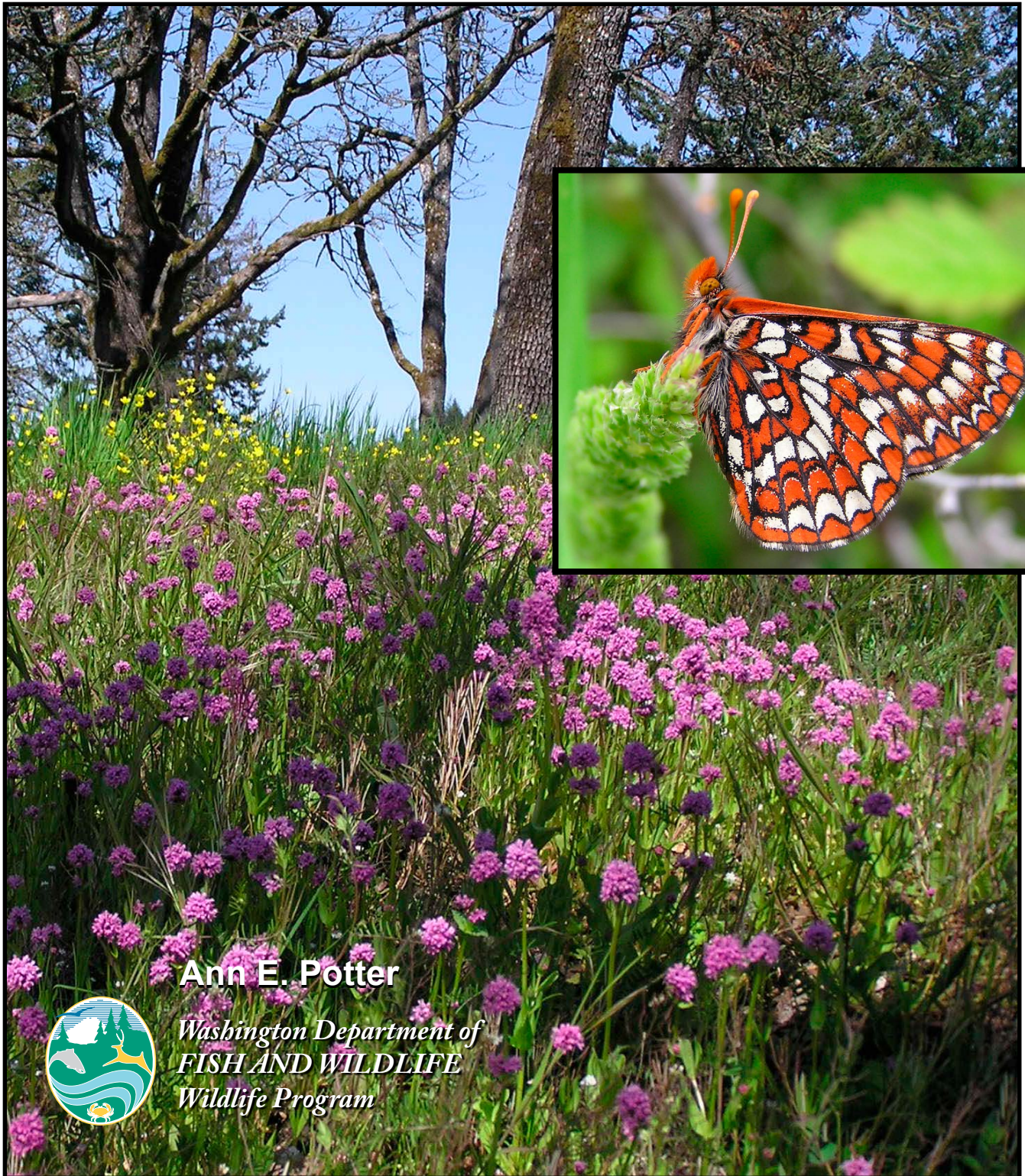


Periodic Status Review for Taylor's Checkerspot



Ann E. Potter



*Washington Department of
FISH AND WILDLIFE
Wildlife Program*

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing by the Washington Fish and Wildlife Commission. The periodic status reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is the Periodic Status Review for Taylor's Checkerspot. It contains a review of information pertaining to the status of the species in Washington. It was reviewed by species experts and was available for a 90-day public comment period. All comments received were considered during the preparation of the final periodic status review. The Department intends to present the results of this periodic status review to the Fish and Wildlife Commission at a meeting on 5 August 2016 in Olympia.

This report should be cited as:

Potter, A. E. 2016. Periodic status review for Taylor's Checkerspot in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 16+iii pp.

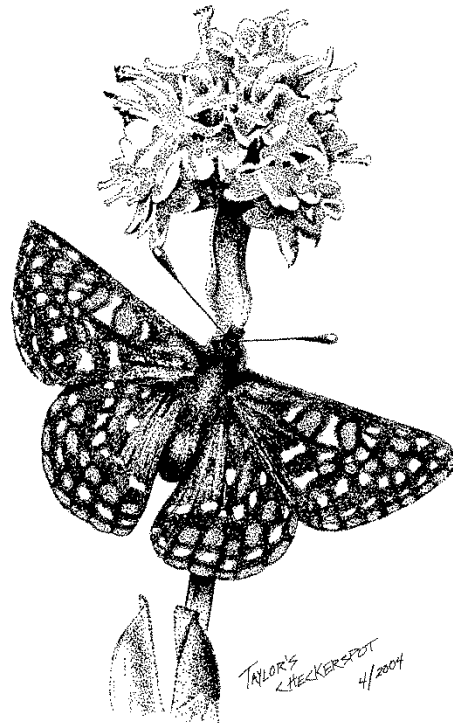
On the cover: Photos of Taylor's Checkerspot and background with *Plectritis* at Nisqually Lake by D. Stinson.
Cover page illustration by Darrell Pruett.



This work was supported in part by personalized and endangered species license plates



PERIODIC STATUS REVIEW FOR TAYLOR'S CHECKERSPOT



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July 2016

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ACKNOWLEDGEMENTS

The careful work and study of many biologists and researchers provided information vital to assessing the status of Taylor's Checkerspot. This report was improved by reviews and constructive comments from Joseph Buchanan, Dave Hays, Mary Linders, Anita McMillan, Robert M. Pyle, Paul Severns, Derek Stinson, and Theodore Thomas. We thank Derek Stinson for cover and distribution map design.

EXECUTIVE SUMMARY

The Taylor's Checkerspot, a Pacific Northwest endemic butterfly, was historically found in grassland habitats from southeastern Vancouver Island, British Columbia, south through the Puget Trough in western Washington, and into the southern Willamette Valley in Oregon. Its distribution included 45 documented locations in Washington from the San Juan Islands south to the Cowlitz River in Lewis County. Today, the butterfly is restricted to 11 known populations: eight in Washington, one in British Columbia, and two in Oregon. Current distribution within Washington is greatly reduced from historical and limited to two geographically isolated areas; the south Puget Sound region (Pierce County), and the northeastern Olympic Peninsula (eastern Clallam County). In addition to the eight naturally occurring populations, efforts to reintroduce the butterfly are underway at four sites in the south Puget Sound region. Taylor's Checkerspot was listed as an endangered species by the Washington State Fish and Wildlife Commission in 2006, the Committee on the Status of Endangered Wildlife in Canada in 2011, and the U.S. Fish and Wildlife Service in 2013.

When listed endangered by the Washington Fish and Wildlife Commission in 2006, Taylor's Checkerspot was known to occur on 10 Washington sites in Clallam, Pierce, and Thurston counties. In the decade that has passed since the original Washington status review, extirpation of the butterfly has been observed on seven of the 10 sites. Also during this decade, searches continued for Taylor's Checkerspot in previously unsurveyed landscapes on the Olympic Peninsula, and five new sites were located within Olympic National Forest. Despite continued exploratory searches to locate additional populations, none have been found since 2009.

Grassland dependent butterflies in the Willamette Valley-Puget Trough-Georgia Basin ecosystem, including Taylor's Checkerspot, have declined dramatically due to widespread habitat degradation and loss of prairie-oak ecosystems from development, invasive species, and loss of beneficial disturbance mechanisms. Habitat enhancement efforts for Taylor's Checkerspot since 2006 have been significant, however, the amount of fully-restored habitat relative to need is low, and the configuration of habitat remains fragmented and isolated.

Due to the small number of mostly isolated populations, continued threats to habitat from invasive native and non-native plants, and vulnerability to severe weather events, Taylor's Checkerspot remains threatened with extinction throughout its range in Washington. As such, we recommend the current listing status of endangered be retained.

INTRODUCTION

The Taylor's Checkerspot, a Pacific Northwest endemic butterfly, was historically found in grassland habitats from southeastern Vancouver Island, British Columbia, south through the Puget Trough in western Washington, and into the southern Willamette Valley in Oregon. Its distribution included 45 documented locations in Washington from the San Juan Islands south to the Cowlitz River in Lewis County (Stinson 2005). Today, the butterfly is restricted to 11 known populations: eight in Washington, one in British Columbia, and two in Oregon. Taylor's Checkerspot was listed as an endangered species by the Washington State Fish and Wildlife Commission in 2006, the Committee on the Status of Endangered Wildlife in Canada in 2011 (COSEWIC 2011), and the U.S. Fish and Wildlife Service in 2013 (USFWS 2013).

This periodic status review summarizes the biology, population status, threats, and recent management actions for Taylor's Checkerspot in Washington. It also assesses whether the species should retain its current endangered status under state law or be reclassified. New information has been collected and significant actions have been undertaken to recover the butterfly since Washington State's listing.

SPECIES BACKGROUND

Description and taxonomy. Taylor's Checkerspot (*Euphydryas editha taylori*, W.H. Edwards, 1888) is a medium-sized butterfly with a striking checkered pattern of orange to brick red, black, and cream (Fig.1). A subspecies of Edith's Checkerspot; three additional Edith's Checkerspot subspecies occur within Washington (*colonia*, *beani*, and *edithana*). A recent study of Taylor's Checkerspot genetics analyzed samples from most of the Oregon and Washington sites, and found strong DNA evidence for five genetically distinct populations, including four in Washington (Severns et al. 2013). However, further study will be necessary to conclusively address questions on the phylogeny and population genetics of Taylor's Checkerspot.

Two additional subspecies of *Euphydryas editha* are also recognized as imperiled butterflies: the long-studied Bay Checkerspot (*Euphydryas editha bayensis*), located in

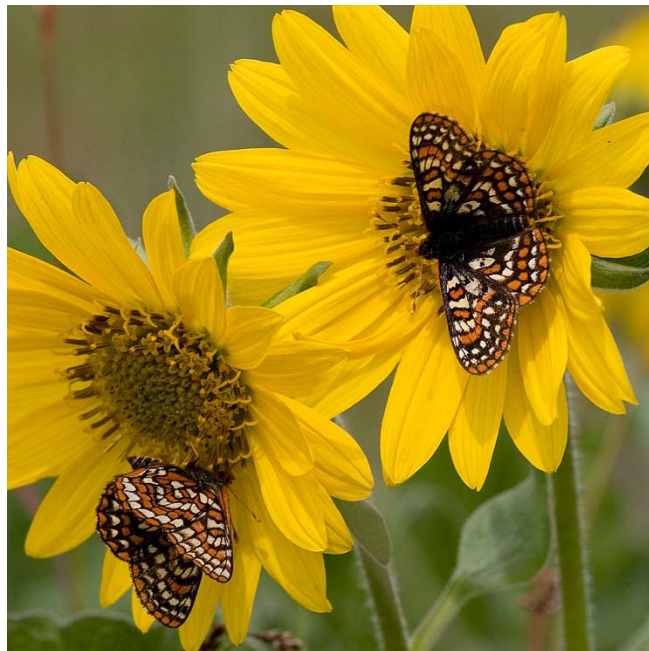


Figure 1. Taylor's Checkerspots feeding on floral nectar from Puget Balsamroot. Photo by Rod Gilbert.

coastal northern California is federally threatened (USFWS 1998), and the Quino Checkerspot (*Euphydryas editha quino*) of southern California is federally endangered (USFWS 2003).

Distribution. Taylor’s Checkerspot, a Pacific Northwest endemic butterfly, has been documented on over 80 locations in the Willamette Valley, Oregon, western Washington, and southern Vancouver Island, British Columbia, Canada (Stinson 2005, Ross 2006, Holtrop 2010), and throughout its range was certainly more widespread than historical records alone indicate. In British Columbia, Taylor’s Checkerspot occupied at least 24 prairie-oak and coastal meadow sites on southern Vancouver Island, and adjacent islands, but today persists on only one site (COSEWIC 2011). In Oregon, the butterfly was historically documented on over 14 sites in the Willamette Valley; today only two are extant (Stinson 2005, Ross 2006).

For the purpose of this document, the terms “site” and “population” are interchangeable; both refer to groupings of butterflies that are largely or completely separate from one another. In general, multiple Taylor’s Checkerspot localities <1 mile (1.6 km) apart are considered a single site (or population). Sites that exist (or existed) in proximity to other sites (1-3 miles) likely have occasional dispersion or exchange of individuals, however, even for such close neighboring sites interchange is thought to be low.

In Washington, Taylor’s Checkerspot has been found on a total of 45 sites; one each in San Juan and Island counties, 11 in eastern Clallam County, and 32 in the south Puget Sound region (Lewis, Mason, Pierce, and Thurston counties) (Fig. 2) (Stinson 2005, Holtrop 2010). It occupies grass and herbaceous vegetation habitat found in small forest openings (balds), coastal bluffs and dunes, and large grassland complexes (prairies); uncommon habitats in the forest-dominated landscapes of western Washington.

Surveys and monitoring of Taylor’s Checkerspot historic locales determined by 2004 that the butterfly was extirpated from all previously known sites in lowland Island, Lewis, Mason, and Thurston counties (Stinson 2005). Surveys in Pierce County, found only one extant site with a few individuals persisting, however, searches of new areas located a sizable new population in 2004 (Chramiec 2004). The status of the sole documented San Juan County site could not be determined due to access limitations by the private landowner.

When listed endangered by the Washington Fish and Wildlife Commission in 2006, Taylor’s Checkerspot was known to occur on 10 Washington sites in Clallam, Pierce, and Thurston counties (Stinson 2005). In the decade that has

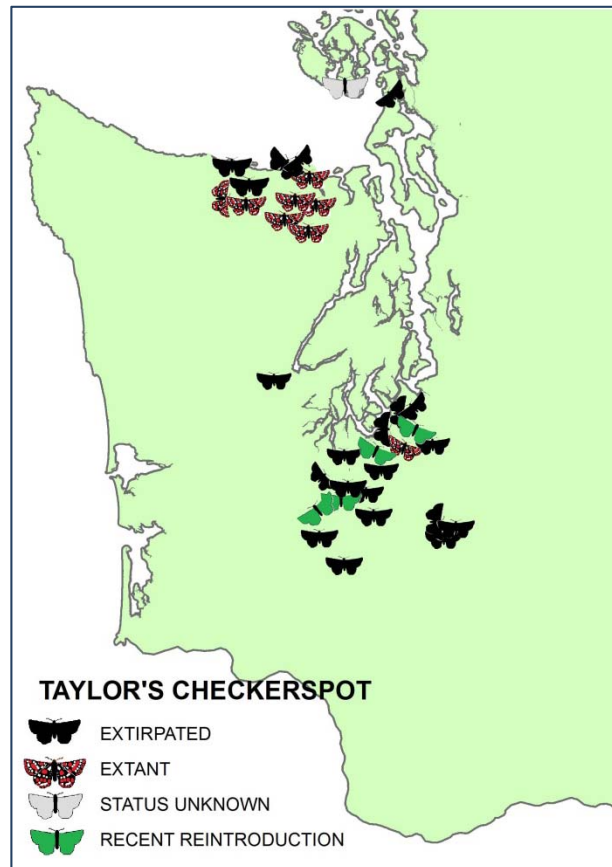


Figure 2. Extirpated, extant, status unknown, and reintroduced populations of Taylor's Checkerspot in Washington.

passed since publication of the Washington status review, extirpation of the butterfly has been observed on seven of the 10 sites (Potter 2011; WDFW unpubl. data). These recent extirpations occurred across the species range in Washington, in both Clallam and Thurston counties. Also during this decade, searches continued for Taylor's Checkerspot in previously unsurveyed landscapes on the Olympic Peninsula, and five new sites were located within Olympic National Forest (Holtrop 2010).

Currently, Taylor's Checkerspot inhabits eight sites in Washington, one in Pierce County within Joint Base Lewis-McChord (JBLM), and seven in eastern Clallam County. Despite continued exploratory searches to locate additional populations in Clallam, Island, Jefferson, Pierce, San Juan, and Thurston counties, none have been found since 2009 (Miskelly and Potter 2005, Holtrop 2010, Potter et al. 2011, WDFW unpubl. data). In addition to the eight naturally occurring extant populations, efforts to reintroduce the butterfly are underway at four sites in the south Puget Sound region, two in Pierce County, within JBLM, and two in southern Thurston County (Linders et al. 2015).

Life cycle and behavior. Taylor's Checkerspot is a univoltine butterfly; each year it completes one life cycle from egg to larva (caterpillar), pupa (chrysalis), and adult (butterfly). They inhabit the same sites year-round, and thus are not migratory.

Adult butterflies, the winged, largest, and often brightly colored life stage, are the reproductive and most mobile phase in the butterfly life cycle. Taylor's Checkerspot butterflies emerge from chrysalids in the spring; April-June depending upon local site and weather conditions. Male butterflies seek mates and defend territories, and females search for suitable host plants and micro-sites for egg-laying (oviposition). Male and female butterflies rely on floral nectar for nutrition and feed from a variety of plants, depending on site condition, often specializing on a few species. For example, in the south Puget Sound region, Taylor's Checkerspot butterflies select the flowers of Common Camas (*Camassia quamash*), Puget Balsamorhiza (*Balsamorhiza deltoidea*), and Nineleaf Biscuitroot (*Lomatium triternatum*) for nectar sources, and in the upland forest balds they frequently use Sea Blush (*Plectritis congesta*) (Jackson 1982, Grosboll 2002, Linders et al. 2015). The adults mate and females subsequently deposit eggs in clusters on plants in the families Plantaginaceae, primarily English Plantain (*Plantago lanceolata*), and Orobanchaceae, primarily Harsh Paintbrush (*Castilleja hispida*). Though there has been no study of adult long-distance movement specific to Taylor's Checkerspot, research on movement in two closely related butterflies, the Bay Checkerspot (*E. editha bayensis*) and Glanville Fritillary (*Melitaea cinxia*) found these butterflies to be consistently sedentary; mark-recapture studies generally observed adult movement <1640 feet (500 meters) (Gilbert and Singer 1973, Harrison 1989, Nieminen et al. 2004). The tightly clustered adult distribution and occupancy patterns observed in Taylor's Checkerspot support the likelihood it too is a highly sedentary butterfly (Bennett et al. 2013, Linders et al. 2015).

Taylor's Checkerspots spend the majority of their lives in the egg, larval, and pupal developmental stages. *Euphydryas editha* eggs hatch in 8-9 days (James and Nunnallee 2011); with the eggs in each cluster typically hatch in synchrony (Barclay et al. 2010). The resulting caterpillars (larvae) create small silk-webbing shelters on their natal plant, and feed gregariously through the spring in the immediate area of their natal site. The larvae grow and expand by shedding and creating new skins in stages that are referred to as instars; *Euphydryas editha* larvae develop through five instar stages (James and Nunnallee 2011). After about one month, in late-June to early-August depending on site conditions, Taylor's Checkerspot larvae enter a dormant phase, termed diapause. This quiescent phase overlaps the time period when host plants are senescing and no longer provide palatable vegetation, and lasts until late the following winter (January to March depending on site conditions). During diapause larvae often shelter under rocks, logs, in soil cracks, plant litter, or duff, and sometimes in the tunnels of ground-nesting bees

and ants (Guppy and Shepard 2001, Fimbel 2009). Upon breaking diapause, larvae reinitiate feeding; post-diapause larvae feed and disperse more broadly than the pre-diapause stage. The oviposition plant species remains a major component of their diet, and additional post-diapause food sources (Sea Blush, Blue-eyed Mary (*Collinsia parviflora*), and Dwarf Owl-clover (*Triphysaria pusilla*) as available, may also be used. After spending 9-10 months in larval stages, including the over-winter period, they progress into pupae in late-March to early-May. Taylor's Checkerspot larvae select locations on vegetation just above ground level to pupate, and emerge as adults in two to six weeks, the duration dependent on environmental conditions.

Habitat requirements. Taylor's Checkerspots inhabit short-stature grasslands in low-elevation prairies, meadows, coastal bluffs, and stabilized dunes; montane meadows, old forest clearings, and balds. Balds are shallow-soiled sites within a forested landscape, dominated by grass, herbaceous vegetation, or lichen and moss, and typically less than 12 acres (5 ha) in size (Chappell 2006). The remaining Taylor's Checkerspot populations in Washington inhabit a variety of conditions: six occur in balds, old forest clearings, and forest road edges between 800 and 4,000 feet elevation (244-1219 meters), within forests of the northeastern Olympic Peninsula; a single coastal population is extant near Sequim, which uses stabilized dune habitat; and the sole population in the south Puget Sound region inhabits a large native grassland (prairie) site. Though sites used by Taylor's Checkerspots occur across a variety of elevations and vegetation types, their habitat is consistently short-stature grass and herbaceous vegetation with an open structure, bare ground, and an abundance of host plants.

The habitat selected for egg-laying (oviposition) by Taylor's Checkerspots has been studied on several sites in Washington (Severns and Grosboll 2011, Grosboll 2011), Oregon (Severns and Warren 2008, Severns 2009), and British Columbia (Page et al. 2009). The attributes of butterfly oviposition habitat are vital to understand because this specialized habitat is often a limiting factor, has specific characteristics that are selected for or avoided by females, determines the location of pre-diapause larvae, and influences the location of diapause, post-diapause larvae, and pupation, and thereby directly influences survival (Singer 2004). Severns and Warren (2008) found Taylor's Checkerspots in Oregon selected habitat for egg-laying that occurred within high cover of short-stature native bunchgrasses and adult nectar resources, indicating females select egg-laying sites based on habitat condition. The study population in British Columbia had multiple host plant species available and females' selection of egg-laying sites in this environment was influenced by host plant phenology and condition (Page et al. 2009). 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 host plants (Page et al. 2009, Severns and Grosboll 2011, Grosboll 2011). Severns and Grosboll (2011) found the butterfly oviposited more frequently along two-track road edges on two sites, and explained this may be due to the strong association between the host plant at these sites (English Plantain) and the road beds. Page et al. (2009) found the most common activity of post-diapause larvae was basking and perching, demonstrating the importance of thermal characteristics in habitat for this life stage. Another key habitat component is diversity of floral nectar resources. Floral nectar abundance affects reproductive success in checkerspots (Murphy et al. 1983) and reliance on single nectar species is risky as variation in both butterfly and plant phenologies may result in a single nectar species not being available during all or a portion of the adult life stage.

POPULATION STATUS AND TREND

The Taylor's Checkerspot has experienced a population decline across its entire range. This decline accompanied the loss of native, low-elevation, open grass and forb dominated habitats. As with other grassland-dependent species in western Washington, forest encroachment together with invasion by non-native grass and forb species and human development pressures have reduced and degraded Taylor's Checkerspot habitat (Stinson 2005, Schultz et al. 2011, USFWS 2013). Although historically documented from over 80 sites rangewide, including 45 sites in Washington, the butterfly occurs today on only 11 sites rangewide. Washington plays a critical role in the conservation and recovery of Taylor's Checkerspot, as eight of the extant sites occur within our state.

Butterfly monitoring, to assess adult abundance and within site distribution is conducted annually on the eight remaining Taylor's Checkerspot populations. Monitoring results from the Clallam County sites indicate population sizes of more than 1000 butterflies on three sites, more modest numbers of at least several hundred on three, and possibly fewer than 100 adults on one site (Holtrop 2010, WDFW unpubl. data). Based on a comparison of annual peak butterfly counts, numbers on two extant Clallam County sites appear to have increased during the 10 year monitoring period. The sole extant south Sound population is located within the Joint Base Lewis-McChord Artillery Impact Area; monitoring data from this site has followed a robust population, with estimated peak daily adult numbers between 1,000-10,000 butterflies in each of the last five years (Linders et al. 2015).

Recently, a captive-rearing and reintroduction program in the south Puget Sound region has added to the number of sites inhabited by the butterfly; releases are underway on four primary sites, and at least one site currently shows promise for meeting establishment criteria (Linders et al. 2015). Butterfly response on these sites has varied, most likely influenced by habitat conditions, weather events, and the number of years of reintroduction. On one reintroduction site, over 1,000 adults have been estimated in single day surveys for the last four years (2012-2015) (Linders et al. 2015, M. Linders pers. comm.). Monitoring on a second site has estimated peak daily adult numbers greater than 100 butterflies in 2013-2015, and small numbers of butterflies have been detected on two sites with recently initiated reintroductions.

FACTORS AFFECTING CONTINUED EXISTENCE

Prairie-oak butterfly species in the Willamette Valley-Puget Trough-Georgia Basin (WPG) ecosystem have declined dramatically due to widespread habitat degradation and loss of prairie-oak ecosystems in the region (Pyle 1989, Schultz et al. 2011). For an extensive discussion of threats to Taylor's Checkerspot see Stinson (2005) and USFWS (2013).

Habitat loss and fragmentation. Habitat loss is the most common threat to butterfly populations (New et al. 1995). Grasslands in western Washington have been lost to development, agriculture, resource extraction, and vegetation succession to forest from wildfire suppression and cessation of regular burning by Native Americans. Crawford and Hall (1997) conservatively estimated more than 148,000 acres (60,000 ha) of prairie existed historically in the south Puget Sound region, and native grassland vegetation occurred on only 3% of that area. Both the number and size of prairies in the south Puget Sound region

have declined. Historically there were 233 prairies, averaging 618 acres (250 ha) in size, including 18 large prairies (>1000 acres (405 ha)), in contrast in 1997 there were 29 prairies, averaging 432 acres (175 ha) in size, with only 2 large prairies extant (Crawford and Hall 1997). Chappell et al. (2001) refined the assessment of historical grassland for the entire WPG ecoregion, and estimated the total amount of prairie, oak woodland, and grassland bluffs and balds prior to Euro-American settlement was over 180,000 acres (72,000 ha). Checkerspot butterflies are also impacted by fragmentation of their habitat (Hellmann et al. 2004). Habitat fragmentation results in smaller and isolated populations, thereby increasing the likelihood of extirpation and inbreeding. Habitat loss and fragmentation has also been documented for the montane balds and meadow grasslands Taylor's Checkerspot inhabits (Thompson 2007, Takaoka and Swanson 2008).

Invasive species. In addition to encroachment by native trees and shrubs, non-native invasive plants have dramatically altered the ecological function of Pacific Northwest grasslands (Dunwiddie and Bakker 2011). Non-native woody shrubs, especially Scot's broom (*Cytisus scoparius*), and non-native grasses have invaded most of the remaining south Puget Sound prairies. Uncontrolled, these plants overwhelm native grassland vegetation, including Taylor's Checkerspot larval and nectar plants, and alter vegetation structure and composition, soil condition, thermal characteristics, and plant availability. In a study of Taylor's Checkerspot habitat in the Willamette Valley, Oregon, Severns and Warren (2008) found tall invasive grasses deterred egg-laying and reduced cover of larval and nectar plants.

Long-term lack of beneficial disturbance. The prairies and oak woodlands of the Puget Sound region are the result of glacial history, climate conditions, especially the warm, dry climatic period between 9,000 and 4,000 B.P. (Holocene Climate Optimum or Hypsithermal), topography, and human interaction (Ewing 1997, Crawford and Hall 1997). Human history played a role, as Native Americans regularly set fire to grasslands in the Pacific Northwest to support food production and manage hunting sites and this process supported the development and maintenance of open grasslands and savannah (Norton 1979, Boyd 1986, Agee 1993). Soil disturbance on prairies regularly occurred from both Native American harvest of bulbs and rhizome plant material (Turner 1999) and the activity of burrowing mammals, especially the Mazama Pocket Gopher (*Thomomys mazama*) (Huntly and Inouye 1988). Cultural practices changed when Euro-Americans settled the Pacific Northwest prairies and began to restrict burning; soil and vegetation disturbance from fires and prairie plant harvesting ceased. The resulting encroachment by trees and shrubs, first native species and then non-native, combined with the introductions of invasive grasses and herbaceous plants, resulted in the conversion of some prairie grassland to forest, and dramatic alterations to remaining prairies. In the montane Taylor's Checkerspot settings, wildfire suppression has greatly reduced and fragmented bald and meadow habitats (Thompson 2007).

Grassland restoration. Restoring prairie habitat is a difficult and time-intensive endeavor, essential to recovery of Taylor's Checkerspot and the prairie ecosystem, including other imperiled prairie plants and wildlife. Fire, herbicide use, mowing, and other grassland habitat management tools are important for recreating or simulating disturbance mechanisms that historically maintained prairies, reducing invasive species, and restoring endangered species habitat connectivity (Dunwiddie and Bakker 2011, Schultz et al. 2011). However, these habitat management practices can also be harmful directly or indirectly to butterflies (Schultz et al. 2011). Conducting invasive species control and the requisite prairie disturbance (from fire or mowing) on lands inhabited by Taylor's Checkerspot must be done with a deliberate and careful approach (Schultz and Crone 1998, Schultz et al. 2011).

Military training. The sole source population for Taylor's Checkerspot captive rearing and reintroduction, and the only other south Sound site that currently supports a robust Taylor's Checkerspot population (from a recent reintroduction) are located within the Artillery Impact Area (AIA) of Joint Base Lewis-McChord. Frequent, low-intensity fires resulting from regular ordnance explosion have maintained short-stature vegetation and native grasslands in portions of the AIA, including key patches of Taylor's Checkerspot habitat. However, the frequency and type of use in the AIA (and JBLM) has changed and likely will continue to change over time. In recent years, development within the AIA increased the footprint and intensity of use of roads and structures within Taylor's Checkerspot occupied areas (USFWS 2013). The recent establishment of roads, buildings, and other structures in occupied areas, along with the accompanying vehicular and foot traffic affect Taylor's Checkerspots directly and reduced habitat amount and quality. Vehicle traffic results in direct mortality by crushing eggs, larvae, pupae, and adults (USFW 2013). The impact of disturbance from establishing roads and structures within occupied Taylor's Checkerspot habitat is increased due to the subsequent rapid establishment of a primary host plant, English Plantain, in high-density in disturbed sites, roadbeds, and road edges, creating an attractive but highly vulnerable habitat for egg-laying.

English Plantain pathogen. A fungal pathogen specific to the primary Taylor's Checkerspot host species, English Plantain, has recently been found infecting English Plantain on Taylor's Checkerspot sites in Oregon (Stone et al. 2011) and Washington (P. Severns, pers. comm.).

This fungal pathogen (*Pyrenopeziza plantaginis*) like the plant it specifically attacks, is native to Europe, and was first documented in the Pacific Northwest (and North America) in 2011 – though the length of time it has been present in these regions is unknown (Stone et al. 2011). Peak necrosis of plantain leaves resulting from infection occurs in late-winter and can overlap with the Taylor's Checkerspot post-diapause larval period (Stone et al. 2011), a time when the plant is needed in abundance to feed larvae.

Metapopulation structure and small population sizes. A metapopulation is a collection of multiple populations occupying spatially distinct patches, with individual animals moving among patches. Studies of the movement and population dynamics of checkerspot butterflies were foundational in the development of metapopulation theory and found that many checkerspot butterfly populations function in this construct (Nieminen et al. 2004).

Loss of habitat patches, along with habitat fragmentation and isolation, upset stability of metapopulations and can cause a cascade of extirpations. Small, isolated populations are at high risk of extirpation from habitat factors, weather extremes, increased mortality from human impacts, and inbreeding. In small populations, a substantial fraction of checkerspot females may remain unmated (Nieminen et al. 2004). The persistence of *Euphydryas editha* butterflies is greatly benefited by protection and maintenance of viable metapopulations that include key source populations as well as smaller populations that allow the re-colonization of vacant patches to continue (Harrison 1989). Modeling by Hellmann et al. (2004) suggested viable *Euphydryas editha* metapopulations should consist of at least 15-20 habitat patches. Little is currently known of the population structure on Taylor's Checkerspot sites; however, long-term recovery of the subspecies may require protection and management of landscapes capable of supporting metapopulations.

Weather. Weather is a well-known driver of butterfly population dynamics (Wallis de Vries et al. 2011) including checkerspots' (Weiss et al. 1993; McLaughlin et al. 2002). Recent observations of localized extinctions and mortality of reintroduced larvae occurring during weather events and cycles suggest Taylor's Checkerspot may be sensitive to weather conditions. A better understanding of weather effects

on Taylor's Checkerspot population dynamics could be used to improve habitat management actions and butterfly reintroduction strategies (Weiss et al. 2013).

Knowledge gap: habitat requirements. Knowledge of habitat needs for adults, larvae, and diapause are essential elements to conserving and managing Taylor's Checkerspot (Schultz et al. 2011). The lack of information for several key habitat elements, particularly the effect of habitat and host plant assemblages on larval survival, reduces the effectiveness of habitat enhancement and other recovery efforts.

MANAGEMENT ACTIVITIES

Several land and wildlife management agencies in Washington are actively engaged in management for the conservation of Taylor's Checkerspot, including Washington Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (USFWS), Joint Base Lewis-McChord, Center for Natural Lands Management, Department of Natural Resources, and Olympic National Forest.

WDFW has conducted and led conservation actions for Taylor's Checkerspot since the butterfly's imperiled status was recognized in the 1990's (Pyle 1989). WDFW actions have included promotion of Taylor's Checkerspot conservation with land management and conservation agencies, management of WDFW lands to protect the butterfly and restore their habitat, surveys to determine the current distribution and status of historical sites, leading the captive-rearing and reintroduction program, and land acquisition for the butterfly and other threatened and endangered native grassland species in western Washington.

Currently, there is no state or federal recovery plan for Taylor's Checkerspot, although USFWS recently initiated development of a federal recovery plan. A rangewide Action Plan is updated annually by the Taylor's Checkerspot Working Group to prioritize a list of short-term (2-3 year) conservation actions. In addition, WDFW recently prepared a two-year Action Plan for Taylor's Checkerspot in September 2014 (WDFW 2014). The purpose of the document is to help direct conservation actions in Washington until a more complete recovery plan can be developed.

Management plans. Management plans for Taylor's Checkerspot have been developed by a number of landowners and managers throughout Washington. In the south Puget Sound region, site specific management plans outlining actions to enhance habitat have been written by a team of prairie land managers with input from species technical specialists. The plans encompass eight sites being managed in part for Taylor's Checkerspot by the Department of Natural Resources, WDFW, Thurston County, and private landowners. Olympic National Forest, in partnership with WDFW, developed a management plan for Taylor's Checkerspot in 2013. The primary goals of this plan are to protect occupied sites, improve habitat quality, and increase the amount of habitat in the old forest clearings and balds inhabited by the butterfly. Joint Base Lewis-McChord has developed an integrated management plan that outlines conservation measures for Taylor's Checkerspot over the next decade.

Following state listing of Taylor's Checkerspot as endangered in 2006, the Forest Practices Board (FPB) determined there was sufficient potential risk to the butterfly from forest practices to warrant specific rule making. Stakeholders subsequently recommended and the FPB adopted a strategy of voluntary protection combined with the Washington Department of Natural Resources' forest practices conditioning authority. Management plans were identified by the FPB as a mechanism for forest landowners wanting to streamline forest practice permit review, and have been developed by the five commercial forest

landowners with lands occupied by Taylor's Checkerspot. The plans primarily address protection measures to be employed when forest practices occur in close proximity to Taylor's Checkerspot sites.

Habitat enhancement. Butterfly conservation is usually best accomplished through habitat management and protection (New et al. 1995). Habitat enhancement efforts have been undertaken by several agencies on many current and historic Taylor's Checkerspot sites in Washington. Enhancement activities include controlling invasive weeds, non-native grasses, woody shrubs, and trees through the use of prescribed fire, mowing, and herbicide. Host and key nectar plants are being augmented (or introduced) on sites, and this activity is supported by the recent development of large-scale seed and whole plant resource facilities by the Center for Natural Lands Management, JBLM, and USFWS.

Habitat management at six of the seven Taylor's Checkerspot sites located on the northeastern Olympic Peninsula has emphasized removal of trees and shrubs encroaching on habitat, and controlling invasive weeds. In the south Puget Sound region, habitat management for Taylor's Checkerspot is a component of integrated conservation efforts for native prairies and the many additional prairie-associated species and the vegetation systems they support. Most south Puget Sound prairie sites formerly occupied by Taylor's Checkerspot no longer support significant patches of butterfly host and nectar plants, and have been invaded by weedy, non-native grasses and forbs.

Habitat enhancement to support reintroduction of Taylor's Checkerspot in this region is a primary action of the Joint Base Lewis-McChord Army Compatible Use Buffer Program (JBLM ACUB). The JBLM ACUB program has brought together prairie restoration and species conservation partners from the south Puget Sound region for a decade to prioritize and fund species recovery efforts on lands outside of JBLM, including habitat enhancement for Taylor's Checkerspot. The JBLM Wildlife Program supports complementary restoration efforts on prairies within JBLM. WDFW, the Department of Natural Resources, Center for Natural Lands Management, and other private landowners also manage key prairie sites for the butterfly in the south Puget Sound region, utilizing funding from ACUB, Natural Resources Conservation Service, and USFWS. The Washington Wildlife and Recreation Coalition state lands restoration and enhancement program also support this work on WDFW and WDNR properties. The scale and success of prairie restoration in this region has been significant and several sites now offer opportunity for Taylor's Checkerspot reintroduction.

Taylor's Checkerspot monitoring. Butterfly monitoring has contributed to conservation of Taylor's Checkerspot by discovering new populations, verifying local extirpations, providing a gauge to assess population robustness and vulnerability and understand populations' capacity to fluctuate, identifying annual and site specific variation in adult timing, assessing effectiveness of restoration, locating unoccupied host plant patches within extant sites for habitat enhancement, and determining the number of individuals that can safely be taken for captive-rearing efforts. Monitoring of adults Taylor's Checkerspots to determine population status, assess adult abundance and within-site distribution is conducted annually on the eight remaining Taylor's Checkerspot populations. Populations in Clallam County are monitored by biologists from Olympic National Forest, WDFW, and a private landowner. South Puget Sound region populations, including reintroduction sites, are intensively monitored by WDFW (Olson and Linders 2010, Linders et al. 2015).

Captive rearing and reintroduction. A major component of recovery in the south Puget Sound region is the Taylor's Checkerspot captive rearing and reintroduction project (Linders 2006, Linders et al. 2015). Given the persistence of only one population in this region and the butterfly's sedentary nature, reintroductions are necessary to re-establish populations. This project is closely coordinated with prairie habitat enhancement actions, and the current objective is to establish at least three Taylor's Checkerspot

populations. Since 2006, over 20,000 larvae and hundreds of adult butterflies have been released, primarily at four primary reintroduction sites. Re-establishing butterfly populations takes time; the current plan calls for releasing larvae (primarily post-diapause stage) at each site for five consecutive years. Reintroduced populations are considered “established” when solely through natural reproduction at least 250 adults are estimated in a single day survey for five consecutive years, and the area occupied is >50 acres (20 ha). To date, two reintroduced populations have demonstrated recruitment success over multiple years (without the addition of new individuals), and at one of those >250 butterflies have been detected for four consecutive years. Taylor’s Checkerspots are collected annually from the sole south Sound source site and reared at the Oregon Zoo in Portland, Oregon, and Mission Creek Corrections Center for Women (Washington Department of Corrections) in Belfair, Washington, the latter effort is through The Evergreen State College’s Sustainability in Prisons Project.

Conservation partners and cooperators: Center for Natural Lands Management, The Evergreen State College Sustainable Prisons Project, Joint Base Lewis-McChord, Mission Creek Corrections Center for Women (Washington Department of Corrections), Oregon Zoo, Thurston County, University of Washington, U.S. Department of Defense, U.S. Fish and Wildlife Service, U. S. Forest Service-Olympic National Forest, U.S. Natural Resources Conservation Service, Washington Department of Natural Resources, Washington State University-Vancouver, Washington Wildlife and Recreation Program, Weyerhaeuser, Wolf Haven International, The Xerces Society for Invertebrate Conservation.

CONCLUSIONS AND RECOMMENDATIONS

Taylor’s Checkerspot, a Pacific Northwest endemic butterfly, was historically documented on 45 sites throughout western Washington and today occurs on only eight. At the time the butterfly was listed as endangered in Washington by the Fish and Wildlife Commission (2006), it was known extant on 10 sites. Localized extinctions have continued since 2006, likely due to continued degradation and loss of habitat and small populations sizes. The U.S. Fish and Wildlife Service listed Taylor’s Checkerspot as endangered in 2013, citing the primary long-term threat as “loss, conversion, and degradation of habitat, particularly as a consequence of agricultural and urban development, successional changes to grassland habitat, and the spread of invasive plants”. The legacy of degraded grassland habitats will require a long-term commitment to restore, and butterfly reintroductions will be necessary to recover Taylor’s Checkerspot in much of its range. Although a committed collective of agencies and individuals have made tremendous efforts and progress to address threats and recover this species in Washington, its persistence remains tenuous. Due to the small number of mostly isolated populations, continued threats to habitat from invasive native and non-native plants, and vulnerability to severe weather events, Taylor’s Checkerspot remains threatened with extinction throughout its range in Washington. As such, we recommend the current listing status of endangered be retained.

REFERENCES CITED

The references cited in the *Periodic Status Review for Taylor's Checkerspot* are categorized for their level of peer review pursuant to section 34.05.271 RCW, which is the codification of Substitute House Bill 2661 that passed the Washington Legislature in 2014. A key to the review categories under section 34.05.271 RCW is provided in Table A. References were categorized by the author in July 2016.

Individual papers cited cover a number of topics discussed in the report, including information on: 1) the species' description, taxonomy, distribution, and biology; 2) habitat requirements; 3) population status and trends; 4) conservation status and protections; 5) research, monitoring, and restoration activities; and 6) factors affecting the continued existence of the species.

Table A. Key to 34.05.271 RCW Categories:

Category Code	34.05.271(1)(c) RCW
i	(i) Independent peer review: review is overseen by an independent third party.
ii	(ii) Internal peer review: review by staff internal to the department of fish and wildlife.
iii	(iii) External peer review: review by persons that are external to and selected by the department of fish and wildlife.
iv	(iv) Open review: documented open public review process that is not limited to invited organizations or individuals.
v	(v) Legal and policy document: documents related to the legal framework for the significant agency action including but not limited to: (A) federal and state statutes; (B) court and hearings board decisions; (C) federal and state administrative rules and regulations; and (D) policy and regulatory documents adopted by local governments.
vi	(vi) Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under the processes described in (c)(i), (ii), (iii), and (iv) of this subsection.
vii	(vii) Records of the best professional judgment of department of fish and wildlife employees or other individuals.
viii	(viii) Other: Sources of information that do not fit into one of the categories identified in this subsection (1)(c).

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PERSONAL COMMUNICATIONS

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APPENDIX A. PUBLIC COMMENTS ON THE DRAFT PERIODIC STATUS REVIEW

	Comment and response
General comments	<p>I strongly agree there's been a precipitous decline in habitat for most prairie species. However, I have two questions and concluding comments:</p> <p>1) Have adequate surveys been conducted on public AND private lands and rights of ways (such as powerline corridors) during the correct flight season to confirm the population is indeed low.</p> <p>2) Has habitat restoration in extirpated sites/populations been attempted to try to restore the population of butterflies in these sites/populations?</p> <p>I encourage the commission to consider funding more surveys in suitable potential habitat before listing as endangered. I encourage the commission to consider funding habitat restoration in extant and extirpated locations to ascertain whether they reappear.</p>
	<p><i>Surveys for Taylor's Checkerspot are indeed key to understanding their distribution. Extensive searches for this butterfly and its potential habitat have been conducted in Washington over the past 20 years, primarily by WDFW, and in addition the US Forest Service, Joint Base Lewis-McChord, and several local lepidopterists; many of these searches were done prior to the 2006 state listing. As a medium-sized, boldly colored butterfly, Taylor's Checkerspot is fairly easy to detect, and public outreach has resulted in several credible reports, though to date all have been from known populations. Taylor's Checkerspot occurs in two regions within Washington: the south Puget Sound region and Clallam County. It is possible a previously undiscovered population could be located; this is more likely to occur in Clallam County, and highly unlikely in the south Puget Sound region. The existence or discovery of a few additional populations in Clallam County, although hopeful, would not significantly change the status of this butterfly.</i></p> <p><i>Habitat management and restoration, critical to recovering Taylor's Checkerspot, is underway on most current and several historic sites. However, since the butterfly is highly sedentary, suitable habitat will be reoccupied only if within close proximity (<1/2 mi) to extant populations. Given the small number and isolated condition of extant populations, especially in the south Puget Sound region, habitat management alone cannot bring back this butterfly.</i></p> <p><i>Thank-you for your support and recognition of the importance of butterfly surveys and habitat management.</i></p>

WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

Status Reports

2015	Tufted Puffin
2007	Bald Eagle
2005	Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot
2005	Aleutian Canada Goose
2004	Killer Whale
2002	Peregrine Falcon
2000	Common Loon
1999	Northern Leopard Frog
1999	Olympic Mudminnow
1999	Mardon Skipper
1999	Lynx Update
1998	Fisher
1998	Margined Sculpin
1998	Pygmy Whitefish
1998	Sharp-tailed Grouse
1998	Sage-grouse
1997	Aleutian Canada Goose
1997	Gray Whale
1997	Olive Ridley Sea Turtle
1997	Oregon Spotted Frog
1993	Larch Mountain Salamander
1993	Lynx
1993	Marbled Murrelet
1993	Oregon Silverspot Butterfly
1993	Pygmy Rabbit
1993	Steller Sea Lion
1993	Western Gray Squirrel
1993	Western Pond Turtle

Periodic Status Reviews

2016	Streaked Horned lark
2016	Killer Whale
2016	Greater Sage-grouse
2016	Snowy Plover
2016	Northern Spotted Owl
2016	Western Gray Squirrel
2015	Steller Sea Lion
2015	Brown Pelican

Recovery Plans

2012	Columbian Sharp-tailed Grouse
2011	Gray Wolf
2011	Pygmy Rabbit: Addendum
2007	Western Gray Squirrel
2006	Fisher
2004	Sea Otter
2004	Greater Sage-Grouse
2003	Pygmy Rabbit: Addendum
2002	Sandhill Crane
2001	Pygmy Rabbit: Addendum
2001	Lynx
1999	Western Pond Turtle
1996	Ferruginous Hawk
1995	Pygmy Rabbit
1995	Upland Sandpiper
1995	Snowy Plover

Conservation Plans

2013	Bats
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Status reports and plans are available on the WDFW website at:
<http://wdfw.wa.gov/publications/search.php>



