

FY2012 ISSSP Report on Determining the Occurrence and Range of *Deroceras hesperium on the Willamette National Forest using Summer Surveys of Unique Habitats and Comparison of Summer Surveys versus Spring/Fall Mollusk Protocol Surveys for Detection of this Species**

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[***Note on Taxonomy:** During the course of our study, a genetic investigation concluded that the *Deroceras hesperium* (the evening field slug) should be considered a junior synonym of *Deroceras laeve* (the meadow slug) (Roth et al. 2013). Our report, based on a study that began when two species were recognized, continues to use the original convention of referring to *Deroceras* with tripartite soles as *D. hesperium* and those with uniformly colored soles as *D. laeve*. We recognize the difficulty in making this distinction and our usage of the 2 species is not intended to imply that we consider them separate species. Moreover, in our study, both types used similar habitat and we have assumed that all detections help define the habitat preferences of both types.]

Introduction:

Prior to Roth et al. (2013.), *Deroceras hesperium* (DEHE) was considered a rare species in Region 6 with few documented locations at scattered sites in western Oregon. In 2008 it was listed as a “suspected” sensitive species on the Willamette NF because it had been found at nearby locations on Salem BLM. However, it has never been detected on the Willamette Forest itself, despite more than a decade of project mollusk surveys. *Deroceras hesperium* is also managed as a Category B sensitive species in Region 6 that requires equivalent effort surveys for habitat disturbing actions. With the recent listing as a sensitive species on the Forest and the return to 2001 Survey and Manage standards and guidelines, additional costs are being accrued by the Forest for DEHE surveys that have not, to date, provided positive results. Therefore, there is a need to better understand the distribution of this species on the Willamette NF.

On August 24, 2011, the authors, in an attempt to learn more about the habitat use of DEHE, visited 3 of the nearby locations on Salem BLM. We conducted a one-hour mollusk search (one-half hour per observer) at each site. DEHE are associated with areas within 30 m of perennial wetlands, springs, seeps, and riparian areas (Duncan 2005). Our surveys occurred in the later part of the summer drought season with air temperatures ranging from 20–23°C as we also wanted to test whether summer surveys would be effective at finding these species. All sites had skunk cabbage (*Lysichiton americanus*) present. By concentrating our search effort on the basal leaves of the plant where some moisture was still present, we found an average of 6.7 individuals externally resembling *Deroceras hesperium* (range 5-8) per site compared to an average of 2 (range 1-4) per site that had been detected using the protocol standard spring and fall mollusk survey periods (Duncan et al. 2003) in 2005. In addition we found *Vespericola* sp., *Haplotrema* sp., *Prophysaon andersoni*, *Pristiloma* sp., and tremendous numbers of *Pisidium* sp. (probably tiny pea clams) in the mud surrounding the plants.

Our 2011 visits suggested that skunk cabbage plants provide a critical reserve habitat during the summer dry period for *Deroceras* and other mollusks and may greatly improve survey efficiency for finding the species compared to surveys during the wet spring and fall period. We proposed to test this further by doing summer mollusk surveys at skunk cabbage sites across the

Willamette National Forest with a particular emphasis on trying to document the presence of DEHE. A funding request review of our proposal expanded the objectives to compare the effectiveness of standard protocol spring and fall mollusks surveys (Duncan et al. 2003) with summer searches of skunk cabbage wetlands.

Methods:

We located skunk cabbage wetlands for terrestrial mollusks on all four ranger districts of the Forest and attempted to survey each site during the spring, summer, and fall in 2012. Areas selected had road access and were located either from prior knowledge or by driving roads and searching for suitable habitat. We attempted to find wetlands with several hundred or more skunk cabbage plants (ideally > 500 plants) within a several-acre area. Sites were dispersed across the watershed, yet within close enough proximity that 4 or more sites could ideally be searched by an observer in a one day. Because finding suitable wetlands was more time-consuming than expected, some sites were not established until the summer. Consequently spring surveys were not conducted at all sites, due to snow conditions and the extra time involved in locating suitable survey areas.

One-hour spring and fall searches followed version 3.0 for terrestrial mollusk surveys (Duncan et al. 2003) with modification tailored to finding DEHE. The terrestrial mollusk survey allows adjustments in search patterns to focus on specific species. We used our *a priori* observations of DEHE use and spent one-half hour searching skunk cabbage vegetation and the area near the base of the plants and the remainder of the hour searching other litter, debris, and vegetation types for a total of two 20-minute intensive searches plus 20 minutes of walk-about spot searching in likely habitat at each wetland site. Field forms for reporting fauna and habitat observation followed standard NRIS Wildlife (FS) forms for mollusk surveys.

Our “western skunk cabbage summer mollusk protocol” consisted of a one-hour search effort entirely concentrated on searching skunk cabbage plants and the area immediately under them. The Willamette NF has a distinct summer dry season. The rainy season typically ends in late May to early July with a prolonged period of limited rain extending into September. The summer search period could typically be conducted from late July to early September with the intent of sampling during the warmest and driest period of the year. Requirements for moisture conditions and temperature given in the standard terrestrial mollusk protocol (Duncan et al. 2005) do not apply. Searching requires separating the skunk cabbage plant leaves, searching both sides of the leaves, as well as searching the basal stalk. The top of the soil and leaf debris (often alder leaves) at the base of the plants is also searched. Data and voucher specimens are recorded similar to the spring and fall surveys. 2012 had exceptionally dry summer weather that extended into the fall. We conducted summer mollusk surveys from 17 July to 6 September.

Twenty two sites with skunk cabbage in six 5th field watersheds were surveyed for DEHE (Figure 1). Elevations of the surveys ranged from 1,735 to 3,850 feet. All 22 sites were surveyed in summer and fall and 15 of these sites were surveyed in the spring. Our hypothesis, based on earlier observations at the BLM sites, was that summer surveys would detect higher numbers of *Deroceras* than either spring or fall surveys. We tested that with a one-tailed Wilcoxon paired-sample test (Zar 1999).

Results:

The summer skunk cabbage mollusk survey detected *Deroceras* at 5 of 6 sites on the Middle Fork Ranger District, 1 of 4 sites on McKenzie River Ranger District, 3 of 10 sites on the Sweet Home Ranger District, and 0 of 2 sites on the Detroit Ranger District for an overall detection rate of 41% (n= 22). At sites where they were detected, one hour of searching during the summer found an average 8.6 individuals (range 2–17). Seventy five percent of the individuals found during the summer dry period were on skunk cabbage plants. The remainder were on the ground or litter at the base of the plants. Elevations that *Deroceras* were found ranged from 2,030 to 3,520 feet. By comparison, fall surveys detected *D. laeve* at 23% of the sites with an average detection of 5.2 individuals (range 1–15) at sites where found.

All *Deroceras* found were classified as *D. laeve* (DELA) based on the lack of a distinct tripartite sole. As noted earlier, *D. hesperium* and *D. laeve* are likely the same species (Roth et al. 2013). The wetland habitat and locations relative to skunk cabbage where *D. laeve* were found in this study were similar to the *Deroceras* locations at skunk cabbage sites on Salem BLM. The *Deroceras* we found on Salem BLM showed evidence of tripartite soles. Our observations indicate that both DELA and DEHE use similar habitat in our area which seems likely if they are the same species.

Spring surveys detected *D. laeve* at 13% of the sites (n= 15) with an average detection of 3 individuals (range 1–5) at sites where found. The summer and the fall detection rates at those 15 sites were 20% and 7%, respectively.

Never did the spring or fall surveys detect *D. laeve* at a site where they were not found during the summer surveys. When detected, never did the number of *D. laeve* found in spring or in fall surveys at a particular site equal or surpass the number found during the summer survey. The summer skunk cabbage surveys detected higher numbers of *D. laeve* than both the spring and fall surveys combined (P<0.0005, n=12) or the fall surveys only (P=0.0025, n=9). [Sites where *Deroceras* were not found during any survey are dropped in this analysis.]

Other terrestrial mollusks found with the summer skunk cabbage surveys in descending order of abundance were *Prophysaon andersoni* (183), *Vespericola* sp. (77), *Ariolimax columbianus* (46), *Euconulus* sp. (30), *Ancotrema sportella* (15), *Haplotrema vancouverense* (8), *Carinacauda stormi* (5), *Arion intermedius* (4), *Prophysaon coeruleum* (2), *Prophysaon dubium* (2), and *Pristiloma* spp. (2) (total number of individuals detected at the 22 sites in parenthesis). Summer surveys also found many *Vertigo*/*Pupillidae* spp. with numbers recorded as >20 individuals at two sites. One skunk cabbage site has a stream where *Juga* sp. was found. *Psidium* spp. (clams) were also abundant in the mud at the base of skunk cabbage plants at some sites. Summer surveys also yielded a higher number of juveniles than adults, indicating that these wet areas may be used as nursery areas due to moisture retention.

Greater numbers of *Prophysaon andersoni* and *Vespericola* spp. were found overall during the summer surveys than during either the spring or fall surveys. However, except for fall surveys for *Prophysaon andersoni*, the differences were not significant (*post hoc* two-tailed Wilcoxon paired-sample test). For other terrestrial mollusk species, the overall numbers of individuals found during the summer surveys were similar to or less than the numbers found during the protocol surveys.

No *Pristiloma arcticum crateris* were detected at the 22 sites.

The mollusk survey data have been entered into NRIS Wildlife. Locations of non-native mollusks will be entered into the NRIS Invasive database.

Discussion:

Our study confirmed that skunk cabbage plants and associated wetlands are important habitat for *Deroceras laeve* on the Willamette National Forest. During dry summer months, the slug inhabits the emerged basal leaves of the plants and the area underneath them, probably because of the moisture that persists there. In fall, individuals were found in the rotting remains of the leaves as well as on other vegetation nearby, including grasses and sedges.

We are not aware of any previous detections of the *Deroceras laeve-D. hesperium* group on the Forest using the standard spring/fall terrestrial mollusk protocol, yet this study found them at 43% of the sites surveyed at wide-spread locations across the Forest. In part, we believe the lack of earlier detections can be attributed to the high preference of the species for skunk cabbage wetlands which are buffered from management activities and thus not often surveyed. In part, we believe it is because our summer search of skunk cabbage plants is a superior survey method for this species since the survey occurs at a time when the slug is concentrated at a place that is simple and straightforward to survey. Our results confirmed our *a priori* hypothesis that the summer skunk cabbage survey would have more detections of the *Deroceras laeve-D. hesperium* group than the spring and fall protocol method.

Skunk cabbage wetlands are considered a Special Habitat on the Willamette National Forest and considerably protected with Forest Plan Standards and Guidelines for the management of special habitats. These protection measures should help assure the persistence and viability of the *Deroceras laeve-D. hesperium* group on the Forest.

The non-native *Arion intermedius* (Hedgehog Arion) was found in skunk cabbage wetlands at two locations on the Salt Creek Watershed of the Middle Fork Ranger District. These are the first two detections on non-native terrestrial mollusks on the Willamette NF that we can confirm, although it seems likely that exotic slugs have been found elsewhere on the Forest. One location was next to a dispersed camping area near Highway 58. The other location was next to a private parcel called Beemers Ranch. We do not know the history of activities on this parcel, but it is currently a cut-over wetland forest with extensive marshy areas. The detection of non-native slugs highlights a need for better tracking of where they are found in order to monitor if their range increases in the future. The Forest Service has a specific database for invasives, but most wildlife biologists on the Forest are unfamiliar with it since, up to now, it has been used solely for recording information on invasive plants.

Management Recommendations

1. For *Deroceras* surveys where skunk cabbage is present, we recommend a single one-hour summer survey as described in this report rather than two protocol surveys for each 10-acre site. Ideally the area should have several hundred or more individual plants (i.e. enough plants that one hour can easily be spent searching the skunk cabbage plants for mollusks rather than searching for skunk cabbage plants).
2. If surveys are still required for *D. hesperium* after the taxonomic review, we recommend they only be done at sites where skunk cabbage is present on the Willamette National Forest. This recommendation is based on consideration that the only reported DEHE locations near the Forest are in skunk cabbage wetlands and that this study found a high apparent preference of *D. laeve* for this habitat.
3. Skunk cabbage wetlands are likely key habitats for a variety of overlooked species, as our finding concerning *D. laeve* highlight. The special measures to protect this habitat should be retained and revised as needed based on the latest science when the Willamette Forest Plan is updated.
4. Recording detections of non-native mollusks should be given more emphasis so the extent of their occurrences is better documented and so that range expansions can be detected if they occur. There is a need to familiarize wildlife biologists in the use of the NRIS Invasive database with has features similar to NRIS Wildlife where they routinely record wildlife surveys and sightings.

Acknowledgements:

Dick Davis provided useful information on locations of skunk cabbage wetlands on the Middle Fork Ranger District. Candice Gray, Ben Limle, Chad Marks-Fife, Susan Odonohoe, Ruby Seitz and Bret Williams helped with survey efforts.

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Figure 1. Vicinity Map for *Deroceras hesperium* Surveys on the Willamette National Forest.

