# *Key to Quiz, week 3*

1. Pick a species that we have seen, or is at least relatively common, in the Pacific Northwest, and invent plausible examples of mutation, genetic drift, gene flow, and selection acting on a population of that species.

There are a huge number of correct answers to this question. That said, there are probably an even larger number of incorrect answers. One answer that would have been given full credit is:

Species: *Rhyacotriton olympicus.*

- Mutation: a dominant mutation for high degree of webbing in the hind feet appears.
- Natural selection: The mutation spreads, as it allows for greater maneuverability, and therefore ability to escape predators, in fast moving streams.
- Genetic drift: A storm wipes out some individuals with the mutation, and some without, but not an equivalent percentage of each, so the population looks different, with regard to how many individuals have strongly-webbed feet, as a result of the storm.
- Gene flow: Some of these salamanders cruise overland to a nearby headwater stream, thus abandoning their former population and joining a new one.

One additional point: Scientific names of species (the genus and species together) are italicized, always.

2. To what do you attribute differences in amphibian densities between what we found at Spoon Creek, and what Adams and Bury report in their 2002 paper? Describe the three factors that you find most relevant, or make a comprehensive list of all the factors that you think contribute. Explain your reasoning.

There are a number of correct answers to this as well. The biggest flaw that I saw in answers to this question was not enough detail, and/or no explicit reference to the results of the Adams and Bury paper. Looking at methods is not sufficient (e.g.—many of you knew that they did their work in the Summer, but few mentioned the particular findings of this research). Also, answers that attempted to deal with the question by responding only to why your particular group didn't find any (or many) animals isn't an adequate response.

Some factors that contributed to different observed amphibian densities:

**Stream width:** Both salamanders species were more common in narrower streams, although this was only significant for Dicamps. This factor likely explain low counts for those groups closer to the confluence—farther downstream from the falls. Those groups closest to the falls, while in the narrowest part of the stream, were still sampling a stream wider than any that Adams and Bury would have included in their work (see their table 1).

**Stream depth:** Same logic as for stream width. Most points along Spoon Creek where we were were simply too deep to be included in Adams and Bury's study, on the basis that there would not be sufficient individuals in such a site to make it worth sampling.

**Gradient:** Torrents prefer steeper gradients than that of Spoon Creak. Dicamps show slight preference, but the preference (the correlation) was not significant. In harvested forests, however, Dicamps were more common in higher gradients streams (from Corn and Bury 1989, as cited in Adams and Bury 2000).

**Degree to which substrate was covered with debris:** Dicamps and tailed frogs were most common in streams with 10% large woody debris (LWD), torrents in streams with 20% LWD (in Adams et al 2000). I did not have you measure amount of substrate, however, so you needed to demonstrate knowledge of difference in substrate cover. Also, their finding was not significant for Dicamps.

**Each other:** Dicamps were positively associated with torrents—so the fact that we were finding few of either is an indication that they have some habitat preferences in common.

**Forest type:** Torrents were not associated with any particular forest type. Dicamps, however, were more frequently found in forests dominated by cedar. What type of forest were we in? This factor can not explain the low numbers of torrents, but might contribute to dicamp numbers.

**Aspect:** Torrents were most abundant on North facing slopes. Dicamps showed no trend relative to aspect.

**Season**: On the Olympic peninsula, amphibians are difficult to find midsummer through midFall, at least until the rains are reliable and temperatures decreasing, signaling the beginning of breeding season. Adams and Bury collected their data early through mid Summer, over the course of several years, so their counts would have been higher due to season, and would not reflect a year in which numbers were low for other reasons, since they conducted a longitudinal study. One point here that several people were confused on: amphibians in the PNW are generally most active and easiest to find in the Winter, not in the Summer, but Fall is precisely the moment when they are most difficult to find, because it's not yet breeding season (not enough precipitation yet), and the season to accrue resources through eating is mostly over.

**Level of protection (aka logging):** Adams and Bury were working in the National Park, which has not been logged, at least not as recently as Spoon Creek. Logging is known to affect amphibian densities for a variety of reasons (see amphibian lecture notes).

**Researcher experience and bias:** Adams and Bury had an experienced team of stream samplers who did not start collecting data until they already knew what they were doing. Our data was collected on the first day that you were trying new techniques, so the observed counts would likely be lower even if we controlled for all other variables.

**Number of transects:** This is an acceptable answer, if you go into enough detail to explain why a low number of samples is unlikely to adequately and accurately sample a population. Simply saying that they sampled a different number of sites, or did a different number of transects, than we did is not sufficient, because you can correct for amount sampled, if the total amount if sufficient.

## Not so good answers:

**Canopy cover:** *R. olympicus* has no association with canopy in their study—neither positively nor inversely correlated with canopy. So canopy cover is unlikely to be a major explanation of the differences between their study and our field work, since *R. olympicus* was the primary species found. Furthermore, Dicamps were inversely correlated with canopy cover—increased in abundance with decreasing canopy cover, so the trend goes in the opposite direction.

**Type of substrate**: Cobble substrate was the strongest predictor of abundance in their research. But Spoon Creek has cobble substrate, though, so this doesn't reflect a difference between their research and ours.

**Higher water temperatures:** While Dicamps and tailed frogs show a clear preference for cooler water, indirect evidence found by Adams and Bury suggest that torrents have broader tolerances, including tolerance for higher temperatures (top of p177).

**Higher tech equipment:** The methods that Adams and Bury used to assess amphibian density were exactly the same as those that we used (by design). The transects were slightly different sizes, but within transects, they were flipping rocks while someone held a large dipnet (D-net) downstream to catch animals. It is true that they had access to slightly higher tech equipment to access climate data, but that didn't affect how many amphibians we found.

3.

| | **Basal area in plot** | **BA/acre** | **% BA/ species** | **# trees/ acre** | **Avg DBH** | **Stdev DBH** |
|---|---|---|---|---|---|---|
| Douglas fir | 8.43 | 84.32 | 36.2% | 60 | 15.76 | 3.33 |
| Western Hemlock | 9.60 | 96.04 | 41.2% | 40 | 20.95 | 1.38 |
| Western Red Cedar | 5.27 | 52.72 | 22.6% | 30 | 17.86 | 2.21 |
| Grand Total | 23.31 | 233.08 | 100.0% | | | |

e. Douglas fir is the most variable, it has the highest standard deviation and the average DBHs are pretty close. If the average DBHs were vastly different, you would need to calculate the coefficient of variation (CV= stdev/average) which takes into account the difference in the values of the mean.

f. Without looking at the canopy cover and tree height, the data support the idea that western hemlock is dominant in this forest because it has the highest basal area per acre.