CONS 451 – TA guide for leading amphibian station (with new insights from 2010)

In 2010, Amanda and I (Jenn Burt) used the 2009 TA template and generated (what we think) to be a slightly better organized and structured way of leading the amphibian station. Our goals this year were to make learning objectives more clear, have greater consistency between information given by both TAs, and to engage the students more in the learning concepts more (via greater dialogue). Hopefully this guide (reorganized and supplemented version of last years 2009 TA guide) will be helpful in leading this station in future years. Feel free to take or leave what you want from this.

Station SET-UP (day before students get there)

- We found it most efficient to have both TAs set the traps at both lakes. Start off at Shirley. Easier to separate and bait traps on land, then load into canoes and deposit around lakes. Make sure to label traps and mark them on a "map" in your book in case students have a hard time locating them. Best areas in Shirley are
- At both lakes, best to attempt to locate all the coverboard transects and ensure boards are present etc. Makes finding them in the week earlier (or knowing, for example, that one of your entire transects is pretty much underwater as was the case at Shirley).
- Take a trip down the marked trail to the **forest terrestrial search site** (see info in box for details) to ensure you can find it okay and the trail is somewhat clear.
- set up took us about 5+ hours.

Directions to forest terrestrial search site:

The trailhead for the forest terrestrial search site is about a 1km drive from the gated entrance to Shirley/Placid turn-off heading towards the main entrance (away from Loon lake camp). On your way, you'll pass a sign on a tree that says "F3", you're close so start looking for some flagging tape hanging from a tree. Park just down the hill from the flagging tape spot (small pullout next to stream crossing). Walk up to flagging tape and path should be flagged with red tape all the way to the 'base camp' for terrestrial search (marked with lots of red tape). Trail is not normally used, so may be a bit of a bush whack. The actual search site is pretty much adjacent to the "F3" sign on the road, but it's nicer to walk to it along the trail.

Random note: remind students to bring headlamps with them – makes terrestrial searching better!!

Station Instruction

(you're standing at the lake edge, students have lifejackets and notebooks, pre-canoe launch chat)
Items in red are things you should be sure to communicate to students.

- **Introduce lake.** Quick natural history.

- **Amphibian basics.**
  Ask the students, "What do you know about amphibians?"
  Try to ask leading questions to get them to cover the "3 main characteristics" of ALL amphibians:
    1. Skin: moist, scaleless, permeable (easy water loss = always trying to avoid desiccation)
    2. Ectothermic
    3. Limited mobility

  ** Many other things may come up so one can go off on any of these other topics, all relevant:
  - they need water to reproduce (exceptions are fully terrestrial amphibs), their reproduction is diverse

- **Amphibian ecology.**
  This will likely flow from your last question, but in general is meant to get students thinking about WHY we are bothering to do this whole amphibian sampling activity or WHAT are the sorts of research that is currently done on amphibians. Good bridge to next topic – what they're actually doing at this station.

  Ask students, "how do amphibians interact in their environment?" or "what aspects of amphibian ecology can we study?". "Why would it be interesting to know about these things?"
  - population monitoring over time (are they increasing, are they decreasing? We are at the northern tip of many spp. distributions, so we might expect to see species expansion/reduction before others??)
  - what impacts do environmental changes have on amphibians and their food webs (ie. fish introductions are a big deal – we introduce them everywhere, what impact does this have? What about if we took out introduced fish from systems?)
  - amphibian health – Cyhtrid fungus is a new emerging issue, need to monitor populations for prevalence and mortality.
  - amphibian conservation (may want to mention global declines…see box)

- **Explain the experimental set-up and generate hypotheses/predictions**
  Describe the layout of the minnow trap array, "we have 16 traps in two lakes, 8 shallow and 8 deep in each. Your group will check 8 traps (4 per canoe team) in the morning, then groups switch and remaining traps are checked. All 16 traps checked each day, and left overnight. We will ALSO do a plankton tow in each lake so that we can examine the zooplankton from both lakes"

  Ask students, "with this experimental set up, what sorts of things can we look at? What comparisons can we make? What hypotheses can we test?" Ask the students to come up with, AND WRITE DOWN, hypotheses (more like predictions) for what they would expect for each item.
  - AMPHIBIAN ABUNDANCE: comparison between fish and fishless lakes
  - (expect to see more in fishless lake) – TOP DOWN EFFECTS!!!

  - HABITAT USE/SELECTION: do amphibians occupy different physical niches in the 2 lakes?
  - (e.g. might expect to see less/no fish in the deep traps in Placid (b/c fish like it there)

  - SPECIES COMPOSTION: Compare between the 2 lakes. What types of species are we likely to find?
  - Expect to find species that can defend themselves against fish in placid (might expect to find higher proportion of newts in Placid b/c they have good defence against fish?)
  - Might however expect more paedomorphic northwesterns b/c maybe they have higher reproductive success and are good at exploiting shallow habitats

  - LIFE HISTORY STAGES: Compare between the two lakes.
  - may need to explain metamorphosis vs. paedomorphois (see box)
  - might expect to see higher ratio of metamorphs to paedomorphs in Placid with fish predation pressure? However, if paedomorphs can reproduce faster, and live happily enough in the shallow envionment hidden from fish, perhaps we wouldn't expect more metamorphs??)
  - might expect to see ALL paedomorphs in Shirley b/c lake is permanent and no fish pressure

  - TRENDS OVER TIME. We can look at this using data from previous years

  - AMPHIBIAN BEHAVIOR: We can't look at this with our experimental set-up, but worth mentioning that other researchers have found that in fish filled lakes, amphibians are more active nocturnally, while in fishless lakes amphibians are found to be active day and night (ie. top predator pressure can alter behavior)

  - ZOOPLANKTON COMMUNITIES: what differences do you expect to see between lakes? (I asked students to think about strategies that you would probably employ to avoid be predated….)

- expect to see a different zooplankton community and composition between lakes due to fishy pressure
- would expect that zooplankton would be more inconspicuous in placid (SMALLER and LESS BRIGHT)
- zooplankton behavior? Vertical migration?

- **Give trap demo, students prepare data sheets**

MAKE SURE STUDENTS KNOW HOW TO RE-SET TRAPS:
- re-bait the trap, even if empty. Can leave old bait in trap, and add new bait.
- make sure to clip BOTH top and bottom of trap
- make sure to only let go of trap float if trap not moving!! Sometimes they roll !!

Amphibian handling
- moist hands.
- no lotions, sunscreen, abrasive jewelery
- sensitive to heat, so be aware of handling

Have students prepare data sheets for when they collect amphibians.
(I liked asking students to try to list all the things they think they should record)
They must remember to record:

1. Date, Time, Weather
2. trap # (make sure they label the bucket that amphibs go into)
3. SHALLOW trap or DEEP trap
4. depth of trap (have students use measuring tape to 'mark' how long 1m is on their armspan)
5. habitat features (LWD, aquatic macrophytes??)
6. estimate of distance from shore

On land students will measure:
1. development stage of each amphibian (hatchling, larvae, adult, paedomorph)
2. Length (SVL)
3. Weight (g)

- **If at Lake Placid – get students to do plankton tow and secci disk during morning session (other group does this during lunch at Shirley)**

Students go in canoes and collect the traps and amphibians. TA chills out and entertains themself.

- **Students measure/weigh amphibians and fish they collect**

Review amphibian morphology students must know (see front of field guide, or nice laminate would be great)
- costal grooves
- parotid glands
- Vent (we measure Snout-to-vent length….WHY? - b/c tails can come off, be bitten off….etc)

Students sample their amphibians

1. Length (SVL) – best done using ziplock bag where students carefully put amphibian in a bag (with a bit of water) and constrain it momentarily to measure SVL.

2. Weight (g) – use the plastic scale container as a weigh boat

3. Development stage: (hatchling, larvae, adult, paedomorph)
- if a Northwestern is bigger then 40mm SVL it is likely a paedomorph (mention this is not a tested fact, but more of a convention. In theory, you could have a 50mm larvae that was soon to metamorphose…but in our lakes, a 40mm+ larvae is likely a paedomorph)

Time for the coverboard transect check and short time-constrained search (TCS)

Discuss Active VS Passive sampling techniques (see box).

Explain the experimental set up for the coverboard transects: coverboards proximal to lake are designed to detect potential differences/shifts in the terrestrial community proximal to Shirley and Placid. Have students think about how they would predict the terrestrial community to change and why.

Go and check ONLY ONE TRANSECT with each MORNING group (no transect check for afternoon group). 3 transects at each lake (6 total = 1 per group)

Have students think about advantages and disadvantages to this sampling technique

After coverboard check, select another terrestrial chunk of forest around lake area and do a time constrained search (maybe 15min??).

Talk about CPUE for each method.

Lunch time (~11:30). Lunch is whenever the other group arrives at Shirley lake.

Group who was at Shirley in the morning, now do a plankton tow and secci disk BEFORE jumping into Placid TA car and heading off to Placid for the afternoon.

While all students together, look at both Shirley and Placid plankton tow samples and discuss differences (easy to see with naked eye!). Recall, top-down effects on zooplankton ecology is major learning objective for this station.

- how are zooplankton affected by presence/absence of fish?
- In a lake WITHOUT fish, zooplankton:
  1. are larger
  2. are brighter
  3. have different species composition
  4. May behave differently (ex. no vertical migration)

Students groups switch, TA has new group for afternoon session.

Same trap collecting procedure as morning group. Probably don't need to go over the whole discussion like in the morning, but can ask students if they want to review any of the concepts.

No coverboard or TSC with second group.

When Shirley lake group is done, they drive to Placid to meet up with other group and go to the forest terrestrial search site.

Combined TSC at the forest terrestrial search site.

Once at forest terrestrial search site "base camp" (area with lots of red tape), explain to students

- about the area (old research project never cleaned up, super old coverboards, most disintegrated…BUT…we know there are amphibians here!!)

- search for 45min or so

- places that amphibians found in the past:
    1. Under rocks and logs. Pick them up, little frogs/amphibians just sitting right there.
    2. In dark crevases between logs and ground, old stumps (use headlamp will see reflective eyes/skin)
    3. Near streams – look for hopping frogs
    4. Actually in the wood rot around old stumps/logs

- if they find a specimen, MARK THE SITE WITH FLAGGING TAPE (give each student a small piece). Put it in a bucket with some moss/soil and continue searching (or bring it back to "base camp" and then continue searching). It is REALLY IMPORTANT that we know where each specimen came from so we can return them at the end of the week to their same spot. Make sure each site is clearly marked, and perhaps even label the flagging tape (ie. Ensatina, Nov. 2, 2010).

- after the time is up, bring everyone back to "base camp" and measure (L and W) all the specimens, look them up in field guide, talk about different features of each critter, have a photo shoot…etc.

Walk out. Drive back to Loon Lake camp!
(usually finish anywhere between 3:30-5pm)
Set up "zoo" with new species found (DON'T FORGET TO LABEL WHICH ANIMAL IN WHICH AQUARIUM !!!)

Discussion on amphibian conservation

This can help frame the context of the field activities and answer the question "why do we want to study amphibian populations". It may help to give specific case examples of current research areas.

- amphibian populations are declining worldwide. They are threatended by many things (habitat destruction, polluted environments, disease, climate…)

In British Colombia, examples of conservation issues are:

i. forestry impacts on amphibians – are there some examples of studies looking at forestry impacts on tailed frogs or tree frogs?
ii. populations at the edge of their distributions – ex. coastal giant salamanders
iii. Fungal infections – BD is spreading in N.America and is a problem for lots of northwest species
iv. Increased UV radition due to ozone depletion resulting in high mortality of embryos

The biology of amphibians make them particularly to particularly vulnerable to human impacts. For this reason they are good environmental indicators. Traits that make them vulnerable include:

- permeable skin (e.g. vulnerable to pollution)
- amphibious life cycles, need quality habitat on land and water
- low motility, dispersal ability
- others?

Paedomorphosis

- in which reproductive maturity is attained while retaining larval or juvenile characteristics OR retention of larval traits in a sexually mature form

- **neoteny** – actually describes the process by which paedomorphosis is possible (the deceleration of somatic development)
- paedomorphs occur as a result of neoteny (deceleration of somatic development) AND progenesis (acceleration of sexual maturation)

- some amphibians show obligate paedomorphosis (various genus), and others, such as the species we have here in MKRF – Ambystoma gracile – demonstrate facultative paedomorphosis (have the option to metamorphose or remain as paedomorphs depending on environmental conditions and pressures).

PAEDOMORPHIC ADVANTAGE HYPOTHESIS: under stable/happy conditions, you will tend to find more paedomorphs

- Earlier sexual maturity (Northwestern paedomorphs can reproduce in 2years and it can take 3+yrs to metamorphose)
- Present at breeding sites as soon as mature
- Don't have to migrate back to breeding site
- Greater chance of survival to first reproduction
- Shorter generation times
- Greater lifetime reproductive success

WHY NOT ALL AMPHIBIANS PAEDOMORPHIC THEN?

- metamorphs are favored during years of unfavorable conditions (low water levels, high conspecific density…or….**fish predation).**

Active VS Passive sampling

Passive techniques

1. Using traps (e.g., minnow traps) . PRO = easy, effective for aquatic life history stages, not biased by researcher checking (maybe researcher placing however..). CONs: Expensive, need lots of gear, traps can harm animals potentially.

2. **Coverboard Array.** PRO = unbiased by researchers checking (no experience needed), consistent over time (check the same spots), cheap and easy. CONs = may not be good cover for species (and therefore you find nothing), it takes a few years for the boards to 'prime' so may bias your findings (ie. few amphibians found initially, more found as years go by..??), only good for terrestrial species, only covers a small amount of physical space

3. **Pitfall trapping.** We don't do this at this station, but worth while explaining how it works b/c it is used frequently in amphibian studies.

Active techniques

1. Time constrained search (TCS). PRO = can be really effective for finding terrestrial animals (especially if you have people who know how to search), no equipment needed. CONs = requires numerous people ($$$), can be easily biased by how good searchers are at finding animals or how enthusiastic/lazy they are.

Catch per Unit Effort (CPUE)
– Why is it a useful measure (standardizing measure for comparison over time). How would you calculate CPUE for each different sampling technique?

Bias in data or sampling techniques

- what is bias (just to be clear on the terminology)?
- how is it different from say 'disadvantages'
- how might each amphibian sampling technique be biased?
    1. traps – knowledge of where to set them
    2. coverboard – where you place coverboards, select for certain species
    3. time constrained – effort of searchers, knowledge of searchers

Note: most of the list of biases would not result in a systematic bias unless they changed over time (e.g. no problem with using unskilled searchers if used consistently over time). Bias associated with the methods themselves might be something like selecting for certain species, or trappability changing over time (e.g. coverboards become more/less attractive to critters). Just a note to be careful of terminology/explanation, especially if the point is to understand 'bias'.