Northern Alligator Lizard (*Elgaria coerulea principis*): Ecology, Threats, and Conservation Recommendations

Created for the Galiano Conservancy Association

ES 471/ER 412

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1.0 Introduction

This project focuses on the habitat and ecology of the Northern Alligator Lizard (*Elgaria coerulea*), with a focus on the Northwestern subspecies **(***Elgaria coerulea principis*) which is the only native lizard on Galiano Island. There is a distinctive opportunity to investigate it without the incipient threat of the invasive European wall lizard (*Podarcis muralis*). The goal of this project is to provide the Galiano Conservancy Association (GCA) with a comprehensive summary of available ecological and conservation information on *E. coerulea***,** and to propose strategies that will support the long-term persistence of the island's population, for which very little site-specific information presently exists. By developing a monitoring and habitat management plan tailored to *E. coerulea***,** I aim to determine whether populations on Galiano remain stable and to identify emerging threats, particularly the potential arrival of *P. muralis***.**

To achieve this, I assessed key habitat characteristics that support the species' life cycle, including retreat site availability, shrub cover, and connectivity between hibernation and foraging areas. My approach also incorporates public engagement, recognizing the value of community involvement in early detection of invasive species and in promoting best practices for habitat stewardship. The outcome of this project is intended not only to improve understanding of the status of *E. coerulea* habitat and threats but also to provide the GCA with suggestions for an annual monitoring program and habitat management.

2.0 Goals

1. Compile and summarize available ecological and conservation information on *E.coerulea*
2. Propose conservation strategies to support Galliano's *E.coerulea* population

3.0 Species Profile

3.1 Conservation status

E. coerulea is currently considered secure across most of its range and is not listed at risk by the Committee on the Status of Endangered Wildlife Canada (COSEWIC) or under the federal Species at Risk Act (SARA). The International Union for Conservation of Nature (IUCN) lists the species as globally as least concern G5, meaning that the alligator lizard is at very low

risk of extinction due to its extensive range, abundant populations or occurrences, and little concern for declines. Provincially in British Columbia, the northern alligator lizard is ranked S4 meaning that they are apparently secure and is on the BC yellow List indicating that they are not currently a conservation priority compared to red or blue listed species (Atkins, 2024; B.C. Ministry of Environment and Climate Change Strategy, n.d.).

3.2 Distribution

E. coerulea inhabits elevations from sea level to 3,200m (Montana Natural Heritage Program, 2023). Globally they are found west of the continental divide from southern British Columbia, south into northern Idaho and western Montana, and through northern and western Washington, western Oregon, and the coast ranges and Sierra Nevada in California. They also occur on several islands off the coasts of Washington and California (Montana Natural Heritage Program and Montana Fish, 2025). In Canada they inhabit southeastern Vancouver Island, several Gulf Islands, and parts of the interior (Rutherford, 2021; Rutherford & Gregory, 2003). Their distribution extends northward to Stuie in Bella Coola Valley, inland to Clearwater and eastward to Creston the Columbian River Valley (Canadian Herpetological Society, n.d).

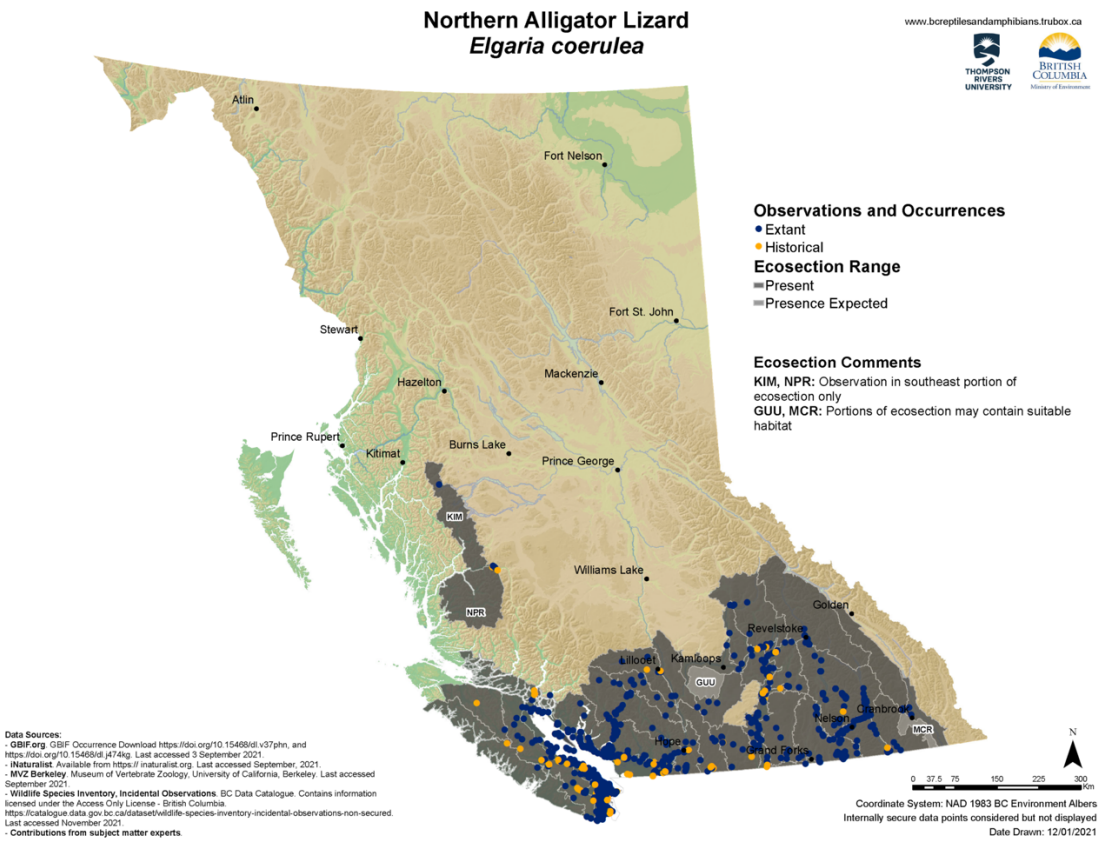

Figure 1. The known rage of *E.coerulea* in British Columbia from the southern border and coast of the mainland and Vancouver Island to the northwest (Atkins, 2024).

3.3 Habitat Preferences

E.coerulea occur in cooler and more humid areas than tolerated by most other lizard species Montana Natural Heritage Program, 2023). Their habitat consists of a varriety of ecosystems, including montane forests, dry woodlands, grasslands, riparian zones, and marine beaches (Atkins, 2024). They are most frequently associated with rocky outcrops, talus slopes, and woody debris near dense vegetation, and streams which provides essential refuge and thermal opportunities supporting their different life stages (Bertram, 2004; Rutherford & Gregory, 2003). During hibernation between September 1st and April 30th they are frequently found sheltering in rock crevices below the frost-line, that are sufficiently humid to prevent overwinter dehydration (Canadian Herpetological Society, n.d.). Retreat basking sites are

typically occupied by only one lizard and are under logs or beneath large thick rocks, often larger than those used by western skinks. These retreat sites are frequently located within 2m of dense low growing shrubs such as oceanspray (*Holodiscus discolor*), mock orange (*Philadelphus lewisii*) and snowberry (*Symphoricarpos albus*). These shrub species along with nearby trees like Ponderosa pine, Douglas fir, and trembling aspen offer both ground-level cover for predator avoidance enabling the lizards to disappear easily into the vegetation but also foraging opportunities for insect prey (Rutherford & Gregory, 2003). *E.coerulea* display high levels of site fidelity, with limited movement and with their hibernation sites located in the same area as their summer habitat (Canadian Herpetological Society, n.d.).

3.4 Identification

Adult *E.coerulea* can measure up to a max of 20cm in length with females being slightly larger than males. They are a gray-brown colour, and their body is stout with keeled scales. Their dorsal and ventral scares are rectangular, and between these scales they have smaller scales on their sides where the skin can expand and fold, which helps their body expand when inflated with air or is distended by eggs or food (Washington Department of Fish & Wildlife, 2025; Atkins, 2024; Rutherford, 2021). Their dorsal colouration is brown with a black spotted transverse band, and they may have white spots on the edges of their lateral scales. The underbelly is a light coloured with dark pigmentation on the lateral edges of each scale. *E.coerulea* have brown eyes and males have a broader more triangular head then females (Washington Department of Fish & Wildlife, 2025). Juveniles are bronze with a single eyeline and a broad stripe along the back. Males have broader heads that are used to grip female's heads while breeding (Atkins, 2024).

Figure 2. Ault Female *E.coerulea* on stump with juvenile. (Lundgren, n.d.).

3.5 Breeding biology

Breeding occurs almost immediately after emergence from hibernation in mid-April (Atkins, 2024; Williams et al., 2020). Males do not display any courtship ritual but simply chase and bite the females heads to initiate copulation, which can last up to 12 hours (Atkins, 2024; Canadian Herpetological Society, n.d.). Mating is followed by a three-month internal gestational period throughout summer with a single brood (Montana Natural Heritage Program, 2023). This allows the females to protect their developing young and provide them with the best heat and humidity conditions. *E.coerulea* are viviparous giving birth between mid-August and mid-September to an average of 5 live young, but this can range between 2-8. Parental care has been observed but requires females to bask more frequently increasing risk to predation. Due to the energetic cost of reproduction, females typically breed every two years because they require a year between clutches to regain their fat reserves (Atkins, 2024). Females will breed until seven years of age and males as old as eight (Rutherford, 2021).

Fig 3. Female *E.coerulea* likely pregnant, basking on rock surface. (WDFW, n.d.).

3.6 Diet

E.coerulea are diurnal foragers with peak activity typically occurring in the late afternoon (Atkins, 2024). They hunt primarily by sight, though they also rely on chemical cues such as scent and taste to locate wounded prey if it escapes after initial capture (Atkins, 2024; Montana Natural Heritage Program, 2023). Foraging behaviour can be slow and deliberate or involve quick, snake-like lunges with limbs tucked alongside the body (Montana Natural Heritage Program, 2023). Their diet is dominated by arthropods, including beetles, caterpillars, grasshoppers, spiders, millipedes, centipedes, and ticks, as well as mollusks such as snails (Atkins, 2024; Montana Natural Heritage Program, 2023; Rutherford, 2021). They will consume prey capable of stinging or biting but generally avoid invertebrates with strong defensive secretions (Rutherford, 2021). Juveniles target many of the same prey species as adults but select smaller individuals (Atkins, 2024).

4.0 Threats

Although *E.coerulea* is currently considered secure at both provincial and federal levels there are several emerging and ongoing threats that have potential to cause localized declines.

Threats include competition from the invasive European wall lizard (*Podarcis muralis*), predation by domestic cats, and habitat loss and fragmentation caused by human activities.

4.1 European Wall lizard

The introduction of the European wall lizard to southern British Columbia originating from the release of 12 individuals in 1970 on the Saanich Peninsula has resulted in established, expanding populations that pose a significant threat to *E.coerulea*. *P.muralis* are highly adaptable, thriving in anthropogenic environments such as gardens, rock walls, and disturbed landscapes, conditions under which they can reach high densities. In parts of their introduced range, population densities have been estimated at 95–111 individuals per hectare, far exceeding those of native lizards (Bertram, 2004). This competitive advantage is reinforced by their reproductive strategy: *P.muralis* are oviparous, producing up to three clutches per active season, without preforming parental care whereas *E. coerulea* are viviparous and reproduces only once every two years on average and displays parental care (Atkins, 2024; Bertram, 2004).

Behavioral trials and field observations indicate that *P.muralis* are aggressive and territorial, monopolizing key habitat resources such as basking sites, retreat crevices, and foraging grounds. The high site fidelity of *E. coerulea* means they are less able to relocate when displaced, increasing their vulnerability. Furthermore, laboratory scent trials have shown that *E. coerulea* is chemically naïve to *P.muralis*, failing to recognize them as potential competitors and in some cases even being attracted to their scent. This naïveté increases the likelihood of harmful encounters, particularly in shared basking or foraging areas as they both feed on invertebrates. *P.muralis* could also be a potential prey for other predators and with their high densities they can be exploited as a food source that could lead to higher populations of predators that would indirectly have negative effects on other prey species such as *E.coerulea* (Bertram, 2004).

Physiologically *P.muralis* also outperforms *E.coerulea* in sprint speed velocity at moderate temperatures, enabling longer daily and seasonal activity periods. This observed disproportionate difference in sprint speed may give *P.muralis* an advantage in food acquisition and predator avoidance and other critical activities requiring movement Bertram, 2004).

The extended foraging and breeding window, combined with high fecundity and territorial dominance, suggests that *P.muralis* may progressively displace *E. coerulea* from optimal habitats. Over time, such displacement could result in reduced reproductive success,

smaller population sizes, and localized extirpations of *E. coerulea* in areas where the two species overlap **(**Bertram, 2004).

4.2 Domestic cats

Domestic cats (*Felis catus*) are abundant generalist predators capable of exploiting a wide range of prey including birds, herpetofauna, and small mammals (Loyed et al., 2013). This predatory flexibility makes them significant threat to *E.coerulea* particularly in urban, suburban, and rural residential areas. When harassed by a cat, *E.coerulea* often employs caudal autotomy, the voluntary shedding of its tail as a defensive strategy. The detached tail wriggles which may distract the cat, potentially allowing the lizard to escape (Washington Department of Fish & Wildlife, 2025). *E.coerulea* will eventually regenerate their lost tail, but it often grows back shorter and fatter than what it was prior to autotomy (Atkins, 2024).

While autotomy offers an immediate survival benefit, it comes with substantial energetic and ecological costs (Barr et al., 2021). The tail of *E. coerulea* serves as an important fat reserve and energy storage site, which supports survival and reproduction (Atkins, 2024; Barr et al., 2021). Loss of this reserve can reduce body condition, limiting the energy available for gestation that can lead to a decreased number of young. Tail loss can also impair locomotion, balance, and agility potentially increasing vulnerability to future predation, and can reduce mate pairing and acquisition (Barr et al., 2021).

Given these impacts, sustained predation pressure from *F.catus* can have compounding effects on *E.coerulea* populations, not only though direct mortality but also by reducing individual fitness and reproductive success over time.

4.3 Habitat loss and fragmentation

Habitat loss and fragmentation are considered among the most significant threats to *E.coerulea* in Canada, particularly for peripheral populations in British Columbia that may contain unique genetic traits important for the species' overall adaptability and resilience (Atkins, 2024; Canadian Herpetological Society, n.d.). Peripheral populations are those at the edges of a species' range and are often genetically distinct from core populations and thus contribute to the overall genetic diversity of the species (Atkins 2024). These traits can be critical for the species to maintain survivorship as they already occupy environments near the limits of the species tolerance and thus can provide the species greater adaptive potential and refugia

under novel stressors like climate shifts and diseases (Hoff et al., 2025). However, these advantages are only maintained if the habitats remain intact. Unfortunately, peripheral populations are particularly vulnerable to habitat loss and fragmentation as they tend to be smaller, more isolated, and ecologically more specialized and thus less resilient to habitat fragmentation (Hoff et al., 2025; Prieto-Ramirez et al., 2020).

E.coerulea exhibit strong site fidelity and depend heavily on rock outcrops and associated vegetative cover for basking, thermoregulation, and overwintering. As a result, localized habitat modifications such as rock removal for road construction, quarrying, or landscaping can have severe consequences by reducing or eliminating essential landscape features. The species' sensitivity to disturbance further amplifies these risks. They are easily startled and may remain hidden for several hours after encountering a predator or human, reducing time available for basking (Atkins, 2024). Frequent disturbances can be especially detrimental to gravid females, whose reproductive success depends on maintaining optimal body temperatures. In cooler years, when thermoregulatory opportunities are already limited, such disturbances can further suppress reproductive output (Rutherford, 2021; Canadian Herpetological Society, n.d.).

5.0 Conservation and Preservation Recommendations

5.1 Monitoring strategy

Monitoring programs for *E. coerulea* should be designed to track population trends, assess habitat quality, and detect emerging threats such as the invasive *P.muralis* or increased domestic cat predation. Field research in British Columbia and Montana indicates that *E.coerulea* exhibit high site fidelity often remaining within 10m of previous capture locations which can make a mark-recapture an effective tool for the GCA for estimating population size, survival rates, and site fidelity (Rutherford & Gregory, 2003; Montana Natural Heritage Program, 2025).

Conducting Visual Encounter Surveys (VES) during peak during peak *E.coerulea* activity periods primarily from late April through August could help detect individuals and document seasonal activity patterns. The GCA could possibly create a standardized survey route at known habitat sites once detected and possibly integrate it with the already present sharp-tailed snake *Contia tenuis* monitoring program to maximize efficiency. Implementing a VES program for *E.coerulea* may also enable early detection of *P.muralis* if spread to Galiano Island.

Public engagement is also a key component of early detection and could be especially valuable in identifying early incursions of *P.muralis* on Galiano Island, where their presence is not yet formally confirmed by any academic or governmental institution. However, there is a confirmed sighting of *P.muralis* on Galiano Island on the shore of Spotlight Dr documented in June 2025 on iNaturalist (Mandrews65, 2025). Thus, educating residents about how to recognize *P.muralis* and differentiate them against *E.coerulea* through outreach materials like posters with illustrated graphics or a short educational video could increase the likelihood of prompt reporting. The graphics could be integrated into the GCA's school program which could even extend to parents by giving the students information brochure, poster, or a flyer with a QR code to a video that could be shown to parents.

5.2 Habitat Suitability Assessment

Prior to any enhancement efforts a structured Habitat Suitability Assessment (HSA) framework guide should be used to identify priority areas for conservation. Known physical attributes within an ecosystem that support *E. coerulea* such as rock crevices, large rocks, talus slopes should be assessed alongside vegetative characteristics like shrub density in potential sites to understand the quality of shelter and food availability. Threat indicators like invasive species presence, predator densities, and human disturbance should be documented. The assessments must also account for habitat connectivity and identify any barriers like roads or high human activity trails. An in-depth field verification will allow for the creation of a realistic expectation for the intensity of enhancements needed.

5.3 Habitat enhancement

E. coerulea is strongly dependent on specific microhabitat features, thus targeted habitat enhancements may further support survival and reproduction success. Increasing retreat site availability is essential and can be supported through the placement of large, stable rocks in suitable areas, particularly where rock cover has been lost due to human activity. Planting dense, low-growing native shrubs such as oceanspray, mock orange, and snowberry within two meters of rocky retreats will provide both protective cover and insect foraging opportunities (Rutherford & Gregory, 2003). Retaining coarse woody debris, such as downed logs, will add structural complexity and offer additional refuges. Managing canopy cover to create a patchwork of sun and shade will ensure adequate basking areas without compromising shelter. Keeping deciduous

leaf litter supports invertebrates as the prey base for many reptiles and thus encourages *E. coerulea* presence. Habitat connectivity should also be improved by establishing corridors between isolated patches, thereby facilitating dispersal and genetic exchange (Pilliod & Wind, 2008). These measures should be accompanied by public education to discourage the removal of rocks and logs.

6.0 Concluding statements

E. coerulea remains a secure species across most of its range, however, the unique conditions on Galiano Island present both an opportunity and a responsibility for proactive conservation. The absence of the invasive *P. muralis* offers a rare chance to safeguard a native reptile population before competitive pressures emerge, while targeted monitoring and habitat stewardship can help address other threats such as predation by domestic cats and habitat fragmentation.

By compiling ecological data, identifying key threats, and recommending site-specific conservation strategies, I hope this report provides the GCA with a foundation for creating a long-term management of *E. coerulea* on the island. Implementation of a standardized monitoring program, coupled with habitat suitability assessments and targeted enhancements, will not only help maintain and identify habitat quality but also support early detection of invasive species. Public engagement through collaboration with the GCA education program will help build capacity to act quickly in response to emerging invasive species threats.

Protecting *E. coerulea* on Galiano Island will contribute to preserving the island's ecological integrity and biodiversity, ensuring that this native lizard continues to thrive in the face of environmental change. The strategies outlined in this plan are intended to help guide conservation actions now that can hopefully develop into a program that supports a resilient population of northern alligator lizard on Galiano Island.

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