Pearlshell (*Margaritifera falcata*)..... 100

MARINE BIVALVE 104
OLYMPIA OYSTER (*Ostrea lurida*) 104
MARINE GASTROPOD 106
PINTO ABALONE (*Haliotis kamtschatkana*) 106
EARTHWORM 108
GIANT PALOUSE EARTHWORM (*Driloleirus americanus*) 108
REFERENCES 110
SECTION A: Alphabetical list of species 110
SECTION B: Explanation of Terms 113
SECTION C: Full List of References 115

What is Included in Appendix A-5

Introduction
Appendix A-5 is one component of the State Wildlife Action Plan (SWAP) Update, and contains information about invertebrates included in our Species of Greatest Conservation Need (SGCN) list for 2015. Included are fact sheets for each of the invertebrates identified as Species of Greatest Conservation Need in the 2015 SWAP. The information provided includes a summary of the conservation concern and conservation status, description distribution and habitat, climate change sensitivity and an overview of key threats and conservation actions needed.

What it means to be an SGCN
The SGCN list includes both animals that have some form of official protection status and those which may be in decline, but are not yet listed as part of either the Federal or State Endangered Species program. One of the purposes of the SWAP is to direct conservation attention to species and habitats *before* they become imperiled and recovery becomes more difficult and costly. Presence on this list does not necessarily mean that conservation attention will be directed towards the animal; rather, that conservation actions for the species are *eligible* for State Wildlife Grants funding, and may be more competitive for other grant programs. It also raises the profile of an animal to a wide audience of conservation partners and may encourage other organizations to initiate projects that may benefit the species.

Climate Vulnerability
Please see Chapter 5 for an explanation of the methodology used to assess climate vulnerability. For a full list of all the SGCN ranks, including a narrative description of sensitivity and references, please see Appendix C.

Explanation of terms used in the document
Please see Section B (page 113) for a description of terms and abbreviations used in this document.

Alphabetical List of Species
For an alphabetical list of all the invertebrates included, please see Section A (page 110).

References
References are provided separately with each fact sheet, and also collectively for all SGCN invertebrates in the REFERENCES section at the end of this document.

MILLIPEDE

LESCHI'S MILLIPEDE (*Leschius mcallisteri*)

Conservation Status and Concern
Very little is known of this cryptic species, which was discovered and identified in 2004. It has only been detected within a small area in Thurston County.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
None	Candidate	Yes	GNR	SNR	Unknown/unknown	N/A

Biology and Life History
This species was discovered and designated as a new genus and species in early 2004. No studies have been conducted.

Photo: W. Leonard

Distribution and Abundance
Six males and seven female paratypes were collected in February 2004 at and close by McAllister Springs near Olympia, WA. The collection area is located upstream of the Nisqually Wildlife Refuge and just downslope of a housing development situated on a bluff. More recent surveys at the type locality detected several individuals of the species. Actual total distribution of the species is unclear. It has not been detected elsewhere, but the species is cryptic and may be more widely distributed.

Habitat
Specimens were collected in leaf litter along a steep, east-facing slope in the lower Nisqually River Valley. The site was vegetated by mature second-growth forest dominated by bigleaf maple (*Acer macrophylum*), red alder (*Alnus rubrum*), western red-cedar (*Thuja plicata*), and western swordfern (*Polystichum munitum*). It appears to be limited to leaf litter in forest bottoms and perennial springs.

References
Shear, W. A. and W. P. Leonard. 2004. The millipede family Anthroleucosomatidae new to North America: Leschius mcallisteri, n. gen., n. sp. (Diplopoda: Chordeumatida: Anthroleucosomatoidea). Zootaxa. 609:1-7. http://www.mapress.com/zootaxa/2004f/z00609f.pdf

W. Leonard, WSDOT, pers.comm.
K. McAllister, WSDOT, pers.comm.

Leschi's Millipede: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection needs	Only a handful of individuals have been found in a localized area with a specific combination of habitat features	Need to establish baseline survey effort beyond current known locations in areas with similar habitat features	Nothing current - new action needed	Both
2	Fish and wildlife habitat loss or degradation	Development on bluff above site location in Nisqually Valley. Area in which *L. mcallisteri* was found is probably private land	Investigate possibility of extending area protectio	Nothing current - new action needed	External

NOTE: Numbers are for reference only and do not reflect priority.

MAYFLIES

MAYFLIES (Ephemeroptera)

Conservation Status and Concern

These mayfly species are generally rare and have very restricted distributions. Mayflies are very sensitive to pollution, and as such are usually only found at high quality, minimally polluted sites. Mayflies are a commonly used index of water quality and aquatic ecosystem health.

COMMON NAME (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
[unnamed] (*Cinygmula gartrelli*)	None	None	No	G2G3	SNR	Low/unknown
[unnamed] (*Paraleptophlebia falcula*)	None	None	No	G1G2	SNR	Low/unknown
[unnamed] (*Paraleptophlebia jenseni*)	None	None	No	G2G4	SNR	Low/unknown
[unnamed] (*Siphlonurus autumnalis*)	None	None	No	G2G4	SNR	Low/unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
[unnamed] (*Cinygmula gartrelli*)	Low-moderate
[unnamed] (*Paraleptophlebia falcula*)	Low-moderate
[unnamed] (*Paraleptophlebia jenseni*)	Low-moderate
[unnamed] *(Siphlonurus autumnalis)*	Low

Biology and Life History

All mayflies are aquatic in their developmental stages. Their lifespan is spent almost entirely undergoing numerous molts. Larval existence is usually 3 to 6 months, but can be as short as 2 weeks or as long as 2 years. The nymphs are generalists, moving over stones and weeds to graze off bacteria, collecting from sediments or feeding on detritus. Most species are feeders or scrapers. Adults do not eat; they have nonfunctional digestive systems. Unlike most insects, the mayfly typically has two winged stages. It is the only existing insect that molts after getting functional wings. The first stage, the subimago, is a subadult stage typically found perched on shoreline vegetation; it lasts from 4 minutes to 48 hours (correlated with the lifespan of the species' adult stage). Soon after it is formed (in most species), the subimago molts to form the imago, the true adult or

Siphlonurus lacustris, a close relative of S. autumnalis. Photo: Hectonichus

reproductive stage. Both subimagos and adults tend to remain along banks at emergence sites. Mayfly eggs are eaten by snails and caddisfly larvae. The nymphs may be eaten by fish, frogs, birds, flies, or water beetles. The subimagos are eaten by fish, birds, dragonflies, water beetles, or other predatory insects. Mating occurs in a swarm, and the eggs are laid as the female skims the water. The eggs sink to the bottom, and develop sticky substances or adhesive disks, depending on the species. Some species are parthenogenic. Adults of most species are short-lived (less than 2 hours to 3 days). Some species emerge in the spring while others dominate in autumn. Mayfly dispersal is limited in the larval stage by drainage systems and in adult stages by relatively short life spans and weak flying ability of gravid females. Dispersal at the population level has been little studied. Adult dispersal ability has not been extensively studied; however, several characteristics appear to limit occurrences to a short distance, including weak flying ability, extremely short life cycle, and tendency to remain in the area of emergence. This may partly account for the wide range of variability in some species, since once a population becomes established there is little opportunity for exchange of genetic materials with populations in other drainage systems.

Distribution and Abundance

***Cinygmula gartrelli*:** In Washington, this species occurs in the Ohanapecosh River, Mt. Rainier National Park, Lewis County; and Huckleberry Creek and Ipsut Falls in Mt. Rainier National Park, Pierce County. It was also recently found in Oregon in the Etolius River, Jefferson County.

***Paraleptophlebia falcula*:** In Washington, this rare species occurs in the South Fork Walla Walla River. In Oregon, it occurs in few historical sites in Benton and Union Counties with new localities in South Fork Walla Walla River, Umatilla County.

***Paraleptophlebia jenseni*:** This species is only known from Badger Gulch, Holter Gulch, and Rock Creeks in Klickitat County.

***Siphlonurus autumnalis*:** In Washington, this species occurred historically in Clallam, Grays Harbor, Jefferson, Lewis, and Pierce Counties; it was recently collected in Clallam County.

Habitat

Some mayflies species have very specific requirements. They are most commonly found on firm substrate in streams and lake littoral zones, but some are adapted for soft substrate. Mayfly nymphs are usually microhabitat specialists. Each species survives best on a specific substrate at a certain depth under water with a certain amount of wave action. Some species generally live in medium to large streams. Other species burrow into soft areas where flow is slower, or in areas of lakes and rivers where deposits occur; the particular substrate and burrow depends on the genus. The primitive habitat of mayflies is lentic (still water), even though most extant mayflies live in lotic (flowing water) environments.

***C. gartrelli*:** This species was found at high-altitude creeks, falls, and rivers in Mt. Rainier National Park.

***P. falcula*:** The genus often prefers moderate to fast streams with sand, gravel and detritus substrates.

***P. jenseni*:** *P. jenseni* is rare and has only been found in one substantial, fast running creek and two of its small, rocky, transient tributaries.

***S. autumnalis*:** This species is associated with medium to large rivers, and has been taken from rocky but somewhat quiet edgewaters along relatively large rivers in the Northwest. It has also been collected at a cold, spring brook in Montana.

References

Edmunds, G. F. and R. D. Waltz. 1996. Ephemeroptera. Pages 126-163 in R.W. Merritt and K.W. Cummins (editors). An introduction to the aquatic insects of North America. 3rd Edition. Kendall/Hunt Publishers, Dubuque, Iowa.

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D. Anderson, WDFW, pers.comm.

Mayflies: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
2	Climate change and severe weather	Potential for streams drying up	Determine distribution, population status	Current insufficient	Both
3	Fish and wildlife habitat loss or degradation	Water quality is of extreme importance to aquatic insects	Protect riparian habitats	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

DRAGONFLIES and DAMSELFLIES

Family Gomphidae: CLUBTAIL DRAGONFLIES

Conservation Status and Concern
These three dragonflies in the Gomphidae family are SGCN in Washington due to the small number of isolated populations and continued threats to their habitat.

COMMON NAME (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Columbia Clubtail (*Gomphus lynnae*)	None	Candidate	Yes	G1	S1	Low/unknown
Pacific Clubtail (*Gomphus kurilis*)	None	Candidate	Yes	G4	S1	Critical/declining
White-belted Ringtail (*Erpetogomphus compositus*)	None	Candidate	No	G5	S1	Low/unknown
	Climate vulnerability: Moderate-high					

Biology and Life History
Clubtail dragonflies complete a life cycle composed of two main phases: a flightless aquatic larva (nymph stage), which may be continuous for 1 to 2 winters, and the adult flight (reproductive stage). They inhabit sites year-round as egg, larval nymph, and adult, typically moving within only a few to several hundred meters of their natal locations. Adults do not seasonally migrate, and die soon after their reproductive summer. Both life stages are predatory; the majority of life cycle is spent as aquatic larvae. Nymphs feed on aquatic invertebrates and possibly small vertebrates (fish, frog and salamander larva). After multiple aquatic instars (gradual metamorphosis) over 1 or 2 winters, mature nymphs crawl onto rocks or vegetation and shed their exoskeleton to become a new adult (teneral) in late spring and summer. Adults are aerial predators of smaller insects and similar sized butterflies and moths (Lepidoptera), as well as smaller Odonates. Water temperature influences the timing of emergence from within a year or over 2 years. Weather influences flight period duration, with wet or cold conditions potentially shortening the flight period and warm, dry conditions promoting the duration and later occurrence dates of the flight period. Male Clubtails seek mates by patrolling a territory that coincides with optimal aquatic habitat for female egg-laying, and hence for larvae. There is usually no courtship behavior. After copulation, females usually hover just above the water of slow moving or gentle current stretches and close to shore while periodically dipping the tail to deposit multiple eggs.

White-belted Ringtail
Photo: W. Leonard

Distribution and Abundance

These species occur in low numbers of small isolated populations (Table 1). For the Columbia Clubtail, only a single population is known in Washington. Only three localities in Washington are known for the Pacific Clubtail, and confirmation is needed for the Thurston County location; a historical record exists from Lake Washington (King County, 1933). The White-belted Ringtail is more widespread throughout the western U.S., but restricted to two known locales in Washington, the extreme northern end of its range.

Table 1. Overall range, counties and estimated number of extant populations in Washington for Dragonfly SGCN.

Species	Range Overall	WA Counties	Populations
Columbia Clubtail	Highly disjunct: E WA; John Day, Owyhee, Malheur rivers in OR	Benton - Yakima River Horn, north of Benton City (1000')	1
Pacific Clubtail	Restricted to N CA–OR Pacific coast and mountains - north to S Puget Trough	Skamania - Bass, Ice House Lakes; Thurston - Black Lake	3?
White-belted Ringtail	Local in S part of Columbia Basin (1000'); CA, ID, OR, NV, AZ, NM, UT, TX	Grant - Crab Creek Benton - Yakima River.	2

Habitat

Research is needed to quantify specific habitat requirements for these species, including aquatic larval substrates, river and stream, or lake and pond characteristics, and other key habitat features.

Columbia Clubtail: Over its range, uses slower-moving, open sandy to muddy, rivers with gravelly rapids in sagebrush-riparian woodland; may be more widespread in Washington.

Pacific Clubtail: At large ponds and lakes in western Washington; in other parts of range, streams and rivers with good currents, sandy to muddy bottoms.

White-belted Ringtail: Open sandy streams/rivers, irrigation ditches, occasionally sink holes; typically in desert country, sagebrush-riparian woodland.

References

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USFS-BLM. 2008b. Species fact sheet: Pacific Clubtail (Gomphus kurilis). Prepared by S. Foltz. Xerces Society for Invertebrate Conservation, Portland, Oregon.

USFS-BLM. 2008c. Species fact sheet: White-belted Ringtail (Erpetogomphus compositus). Prepared by S. Foltz. Xerces Society for Invertebrate Conservation, Portland, Oregon.

Family Gomphidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Agriculture and aquaculture side effects	Pesticide and fertilizer runoff into streams	Monitor occurrence waters for chemical contaminants	Nothing current - new action needed	Both
2	Agriculture and aquaculture side effects	Siltation and degradation of stream and bottom habitat used by developing larvae by unsustainable grazing, commercial or recreational uses	Work to improve unsustainable grazing and commercial use practices in waters of known occurrence	Nothing current - new action needed	Both
3	Climate change and severe weather	Increased environmental temperatures may affect life history with unknown consequences	Monitor streams in context of climate changes	Nothing current - new action needed	Both
4	Fish and wildlife habitat loss or degradation	Vulnerable mostly because of extreme rarity of any known populations	Efforts that protect water quality most important to larval development. Use land acquisitions, conservation easements and landowner agreements to protect significant shoreline areas from degradation	Nothing current - new action needed	Both
5	Fish and wildlife habitat loss or degradation	Loss of riparian vegetation that provide shade and perch sites; ameliorates stream temps.	Monitor vegetation around know occurrence sites	Nothing current - new action needed	Both
6	Invasive and other problematic species	Introduced predatory fish species that may not have co-evolved with these species	Monitor streams in context of non-native aquatic species	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

SUBARCTIC BLUET (*Coenagrion interrogatum*)

Conservation Status and Concern

The Subarctic Bluet is a species of damselfly that is restricted to boreal fens and bogs in the northeastern corner of the state. Only two populations of Subarctic Bluet have been located in Washington.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
None	None	No	G5	S1	Low/unknown	Moderate-high

Biology and Life History

The Subarctic Bluet is a damselfly in the pond damsel family (Coenagrionidae). Adults mate in dense vegetation; females lay eggs in small slits they cut in aquatic plants and have been observed egg-laying in floating sedge and grass leaves and stems, and emergent grass stems. Eggs develop quickly, and the resulting larvae are aquatic and feed on other aquatic invertebrates. This species overwinters in the larval stage. Adults are also predators that specialize on flying insects. The adult period for this species may be relatively short; adults have been detected at Washington sites in July.

Photo: M. Reese

Distribution and Abundance

The Subarctic Bluet is a boreal species, and ranges across most of Canada and into the western United States in northern Washington and Montana. The species is known from only two sites in Washington, in Ferry and Pend Oreille Counties, between 4500 to 5000 feet in elevation. It may occur in additional boreal bogs and fens in this region. There is no information on population size from either Washington locality.

Habitat

This species depends on boreal bogs and fens, rare habitat types that are restricted to the northeast corner of the state. Within these rare wetlands, Subarctic Bluets use dense sedge and moss mats, and adults also use the shrub ecotone. These habitats are sensitive to disturbance and many activities that impact local hydrology.

References

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Subarctic Bluet: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Agriculture and aquaculture side effects	Bog/fen obligate; habitat and species are vulnerable to alteration of local hydrology from logging and road building	Identify bog/fen sites and landowners within species range and develop plans to conserve	Nothing current - new action needed	Both
2	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

STONEFLIES

STONEFLIES (Plecoptera)

Conservation Status and Concern
Stoneflies generally require cold, clear, running water and are especially sensitive to human disturbance; they are excellent indicators of water quality. An estimated 43 percent of North American stoneflies are vulnerable to extinction, imperiled, or extinct. Adults are weak fliers, and there is a high level of endemism; four of these specie shave only been found in Washington. Some of these species are restricted to glacier-fed streams, at risk due to climate change.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Sasquatch Snowfly (*Bolshecapnia sasquatchi*)	None	None	No	G2	SNR	Low/unknown
Northern Forestfly (*Lednia borealis*)	Candidate	None	No	G3G4	S3S4	Low/unknown
Wenatchee Forestfly (*Malenka wenatchee*)	None	None	No	G2	SU	Low/unknown
Pacific Needlefly *(Megaleuctra complicata)*	None	None	No	G3	SU	Low/unknown
Cascades Needlefly *(Megaleuctra kincaidi)*	None	None	No	G2	SU	Low/unknown
Yosemite Springfly *(Megarcys yosemite)*	None	None	No	G2	SNR	Low/unknown
Talol Springfly *(Pictetiella lechleitneri)*	None	None	No	G1G3	SNR	Low/unknown
Rainier Roachfly *(Soliperla fenderi)*	Species of Concern	None	No	G2	S1S2	Low/unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Sasquatch Snowfly (*Bolshecapnia sasquatchi*)	Moderate-high
Northern Forestfly (*Lednia borealis*)	High
Wenatchee Forestfly (*Malenka wenatchee*)	Moderate-high
Pacific Needlefly *(Megaleuctra complicata)*	Moderate-high
Cascades Needlefly *(Megaleuctra kincaidi)*	Moderate-high
Yosemite Springfly *(Megarcys yosemite)*	High
Talol Springfly *(Pictetiella lechleitneri)*	Moderate
Rainier Roachfly *(Soliperla fenderi)*	Moderate-high

Taxonomic note: The Northern Forestfly (*Lednia borealis*) was recently described from specimens originally identified as *L. tumana*, a Candidate for listing under the Endangered Species Act (ESA). The Talol Springfly (*Pictetiella lechleitneri*) was described by Stark and Kondratieff (2004). Baumann and Potter (2007) determined that *Bolshecapnia sasquatchi* is restricted to British Columbia and Washington; Montana specimens, previously assigned to this species, were described as *B. missiona.* *Soliperla* specimens from Mt. Adams, Skamania County, were originally thought to be *S. fenderi*, but have been reclassified as the type specimens of a new species, *S. cowlitz*.

Biology and Life History

Soliperla sierra, a close relative of *S. fenderi*
Photo: B. Stark

Stoneflies usually live in areas with running water, and are important predators and shredders in aquatic ecosystems. The females lay hundreds or even thousands of eggs in a ball which they initially carry on their abdomens, and later deposit into the water. The eggs typically hatch in 2 to 3 weeks, but some species undergo diapause as eggs during the dry season. The nymphs physically resemble wingless adults, but often have external gills, which may be present on almost any part of the body. The nymphs (technically, "naiads") are aquatic and live in the benthic zone of well-oxygenated creeks and lakes. In early stages (called instars), stoneflies tend to be herbivores or detritivores, feeding on plant material such as algae, leaves, and other fresh or decaying vegetation; in later instars, the nymphs of many species shift to being omnivores or carnivores, and some species become predators on other aquatic invertebrates. The insects remain in the nymphal form for one to four years, depending on species, and undergo from 12 to 33 molts before emerging and becoming terrestrial as adults. Stonefly adults are generally weak fliers and stay close to stream, river, or lake margins where the nymphs are likely to be found. The adults emerge only during specific times of the year and only survive 1 to 4 weeks. As adults, very few stonefly species feed but those that do, feed on algae and lichens, nectar, or pollen.

Distribution and Abundance

Sasquatch Snowfly: This species' range includes Washington and British Columbia. In Washington, it is known from Lewis and Whatcom Counties (Ohanapecosh River, Mt. Rainier

National Park, and Razor Hone Creek, near Mt. Baker). British Columbia records are from the Fraser River near Agassiz, and the Similkameen and Skagit rivers in Manning Provincial Park.

Northern Forestfly: The Northern Forestfly, a Washington endemic, is only known from high elevation glacial-fed streams in the Cascades, including Mt Rainier and North Cascades National Parks, and Mt. Baker-Snoqualmie National Forest.

Wenatchee Forestfly: This species is known only from springs draining into Lake Wenatchee in Chelan County, Washington.

Pacific Needlefly: Megaleuctra species are "always rare". This species is found in the Cascades in Washington, Oregon, and northern California. Washington records include King, Pierce, Lewis, Skamania, and Cowlitz Counties.

Cascades Needlefly: This species is known from a few dozen occurrences from Oregon and Washington. An additional record is available from Lolo Pass, Clearwater County, Idaho and the Flathead River basin in western Montana.

Yosemite Springfly: It is known from Mt Rainier National Park (Fryingpan Creek at Sunrise Road Bridge, Pierce County), Mt. Hood, Oregon, and Mt. Lyell, (Yosemite National Park) California.

Talol Springfly: This species is only known from Carbon River, Mt. Rainier National Park, Pierce County, Washington.

Rainier Roachfly: This species is known from around fifteen occurrences within Mt. Rainier National Park, Pierce County, Washington. The species is presently known only from the Mt. Rainier National Park, but may occur elsewhere.

Habitat

Adults are terrestrial and can be found near aquatic habitats with running water, resting on rocks, debris, and vegetation. As nymphs, stoneflies live in aquatic habitats, mainly along the bottom of cool, clean, flowing waters with relatively high oxygen concentrations, mainly on rocky, stony, or gravel substrates. A few species are found in cold ponds and lakes at high elevations and northern latitudes.

Sasquatch Snowfly: This species is associated with creeks and rivers.

Northern Forestfly: This species has been collected from springs draining into alpine lakes.

Needleflies: These species are restricted to springs, seeps and rheocrenes (springs that flow from a defined opening into a confined channel). *Megaleuctra* species are usually associated with spring seeps and rheocrenes. They inhabit exclusively spring habitats, ranging from small seeps to large flowing springs. Even when it occurs in large springs, it is usually found along the edges instead of out in the area of flow. Water quality must be consistently good and the temperature cold. The nymphs are often found in small, consistently wet seepage areas some distance from nearest the creek, river or lake habitat. The essential habitat for the nymphs is springs or seeps that might not even be visibly flowing.

Wenatchee Forestfly: The Wenatchee Forestfly is found in springs draining into a large lake.

Yosemite Springfly: This species is reported from glacier-fed streams.

Talol Springfly: This species is reported from glacier-fed streams.

Rainier Roachfly: This species occurs in spring-fed seeps and streams (rheocrenes). Nymphs in this genus are generally collected in seeps and in the splash zones of small springs and streams.

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Stoneflies: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Cascades Needlefly, Northern Forestfly, Pacific Needlefly, Rainier Roachfly, Wenatchee Forestfly					
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
2	Climate change and severe weather	Potential for springs to dry up	Monitor spring/seep habitats	Current insufficient	Both
Sasquatch Snowfly					
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
Talol Springfly					
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
2	Resource information collection needs	Little life history information	Investigate life history, ecology	Nothing current - new action needed	External
3	Climate change and severe weather	Potential for glacial-fed habitat to dry up	Monitor glacial-fed river habitat	Current insufficient	External
Yosemite Springfly					
1	Resource Information Collection Needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

BEETLES

HATCH'S CLICK BEETLE (*Eanus hatchi*)

Conservation Status and Concern

Hatch's Click Beetle is a SGCN due to its small number of isolated populations, highly limited distribution and range, and use of specialized, highly restricted, and threatened *Sphagnum* moss bog habitat.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
Species of Concern	Candidate	Yes	G1	S1	Low/declining	Moderate-high

Biology and Life History

Photo: T. Loh

Click beetles (Elateridae) have a unique prothorax anatomy that allows them to suddenly flip into the air, emitting a 'click' sound. This behavior is used to right the beetle when on its back and to escape predators. Adult Hatch's Click Beetles are active in the spring, typically on floating mats of Sphagnum moss. Elaterid adults and larvae are known to be carnivorous as well as herbivorous; however, no studies of adult or larval *E. hatchi* diets have been reported. Adults are thought to feed within flowers on honey dew, pollen, nectar, and the flowers themselves. Larvae appear to inhabit *Sphagnum* moss mats, and likely predate small insects and require multiple years to develop.

Distribution and Abundance

Known from only four bogs in lowland King and Snohomish Counties; one of these sites is now highly degraded and unlikely to support this beetle. Extensive searches have been made for Hatch's Click Beetle; however, additional surveys in the Puget Trough region are needed. No populations of this species have been estimated.

Habitat

Hatch's Click Beetle is a *Sphagnum* bog obligate species, inhabiting bogs between 0 to 1640 feet in elevation. *Sphagnum* bogs are unique, peat-forming wetlands with vegetation dominated by *Sphagnum* mosses. Bogs are typically small in size and situated in closed depressions within small watersheds, and thus geographically isolated. An ancient habitat, today bogs persist in relict patches that thousands of years ago were part of more broadly occurring muskeg-like vegetation following the retreat of the glaciers at the end of the last ice age. *Sphagnum* bogs make up only 3 percent of the wetlands in western Washington. Adults have been collected in low, floating *Sphagnum* mats and also encountered in bog shrubs and trees. Larvae have been found near bog margins, above the water line. No formal habitat studies have been conducted for this rare beetle.

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Hatch's Click Beetle: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Fish and wildlife habitat loss or degradation	Bog/fen obligate; habitat and species are vulnerable to alteration of local hydrology from development	Designation of sites as having unique and important value to fish and wildlife	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

Family Carabidae: GROUND AND TIGER BEETLES

Conservation Status and Concern

These four beetle species are SGCN due to the small number of isolated populations, highly limited distribution and range, and dependence on specialized, restricted and threatened habitats.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Mann's Mollusk-eating Ground Beetle (*Scaphinotus mannii*)	None	Candidate	Yes	GNR	SNR	Low/unknown
Beller's Ground Beetle (*Agonum belleri*)	Species of Concern	Candidate	Yes	G3	S3	Low/unknown
Columbia River Tiger Beetle (*Cicindela columbica*)	None	Candidate	Yes	G2	SH	Extirpated?
Siuslaw Sand Tiger Beetle (*Cicindela hirticollis siuslawensis*)	None	Monitor	No	G5T1T2	S1	Critical/unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Mann's Mollusk-eating Ground Beetle *(Scaphinotus mannii)*	Moderate-high
Beller's Ground Beetle *(Agonum belleri)*	Moderate-high
Columbia River Tiger Beetle *(Cicindela columbica)*	Moderate
Siuslaw Sand Tiger Beetle *(Cicindela hirticollis siuslawensis)*	Moderate-high

Biology and Life History

Siuslaw Sand Tiger Beetle
Photo: R. Lyons, Xerxes Society

Four Carabidae beetles are designated as SGCN in Washington; two are ground beetles (subfamily Carabinae) and two are tiger beetles (subfamily Cicindelinae). Carabid beetles live on and in the soil; carabid SGCN depend on a narrow range of soil conditions within rare habitat types. Carabids are key predators of the insect world; as both larvae and adults they feed on other insects and, to a lesser extent, plant material. Adults hunt by sight and are fast runners that can quickly subdue their prey. Siuslaw Sand Tiger Beetle, Columbia River Tiger Beetle, and Beller's Ground Beetle adults generally forage during the day, and at night burrow into soil, sand, or other

substrate. Mann's Mollusk-eating Ground Beetle is a slug and snail feeding specialist; adults hunt at night, taking cover under stones during the day. Carabids undergo complete metamorphosis, which means they have egg, larval, pupal, and adult life stages. Females create shallow burrows in the soil with their ovipositor, where they lay eggs singly; larvae feed and develop, pupation occurs, and adults emerge from these tunnel-like burrows. Thus, soil condition, including texture, moisture, and temperature is a vital element of habitat quality. Carabid beetles typically reproduce annually; adults can live for several years, and larvae may require multiple years for complete development. Mann's Mollusk-eating Ground Beetle and Beller's Ground Beetle are flightless species with highly limited dispersal capability. Adults of both tiger beetle SGCN can fly, but these species too are highly localized and sedentary. All four carabid SGCN inhabit their sites year-round (as egg, larva, pupa and adult).

Distribution and Abundance

Carabid beetle SGCN have restricted ranges and distributions within Washington (summarized in Table 1). Distribution is limited in part by a combination of their dependence on restricted ecological niches, and those niches' location within rare habitat types. Their distribution and abundance is characterized by small numbers of isolated populations. Limited surveys have been conducted in Washington to determine the current distribution of Mann's Mollusk-eating Ground Beetle, Beller's Ground Beetle, and Columbia River Tiger Beetle. However, further surveys are needed to determine their distributions, and locate any extant Washington populations of Columbia River Tiger Beetle and Siuslaw Sand Tiger Beetle. Population sizes have not been determined for these species on any site.

Overall range, WA counties and estimated number of extant populations for carabid beetle SGCN.

Species	Range Overall	Washington Counties	Populations
Mann's Mollusk-eating Ground Beetle	SE WA and NE Oregon: Snake River tributaries	Asotin, Whitman	<10
Beller's Ground Beetle	Disjunct: Queen Charlotte Islands, SW British Columbia (Canada); Puget Sound lowlands, WA; NW Oregon	King, Kitsap, Mason, Skagit, Snohomish, Thurston	20-30
Columbia River Tiger Beetle	SE WA, NE Oregon, Idaho: along the Columbia, Snake, and Salmon Rivers Recent detection: Idaho only	Asotin, Benton, Columbia, Franklin, Garfield, Walla Walla	Extant?
Siuslaw Sand Tiger Beetle	Coastal beaches SW WA south to N California. Recent detections: Oregon only	Pacific	Extant?

Habitat

Carabid beetles occupy a wide variety of habitat types and ecological niches. The four Washington carabid SGCN are habitat specialists; they require soil and substrate texture, temperature, and moisture within narrow ranges, and those conditions must be found within rare habitat types, for example *Sphagnum* bogs or undisturbed and uniquely situated riverine or coastal sands.

Mann's Mollusk-eating Ground Beetle: This species uses shaded moist ground in low elevation (less than 2600 feet) forest and shrub-vegetated springs and damp canyons within the Snake River drainage that are not subject to periodic inundation of water from dams.

Beller's Ground Beetle: This species occurs only in low to mid-elevation (less than 3280 feet) Puget Trough *Sphagnum* bogs; unique, peat-forming wetlands with vegetation dominated by

Sphagnum genus mosses. *Sphagnum* bogs are typically small in size and situated in closed depressions within small watersheds, and thus are geographically isolated. An ancient habitat, today bogs persist in relict patches that thousands of years ago were part of more broadly occurring muskeg-like vegetation. *Sphagnum* bogs make up only 3 percent of the wetlands in western Washington.

Columbia River Tiger Beetle: This beetle uses well-established riverine sandbars and dunes along the Columbia and Snake River systems that are not inundated by spring floods or high water levels resulting from dam management. These sand habitats are open and only sparsely vegetated with shrubs and herbaceous species.

Siuslaw Sand Tiger Beetle: Inhabits a narrow ecological niche: unvegetated sands at the edge of freshwater outflows on Pacific Coast beaches. A study of this species' habitat in Oregon found adult beetles using firm, flat, moist sand at and near the freshwater edge, including areas upstream of the river mouth and along backwater lagoons and wetlands; and the sloping edge of dryer dunes just above the river's high water mark.

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Family Carabidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Columbia River Tiger Beetle					
1	Energy development and distribution	Requires narrow range of soil texture and moisture: threatened by inundation of reservoirs on Columbia/Snake Rivers	Where dams remain in rivers, develop timing and duration water level control best management practices to support species	Nothing current - new action needed	Both
2	Resource information collection needs	Knowledge of current distribution is incomplete	Conduct baseline inventory on Snake River, and revisit historic locales and potential habitat on Columbia	Nothing current - new action needed	Resource Information Collection Needs
Mann's Mollusk-eating Ground Beetle					
1	Energy development and distribution	Requires riparian forest areas threatened by inundation of reservoirs on Snake River	Where dams remain in rivers, develop timing and duration water level control best management practices to support species	Nothing current - new action needed	Both
2	Agriculture and aquaculture side effects	Intensive livestock use may trample the beetle or reduce riparian vegetation and compact soil	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Nothing current - new action needed	Both
3	Resource information collection needs	Lacking information on complete species distribution in WA, ID, and OR	Conduct baseline inventory along Snake River	Nothing current - new action needed	Both
Beller's Ground Beetle					
1	Fish and wildlife habitat loss or degradation	Bog/fen obligate; habitat and species are vulnerable to alteration of local hydrology from development	Designation of sites as having unique and important value to fish and wildlife	Current insufficient	Both
2	Agriculture and aquaculture side effects	Bog/fen obligate; habitat and species are vulnerable to alteration of local hydrology from logging and road building	Leading or participating in land use planning for rural, urban, and forestry lands	Current insufficient	Both
3	Resource information collection needs	Knowledge of current distribution is incomplete	Baseline survey and inventory to understand distribution of fish and wildlife populations	Current insufficient	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Siuslaw Sand Tiger Beetle					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, establish in habitat and stabilize soil, thereby making habitat unsuitable	Using herbicide and mechanical methods to maintain open ground and appropriate soil condition	Nothing current - new action needed	Both
2	Resource Information Collection Needs	Need to determine where extant in WA	Revisit historic locales and search for new populations	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

CADDISFLIES

CADDISFLIES (Trichoptera)

Conservation Status and Concern
Caddisflies are aquatic insects. They are very sensitive to water quality and changes in water flow. Certain species have been used as biotic indicators of pollution.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
[unnamed] (*Allomyia acanthis*)	None	None	No	G2G3	SNR	Low/unknown
[unnamed] (*Goereilla baumanni*)	None	None	No	G2	SNR	Low/unknown
[unnamed] *(Limnephilus flavastellus)*	None	None	No	G2	SNR	Low/unknown
[unnamed] *(Psychoglypha browni)*	None	None	No	G2G4	SNR	Low/unknown
[unnamed] *(Rhyacophila pichaca)*	None	None	No	G2G3	SNR	Low/unknown
[unnamed] *(Rhyacophila vetina)*	None	None	No	G2	SNR	Low/unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
[unnamed] (*Allomyia acanthis)*	High
[unnamed] *(Goereilla baumanni)*	High
[unnamed] (*Limnephilus flavastellus)*	Moderate-high
[unnamed] (*Psychoglypha browni)*	Moderate-high
[unnamed] (*Rhyacophila pichaca)*	Moderate
[unnamed] (*Rhyacophila vetina)*	High

Biology and Life History
Caddisflies are closely related to the Lepidoptera (moths and butterflies). They are aquatic in the immature stages. During the day, adults hide in cool, moist environments such as the vegetation along river banks. Few species have actually been observed feeding; they imbibe nectar. The body and wings are covered with long silky hairs (setae) – a distinctive characteristic of the order. Adults live several weeks and usually mate on vegetation or rocks surrounding water. There is generally one complete generation per year, although some species require two years for development and some less than a year. Eggs, in masses numbering up to 800, are laid within a jelly that swells on contact with water. A

female may wash off a partially extruded egg mass by dipping her abdomen into water during flight, or she may place the mass on stones in the water or on aquatic plants just above the water. Young larvae hatch within a few days and most species progress through five instars before emerging as a winged adult. Although most larvae feed on aquatic plants, algae, diatoms, or plant debris, a few are predatory on other aquatic insects, crustaceans, and mollusks, and a few are omnivorous. The larvae play an important role in the aquatic community, reducing plant growth and disposing of animal and plant debris. In some species the larvae form webs of debris for protection, while others form a funnel-like web between stones in running water to catch food. Some protect their bodies with cases, whereas others spin protective lairs or are free-living. They produce silk from glands on the lower lip (labium), and many herbivorous species spin tubular protective cases that are open at both ends and enlarge as the larvae grow. Sand grains, pebbles, bits of wood or vegetation are added to cases to provide protection and rigidity. In case-bearing forms, the head and thorax protrude from the case, which is pulled along by the abdomen. The larva pupates inside the larval case, which then becomes a cocoon, or inside a specially constructed cocoon. After 2 or 3 weeks the pupa bites its way out of the cocoon and swims or crawls to the water surface, using its hair-fringed middle pair of legs. Caddisfly adults sometimes emerge in large numbers, often forming swarms. Adults tend to remain somewhat near the emergence site where oviposition occurs. They tend to disperse shorter distances in dense forest compared with more open vegetation. Although dispersal flights are common, such flights are relatively short and only occur immediately following emergence. Large river caddisflies have been collected over 3 miles from water.

Rhyacophila acutiloba – a caddisfly in the Rhyacophila genus.
Photo: T. Murray

Distribution and Abundance

***Allomyia acanthis*:** Adults of this species are known from the Cascade Range in Washington and Oregon. Reported from Paradise Ice Caves, Mt. Rainier National Park, Pierce County, Washington. Larvae are undescribed/unknown. *Allomyia* species occur in very small, localized populations, with many isolated mountains inhabited by a single endemic species, and many species in this genus remain undescribed or undiscovered.

***Goereilla baumanni*:** In Washington, this species is known from streams in the Big Spring Picnic Ground on Mt. Spokane, Spokane County. Also reported from spring seepage areas in Montana and Idaho. In all three states, it is always reported in very low abundance.

***Limnephilus flavastellus*:** This species has been recorded in Mason County, and was recently reported from Mt. Rainier National Park, Pierce County, Washington. It is also found in British Columbia, Oregon (Douglas, Klamath, Yamhill Counties). The larvae are undescribed/unknown.

***Psychoglypha browni*:** Recently reported from Mt. Rainier National Park, Pierce County, Washington. Adults are known from Oregon (Clackamas, Klamath, and Lane Counties). The larvae are undescribed/unknown.

***Rhyacophila pichaca*:** This species is recorded from Olympic Hot Springs, Boulder Lake, Washington, Clallam County. Also known from Cascade Head Experimental Forest, Tillamook County, near Otis, Oregon.

***Rhyacophila vetina*:** This species is uncommon in the high Cascades of Washington. It was recently reported from Mt. Rainier National Park, Lewis and Pierce Counties. It has also been reported in Clackamas County, Oregon.

Habitat

Most North American caddisfly species occur in cool, running freshwater, but some also occur in most types of freshwater habitats: spring streams and seepage areas, rivers, lakes, marshes, and temporary pools.

***A. acanthis*:** This species is normally found in very cold, high altitude springs, seeps, and small spring streams up to 6 feet across. They are often found grazing on the surface or sides of larger rocks in open, sunny areas.

***G. baumanni*:** *G. baumanni* appears to inhabit organic muck in spring areas. It is currently known from higher altitudes.

***L. flavastellus*:** This species has a broad altitudinal range from low altitude valley ponds to high mountain ponds and lakes, and is tolerant of large temperature variations. It is most abundant in waters without salmonids.

***P. browni*:** This species inhabits depositional areas of streams and large springs in mid- and high altitude localities.

***R. pichaca*:** This species has been found at low and high altitude lakes, possibly along tributaries. Specific habitat information has not been described.

***R. vetina*:** This species is associated with cold springs and spring channels at mid- to high altitudes.

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Caddisflies: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
2	Climate change and severe weather	Drying of streams	Determine distribution, population status	Current insufficient	Both
3	Fish and wildlife habitat loss or degradation	Water quality is of extreme importance to aquatic insects.	Protect riparian habitats	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

MOTHS

Genus *Copablepharon*

Conservation Status and Concern
These four *Copablepharon* moths (Family Noctuidae) are imperiled due to rare habitat types, small number of isolated populations, extremely limited range, and known threats to their habitats. The Sand Verbena Moth was petitioned for listing under the ESA, and the US Fish and Wildlife Service (USFWS) found "the petition presents substantial information indicating that listing the Sand Verbena Moth may be warranted."

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Sand Verbena Moth (*Copablepharon fuscum*)	In review	Candidate	Yes	G1G2	S1	Low/unknown
[unnamed] *(Copablepharon columbia)*	None	None	No	GNR	SNR	Critical/declining
[unnamed] ***(****Copablepharon mutans)*	None	None	No	GNR	SNR	Critical/declining
[unnamed] *(Copablepharon viridisparsa hopfingeri)*	None	None	No	GNR	SNR	Critical/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Sand Verbena Moth *(Copablepharon fuscum)*	Moderate-high
[unnamed] *(Copablepharon columbia)*	Moderate
[unnamed] (*Copablepharon mutans)*	Moderate
[unnamed] *(Copablepharon viridisparsa hopfingeri)*	Moderate

Biology and Life History
The Sand Verbena Moth was discovered on a few coastal beach sites on Vancouver Island, British Columbia, Canada, and Whidbey Island, in northwestern Washington, and described as a new species in 1995. The three additional *Copablepharon* moth species were described in 2004. They inhabit small, geographically isolated sand dune complexes in the Columbia River Basin of eastern Washington, rare ecological systems that are threatened by several factors. There has been little study of the biology and life history of these species. Sand Verbena Moth has received some attention from Pacific Northwest biologists; however, even

Sand Verbena Moth larva feeding on host flowers.
Photo: N. Page

host plants are not confirmed for the other three species. *Copablepharon* moths complete a single life cycle annually (univoltine). They are sedentary, nocturnal moths that do not stray far from their restricted habitats and host plants. Specialists of well-drained and sandy soils, the larvae burrow into the soil, emerging at night to feed on vegetation. Sand Verbena Moth larvae feed on only a single plant, yellow sand verbena (*Abronia latifolia*) (Family Nyctaginaceae), a regionally rare, perennial species found on coastal dunes and beaches. Adult moths nectar primarily from this plant as well and females lay eggs directly on the flowers. Larvae feed on both flowers and leaves. Adults are present from mid-May through early July, and usually fly during dusk and early evening. Larvae are dormant, burrowed in the sand during winter, reemerging in early-spring to feed and then pupate. *C. columbia* adults occur in early-June; *C. mutans* adults in late August and early September; and *C. viridisparsa hopfingeri* flies in July and August.

Distribution and Abundance

The distributions of these species are limited by their dependence on rare and highly restricted ecological systems. An endemic of Salish Sea sandy coastal sites, the Sand Verbena Moth is known from only 10 sites; five on Vancouver Island, British Columbia, Canada, and five in Washington along the eastern edge of the Straits of Juan de Fuca (San Juan, Island, Jefferson, and Clallam Counties). Sand Verbena Moth is the only *Copablepharon* species known from west of the Cascades Mountains. Recent efforts have been made to locate additional populations within and outside of this area.

C. columbia, C. mutans, and C. viridisparsa hopfingeri are each restricted to a small number of sand dune sites in the semiarid Columbia Basin in eastern Washington. *C. columbia* is known from only a single sand dune complex, located on the southwest shore of Moses Lake (Grant County), and despite extensive sampling in this region, most specimens have been collected from a single dune within this site. *C. mutans* has been found in two sand dune areas along the Columbia River: near the Wanapum Dam (Grant County) and within the US Department of Energy Hanford site (Benton County). *C. viridisparsa hopfingeri* historically occurred in sand dunes along the Columbia River from Trail, British Columbia, Canada to Wenatchee, Washington. However, the only recent records are from Bridgeport State Park (Okanogan County) and Fort Spokane State Park (Lincoln County).

Habitat

Copablepharon moths are habitat specialists that rely on loose, well-drained soils, especially sand. They are restricted to active (non-stabilized) sandy sites, coastal sand beaches and spits for Sand Verbena Moth, and for the three other taxa, inland sand dunes in an arid shrub-steppe setting. The sands in all cases are glacially derived, and wind action provides soil disturbance that supports native vegetation. Beach and sand dune sites that have been stabilized from introduced plants or by other actions typically lose much of their native vegetation. These sand substrate habitats are rare in the Pacific Northwest. Additional habitat parameters are known for Sand Verbena Moth, which has received some study; this moth persists only on sites with large, dense, flowering patches of yellow sand verbena.

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Genus Copablepharon: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Sand Verbena Moth					
1	Climate change and severe weather	Populations located adjacent to marine waters- that are rising	Evaluate landscape and develop plan to increase habitat area and habitat heterogeneity in currently occupied sites and within occupied landscapes	Nothing current - new action needed	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete natives and otherwise make habitat unsuitable	Using herbicide and mechanical methods to maintain open sand dunes	Nothing current - new action needed	Both
Copablepharon columbia					
1	Invasive and other problematic species	Sand dune obligate: dunes are being stabilized by invasive species, especially cheatgrass	Eradicate cheatgrass and other invasive plants from dune systems	Nothing current - new action needed	Both
Copablepharon mutans					
1	Invasive and other problematic species	Sand dune obligate: dunes are being stabilized by invasive species, especially cheatgrass	Eradicate cheatgrass and other invasive plants from dune systems	Nothing current - new action needed	Both
Copablepharon viridisparsa hopfingeri					
1	Invasive and other problematic species	Sand dune obligate: dunes are being stabilized by invasive species, especially cheatgrass	Eradicate cheatgrass and other invasive plants from dune systems	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

BUTTERFLIES

GREAT ARCTIC *(Oeneis nevadensis gigas)*

Conservation Status and Concern

A Pacific Northwest endemic, this butterfly has been found on a single site within the United States, in northwestern Washington; it also occurs in southwestern British Columbia, and may occur on other sites with similar habitat. It is a SGCN due to its restricted range, distribution, and habitat, and many threats to its grassland-forest edge habitat.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
None	Candidate	Yes	G5TU	SH	Critical/unknown	Low-moderate

Biology and Life History

Photo: M. Patterson

The Great Arctic, a member of the Satyr (Satyrinae) butterfly subfamily, is a large tawny brown butterfly with a bark-like patterned ventral hindwing, such that when perched they are quite camouflaged. Great Arctic belongs to a group of butterflies, the arctics and alpines, that inhabit far northern and alpine climes. One unusual aspect of their life history is a life cycle, from egg to adult that spans 2 years. The life history of Great Artic is not well known. Adults are present in June and July, and females lay eggs on unknown species of grasses where larvae develop over two years; the timing and location of larval and pupal stages are unknown. This 2-year life cycle is synchronized amongst individuals and results in adults mostly occurring in even-numbered years. Males exhibit territorial flight behaviors of perching and patrolling, and are known to congregate on ridges and hilltops, a behavior called "hilltopping". This butterfly's habits of jerky flights through open forest and perching on trees where they are concealed makes them difficult to detect.

Distribution and Abundance

The species occurs in British Columbia, primarily on Vancouver Island, with a few sites in the mainland Coast Range, and a single site known from Washington, on Orcas Island (San Juan County) in the northwestern portion of the state. Recent efforts to relocate Great Arctic on Orcas Island have been inconclusive; WDFW surveyors had fleeting observations of unidentified but similar looking butterflies, and located additional potential habitat for future survey. If this butterfly persists in Washington, population sizes are likely small.

Habitat

The Great Arctic inhabits forest openings, meadow edges, and rocky slopes and outcrops from sea level to mid-elevations. Aside from dependence on specific but unknown grasses and forest edge ecotone, little is known of their habitat requirements.

References

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Great Arctic: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection Needs	Current status and distribution in WA unknown	Survey historic locale and other potential sites	Current insufficient	WDFW
2	Invasive and other problematic species	Forest encroachment due to long-term fire suppression has reduced amount and quality of habitat. Host plant is a grass, and species utilizes open forest and forest edge	Remove invading trees and shrubs	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

ISLAND MARBLE (*Euchloe ausonides insulanus*)

Conservation Status and Concern

The Island Marble is a rare butterfly, restricted to two San Juan Islands. Petitioned for listing under the ESA in 2012, the USFWS found "listing the island marble butterfly as an endangered species may be warranted.".

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
In review	Candidate	Yes	G5T1	S1	Critical/declining	Moderate-high

Biology and Life History

Photo: T. Hanson

The Island Marble is a univoltine butterfly; the adult flight period extends from approximately mid-April through late June. Adults feed on floral nectar, and more than 10 plant species have been documented as nectar sources, primarily of the mustard family (Brassicaceae). Species that serve as larval hosts include field mustard (*Brassica campestris)*, tall tumble-mustard (*Sisymbrium altissimum)*, and Menzies pepper-grass (*Lepidium virginicum* var. menziesii*).* Adults regularly travel from their natal patches and have been observed flying a mile or more. Island Marble females lay eggs on the flowers of specific mustard species, and when egg-laying are selective about individual plants, location within mustard patches, and at the micro-scale, flower phenology and the location on plants. Larvae feed on flowers, pedicels and developing fruits through five growth stages (instars) before leaving the host plant and making their way through the plant canopy in search of pupation sites. Pupation sites are located above the ground on senesced grasses or other low vegetation, within 25 feet of their hostplant. This species spends the majority of its annual life cycle (July to April), including winter as a pupa (chrysalis). Larval survival is low (6 percent to fifth instar), with threats including predation (especially by spiders), browsing deer, human disturbance, and weather events.

Distribution and Abundance

The Island Marble was found in a total of four distinct populations at 52 sites on San Juan and Lopez islands. It was originally known from only 14 specimens collected on Vancouver and Gabriola Islands in southwestern British Columbia, between 1861 and 1908. It was believed extinct, and then rediscovered at the San Juan Island National Historical Park in 1998, and formally described in 2001. WDFW surveys found that most Island Marble sites and populations discovered early on are now extinct. The sole definitively extant population persists with an estimated 50 to 100 adults on the south end of San Juan Island.

Habitat

The Island Marble inhabits open grasslands, disturbed sites, and herbaceous or sparsely vegetated habitats including native prairie, fields and pastures, sand dunes, gravel pits, and marine beach and lagoon margins where their annual hostplants persist. Extensive research has been conducted on the host patch characteristics selected by females for egg-laying.

References

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Island Marble: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Invasive and other problematic species	Black-tailed deer abundance and extensive herbivory of hostplants and eggs/larvae	Erect deer-exclusion fences in areas of habitat	Current insufficient	Both
2	Agriculture and aquaculture side effects	Development of commercial fields of butterfly's host within area occupied, that serve as ecological traps	Consider planning for zones that would exclude large-scale farming of hostplant as a crop	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

MONARCH BUTTERFLY (*Danaus plexippus*)

Conservation Status and Concern

The Monarch butterfly faces significant threats in both summer and winter habitats, and action is needed to restore populations. Western Monarchs, including those breeding within Washington, have declined by more than 50 percent since 1997.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
In review	None	No	G4	S4	Low/declining	Moderate

Biology and Life History

Photo: D. Ramsey

Monarchs, once common throughout the United States, undertake a spectacular multi-generational migration of thousands of miles between their northern breeding areas and overwintering areas in interior montane Mexico and coastal California. Most Monarchs that breed west of the Rocky Mountains, including in Washington State, overwinter in California. The life cycle of the Monarch butterfly is directly intertwined with their milkweed host (genus *Asclepias*). Monarchs lay their eggs on milkweed species, and resulting larvae and pupae develop on these plants. The milkweed plants' chemical defense compounds are accumulated in Monarch larvae, pupae, and adults and used to defend against their predators. The duration of complete development (from egg to adult) is dependent on weather conditions and can vary from 25 days to 7 weeks. Like most butterflies, Monarch adults rely on floral nectar for nutrition. Although Monarchs are dependent on temperate zones for reproduction, the adults cannot survive freezing temperatures. Late summer adults undergo a physiological transformation to fat-storing, non-reproductive butterflies. They commence movements south (often in groups) to overwintering sites, covering an average of 25 to 30 miles per day, stopping at night, to feed, and during inclement weather. During spring migration, Monarchs typically do not travel in groups. They make their way north through subsequent generations until late summer.

Distribution and Abundance

Monarchs occur throughout most of the United States, southern Canada, and northern Mexico. In Washington, they are found east of the Cascades where milkweed occurs. Estimates of the historic California wintering population range from 1 million to 10 million butterflies. Monarchs have undergone an enormous decline in numbers in both eastern and western populations. The California overwintering population dropped from an estimated 1.2 million butterflies in 1997 to 200,000 in 2013. The number of Monarchs in Washington State is relatively low. Milkweeds are patchily distributed within the Columbia Basin. Monarchs migrating south through Washington often concentrate along the large river courses of the Columbia and Snake Rivers.

Habitat

Monarchs breed and travel through Washington but do not overwinter in the state. Monarchs require secure patches of milkweed and nectar resources during breeding, roosting sites and safe travel corridors for migration. Milkweeds and Monarchs in Washington occur in weedy fields and sparsely vegetated habitats, typically near wetlands or riparian areas. Southbound travel corridors, often river courses, need abundant late season nectar and trees for roosting at night and during periods of inclement weather.

References

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Monarch Butterfly: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection needs	Out of date and incomplete information on distribution	Conduct inventory and revisit historic locales (E WA)	Nothing current - new action needed	Both
2	Education needs	Hostplants are often targeted for removal by herbicide and mechanical methods	Habitat management planning	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

TAYLOR'S CHECKERSPOT (*Euphydryas editha taylori*)

*See Appendix B for a range and potential habitat distribution map

Conservation Status and Concern

This subspecies is currently restricted to a small scattering of eight populations in Washington, a single population in British Columbia, and two populations in Oregon. The decline of Taylor's Checkerspot has accompanied the loss of open prairie and grassland habitats. Taylor's Checkerspot was listed by the Washington Fish and Wildlife Commission as endangered in 2006, and listed endangered federally by the USFWS in 2013.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
Endangered	Endangered	Yes	G5T1	S1	Critical/stable	Moderate-high

Biology and Life History

Photo: WDFW

Taylor's Checkerspot, a subspecies of Edith's Checkerspot, is a medium-sized butterfly with a striking checkered pattern of orange to brick red, black and cream. They complete one life cycle each year, and inhabit their sites year-round as eggs, larvae, pupae and adults. Adults emerge from pupation in the spring and feed on floral nectar from a variety of plants, often specializing on a few plant species. Adults mate and females subsequently lay eggs in clusters on plants in the family Plantaginaceae, primarily English plantain (*Plantago lanceolata)* and members of the Scrophulariaceae, primarily harsh paintbrush (*Castilleja hispida).* Eggs hatch in 8 to 9 days, and the resulting caterpillars (larvae) create webbing and feed communally through the spring on the hostplant species. Larvae enter a dormant phase (diapause) in late June to early August (exact timing dependent upon site conditions) when hostplants are no longer palatable. Larvae often diapause in a sheltered location under rocks, logs, or litter. The diapause phase lasts from summer until late winter (late January to late March). Upon breaking diapause, Checkerspot larvae resume feeding more broadly on oviposition plants and additional food sources (including sea blush (*Plectritis congesta*) and blue-eyed Mary (*Collinsia parviflora*). After spending 9 to 10 months as larvae, they progress into pupae in late March through early May. Adults emerge 2 weeks later and live for a few days to 2 weeks.

Distribution and Abundance

In Washington, the species was historically found on over 80 grassland sites from southeastern Vancouver Island, British Columbia through the southern Willamette Valley in Oregon. Taylor's Checkerspot is now restricted to a handful of populations; six populations are found in Clallam County on the northeastern Olympic Peninsula, and a single population persists in the south Puget Sound region, located on the Joint Base Lewis-McChord (JBLM). Efforts are currently underway to reestablish the butterfly on three south Sound sites. The Clallam County sites have populations of 1,000 or more butterflies on two sites, with more modest numbers at four others. The JBLM site has been estimated at >10,000 individuals.

Habitat

Taylor's Checkerspot inhabits short-stature grasslands in low-elevation prairies and meadows, old forest clearings, coastal meadows and stabilized dunes, and montane meadows, and balds. A study in Oregon found that Taylor's Checkerspots selected habitat for egg-laying that occurred within high cover of short-stature native bunchgrasses and adult nectar resources, indicating that females select egg-laying sites based on habitat condition. The British Columbia study population had multiple hostplant species available and females' selection of egg-laying sites in this environment was influenced by hostplant phenology and condition. Characteristics of egg-laying habitat consistently identified in the British Columbia and three Olympic Peninsula populations were abundance (number or percent cover) and density of hostplants.

References

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Taylor's Checkerspot: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
3	Invasive and other problematic species	Trees and shrubs encroaching on habitat in forest matrix sites, primarily within Clallam Co, due to long-term fire suppression	Remove invading trees and shrubs	Current insufficient	Both
4	Fish and wildlife habitat loss or degradation	Only a few, small and disjunct populations remain in the south Sound region.	Reintroduce at restored prairie sites	Current sufficient	WDFW
5	Fish and wildlife habitat loss or degradation	Military training on JBLM that is poorly timed or placed and significantly impacts populations	Develop best management practices for areas occupied by butterfly within JBLM	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

Family Lycaenidae: GOSSAMER WING BUTTERFLIES

Conservation Status and Concern

Seven lycaenid butterflies were recognized as SGCN due to their rare and restricted hostplants and habitat types, small number of isolated populations, highly limited range and distribution, and threats to their habitat.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Makah Copper (*Lycaena mariposa charlottensis*)	None	Candidate	Yes	G5T5	S2	Low/declining
Golden Hairstreak (*Habrodais grunus herri*)	None	Candidate	Yes	G4G5	S1	Critical/declining
Johnson's Hairstreak (*Callophrys johnsoni*)	None	Candidate	Yes	G3G4	S2S3	Low/unknown
Juniper Hairstreak (*Callophrys gryneus* Columbia Basin segregate)	None	Candidate	Yes	G5TU	S2?	Low/unknown
Hoary Elfin (*Callophrys polios* Puget Trough segregate)	None	Monitor	No	G5T2T3	S2S3	Critical/declining
Puget (Blackmore's) Blue (*Icaricia icarioides blackmorei*)	None	Candidate	Yes	G5T3	S2	Low/declining
Straits Acmon Blue (*Icaricia acmon sp.*)	None	None	No	G5T?	SNR	Critical/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Makah Copper *(Lycaena mariposa charlottensis)*	Moderate-high
Golden Hairstreak *(Habrodais grunus herri)*	N/A
Johnson's Hairstreak *(Callophrys johnsoni)*	Moderate-high
Juniper Hairstreak *(Callophrys gryneus Columbia Basin segregate)*	Moderate
Hoary Elfin *(Callophrys polios Puget Trough segregate)*	Low-moderate
Puget (Blackmore's) Blue *(Icaricia icarioides blackmorei)*	Alpine populations - High Low elevation populations - Low-moderate
Straits Acmon Blue (*Icaricia acmon sp.)*	Moderate-high

Taxonomic note: Genera synonyms: Hairstreak *Callophrys* = *Mitoura*; Elfin *Callophrys* = *Incisalia*; Blue *Icaricia* = *Plebejus*; Straits Acmon Blue was discovered in 2005.

Biology and Life History

Hoary Elfin perched in kinnikinnick on south Puget Sound prairie. Photo: R. Gilbert

The Lycaenidae butterfly family consists of small and often brightly colored species with the common names: copper, hairstreak, elfin, and blue. Lycaenid butterfly SGCN complete a single life cycle annually (univoltine), except Straits Acmon Blue which has two generations per year (spring and late summer). All are sedentary butterflies and do not migrate; instead, the species inhabits sites year-round (as egg, larva, pupa and adult), typically moving within only a few hundred yards of their natal locations. Adults emerge from their chrysalids (pupae) during species-specific time periods (See Table 1). Males begin emergence first, followed by females; late season individuals are primarily or solely females. Weather influences butterfly emergence and the flight period duration, with wet or cold conditions potentially delaying emergence, and warm, dry conditions promoting earlier emergence. Male lycaenids seek mates using patrolling patterned flight or perching on vegetation in select spots and darting out to inspect passing butterflies. Females search for egg-laying sites by slowly flying and hovering above hostplant vegetation, and then landing and crawling to inspect vegetation before depositing eggs singly. Both males and females feed by using their long proboscis to sip floral nectar. Males of most species require salts, which they obtain from evaporated puddles and moist soil and animal urine and feces. Larvae are slug-like in appearance and highly camouflaged in their host species. Many lycaenid larvae engage in mutualistic relationships with ants, known as myrmecophily, which typically consists of ants tending and milking larvae, obtaining nutrition in the form of a nectar-like substance (honeydew) in the process, and also protecting larvae from predators and parasitoids; in some situations the ants move butterfly larvae or pupae into ground chambers, including their nests. Ant interactions have been observed with Golden Hairstreak and Puget Blue; however, more study is needed to determine the extent of interaction and ecological significance of ant-larval relationships in

these species. The overwintering stage varies by species: Makah Copper and Golden Hairstreak overwinter as eggs; Puget Blue as larvae; and Johnson's and Juniper Hairstreaks, and Hoary Elfins as pupae. The overwintering stage is not known for Straits Acmon Blue.

Key life history attributes for Washington populations of lycaenid butterfly SGCN.

Species	Adult Period	Hostplants	Primary Nectar Plants
Makah Copper	Jul-Aug	Bog cranberry (*Vaccinium oxycoccos*)	Swamp gentian (*Gentiana douglasiana*)
Golden Hairstreak	Aug-Sep	Golden chinquapin (*Chrysolepis chrysophylla*)	Late-summer flowers in tree canopy and herbaceous forest edge
Johnson's Hairstreak	Jun-Jul	Western dwarf mistletoe (*Arceuthobium campylopodum)*	Variety of herbaceous and shrub, mid-summer flowering plants
Juniper Hairstreak	Apr-May	Western juniper (*Juniperus occidentalis*)	Unknown
Hoary Elfin	Apr-May	Kinnikinnick (*Arctostaphylos uva-ursi*)	Kinnikinnick
Puget (Blackmore's) Blue	Jun-Jul	Sickle-keeled lupine, broadleaf lupine (*Lupinus albicaulis, L. latifolius*)	Host lupine
Straits Acmon Blue	May-Jun; Aug	Black knotweed (*Polygonum paronychia*)	Unknown

Distribution and Abundance

The distributions of these species are limited in part by a combination of their dependence on rare hostplant occurrence within rare habitat types. Their distribution and abundance in Washington is characterized by small numbers of small isolated populations. Recent survey efforts have been undertaken in Washington to determine the current distribution of Makah Copper, Golden Hairstreak, Johnson's Hairstreak, Hoary Elfin, Puget Blue, and Straits Acmon Blue. Still, little is known of the current distribution of Johnson's Hairstreak and Juniper Hairstreak, and of Hoary Elfin on the Kitsap Peninsula. Species overall range in Washington and estimated number of populations are summarized in Table 2.

Overall range; Washington counties and estimated number of extant populations for lycaenid butterfly SGCN.

Species	Range-Overall	Counties in WA	Est # Pop in WA
Makah Copper	Outer coast and low-elevation Olympic Peninsula, WA	Clallam, Grays Harbor, Jefferson, Mason,	10-15
Golden Hairstreak	Disjunct, and limited by chinquapin host: N Oregon Cascades; small area in Oregon Coast Range; small area in S WA Cascades	Skamania	1-2
Johnson's Hairstreak	Mature forests in SW British Columbia; western WA; W Oregon and N California	Jefferson, Lewis, Mason, Pierce, Skamania, Snohomish	5-10? Few recent detections
Juniper Hairstreak	Scattered in central Columbia Basin: SE WA; NE Oregon	Asotin, Columbia, Douglas, Franklin, Garfield, Grant, Klickitat	5-10? Few recent detections

Hoary Elfin	South Puget Sound region	Kitsap, Mason, Pierce, Thurston	10-15
Puget (Blackmore's) Blue	S Vancouver Is, British Columbia; eastern Olympic Mountain range, south Puget Sound region, WA	Clallam, Grays Harbor, Jefferson, Mason, Pierce, Thurston	7-10 (S Puget Sound), 30-40 (Olympic Mountains)
Straits Acmon Blue	Coastal WA: Straits of Juan de Fuca	Clallam	3

Habitat

These species inhabit a wide diversity of ecological systems, from forests to prairies, all of which are rare and declining. Hostplants for these butterflies are also rare, uncommon, or ecologically restricted. This species group includes butterflies that use tree or tree-growing (mistletoe) hostplants and inhabit the forest canopy (Golden Hairstreak, Johnson's Hairstreak, Juniper Hairstreak), as well as prostrate, woody shrub-dependent species (Makah Copper, Hoary Elfin, Straits Acmon Blue), and an herbaceous plant (lupine) feeder (Puget Blue) (see Table 1). Research is needed on all species to understand their life history and quantify specific habitat requirements including vegetation structure, food plant size and density, and key habitat features.

Makah Copper: A coastal *Sphagnum* bog obligate, this butterfly's hostplant is bog cranberry, a prostrate, vine-like, dwarf evergreen shrub. Both butterfly and host occur within 20 miles of the outer coast and Salish Sea. Bogs in this region are small, low elevation patches dominated by *Sphagnum* mosses and other bog-specific herbaceous plants and shrubs within an otherwise heavily forested landscape.

Golden Hairstreak: Confined to the few small patches of golden chinquapin, a broadleaf evergreen tree that occurs in low to middle elevations in southern Skamania County, the northern extent of the species' range. The Golden Hairstreak spends much of its adult life, and all of its egg, larval, and pupal life stages in the open forest canopy of chinquapins. Small, adjacent forest openings in this landscape often provide additional floral nectar sources and puddling sites. Beyond their chinquapin host requirement, little is known of their habitat needs.

Johnson's Hairstreak: This butterfly depends on western dwarf mistletoe, a plant that parasitizes old-growth western hemlock (*Tsuga heterophylla*) trees. Eggs are laid and larvae feed on western dwarf mistletoe, which typically grows high up in its host tree. Western hemlock occurs in low to middle elevations; Johnson's Hairstreak has been found in western Washington forests from 100 to 2500 feet in elevation. Small, adjacent forest openings in this landscape often provide additional floral nectar sources and puddling sites.

Juniper Hairstreak: Inhabits low to middle elevation, Columbia River Basin shrub-steppe where stands of its host western juniper, a short evergreen tree, occur. Nectaring occurs on spring flowering shrub-steppe plants in close proximity to host junipers. The Juniper Dunes Wilderness (Bureau of Land Management) in Franklin County is one of the few Washington locations where the species can reliably be found. Beyond their juniper host need, little is known of their habitat requirements.

Hoary Elfin: This species' hostplant, kinnikinnick, is a short, prostrate, evergreen woody shrub, relatively common at most elevations in western Washington; however the butterfly occurs only at low elevations on glacial outwash prairies and forest opening balds in the south Puget Sound region and early successional scrub-heath habitats (including forest clearings) on the Kitsap Peninsula. Hoary Elfin habitat across all regions is open or located at forest edge.

Puget (Blackmore's) Blue: Inhabits low elevation grasslands (prairies) in south Puget Sound, and sub-alpine meadows in the Olympic Mountains. The perennial sickle-keeled lupine is the larval host and primary adult nectar source for the Puget Blue on two south Sound prairies. The butterfly's dependence on sickle-keeled lupine limits their habitat to areas and sites that support significant patches of this plant. Density of host lupine across two Puget Blue varied between years and sites from 0.08-0.48 plants per square yard. Another important habitat feature is bare ground depressions where water collects and evaporates during the adult flight period; males rely on these sites to obtain minerals (puddling). There have been no studies of habitat requirements for sub-alpine Olympic Mountain Puget Blue populations.

Straits Acmon Blue: This Acmon Blue subspecies is restricted to a few coastal sand spits and beaches along the southern shores of the Straits of Juan de Fuca, in Clallam County where it uses the semi-shrubby, prostrate, black knotweed for its host. Beyond their host need and sand spit and beach occurrence, little is known of their habitat requirements.

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Family Lycaenidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Makah Copper					
1	Agriculture and aquaculture side effects	Bog/fen obligate; habitat and species are vulnerable to alteration of local hydrology from logging and road building	Leading or participating in land use planning for rural, urban, and forestry lands	Current insufficient	Both
2	Resource information collection needs	Species in WA likely distinct subspecies	Genetic study to determine if WA populations are distinct subspecies	Nothing current - new action needed	Both
Golden Hairstreak					
1	Agriculture and aquaculture side effects	Habitat and hostplant, a rare tree/shrub occurs in areas with active logging practices	Develop plan with landowners to manage sites for butterfly, host, and habitat	Nothing current - new action needed	Both
2	Resource information collection needs	Current distribution unknown	Identify host patches and survey for butterfly	Current insufficient	Both
3	Resource information collection needs	Need to identify habitat needs, including optimal canopy cover in order to manage for species	Study habitat selection and requirements and use this information to develop management plans	Nothing current - new action needed	Both
Johnson's Hairstreak					
1	Agriculture and aquaculture side effects	Species habitat is low-elevation, old-growth forest that has been impacted by logging	Habitat management planning that recognizes importance of forest type and mistletoe species	Current insufficient	External
2	Resource information collection needs	Lacking information on current status of known sites and distribution	inventory; status assessment	Current insufficient	Both
Juniper Hairstreak					
1	Resource information collection needs	Lacking information on current status of known sites and distribution	Inventory; status assessment	Nothing current - new action needed	WDFW
2	Fish and wildlife habitat loss or degradation	Juniper woodlands are threatened with development, unsustainable grazing practices, ORV use, etc.	Habitat management planning that recognizes importance of juniper woodlands	Current insufficient	External
Hoary Elfin					
1	Fish and wildlife habitat loss or degradation	Development destroying prairie habitat	Species and habitat management plans for occupied sites	Current insufficient	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
2	Fish and wildlife habitat loss or degradation	Development destroying prairie habitat, including highway building	Purchase and protect prairie sites	Current insufficient	Both
3	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
4	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
5	Resource information collection needs	Knowledge of current distribution is incomplete	Conduct surveys to determine current status and distribution of populations, especially needed on the Kitsap Peninsula	Nothing current - new action needed	WDFW
Puget (Blackmore's) Blue					
1	Resource information collection needs	Knowledge of current distribution is incomplete	Conduct surveys to determine current status and distribution of populations, primarily needed on the Kitsap Peninsula and northeast Olympic Peninsula	Nothing current - new action needed	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
3	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
Straits Acmon Blue					

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Climate change and severe weather	Populations located adjacent to marine waters- that are rising	Evaluate landscape and develop plan to increase habitat area and habitat heterogeneity in currently occupied sites and within occupied landscapes	Nothing current - new action needed	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete natives and otherwise make habitat unsuitable	Using herbicide and mechanical methods to maintain open condition of vegetation	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

Subfamily Heliconiinae: FRITILLARY BUTTERFLIES

*See Appendix B for range and potential habitat distribution maps for the Oregon and Valley Silverspots

Conservation Status and Concern

These species were recognized as SGCN in Washington due to their rare and restricted hostplants and habitat types, small number of isolated populations, limited range and distribution, and known threats to their habitats.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Puget Sound Fritillary (*Speyeria cybele pugetensis*)	None	None	No	G5TU	S3?	Low/declining
Valley Silverspot (*Speyeria zerene bremnerii*)	None	Candidate	Yes	G5T3T4	S2S3	Critical/declining
Oregon Silverspot (Speyeria zerene *hippolyta***)**	Threatened	Endangered	Yes	G5T1	SX	Extirpated
Meadow Fritillary (*Boloria bellona toddi*)	None	None	No	GNR	SNR	Low/declining
Silver-bordered Fritillary (*Boloria selene atrocostalis*)	None	Candidate	Yes	GNR	SNR	Low/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Puget Sound Fritillary *(Speyeria cybele pugetensis)*	Low-moderate
Valley Silverspot (*Speyeria zerene bremnerii)*	Low-moderate
Oregon Silverspot (*Speyeria zerene hippolyta)*	Moderate
Meadow Fritillary (*Boloria bellona toddi)*	Low-moderate
Silver-bordered Fritillary (*Boloria selene atrocostalis)*	Moderate-high

Biology and Life History

Puget Sound Fritillary
Photo: R. Gilbert

The Heliconiinae (Fritillary) subfamily consists of medium and large sized butterflies with distinctive black line and dot patterning on bright orange dorsally, and a heavily-patterned ventrum with silvery orbs (genus *Speyeria:* greater fritillaries) or muted colored triangles (genus *Boloria*: lesser fritillaries). The greater fritillaries (genus *Speyeria*) complete a single life cycle annually (univoltine), while the lesser fritillaries (genus *Boloria*) have two generations per year (spring and late summer). All are sedentary butterflies and do not migrate; instead, the species inhabits sites year-round (as egg, larva, pupa and adult). Adults emerge from their chrysalids (pupae) during species-specific time periods; typically early-to-late summer for *Speyeria,* and both spring and late summer for *Boloria*. Males begin emergence first, followed by females; late season individuals are primarily or solely females. Weather influences butterfly emergence and flight period duration, with wet or cold conditions potentially delaying emergence. Male fritillaries seek mates using rapid patrolling and searching flight behavior. Females search for egg-laying sites by slowly flying and hovering above hostplants and then landing and crawling to inspect vegetation before depositing eggs singly. Both males and females feed by using their long proboscis to sip floral nectar. Research on other *Speyeria* spp. suggests that nectar availability affects the number of eggs laid by females. These species depend on violets (genus *Viola*) for their hostplants. *Speyeria* fritillaries lay eggs late in the summer. A tiny larva hatches within a few weeks and seeks shelter to overwinter, but does not feed until the following spring. In *Boloria* fritillaries, the first (spring) generation of eggs mostly develops quickly, resulting in the second (summer) generation. Larvae from this second generation develop slowly and are the overwintering form for these butterflies. Fritillary larvae are generally dark with many bristled spines, and feed nocturnally; these characteristics, along with a gland that secretes defensive chemicals, protect larvae from predators.

Distribution and Abundance

The distribution of these species is limited in part by their dependence on rare habitat types. Their distribution and abundance in Washington is characterized by low numbers of small isolated populations. The Oregon Silverspot has been extirpated from Washington, though habitat has been restored and plans have been made to reintroduce this species. Declines in both the number and size of populations have been documented for the other four species. Surveys were recently conducted to determine the current distribution of the Puget Sound Fritillary and Valley Silverspot in the south Puget Sound region, and Meadow and Silver-bordered Fritillary in northeastern Washington. Little is known of the current status and distribution of these species in other portions of their range within the state. Species overall range, Washington counties, and estimated number of populations are summarized in Table 1.

Table 1. Overall range; Washington counties and estimated number of extant populations for fritillary butterfly SGCN.

Species	Range-Overall	Counties in WA	Est # Pop in WA
Puget Sound Fritillary	Scattered populations: W Oregon; SW WA; montane NE Olympic Mountains, WA	Clallam, Clark, Cowlitz, Lewis, Mason, Pierce, Skamania, Thurston	15-20
Valley Silverspot	Scattered populations: SW WA; south Puget Sound region, WA; montane NE Olympic Mountains, WA; San Juan Islands, WA; southern Vancouver Island, Canada. Extirpated from Oregon.	Clallam, Cowlitz, Jefferson, Lewis, Pierce, Thurston	10-15
Oregon Silverspot	Coastal Oregon and Northern CA	Grays Harbor, Pacific	Extirpated from WA
Meadow Fritillary	Okanogan Highlands: British Columbia, Canada and northeastern WA	Ferry, Okanogan *possible* Stevens, Pend Oreille	5-10 (few recent detections)
Silver-bordered Fritillary	Scattered populations: E Oregon; E WA; N Idaho; NW Montana; E British Columbia; W Alberta	Grant, Lincoln, Okanogan, Pend Oreille, Stevens, Whitman	15-20 (few recent detections)

Habitat

These species inhabit a wide diversity of ecological systems, from coastal dunes to native prairies, boreal bogs, and aspen meadows, all of which are rare and declining. Research is especially needed for the Meadow and Silver-bordered Fritillaries to understand and quantify specific habitat requirements including vegetation structure, food plant size and density, and key habitat features.

Puget Sound Fritillary: Relies on open habitats in western Washington where its host violets grow, including montane meadows in the northeastern Olympic Mountains, and low-elevation river and creek courses, forest openings, and native grasslands. Egg-laying has been observed in the south Puget Sound region on two violet species (*V. praemorsa* and early blue violet, *V. adunca*). Adults require late-season nectar, and especially seek out native and non-native thistles (*Cirsium).* There have been no hostplant or habitat studies in Olympic Mountain populations.

Valley Silverspot: Restricted to native grasslands in western Washington, primarily montane meadows in the northeastern Olympic Mountains, and low-elevation, short-stature grasslands in the south Puget Sound region. In a 2-year study of Valley Silverspot habitat and nectar use on two south Sound prairies, early blue violet was identified as a larval host, and two plants were selected for adult nectar sources (showy fleabane, [*Erigeron speciosus*] and Canada thistle [*C. arvense*]). There have been no hostplant or habitat studies in Olympic Mountain populations.

Oregon Silverspot: Uses open, short-stature grasslands in coastal dunes, bluffs, and nearby forest glades. Habitat studies have been conducted for this butterfly on the remaining sites in Oregon; early blue violet is the sole hostplant for this butterfly, and females selected patches with more than 20 plants per square yard for egg-laying sites. Although the Oregon Silverspot has been extirpated from Washington, WDFW has led habitat restoration efforts on coastal sites in Pacific County in preparation for future butterfly reintroductions.

Meadow Fritillary: Inhabits meadows, forest openings, and riparian corridors in aspen and pine woodlands between 2000 to 4500 feet in elevation in northeastern Washington. Another violet host butterfly, it is found with the white-flowering Canada violet (*V. canadensis*). Beyond their violet host need, little is known of their habitat requirements.

Silver-bordered Fritillary: This butterfly is dependent on fen and *Sphagnum* bog sites located in the xeric steppe and open forests of the Columbia River Basin. Bogs in this region are small, mid-elevation patches dominated by *Sphagnum* moss species and other bog-specific herbaceous plants and shrubs. Their hostplants are unknown violet species, likely marsh violet (*V. palustris*) and bog violet (*V. nephrophylla*). Beyond their fen and bog habitat restriction, little is known of their habitat requirements.

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Subfamily Heliconiinae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Puget Sound Fritillary					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
3	Resource information collection needs	Knowledge of current distribution is incomplete	Conduct surveys to determine current status and distribution of populations, primarily needed on the Kitsap Peninsula and northeast Olympic Peninsula	Nothing current - new action needed	Both
4	Invasive and other problematic species	Trees and shrubs encroaching on habitat in forest matrix sites throughout range, due to long-term fire suppression	Remove invading trees and shrubs	Current insufficient	Both
Valley Silverspot					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
3	Resource Information Collection Needs	Incomplete knowledge of distribution in NE Olympic Mountains	Conduct surveys to determine current status and distribution of populations in the WA southern Cascades	Nothing current - new action needed	WDFW
Oregon Silverspot					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
3	Fish and wildlife habitat loss or degradation	No populations currently extant in WA	Reintroduce at restored sites	Nothing current - new action needed	Both
Meadow Fritillary					
1	Agriculture and aquaculture side effects	Intensive livestock use may cause direct harm to butterfly through trampling, and indirect harm by reducing host and nectar species and compacting soil	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Nothing current - new action needed	Both
2	Invasive and other problematic species	Forest encroachment due to long-term fire suppression has reduced amount and quality of habitat. Hostplant is an herbaceous species and butterfly occupies open habitats	Remove invading trees and shrubs	Nothing current - new action needed	Both
3	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore meadows	Nothing current - new action needed	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Silver-bordered Fritillary					
1	Agriculture and aquaculture side effects	Intensive livestock use may cause direct harm to butterfly through trampling, and indirect harm by reducing host and nectar species and compacting soil	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Nothing current - new action needed	Both
2	Invasive and other problematic species	Forest encroachment due to long-term fire suppression has reduced amount and quality of habitat. Hostplant is an herbaceous species and butterfly occupies open habitats	Remove invading trees and shrubs	Nothing Current - new action needed	Both
3	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore meadows	Nothing Current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

Family Hesperiidae: SKIPPER BUTTERFLIES

*See Appendix B for a range and potential habitat distribution map for the Mardon Skipper

Conservation Status and Concern

These five butterflies in the Skipper Family were recognized as SGCN throughout their ranges due to the small number of isolated populations, specialized and restricted habitat, and known threats to their habitat.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Propertius Duskywing (*Erynnis propertius*) western Washington populations only	None	None	No	G5	S3	Low/declining
Oregon Branded Skipper (*Hesperia colorado* Salish Sea segregate)	None	None	No	G5T3T4	S2	Critical/declining
Mardon Skipper (*Polites mardon*)	Species of Concern	Candidate	Yes	G2G3T2 T3	S1	Low/declining
Sonora Skipper (*Polites sonora siris*)	None	None	No	G4T3	S2S3	Critical/declining
Yuma Skipper (*Ochlodes yuma*)	None	Candidate	Yes	G5	S1	Critical/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Propertius Duskywing (*Erynnis propertius*) western Washington populations only	Moderate
Oregon Branded Skipper (*Hesperia colorado* Salish Sea segregate)	Moderate
Mardon Skipper (*Polites mardon*)	Moderate-high
Sonora Skipper (*Polites sonora siris*)	Low-moderate
Yuma Skipper (*Ochlodes yuma*)	Moderate

Taxonomic note: Skipper butterflies are members of two subfamilies: Propertius Duskywing is a Pyrginae (dicot or spread-wing skippers); Oregon Branded, Mardon, Sonora, and Yuma Skipper are Hesperiinae (monocot or folded-wing skippers).

Biology and Life History

These skippers complete a single life cycle annually (univoltine). All are sedentary butterflies and do not migrate; instead, the species inhabits sites year-round (as egg, larva, pupa and adult), typically moving within only a few hundred meters of their natal locations. Adults emerge from their chrysalids (pupae) during species-specific time periods (See Table 1). Males begin emergence first, followed by females; late-season individuals are primarily or solely females. Weather influences butterfly emergence and the flight period duration, with wet or cold conditions delaying emergence. Male skippers seek mates by perching on low vegetation and then darting out to inspect passing butterflies. Males that detect females commence courtship behavior; when males detect another male they engage in a territory defense behavior of tight, upward spiraling flight. Females search for egg-laying sites by slowly flying and hovering just above hostplant vegetation and then depositing single eggs. Both males and females feed by using their long proboscis to sip floral nectar. Skipper larvae conceal themselves in silken shelters and primarily feed at night. Hesperiinae larvae create shelters formed by webbing their hostplant grass blades together, and their prepupal larvae construct strong silken shelters in hostplant grasses in which pupation occurs. Propertius Duskywing (Pyrginae Skipper) larvae construct large cocoons in folded oak leaves, which drop to the ground over the winter, where pupation occurs in early-spring. These species overwinter as larvae, except for Oregon Branded Skipper which survives the winter period in the egg stage.

Propertius Duskywing
Photo: A. Barna

Table 1. Key life history attributes for Washington populations of skipper butterfly SGCN.

Species	**Adult Period**	Hostplants	**Primary Nectar Plants**
Propertius Duskywing	Apr-May	Garry oak (*Quercus garryana*)	Common camas (*Camassia quamash*)
Oregon Branded Skipper	Jul-Aug	Unknown grass/sedge	Tansy ragwort (*Tanacetum vulgare*), white-top aster (*Sericocarpus rigidus*)
Mardon Skipper	May-Jun	Grasses/sedges (spp. are site specific)	Violets (*Viola*), common vetch (*Vicia sativa*)
Sonora Skipper	Jun-Jul	Unknown grass/sedge	Unknown
Yuma Skipper	Jun-Jul	Common reed (*Phragmites americanus*)	Unknown

Distribution and Abundance

These skippers primarily occur in a few small isolated populations. Though once common, large populations of these butterflies in Washington are extant today only for Mardon Skipper in the southeastern Cascades.

Table 2. Overall range; counties and estimated number of Washington populations for skipper butterfly SGCN.

Species	Range-Overall	Counties in WA	Est # Pop in WA
Propertius Duskywing (western Washington only)	Aligned with oak host distribution: SW British Columbia; south and north Puget Sound, WA; E slope Cascades, WA; W Oregon; south to NW California	Mason, San Juan, Skamania, Thurston	6-10
Oregon Branded Skipper	SW British Columbia; south and north Puget Sound, WA	Pierce, San Juan, Thurston	5
Mardon Skipper	Highly disjunct: South Puget Sound, WA; Southeast Cascades, WA; Southwest Oregon; NW California	Klickitat, Lewis, Pierce, Skamania, Thurston, Yakima	3 (S Puget Sound) 30-40 (SE Cascades)
Sonora Skipper	SW WA	Grays Harbor, Mason, Thurston	2-5?
Yuma Skipper	Highly disjunct: Columbia Basin, WA; SE Oregon; E Central California; Nevada; S Utah; E Colorado; N Arizona	Asotin, Grant, Klickitat	3-5?

Habitat

These species use rare and declining habitat types. Oregon Branded, Mardon, and Sonora Skippers inhabit glacial outwash prairies in western Washington that have been reduced to less than 3 percent of historical cover. Research is needed for all species to more accurately quantify specific habitat requirements including vegetation structure, food plant size and density, and key habitat features.

Propertius Duskywing: An obligate of Garry oak (*Quercus garryana*), this species Inhabits low-elevation (up to 2000 feet), open-canopied, oak woodlands and savannah. Oak woodlands are rare, patchily distributed, and declining in western Washington. Research is needed to determine the specific Garry oak understory requirements of Propertius Duskywing larvae for overwintering, and by pupae for their development.

Oregon Branded Skipper: In the south Puget Sound region, this species selects habitat within glacial outwash prairies dominated by short-stature native grasses and sedges, especially Roemer's fescue (*Festuca roemeri*) and long-stoloned sedge (*Carex inops*), with open structure, and abundant bare ground (or moss/lichen). The sole extant San Juan County population uses open meadows between 1500 to 2200 feet in elevation. Egg-laying has been observed on Roemer's fescue and long-stoloned sedge, however, their use as larval hostplants have not been confirmed with larval feeding.

Mardon Skipper: Inhabits glacial outwash prairies in the south Puget Sound region, and montane meadows 1800 to 5500 feet in elevation in the southeastern Cascade Mountain Range. In south Puget Sound grasslands, Mardon Skippers use open, grass dominated habitat with abundant Roemer's Fescue interspersed with early blue violet and select early blue violet and common vetch as nectar sources. Adult Mardon Skippers select for short, open-structured, native fescue grasslands, which provide access to nectar and oviposition plants and a requisite thermal environment. Mardon Skippers on two south Sound prairies oviposited on Roemer's fescue, and females selected for small, mostly green fescue plants, in sparse, short-statured, and open-structured vegetation. In the southeastern Cascade Mountains, Mardon Skippers are found in meadows in an otherwise forested landscape; a variety of grasses and sedges are used for egg-

laying (and larval hosts) and females select for large, well developed plants. The historical and ongoing loss of montane meadow habitat is well-documented.

Sonora Skipper: Sonora Skipper inhabits glacial outwash prairies, forest glades, and road edges in southwest Washington lowlands. The hostplants for this species have not been identified, and habitat selection and suitability have not been studied.

Yuma Skipper: The native common reed is the known hostplant for this skipper which is limited to a few marshes in the xeric Columbia Basin steppe. To date, this butterfly has not been found in stands of the invasive, non-native common reed, although further surveys are needed to address this potential. Beyond their need for the native species of common reed, little is known of their habitat requirements.

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Family Hesperiidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Propertius Duskywing					
1	Fish and wildlife habitat loss or degradation	Oak woodland requisite habitat still being developed	Review proposed projects and protect oak woodland and savanna habitat	Current insufficient	Both
2	Invasive and other problematic species	Oak woodland and savanna being invaded by non-native shrubs and grasses	Using herbicide, fire, and mechanical methods to restore native oak woodland and savanna	Current insufficient	Both
3	Invasive and other problematic species	Oak woodland and savanna being invaded by native trees, especially Douglas-fir	Remove invading trees	Current insufficient	Both
4	Resource Information Collection Needs	Knowledge of current distribution is incomplete	Revisit historic locales and search for new populations	Current insufficient	Both
Oregon Branded Skipper					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	Both
3	Resource information collection needs	Effectiveness of management is minimized by the little known of the habitat requirements for this butterfly	Conduct research to characterize the habitat selected by females for oviposition (multi-year).	Nothing current - new action needed	Both
4	Fish and wildlife habitat loss or degradation	Only a few, small and disjunct populations remain in the south Sound region	Reintroduce at restored prairie sites	Nothing current - new action needed	WDFW

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Mardon Skipper					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	WDFW
2	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Planting/seeding native prairie species	Current insufficient	WDFW
3	Resource information collection needs	Knowledge of current distribution and site status in southern Cascades is incomplete	Conduct surveys to determine current status and distribution of populations in the WA southern Cascades	Current insufficient	Both
4	Invasive and other problematic species	Forest encroachment due to long-term fire suppression has reduced amount and quality of habitat. Hostplant is a grass, and species utilizes open meadows.	Remove invading trees and shrubs	Current insufficient	External
5	Fish and wildlife habitat loss or degradation	Only a few, small and disjunct populations remain in the south Sound region.	Reintroduce at restored prairie sites	Nothing current - new action needed	WDFW
6	Resource information collection needs	High likelihood south Sound and Cascades populations are distinct subspecies.	Genetic study to evaluate difference between south Sound and Cascades populations	Nothing current - new action needed	Both
7	Climate change and severe weather	Species vulnerable in south Sound to cool, wet spring weather; in Cascades to warm winters with low snowpack	Evaluate landscape and develop plan to increase habitat area and habitat heterogeneity in currently occupied sites and within occupied landscapes	Current insufficient	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Sonora Skipper					
1	Invasive and other problematic species	Invasive plants, those currently here, and many yet to come in the future, out-compete native grassland species, and otherwise make habitat unsuitable	Using herbicide, fire, and mechanical methods to restore native prairie	Current insufficient	Both
Yuma Skipper					
1	Management Decision Needs	State Parks and other land managers not aware that native Phragmites exists and is the host for this butterfly - so they often attempt to treat native Phragmites as a weed	Develop management plans specific to occupied sites	Current insufficient	Both
2	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Nothing current - new action needed	WDFW

NOTE: Numbers are for reference only and do not reflect priority.

BUMBLE BEES

Genus *Bombus*: BUMBLE BEES

Conservation Status and Concern

Bumble bees have recently become the focus of conservation concern and efforts due to their precipitous population declines and prodigious capabilities as pollinators. In a recent status assessment, IUCN (International Union of Conservation of Nature) identified three Washington species as facing high or extremely high risk of extinction: Western Bumble Bee and Morrison's Bumble Bee were ranked Vulnerable, and Suckley Cuckoo Bumble Bee was ranked Critically Endangered.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Western Bumble Bee (*Bombus occidentalis*)	None	None	No	G2G3	S2S3	Low/declining
Morrison's Bumble Bee (*Bombus morrisoni*)	None	None	No	G4G5	SNR	Critical/unknown
Suckley Cuckoo Bumble Bee (*Bombus suckleyi*)	None	None	No	GH	SNR	Critical/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Western Bumble Bee (*Bombus occidentalis*)	Moderate-high
Morrison's Bumble Bee (*Bombus morrisoni*)	Moderate
Suckley Cuckoo Bumble Bee (*Bombus suckleyi*)	Moderate

Biology and Life History

Morrison's Bumble Bee
Photo: H. V. Davis

These three bumble bee species are from two distinct subgenera: Western and Morrison's Bumble Bees are classified within the *Bombus* subgenus, and Suckley Cuckoo Bumble Bee in the *Psithyrus* subgenus. Bees from these two subgenera have markedly different life histories. *Bombus* subgenus species live in small, highly social and interdependent colonies with structured roles: egg-laying females (queens), foraging and nesting females (workers), and males. Cuckoo bumble bees do not live in a social group, but use the nests and tending workers of social bumble bee species to reproduce. Suckley Cuckoo Bumble Bees use the nests of Western Bumble Bee and likely several other *Bombus* species. Bumble bee colonies are annual. In late-winter or early-spring, queens, which are the sole survivors from the previous year, emerge from their overwintering sites to feed on floral nectar, collect pollen, and search for suitable nest sites, which are often abandoned rodent holes. *Bombus* subgenus queens lay eggs in their individual nests and gather nectar and pollen to feed their first brood of workers. In the nest, eggs develop into larvae and then spin cocoons in which they pupate. Once they emerge from their cocoons,

the workers then take over tending and provisioning young, while the queen continues to lay eggs, and typically no longer leaves the nest. Late in the season, the colony produces males and new queens which mate. Males, workers, and old queens eventually die; only the newly mated queens are capable of surviving through winter. Bumble bees are key generalist pollinators of native plants and agricultural crops. Through their foraging and collection of nectar and pollen they physically transfer the latter between plants, allowing them to reproduce. Their unique behavior of "buzz pollination", in which they grab onto and strongly shake an entire flower by vibrating their powerful wing muscles, results in large amounts of pollen being released and produces a more complete fruit set than other pollinators, including honey bees.

Distribution and Abundance

All three bumble bee species historically occurred in healthy populations across large geographic areas. Recent surveys reveal significant declines in their numbers, distribution, and ranges. Additional surveys are needed to determine the location and number of extant Washington populations for all three species, especially for Morrison's Bumble Bee and Suckley Cuckoo Bumble Bee.

Western Bumble Bee: Historically common in the western United States and Canada: western South Dakota south to northern New Mexico west to northern California and north to southern Alaska. Recent surveys have located only a handful of populations in Washington, primarily in remote subalpine and montane sites. A 28 percent reduction was estimated in detected range-area in a recent study, and Western Bumble Bee was found largely absent from the western portion of its range (including Washington). Over the past decade, relative abundance of Western Bumble Bee populations is estimated to have declined approximately 50 percent, while Washington has experienced even greater decline.

Morrison's Bumble Bee: Historical geographic range primarily within the intermountain western United States: northern Colorado south to northern Mexico west to southern California and north to southern British Columbia, Canada. Within Washington, Morrison's Bumble Bee occurred historically in the Columbia Basin; however, only a few recent sightings are known from this region. Many previously known strongholds for this bumble bee have been intensively surveyed in recent years without detection; the decline in rangewide relative abundance is estimated at 82.6 percent.

Suckley Cuckoo Bumble Bee: Occurred historically in western Canada and the United States: southwestern Manitoba southwest to western South Dakota south to southern Colorado west to northern California north to the Yukon and Northwest Territories south to central British Columbia; a few populations have also been documented in eastern Canada. This cuckoo bumble bee historically was found throughout Washington. Recent rangewide surveys detected this species in only six localities, including one near far northeastern Washington.

Habitat

Bumble bees depend on habitats with rich floral resources throughout the nesting season, and many species select specific suites of plants for obtaining nectar and pollen. They also select flowers based on their structure and the bee's tongue length. For example, the short to medium length-tongued Suckley Cuckoo Bumble Bee uses shallow to medium-depth flowers. Bumble bees require above and below-ground micro-sites for overwintering and nesting, including logs, stumps, and abandoned rodent and ground-nesting bird nests. Their habitats must also be protected from insecticides. Bumble bees are adaptable; they do not require native vegetation. However, intensive agricultural development has been shown to result in regional bumble bee declines. Although habitat loss and insecticide use have

played a role in bumble bee declines, their rapid and widespread declines even from apparently high quality habitats support the current prevailing hypothesis that pathogens introduced into the wild from commercial bumble bee facilities are the main factor in declines.

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Genus Bombus: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Western Bumble Bee					
1	Agriculture and aquaculture side effects	Importation of bumble bees for use in pollination of commercial crops introduces pathogens into the wild	Review of federal/state policies that allow translocation and establishment of commercially-reared bumble bees in North America	Current insufficient	Both
2	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
Morrison's Bumble Bee					
1	Agriculture and aquaculture side effects	Importation of bumble bees for use in pollination of commercial crops introduces pathogens into the wild	Review of federal/state policies that allow translocation and establishment of commercially-reared bumble bees in North America	Current insufficient	Both
2	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both
Suckley Cuckoo Bumble Bee					
1	Agriculture and aquaculture side effects	Importation of bumble bees for use in pollination of commercial crops introduces pathogens into the wild	Review of federal/state policies that allow translocation and establishment of commercially-reared bumble bees in North America	Current insufficient	Both
2	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current Insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

MOLLUSKS

Family Oreohelicidae: MOUNTAINSNAILS

Conservation Status and Concern
Many mountainsnail species and subspecies have specialized habitat requirements and very restricted ranges, low ability to disperse, and are vulnerable to disturbances such as logging, fire, unsustainable grazing, or introduced predators. Most mountainsnail species and subspecies (roughly 91 percent) are considered imperiled or critically imperiled by NatureServe.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Chelan Mountainsnail (*Oreohelix sp. 1)*	In review	None	No	G2	S2	Critical/declining
Hoder's Mountainsnail (*Oreohelix n. sp.*)	None	None	No	GNR	SNR	Critical/declining
Mad River Mountainsnail (*Oreohelix n. sp.*)	None	None	No	GNR	SNR	Critical/declining
Ranne's Mountainsnail (*Oreohelix n. sp.*)	None	None	No	GNR	SNR	Critical/declining
Limestone Point Mountainsnail (*Oreohelix sp. 18* or *O. idahoensis baileyi)*	None	None	No	G1	SH	Critical/declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Chelan Mountainsnail (*Oreohelix sp. 1)*	Low-moderate
Hoder's Mountainsnail (*Oreohelix n. sp.*)	Low-moderate
Mad River Mountainsnail (*Oreohelix n. sp.*)	Low-moderate
Ranne's Mountainsnail (*Oreohelix n. sp.*)	Low
Limestone Point Mountainsnail (*Oreohelix sp. 18* or *O. idahoensis baileyi)*	Low-moderate

Taxonomic note: Many of the Oreohelicidae that are considered distinct species are not yet formally described, and it is likely that additional rare species of *Oreohelix* will be discovered with further investigation.

Biology and Life History

Mountainsnails are terrestrial gastropods of western North America. Mountainsnails eat leaf litter, detritus, and microorganisms on the surface of logs, rocks, or soil. They are hermaphroditic, having both male and female organs. They are live-bearers; the eggs hatch before leaving the uterus of the parent, and they raise their young within their shells until they reach a certain size. It is not known how long they live, or how often they reproduce.

Limestone Point Mountainsnail
Photo: from Jensen et al. 2012

Distribution and Abundance

Chelan Mountainsnail a.k.a. Tiny Canyon Mountainsnail (*Oreohelix sp. 1*): A local endemic of the eastern foothills of the Cascades in central Washington. Populations of the Chelan Mountainsnail are few, small, and scattered. Its known range covers about 270 square miles in eastern Chelan County. Within this area this snail has been found at less than 10 sites from about one-fourth acre to 10 acres in size. Most of the sites are scattered, ranging from less than one acre to a few acres in size, and only one individual was observed (seven sites destroyed in the 1994 Tyee Fire were those of the Entiat Mountainsnail, erroneously identified as this species). Sites scattered within an area roughly bounded by the Columbia River on the southeast, Lake Chelan on the northwest to include the Twentyfive Mile Creek drainage, then southwest to Tyee Mountain, south to Chumstick Mountain, and following the ridge south and southeast to Burch Mountain, then south to the confluence of the Wenatchee and Columbia Rivers. The USFWS is conducting a status review after a finding that it may warrant listing under the ESA.

Hoder's Mountainsnail: This species is only known from Dick Mesa, about 3.5 miles northeast of Entiat, Chelan County.

Mad River Mountainsnail: This species has only been collected at one site on the Mad River in the Entiat Valley, eastern Chelan County.

Ranne's Mountainsnail: This species is only known from one site of less than 10 acres on Dick Mesa, about 3 miles northeast of Entiat, Chelan County.

Limestone Point Mountainsnail: Known from Lime Point, Asotin County, WA, and the Seven Devils Mountains and Snake River Canyon below the mouth of the Salmon River, Idaho. At Limestone Point, empty shells are scattered over the northeastern slope; no living specimens have been found in Washington in recent years, but additional season appropriate surveys are needed.

Habitat

Oreohelix species are often associated with limestone outcrops, or areas with soil or rock with a fair percentage of lime.

Chelan Mountainsnail: Generally open Douglas-fir and ponderosa pine; this species has been found in two types of habitats broadly described as: 1) in schist talus, and 2) in litter or under shrubs in and adjacent to open dry forest stands with pinegrass or elk sedge understory. The typical site occurs within concave landforms that accumulate and maintain moisture more efficiently than the surrounding landscape. Elevations range from 1200 to 2600 feet; site aspect is variable.

Hoder's Mountainsnail: On or near ridgetop in grassland and timber edge, with buckwheat (*Eriogonum* sp.) and arrowleaf balsamroot (*Balsamorrhiza sagitta*).

Mad River Mountainsnail: In talus under black cottonwood (*Populus balsamifera*) or bigleaf maple.

Ranne's Mountainsnail: On southeasterly aspect near the ridgetop, in grassland with buckwheat and arrowleaf balsamroot.

Limestone Point Mountainsnail: Associated with limestone outcrops and talus at mid-elevations in arid land.

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Family Oreohelicidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Chelan Mountainsnail					
1	Resource information collection needs	Need taxonomic clarification	Taxonomic clarification; delineate occupied habitat	Current insufficient	External
2	Fish and wildlife habitat loss or degradation	Fires; road building, unsustainable logging	Need to identify core habitat sites and protect alteration	Current insufficient	External
3	Invasive and other problematic species	Predation by wild turkeys	Increase turkey harvest, if needed	Nothing current - new action needed	WDFW
Hoder's Mountainsnail					
1	Agriculture and aquaculture side effects	Fires; road building	Develop management recommendations	Current insufficient	External

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
2	Invasive and other problematic species	Predation by wild turkeys	Increase turkey harvest, if needed	Current insufficient	WDFW
3	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline	Need taxonomic clarification	Current insufficient	External
Limestone Point Mountainsnail					
1	Resource information collection needs	Need information; confirm still extant	Taxonomic and status clarification	Current insufficient	Both
Mad River Mountainsnail					
1	Agriculture and aquaculture side effects	Fires; road building; need taxonomic clarification	Delineate and protect occupied habitat	Current insufficient	Both
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline	Taxonomic confirmation, description	Nothing current - new action needed	External
Ranne's Mountainsnail					
1	Resource Information collection needs	Taxonomic clarification	Formal species description; taxonomic clarification	Nothing current - new action needed	External
2	Agriculture and aquaculture side effects	Prescribed fires	Special management, or designation	Current insufficient	External
3	Agriculture and aquaculture side effects	Unsustainable grazing of mountainsnail habitat	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Current insufficient	External
4	Invasive and other problematic species	Predation by wild turkeys	Increase turkey harvest, if needed	Nothing current - new action needed	WDFW

NOTE: Numbers are for reference only and do not reflect priority.

Family Polygyridae: FORESTSNAILS, DUSKYSNAILS, OREGONIANS, AND HESPERIANS

Conservation Status and Concern

These snails are of conservation concern because they have specialized habitat requirements, such as moist mature forest with a hardwood component, or moist sites in otherwise dry environments. Snails do not readily disperse and populations are isolated. They are vulnerable to disturbances or alteration of these sites, which may occur through logging, development, use of talus for road-building, or large ungulate grazing of springs.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Dry land forestsnail (*Allogona ptychophora solida*)	None	None	No	G5T2	S1S2	Low/unknown
Washington Duskysnail (*Amnicola sp. 2*)	None	None	No	G1	S1	Low/declining
Columbia Oregonian (*Cryptomastix hendersoni*)	In review	Candidate	Yes	G1G2	S1	Critical/declining
Puget Oregonian (*Cryptomastix devia*)	In review	None	No	G3	S2S3	Low/declining
Poplar Oregonian (*Cryptomastix populi*)	None	Candidate	Yes	G2	S1S2	Low/declining
Mission Creek Oregonian (*Cryptomastix magnidentata*)	None	None	No	G1	SNR	Low/unknown
[unnamed Oregonian] (*Cryptomastix mullani hemphilli*)	None	None	No	GNR	SNR	Low/unknown
Dalles Hesperian (*Vespericola depressa*)	None	None	No	G2Q	S1	Low/unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Dry land forestsnail (*Allogona ptychophora solida*)	Low-moderate
Washington Duskysnail (*Amnicola sp. 2*)	Low-moderate
Columbia Oregonian (*Cryptomastix hendersoni*)	Moderate-high
Puget Oregonian (*Cryptomastix devia*)	Low-moderate
Poplar Oregonian (*Cryptomastix populi*)	Low
Mission Creek Oregonian (*Cryptomastix magnidentata*)	N/A
[unnamed Oregonian] (*Cryptomastix mullani hemphilli*)	N/A
Dalles Hesperian (*Vespericola depressa*)	Low-moderate

Taxonomic notes: The Polygyridae is a large and diverse family of roughly 294 described snail species in North America. The *Cryptomastix* species are medium to moderately large Pacific Northwest endemics; there are likely more *Cryptomastix* and other Polygyrids that will be described with genetic analysis, and some will deserve conservation attention. *C. magnidentata* (Pilsbry 1940) [=*Cryptomastix* (*Cryptomastix*) *n. sp. 2* ['Hells Canyon Oregonian' of Frest and Johannes 1995].

Biology and Life History

Polygyrids are generally herbivorous and fungivorous snails; Dalles Hesperian feed by scraping algae, yeast, bacteria and diatoms from rock and woody surfaces; they may also consume green plant materials (Duncan 2009). All of the species addressed here are terrestrial, except the Washington Duskysnail (*Amnicola sp. no.2*), which is a freshwater snail. Washington Duskysnail is a detritivore and grazes along the stems and leaves of aquatic plants eating small organisms clinging to this material (Frest and Johannes, 1995). In most terrestrial gastropods, cross-fertilization appears to be the norm, but self-fertilization can occur in at least some species in the absence of potential mates. Pilsbry (1940) states of the family Polygyridae, "Their food is chiefly the mycelia of fungi." While it is suspected that mycophagy is the primary life style of these species, it appears that at least the young may be partially herbivorous on green plants during certain seasons.

Dalles Hesperian
Photo: W. Leonard

Life history of the terrestrial Polygyrids may resemble that described for the Oregon Forestsnail (*Allogona townsendiana*). This species is most active during the wet spring months when mating occurs. Adults lay eggs in new or existing flask-shaped nesting holes, or sometimes in pre-existing depressions in soil, moss, and under coarse woody debris, or at the base of vegetation. Juvenile snails hatch approximately 8 to 9 weeks after oviposition, and disperse from the nest site within hours of hatching.

Oregon Forestsnails estivate deep within litter, under logs or the bark of coarse woody debris during dry summer months and become active again with fall rains. Once the first frosts occur, Oregon Forestsnails enter hibernation until the following spring. Adults likely reach reproductive maturity by two years and have a life span of at least 5 to 8 years, though this may be an underestimate. Edworthy *et al.* (2012) reported that adults generally remained in a core area of less than 18 square yards. (The maximum daily dispersal was 15 feet and the maximum displacement over three years was 105 feet.

Columbia Oregonians consume herbaceous plants in captivity, and may also consume algae on wet surfaces and decaying remains of herbaceous plants.

Puget Oregonians hatch from eggs and live for more than one year. However, specific details on life span and reproduction for this species were not found. Like most terrestrial gastropods, *Cryptomastix* are hermaphroditic, having both male and female organs. Burke (1999) suggested that Puget Oregonian (*C. devia*) might aid in the dispersal of fungal spores, including mycorrhizal fungi that form tree-root associations which promote healthy tree growth.

Dalles Hesperians live approximately 3 to 5 years. Individuals may breed during their second season. Egg laying sites are thought to be in very moist or wet locations, such as in wet moss or under rocks or wood. They are present all year, but probably not active under snow in winter. Individuals are entirely terrestrial, but seek refugia sites where the humidity level is relatively high and temperature is constant, such as deep within cracks in mud, in rock talus or under permanently moist vegetation. May travel several hundred feet during a season, only to return to original refugia sites.

Distribution and Abundance

Dry Land Forestsnail: *Allogona* in the Pacific Northwest include three species; the very common *A. ptychophora* occurs from the Cascade Range in British Columbia into northern Oregon and east to the Continental Divide. A distinct subspecies, *A. ptychophora solida*, is confined to local populations in the Snake River Canyon, Asotin County, Washington, and eastward in Nez Perce and into Lewis Counties, Idaho. Distinct *A.p. solida* are locally common in Idaho, but appear rare west of the Snake River.

Washington Duskysnail: This species is currently known from only three lake sites: one in Ferry County, one in Okanogan County, and one in northwestern Montana. The Washington Duskysnail is declining due mainly to habitat degradation and destruction, both in terms of populations and numbers of individuals.

Columbia Oregonian: This species is known from 13 locations at the east end of the Columbia Gorge along both sides of the river from The Dalles to Rufus, Wasco and Sherman Counties in Oregon; this includes only four small sites in Klickitat County, Washington. Most locations are isolated from one another by the arid surrounding landscape. Originally also occurred in Skamania County, and in The Dalles, Oregon, but these sites were lost to by development. Specimens that may be this species suggest its range may extend north into Yakima County, and east along the Columbia and Snake Rivers and the Washington-Oregon border, in Umatilla and Wallowa Counties, Oregon, to Adams and Washington Counties, Idaho, but this requires confirmation.

Puget Oregonian: This species is found in the western Cascade Range and Puget Trough from southern Vancouver Island, B.C. through western Washington to the Oregon side of the Columbia Gorge. Records exist from Clark, Cowlitz, King, Lewis, Pierce, Skamania, and Thurston Counties,

Washington. Kogut and Duncan (2005) noted 178 locations, but at most sites only one to three snails were found. Most sites are in Gifford Pinchot National Forest, where it is relatively common only in the Cowlitz and Cispus River drainages; elsewhere it is quite rare and local. Much of its former range is now urban or has been developed for agriculture; 10 of 42 records from prior to 1994 are from the metropolitan Seattle area. There is a single record from the eastern Cascades near Cle Elum. Formerly found in Hood River and Wasco Counties of Oregon, and in British Columbia (primarily Vancouver Island). In Oregon, this species is in severe decline; currently only a few sites in Multnomah County remain.

Poplar Oregonian: This species is found along the Snake River in Whitman and Asotin Counties, Washington, and in Cottonwood Canyon, Nez Perce County, Idaho.

Mission Creek Oregonian: This species is found in the Snake River Canyon, Grand Ronde Canyon, and Joseph Creek Wildlife Area in Asotin County, Joseph Canyon, Wallowa County, Oregon, and in Lewis and Nez Perce Counties, Idaho.

[unnamed Oregonian] (*C. mullani hemphilli*): A small disjunct population of this taxa occurs in Swakane Canyon in Chelan County. Also found in northern Idaho and Sanders and Missoula Counties, Montana.

Dalles Hesperian: This species survives at a few scattered, widely separate colonies in the Columbia Gorge: from Rufus, Oregon downstream to Vancouver, Washington. Historic sites are located in Wasco, Hood River and Sherman Counties in Oregon; and Clark, Skamania and Klickitat Counties in Washington. No specific information on abundance at these sites is documented.

Habitat

Dry Land Forestsnail: The Dry Land Forestsnail is found in talus and rocky riparian areas in the Snake River Canyon.

Washington Duskysnail: This is a freshwater species that occurs in kettle lakes among aquatic vegetation beds, but is absent from dense aquatic vegetation areas. The species is found on soft oxygen-rich substrate at a depth of approximately 2 to 6 feet.

Columbia Oregonian: This species occurs at seeps and spring-fed streams and in associated talus in the semi-arid eastern portion of the Columbia River Gorge. Inhabits margins of low to mid-elevation seeps, and spring-fed streams in an otherwise arid landscape. Typically found among moist talus, leaf litter and shrubs, or under logs and other debris.

Puget Oregonian: This species is thought to be a mature forest specialist and inhabits moist old-growth and late successional stage forests and riparian areas at low and middle elevations (below 600 feet). Mature to late successional moist forest and riparian zones, under logs, in leaf litter, around seeps and springs, and often associated with hardwood debris and leaf litter and/or talus. It is often found under or near bigleaf maple and may be under western swordferns growing under these trees, or on the underside of bigleaf maple logs. Canopy cover is generally high. Often found in old-growth western hemlock/swordfern plant associations with bigleaf maple and/or possibly other hardwood components well represented.

Poplar Oregonian: This species is found in talus and brushy draws in canyons in moderately xeric, rather open and dry situations, in talus on steep, cool (generally north or east facing) lower slopes in major river basins. Surrounding vegetation is sage scrub. Talus vegetation includes *Celtus*, *Artemesia*, *Prunus*, *Balsamorrhiza*, grasses, small limestone moss (*Seligeria* sp.) and bryophytes.

Mission Creek Oregonian: This species has been found in rocky, brushy draws and riparian areas.

[unnamed Oregonian] (*C. mullani hemphilli*): There is no habitat data available for this species.

Dalles Hesperian: This species is generally found in wet or very moist sites. In dry areas, it is associated with a permanent water source such as a spring or seep.

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Family Polygyridae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Columbia Oregonian					
1	Fish and wildlife habitat loss or degradation	Loss of perennial flow due to diversions	Taxonomic clarification for additional taxa; delineate occupied sites	Unknown	Both
2	Fish and wildlife habitat loss or degradation	Habitat loss to development	Delineate and protect sites	Unknown	Both
Dalles Hesperian					
1	Fish and wildlife habitat loss or degradation	Road building, disturbance of talus; habitat alteration that creates xeric conditions; need distribution data	Delineate and protect sites	Current insufficient	WDFW
2	Agriculture and aquaculture side effects	Unsustainable grazing of habitat	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Current insufficient	Both
3	Resource information collection needs	Need distribution data	Inventory	Current insufficient	WDFW
Dry land Forestsnail					
1	Fish and wildlife habitat loss or degradation	Road building and maintenance	Delineate and protect sites	Current insufficient	WDFW
2	Resource information collection needs	Need distribution data	Identify sites	Current insufficient	WDFW
Mission Creek Oregonian					
1	Fish and wildlife habitat loss or degradation	Limestone quarrying	Develop management recommendations	Nothing current - new action needed	WDFW
2	Agriculture and aquaculture side effects	Unsustainable logging practices	Develop management recommendations	Nothing current - new action needed	WDFW
3	Agriculture and aquaculture side effects	Unsustainable grazing of riparian habitat	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Nothing current - new action needed	Both
Poplar Oregonian					
1	Resource information collection needs	Status assessment	Status assessment	Current insufficient	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
2	Fish and wildlife habitat loss or degradation	Mining of basalt talus	Management recommendations; tech assistance	Nothing current - new action needed	WDFW
3	Agriculture and aquaculture side effects	Livestock grazing practices that do not benefit the species	Outreach, coordinate with landowners to incorporate management recommendations to benefit the species	Nothing current - new action needed	Both
Puget Oregonian					
1	Resource information collection needs	Status assessment	Status assessment	Current insufficient	Both
2	Fish and wildlife habitat loss or degradation	Habitat loss to urbanization	Management recommendations; tech assistance	Nothing current - new action needed	WDFW
3	Agriculture and aquaculture side effects	Habitat loss to logging of old-growth; bigleaf maple	Management recommendations; tech assistance	Current insufficient	Both
Washington Duskysnail					
1	Fish and wildlife habitat loss or degradation	Pollution, siltation	Protect water quality	Current insufficient	External
2	Resource information collection needs	Taxonomic clarification	Formally describe species	Nothing current - new action needed	External
[unnamed Oregonian] (*Cryptomastix mullani hemphilli*)					
1	Resource information collection needs	Need taxonomic confirmation	Inventory; taxonomic clarification	Nothing current - new action needed	External

NOTE: Numbers are for reference only and do not reflect priority.

Family Vertiginidae

Conservation Status and Concern

These three very rare *Vertigo* species are small snails found in small isolated populations, perhaps remnants of a previously much wider range. These small populations, associated with old-growth and/or riparian hardwoods are very vulnerable to logging, road building, fires, or other disturbances.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Hoko Vertigo (*Nearctula new sp*. or *Vertigo new sp*.)	In review	None	No	G1	S1	Critical/unknown
Pacific Vertigo (*Vertigo andrusiana*)	None	None	No	GNR	S1?	Critical/ extirpated?
Idaho Vertigo (*Vertigo idahoensis*)	None	None	No	G1G2	SNR	Critical/unknown
	Climate vulnerability: Low-moderate					

Taxonomic note: Burke (2013) considers this group within the family Vertiginidae; earlier authorities placed the subfamily Vertigininae in the family Pupillidae, and in the superfamily Pupilloidea, order Pulmonata, and class Mollusca (Duncan 2005). Frest and Johannes (1996b) placed the Hoko Vertigo into the *Vertigo californica* group. Sterki (1892) gave this group a subgeneric name, *Nearctula*, which was regarded as a synonym of the genus *Vertigo* by Pilsbry (1948). Recently *Nearctula* has been used by some authors as the valid genus for this species group. The Hoko Vertigo has not yet been formally named or described.

Biology and Life History

The Vertiginidae are minute (roughly .05 to 0.12 inch) terrestrial snails with ovoid-shaped shells. Land snails, including Vertiginid snails, are hermaphroditic and exchange gametes with conspecific individuals when conditions are favorable. At least some species seem to retain the fertilized eggs and give birth to small numbers of live young. The Hoko Vertigo is thought to be a short-lived species with a potential life span of less than 2 years. The distinctly arboreal lifestyle and mouthparts of this group of snails suggest that they feed on microorganisms growing on the surfaces of smooth-barked trees and shrubs or epiphytic lichens. In Pacific Northwest forests, Vertiginidae snails overwinter on tree limbs, so presumably they are not killed by freezing temperatures.

Vertigo columbiana
Photo: W. Leonard

Distribution and Abundance

Hoko Vertigo: Hoko Vertigo is known only from along the east side of the Hoko River in Clallam County in the northwestern part of the Olympic Peninsula. The tendency of these snails to have a patchy distribution may make it difficult to make estimates of population size and population trends. Surveys of roughly 300 acres in Olympic National Forest did not find any new locations. Random grid surveys across the Northwest Forest Plan area in Oregon and Washington did not locate this species in any of 498 plots searched. However, a specimen that may prove to be this

species was collected in the Salem BLM district of Oregon. This species is under review by the USFWS for listing under the ESA.

Pacific Vertigo: This species appears to have once been widely distributed in the Pacific Northwest, with a historical range including well-separated areas of the Cascade and Klamath provinces. It is now apparently very rare, with no confirmed sightings in the Oregon/Washington region in recent years. There are historical records from the San Bernardino Mountains of California north through western Oregon and southwest Washington to Vancouver Island, British Columbia. In Washington, records are in the Puget Trough and Olympic Peninsula (Grays Harbor, Thurston, and King Counties). In Oregon, the species occurred west of the Cascade Mountains, with records from Clackamas, Douglas and Klamath Counties. To date, most known records are from before 1950, with the exception of one 1979 record from Thurston County, Washington, and one 1999 record from Fremont-Winema National Forest, Klamath County, Oregon (Jordan 2013).

Idaho Vertigo: Burke (2013) collected this species along a creek in Stevens County, Washington. Pilsbry (1948) found it along a creek east and northeast of the old town, Meadows, Adams County, Idaho. The type locality is the only known Idaho site, but this population has not been relocated. Searches during 1988, 1993, and 1994 within the lower Salmon River, Little Salmon River, and Payette River drainages in Idaho have also failed to find this species.

Habitat

The typical habitat for Vertigo snails ranges from moist riparian to relatively dry forests dominated by cottonwood, alder, Douglas-fir, spruce, or hemlock, depending on the species.

Hoko Vertigo: The Hoko Vertigo seems to be an old-growth riparian associate. The two known locations are at the bases of wooded slopes near streams at low elevations of between roughly 40 and 300 feet; it is unknown if the species occurs at higher elevations. The habitat seems to be characterized by old trees, riparian hardwoods, and mesic conditions. This species is arboreal and has been found on trunks and lower limbs of deciduous trees, mainly alders. They are most easily detected on the undersides of limbs and leaning trunks of young alders that have relatively smooth bark. One of the two known sites is at the base of a steep northwest-facing slope with seeps and consists of second-growth Douglas-fir forest with a sizable component of bigleaf maple. This site is near a stream; understory vegetation includes liverworts, large swordfern, and maidenhair fern. The other site is at the foot of a slope next to the Hoko River and is characterized by the presence of old hardwood trees, mostly alder.

Pacific Vertigo: This species occurred in forested sites at lower elevations and may be found on trunks and lower branches of deciduous trees and shrubs, as well as among the litter beneath them. Pilsbry (1948) wrote that “some thousands of specimens were taken…about clumps of bushes in a meadow" in Oswego, Clackamas County, Oregon. A 1979 Thurston County record notes “maple, salal” as the habitat. A 1999 record from Klamath County, Oregon (Fremont-Winema National Forest) lists the habitat as a drainage through a small open meadow with an overstory of ponderosa pine and western juniper.

Idaho Vertigo: This species is a riparian associate, but there is little other information. Habitat characteristics are described from only the type locality. At this site, the Idaho Vertigo inhabits a mid-elevation grass and sedge meadow with springs, seeps, bogs, and fens.

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Family Vertiginidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Hoko Vertigo					
1	Agriculture and aquaculture side effects	Activities that result in drying of habitat (such as logging); need formal species description	Protect sites	Current insufficient	Both
2	Resource information collection needs	Need formal species description	Taxonomy; describe species; protect sites	Current insufficient	External
Idaho Vertigo					
1	Resource information collection needs	Need distribution data	Inventory; status assessment	Current insufficient	Both
Pacific Vertigo					
1	Resource information collection needs	Need distribution data; may be extirpated	Inventory/status information	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

OTHER TERRESTRIAL SNAILS

Conservation Status and Concern

These terrestrial snails are very rare and have distributions that include small isolated populations, perhaps remnants of previously much wider ranges. These small isolated populations, often associated with old-growth and/or riparian hardwoods and are very vulnerable to logging, road building, fires, or other disturbances.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Oregon Megomphix (*Megomphix hemphilli*)	None	None	No	G3	S1	Low/unknown
Dalles Sideband (*Monadenia fidelis minor*)	In review	Candidate	Yes	G4G5T2	S1	Low/unknown
Crowned Tightcoil (*Pristiloma pilsbryi*)	None	None	No	G1	S1	Low/unknown
Nimapuna Tigersnail (*Anguispira nimapuna new spp*.)	None	None	No	G1	SNR	Critical/ unknown

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Oregon Megomphix (*Megomphix hemphilli*)	Low-moderate
Dalles Sideband (*Monadenia fidelis minor*)	Low-moderate
Crowned Tightcoil (*Pristiloma pilsbryi*)	Low-moderate
Nimapuna Tigersnail (*Anguispira nimapuna new spp*.)	N/A

Taxonomic note: Oregon Megomphix is in the family Megophicidae; Dalles Sideband is in the Bradybaenidae; Crowned Tightcoil is in the Pristilomatidae; Nimapuna Tigersnail is in the Discidae. '*Anguispira nimapuna* new spp' appears to be an undescribed subspecies (T. Burke, pers. comm.); they are distinctly like *A. nimapuna* from Idaho, but are smaller, with thinner shells and with weaker rib sculpturing.

Biology and Life History

Land snails are hermaphroditic and exchange gametes with other conspecific individuals when conditions are favorable, typically in the spring, and then both will lay eggs in damp subsurface situations where the eggs will be relatively safe from predators and desiccation. Land snails do not tend their eggs or young. There is no larval stage and newborn snails look like miniature adults (the innermost part of the shell develops within the egg).

Snails need moisture, so where the habitat dries out, they will estivate in the summer, become active with fall rains,

Oregon Megomphix
Photo: W. Leonard

and hibernate when the season turns cold. Land snails eat plants (living or dead), fungi, fruit, microorganisms, litter, wood, and dead animals. Of these species, more is known about Oregon Megomphix and the Dalles Sideband. The Oregon Megomphix seems to be more secretive and photophobic than other Northwest land snails, as no live animals and very few of their shells have been found out in the open; all have been found under the cover of leaf mold or within soft soil or in spaces within rock heaps. Loose soil may be necessary for egg-laying by sideband snails, which lay several dozen eggs; they are likely to live more than 6 years, and probably mature in 2 years. During the moist spring and fall seasons, Dalles Sidebands may be found in the open, away from refugia. Daily refugia used during moist seasons can be down wood, rock or accumulations of litter. During the summer, snails are found deep in talus accumulations which are adjacent to springs or streams and which serve as refuge sites from desiccation and protection from predators while the snails are immobile. These deep rock refugia also provide the important, environmentally stable sites needed to survive wildfire events and cold winter conditions. Mollusks which inhabit talus habitats also utilize the surrounding forest areas during moist, cool conditions, ranging out from the refugia provided by the rocks to forage in the adjacent forest floor litter.

Distribution and Abundance

Oregon Megomphix: This species is known from Olympia southward in foothills of the Cascade and Coast Ranges in conifer/hardwood forests up to 3000 feet in elevation, south through the Willamette Valley, Cascade Range foothills, and Coast Range of Oregon. For Washington there are 12 records from Thurston, Lewis, and Cowlitz Counties based on 45 specimens (many collected 30 to 120 years ago) that provide seven mappable locations, which are all at low elevations (below 500 feet) in the southwestern part of the state. It is more widespread in Oregon, known from the Siuslaw, Umpqua, and Willamette National Forests and is suspected to occur in the Mt. Hood, Rogue River, and Siskiyou National Forests, and the Columbia River Gorge National Scenic Area.

Dalles Sideband: This species is known from the Columbia Gorge from Hood River east to the vicinity of The Dalles on both sides of the Columbia River and in upland sites in the lower Deschutes River watershed within Mt. Hood National Forest in Wasco County, Oregon. The species may have occurred historically in the central and part of the eastern Columbia Gorge and south up the Deschutes River Valley as far as 50 miles from the confluence. A total of 98 sites are known, but most sites are in Oregon, and only a few individuals have been found at most sites. Known sites are widely scattered across the species' range and separated by non-habitat. The distribution of stable rock refugia sites across the landscape may determine or help to explain the distribution of the species in areas with short fire-return intervals.

Crowned Tightcoil: This species is known from Pacific County, Washington and the Northern Coast Range of Oregon; there are also historical records from Portland. Stone (2009) states it has also been found in Clallam County, Washington, and is suspected to occur in Grays Harbor, Wahkiakum, Cowlitz and Clark Counties, Washington and Multnomah, Clatsop and Columbia Counties, Oregon.

Nimapuna Tigersnail: This yet-to-be described subspecies occurs at two locations on ridges on opposite sides of Lake Chelan, Chelan County, Washington (Burke 2013). Outside of Washington, this species is known from less than 10 localities in the Clearwater, Lochsa, and Selway Rivers' drainages in Idaho County, Idaho, and Wallowa County, Oregon (Hendricks et al. 2006, Burke 2013).

Habitat

Oregon Megomphix: Habitat is within moist conifer/hardwood forests up to 3000 feet in elevation in hardwood leaf litter and decaying non-coniferous plant matter under bigleaf maple trees, or beaked hazelnut (*Corylus cornuta*) bushes, and swordferns, often near rotten logs or stumps. A bigleaf maple component in the tree canopy and an abundance of swordfern on forested slopes and terraces seem characteristic. Appears to be primarily fossorial, often found on soil under leaf litter or in rodent burrows. The presence of rotten logs seems to be important to local survival. Unusually large or multiple-stemmed bigleaf maples, or clumps of bigleaf maples, seem to provide the most favorable habitat.

Dalles Sideband: The species has been found in moist talus habitat (especially around seeps and springs), and in forested areas in upland sites near, but outside of, riparian corridors. In some forested sites, the species has been found associated with down wood where no rock substrates occur. Down wood may provide temporary refugia used during dispersal in the wet season, while rock substrates provide more stable refugia used for estivation during summer and winter and during fire events.

Crowned Tightcoil*:* This species has been collected in moist leaf and woody debris litter in low elevation forested areas under the dense thickets of salal (*Gaultheria shallon*) near the coastal beaches, and in riparian areas under red alder and swordfern. Stone (2009) characterizes it as associated with riparian and old-growth habitat, though it has been collected in the headwater riparian areas of managed second-growth western hemlock forests. Typically associated with abundant, persistent moisture.

Nimapuna Tigersnail: In Idaho this species has been found between 1500-2550 feet in elevation at sites with an overstory that included western red-cedar and grand fir, with some alder, paper birch, Douglas-fir and/or ponderosa pine; often under wood or on bryophyte mats among dense ferns.

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OTHER TERRESTRIAL SNAILS: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Crowned Tightcoil					
1	Fish and wildlife habitat loss or degradation	Habitat loss to development	Technical assistance to regulatory agencies	Current insufficient	WDFW
2	Agriculture and aquaculture side effects	Logging of mature timber	Develop management recommendations	Current insufficient	WDFW
3	Resource information collection needs	Need to delineate distribution	Inventory	Current insufficient	Both
Dalles Sideband					
1	Fish and wildlife habitat loss or degradation	Road building; fires; habitat alteration that creates xeric conditions	Develop management recommendations	Current insufficient	WDFW
Nimapuna Tigersnail					
1	Resource information collection needs	Lack of data; need distribution data.	Describe and protect sites	Nothing current - new action needed	WDFW
2	Resource information collection needs	Possible new subspecies; need taxonomic clarification	Clarify taxonomy	Nothing current - new action needed	External
Oregon Megomphix					
1	Overharvesting of biological resources	Cutting of bigleaf maples for burls; loss of rotten logs	Increased protection of bigleaf maples by enforcement, outreach, etc.	Current insufficient	External
2	Resource information collection needs	Clarify distribution, status	Status assessment	Nothing current - new action needed	Both

NOTE: Numbers are for reference only and do not reflect priority.

Families: Lymnaeidae and Hydrobiidae

Conservation Status and Concern

These species require clear, cold, well-oxygenated waters, and are threatened by pollution and siltation. North America once had approximately 700 species of native freshwater snails from 16 families. Currently, 67 species (10 percent) are considered likely extinct, 278 (40 percent) endangered, 102 (15 percent), threatened, 73 (10 percent) vulnerable, and 26 (4 percent) have uncertain taxonomic status.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Shortface Lanx *or* Giant Columbia River Limpet (*Fisherola nuttalli*)	None	Candidate	Yes	G2	S2	Uncommon/ declining
Masked Duskysnail (*Lyogyrus sp. 2*)	None	None	No	G1G2	S1	Critical/declining
Olympia Pebblesnail (*Fluminicola virens*)	None	None	No	G2	S2	Low/unknown
Salmon River Pebblesnail (*Fluminicola gustafsoni*)	None	None	No	GNR	SNR	Low/unknown
Ashy Pebblesnail (*Fluminicola fuscus*)	None	Candidate	Yes	G2	S2	Uncommon/ declining

CLIMATE VULNERABILITY RANKING	
Common Name (Scientific name)	Ranking
Shortface Lanx *or* Giant Columbia River Limpet (*Fisherola nuttalli*)	Moderate
Masked Duskysnail (*Lyogyrus sp. 2*)	Low-moderate
Olympia Pebblesnail (*Fluminicola virens*)	Low-moderate
Salmon River Pebblesnail (*Fluminicola gustafsoni*)	N/A
Ashy Pebblesnail (*Fluminicola fuscus*)	Moderate

Taxonomic notes: The Shortface Lanx (*Fisherola nuttalli*) is in the family Lymnaeidae (it is not a limpet); Masked Duskysnail (*Lyogyrus sp. 2*) is an undescribed species in the family Hydrobiidae. The genus *Fluminicola* was formerly considered to be in the family Hydrobiidae, but more recent classification system based on genetics treats Lithoglyphidae at the family level, instead of as a subfamily (Lithoglyphinae) in the Hydrobiidae family (Jordan 2013). Hershler and Liu (2012) indicate that the genus *Fluminicola* includes two separate lineages and is in need of revision. The Salmon River Pebblesnail (*F. gustafsoni*) is a recently described species, closely related to *F. virens*.

Ashy Pebblesnail
Photo: WDFW

Biology and Life History

For these aquatic snails, limiting factors may include hardness, acidity, dissolved oxygen, salinity, high temperature, and food availability as associated with depth. Snails are uncommon in habitats with surface acidity greater than pH 5. Dissolved oxygen limits diversity, so severely polluted waters (oxygen consumed by algae blooms) are often devoid of freshwater snails excepting pollution-tolerant species. Most species live in the shallows, (depths less than 10 feet) where food abundance is greatest. As a result, drastic water fluctuations (draw-downs) may cause declines in snail populations.

Shortface Lanx: This is a small pulmonate (lunged) snail; it feeds by scraping algae and diatoms from rock surfaces in streams. May occasionally feed on other plant surfaces. *Fisherola* are hermaphrodites but do not appear to be self-fertilized, thus mating occurs between two individuals. Eggs are laid from spring to autumn in gelatinous capsules attached to plants, stones, or other objects. They lack a free-swimming larval stage, and hatchlings are morphologically similar to adults, except that they lack a functional reproductive system. Young snails appear to grow rapidly and require only a few months to reach full size. Individual *F. nuttalli* probably live for only one year, as this species breeds once and dies afterwards (semelparous breeding). Individuals are present year-round in the streams they inhabit, but are inactive during the winter.

Masked Duskysnail*:* This species, like all Hydrobiid snails, has gills that make them dependent upon dissolved oxygen in the water. This species feeds on the algal and microbial film on aquatic plants, and likely on detritus. Individuals overwinter as adults and do not disperse widely, so populations remain very localized in their distribution. Information is sparse, but reproductive biology is probably similar to other Hydrobiid species. Hydrobiids typically are dioecious (i.e., have separate sexes) and semelparous (i.e., breed only once in their life time and then die), and individuals have a life span of one year, with 90 percent or more of the population turning over annually. Surviving individuals are generally those that do not breed during their first year. Eggs are laid in the spring and hatch in approximately 2 to 4 weeks. Sexual maturity is reached by late summer after a few months of growth.

Pebblesnails: Pebblesnails feed by scraping bacteria, diatoms and other perilithic organisms from rock surfaces, and may occasionally feed on aquatic plant surfaces. This species is present all year, but not active in winter. Having no lungs or gills, snails in this genus respire through the mantle cavity, and have low tolerance for hypoxia and anoxia. The *Fluminicola* genus exhibits separate sexes with both male and female individuals. Reproduction is by copulation and cross-fertilization, and these species are believed to be semelparous (reproducing only once in a lifetime). Eggs are laid from spring to autumn in gelatinous capsules attached to plants, stones, or other objects. The individual life span of these species is thought to be approximately 1 to 2 years, and population turnover is probably greater than 90 percent. Often, species in this genus appear to be community dominants, comprising most of the invertebrate biomass.

Distribution and Abundance

Shortface Lanx: This species was historically present throughout much of the Columbia River drainage in Washington, Montana, Oregon, Idaho, and British Columbia, but most populations were extirpated due to habitat loss resulting from dams, impoundments, water removal, and pollution. This species is now presumed extirpated in Montana and possibly in British Columbia. Currently in Washington, large populations of *F. nuttalli* persist in the Okanogan River and the Hanford Reach of the Columbia River; small populations are found in the Methow and Grand Ronde rivers. The species also occurs in the lower Deschutes River in Oregon, and the Snake River

in Oregon and Idaho. In Idaho, it occurs in the Middle and Upper Snake River reaches from Elmore County, upstream to at least Bingham County. Populations also occur in the Salmon River and Hells Canyon of the Snake River including parts of Nez Perce and Idaho Counties. Additional small populations are found in Oregon in the Grande Ronde, John Day, and Imnaha Rivers, and the lower Columbia River near Bonneville Dam.

Masked Duskysnail: The Masked Duskysnail is currently known from three or four sites in two kettle lakes: Curlew Lake in Ferry County, Washington, and Fish Lake, Chelan County, Washington.

Olympia Pebblesnail: The Olympia Pebblesnail is known only from Oregon and Washington. In Washington, it is known from about 12 locations, including Cowlitz, Grays Harbor, Pacific, San Juan, Skamania and Thurston Counties in Washington. In Oregon, it is limited in distribution to the lower Columbia River below Portland, the upper Deschutes River, the Umpqua River, the Willamette River from Corvallis to its mouth, and large tributary streams of the Willamette River including the Tualatin and Clackamas Rivers.

Salmon River Pebblesnail: This species is known only from the Salmon, Clearwater and lower Snake Rivers. In Washington it is only recorded from Asotin County.

Ashy Pebblesnail: This species has been extirpated from much of its historic range. It was historically widespread, with populations scattered throughout Washington in the lower Snake River, lower to middle Columbia River, and large tributaries of these rivers including the Methow, Willamette, Wenatchee, Deschutes, Okanogan, Grande Ronde, and Spokane Rivers (Asotin, Benton, Cowlitz, Chelan, Clark, Franklin, Klickitat, Okanogan, Skamania, Spokane, and Walla Walla Counties). Targeted surveys were conducted at over 500 sites in more than 30 streams in the Columbia Basin (Oregon, Washington, Idaho); this species was absent from nearly all sites (including some historic sites), and detected at just five streams. In Washington, it has been detected relatively recently (1990 or later) in the Okanogan, Grande Ronde and Methow Rivers; Hanford Reach of the Columbia River; and a limited portion of the Snake River.

Habitat

Shortface Lanx: Shortface lanx are found in unpolluted, cold, well-oxygenated perennial streams and rivers, generally 100 to 325 feet wide, with a cobble-boulder substrate. Within such streams it is found primarily on diatom-covered rocks at the edges of rapids or immediately downstream from rapids in areas that have suitable substrate. Shortface Lanx have not been found in areas with silt or mud substrates, extreme seasonal variations in water level, an abundance of aquatic plants or algae, bedrock substrate, or where dredging or mining occurs.

Masked Duskysnail: This species is a kettle lake inhabitant and riparian associate. It lives in lentic ecosystems on oxygenated mud substrates with aquatic plants.

Pebblesnails: This genus is fairly intolerant of impounded waters and soft substrates as well as nutrient-enhanced or lacustrine (lake) habitats. These species are usually found in clear, cold streams with high dissolved oxygen content. They are generally found on hard rocky surfaces where they graze on algae and detritus. They occur under rocks and vegetation in the slow to rapid currents of streams. It is common at the edges of rapids or immediately downstream from whitewater areas, and becomes much less common or absent in major rapids. In the absence of rapids or whitewater areas, this species is restricted to habitat with sufficient flow, oxygenation, and stable substrate.

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Families: Lymnaeidae and Hydrobiidae

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Ashy Pebblesnail					
1	Fish and wildlife habitat loss or degradation	Water pollution, siltation	Protect water quality	Current Insufficient	Both
Masked Duskysnail					
1	Fish and wildlife habitat loss or degradation	Pollution	Protect sites	Nothing current - new action needed	Both
2	Resource information collection needs	Formally describe species	Taxonomy; describe species	Nothing current - new action needed	External
Olympia Pebblesnail					
1	Fish and wildlife habitat loss or degradation	Pollution, siltation	Improve water quality of occupied streams	Current insufficient	Both
Salmon River Pebblesnail					
1	Fish and wildlife habitat loss or degradation	Pollution, siltation	Improve water quality of occupied streams	Current insufficient	External
Shortface Lanx					
1	Fish and wildlife habitat loss or degradation	Pollution and siltation	Protection of water quality	Current insufficient	WDFW
2	Agriculture and aquaculture side effects	Pollution and siltation	Develop management recommendations	Current insufficient	WDFW

NOTE: Numbers are for reference only and do not reflect priority.

Family Pleuroceridae (Genus *Juga*): FRESHWATER AQUATIC SNAILS

Conservation Status and Concern

These species require cold, clear, well-oxygenated water; they are sensitive to pollution, and intolerant of warm waters, low dissolved oxygen, or major seasonal fluctuations. Destruction of springs by grazing, logging, and diversions (e.g. for water supply, fish hatcheries) has already caused extensive extinction of *Juga* species throughout western North America.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Barren Juga (*Juga hemphilli hemphilli*)	None	None	No	G2T1	S1	Low/unknown
Dalles Juga (*Juga hemphilli dallesensis*)	None	None	No	G2T1	S1	Low/unknown
Brown Juga (*Juga sp. 3*)	None	None	No	G1	S1	Low/unknown
Three-band Juga (*Juga sp. 7*)	None	None	No	G1	S1	Low/unknown
One-band Juga (*Juga sp. 8*)	None	None	No	G2G3	SNR	Low/unknown
	Climate vulnerability: Moderate-high					

Taxonomic notes: The genus *Juga* and *Oreobasis* are synonymous. Three-Band Juga (*Juga* sp. 7) listed as Juga (*Juga* n. sp. 2) and One-band Juga (*Juga sp. 8)* listed as *Juga* n. sp. 1 in Frest and Johannes (1995: 178). The taxonomy of the Pleuroceridae, like most freshwater gastropods, has been based largely on shell morphology, and the tremendous variation makes the current taxonomy problematic and species identification difficult. Current work using reproductive anatomy and DNA to help resolve some of the taxonomic problems will likely result in changes in taxonomy in the future. Lee et al. (2006) analyzed DNA and suggested that *J. hemphilli* is a disjunct lineage from eastern North America, and should be designated *Elimia hemphilli*, but O'Foighil et al. (2009) reported that the Lee et al. (2006) paper was based on mislabeled voucher specimens, and confirmed that *J. hemphilli* belongs in *Juga* based on both DNA and anatomical evidence.

Biology and Life History

Juga species are freshwater aquatic snails with tall conical shells, native to the streams and springs of the Pacific Northwest and the Great Basin. *Juga* snails are characterized as rasper-grazers, feeding on both algae and detritus on rock surfaces and deciduous leaf litter. They exhibit seasonal migrations both upstream and downstream. The egg masses of *Juga* are most often found in loose (non-cemented) but stable cobble substrate, with free and fairly vigorous flow through at least the upper substrate layers. Egg masses are located under rocks in the spring, and eggs hatch in one month. *Juga* species live from 5 to 7 years, reaching sexual maturity in 3 years, and can continue to grow.

Genus *Juga*
Photo: nwnature.net

Distribution and Abundance

Where found, *Juga* can comprise over 90 percent of the invertebrate biomass in some streams. These five species seem to be restricted in distribution in Washington to the Columbia River Gorge, which historically provided abundant springs for habitat. Frest and Johannes (1995) systematically collected throughout much of the Gorge from 1987-1992, so that substantial additions to the range or an increase in the number of sites is highly unlikely.

Barren Juga: Barren Juga are known from a few populations on the west end of the Columbia Gorge in Washington and Oregon (mostly urbanized areas in Clark and Skamania Counties, Washington and Multnomah County, Oregon). Dillon (1989) lists occurrences from Oak Creek west of Corvallis, Benton County, Oregon.

Dalles Juga: The Dalles Juga has been found in Mill Creek and the central and eastern Columbia River Gorge from Hood River to the Dalles, in Hood River and Wasco Counties, Oregon and Skamania County, Washington. Lee et al. (2006) determined that material collected in 1883 by Whiteaves at the headwaters of the Columbia River in British Columbia and described as *Goniobasis columbiensis* is, in fact, this species.

Brown Juga: The Brown Juga is rare, found only in a few of the central and eastern Columbia Gorge tributaries, Skamania and Klickitat Counties, Washington, and in Multnomah and Hood River Counties, Oregon (Frest and Johannes 1995).

Three-band Juga: Three-band Juga are known from scattered sites, mostly in the eastern Columbia Gorge: Skamania and Klickitat Counties., WA, and Hood River, Wasco, Sherman, and Gilliam Counties, Oregon.

One-band Juga: One-band Jugas are known from a few of the central and eastern Columbia Gorge tributaries in Skamania and Klickitat Counties, Washington. Substantive range extensions are unlikely as most of the Columbia Gorge streams, as well as tributaries of the Klickitat and White Salmon rivers in recent years were surveyed.

Habitat

Barren Juga: The Barren Juga is found at low elevation large springs and small to medium streams with a level bottom and a stable gravel substrate and fast-flowing, unpolluted, highly oxygenated cold water. These typically lack aquatic macrophytes and have little epiphytic algae.

Dalles Juga: This species is found in low elevation large springs and small to medium streams with a stable gravel substrate and fast-flowing, unpolluted, highly oxygenated cold water. Relatively few macrophytes or epiphytic algal taxa are present.

Brown Juga: This species is found in low to medium elevation small spring-fed streams and springs, with cold, fast-flowing, well oxygenated water and gravel substrate. It is most frequently found in very small and shallow but perennial spring-fed streams and springs.

Three-band Juga: This species occurs in shallow, slow flowing springs and permanent seeps, sometimes associated with talus. Most often, these are covered by dense brush; the substrate ranges from bare rock faces to mud and sand. Rarely, this species occurs in smaller spring-fed streams.

One-band Juga: This species occurs in low to mid-elevation spring-fed streams and large springs with, cold, fast flowing, highly oxygenated water and a level bottom; if in streams, only in low-gradient streams, generally spring-fed.

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Family Pleuroceridae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Barren Juga					
1	Fish and wildlife habitat loss or degradation	Water diversions; habitat destruction; pollution	Protect water quality	Current insufficient	Both
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline;	Taxonomic clarification	Current insufficient	External
Brown Juga					
1	Fish and wildlife habitat loss or degradation	Water diversions; habitat loss to development	Protect small spring-fed streams	Current insufficient	WDFW
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline;	Taxonomic clarification	Current insufficient	External
Dalles Juga					
1	Fish and wildlife habitat loss or degradation	Water diversions; habitat loss to development	Taxonomic clarification	Nothing current - new action needed	Both
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline;	Taxonomic clarification	Current insufficient	External
One-band Juga					
1	Fish and wildlife habitat loss or degradation	Water diversions; habitat loss to development	Taxonomic clarification	Unknown	Both

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline;	Formal species description, taxonomic clarification	Nothing current - new action needed	External
Three-band Juga					
1	Resource information collection Needs	Need formal species description and status assessment	Formal species description, and status assessment	Nothing current - new action needed	Both
2	Fish and wildlife habitat loss or degradation	Water diversions; habitat loss to development	Management recommendations; identification and protection of sites;	Nothing current - new action needed	Both
3	Agriculture and aquaculture side effects	Intensive livestock use may trample the species or reduce riparian vegetation	Install fencing to carefully manage or prohibit livestock access to occupied riparian areas	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

SLUGS

TAILDROPPER SLUGS

Conservation Status and Concern
These endemic taildropper slugs are of concern due to their rarity. The Spotted Taildropper is only found in part of one county, and the rarity of both species suggest they have specific habitat needs that make them sensitive to land use activities, such as logging and loss of coarse woody debris.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
Bluegray Taildropper (*Prophysaon coeruleum*)	None	Candidate	Yes	G3G4	S1	Low/declining
Spotted Taildropper (*Prophysaon vanattae pardalis*)	None	None	No	GNR	SNR	Critical/ unknown
	Climate vulnerability: Low-moderate					

Taxonomic note: *P.v. pardalis* has not been formally described as a subspecies; some specimens collected in northwestern Oregon assigned to this taxa appear to be a color variation of *P. andersoni*. Molecular analysis compared the genetic similarities of specimens identified as *P. coeruleum* from locations in western Oregon, Washington, California and Idaho. The results indicate that the species is not monophyletic in regards to color (i.e., body color is not related to genetic similarity), and there is a divergence in genetic similarity that occurs in southwestern Oregon populations which has resulted in several "clades" or variants in that region. None of these clades as yet have been officially named or described as subspecies or separate species.

Biology and Life History
Like most terrestrial gastropods, taildroppers are hermaphroditic, having both male and female organs. Although not confirmed specifically for *P. coeruleum*, self-fertilization has been demonstrated in some species of gastropods, but cross-fertilization is the norm. Slugs are generally oviparous (egg-laying). Eggs of *Prophysaon* slugs are laid in clusters in cool damp spots including under logs or pieces of wood on the shaded forest floor. Slugs are preyed upon by a variety of vertebrates and other invertebrates. Tail-dropping is a means to escape some predators. Fungi made up most (90 percent) of the identifiable food ingested by *P. coeruleum*; this included a variety of mycorrhizal fungi and the species may be an agent of spore dispersal for these fungi, which are beneficial symbionts of many plants. Other food items include plant material and lichens; plant material is more commonly consumed in spring than in fall. There is no specific information available about the life history of the Spotted Taildropper.

Bluegray Taildropper
Photo: J.S. Applegarth

Distribution and Abundance

Bluegray Taildropper: This species occurs in a few isolated populations and is a rare Pacific Northwest endemic closely associated with coniferous forest stands and conifer debris. In Washington, scattered sites are documented within the Puget Trough; extant populations occur in Lewis and Cowlitz Counties. The entire species range encompasses the Oregon Coast Range, Oregon and Washington Cascades, Puget Trough, Klamath Mountains of southwestern Oregon and northern California, western Idaho, and southern Vancouver Island, British Columbia. Although somewhat widespread and abundant in southwestern Oregon, it is rare and likely declining elsewhere in its range (including the rest of Oregon, and in California, Washington, Idaho, and British Columbia) with populations scattered and disjunct.

Spotted Taildropper: A quite rare subspecies from a very limited range in Pacific County, Washington. It is a rare spotted form of the Scarletback Taildropper, a common slug of western Washington and western Oregon forests. May or may not also occur in northwestern Oregon.

Habitat

Bluegray Taildropper: This species inhabits moist, coniferous or mixed-wood forests of varying age classes and is associated with moist forest floor conditions and abundant coarse woody debris, particularly of bigleaf maple. All records from British Columbia are from within the Coastal Douglas-fir biogeoclimatic zone, while in Washington, it is often associated with older forests and required microhabitat features, including abundant coarse woody debris or other cover, a deep forest litter layer and shaded, moist forest floor conditions.

Spotted Taildropper: Little habitat information is available for this subspecies; they have been found in snags, stumps, coarse woody debris, and large swordferns.

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Taildropper Slugs: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
Bluegray Taildropper					
1	Agriculture and aquaculture side effects	Logging of mature forest sites, loss of coarse woody debris	Identify and protect sites	Nothing current - new action needed	External
Spotted Taildropper					
1	Resource information collection needs	Lack of data on current status and distribution	Determine distribution, population status	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

FRESHWATER BIVALVES

Families Unionidae and Margaritiferidae: FRESHWATER MUSSELS

Conservation Status and Concern

Freshwater mussels have been greatly affected by dams and annual water drawdowns, as well as degraded water quality resulting from development and agriculture. Many historical sites no longer support mussels, and many local populations no longer successfully reproduce.

Common Name (Scientific name)	Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend
California Floater (*Anodonta californiensis*)	None	Candidate	Yes	G3Q	S2	Low/declining
Winged Floater (*Anodonta nuttaliana*)	None	None	No	G4Q	S1	Low/declining
Western Ridged Mussel (*Gonidea angulata*)	None	None	No	G3	S2S3	Uncommon/ declining
Western Pearlshell (*Margaritifera falcata*)	None	None	No	G4G5	S3S4	Uncommon/ declining
	Climate vulnerability: Moderate					

Taxonomic notes: Recent genetic research suggests that the California and Winged Floaters belong to a single clade, and that this clade exhibits basin-specific substructuring and may contain at least six distinct groups. However, before new species or genus level designations are made, the taxonomy for the entire Unionidae family needs to be resolved. The Western Ridged Mussel is the only species in the genus Gonidea.

Biology and Life History

Western Pearlshell
Photo: WDFW

Freshwater mussels are filter feeders that consume phytoplankton and zooplankton suspended in the water. Freshwater mussels have separate sexes, although hermaphrodites (individuals with male and female traits that are capable of self-fertilization) have been documented for some North American species, including the Western Pearlshell. Freshwater mussels have a complex life cycle. During breeding, males release sperm into the water and females filter it from the water for fertilization to occur. Embryos develop into larvae called glochidia, which are released into the water and must encounter and attach to a fin or gill filaments of host fish. Glochidia form a cyst around themselves and remain on a host for several weeks. They subsequently release from the host fish and sink to the bottom, burrow in the sediment and remain buried until they mature. During their lives, mussels may move less than a few yards from the spot where they first landed after dropping from their host fish. Because freshwater mussels are not able to move far on their own, their association with fish allows them to colonize new areas, or repopulate areas from which they have been extirpated. Freshwater mussels that live in dense beds, including Western Ridged Mussel and Western Pearlshells, provide an important water purification service; they can filter suspended solids, nutrients

and contaminants from the water column and collectively improve water quality by reducing turbidity and controlling nutrient levels.

California Floater/Winged Floater: Floater species grow quickly, reach sexual maturity in 4 to 5 years, and probably have a maximum life span of about 15 years. Host fish are unknown, but may include Chiselmouth (*Acrocheilus alutaccus*) and Northern Pikeminnow (*Ptychocheilus oregonensis*). Like other freshwater mussels, California and Winged Floaters rely on host fishes to reproduce and disperse.

Western Ridged Mussel: The Western Ridged Mussel is a relatively slow growing and long-lived species perhaps living 20 to 30 years, and can be an important indicator of water quality. The fish host species in Washington are unknown, but in northern California, Hardhead (*Mylopharodon conocephalus*), Pit Sculpin (*Cottus pitensis*), and Tule Perch (*Hysterocarpus traski*) are hosts for Western Ridged Mussels.

Western Pearlshell: The average life span is approximately 60 to 70 years, although some individuals are thought to have lived more than 100 years. Because this species is sedentary, sensitive to environmental changes, and long-lived, it can be an excellent biological indicator of water quality. Documented host fishes for Western Pearlshells include Cutthroat Trout (*Oncorhyncus clarkii*), Rainbow/Steelhead Trout (*O. mykiss*), Chinook Salmon (*O. tshawytscha*), and Brown Trout (*Salmo trutta*), and a number of other fish are considered potential hosts.

Distribution and Abundance

California Floater/Winged Floater: Historically widespread west of the Continental Divide from British Columbia to Baja, but extirpated from many areas by dams. It is problematic to determine the distribution of these species because of their morphological similarity and confusion of taxonomy; this range description may prove to apply to several distinct species. Frest and Johannes (1995) reported the range has been reduced and extant populations were found in the following areas: the Middle Snake River in Idaho; the Fall and Pit Rivers in Shasta County, California; the Okanogan River in Chelan County, Washington; and Roosevelt and Curlew Lakes in Ferry County, Washington. Extirpated from much of historic range, including the Willamette and lower Columbia Rivers and the Central Valley in California.

Western Ridged Mussel: The Western Ridged Mussel is widely distributed in Washington, Oregon, California, Idaho, Nevada, and southern British Columbia. This species is more common east of the Cascades of Oregon and Washington than on the western side. In Washington, the Western Ridged Mussel was known from the Columbia River (Kittitas County), Toppenish Creek (Yakima County), Yakima River (Benton County), the Snake River (Columbia County), Chehalis River (Grays Harbor, Lewis Counties), Skookumchuck River (Lewis County), Spokane River (Lincoln County), the Columbia, Okanagan, Similkameen, Spokane and Little Spokane Rivers, Osoyoos Lake, Palmer and Hangman Creeks, and Spokane Falls (Okanagan County), and Colville River (Stevens County). Declines or extirpations have been reported in the Little Spokane, Wenatchee, and Yakima Rivers.

Western Pearlshell: The range of the Western Pearlshell extends from Alaska and British Columbia south to California and east to Nevada, Wyoming, Utah and Montana; it is apparently most abundant in Oregon, Washington, Idaho and British Columbia. In Washington, Pearlshells have been extirpated from much of the mainstem Columbia and Snake Rivers; substantial declines, die-offs, or lack of recent reproduction have also been reported from the SanPoil River (Ferry County), Kettle River (Stevens County), the Little Spokane River (Spokane County),

Snohomish River, Muck Creek (Pierce County), Bear Creek (King County), and Nason Creek (Chelan County). High levels of arsenic and organochlorine pesticides were found in the tissues of other mussel species collected from the mid-Columbia River during that survey. This species has also been extirpated from northern Nevada, from most areas in northern Utah, several rivers in Montana, and numerous other locations. In addition, there are reports of populations of Western Pearlshells that apparently have not reproduced for decades. Populations of such a long-lived species may appear stable, when in fact they are not reproducing; populations showing repeated reproduction, evidenced by multiple age classes, are now rare.

Habitat

Freshwater mussels are found in shallow habitats in permanent bodies of water, including creeks, rivers, and ponds generally at low elevations. Mussels tend to concentrate in areas of streams with consistent flows and stable substrate conditions. They are often absent or sparse in high-gradient, rocky rivers, but are frequently encountered in low-gradient creeks and rivers, perhaps because they provide a variety of habitat conditions, reliable flow, good water quality, and diverse fish communities.

California Floater/Winged Floater: Floaters occur in natural lakes, reservoirs, and downstream low-gradient reaches of rivers in pool habitats. Because their thin shells are prone to damage, floaters favor habitats of sand and silt substrates in lower gradient streams than those favored by Western Pearlshells and Western Ridged Mussels; sandbars near the mouths of tributary streams or below riffles are important habitats.

Western Ridged Mussel: Western Ridged Mussels inhabit the bottom of cold creeks, rivers, and lakes from low to mid-elevations with substrates that vary from gravel to firm mud, and include at least some sand, silt or clay. It is generally associated with constant flow, shallow water (less than 10 feet in depth), and well-oxygenated substrates. This species is often present in seasonally turbid streams, but absent from continuously turbid water (e.g. glacial meltwater streams).

Western Pearlshell: This species inhabits cold creeks and rivers with clear, cold water and sea-run salmon or native trout including waterways above 5,000 feet in elevation. Western Pearlshells are typically found at depths of 1.5 to 5 feet, and they tend to congregate in areas with boulders and gravel substrate, with some sand, silt and clay. Western Pearlshells occur in waterways with low velocities and stable substrates and are frequently found in eddies or pools and areas with stones or boulders that likely shelter mussel beds from scour during flood events. This species appears to be intolerant of sedimentation.

References

Frest, T. J. and E. J. Johannes. 1995. Interior Columbia Basin mollusk species of special concern. Final report to the Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA. Contract #43-0E00-4-9112. 274 pp. plus appendices.

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Nedeau, E. J., A. K. Smith, J. Stione, and S. Jepsen. 2009. Freshwater Mussels of the Pacific Northwest. 2nd edition. The Xerces Society. 51pp.

Families Unionidae and Margaritiferidae: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
California Floater					
1	Agriculture and aquaculture side effects	Water level fluctuations; pollution	Protect water quality	Current insufficient	External
2	Resource information collection needs	Taxonomic uncertainty may mean one or more taxa are in greater decline	Taxonomic clarification	Current insufficient	External
Western Pearlshell					
1	Fish and wildlife habitat loss or degradation	Pollution, siltation	Protect water quality	Current insufficient	External
2	Agriculture and aquaculture side effects	Pollution, siltation	Protect water quality	Current insufficient	External
3	Fish and wildlife habitat loss or degradation	Suction dredging for gold	Delineate and protect sites	Current insufficient	Both
Western Ridged Mussel					
1	Fish and wildlife habitat loss or degradation	Pollution; need info on life history, ecology	Protect water quality	Current insufficient	External
2	Resource information collection needs	Need info on life history, ecology	Life history research	Current insufficient	External
Winged Floater					
1	Agriculture and aquaculture side effects	Water level fluctuations; pollution; need taxonomic clarification	Technical assistance to regulatory agencies	Current insufficient	Both
2	Resource information collection needs	Need taxonomic clarification	Taxonomic clarification;	Current insufficient	External

NOTE: Numbers are for reference only and do not reflect priority.

MARINE BIVALVE

OLYMPIA OYSTER (*Ostrea lurida*)

Conservation Status and Concern:
Washington's only native oyster, it is currently present in diminished abundance (less than 5 percent) due to overharvest and habitat alterations throughout most of the species historical range (circa 1850) in Washington. Evidence of natural recruitment and restoration success observed but lack of suitable habitat limits further increases.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
None	Candidate	Yes	G5	SNR	Low/stable	High

Biology and Life History

Photo: Wikipedia Commons

Olympia Oysters are hermaphroditic and able to alternate between male and female annually during reproduction cycles. Sexual maturity is observed in oysters greater than 0.6 inch shell length, which is typically reached in 12 months. Fecundity is observed to be very high for young oysters in comparison to older oysters. Fertilized larvae are initially brooded internally by the female and then released as large, free-swimming pediveligers for 7 to 10 days before settlement and attachment to available hard substrates. Populations are tolerant of a wide range of environmental conditions and salinity values but are intolerant of freshwater exposures. Intertidal survival is dependent upon thermal refuges provided by immersion, partial immersion, moist substrates, or by location on or underneath rocks, boulders, oysters or other structure. Extreme freezing weather events may result in significant mortalities in exposed intertidal occurrences. Maximum adult size appears to be 3.5 inches but typically they range from 2 to 2.4 inches, reached in 5 to 6 years. Maximum age is generally 10 years.

Distribution and Abundance
Olympia Oysters are native along the Pacific coast of North America, form Gale Passage (British Columbia) to Bahia de San Quintin (Baja California). Primarily found, historically and currently, in the low intertidal zone in Puget Sound with rare subtidal occurrences. In Willapa Bay the species occurred both in the intertidal and subtidal historically but now appear to be limited to subtidal occurrences. Occurrences in Grays Harbor appear to be historically and currently of very limited abundance. Present throughout nearly all of the species historical range in Washington. While currently found in diminished abundance, the species is commonly observed intertidally in portions of Hood Canal, South Puget Sound, and Central Puget Sound plus specific embayments in North Sound, Admiralty Inlet and Straits of Juan de Fuca. Dense occurrences in natural beds are limited and estimated to be less than 5 percent of total historical extents and numbers of beds (circa 1850). The Willapa Bay population exhibits observable larval production but abundance of adults remains unknown. Adults are occasionally observed in Grays Harbor. Natural recruitment success in portions of Puget Sound appears to be on the increase.

Habitat

Olympia Oysters occur primarily as an intertidal species in Puget Sound and both intertidal and subtidal in Willapa Bay. They form shallow (less than 2 feet in elevation) loose beds of oysters and shell on unconsolidated mud, sand, gravel substrates. They may also be found attached to rocky structures. The species requires hard substrates (oysters, shell, gravel, rock) for attachment of recruits and formation of natural beds.

References

Blake, B. and A. Bradbury. 2012. Plan for Rebuilding Olympia Oyster (*Ostrea lurida)* Populations in Puget Sound with a Historical and Contemporary Overview. Washington Department of Fish and Wildlife, Olympia.

Olympia Oyster: Conservation Threats and Strategies

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Invasive and other problematic species	Localized occurrences of the non-native predators *Ocinebrellus inornatus* and *Koinostylochus ostreaophagus.*	Re-establish or enhance presence of viable, self-sustaining source populations.	Current sufficient	Both
2	Overharvesting of biological resources	By-catch mortality from Pacific Oyster commercial harvest and other uses of tidelands	Re-establish or enhance presence of viable, self-sustaining source populations.	Current sufficient	Both
3	Fish and wildlife habitat loss or degradation	Shoreline and tideland modifications, including nearshore or estuarine restoration projects.	Re-establish or enhance presence of viable, self-sustaining source populations.	Current sufficient	Both
4	Fish and wildlife habitat loss or degradation	Siltation from upland practices and nutrient inputs	Re-establish or enhance presence of viable, self-sustaining source populations.	Current sufficient	Both
5	Agriculture and aquaculture side effects	Genetic fitness impacts from unrestricted distribution of generic hatchery-origin native oysters	Re-establishment and enhancement of genetic diversity through restoration historic and new sites.	Current sufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

MARINE GASTROPOD

PINTO ABALONE (*Haliotis kamtschatkana*)

Conservation Status and Concern

The Pinto Abalone has failed to recover from dramatic declines resulting from excessive recreational and illegal harvest, despite fishery closure. There is strong evidence of recruitment failure, perhaps because the densities of remaining populations are below the threshold for successful reproduction.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
Species of Concern	Candidate	Yes	G3G4	SNR	Uncommon/declining	Moderate-high

Biology and Life History

Photo: Wikimedia Commons

Adult Pinto Abalone feed primarily on drift macroalgae, such as bull kelp (*Nereocystis luetkeana*), and juveniles feed predominantly on microalgae and diatoms. Pinto Abalone are broadcast spawners and the sperm and eggs are only viable for a short period, so successful reproduction requires that adults be aggregated. After eggs are successfully fertilized, embryos rapidly become free-swimming trochophores, which metamorphose into veliger larvae. After approximately 10 to 14 days as plankton, the swimming veligers settle onto suitable substrate. Newly settled juvenile abalone require crevices for added protection from predators and remain cryptic until mature. Upon maturation at approximately 2 inches in shell length, abalone become more exposed and are more easily found in their habitat. Many are semi-exposed or fully exposed on open rocky habitat by the time they reach 3.5 inches in shell length.

Distribution and Abundance

Pinto Abalone are distributed from Point Conception, California to southeast Alaska. In Washington, they are generally found on hard, rocky substrates in exposed coastal areas, including Puget Sound, Strait of Juan de Fuca and the San Juan Archipelago. Abundance at index sites in the San Juan Islands declined 92 percent between 1992 and 2013.

Habitat

Pinto Abalone are typically found on rocky substrate, in water between 10 and 65 feet deep. Their preferred habitat in the San Juan Archipelago and the Strait of Juan de Fuca is exposed rock, often covered (at least partially) with crustose coralline algae.

References

Vadopalas, B. and J. Watson. 2014. Recovery Plan for Pinto Abalone (*Haliotis kamtschatkana*) in Washington state. Puget Sound Restoration Fund. 50 pp.

Pinto Abalone: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Resource information collection needs	Reproductive failure due to low densities	Research augmentation methods	Current insufficient	WDFW
2	Overharvesting of biological resources	Reproductive failure due to low densities	Life history research	Current insufficient	WDFW
3	Overharvesting of biological resources	Small populations vulnerable to illegal harvest	Outreach and enforcement of harvest restrictions	Current insufficient	WDFW
4	Resource information collection needs	Limited understanding of life history and limiting factors	Life history research	Current insufficient	WDFW

NOTE: Numbers are for reference only and do not reflect priority.

EARTHWORM

GIANT PALOUSE EARTHWORM (*Driloleirus americanus*)

Conservation Status and Concern
Data on this species are sparse. It is difficult to detect and few surveys have been performed to determine its distribution and abundance. There has been an obvious reduction of range in the Palouse region of Washington with conversion of prairie to cropland. Introduced worm species appear to exclude native species, including this one.

Federal Status	State Status	PHS	Global Ranking	State Ranking	Population size/trend	Climate Vulnerability
None	Candidate	Yes	G1	S2	Unknown/unknown	Low-moderate

Taxonomic note: A genetics study is currently underway to determine whether the worms found in the East Cascades are the same as those found in the Palouse regions of Washington and Idaho. Preliminary findings indicate that these populations are likely the same species.

Biology and Life History
A large, pale or white earthworm, this species has until relatively recently been considered endemic to the Palouse prairies of eastern Washington and Idaho, where it was discovered in 1897. This species is considered to be "anecic", meaning that it burrows vertically deep into the ground and lives in deep, semi-permanent burrows, coming to the surface in wet conditions. Burrows have been found at a depth of 15 feet.

Giant Palouse Earthworm
Photo: M. Teske

Distribution and Abundance
In Washington, the Giant Palouse Earthworm has been found in Chelan, Kittitas and Whitman Counties. It may be more widespread because recent records from the east slope of the Cascades have expanded its known range. Based on knowledge of other species in the Megascolecidae family to which this species belongs, the worm's range could extend along the Columbia Plateau in a band just below the terminal moraines of the Pleistocene glaciation. Because these worms are very slow colonists, range limits are probably determined by the extent of Pleistocene glaciation and the Missoula Floods, both of which would have eliminated earthworms.

Habitat
Originally assumed to require deep, loamy soils characteristic of the Palouse bunchgrass prairies, the species was found in the eastern Cascades occupying gravelly sandy loam and other rocky soils in forested areas. They have been found in open forest, shrub-steppe, and prairie. Of sites surveyed, only one occurrence was in non-native vegetation on land enrolled in the Conservation Reserve Program.

References

USFWS. 2011. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Giant Palouse Earthworm (Driloleirus americanus) as Threatened or Endangered. Federal Register 76(143):44547-44564.

J. Fleckenstein, WDNR, pers.comm.
J. Maynard-Johnson, University of Idaho, pers.comm.
K. McAllister, WSDOT, pers.comm.

Giant Palouse Earthworm: Conservation Threats and Actions

	STRESSOR	DESCRIPTION	ACTION NEEDED	LEVEL OF INVESTMENT	LEAD
1	Agriculture and aquaculture side effects	In the Palouse region, plowing and soil disturbance due to agricultural activity has converted GPE habitat	Surveys are needed in undisturbed areas to determine site occupancy.	Nothing current - new action needed	Both
2	Resource information collection needs	Originally found in Palouse prairie and thought to be endemic there, but recent detections in the East Cascades and clues regarding range characteristics indicate the need for greater survey efforts	Past surveys have been conducted in the Palouse region. East Cascades detections were accidental at first. Very limited, spot surveys done since.	Current insufficient	External
3	Resource information collection needs	Questions remain regarding possible genetic differences between the Palouse and East Cascade populations	Research on genetics being done by J. Maynard-Johnson at University of Idaho. Results not definitive.	Current sufficient	External
4	Fish and wildlife habitat loss or degration	WSDOT highway and USFS road building and alteration have disrupted earthworm concentrations. This is how they were discovered in the East Cascades.	Review of proposed transportation projects	Current insufficient	Both
5	Invasive and other problematic species	Invasive, non-native earthworm species, notably the European earthworm (*Lumbricus terrestris*).	Note occurrences and continue surveys	Current insufficient	Both

NOTE: Numbers are for reference only and do not reflect priority.

REFERENCES

SECTION A: Alphabetical list of species

A Caddisfly	*Allomyia acanthis*……	28
A Caddisfly	*Goereilla baumanni*……	28
A Caddisfly	*Limnephilus flavastellus*……	28
A Caddisfly	*Psychoglypha browni*……	28
A Caddisfly	*Rhyacophila pichaca*……	28
A Caddisfly	*Rhyacophila vetina*……	28
A Mayfly	*Cinygmula gartrelli*……	8
A Mayfly	*Paraleptophlebia falcula*……	8
A Mayfly	*Paraleptophlebia jenseni*……	8
A Mayfly	*Siphlonurus autumnalis*……	8
A Noctuid Moth	*Copablepharon columbia* ……	32
A Noctuid Moth	*Copablepharon mutans*……	32
A Noctuid Moth	*Copablepharon viridisparsa hopfingeri*……	32
Ashy Pebblesnail	*Fluminicola fuscus*……	88
Barren Juga	*Juga hemphilli hemphilli*……	93
Beller's Ground Beetle	*Agonum belleri*……	23
Bluegray Taildropper	*Prophysaon coeruleum*……	97
Brown Juga	*Juga sp. 3*……	93
California Floater	*Anodonta californiensis*……	100
Cascades Needlefly	*Megaleuctra kincaidi*……	16
Chelan Mountainsnail	*Oreohelix sp. 1*……	70
Columbia Clubtail	*Gomphus lynnae*……	11
Columbia Oregonian	*Cryptomastix hendersoni*……	74
Columbia River Tiger Beetle	*Cicindela columbica*……	23
Crowned Tightcoil	*Pristiloma pilsbryi*……	84
Dalles Hesperian	*Vespericola depressa*……	74
Dalles Juga	*Juga hemphilli dallesensis*……	93
Dalles Sideband	*Monadenia fidelis minor*……	84
Dry Land Forestsnail	*Allogona ptychophora solida*……	74
Giant Palouse Earthworm	*Driloleirus americanus*……	108
Golden Hairstreak	*Habrodais grunus herri*……	44
Great Arctic	*Oeneis nevadensis gigas*……	35
Hatch's Click Beetle	*Eanus hatchii*……	21
Hoary Elfin	*Callophrys polios Puget Trough segregate* ……	44
Hoder's Mountainsnail	*Oreohelix n. spp.* ……	70
Hoko Vertigo	*Vertigo sp. 1 (Nearctula new spp.)* ……	81
Idaho Vertigo	*Vertigo idahoensis*……	81

Island Marble	*Euchloe ausonides insulanus*……	37
Johnson's Hairstreak	*Callophrys johnsoni*……	44
Juniper Hairstreak	*Callophrys gryneus Columbia Basin segregate*……..	44
Leschi's Millipede	*Leschius mcallisteri*……	6
Limestone Point Mountainsnail	*Oreohelix sp. 18 (O. idahoensis baileyi)*……	70
Mad River Mountainsnail	*Oreohelix n. spp.* ……..	70
Makah Copper	*Lycaena mariposa charlottensis*……	44
Mann's Mollusk-eating Ground Beetle	*Scaphinotus mannii*……	23
Mardon Skipper	*Polites mardon* ……	59
Masked Duskysnail	*Lyogyrus sp. 2*……	88
Meadow Fritillary	*Boloria bellona toddi*……	52
Mission Creek Oregonian	*Cryptomastix magnidentata*……	74
Monarch Butterfly	*Danaus plexippus*……	39
Morrison's Bumblebee	*Bombus morrisoni*……	66
Nimapuna Tigersnail	*Anguispira nimapuna* ……	84
Pinto Abalone	*Haliotis kamtschatkana*……	106
Northern Forestfly	*Lednia borealis*……	16
Olympia Oyster	*Ostrea conchaphila* ……	104
Olympia Pebblesnail	*Fluminicola virens*……	88
One-band Juga	*Juga sp. 8*……	93
Oregon Branded Skipper	*Hesperia colorado Salish Sea segregate*……	59
Oregon Megomphix	*Megomphix hemphilli*……	84
Oregon Silverspot	*Speyeria zerene hippolyta*……	52
Pacific Clubtail	*Gomphus kurilis*……	11
Pacific Needlefly	*Megaleuctra complicata*……	16
Pacific Vertigo	*Vertigo andrusiana*……	81
Poplar Oregonian	*Cryptomastix populi*……	74
Propertius Duskywing	*Erynnis propertius*……	59
Puget (Blackmore's) Blue	*Icaricia icarioides blackmorei*……	44
Puget Oregonian	*Cryptomastix devia*……	74
Puget Sound Fritillary	*Speyeria cybele pugetensis*……	52
Rainier Roachfly	*Soliperla fenderi*……	16
Ranne's Mountainsnail	*Oreohelix n. sp.* ……	70
Salmon River Pebblesnail	*Fluminicola gustafsoni*……	88
Sand Verbena Moth	*Copablepharon fuscum*……	32
Sasquatch Snowfly	*Bolshecapnia sasquatchi*……	16
Shortface Lanx	*Fisherola nuttalli*……	88
Silver-bordered Fritillary	*Boloria selene atrocostalis*……	52
Siuslaw Sand Tiger Beetle	*Cicindela hirticollis siuslawensis*……	23
Sonora Skipper	*Polites sonora siris*……	59
Spotted Taildropper	*Prophysaon vanattae pardalis*……	97
Straits Acmon blue	*Icaricia acmon ssp.* ……	44
Subarctic Bluet	*Coenagrion interrogatum*……	14

Suckley Cuckoo Bumblebee	*Bombus suckleyi*……	66
Talol Springfly	*Pictetiella lechleitneri*……	16
Taylor's Checkerspot	*Euphydryas editha taylori*……	41
Three-band Juga	*Juga sp. 7*……	93
Unnamed Oregonian	*Cryptomastix maullani hemphilli*……	74
Valley Silverspot	*Speyeria zerene bremnerii*……	52
Washington Duskysnail	*Amnicola sp. 2*……	74
Wenatchee Forestfly	*Malenka wenatchee*……	16
Western Bumblebee	*Bombus occidentalis*……	66
Western Pearlshell	*Margaritifera falcata*……	100
Western Ridged Mussel	*Gonidea angulata*……	100
White-belted Ringtail	*Erpetogomphus compositus*……	11
Winged Floater	*Anodonta nuttaliana*……	100
Yosemite Springfly	*Megarcys yosemite*……	16
Yuma Skipper	*Ochlodes yuma*……	59

SECTION B: Explanation of Terms

Conservation Status Table

Federal Status
Refers to legal designations under the Federal ESA (listed as Endangered or Threatened or recognized as a Candidate species for listing), or designated as a Sensitive species.

State Status
The Washington Fish and Wildlife Commission has classified 46 species as Endangered, Threatened or Sensitive, under WAC 232-12-014 and WAC 232-12-011. Species can also be designated Candidate Species for state listing by WDFW policy.

PHS (Priority Habitats and Species Program)
A species listed under the PHS program is considered to be a priority for conservation and management and requires protective measures for survival due to population status, sensitivity to habitat alteration and/or tribal, recreational or commercial importance. Management recommendations have been developed for PHS species and habitats, and can assist landowners, managers and others in conducting land use activities in a manner that incorporates the needs of fish and wildlife.

Global (G) and State (S) Rankings: Refers to NatureServe status rankings provided by the Natural Heritage Program. These conservation status ranks complement legal status designations and are based on a one to five scale, ranging from critically imperiled (1) to demonstrably secure (5). The global (G) and state (S) geographic scales were used for the SGCN species fact sheets. For more on the methodology used for these assessments, please see: Methodology for Assigning Ranks - NatureServe.

State Rank: characterizes the relative rarity or endangerment within the state of Washington.
S1 = Critically imperiled
S2 = Imperiled
S3 = Rare or uncommon in the state – vulnerable
S4 = Widespread, abundant, and apparently secure i
S5 = Demonstrably widespread, abundant, and secure in the State
SA = Accidental in the state.
SE = An exotic species that has become established in the state.
SH = Historical occurrences only are known, perhaps not verified in the past 20 years, but the taxon is suspected to still exist in the state.
SNR = Not yet ranked. Sufficient time and effort have not yet been devoted to ranking of this taxon.
SP = Potential for occurrence of the taxon in the state but no occurrences have been documented.
SR = Reported in the state but without persuasive documentation which would provide a basis for either accepting or rejecting the report (e.g., misidentified specimen).
SRF = Reported falsely in the state but the error persists in the literature.
SU= Unrankable. Possibly in peril in the state, but status is uncertain. More information is need.
SX = Believed to be extirpated from the state with little likelihood that it will be rediscovered.
SZ = Not of conservation concern in the state.

Qualifiers are sometimes used in conjunction with the State Ranks described above:

B - Rank of the breeding population in the state.
N - Rank of the non-breeding population in the state.

Global Rank: characterizes the relative rarity or endangerment of the element world-wide.
G1 = Critically imperiled globally
G2 = Imperiled globally
G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range - vulnerable
G4 = Widespread, abundant, and apparently secure globally
G5 = Demonstrably widespread, abundant, and secure globally, though it may be quite rare in parts of its range
GH = Historical occurrences only are known, perhaps not verified in the past 20 years, but the taxon is suspected to still exist somewhere in its former range.
GNR = Not yet ranked. Sufficient time and effort have not yet been devoted to ranking of this taxon.
GU = Unrankable. Possibly in peril range-wide but status uncertain. More information is needed.
GX = Believed to be extinct and there is little likelihood that it will be rediscovered.

Qualifiers are used in conjunction with the Global Ranks described above:
Tn Where n is a number or letter similar to those for Gn ranks, above, but indicating subspecies or variety rank. For example, G3TH indicates a species that is ranked G3 with this subspecies ranked as historic.

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