Survey Methods

James Bettaso, Don Ashton,

Ryan Peek, Sarah Kupferberg

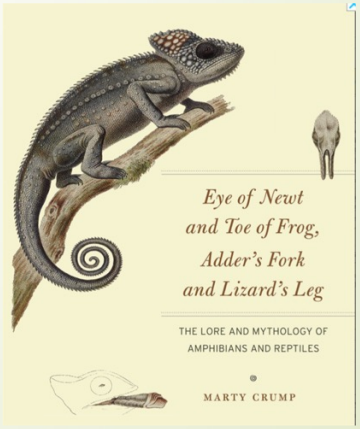
FYLF - TWS
Workshop
Arcata CA
May 2018

“One thing to remember is to talk to the animals. If you do, they will talk back to you. But if you don’t talk to them, they won’t talk back to you, then you won’t understand. And when you don’t understand, you will fear, and when you fear, you will destroy the animals, and if you destroy the animals you will destroy yourself.”

Chief Dan George,

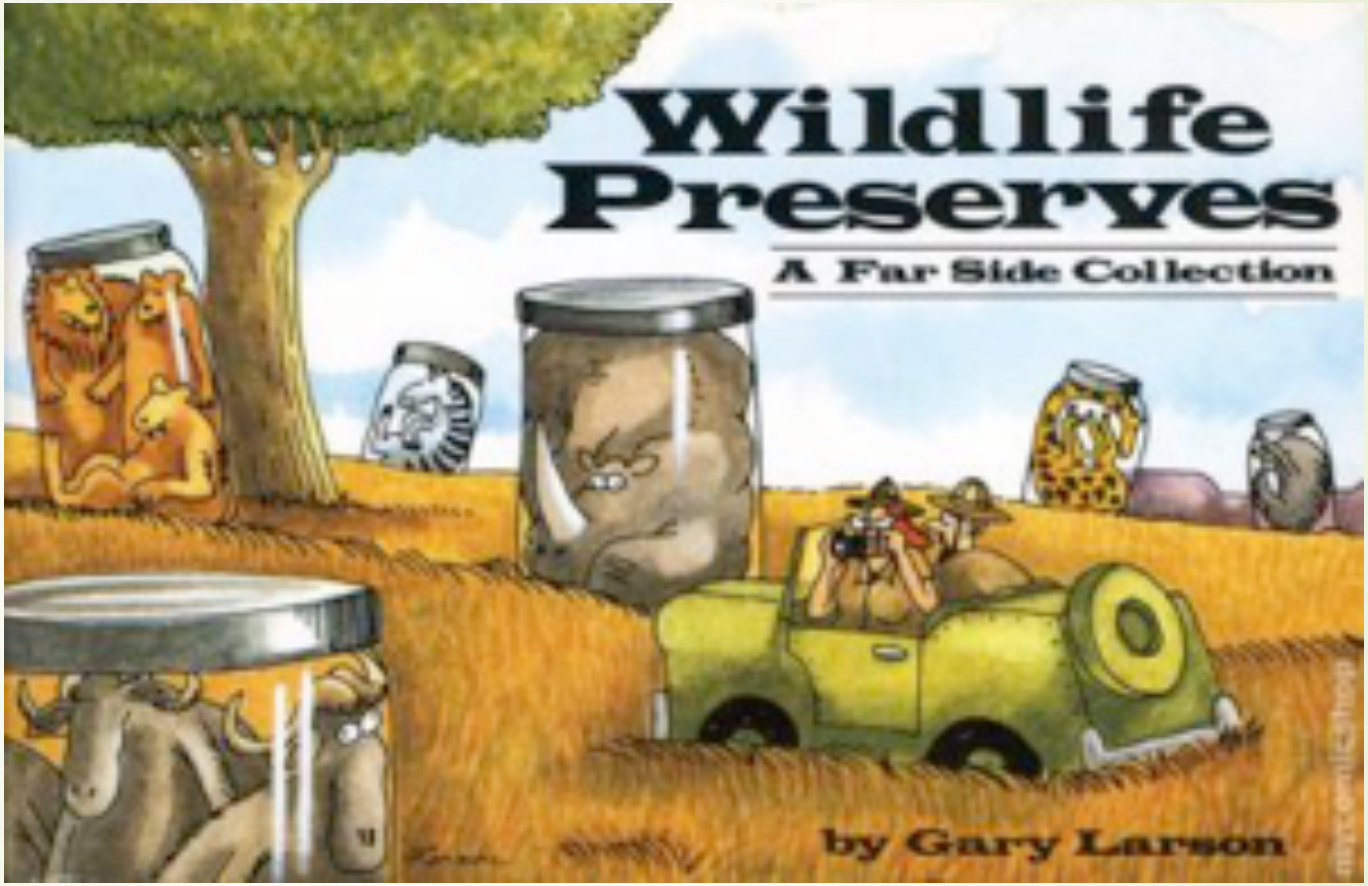
Tseil-Waututh Nation, North Vancouver

1899-1981



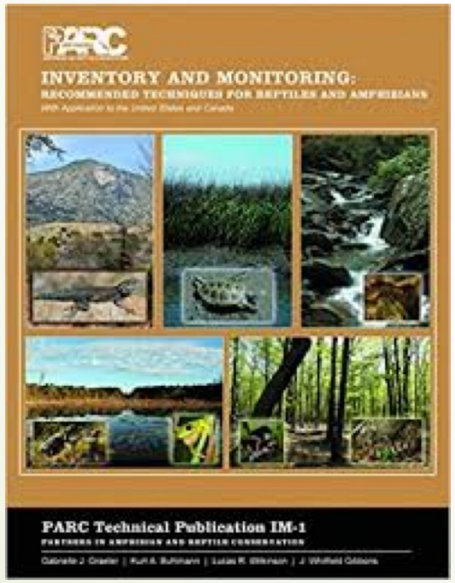
Overview

- Adult Surveys (comparison of VES to radio-telemetry)
- Underwater calling
- Tadpole surveys
- Egg Mass (EM) surveys
- eDNA monitoring (methodology & application)
- How survey techniques changes with size of river
- Detection Inhibitors
- Equipment
- Decontamination

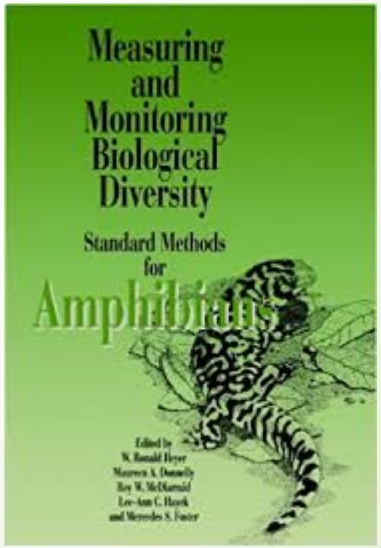

Wildlife Preserves
A Far Side Collection
by Gary Larson

Suggested Reference Material

PARC 2013
Gabrielle J. Graeter,
Kurt A. Buhlmann,
Lucas R. Wilkinson,
J. Whitfield Gibbons



Smithsonian 1994
Heyer, W. R.,
M. D. Donnelly,
R. W. McDiarmid,
L. C. Hayek,
M. S. Foster

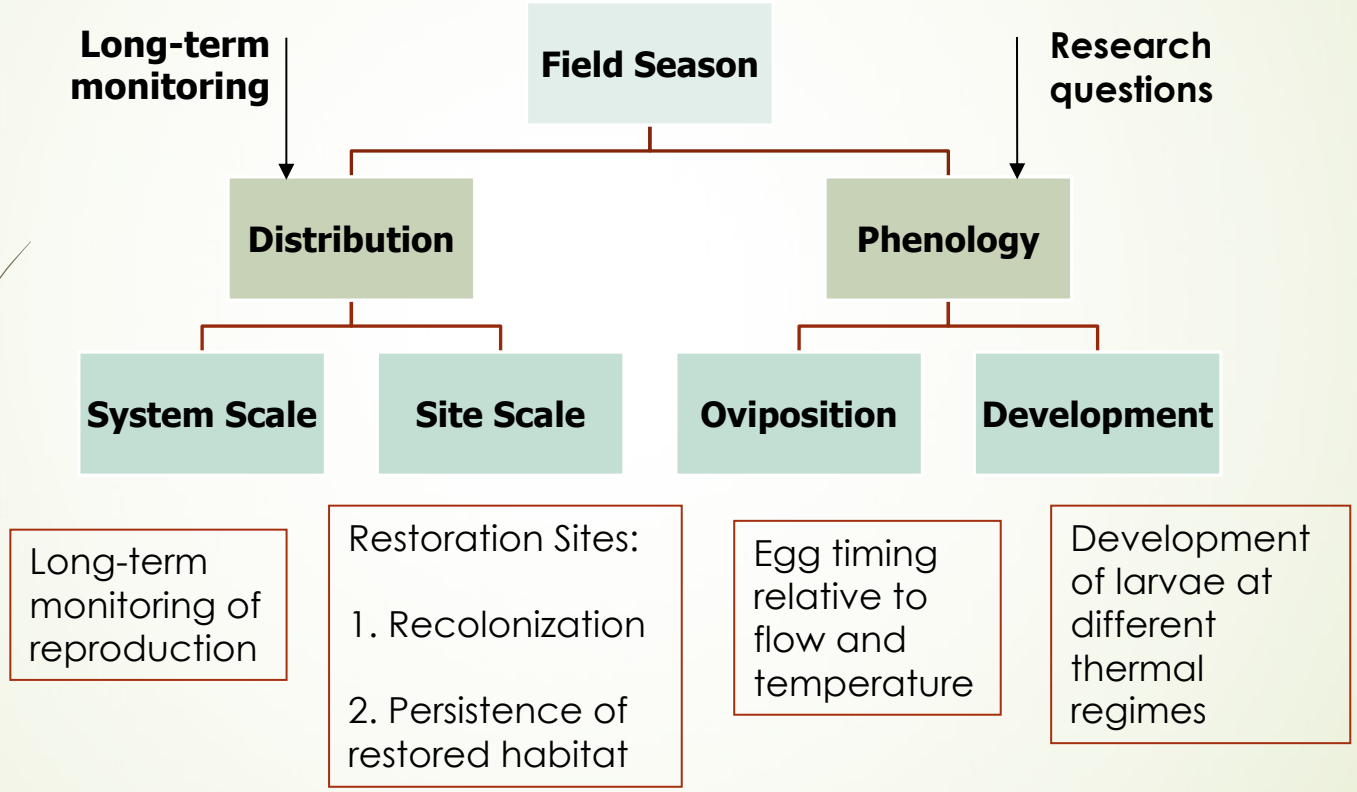


Definitions---

Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. 1994. Eds, Heyer *et al*.

- **Relative abundance**: proportional representation of species in a sample
- **Inventory**: study of a specific area, site, or habitat to determine the number of species present (i.e. species richness)
- **Monitoring**: study of the abundance of individuals in one or more populations of a species at a site through time
- **Mark-recapture techniques**: methods for determining population size that involve capturing, marking, and releasing animals, and subsequently recapturing or re-sighting them one or more times.
- **Visual Encounter Survey (VES):** estimate the diversity (number of. different species) and abundance (number of different individuals) of animals at a particular location

What question(s)will surveys address?



Example conceptual diagram

Life Cycle

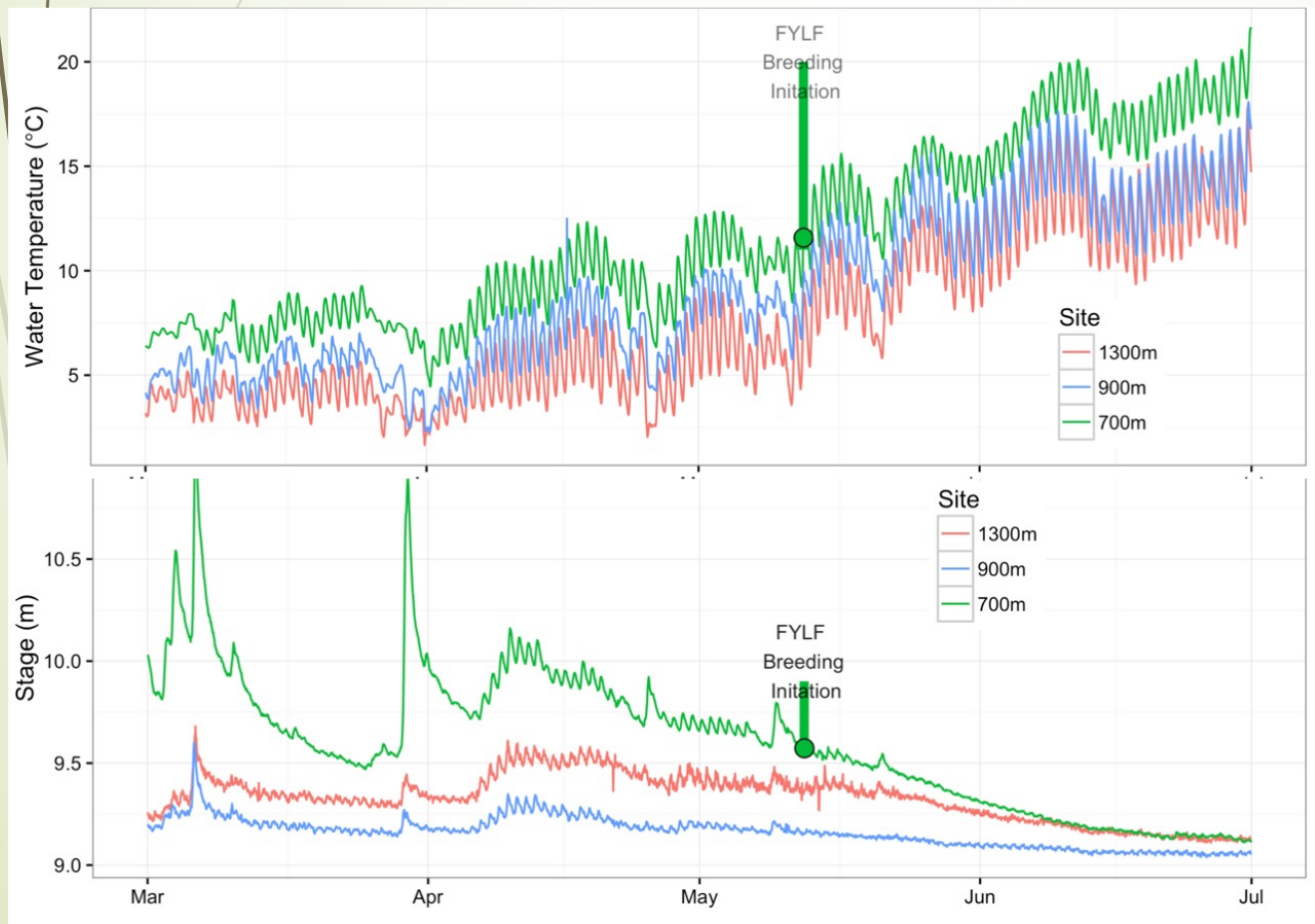
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER

Timing of Surveys

- **Monitor:**
  - River stage
  - Storm forecasts
  - Water temperature
- **Check activity at reference sites**

Timing of Surveys: Webdata

- Useful websites for monitoring flow/temp:
  - USGS (https://waterdata.usgs.gov/ca/nwis/rt)
  - CDEC (http://cdec.water.ca.gov/cdecstation2/)
  - Dreamflows (http://www.dreamflows.com/realtime.php)



Survey Considerations/Gear

- Polarized glasses
- Search time
  - 9:00-19:00
- Search duration
- Search area
- Weather
  - Warm, sunny
  - Calm or light wind

Breeding dates are variable; timing of surveys is critical


Environmental/habitat variables

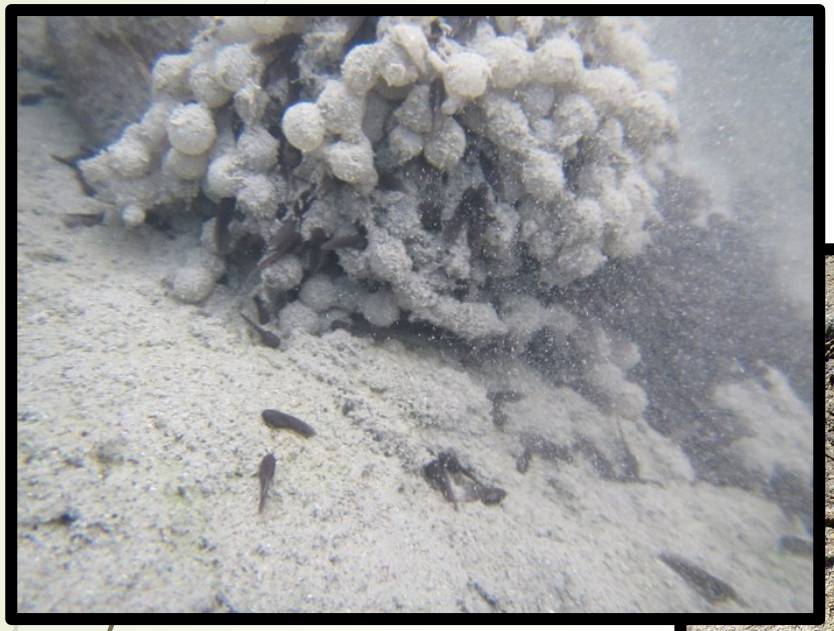
Oviposition Habitat

- **Stream Habitat – Physical Attributes**
  - Water Temperature
  - Water Velocity
  - Water Depth
  - Distance to Shore
- **Attachment Substrate**
  - Pebble (33-64 mm)
  - Cobble (65-256 mm)
  - Boulder (>256 mm)
  - Bedrock
  - Woody material
  - Live riparian vegetation
- **Orientation of Egg Mass on Substrate**
  - Upstream
  - Shore side
  - Thalweg side
  - Top of substrate
- **Flow Direction Relative to Egg Mass**
  - No Flow
  - With Flow
    - Away
    - Alongside
    - Backflow
    - Flow over top

Nate Nieto measuring egg mass

Visual Encounter Surveys (VES)

Visual Encounter Surveys (VES)



Check edgewaters & dry shoreline

VES: CWS Protocol

https://watershed.ucdavis.edu/project/long-term-river-monitoring

- VES-based, see website for datasheet/details
- Snorkeling highly recommended/mandatory for spring egg mass surveys
- Suitable for assessing/monitoring the abundance, distribution and habitat associations of *R. boylii*

VISUAL ENCOUNTER SURVEY PROTOCOL FOR *RANA BOYLII* IN LOTIC ENVIRONMENTS

June, 2017

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NOTE: This field survey protocol can be used in support of instream flow studies or as part of a monitoring program, but it should not be implemented without a study design and associated state or federal permits. This protocol does not substitute for a well-designed field study, but is a suitable methodology for collection of field data.

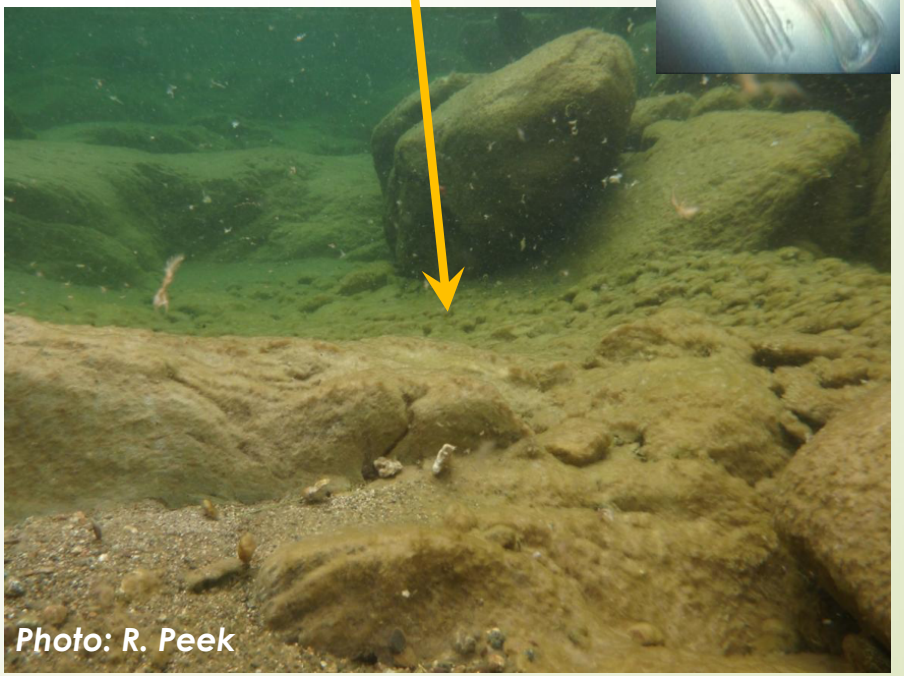
VES OVERVIEW

This Visual Encounter Survey (VES) protocol and associated datasheet are for use in river and stream reaches up several kilometers in length where information on all lifestages and the habitat associations of each individual is desired. The data from this survey protocol is intended to 1) describe the abundance, distribution and habitat associations of *R. boylii* (Foothill yellow-legged frog or FYLF), and 2) provide the data necessary to coordinate with other stream reach study efforts, such as instream flow studies where hydrodynamic modeling will be used.

VES: Snorkeling

- Egg masses can be very cryptic
- Snorkeling for egg masses can be highly effective
- Site conditions can greatly impact where egg masses are located (e.g., didymo mats

Didymo/rocksnot!




Larger substrates

VES: Float Surveys For Egg Masses

Egg Mass Desiccation

Tracking Fate of Individual Egg Masses

17 JULY 2006 965 cfs

Egg mass hatching

24 JULY 2006 508 cfs

Young tadpoles trapped

31 JULY 2006 489 cfs

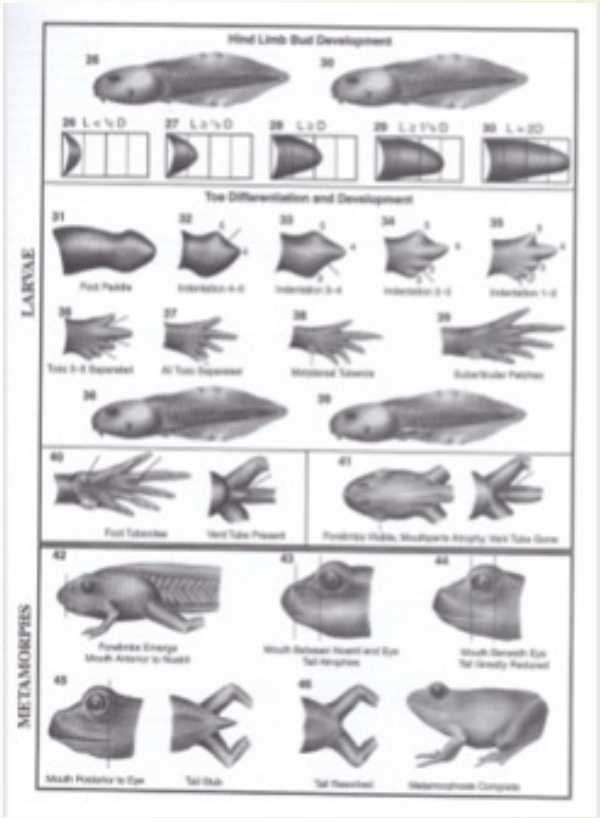
100% mortality (6 egg masses)

Eggs: Viewed from below

Gosner Stage
Ken Gosner (1960)

Gosner Stage

Kenneth L. Gosner (1960)



Gosner App (beta)

http://shiny.cws.ucdavis.edu/shiny/rapeek/Gosner_photos/

UCDAVIS
CENTER FOR WATERSHED SCIENCES

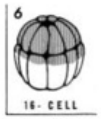
Gosner Stages of *Rana boylii*

Select or type a Gosner Stage (**1-46**) to view a corresponding photo of Foothill yellow-legged frog (*R. boylii*) development. Not all stages currently have photos. See Github for code: (https://github.com/ryan-ucd/gosner_boylii)

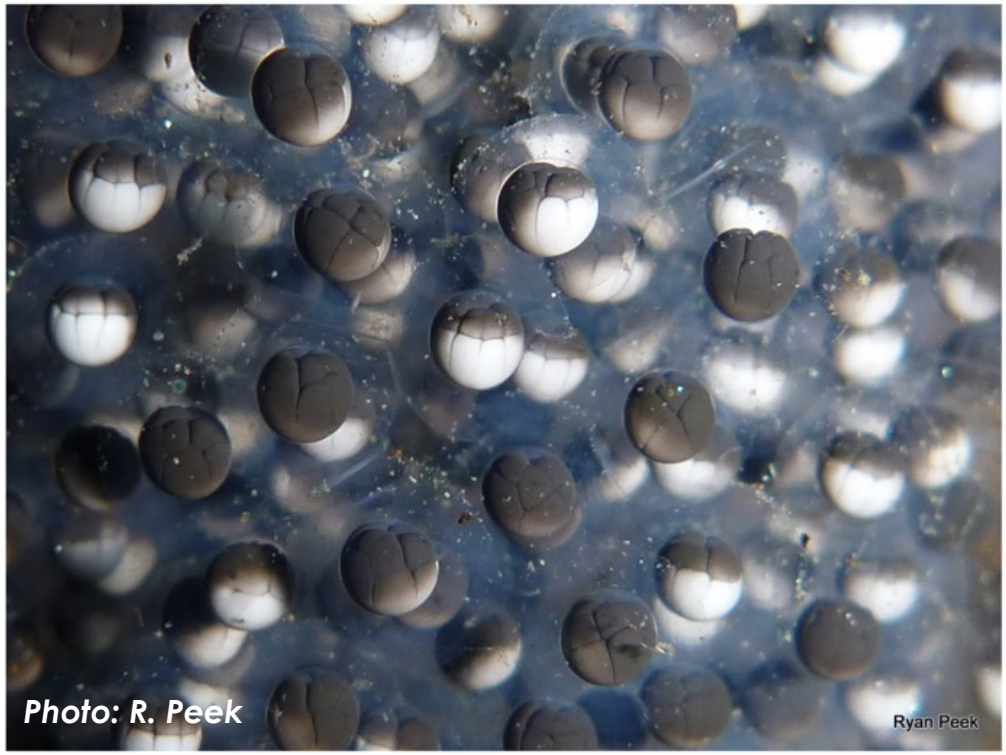
Select a Gosner Stage

6

From Gosner 1960. Herpetologica, Vol. 16, No. 3 (Sep. 23, 1960), pp. 183-190.



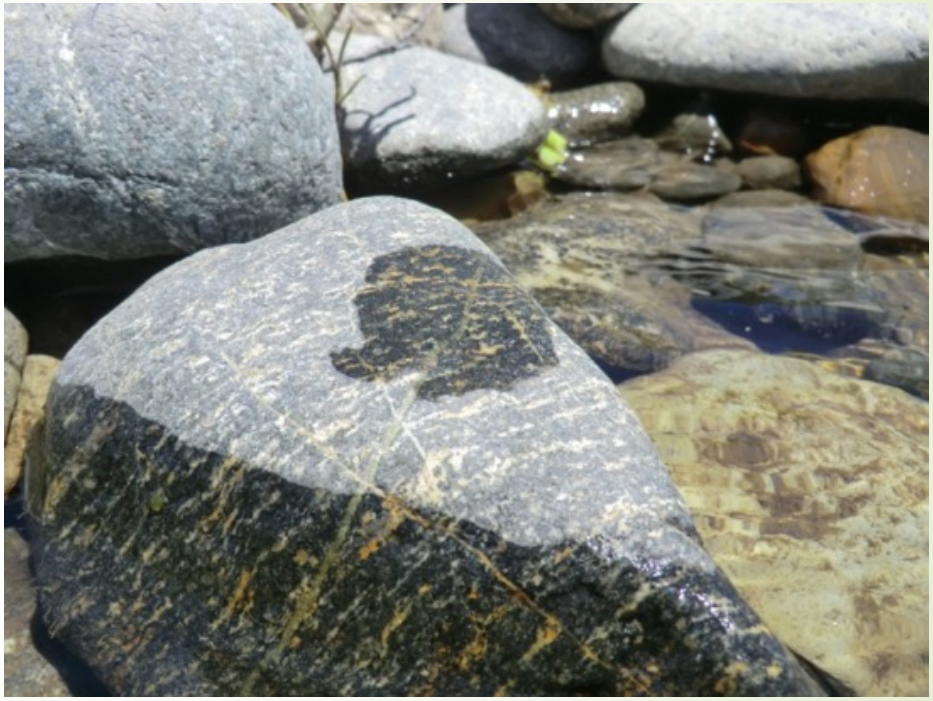
- *Shows photos of various Gosner Stages*



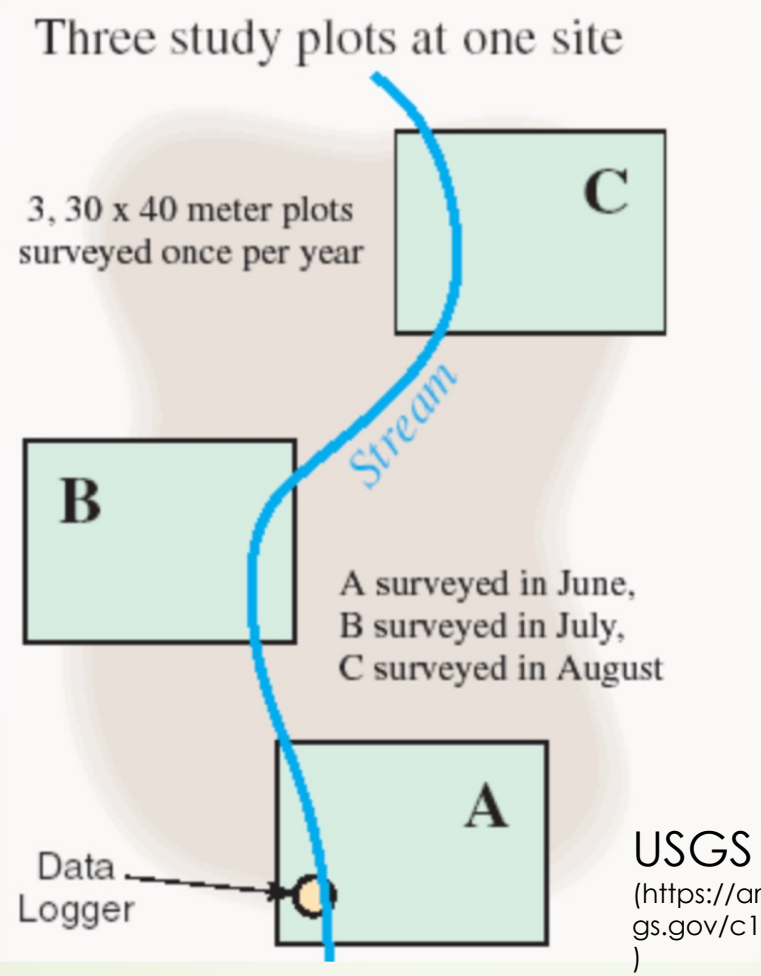
Tadpole Spirals (poop)

- Helpful hint that tadpoles may be nearby
- Spirals/semi-circles, same color as algae
- Flip some rocks!

Additional Survey Methods



Time-Constraint / Area-Constraint Searches (TCS/ACS)



USGS
(https://archive.usgs.gov/archive/sites/fl.biology.usgs.gov/c1258_Dodd/html/sampling_protocols.html)

PIT-Tagging

PIT tag: a marking tag made of a passive integrated transponder (PIT) that relies on passive radio-frequency identification of a 10-digit hexadecimal number, read with a scanner and portable reader.

Photo ID

Chin-spot photo recognition

- Koen Breedveld
  - Pit River
- Clara Wheeler
  - Smith River

eDNA *(Environmental DNA)*

- Goldberg Lab (M. Bedwell and C. Goldberg)
  - **https://labs.wsu.edu/edna/**
- Developed assay for *Rana boylii* and *Rana sierrae*
- Successfully deployed in Feather, Merced, and a few other watersheds
- Active work by other labs/consulting firms to get labs up and running

eDNA

MOLECULAR ECOLOGY

Molecular Ecology (2012) 21, 2565–2573 doi: 10.1111/j.1365-294X.2011.05418.x

FROM THE COVER

Monitoring endangered freshwater biodiversity using environmental DNA

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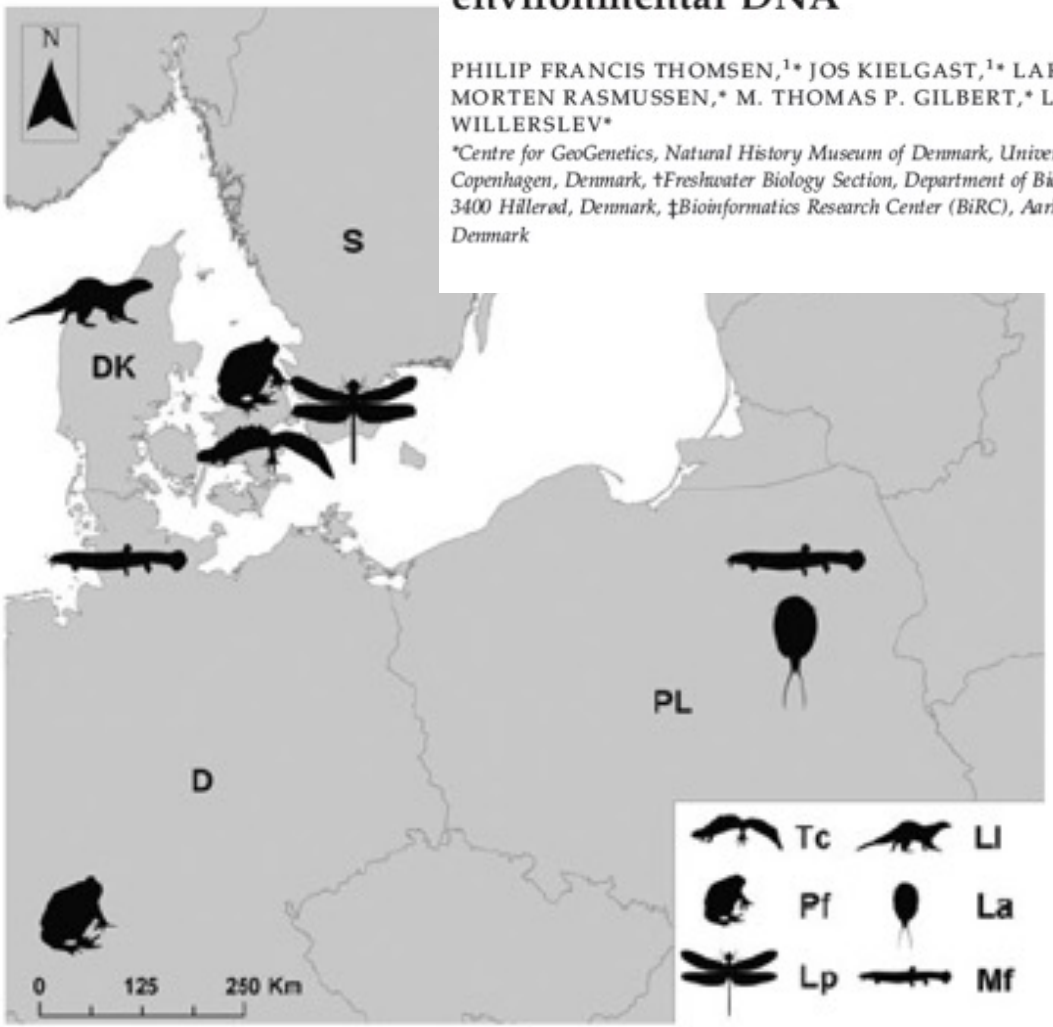
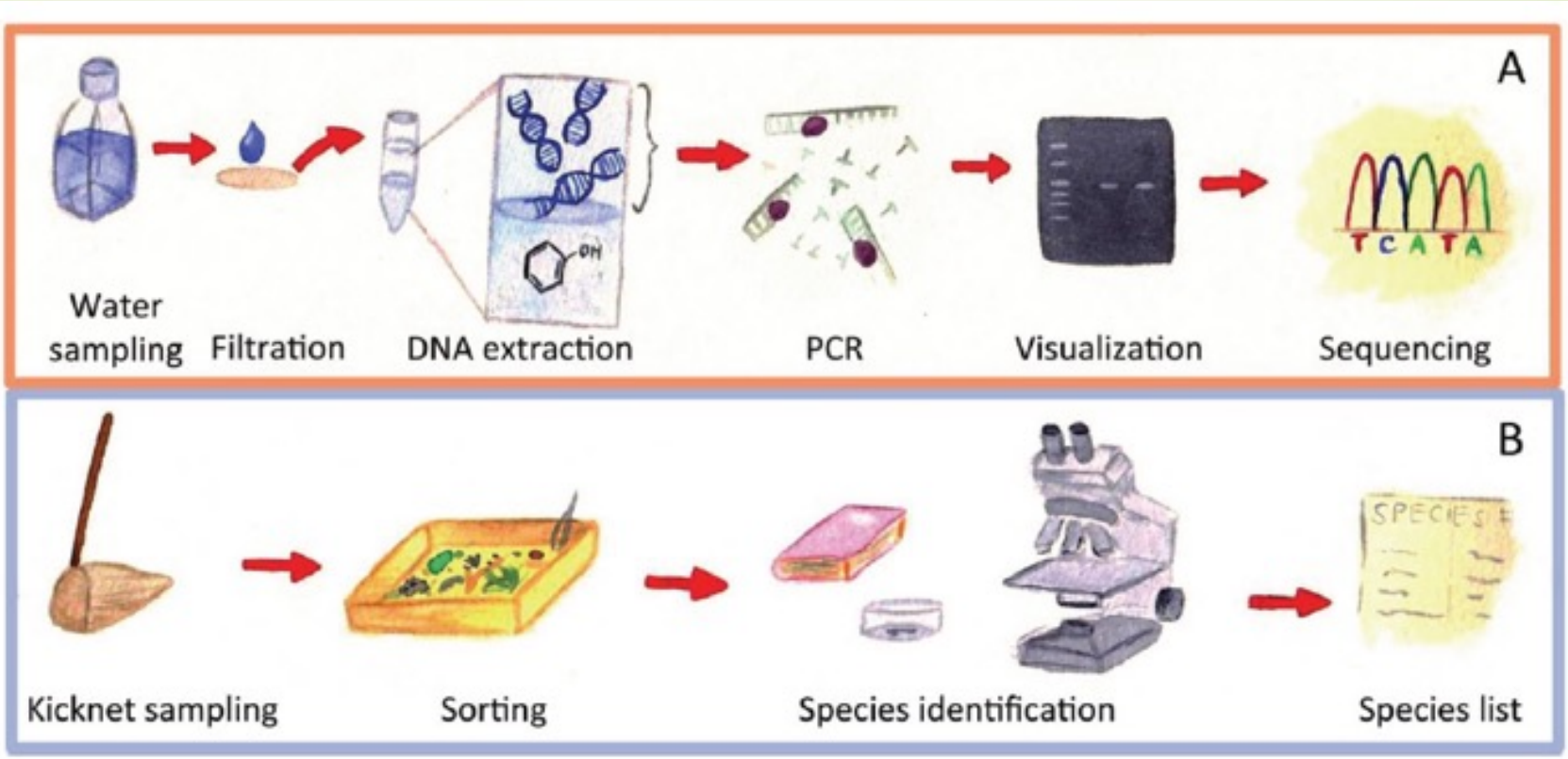


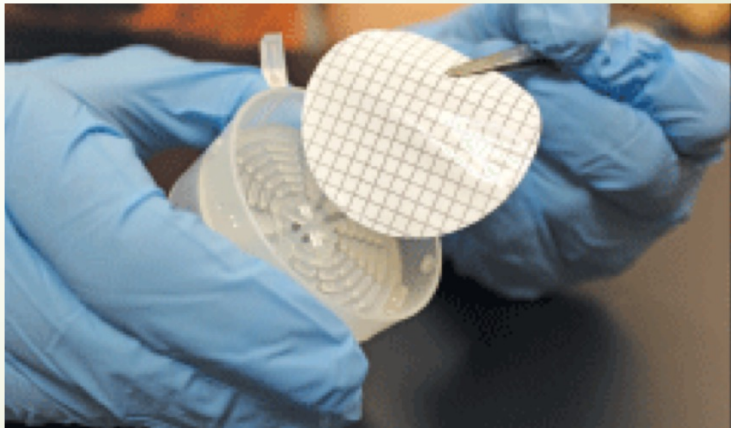
Fig. 1 Sampling locations of the 90 European natural freshwater systems targeted in this study. Samples we (DK), Sweden (S), Germany (D), Poland (PL) and Estonia (EST) and covers Tc (*Triturus cristatus*, 11 ponds), P ponds), Lp (*Leucorrhinia pectoralis*, 11 ponds), Ll (*Lutra lutra*, 15 streams and lakes), Mf (*Misgurnus fossilis*, 11 p

eDNA



from **Machler et al. 2014. Freshwater Science**

- Filter a lot of water
- Clean/sterile replicates
- Cover more ground
- Not definitive!



Telemetry

Movement studies, habitat use

Decontamination

- http://www.ccadc.us/docs/DeconForProfessionals.pdf
- http://www.cwhc-rcsf.ca/docs/HHWG%20Decontamination%20Protocol%202017-05-30.pdf

Decontamination

http://www.cwhc-rcsf.ca/docs/HHWG%20Decontamination%20Protocol%202017-05-30.pdf

Appendix 1: Tested efficiency of decontamination products

Product (% active ingredient)	Tested concentration	Exposure time (min)	Effective against	Notes	Source* (see references)
Bleach (6% Sodium Hypochlorite)	1:32 (0.2% Sodium Hypochlorite)	1-10	*Bd* RV SFD	Vapor may cause severe irritation or damage to eyes and skin; harmful if swallowed. Fatal to amphibians at high concentrations. Corrodes metals; fades colours and breaks down cloth fibers.	1, 5, 9, 13
70% Ethanol	70% ethyl alcohol	2	*Bd* RV SFD	May be fatal if swallowed or inhaled; can damage liver, kidneys and nervous system by repeated or prolonged exposure; may be absorbed through skin; repeated or prolonged contact can cause eye irritation or dermatitis. May harm amphibians by damaging epidermal coating. May damage rubber and plastics; may cause deterioration of glues.	1, 5, 9, 13
Benzalkonium chloride	1mg/ml	10	*Bd* RV SFD	Requires extreme care in handling (see M.S.D.S.). Very toxic to aquatic organisms. Essential to ensure this chemical does **not** enter the environment.	5, 13, 15
Virkon S® (20.4% Potassium peroxymonosulfate)	1mg/ml	1	*Bd* RV	Not tested against SFD. Harmful if swallowed; irritating to respiratory system and skin; may cause serious eye damage. Non-toxic to amphibians. Safe for fabric; may cause pitting on galvanized or soft metal if not rinsed with water.	1, 5, 8, 9, 15, 18
Nolvasan® (2% Chlorohexidine)	1:127	1	RV	Not effective against SFD. May be fatal if inhaled; causes irreversible eye damage; harmful if swallowed. Safe for amphibians for short durations. No reported effects on equipment.	1, 9, 13
Lysol® Power Bathroom Cleaner	100%	10	SFD	Not tested against *Bd*, RV.	13
Lysol® All Purpose Cleaner	100%	10	SFD	Not tested against *Bd*, RV.	13
NPD®	100%	10	SFD	Not tested against *Bd*, RV.	13
CLR® Bath & Kitchen Cleaner	100%	10	SFD	Not tested against *Bd*, RV.	13
409®	100%	10	SFD	Not tested against *Bd*, RV.	13
Didecyl dimethyl ammonium chloride	2ml/L	1	*Bd* RV	Not tested against SFD.	5, 15, 18
Quaternary ammonium compound 128	Full strength to $1X10^{-3}$	5	*Bd* RV	Not tested against SFD.	5, 8
F10® Super Concentrate Disinfectant	0.7 ml/litre	1	*Bd* RV	Not tested against SFD.	5, 18
TriGene® Virucidal Surface Disinfectant Cleaner	0.2 ml/L	1	*Bd* RV	Not tested against SFD.	5, 18
10% sodium chloride	10%	5	*Bd* RV	Not tested against SFD.	5, 8
2% potassium permanganate	2%	10	*Bd* RV	Not tested against SFD.	5, 8
Sterilizing UV light	1000 mW m^{-2} wavelength 254nm	1	RV	Not effective against *Bd*. Not tested against SFD.	5, 8, 15

Incidental Observations

- Make note of other things at site
- May not see relevant at the time, important later

Questions?

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