AMPHIBIAN MIGRATION ACROSS A NEW RESIDENTIAL ROAD

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Introduction

The Pacific Northwest is a challenging region in which to identify, plan, and mitigate for vehicle-caused road mortality on amphibians. This region, especially the Salish lowlands of the Puget Sound-Georgia Basin, is experiencing rapid human population growth, which increases habitat alteration and fragmentation in the form of new housing and associated infrastructure (White and Ernst 2003; Andrews et al. 2008). Roads built near wetlands can isolate breeding habitats and disrupt the migration routes of native amphibians (Ashley and Robinson, 1996). This region sustains months of wet conditions favorable for amphibian migration when migrating animals may risk mortality from vehicles. Road mortality surveys conducted in 2006 and 2007 (JSH, unpubl. data) pinpointed concentration areas of amphibian mortality on a rural residential road within Thurston County, Washington, USA. Concurrent with this discovery was the platting of a new large-lot subdivision between one of the areas where high amphibian mortality had been observed and a large wetland complex. The new access road and the impending housing development presented a unique opportunity to proactively develop guidance for measures to allow amphibians to cross safely. It also enabled an overview of the migrating amphibian assemblage and their migration patterns across these new roads prior to residential development (Fig 1). In this study, our overarching goal was to develop a knowledge base of where and when amphibians might be crossing the new roads such that future efforts might refine this knowledge and provide guidance to thoughtfully implement safe crossing measures.

Methods

Study Site: The new development roads consisted of a main segment 1,260 m long and a 133 m spur. Roads had an asphalt surface ~6 m wide, with the exception of three circular asphalt areas ~20 m in diameter (two located along the main segment and one at the end of the spur). All roads were bounded by mown grass strips 6-20 m wide. A small ephemeral stream originating from the aforementioned wetland complex flowed under the road through a 1.8-m diameter culvert roughly midway along the main segment (*Fig 3*). The surrounding landscape is a mix of second-growth Douglas-fir (*Pseudotsuga menziesii*) forest and coniferous-deciduous forest dominated by Big-leaf Maple (*Acer macrophyllum*) with a secondary canopy of Douglas-fir and Western Red Cedar (*Thuja plicata*).We surveyed once a month from October 2008 to February 2009 except for January.

Survey: We selected dates conducive to amphibian movement (wet, relatively warm [minimum 8-10 °C] conditions). Each survey was conducted over 24 hours, starting at 16:00 h. During each of six sequential 4-h intervals within this period, one to five surveyors walked the entire length of road (main segment and spur), in one back-and-forth pass. Observers walked at a slow pace to minimize the likelihood of missing amphibians crossing the road. As a consequence, one back-and-forth pass averaged 147 min (range: 90-224 min). When we found an animal, we recorded its biological (species, size, and gender), spatial (location along the road), and directional (movement direction) data. Following data collection, we placed the animal off the road on the side of its direction of travel. The culvert was surveyed twice during each interval, once each on the outgoing and return passes. Beginning with the November survey, we installed paired funnel traps at each end of the culvert during the first pass of each survey.

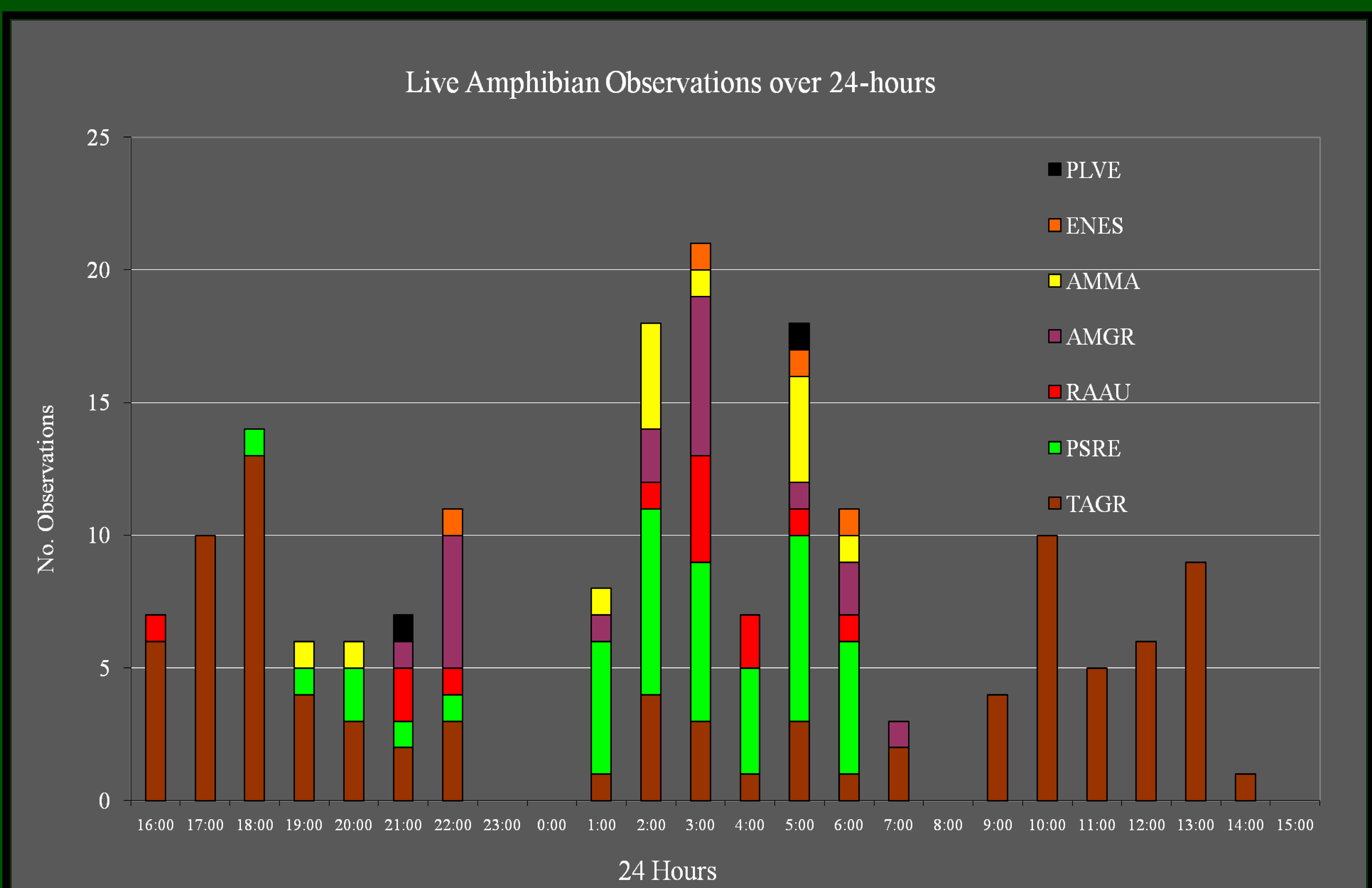

Figure 1: This graph displays the distribution of species observed over 24 hours. Note that between 06:00 and 19:00 newts were almost exclusively encountered.

Results

We observed seven native amphibian species on the new development roads. A total of 182 live animals were found (numbers of each species in parens), including two pond-breeding anurans: Pacific Treefrog (*Pseudacris regilla*; 40), and Northern Red-legged Frog (*Rana aurora*; 13); three pond-breeding salamander species: Rough-skinned Newt (*Taricha granulosa*; 91), Northwestern Salamander (*Ambystoma gracile*; 19), and Long-toed Salamander (*Ambystoma macrodactylum*; 13); and two terrestrially breeding lungless salamander species: Oregon Ensatina (*Ensatina eschscholtzii*; 4), and Western Red-backed Salamander (*Plethodon vehiculum*; 2). Amphibian mortality (numbers in parens) was encountered for four species (Northwestern Salamander [1], Long-toed Salamander [1], Pacific Treefrog [10], and Rough-skinned Newt [31]).We observed a diffuse spatial pattern of amphibians crossing the new roads (Fig 2), and future analyses will clarify this result. Interestingly, 14% (n = 25) of our live amphibian encounters occurred within the culvert; whether this implies preference for its use merits investigation. We encountered most live amphibians (69%; n = 125) and all species except Rough-skinned Newts under dark conditions, based on civil twilight-defined boundaries (Fig 1). Using this definition, Rough-skinned Newts were observed roughly 1.6 times more frequently during the day than at night.

Figure 2: The study area included the surveyed road (color coded according to observed amphibian densities per 100m) and the nearby wetlands (boundaries outlined in blue). The background image was captured prior to the sale or development of any of the parcels. Note the location of the culvert in relation to the wetland complex and upland habitat.

Discussion

Our preliminary results indicate amphibian movement patterns span the breadth of the road length; had we instead identified one or a few concise routes, this could have provided a basis for considering structural safe-crossing measures. For some species, we cannot exclude the latter possibility because our numbers were too few. Most species crossing during darkness except newts may justify measures that alert drivers to crossing events at that time. As we further analyze our data for movement timing, species, and age-class specific patterns we hope to clarify details useful for identifying priority migration needs, and future research necessary to adequately support recommendations for safe crossing measures. We are very fortunate to be working in conjunction with a developer that is willing to consider the implementation of safe-crossing measures. Because the spectrum of measures (ex: signs to alert drivers, drift fences paired with underpasses, or culverts) that might be employed involves a substantial cost range our recommendations must be solidly backed-up and credible. To ensure the application of identified measures not only to the survey site, but also to assist with the development of protocols and acceptance for amphibian safe-crossing measures elsewhere in our region, we will need to ensure that implemented measures are effective over time.

Figure 3: A 6-foot diameter culvert was installed to allow passage of an ephemeral stream. Three species, Rough–skinned Newts, Long-toed Salamanders, and Northern Red-legged Frogs were observed in it.

Selected Literature

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