
Workshop Proceedings
January 28th - 30th, 2014

**Conservation and
management of three
imperiled West Coast
butterflies: Bay, Quino,
and Taylor's checkerspots**

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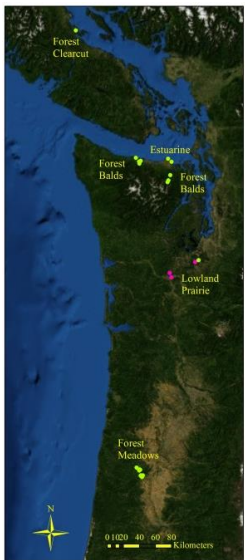
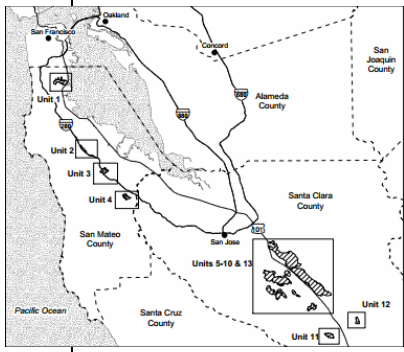
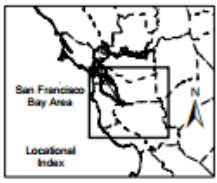
Washington
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**FISH and
WILDLIFE**



Support for this workshop provided by Center for Natural Lands Management, Creekside Science, and the Xerces Society for Invertebrate Conservation, as well as Disney Wildlife Conservation Fund, Turner Foundation, the Santa Clara County Open Space Authority, and the US Fish and Wildlife Service.

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Edith's checkerspot butterfly (<i>Euphydryas editha</i>) Subspecies of focus			
Sub-species	Taylor's (<i>taylori</i>)	Bay (<i>bayensis</i>)	Quino (<i>quino</i>)
Adult	 Photo: Rod Gilbert	 Photo: Creekside Science	 Photo: Lynn Miller
	 Photo: Mary Linders	 Photo: Creekside Science	 Photo: Andrew Borchert
Abbreviation (as used in this document)	TCB	BCB	QCB
Federal Status	Endangered	Threatened	Endangered
Range (also see map below)	Southwestern British Columbia, Western Washington and Oregon	Santa Clara and San Mateo Counties, California	San Diego and Riverside Counties, California; Northern Baja, Mexico
Range Map/Known Populations	   Only units 3, 5-10, and 13 are known extant BCB populations.  		

“Treat it like an insect, not a grizzly bear”

Takeaways from a Checkerspot Workshop in California

This post originally appeared on the [South Sound Prairies blog](#) in February 2014 and has been modified.

“I can’t stop thinking about my landscape-scale view of the world and how it has been forever modified by the hilltop landscapes of the Bay and Quino checkerspots” (Washington Department of Fish and Wildlife’s Mary Linders, speaking about Taylor’s checkerspot recovery and management). In late January, thirty people traveled from as far as San Diego and Vancouver to gather in San Jose and talk about one thing and one thing only – Edith’s checkerspot butterfly (*Euphydryas editha*). In October 2013 the Taylor’s checkerspot butterfly was [listed as Endangered](#), joining two other listed Editha checkerspot subspecies – the Bay and Quino. With all three coastal subspecies listed, the idea of a workshop for all three conservation communities was put forth and greeted with much enthusiasm.

Occurring in the western Pacific Northwest, Bay area and Southern California, the Taylor’s, Bay and Quino (respectively) share a lot in common. The three subspecies each have a similar life history, occur in grasslands and rocky outcrops with nutrient poor soil, and are threatened by land conversion and habitat degradation. But the way each subspecies has adapted to the different environments and on-the-ground realities have led the butterflies, and the people that are working to protect and restore these populations, down different paths. With so many commonalities playing out in different situations, it was remarkable to bring this wide-ranging group of knowledgeable, experienced and enthusiastic people together in one place to learn from one another. Mary Linders of WA Dept. of Fish and Wildlife said that “Participation in this and similar meetings nationwide has demonstrated the value of face-to-face meetings and a multi-disciplinary approach to promote large-scale conservation while also considering the complexity and nuance of the local biological, physical and socio-political landscapes.” Stu Weiss, of Creekside Science emphasized that the “power of the networking – to see how other people are doing things in terms of practical conservation, is very critical. Each place has its own history and culture and somehow we have to adapt to the need of the butterfly out there.”

[The Center for Natural Lands Management](#), [Creekside Science](#), [Washington Dept. of Fish and Wildlife](#) and the [Xerces Society](#) partnered to host a three-day workshop that brought together individuals from the three conservation communities with a goal to strengthen collective recovery efforts by providing a forum for information sharing and catalyzing priority actions between practitioners working on recovery of each sub-species. As the workshop got underway there were hugs from long ago colleagues and first-time meetings of people who had conversed over phone and email for years.

Over the course of twenty-two [presentations](#) spread across six topics, members of each group presented specific examples of their work, challenges and future plans for checkerspot conservation. Eric Porter from the US Fish and Wildlife Service in Carlsbad, CA found it helpful to learn the history and development of partnerships and conservation strategies from other regions and has been sharing his observations with his team. One of the most common takeaways attendees noted was the evidence of the overwhelming need for active management, even in the face of difficulties due to small population sizes, fragmentation, and regulatory and institutional structures. A lot of discussion about the level of management, such as prescribed fire, mowing, and herbicide use, that can and should be utilized stemmed from the statement “Treat it like an insect, not a grizzly bear”, noting the cognitive



The Taylor's checkerspot butterfly, shown here at Glacial Heritage is one of three federally listed checkerspots on the West coast.



On Day 3, Creekside Science took workshop attendees out to some of their sites, including Coyote Ridge (pictured) to get a feel for the habitat.

dissonance often felt by regulatory bodies and biologists alike about the need to balance survival of individuals against population maintenance and the long term value of improved habitat.

The positive impact of this workshop is already being felt and the group has more activities planned – sharing best practices, an email list, and a white paper generated from the workshop - to name a few. Presentations will be made available and tidbits of information are percolating through the community, but tangible outcomes are expected – and eagerly anticipated - from this workshop. The Quino community is utilizing the excitement from the workshop to rally their colleagues to see a long-

hoped-for Quino Working Group come to fruition. Similar to the Taylor's checkerspot Working Group, the group will allow biologists, land managers and policy makers to talk more frequently and work together more often. Those involved in the [captive rearing and reintroduction work](#) in the South Puget Sound exchanged information with the San Diego Zoo to support their efforts to captive rear Quino for potential future reintroductions. From the habitat management perspective, a white paper will summarize strategies for active habitat management in occupied areas and highlight a collection of case studies.

Perhaps most importantly, this workshop allowed everyone to take a step back and assess their own work, the work of others, and ways we can all improve our efficacy in the future. Substantial time set aside for discussion allowed the group to give serious consideration to an abundance of ideas. It was non-stop checkerspot butterfly talk for 36 hours straight, and rather than see the excitement wane, it grew as people challenged ideas, thoughtfully discussed pros and cons of different approaches and learned of more and more ways their work could be improved. Stu Weiss summed it up best when he said that being able to focus on just checkerspots for a few days with such an interesting smart and committed group of people was “paradise.”

About this Report

The following report provides a more detailed account of the tangible results of the workshop – presentations, discussion threads, action items, project ideas and other information of interest from the workshop. In addition, there are many results from the workshop, such as new relationships, that are intangible, and will be expressed through increased communication between individuals and the three checkerspot communities, as well as improved information exchange. In the pages below look for ***Action Item*** to indicate a proposed idea that will require action on behalf of one or many individuals moving forward. Look for ***Research Question*** to locate specific notes of research needs and ideas. A full list of action items and research questions can be found at the end of this report. To facilitate future communication and outreach, a list of attendees and their affiliations is included here, and contact information has been circulated amongst the group.

Attendees

Subspecies	Name	Affiliation
Baltimore	Jennifer Frye	Maryland Department of Natural Resources
Bay	Lech Naumovich	Creekside Center for Earth Observation
Bay	Christal Niederer	Creekside Center for Earth Observation
Bay	Jimmy Quenelle	Creekside Center for Earth Observation
Bay	Stuart Weiss	Creekside Center for Earth Observation
Bay/Quino	Kailash Mozumder	ICF International
Quino	Ester Chang	San Diego Zoo
Quino	James Gannon	US Bureau of Land Management (BLM)
Quino	Eric Porter	US Fish and Wildlife Service, Carlsbad (FWS)
Quino	Paige Howorth	San Diego Zoo
Quino	Kim Klementowski	Center for Natural Lands Management(CNLM)
Quino	Beau MacDonald	Urban Wildlands Group
Quino	Adam Malisch	Western Riverside Multiple Species Habitat Conservation Plan
Quino	John Martin	US Fish and Wildlife Service, San Diego
Quino	Yvonne Moore	San Diego Management & Monitoring Program (SDMMP)
Quino	Ken Osborne	Osborne Biological Consulting
Quino	Kristine Preston	US Geological Service (USGS)/SDMMP
Quino	Kelli Walker	San Diego Zoo
Taylor's	Hannah Anderson	South Sound Program, CNLM
Taylor's	Scott Hoffman Black	Xerces Society
Taylor's	Patrick Dunn	South Sound Program, CNLM
Taylor's	Peter Dunwiddie	University of Washington/CNLM
Taylor's	Jenny Heron	British Columbia Ministry of the Environment
Taylor's	Karen Holtrop	US Forest Service (USFS)
Taylor's	Elsbeth Hilton Kim	South Sound Program, CNLM
Taylor's	Al Kitzman	Benton County Natural Areas & Parks
Taylor's	Karen Lewis	Oregon Zoo
Taylor's	Mary Linders	Washington Department of Fish and Wildlife
Taylor's	Nick Page	Raincoast Applied Ecology

Executive Summary

The Conservation and Management of Three Imperiled West Coast Butterflies workshop brought together key conservation professionals, and through presentations and discussions, enabled the group as whole to identify strengths, weaknesses, and areas for improvement. Each community supporting the conservation and recovery of federally listed checkerspots – the Taylor's, Bay, and Quino – face different institutional and environmental landscapes. Highlighting the efforts that each group has prioritized or succeeded in, in turn helped to identify where more emphasis was needed on a regional basis and by the group as a whole.

The Taylor's checkerspot conservation community is made up of multiple partners. Habitat enhancement to improve extant populations is being carried out throughout the species range, and research on the subspecies has also been broadly focused. In one portion of the range, emphasis has been placed on land management and increasing the number of populations through captive rearing and reintroduction. This proactive approach is implemented by a suite of conservation partners including local, state, and federal agencies. The recent listing of Taylor's checkerspot means the community is now operating in a new regulatory landscape and recovery efforts may raise new questions and priorities for the group. Protected habitat is owned and managed by local, state and federal agencies as well as nonprofit groups.

The Bay checkerspot conservation community is led for the most part by one organization – Creekside Science. Due to the strength and size of one wild population, captive rearing has not been necessary and direct translocation is being used to increase the number of populations across multiple sites. The Bay checkerspot has been the focus of substantial research by Paul Ehrlich and his students at Stanford University, which is the foundation for much of what is known about Edith's checkerspot today. Multiple outreach efforts to the public as well as to local groups has resulted in good public support. Mitigation funding has enabled acquisition and management of large units of land.

The Quino checkerspot has the most disparate geographic distribution, with the animal occurring at low densities across a wide range of habitat types. Multiple organizations are involved but interaction among groups is not consistent, though coordinated efforts are increasing and the formation of a working group is strongly supported by the community. Regulatory restrictions have limited efforts to monitor and translocate the species, though a captive rearing pilot project has the potential to support reintroduction in the future. Quino has also been the focus of substantial research, and like Taylor's, occupied habitat is owned and managed by a variety of groups.

A major topic of interest for all three groups was habitat management – what types, how often, and how aggressively treatments can be carried out was a focus of much discussion. The workshop group plans to address this broad, ranging issue by producing a white paper outlining a set of recommendations regarding each type of management as well as actions suitable for occupied versus unoccupied habitat.

Another area for improvement identified by the group was the need to share information across the three communities. This would enable better understanding of the phenology of the checkerspot life cycle relative to its habitat, and enable the identification of shared trends as well as key differences between the subspecies. This also highlighted how the groups differ in their choice of monitoring strategies, which lead to a desire by the group to share monitoring protocols with a goal of comparison and improvement.

The workshop was an effective way to enable these three communities to share their work, learn about the work of others, and evaluate the strengths and weaknesses of their conservation efforts. The above information highlights some key takeaways from the week. The following proceedings allow a better understanding of the full range of topics discussed and the needs identified by the group.

Workshop Schedule (Overview)

Day 1	<i>Topic</i>	<i>Presenter(s)</i>
	<i>Welcome</i>	Scott Hoffman Black
<i>Session 1</i>	Subspecies Intro & Overview	Stu Weiss, Ken Osborne, Elspeth Hilton Kim, Jenny Heron
<i>Session 2</i>	Habitat Restoration & Management	James Quenelle, James Gannon, Kim Kelmentowski, Peter Dunwiddie
<i>Session 3</i>	Institutional & Regulatory Landscape	Stu Weiss, Yvonne Moore, Eric Porter
<i>Session 4</i>	Advocacy, Media & Education	Stu Weiss, Scott Hoffman Black
Day 2	<i>Topic</i>	<i>Presenter(s)</i>
<i>Session 1</i>	Reintroductions: the How and the Why	Paige Howorth, Karen Lewis, Mary Linders, Christal Niederer, Beau MacDonald, Eric Porter
<i>Session 2</i>	Climate Change and Beyond: Management for Species in the 21 st Century	Stu Weiss, Kristine Preston, Nick Page
	<i>Wrap Up</i>	Scott Hoffman Black
Day 3	<i>Topic</i>	<i>Trip Leader(s)</i>
<i>Field Trip A</i>	Coyote Ridge	Stu Weiss & James Quenelle
<i>Field Trip B</i>	Edgewood Park & Natural Preserve	Christal Niederer & Lech Naumovich

Day 1 *Click on title to view PDF of presentation slides*

Welcome	Scott Hoffman Black
Subspecies Intro/Overview	
Phenology, topography, and population dynamics of the Bay checkerspot butterfly	Stu Weiss, <i>Creekside Science</i>
Idiosyncratic Ecological, Biological, and Behavioral Aspects of the Quino Checkerspot (<i>Euphydryas editha quino</i>) Adapted to Diverse Environmental and Climatological Conditions within its Southern Range	Ken Osborne, <i>Osborne Biological Consulting</i>
Taylor's Checkerspot Introduction (Rangewide)	Elspeth Hilton Kim, <i>South Sound Program, CNLM</i>
Overview of Taylor's Checkerspot in British Columbia	Jenny Heron, <i>BC Ministry of the Environment</i>
Discussion <i>Moderated by Scott Hoffman Black</i>	
Habitat Restoration & Management	
Nonnative Grass Invasions on Bay Checkerspot Butterfly Habitat	James Quenelle, <i>Creekside Science</i>
Habitat Restoration/Management Options Available for Quino	James Gannon, <i>Bureau of Land Management</i>
Challenges with Managing and Monitoring Quino Checkerspot Butterfly	Kim Klementowski, <i>CNLM</i>
Restoring Habitat in South Puget Sound for Reintroduction of Taylor's Checkerspot Butterflies	Peter Dunwiddie, <i>South Sound Program, CNLM</i>
Discussion <i>Moderated by Scott Hoffman Black</i>	
Institutional and Regulatory Landscape	
Institutional Landscape for Bay checkerspot	Stu Weiss, <i>Creekside Science</i>
A Regional Approach to Management of Quino checkerspot in Western San Diego County	Yvonne Moore, <i>SDMPP</i>
The Regulatory Landscape for Quino	Eric Porter, <i>Carlsbad FWS</i>
Discussion <i>Moderated by Scott Hoffman Black</i>	
Advocacy, Media, and Education	
Advocacy, media, and conservation of the Bay checkerspot butterfly	Stu Weiss, <i>Creekside Science</i>
The Importance of Engaging The Public, Local and State and Federal Agencies and Other Stakeholders in Listed Species Conservation	Scott Hoffman Black, <i>Xerces Society</i>
Discussion <i>Moderated by Scott Hoffman Black</i>	

Subspecies Introduction and Overview

To provide information on the status, biology, natural history, and current conservation actions for each subspecies as a basis for the presentations and discussions that followed.

Phenology, topography, and population dynamics of the Bay checkerspot butterfly *Stu Weiss, Creekside Science*

Bay checkerspot butterfly population dynamics are driven by the phenological relationship between butterfly emergence and hostplant senescence, which determines prediapause larval survival rates. Phenological variation across complex terrain buffers population fluctuations. A 29-year population record at Kirby Canyon, supplemented by shorter records across much of the butterfly's range, shows how this mechanism has played out through population booms and busts, and identifies key weather variables.

Stuart B. Weiss, Ph.D. is Chief Scientist of Creekside Center for Earth Observation and has been studying the Bay checkerspot butterfly since 1979. Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis. Our clients include city, state, and federal agencies, private companies, academic institutions, and non-profit organizations.

Idiosyncratic Ecological, Biological, and Behavioral Aspects of the Quino Checkerspot Adapted to Diverse Environmental and Climatological Conditions within its Southern Range *Ken Osborne, Osborne Biological Consulting*

Quino has traditionally been understood as having only *Plantago erecta*-driven ecology. Quino has more extensive, numerous, and substantial populations than either Bay or Taylor's subspecies of *E. editha*. Metapopulation dynamics driven by the ecology of *Plantago erecta* are similar to Bay checkerspot with discrete habitat patches and unique geological constraints. Quino ecology differs from Bay checkerspot perhaps owing to differences in reliability of annual precipitation in its range, having a volatile eruptive boom-bust population dynamics, as well as high adult vagility and dispersal capabilities. Hilltopping is a prominent mating-finding strategy, and potential multi-year larval diapause sets it apart from other subspecies. A recently discovered range extension into central Baja Norte doubles the known Quino latitudinal distribution. Briefly discussed are the basic elements of the metapopulation resource base and the geological constraints on habitat particular to Quino (on *Plantago*). Also described and discussed are the high elevation ecological segregate of Quino: on novel hosts *Collinsia*, *Antirrhinum*, *Cordylanthus*; on granitic soils of the peninsular range; where resultant Quino population fluctuations appear to be more stable and of lower population density; with hilltopping and high vagility likely critical to ecological success. Presented is a model of feedback and interaction between the two major ecological segregates on a regional scale that may explain the maintenance of the *Plantago* segregate by re-initiative immigration from more stable populations.

Entomologist Ken Osborne provides biological consulting services as Osborne Biological Consulting. Research specializations and conservation interests range across various insect taxonomic groups.

Taylor's Checkerspot Introduction and Overview (Rangewide) *Elsbeth Hilton Kim, Center for Natural Lands Management*

This talk provides a broad overview of the conservation status and natural history of Taylor's checkerspot, as well as a review of recent and ongoing conservation actions being undertaken by the conservation community in British Columbia, Washington, and Oregon.

Elspeth Hilton Kim is the Conservation Coordinator at the Center for Natural Lands Management's South Sound Program. Elspeth's role focuses on supporting prairie-oak cooperative conservation initiatives in the Willamette Valley–Puget Sound-Georgia Basin (WPG) ecoregion. The Center for Natural Lands Management is a nonprofit organization that protects sensitive biological resources through professional, science based stewardship of mitigation and conservation lands in perpetuity. The South Sound Program conserves prairies, oak woodlands and freshwater ecosystems in South Puget Sound, Washington.

Overview of Taylor's Checkerspot in British Columbia

Jenny Heron, British Columbia Ministry of the Environment

Taylor's Checkerspot was thought extirpated from British Columbia until it was recorded from a recent clearcut on Denman Island in 2005. This talk gives an overview of the ongoing conservation work for the butterfly by the recovery group, including preliminary planning for habitat restoration and translocation to historic sites.

Jennifer Heron is the provincial invertebrate conservation specialist with the B.C. Ministry of Environment. She directs and manages the provincial approach to invertebrate conservation, including the development and implementation of provincial legislation, policy, and standards for the conservation, and recovery of invertebrate species-at-risk, their habitats and ecosystems, and to keep these species from becoming at risk. She works with other invertebrate specialists to develop recovery-planning approaches and assign conservation status ranks to invertebrate groups. She chairs the provincial Garry Oak Invertebrates Recovery Implementation Group Taylor's Checkerspot Recovery Working Group.

Discussion Notes

The breadth of knowledge outlined for each sub-species demonstrated the history of conservation while also demonstrating areas where information is lacking. Outside of the United States for instance, British Columbia is involved in Taylor's checkerspot conservation and shares information about status and range north of the US border, although little collaboration is underway south of the US border for Quino checkerspot in Baja, Mexico.

Action Item - Survey/monitor potential checkerspot habitat in Mexico.

Also of note, the extensive research conducted on QCB and BCB illustrated the emphasis that the group has put on gathering information about climate variability, distribution, phenology, and habitat mapping, whereas TCB conservation has emphasized species and habitat management.

Research item - What is the history and relation between different populations within a subspecies (e.g. higher elevation balds vs prairies)? Are these actually different subspecies?

Habitat Restoration and Management

What are the biggest habitat obstacles for each subspecies? What strategies are being used to overcome them and with what outcomes?

Nonnative Grass Invasions on Bay Checkerspot Butterfly Habitat

James Quenelle, Creekside Science

Nonnative grass invasions onto serpentine soils, driven in part by nitrogen deposition, pose the greatest threat to existing Bay checkerspot butterfly habitat. Cattle grazing has been a vital tool in limiting many of these exotic grasses on Bay checkerspot habitat on Coyote Ridge. However, because Barbed goatgrass (*Aegilops triuncialis*) can be harmful to cattle, a relatively recent invasion of this species onto Coyote Ridge poses additional challenges to land managers in this habitat. At Edgewood County Park, where infrastructure and policies are not conducive to grazing, mowing is the most pragmatic and effective treatment for nonnative grasses.

Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis. Our clients include city, state, and federal agencies, private companies, academic institutions, and non-profit organizations. James Quenelle has been a biologist with Creekside since 2008.

Challenges with Managing and Monitoring Quino Checkerspot Butterfly

Kim Klementowski, Center for Natural Lands Management

The boom-bust metapopulation dynamics of the Quino checkerspot butterfly combined with habitat loss due to rapid development have created many challenges for the perpetual monitoring and management of this species and its remaining habitat. This presentation provides two case studies that highlight 10 years of monitoring, summarize management actions taken, and demonstrate the need for additional research in order to ensure that management actions will benefit existing and future populations.

Kim Klementowski is a Preserve Manager with the Center for Natural Lands Management. She manages preserves in Western Riverside and Orange Counties that have been set aside as mitigation for various federal and state listed species, including over 4,000 acres of Quino checkerspot butterfly habitat. The Center for Natural Lands Management is a nonprofit organization that protects sensitive biological resources through professional, science-based stewardship of mitigation and conservation lands in perpetuity.

Habitat Restoration/Management options available for Quino

James Gannon, BLM

This talk discusses habitat restoration and management options available for the Quino checkerspot.

James Gannon is a Prescribed Fire and Fuels Specialist at the Bureau of Land Management.

Restoring Habitat in South Puget Sound for Reintroduction of Taylor's Checkerspot Butterflies

Peter Dunwiddie, Center for Natural Lands Management

There is only a single “wild” Taylor's checkerspot population surviving in the Puget Lowlands of Washington. Therefore, aggressive efforts are being taken to establish populations at other sites in the region. This talk describes actions we are taking to enhance the suitability of various sites where checkerspots are being, or will be, introduced.

The Center for Natural Lands Management is a nonprofit organization that protects sensitive biological resources through professional, science based stewardship of mitigation and conservation lands in perpetuity. The South Sound Program conserves prairies, oak woodlands and freshwaters in South Puget Sound, Washington. Peter Dunwiddie is an ecologist with CNLM working on various issues related to rare species management, habitat restoration, invasive species control, and prescribed burning. Peter is also an affiliate professor at the University of Washington's Department of Biology.

Discussion Notes

This session brought to light the similarities and differences between the three sub-species, as they have adapted to the particular climate in which they occur (level of precipitation, temperature, vegetation structure). Major discussion threads included the different types of habitat treatments available (e.g. fire, herbicide, mowing, grazing) as well as how these are applied in occupied versus unoccupied habitat. Many of these habitat treatments are limited by regulations and/or are prohibitive (e.g., fire) for reasons such as public opinion. The group discussed the need to consider the varied dynamics of each ecosystem to determine what treatment type is appropriate, as well as the need to conduct management activities on a rotational basis and at appropriate scales so to allow areas of refugia, patchiness, and other benefits. Discussion about how to quantify and incorporate the impact of not taking action and of negative impacts from taking action brought up the possible need for a set of objective criteria to measure impacts. Pat Dunn recommended to the group the practice of utilizing annual reporting to document concerns about impact of no action at occupied or potential habitat. This will create evidence of ongoing concern about this issue. This all came back to the question of how to minimize impacts to populations when doing management in occupied sites.

Action Item - Develop management guidelines for occupied versus unoccupied habitat.

Action Item - Develop a calendar that identifies recommended dates for monitoring, habitat treatment, and release activities in light of the life cycle of the butterfly, host plants, invasives.

Additionally, the group discussed situationally-dependent management. For instance, the soil composition in some Quino habitat is changing and increasingly is supporting non-native grasses due to the slow release of nitrogen from smog. Grazing and mowing have been shown to be effective tools to control these non-native grasses in California, whereas mowing has not been shown to be sufficient for controlling invasive grasses in Washington and Oregon. While nitrogen deposition as a result of pollution is a known threat for BCB, the role that pollution-based nitrogen deposition plays in TCB habitat degradation is unknown.

Research question - Is nitrogen deposition a significant issue for TCB habitat conservation? How does nitrogen deposition from pollution compare to nitrogen deposition from scotch broom?

Discussion about habitat management issues came up frequently throughout the workshop, with two major threads being the most common. First, as already mentioned, questions about what types of habitat management are appropriate and at what level; and second, is long-term population management the new status-quo and something we should plan for up front?

The first part pertains to balancing competing priorities. The question of how to balance the need for active management and restoration of habitat against the concern for causing harm to

individual butterflies is an ongoing concern for land managers and biologists alike. The phrase ‘manage for an insect, not a grizzly bear’ resonated with the group as an important reminder about the scale and context in which we all work. There are many factors at play in this balancing act – the impact of management as well as the impact of no action; harm to an individual versus long-term benefit to the population.

The use of fire as a restoration tool was a frequent discussion item and is an interesting topic between the three groups, because each group/locale has different regulations, capacity limits, habitat specifications, and personal and professional opinions. While fire is generally unpopular among lepidopterists, the group acknowledged that people on both sides of the argument are learning more about the nuances of fire, and continued dialogue and understanding is necessary. In Washington, fire is a common restoration tool thanks to a large group of cooperators that support infrastructure and capacity for both large and small-scale burns across a suite of land ownerships.

Having a document that reviews and clarifies what is known about the short and long-term impacts (positive and negative) from active management would be useful and helpful in improving group consensus on management actions.

Action Item - Create a white paper that documents management recommendations for butterfly habitat using a variety of treatments (e.g., fire, herbicides, grazing, etc). The paper should include background information and a common body of information that supports the need for active management even in the case where it may introduce potential impact to individual butterflies. The paper should also include case studies that illustrate the long-term benefits of active management at occupied sites, should factor in population dynamics, and conclude with recommendations for wise management for the benefit of the butterflies and the grassland systems they depend on. Stuart Weiss and Scott Hoffman Black will develop an outline and request submissions from workshop attendees and their colleagues to populate the document.

Secondly, the notion of long-term management leads to questions about how to define self-sustaining populations and habitat. If we move forward with the acceptance that most sites will need ongoing, even if infrequent, maintenance to sustain high-quality habitat, it would be useful to create protocol for identifying degradation thresholds at which point management action is necessary. Degradation thresholds would trigger the need for more intensive management, and could be based on benefits to a specific species, need to retain or restore an overall ratio of native vs. non-natives system-wide, or whatever measure of habitat quality may be the target. Included in this discussion was the notion that while self-sustaining populations are often the ideal, it is not unrealistic to include long-term management in the plan from the outset, which may require a cognitive shift for some. Regardless, including more clarification on habitat thresholds would provide clarity and understanding for the purpose of project approval, permits, funders, etc.

Action Item - Gather from each partner what measures and techniques they are using to quantify habitat characteristics and level of success (for management, site readiness, etc), including how fluid the triggers are. *Mary Linders will take the lead on this.*

Institutional and Regulatory Landscape

How can practitioners capitalize on listing to provide maximum return for recovery?

The Institutional Landscape of Bay Checkerspot Butterfly Conservation: A Whirlwind History and Tour Stu Weiss, Creekside Science

A historical narrative of Bay checkerspot conservation highlights the complexities of the institutional landscape with a series of failures and successes. Numerous government agencies, private industry, non-governmental organizations, academic institutions, and individuals have been involved over several decades. Outcomes depend on the institutions and people involved and channeling motivations and incentives toward effective conservation. The culmination of institutional efforts is found in the Santa Clara Valley Habitat Plan, which was recently adopted and is in implementation.

Stuart B. Weiss, Ph.D. is Chief Scientist of Creekside Center for Earth Observation and has been studying the Bay checkerspot butterfly since 1979. Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis.

A Regional Approach to Management of Quino checkerspot in Western San Diego County Yvonne Moore, San Diego Management and Monitoring Program (SDMMP)

A regional program exists in San Diego Co. that provides funding for management and monitoring of sensitive species across existing and proposed conservation plan boundaries. In 2013, the SDMMP prepared a Management Strategic Plan (MSP) for the western San Diego region which included goals and objectives for management of QCB within the MSP area. The QCB was categorized as an “SL” species, meaning the species is at risk of loss entirely on Conserved Lands in the MSP area. The goal for the species is to protect, restore, and enhance QCB habitat within currently occupied and historically occupied sites and the landscape connections between them to create resilient occurrences and to allow for potential reintroduction to ensure persistence over the long-term (>100 years). Objectives include preparing and implementing a 5-year implementation plan, developing BMPs for habitat restoration, establishing a seed bank and bulking seed, and implementing pre-fire management actions.

The SDMMP is a science based program seeking to provide a coordinated approach to management and biological monitoring of lands in San Diego that have been conserved through various programs including the MSCP, the MHCP, the TransNet EMP, and various other conservation and mitigation efforts. As the coordinator for the SDMMP, Yvonne Moore is responsible for facilitating communication regarding the implementation of coordinated management and monitoring efforts among contractors, wildlife agencies, jurisdictions, researchers, lands managers, and other regional stakeholders as identified in multiple strategic plans including the Management Strategic Plan, Connectivity Monitoring Strategic Plan, and Invasive Plant Strategic Plan.

The Regulatory Landscape for Quino Eric Porter, US Fish and Wildlife Service, Carlsbad

This talk describes the regulatory landscape for Quino throughout its range. The Quino falls within several regional habitat conservation plans and has different protections afforded it in each plan.

Eric Porter works for the Carlsbad Fish and Wildlife Office (U.S. Fish and Wildlife Service) as a biologist with primary responsibility for section 7 consultations and habitat conservation plans with an emphasis on insects.

Discussion Notes

This session articulated the different ways in which each community has navigated the regulatory and institutional landscape to fit the needs of the butterfly. BCB conservation has utilized funds resulting from mitigation settlements (e.g. utilities, transportation, and military) to conserve land and build endowments, paired with systematic conservation planning in Santa Clara County. The acquisition of Tulare Hill with mitigation funds from Metcalf Energy Center was precedent setting – including funds for acquisition, endowment, and thirty years of operating support. Mitigation funds from the widening of Route 101 included the protection of 540 acres and the development of a habitat conservation plan (HCP).

QCB conservation in Riverside and San Diego Counties has mostly occurred through conservation easements gained through development projects, with additional conservation occurring through preserve lands set aside for conservation of other species. The QCB was not covered in the San Diego MSCP because it was not federally listed at the time the plan was being prepared. Monitoring and management of QCB thus far has been localized and limited in scope and duration due to lack of funding. The San Diego Management and Monitoring Program has prepared a Management Strategic Plan (MSP) for 110 species, including QCB. Funding through SANDAG is now available for regional monitoring and management of the species in San Diego County to meet the goals and objectives laid out in the MSP. The international boundary in the midst of the QCB range has limited understanding about the full range and status of the QCB.

Action Item - Engage researchers and practitioners in Baja, Mexico to encourage participation from Mexican NGO's and academia.

TCB conservation in Washington and Oregon has benefitted from strong support from Joint Base Lewis-McChord, multiple public agencies, and active private and non-profit partners. TCB conservation in British Columbia has benefitted from support for invertebrate conservation from the BC Ministry of the Environment and active community and non-profit partners. One issue for TCB conservation is that the Oregon Department of Fish and Wildlife has no authority to list or manage invertebrates, so there is no state focus on butterfly research or conservation.

Eric Porter of Carlsbad FWS recommended to the Taylor's group that including reintroduction and captive breeding in the recovery plan will make permitting easier, and noted that if reintroduction is being carried out in the historic range, it may be possible to get a categorical exclusion through NEPA. Recovery planning and permitting does vary from office to office throughout the country so ensuring there is a knowledgeable FWS advocate for the species in the recovery planning process is paramount. The group advised that including actions in the plan while keeping information on how those actions will be carried out fairly general will provide the flexibility needed to use best-available science at the time actions occur. Additionally, utilizing existing butterfly recovery plans will be helpful regarding what to include, what has been useful, what has been challenging, etc.

Action Item - Collect notes from QCB and BCB groups about what they wish was different in their respective recovery plans and what they feel is beneficial.

Advocacy, Media, and Education

What are the tools for agency and non-profit personnel to promote endangered butterfly conservation through various means. How can we have the biggest impact?

Advocacy, media, and conservation of the Bay checkerspot butterfly

Stu Weiss, Creekside Science

Bringing conservation issues to the public and decision makers requires engagement with advocacy and media. Such engagement has been critical for moving conservation of the Bay checkerspot butterfly forward. A selective review of advocacy and media (print and television) successes highlights strategies that have worked over the years.

Stuart B. Weiss, Ph.D. is Chief Scientist of Creekside Center for Earth Observation and has been studying the Bay checkerspot butterfly since 1979. Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis. Our clients include city, state, and federal agencies, private companies, academic institutions, and non-profit organizations.

The Importance of Engaging The Public, Local and State And Federal Agencies And Other Stakeholders in Listed Species Conservation

Scott Hoffman Black, Xerces Society

In order to effectively conserve listed species the USFWS and conservation organizations should reach out broadly to a variety of stakeholders. Briefly discussed is how local citizens, conservation groups and the USFWS effectively advocated for better roadside management for the Fender's blue butterfly, how scientists have been the leaders in pushing for effective conservation measures for the Salt Creek Tiger Beetle and how the USDA Natural Resource Conservation Service partnered with academic scientists and the Xerces Society to fund restoration for the Karner blue butterfly.

Scott Hoffman Black is an ecologist and the Executive Director with the Xerces Society for Invertebrate Conservation in Portland, Oregon. He also serves as the Chair of the International Union for Conservation of Nature (IUCN) Butterfly Specialist Group, Chair of the Migratory Dragonfly Partnership and Vice Chair of the Monarch Joint Venture. Scott has a graduate degree in ecology from Colorado State University. He has extensive experience in endangered species conservation, pollinator conservation, macroinvertebrate monitoring, and forest and range management issues. Scott has authored over 200 scientific and popular publications, co-authored two books and contributed chapters to several others, dozens of reports on land management issues and his work has been featured in newspapers, magazines, books and on radio and television. He has presented to universities across the United States, as well as to international meetings and the National Academy of Sciences. Scott has received several awards including the 2011 Colorado State University College of Agricultural Sciences Honor Alumnus Award and National Forest Service Wings Across Americas 2012 Butterfly Conservation Award.

Group Discussion (continued on next page)

Group Discussion

The goal of this session was to highlight successful outreach and education campaigns and to discuss best practices for gaining supportive media attention and educating the public. The presentations outlined specific outreach and education campaigns to illustrate best practices.

- Reporters
 - Build and maintain positive relationships with reporters, treat them well.
 - Host a site visit or have an event to provide a narrative and a memorable experience.
 - Follow-up with reporters to ensure any critical facts were clearly communicated.
- Decision Makers
 - Host a site visit or have an on-site event that garners excitement and shows support.
 - Create a campaign (e.g. postcard) to encourage supporters to get in touch with decision makers. Make it easy for the supporter and impactful for the decision maker.
 - Utilize photographs of the species, landscape, and people who will benefit.
- General Public
 - Utilize high quality and appealing photographs to garner support.
 - Create personal connections, find champions in each arena.

Day 2 *Click on title to view PDF of presentation slides*

Reintroductions: The How and The Why

Getting Started with the Quino Checkerspot Butterfly, *Euphydryas editha quino*, at the San Diego Zoo (*pdf not available*)

Paige Howorth
San Diego Zoo

[Considerations in Production Scale Rearing of Taylor's Checkerspot for Reintroduction](#)

Karen Lewis
Oregon Zoo

[Reintroducing Taylor's Checkerspot: Descent and Rebirth of the Dark Sister](#)

Mary Linders
WA Dept. of Fish and Wildlife

[Bay Checkerspot Butterfly Reintroduction at Edgewood Preserve and Tulare Hill](#)

Christal Niederer
Creekside Science

[Quino Reintroduction Planning](#)

Beau MacDonald
Urban Wildlands Group

[Steps to Implementing Reintroduction of Quino](#)

Eric Porter
Carlsbad Fish and Wildlife Service

Discussion

Moderated by Scott Hoffman Black

Climate Change and Beyond, Managing for Species in the 21st Century

[Nitrogen Overdose: The Biggest Environmental Change \(Almost\) Nobody Has Heard Of](#)

Stu Weiss
Creekside Science

[Changing Distribution Patterns of Quino Checkerspot in Response to a Changing Environment](#)

Kristine Preston
USGS

[The Rise and Fall of Taylor's Checkerspot on Denman Island, BC: Observations from a Rapidly Changing Landscape](#)

Nick Page
Raincoast Applied Ecology

Discussion

Moderated by Scott Hoffman Black

Wrap Up Discussion

Moderated by Scott Hoffman Black, Xerces Society

Reintroductions: The How and the Why

What strategy is being used for reintroduction in each community? Why? What are the challenges?

Getting Started with the Quino Checkerspot Butterfly, *Euphydryas editha quino*, at the San Diego Zoo Paige Howorth, San Diego Zoo

This talk included a short overview of the activities of the Entomology Department in the managed care of multiple invertebrate species, and introduced the Zoo's pilot program to rear a non-releasable population of quino checkerspot butterfly.

As the head of the Entomology Department at San Diego Zoo Global, Paige Howorth is responsible for the stewardship and management of the invertebrate animal collection, facilities and staff, including two insect conservation programs. San Diego Zoo Global is a not-for-profit organization that operates the San Diego Zoo, the San Diego Zoo Safari Park, and the San Diego Zoo Institute for Conservation Research. It is the largest zoological membership association in the world, with more than 250,000 member households and 130,000 child memberships, representing more than a half million people. The 100-acre (40-hectare) Zoo is home to over 3,700 rare and endangered animals representing more than 650 species and subspecies, and a prominent botanical collection with more than 700,000 exotic plants. Our mission statement: San Diego Zoo Global is committed to saving species worldwide by uniting our expertise in animal care and conservation science with our dedication to inspiring passion for nature.

Considerations in production scale rearing of Taylor's checkerspot for reintroduction Karen Lewis, Oregon Zoo

This talk focuses on what it takes to rear animals *en masse* and how that is different from working with a research population, including: captive breeding and population management, review of our life stage survival statistics, the relationship between survival and setting of production targets, providing enough food for larvae, and expansion of rearing to multiple facilities to increase capacity and decrease risk.

The Oregon Zoo is the largest tourist attraction in Oregon and SW Washington with over 1.5 million visitors per year. The zoo covers 64-acres, and holds almost 2,000 individual animals (not including caterpillars!) from over 200 species. Karen Lewis is the Conservation Research Associate at the Zoo and a member of the Conservation Research Staff. We are responsible for coordinating the NW species recovery projects as well as oversight of the behavioral, endocrine, animal welfare, and conservation research that is conducted at the zoo.

Reintroducing Taylor's Checkerspot: Descent And Rebirth Of The Dark Sister Mary Linders, Washington Department of Fish and Wildlife

State-endangered in Washington and endangered under the ESA, Taylor's checkerspot (*Euphydryas editha taylora*) is the third subspecies of Edith's checkerspot to gain federal recognition for its dramatic and perilous decline. Reduced to a single population, *E. e. taylora* was nearly extirpated in the Puget lowlands of western Washington, a region that remains the stronghold for native grasslands of the Georgia Basin, Puget Trough, and Willamette Valley ecoregions. But a female captured as a voucher specimen in 2003 laid eggs, launching a world of new potential. Yet hundreds of butterfly (re)introductions in the past century shed little light on a successful path forward (Oates and Warren 1990, Thomas 1989, Schultz et al. 2008). With little more than a "sandbox" of habitat in which to work, we initiated release trials using several life stages, and found that releasing postdiapause larvae produced

favorable results. Our reintroduction project objective is to establish at least three new checkerspot populations at three Puget lowland sites in the next decade. Reintroductions are now underway at several sites. Since 2008, releases have produced juvenile and adult butterflies with apparently normal foraging, basking, mating and ovipositioning behaviors. We have demonstrated successful reproduction and persistence in the absence of continued release. We have also developed long-term monitoring and population goals, and the monitoring methods needed to achieve them.

The mission of the Washington Department of Fish and Wildlife is to protect, preserve and perpetuate fish, wildlife and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities. Unlike many states, Washington's definition of fish and wildlife includes all invertebrates. Mary Linders is a rare species recovery biologist focused on recovery of threatened and endangered species in the Puget lowland prairies of western Washington.

Bay checkerspot butterfly reintroduction at Edgewood Preserve and Tulare Hill

Christal Niederer, Creekside Science

This talk discusses Creekside Science's reintroduction efforts of Bay checkerspot to two locations: Edgewood and Tulare Hill. Included in this talk will be a review of population declines at each site, habitat management/restoration, physical efforts of reintroduction, and monitoring. Lessons learned and the current assessment of success will also be discussed.

Christal Niederer is a biologist for Creekside Science, where she has worked for eight years. Christal has been involved with another butterfly reintroduction in the Bay Area (Mission Blue). She works mainly in serpentine grasslands, focusing on rare species and weed management. Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis. Our clients include city, state, and federal agencies, private companies, academic institutions, and non-profit organizations.

Quino Reintroduction Planning

Beau MacDonald, Urban Wildlands Group

Eric Porter, Carlsbad Fish and Wildlife Service (Q & A)

This talk presents an update to the 2012 Captive Propagation and Release Plan for Quino Checkerspot Butterfly (Longcore & Bonebrake, The Urban Wildlands Group). Discussion of the opportunities, challenges, and uncertainties associated with reintroduction of Quino checkerspot, followed by Q & A from an ecological and regulatory perspective.

The Urban Wildlands Group, based in Los Angeles, is dedicated to the protection of species, habitats, and ecological processes in urban and urbanizing areas. Beau MacDonald has worked with UWG since 2004 as an applied biogeographer specializing in habitat suitability modeling, GIS, and data QA/QC, and is involved with various types of research for multiple projects.

Eric Porter works for the Carlsbad Fish and Wildlife Office (U.S. Fish and Wildlife Service) as a biologist with primary responsibility for section 7 consultations and habitat conservation plans with an emphasis on insects.

Group Discussion (continued on next page)

Group Discussion

This session focused on enhancing checkerspot populations through captive rearing and reintroduction, direct translocation, and the planning necessary for these activities. The issues that became clear across the presentations was the complexity of captive rearing and the importance of planning and preparing the habitat to receive checkerspots. This session also brought to light the very different approaches and capacity that each group has for enhancing or introducing populations. As previously mentioned, TCB conservation efforts in the South Puget Sound region of Washington have focused on habitat management and captive rearing, allowing for the reintroduction of populations. The BCB group on the other hand has a healthy wild source population that has allowed for translocation without the need for captive breeding. The QCB group has not yet conducted any translocations or reintroductions, but in 2012 began a trial captive breeding program to evaluate the viability of the method.

Efforts to captive rear checkerspots have been the source of cross-group communication already, as the TCB group advised the San Diego Zoo, which is currently working with a non-releasable population and will rely on collecting wild individuals to acquire a new founder population. With current drought conditions, it is hard to predict when populations will be large enough to collect individuals for the QCB captive rearing program. The TCB captive rearing program on the other hand has created a strong program and seen success in both the rearing and release of checkerspots, but may face challenges in scaling up the program if all reintroductions are based strictly on captive-reared animals. The TCB group favors post-diapause release and has determined that multi-stage releases may also be a good strategy. The BCB group favors releasing post-diapause larvae because they are easy to handle and do not fly away, in addition to the fact that they are easy to find at the source site. It was noted that releasing a very large number of larvae (thousands) is best, and brought to light the benefit that a release strategy would have for groups new to reintroduction and translocation work.

Action Item - Collect, collate, refine as applicable, and distribute standard release strategies, especially in locations of heavily restored habitat.

A major task for the QCB group has been to determine where to place the butterflies when they are ready to carry out an introduction. The biggest different between QCB and the other subspecies is that QCB dispersal ability is much greater and there is less site fidelity. The QCB community differs on what the top priority is – enhancing existing populations versus starting new populations. A hopeful outcome of this workshop is to create an active Quino working group that can create an action plan for conservation.

Action Item - Create a QCB working group, hold a meeting and develop an action plan.

Population monitoring was a popular item of discussion as each group uses different protocols, has different challenges and expectations. The QCB group noted that they are limited in their monitoring abilities because the local FWS office considers monitoring ‘pursuit’, which is potential take – this means that anyone doing monitoring has to be a FWS permitted expert. British Columbia has done little monitoring as it is only done when someone is qualified and available – weekly Pollard transects have been occurring for the Denman population since 2006 but the information is rarely shared.

Action Item - Collect, collate, and distribute standard monitoring protocols used by each group. *Jenny Heron will take the lead on this.*

In the earlier habitat management session and this session, there was discussion about different phenology and adaptations between instars and emergence from diapause was extensive, finding both overlaps and clear differences between the subspecies. Observations from each subspecies' community regarding the preference and use of nectar sources and the impact to egg laying, length of diapause, numbers of instars, etc. illustrated that recording and comparing observations between the subspecies and even within the subspecies may reveal consistent data for future use.

Action Item - Pull all available observations regarding plant use from captive propagation and field work into a fact sheet about preferences and tendencies of the Edith's checkerspot, including differences between the three sub-species.

Lastly, a common thread during this session was the flexibility in selection of host plants by Edith's checkerspot, especially regarding the use of *Plantago*. In California, there is a native as well as a non-native *Plantago* used by BCB and QCB, whereas the *Plantago* utilized by TCB in the Northwest is non-native, although native *Plantagos* do occur in some environments.

Research Question - There have been observations at the Oregon Zoo that some matrilineal have a greater tendency to return to diapause when there is insufficient food or food plants have dried out. Further study about how and when this occurs would be beneficial.

Research question - Some QCB undergo multi-year larval diapause in the lab. What is the best way to preserve this strategy for captive management of individuals for release?

Action Item - Develop a curated list of questions to be researched across all sub-species.

Climate Change and Beyond: Managing for Species in the 21st Century

As we face ever-changing landscapes due to environmental changes, we must create a vision of what we are working towards and a strategy that accommodates new and unforeseen changes in order to attain that vision.

Nitrogen overdose: the biggest environmental change (almost) nobody has heard of
Stu Weiss, Creekside Science

The global nitrogen cycle is the most disrupted biogeochemical cycle. Local manifestations of “nitrogen overdose” are highlighted with the Bay checkerspot butterfly, where nutrient-poor soils are enriched by atmospheric dry deposition of reactive nitrogen and become susceptible to non-native grass invasions in the absence of grazing and other habitat management. The basics of atmospheric deposition, ecosystem impacts, and the course of turning the discovery into conservation actions will be covered.

Stuart B. Weiss, Ph.D. is Chief Scientist of Creekside Center for Earth Observation and has been studying the Bay checkerspot butterfly since 1979. Creekside Science was founded by Drs. Stuart Weiss and Paul Rich in 2006 to apply the latest science and technology to address challenging conservation problems. The organization specializes in experimental design, field measurement, and quantitative analysis. Our clients include city, state, and federal agencies, private companies, academic institutions, and non-profit organizations.

Changing Distribution Patterns of Quino checkerspot in Response to a Changing Environment
Kristine Preston, United States Geological Survey

The distribution of Quino checkerspot in coastal southern California has shifted away from the coast since the 1930s and more recently has expanded eastward into higher elevation foothills of the Peninsular Ranges. Early extinctions along the coastal plain and valleys appear related to land use and a decline in wildflowers coinciding with an increase in invasive non-native grasses and forbs. More recent expansions into the foothills since the late 1990s are more closely associated with climate variables than to land use. This upward shift in elevation is consistent with models predicting Quino checkerspot distributions under altered climate conditions.

Kristine Preston provides science support for the San Diego Management and Monitoring Program (SDMMP). In a previous position at UC Riverside's Center for Conservation Biology, she developed models predicting Quino checkerspot habitat distributions and local population extinctions/expansions in relation to changing environmental conditions. Working with the SDMMP team, she is currently developing habitat models for Quino checkerspot that are at a fine enough resolution to inform monitoring and management activities in western San Diego County. These activities include restoring Quino checkerspot habitat to allow for more resilient populations and greater connectivity between occurrences.

The Rise and Fall of Taylor's Checkerspot on Denman Island, BC: Observations from a Rapidly Changing Landscape
Nick Page, Raincoast Applied Ecology

Taylor's checkerspot rapidly expanded into early successional habitats created by large-scale forest harvesting on Denman Island, BC. It exploited unusual host-plant resources composed mainly of native wetland Veronica species. The population thrived from the mid 2000's to 2010 when it was the most

abundant butterfly species encountered during surveys. The population has declined precipitously in the past three years, although the exact causes are not known. The presentation discusses the unique characteristics of Canada's only Taylor's checkerspot population.

Nick Page is a professional biologist with Raincoast Applied Ecology. He has a master's degree in plant ecology and works on a range of conservation planning projects on BC's south coast. He has been involved in surveys, stewardship, and recovery planning for Taylor's Checkerspot since 2007.

Group Discussion

The goal of this session was to take note of past and current challenges and observations to spur conversation about future concerns and possible solutions. Much of the conversation focused on how we can model and plan for future habitat shifts to support checkerspots and allow the species to adapt. The importance of corridors and networked land was a key example of how we might support checkerspots into the future.

For the BCB, air pollution has been a major driver of habitat degradation. Nitrogen deposition from air traffic and ammonia deposition from agriculture have both led to increased non-native grasses, which reduces hostplant and nectar source cover via overgrowth and accumulation of thatch. The good news is, regulations are working and nitrogen levels are going down, but critical nitrogen loads for the habitat will be exceeded many years into the future. Climate change impacts include droughts and deluge, and warmer temperatures can decouple the phenology of butterflies and their hostplants. Having a network of topographically diverse lands that will feel the impact of climate change at varying scales will determine the resiliency of Bay checkerspots in the face of climate change.

For QCB, modeling has shown that the main difference between extinct and extant populations is the level of agriculture and human development. Extinct populations were more isolated from other populations, and significantly fewer wildflowers were present during periods when the butterflies went extinct. Currently, QCB populations are being observed at higher elevations where annual precipitation is higher. The distribution and matrix of vegetation is responding to the changing levels of precipitation and temperature, but the concern is that checkerspots will not be able to respond as quickly as vegetation already is, leaving checkerspot populations both in areas of poor environmental conditions but also at a loss of key vegetation.

Lastly, the discussion about TCB in terms of changing landscapes reflected much of the previous discussion as well. Taylor's checkerspot are observed to be flexible, a trait that will hopefully enable them to capitalize on changes and shifts in the environment, as long as they can adapt at a pace that keeps up with the changing landscape. The quick arrival of checkerspots in the Denman Island clearcut begs the question of where the checkerspot were before that. Attaining a better understanding of how this population was able to quickly utilize newly suitable habitat will help us understand how to support similar occupation of newly suitable habitat in the future.

Other butterflies on Denman Island and nearby suitable habitat are declining as well. It was not discussed if other checkerspot butterfly populations are seeing declines around occupied areas, but a better understanding of the big picture might identify key factors causing decline.

Wrap Up Session

How can the region (West Coast) as a whole work collaborate more closely and how can we improve conservation efforts for all subspecies of Edith's checkerspot? Include discussion of research needs, funding and identify other unmet needs.

Discussion & Action Setting

Moderated by Scott Hoffman Black, Xerces Society

Discussion Notes

This workshop illustrated the value that communicating and sharing information between communities can be beneficial to all. Although each group works with slightly different habitat conditions, regulatory structures, institutional expectations, and funding sources, the focus of efforts is on three sub-species of butterfly that have many similarities. There is much to learn from each group about how we can each be more knowledgeable and effective. Continued communication between the groups will occur through the group list-serv that was set up and there is potential for future meetings between the whole group or smaller sub groups. Acting on the action items outlined in these discussion notes will spur progress made during the workshop and take it to the next level. The identified action items and research questions can be found summarized below.

Note: Wrap up discussions about a particular subject were incorporated into the discussion notes for the appropriate session.

Day 3 - Field Trips

The folks of Creekside Science took members of the workshop out to the two BCB sites used in the translocation project. The first, Coyote Ridge, is the site of the source population. The second, Edgewood Park & Natural Preserve, is the receiving site. Though the area was experiencing extreme drought conditions, limiting plant growth and the presence of checkerspots, both trips were a great success. The team members from Creekside Science walked attendees through the types of conservation actions being undertaken at each site and the field trips allowed attendees to have follow-up conversations about discussion threads that arose during the workshop.

About the Sites

[Coyote Ridge](#), located on the east side of the Santa Clara Valley floor, is dominated by serpentine grasslands that provide habitat for the Bay Checkerspot butterfly (*Euphydryas editha bayensis*). The population of Bay Checkerspots at Coyote Ridge serves as a source population for the reintroduction project at Edgewood Park & Natural Preserve. After a 900 ft-elevation-gain hike we reached a ridge top where postdiapause larvae would typically be abundant.

[Edgewood Park & Natural Preserve](#) is home to 467 acres of woodlands and grasslands. Using Bay Checkerspots from Coyote Ridge, a reintroduction effort is being undertaken at Edgewood to return the Bay Checkerspot to historic habitat. After a gentle hike, we entered the main butterfly habitat area and saw the effects of habitat management by mowing. We also visited the Bill & Jean Lane Education Center, which is the home to a 3-foot wingspan model of a checkerspot and 2-foot larvae crawling on towering *Plantago erecta* and other wildflowers.

Full List of Recommended Action Items

- Survey/monitor potential checkerspot habitat in Mexico.
- Develop management guidelines for occupied versus unoccupied habitat.
- Develop a calendar that identifies recommended dates for restoration, monitoring and release activities in light of the life cycle of the butterfly, host plants, invasives, etc.
- Gather from each partner what measures and techniques they are using to quantify habitat characteristics and level of success (for management, site readiness, etc.), including how fluid the triggers are. *Mary Linders will take the lead on this.*
- Create a white paper that documents management recommendations for butterfly habitat on a variety of subjects (e.g., fire, herbicides, grazing, etc.). This should include background information and a common body of information that supports the need for active management even in the case where it may introduce potential impacts to individual butterflies. This should include case studies that illustrate the long-term benefits of active management at occupied sites, should factor in population dynamics, and conclude with recommendations for wise management for the benefit of the butterflies and the grassland systems they depend on. *Stuart Weiss and Scott Hoffman Black will develop an outline and request submissions from workshop attendees and their colleagues to populate the document.*
- Engage researchers and practitioners in Baja, Mexico to encourage participation from Mexican NGO's and academia.
- Collect notes from QCB and BCB groups about what they wish was different in their respective recovery plans and what they feel is beneficial.
- Collect, collate, refine as applicable, and distribute standard release strategies, especially in locations of heavily restored habitat.
- Create a QCB working group, hold a meeting and develop an action plan.
- Collect, collate, and distribute standard monitoring protocols used by each group. *Jenny Heron will take the lead on this.*
- Pull all available observations regarding plant use from captive propagation and field work into a fact sheet about preferences and tendencies of the Edith's checkerspot, including differences between the three sub-species.
- Develop a curated list of questions to be researched across all sub-species.

Full List of Recommended Research Questions

- What is the history and relation between different populations within a subspecies (e.g. higher elevation balds vs prairies)? Are these actually different subspecies?
- Is nitrogen deposition an issue for TCB habitat conservation? How does nitrogen from pollution compare to nitrogen from scotch broom?
- There have been observations at the Oregon Zoo that some matralines have a greater tendency to return to diapause when there is insufficient food or food plants have dried out. Further study about how and when this occurs would be beneficial.
- Some QCB undergo multi-year larval diapause in the lab. What is the best way to preserve this strategy for captive management of individuals for release?