

Assignment: a literature review

- The directions for the assignment stated to develop a species' overview in the form of a literature review. A literature review differs in some ways from a lab report. Lab reports have sections of literature review, especially when explaining the rationale behind a study or in justifying methodologies.
- The first step of a literature review is to become highly knowledgeable on the subject in question. I advise you do this systematically in order to save yourself an immense amount of time. Biological reports in the Natural Resources field generally have a set standard, one that appeals to the scientific ideals of sound science and peer-reviewed literature. Environmental scientists must refer to the literature to support their assertions.
- The footnotes break down how to go about writing a literature review
- The text provides an example of the general language and expectations of the discipline.

THE EASTERN RED-SPOTTED NEWT: A META-ANALYSIS OF THE SPECIES NATURAL HISTORY, HABITAT REQUIREMENTS, AND MANAGEMENT FOR THE VERMONT DEPARTMENT OF FISH AND WILDLIFE¹

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TAXONOMY

Kingdom: Animalia
Phylum: Chordata
Class: Amphibia
Order: Caudata
Family: Salamandridae
Genus: *Notophthalmus*
Species: *viridescens*
Subspecies: *viridescens*

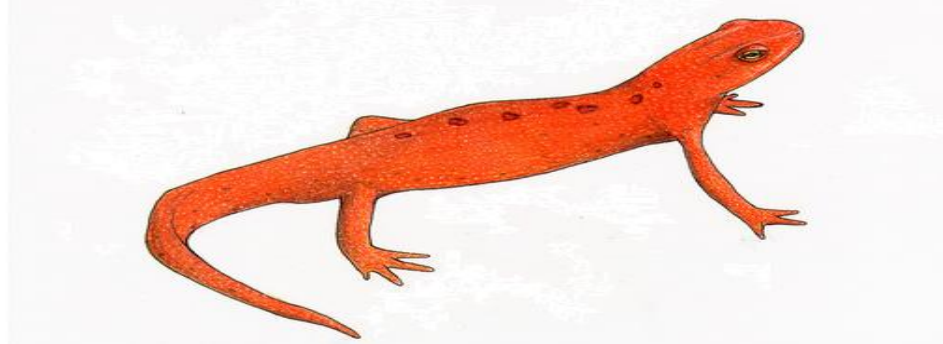


FIGURE 1: A picture of the Red eft (juvenile phase of the red-spotted newt)²

Common Names include: Eastern Red-spotted newt, Red eft (terrestrial juvenile state), Red-spotted newt, Spotted newt, Common newt, Eastern newt,

The Eastern red-spotted newt (*N. v. viridescens*)³ is a member of the animal kingdom (Animalia). It possesses a spinal apparatus and, as such, the species is a member of the phylum inclusive to all vertebrate

¹ This particular example is stylized as it would appear in governmental use for the Vermont Fish and Game Service. Often times biological reports will have an official standard. Whether you are writing a lab report, habitat suitability index, policy review and so forth, there is likely a real world equivalent or standard. A well-worded query in an internet search engine should yield examples of the type of document you are interested in. Natural resource writing addresses issues that are of concern to people of various professional levels. Examples produced by polished professionals provide the best framework for your own work.

² All GRAPHS (i.e. plotted data) and FIGURES (i.e. tables, pictures, etc.) must be labeled and numbered. GRAPHS are labeled above, FIGURES are labeled below. The reader must be able to understand BOTH fully through the description provided. EACH figure must be referenced in the text. FYI: This on the first page because it is very important. You will lose points if you forget to do this

animals (Chordata). The Eastern red-spotted newt is further characterized by its poikilothermic heat regulation and tetrapodal morphology; which validates its inclusion in the class containing all amphibians (Amphibia). Salamandridae is of the order Caudata; which includes all members of the salamander family, past or present. This species is in the genus belonging to North American newts, (*Notophthalmus*), one of fourteen in the true salamander and newt family (Salamandridae). Phylogenetic tree produced by David and Wake suggest that *Notophthalmus* share a phylogenetic clade with the genus *Taricha*, or Western newts; as well as showing close evolutionary relations to the following genera: Crested and Marbled newts (*Triturus*), Middle Eastern newts (*Neurergus*), and a number of Eastern Asia species in the genera *Paramesotriton*, *Cynops* and *Hypselotriton* (1969). An analysis of the Mitochondrial DNA of members of the Salamandridae family resulted in similar conclusions; however the degree of evolutionary association was appealed as less conclusive to what clade *Notophthalmus* belongs to (Titus and Larson 1995).⁴

The Eastern Red-spotted newt is one variation of four found in the species *Notophthalmus viridescens*. These differences were initially a result of geographic variation along the landscape due to their different ranges (Kurzava and Morin 1994). Other members of this species include: the Broken-striped newt (*N. v. dorsalis*), the Central newt (*N. v. louisianensis*), and the Peninsula newt (*N. v. piaropicola*). Differences between species are noted in: body size, predator choice, dorsal coloration patterns, and in respect to particular life history strategies. The Eastern red-spotted newt is the largest of the subspecies (Kurzava and Morin 1994). Bergmann's rule of natural sciences recognizes the correlation between increasing body size and latitudinal increases; fitly following var. *viridescens* sole representation of the species in the State of Vermont. The Eastern red-spotted newt species is recognized by its characteristic red spots, which persist through the juvenile red eft (FIGURE 1)⁵ and adult phases.

RANGE AND DISTRIBUTION⁶

The Eastern red-spotted newt population is restricted to the eastern portions of North America; being one of the few species of Salamandridae native to the region (Figure 2). The outward boundaries enclosing the specie's native range extend from Canada's southernmost province, Quebec; to the Great Lakes region; furthermore on to Texas and Florida, following the perimeter of the Atlantic Ocean northwards (Petranka 1998). The Eastern

³ WRITING IN BIOLOGY HINT: The first time a species or group of species is mentioned in a paper, its taxonomy must be referenced. Numerous examples are provided throughout the text but the general format is as follows (notice uncapped secondary word): (*Genus specific epithet*) ex. *Canis lupus* (Genus species) ex. Canis latrans The highlighted example provides the framework for a more complicated inclusion of subspecies information.

⁴ QUICK TIP→CITATIONS: Keeping track of your citations early on is strongly advised. As you research your topic, paraphrase useful papers underneath the required citation (scroll to the tail end for advice on citation styling). Then use your paraphrased information as it becomes relevant to your paper and cite appropriately IN-TEXT and in the WORKS CITED page. IN-TEXT CITATIONS (two methods included in highlighted text): Author names referenced in text (Dave and Wake) with date mention to the anterior (1969) and author names and date referenced together at end of sentence (Titus and Larson 1995) * more than three authors? Use the first name followed by the term et al. (Latin for 'and others')

⁵ Notice the in-text reference to the figure

⁶ ORGANIZE YOUR INFO: When reading through the sections (taxonomy, range and distribution, habitat requirements, natural history and population and habitat recommendations) look at how information is divided explicitly under its label. This results in very little informational repeat. In this respect, this paper is very similar to a traditional scientific report, with introduction, methods, results, conclusion, works cited. Many NR papers are written under the scientific process, although the connections may be difficult to recognize at first.

red-spotted newt can survive in both deciduous and coniferous forests, allowing it significant flexibility in the expansion of its range (Petranka 1998). The complex life cycle of the species mandates close proximity to an open body of water, highly affecting its distribution throughout the landscape (deMaynadier and Hunter 1999).⁷ The species is commonly found throughout the entirety of its range (Hammerson 2004). Middlebury College has continued an extensive and accurate amphibian monitoring project in the State of Vermont since 1986, concluding that Eastern red-spotted newts are present in all counties in the state (Figure 3). The species is one of the few believed to increase in numbers post European settlement; an effect attributed to widespread development of farm-based ponds (Petranka 1998).

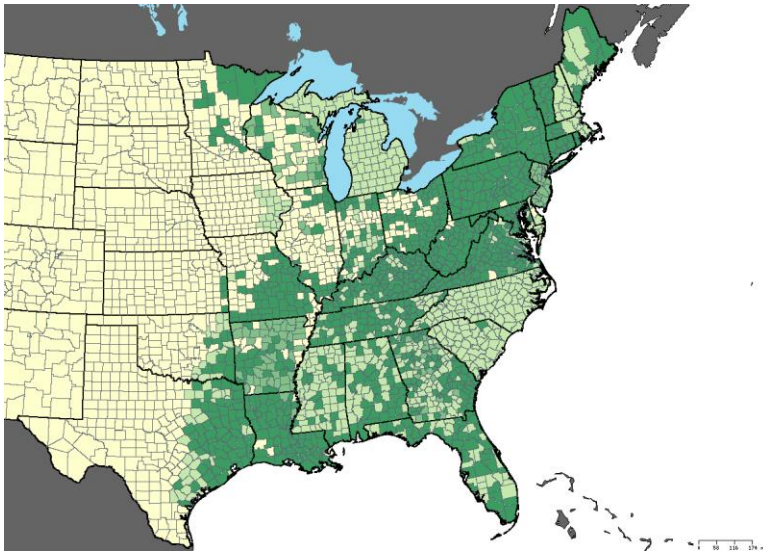


FIGURE 2: Range map of the Eastern red-spotted newt produced by the USGS Patuxent Wildlife Research Center. Depth of green pigment indicates intensity of presence.

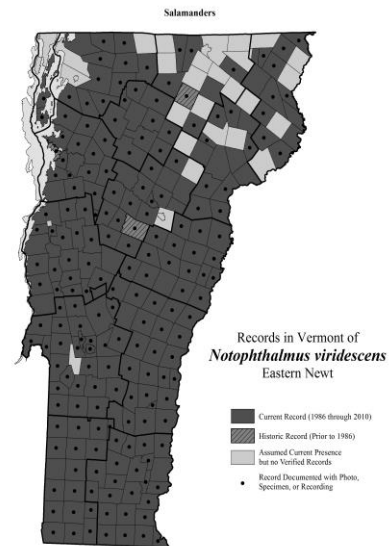


FIGURE 3: Map of Vermont noting the observed presence (dark grey), assumed presence (light grey), and historic presence (barred) of the Eastern red-spotted newt. Survey provided for by Middlebury College.⁸

HABITAT REQUIREMENTS

⁷ WRITE CONCISELY: Try to include as much information as can possibly fit into one sentence. This sentence, for example, tells us three things. First that the species has a complex life cycle, meaning that it transforms bodily form throughout its life. Second, that they must live next to open water. And thirdly that this affects their distribution across the landscape (which was supported by evidence from deMaynadier and Hunter). Power sentences like these help keep your writing succinct.

Other hints: avoid unnecessary descriptive words, especially words like very and really. Become comfortable with using semi colons in order to expand upon ideas without rephrasing. Familiarize yourself with key vocabulary terms instead of talking around them.

⁸ These figures provide an explanatory view of how figures MUST BE numbered in succession and explained in a 'stand-alone' fashion. Only the necessary information must be provide per each individual figure. For example, color grading was explained where ambiguous on the reader's right, but left unmentioned on the left where the color scheme is intuitive.

The Red-spotted newt's complex life strategy mandates inclusion of two habitat types: aquatic and terrestrial. Adults and developing larvae require lotic environments such as ponds, large puddles, lakes, and in some cases slow moving lotic environments such as meandering and wide rivers. Particularly muddy substrates with larger, coarse organic matter, such as logs, provide adults with ideal cover. Increasing densities of macrophytes in the water positively affect population sizes; however it is noted that the species will persist without the presence of vegetation (Burton 1977). No plant associations have been acknowledged as indices of suitable habitat for juveniles and adults as long as the associations provide adequate cover.

Terrestrial individuals (juveniles) can colonize both coniferous and deciduous forests (Bishop 1941). There is a preference towards deciduous forests, as the species has a moderate sensitivity to acidity in soils (Wyman and Jancola 1992). Cover and litter must be dense and moist, as red-spotted newts have been observed to persist only in areas with a forest cover threshold greater than 50% (Gibbs 1998). Particular tree species have been recognized to promote success of juveniles more than others; notably oak (*Quercus* spp.)⁹ associations (Healy 1974).

NATURAL HISTORY

The Red-spotted newt generally undertakes three phases of polyphenism throughout its life cycle. This strategy has been evolutionarily hypothesized as a means to increase ecological speciation; effectively reducing competition in valued habitat (Takahashi et al 2011).¹⁰ The most critical of these stages is that of the red eft, which has adaptations that allow for terrestrial dispersion. The two bouts of metamorphosis undertaken by the Eastern red-spotted newt are: the transformation from the larval (gilled) form to the juvenile state, and the morphological maturation from a juvenile, to an olive-colored breeding adult. It should be noted that some distinct populations have different life history strategies, an example being a coastal Massachusetts population that omits a terrestrial adaptation phase (Healy 1973).

Adults have two annual peak migration periods: the first being a movement towards aquatic breeding habitats in the spring, the second being a terrestrial migration for the sake of hibernacula (Gill 1978). Breeding adults exhibit philopatry and use homing abilities to ensure successful location of their specific vernal pool (Gill 1978).

When present, the terrestrial juvenile state inhabits damp woodlands (Bishop 1941). Individuals in the juvenile stage are recognized by their distinct orange coloration and quadrupedal locomotion. Juvenile newts may remain as such for a period of 3-8 years while dispersing to new habitats. Once they find a pond they will begin metamorphosis again (Burton 1976). Aquatic constituents of the species, which include both the larval and adult phases, typically occupy lentic water systems (Mecham 1967).

Male to female ratios in breeding ponds on average favor males by a factor of two (Bellis 1968) and females will breed 20-30 times in a season; producing 6-10 eggs for each round of fertilization, each egg being

⁹ BIOLOGICAL TERMINOLOGY: *Quercus* spp. is inclusive of all members of the Oak family as spp. is the plural contraction of the word species (singular - sp.) . Using the proper abbreviations is equivalent to spelling correctly.

¹⁰ TO CITE OR NOT TO CITE: Writers are required to cite the ideas and creative works of others, that is unless the knowledge under scrutiny is considered commonplace or common knowledge. The general consensus is that if a topic can be sourced from five independent origins, it is considered to be common knowledge. Common knowledge is a flexible term and it is well advised to cite whenever in question. In this particular example, the first sentence contains only common knowledge and doesn't require a citation. Undertaking three phases of polyphenism is a scientific way of saying that they transform physical state three times as functioning organisms, a fact that has been established for decades. The second sentence is an example of specific knowledge and must be credited to its source. The recent study cited was one of the first to examine this particular hypothesis. Therefore, the credit must go to the idea's origin.

carefully attached to aquatic vegetation (Bishop 1941). No parental care is provided to offspring and, in some communities, larval offspring are predated upon by the same adults that spawned them (Gill 1978). Female adults typically breed 1.3 times during their lifespan, whereas males on average manage to breed 1.9 times (Gill 1978).

Eastern red-spotted newts are often considered keystone predators in pond ecosystems and are opportunistic carnivores during all life stages. As a result of its predatorial nature, the newt helps maintain stability in aquatic systems through the effects of a trophic cascade (Strohmeier et al 1989). Without the presence of a top predator, many ecosystems lose their ability to support higher levels of diversity (Ripple and Beschta 2003). Larval newts feed primarily on macroinvertebrates such as: amphipods (Amphipoda), midges (Chironomidae), and water fleas (Cladocera) (Burton 1977). Adults eat cladocerans, aquatic insects, mollusks (Pelecypoda, Gastropoda), larval newts (Burton 1977), aquatic earthworms (Oligochaeta), and leeches (Hirudinea) (Ries and Bellis 1966), and eggs and larvae of other amphibious species (Bishop 1941). The feeding success of juveniles is dependent upon the moisture content of leaf litter and has been observed to increase in response to rainfall, positively affecting growth; temperature is a factor with similar effects (>50°F equates little to no feeding) (Healy 1975). Efts typically feed on a variety of forest litter dwelling organisms, including: flies (Diptera), springtails (Collembola), beetles (Coleoptera), aphids and leafhoppers (Homoptera), spiders (Areneida), mites (Acarina), and snails (Gastropoda) (Burton 1976).¹¹

The species is rarely predated upon due to the high toxin content found in the skin of the newt; which is ten times as affective in efts, likely explaining their aposematic coloration (Brodie 1968). However, the species does heavily interact with other species in the form of competition. The species heavily competes with other species of carnivorous salamanders as well as a number of fish that derive their nutrients from similar sources. The Eastern red-spotted newt has been observed to grow at slower rates in the presence of other competitors; however larval offspring success and production are not heavily affected by competition (Fauth and Resetarits 1991).

The Eastern red-spotted newt, like all newts, is highly sensitive to anthropogenic pollutants. In a study performed by Hempleman and Propper, they noted over fifteen common pollutants that exhibited negative effects on the pheromonal systems of female newts (2001). The chemicals studied often interrupted successful completion of the mating season in the females. Diseases and parasites have not been recognized to contribute additive mortality to the species as of this point in time.

¹¹ CITATIONS CONTINUED:

When writing this segment, the only knowledge I had on the feeding habits of this species came from articles that I had found. Food preference studies are common in the biological sciences, and thus discrepancies arose between the various articles. When you are forced to pick one to cite, it is important to use your judgment to pick the best one. Scientific findings are based on STATISTICAL MERIT; therefore, when determining the quality of a study you must look at the statistics. Review the paper looking to see how the study was designed, how they addressed sources of error, and how many observation they had. The more observations, the stronger the study—assuming the results are scientifically significant. Some studies will publish data even if it doesn't show the intended results, so it is very important to read over your references carefully.

POPULATION AND HABITAT RECOMMENDATIONS¹²

Nationally and state wide the Eastern red-spotted newt is of low concern for the department. With the 2007 IUCN red list recognizing the species as one of least concern, the red-spotted newt is commonly considered one of these most abundant newts to the region. Although no definitive studies have been conducted to determine population sizes in the state of Vermont, monitoring projects have been conducted through the services of the University of Vermont. Graduate student Kurt Rinehart, of the University's Masters of Science program, performed a study on factors affecting occupancy patterns of the newt in the State of Vermont in 2007. The results suggested that the southern counties, with forests composed primarily of hardwoods stands, maintain larger populations. Rinehart also recognized five major factors that negatively affect the viability of healthy Eastern red-spotted newt populations. These factors are sensitivities to: pollutants, low pH levels, the effects of global warming, loss of vernal pools, and forest fragmentation (Rinehart 2007). The high sensitivities of amphibians to the factors aforementioned have traditionally marked them as important biological indicators of the wellbeing of an ecosystem. However, the relative value of amphibians in respect to other taxa as proxy measures of biodiversity is currently unrealized; and the sheer magnitude of the issues causing global amphibian declines are often beyond the scope of the department to manage (Beebee and Griffiths 2004). Certain population dynamics of the Eastern red-spotted newt, if recognized, can be managed for properly; ensuring continual success of the existent populations in the state. The two most prevalent management concerns are fragmentation of the forested landscape and the increasing loss of vernal pools to development and reforestation (Preisser et al 2000). The Eastern red-spotted newt depends upon a select few vernal pools that function as sources in a landscape; a landscape that contains mostly metapopulations that are reproductive sinks serving a dispersal function (Gill 1978). The constant shift of vernal pools in size and space across Vermont mandate a terrestrial emigration; a necessary step in the promotion of successful colonization of a prolific habitat (Gill 1978). Roadways, especially those next to ponds, greatly increase mortality of migrating adults and interfere with the dispersion of the terrestrial juveniles (Paten and Egan 2001). Further aggravations to the success of the species include the destruction of forested landscape due to logging, especially in matured deciduous forests surrounding ponds (Petranka 1994). In juxtapose with the previous statement, reforestation of

¹² Although this particular document is a literature review, most environmental science papers, including this one, follow loose formatting similar to the scientific method. The introduction to this essay explicitly described the study object through its taxonomy and range. The habitat requirements section mandates where and what we study, like a method section. The results of years of studying the species culminate in the natural history segment, and we are finally left with the discussion section. The section on population and habitat recommendations is similar in effect and purpose to any other written conclusion. When writing your own conclusions, focus on bringing together the various pieces of knowledge you have acquired throughout and synthesizing the points into something meaningful and potentially important. In this case, the information I found suggested that the Eastern Red-spotted newt is not a species to fret over; moving forward with this point required more creativity. I had to think of various possible concerns and research them. When I found resources that supported my thoughts, I then included them into the text. It is very important to provide support from the literature when making claims. A point made without evidence is made null, and you may be discredited for including such points. Clearly the process of writing a scientific lab report, which includes sections of literature review, requires the writer to do a lot of research. I use UVM's access to JSTOR as my primary source of journal articles.

agriculturally based land has resulted in a decline in the amount of vernal pools, which had previously allowed the population to flourish (Petranka 1994).

Ideally, pools that function as population sources should be identified and protected, an act that would help secure future populations. In our current situation, minimizing the negative effects of fragmentation and habitat loss will reduce stresses on taxa already experiencing global declines (Alfred et al 2001). The Eastern red-spotted newt does not qualify for funds or federal protection under the Endangered Species Act of 1973¹³. As such, expensive measures to remove pollutants locally affecting populations are unlikely and management projects on private lands as well as the alterations of existing roadways are also unlikely at this point in time.

For the extents and purposes of this department, monitoring the value of habitat on state owned lands is the only current option. Turtle crossing signs have been observed to reduce car induced mortality of turtles in Burke, Vermont; a model that could easily be adapted to salamanders (personal observation). Furthermore, protecting habitat from logging operations permitted on state lands can potentially protect populations and is within jurisdiction of the department. Monitoring the species numbers may also prove critical in recognizing future threats, especially if the effects of global warming amplify as projected (Beebee and Griffiths 2004).

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¹³ I always try to include referencing laws when relevant because they often have large implications for environmental efforts. It's something you may want to consider when scripting management plans or environmental concerns.

¹⁴ Scholars in the NR field generally are interested in peer-reviewed works only. The citation style is often either APA format or modeled after a specific journal. For example, a wildlife biology assignment may specify that the citation format follows the standard set by the Wildlife Society Bulletin. Regardless of style, consistency is of high importance. In this case the exact formatting required the citations to be both alphabetically arranged and indented by ten spaces for any secondary lines. Normally, your professor will specify the exact style, so look over the assignment in depth. The general formatting is the same for most papers however. The many parts are described immediately below in examples.

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- Wyman, R. L., Jancola, J. 1992. Degree and Scale of Terrestrial Acidification and Amphibian Community Structure. *Journal of Herpetology* 26:392-401

Photos and Figures¹⁵

Red Eft - http://www.discoverlife.org/IM/I_DL/0006/640/

USGS Range map- [USGS National Amphibian Atlas](#)

Vermont distribution map-

http://community.middlebury.edu/~herpatlas/spp_pages/sppN-viridescens.php

¹⁵ CITATION BREAKDOWN

AUTHOR(S):

Alford, R.A., Dixon, P.M., Pechmann, H.K.
(last name, initials, last name, initials.....)

DATE:

2001

ARTICLE NAME:

Ecology: Global amphibian population declines.

JOURNAL NAME:

Nature

ISSUE/PAGE NUMBER(S):

412: 499-500

It should be noted that all of this information can be found on the first few pages of a scientific article and that the above mentioned information is generally what you will be asked to supply. The formatting is what will differ. You should also include links or credit to any photos, figures and graphs that are not your own. Giving credit where credit is due is a highly important when composing any type of document. A meta-analysis is no different. Remember to do your citations well and you will likely do well too. Ask your professor how formal these citations must be. In this particular case links were sufficient