

CALIFORNIA RED-LEGGED FROG WORKSHOP



Trish Tatarian and Greg Tatarian

BIOGRAPHY

Trish Tatarian

Researcher – 13 years

- ❖ CRF Radio-telemetry
- ❖ Bd occurrence in Sierran CRF populations
- ❖ Genetic composition of Sierran populations

Biological consultant – 23 years

BIOGRAPHY

Greg Tatarian

Researcher – 5 years

- ❖ CRF Radio-telemetry
- ❖ Bd occurrence in Sierran CRF populations
- ❖ Bat Specialist – banding, telemetry, roosts, mitigation

Biological Consultant – 23 years

ACKNOWLEDGEMENTS

Norm Scott and Galen Rathbun

U. S. Fish and Wildlife Service

U.S. Forest Service

East Bay Regional Park District

East Bay Municipal Utility District

California Department of Transportation

U. S. Geological Survey

California State Parks

ACKNOWLEDGEMENTS

Elkhorn Slough Coastal Training Program
Grey Hayes
Virginia Guhin

Elkhorn Ranch
Pedro Rodriguez

TODAY'S SCHEDULE

0800-1200	Lecture
1200-1230	Lunch
1230-1430	Lecture & Demonstrations
1530-1800	Field Demonstrations
1830-2000	Dinner Break
2000-2400	Nighttime Instruction

ADDITIONAL INFORMATION

ELKHORNSLOUGHCTP.ORG

Bibliography
Peer-reviewed papers

IMPORTANT BIOLOGICAL FACTORS

- Mediterranean climate - water regimes
- Habitat types
- Population dynamics
- Threats
- Population-level management
- Clear objectives for species management

RECENT TAXONOMIC CHANGES

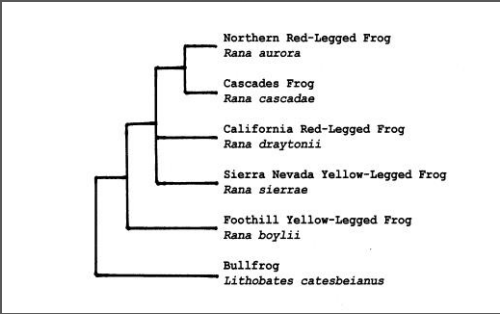
- Sierran Treefrog
 - Hyla regilla* >> *Pseudacris sierra*
- Western Toad
 - Bufo boreas* >> *Anaxyrus boreas*
- Bullfrog
 - Rana catesbeiana* >> *Lithobates catesbeianus*
- California Red-legged Frog
 - Rana aurora draytonii* >> *Rana draytonii*

RECENT TAXONOMIC CHANGES
(CONTINUED)

- Mountain Yellow-legged Frog
 - Rana muscosa* >>>>
- Sierra Madre Yellow-legged Frog
 - Rana muscosa* in Southern California
- Sierra Nevada Yellow-legged Frog
 - Rana sierrae* in the Sierra Nevada

PHYLOGENY

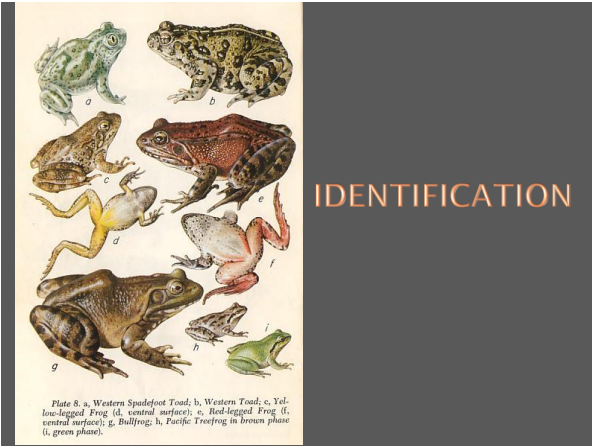
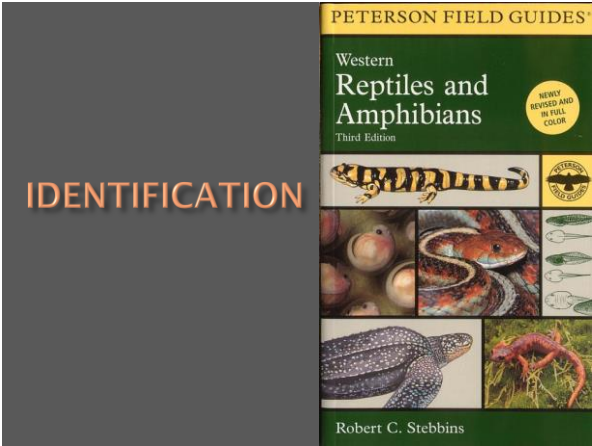
Rana draytonii Phylogeny
(Shaffer, et. al. 2004)





PHYLOGENY

Phylogeny - looks can be deceiving

	<i>Rana aurora</i>	<i>Rana draytonii</i>
Male size	65 mm	116 mm
Female size	93	138 mm
Calling position	Underwater	Above water surface
Egg position	Below surface	At surface



IDENTIFICATION





Sierran Treefrog
Pseudacris sierra

IDENTIFICATION



Bullfrog
Lithobates catesbeianus

IDENTIFICATION



Bullfrog

California
Red-Legged Frog

IDENTIFICATION



California
Red-Legged Frog
Rana draytonii



IDENTIFICATION

Nomenclature

- ❖ Age
- ❖ Egg
- ❖ Embryo
- ❖ Tadpole (Larva)
- ❖ Metamorph
- ❖ Froglet
- ❖ Juvenile
- ❖ Adult

IDENTIFICATION

CRF Egg Masses



IDENTIFICATION

Bullfrog Egg Mass



IDENTIFICATION

Bullfrog Egg Mass





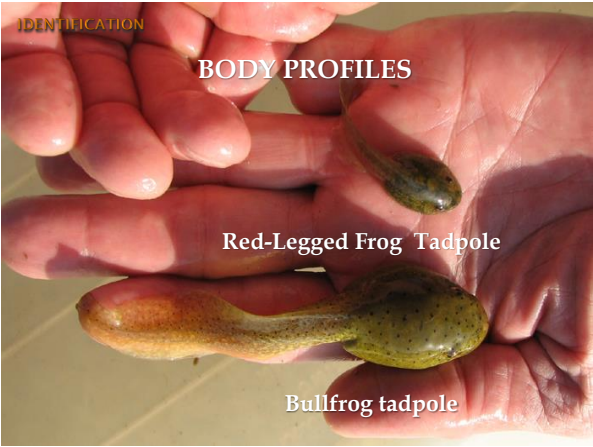
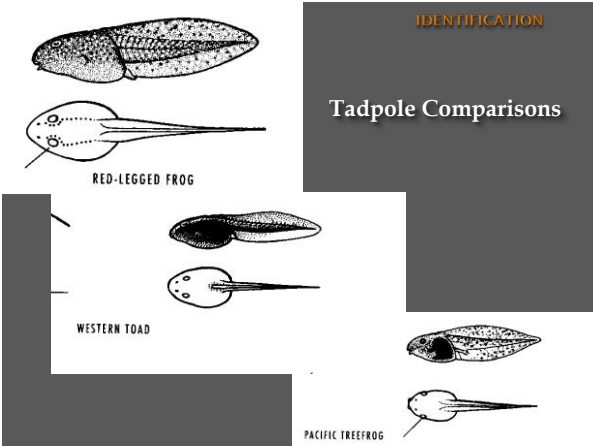
IDENTIFICATION

Gosner Embryo/Tadpole Staging System

Stage 1= Undivided fertilized egg
Stage 26 = Hind leg bud apparent
Stage 46 = Metamorphosis complete

(Gosner 1960)





IDENTIFICATION

TADPOLE COMPARISONS

	Bullfrog	Red-legged
Hatching period	April - September	December - April
Overwinter	Sometimes	Sometimes
Color	Greenish-yellow with dots, white ventral	Brown dorsal, pinkish ventral
Size	Larger than most, up to 8 in.	Up to 4 in.

IDENTIFICATION



IDENTIFICATION

Breeding Call Comparisons:
California red-legged frog
vs. American bullfrog

(Davidson 1995)



R. draytonii



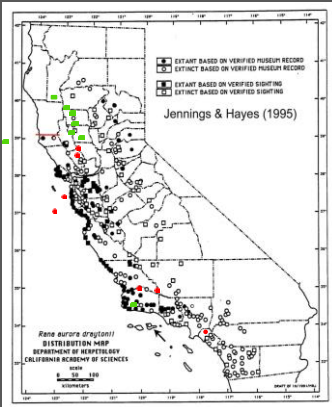
R. draytonii



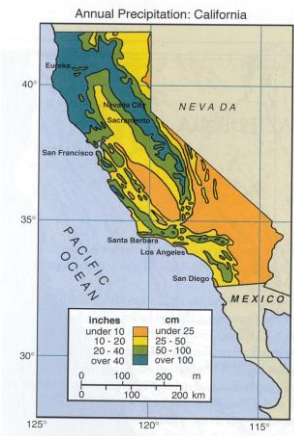
L. catesbeianus

DISTRIBUTION

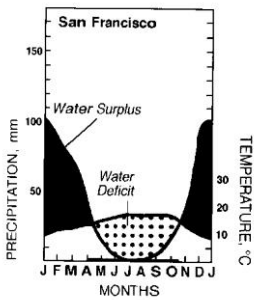
DISTRIBUTION



CALIFORNIA'S
MEDITERRANEAN
CLIMATE

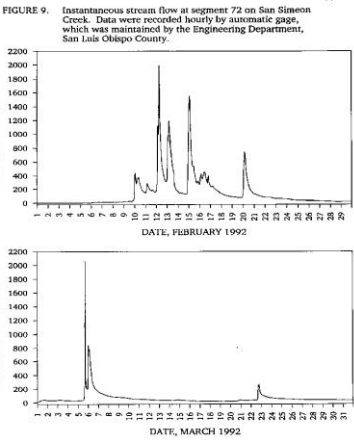


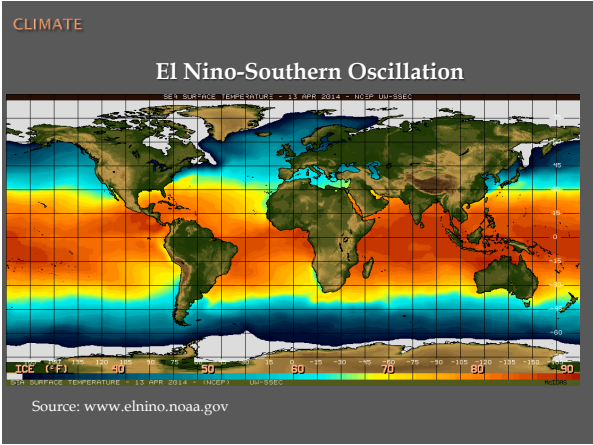
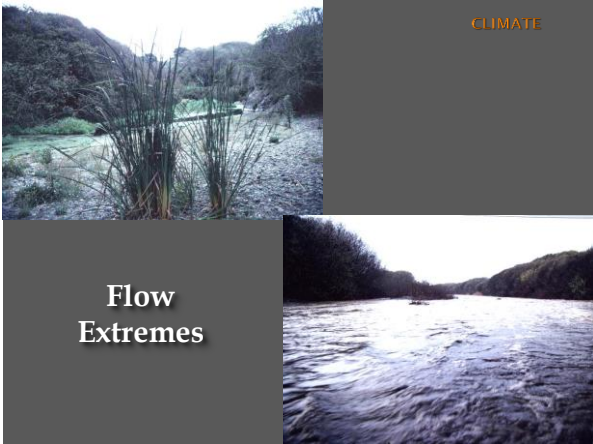
Mediterranean
Climate

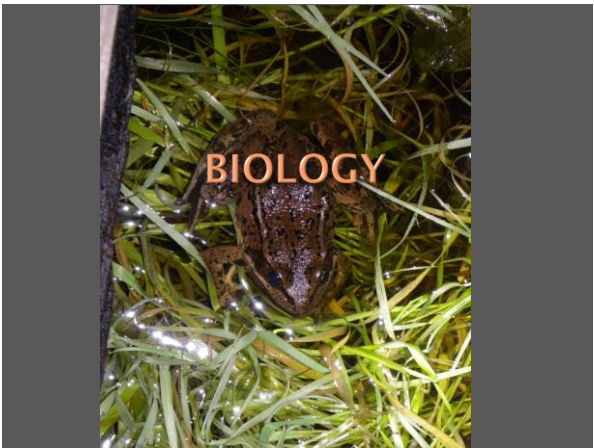
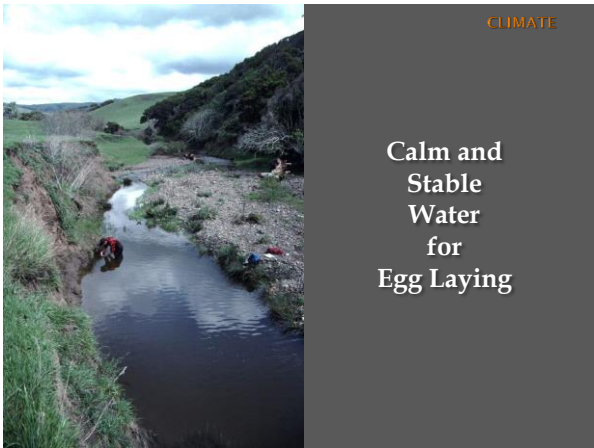


CLIMATE

Stream
Flow
Extremes







BIOLOGY

Annual Cycle

Year 1

December-April.....Calling and Egg Laying

January-September.....Tadpole Stage

June-September.....Metamorphs Appear

June-December.....Juvenile Period

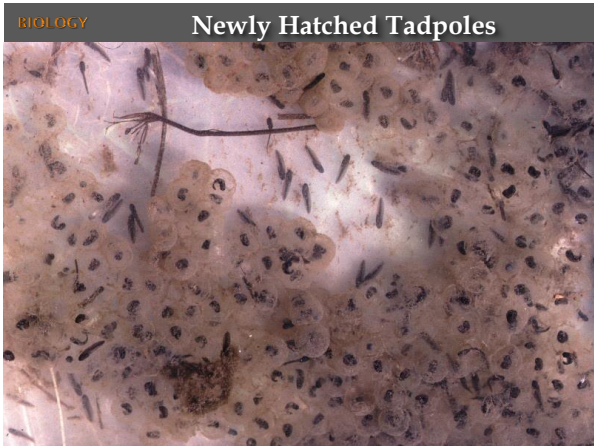
Year 2

Juvenile Period

Year 3

December-April.....First Breeding (males and some females)







BIOLOGY

Physiology of Anurans

Majority of water loss is through the skin.

Reabsorption through the ventral pelvic region.

The larger the size the greater the distance travelled between aquatic sites.

Small amphibians have proportionately more surface area and, therefore, have higher rates of evaporative loss.

(Duellman and Trueb 1994)



BIOLOGY

Tadpole Food

“Aufwuchs” (Slime!)

Algae, fungi

Microscopic animals

Carrion

BIOLOGY

Frog Food

Arthropods

Molluscs

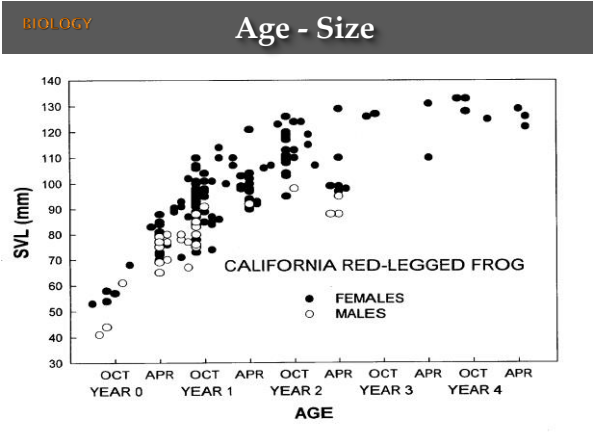
Annelid worms

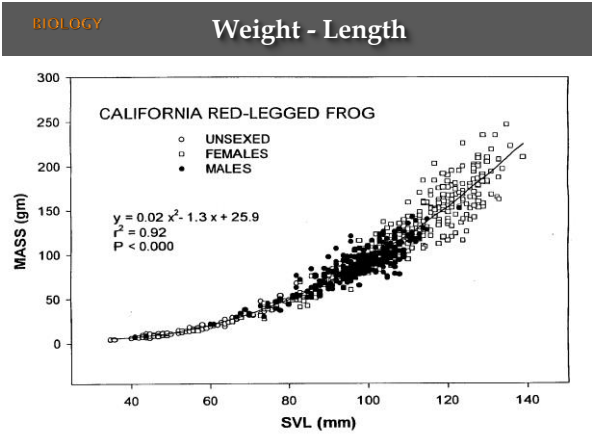
Largest frogs eat fish, other frogs, mice

Terrestrial prey = 90% of total prey items
(Bishop 2011)

BIOLOGY

SIZE AND WEIGHT





POPULATION DATA

POPULATION DATA

EIGHT-YEAR STUDY
(Scott, et. al., 2001)

Populations in four coastal streams

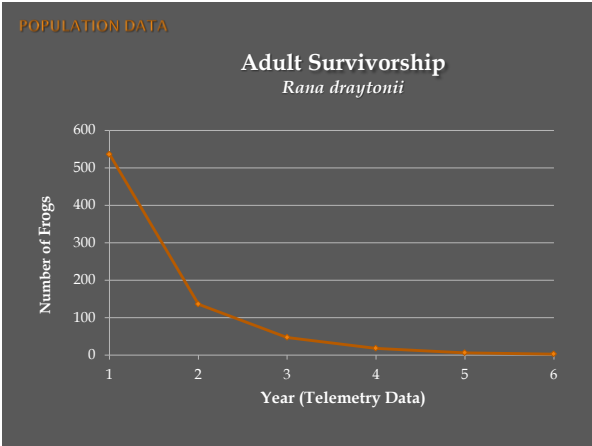
San Luis Obispo County

> 700 marked frogs

POPULATION DATA

Survivorship

Stage	Age (months)	Survival Rate	Number of Individuals
Egg>>metamorph (assume 2,500/mass)	0-5	1-5%**	125
Metamorph>> juvenile	5-12	10%	12.5
Juvenile>>adult	12-24	25%	~ 3.12
Adults	24-80	~33%/yr	1



POPULATION DATA

Roughly Speaking...

The average female (~66%) only breeds once

and

One egg mass (2,000-4,000 eggs) will produce ~1 breeding pair

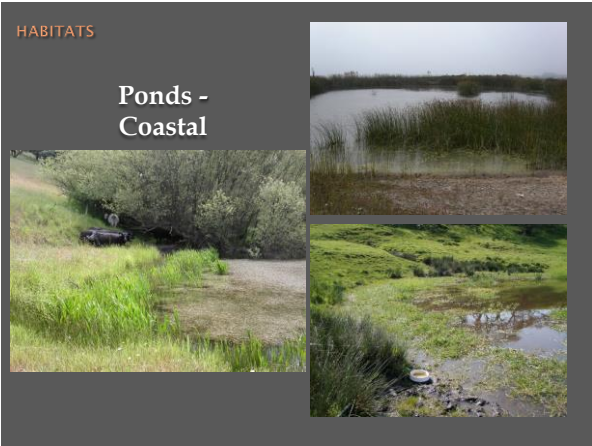
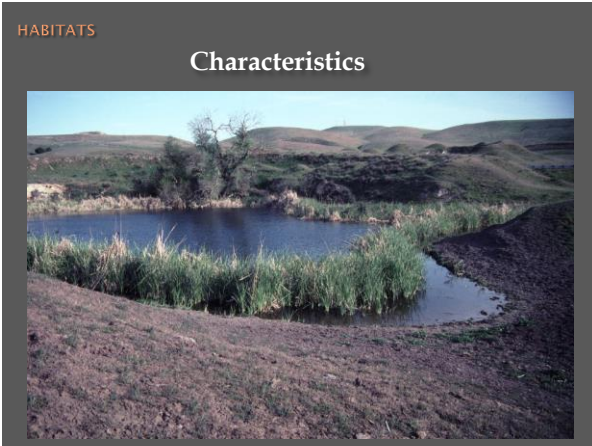
HABITATS

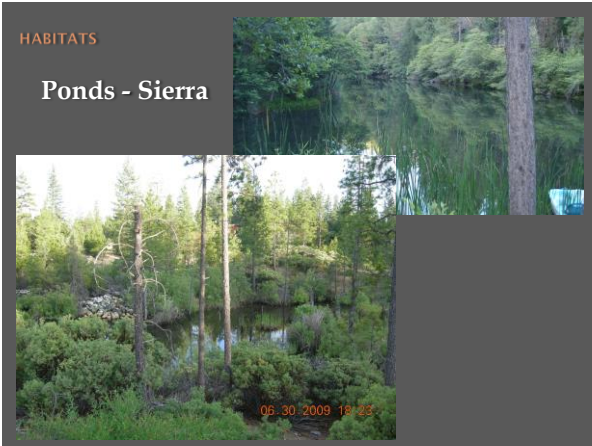
HABITATS

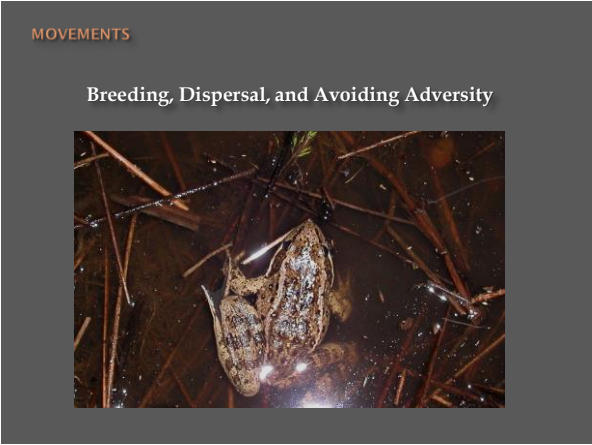
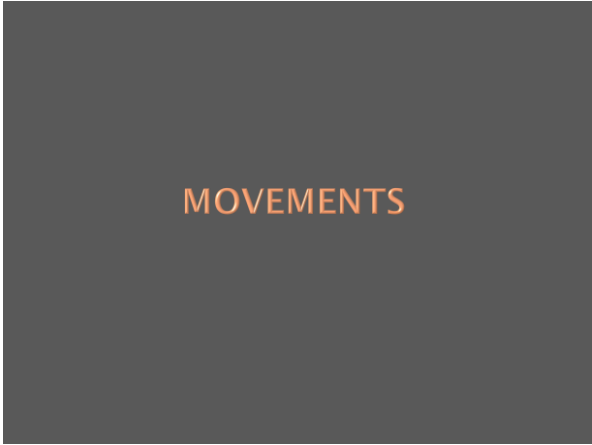
General Characteristics

Structural:
Pools vs Ponds, Seeps, other

Geographical:
Coastal, Inland, Sierran







MOVEMENTS

RESEARCH STUDIES

Scott and Rathbun
San Luis Obispo Co. (Observations 1993-1999)

Bulger, et al. (2003)
Santa Cruz Co.

Fellers & Kleeman (2007)
Marin Co.

Tatarian (2008)
Contra Costa Co.
Butte Co. (Observations 2007- 2009)

MOVEMENTS

INTERPRETING MOVEMENT STUDIES

Climatic Regime

Length & Seasonality of study

Habitat Characteristics

MOVEMENTS

Inland Habitat Movement Comparisons

	Round Valley	San Pablo Watershed	Plumas Nat. Forest
Breeding Timing (Male vocalizations)	December	December	February
Sample Size	n = 49	n = 22	n = 13
% of Sample Moved	42%	50%	100%
Terrestrial	26.5%	18%	1%
Aquatic	24.4%	36%	100%
Duration of Terrestrial Movements			
Average	1-4 days	1-6 days	1-7 days
Maximum	50 days		
Greatest Distances			
Terrestrial	91 m	215 m	10 m
Aquatic	661 m	643 m	152 m

MOVEMENTS

Coastal Habitat Movement Comparisons

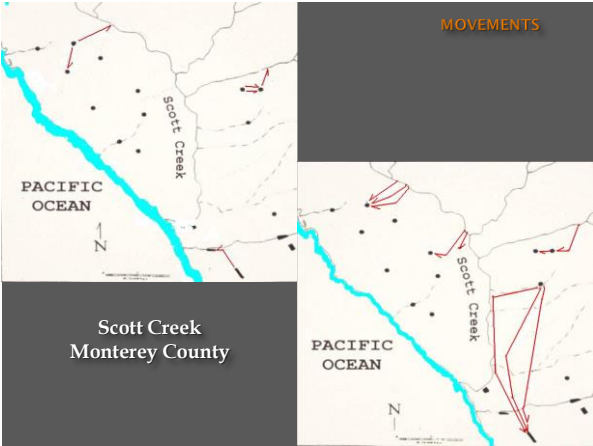
	Santa Cruz Co	Marin Co
Breeding Timing (Male vocalizations)	November	December
Sample Size	n = 56	n = 123
% of Sample Moved	14-32%	29%
Terrestrial	10-23%	2%
Aquatic	16%	27%
Duration of Terrestrial Movements		
Average	23-30 days	4 days
Maximum	63 days	6 days
Greatest Distances		
Terrestrial	1,200 m	430 m
Aquatic (riparian)	2,800 m	1,400 m

MOVEMENTS

Generalities

- ❖ Most do not move far
- ❖ Movement between aquatic habitats
- ❖ Escape adversity
- ❖ Move in damp conditions (first rains)
- ❖ Move at night
- ❖ Rarely use corridors

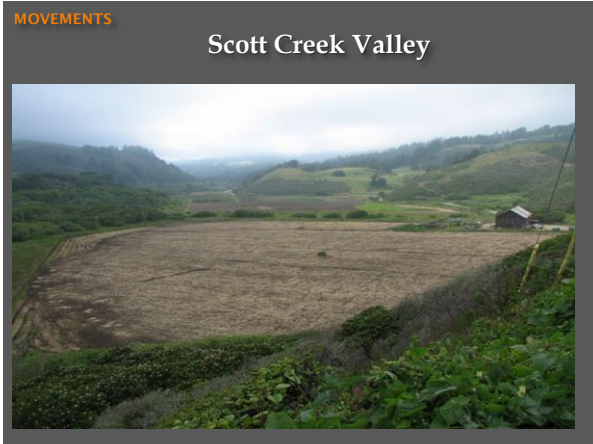
MOVEMENTS



Scott Creek
Monterey County

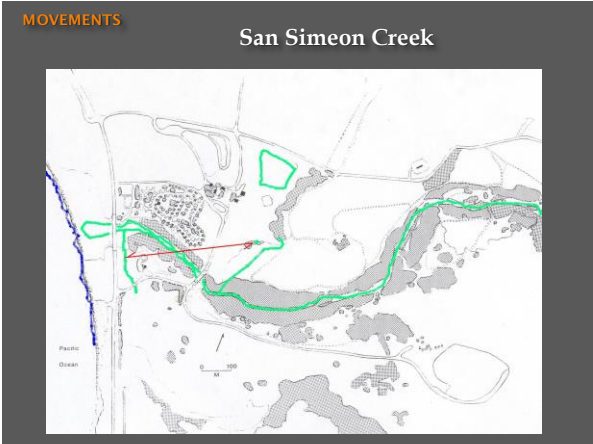
MOVEMENTS

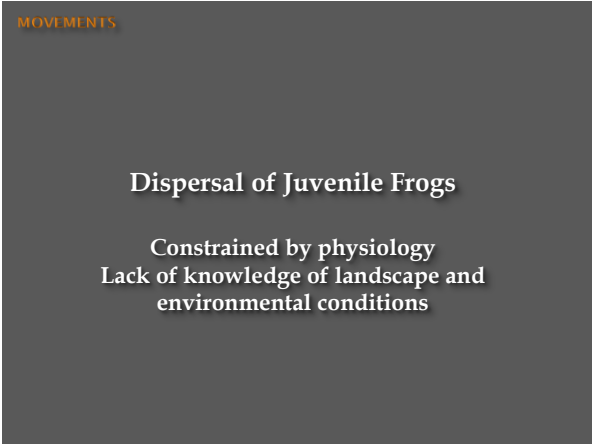
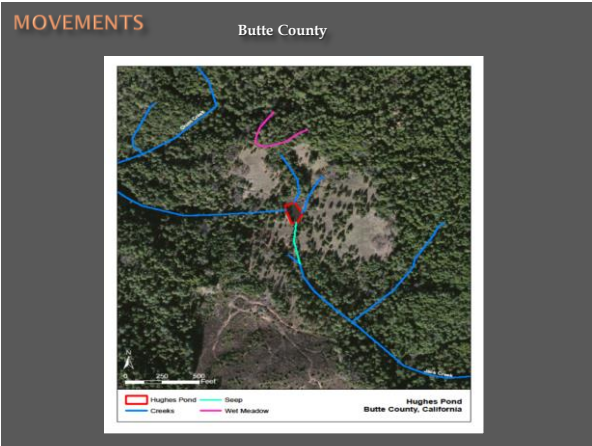
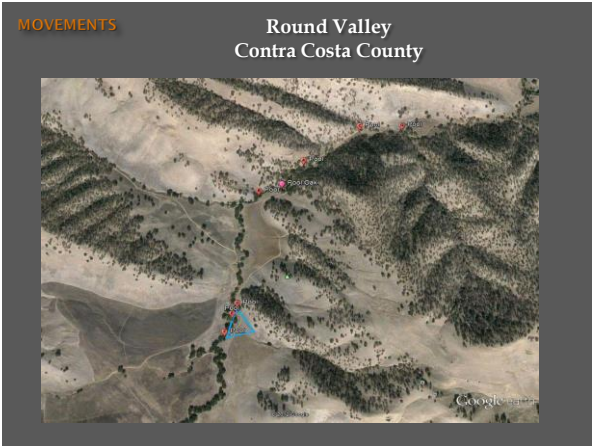
Scott Creek Valley



MOVEMENTS

San Simeon Creek



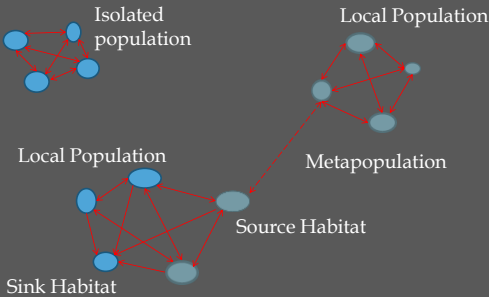


POPULATION BIOLOGY

Terminology

- LOCAL POPULATION - Frogs in habitats linked by the regular exchange of individuals
- METAPOPULATION - Two or more local populations rarely linked by migrating individuals
- ISOLATED POPULATION - A local population not exchanging individuals with any other local population

POPULATION BIOLOGY

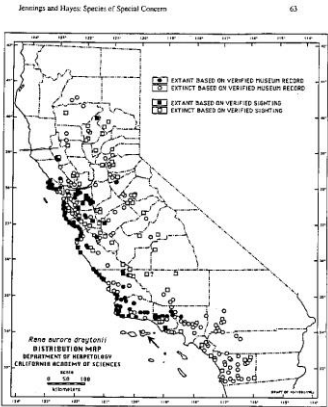


POPULATION BIOLOGY

European Pool Frog
(*Rana lessonae*)

- ❖ 155 permanent ponds in Sweden
- ❖ 60 local frog populations
- ❖ All 24 ponds >4 km from another population had no frogs
- ❖ 70% of ponds <1 km from another population had frogs
- ❖ 33% of ponds 1-4 km from another had frogs (Sjögren 1991)

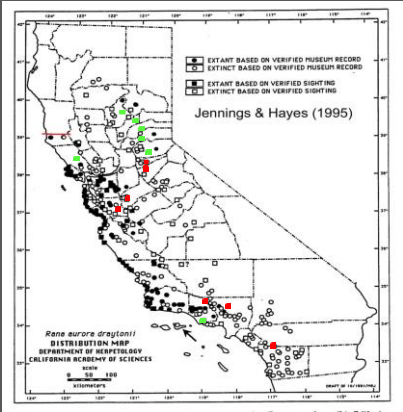
THE GEOGRAPHY
OF EXTINCTION



POPULATION BIOLOGY

Extinction Sequence

- 1. Metapopulation linkages are broken, creating isolated local populations
- 2. Local populations lose mosaic of local habitats
- 3. Local populations go extinct

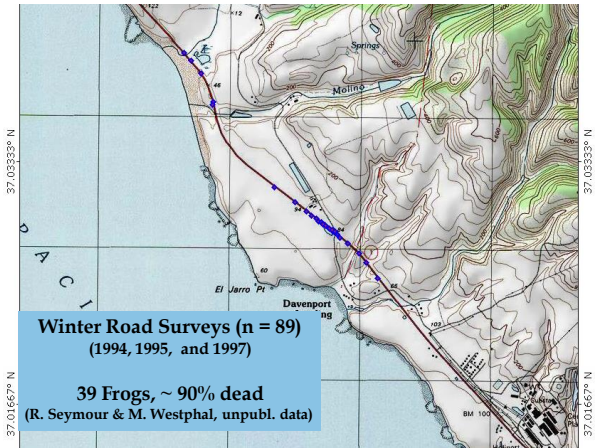


POPULATION BIOLOGY

“Isolated populations will not persist without management.”

(Hanski and Gilpin 1997)

THREATS



THREATS

Roadway Barriers

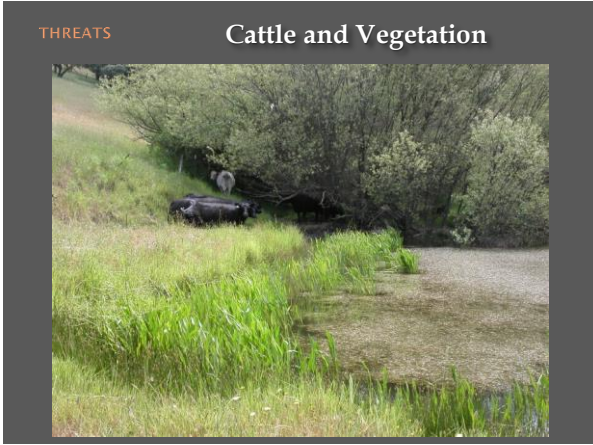
Canadian study (Carr and Fahrig 2001): Significant negative effect on leopard frog (*Lithobates pipiens*) abundance due to vehicular traffic density within 1.5 km radius of pond (i.e., greater impact because of increased traffic density).

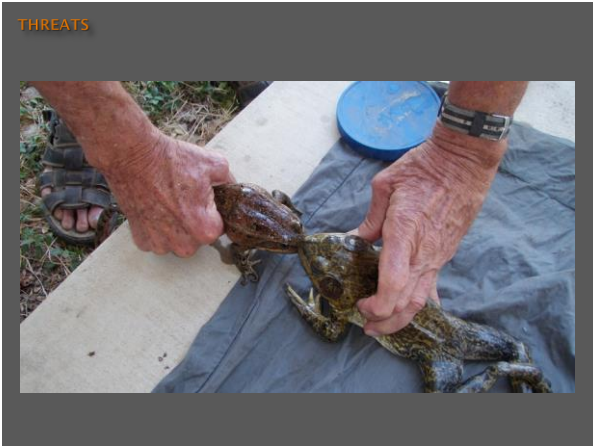
German study (Andrews and Jochimsen 2007) - Zero to 50% survival rate of toads (*Bufo bufo*) crossing roads with traffic densities of 24-40 cars per hour.

THREATS

Urban Impacts

- ❖ Loss/Modification of Wetlands
- ❖ Loss of Terrestrial Habitats
- ❖ Loss of Habitat Connectivity
- ❖ Toxins – pesticides, pharmaceuticals, heavy metals





THREATS

Agricultural Chemicals

[www.epa.gov/espp/litstatus/
effects/redleg-frog/](http://www.epa.gov/espp/litstatus/effects/redleg-frog/)

THREATS

Emerging Diseases

Batrachochytrium dendrobatidis genome sequenced and even most recently evolved clade contained more genetic variation than previously reported. Important to consider Bd in broader evolutionary context and identify mechanisms that led to shift in virulence.
(Rosenblum, et al. 2013)

Ranavirus – frogs and salamanders , U.K., U.S.A and Canada

THREATS

Climate Change

- ❖ Decrease in cold days and nights and frost occurrences
- ❖ Increase in hot days and nights
- ❖ Increase in heat waves
- ❖ Stronger storm events
- ❖ Wildfires
- ❖ Emerging pathogens and invasive species

(Intergovernmental Panel on Climate Change (IPCC) Synthesis Report 2013)

THREATS

Climate Change Potential Effects

Biology	Deluge	Drought
Breeding habitat	Increases	Decreases
Egg survival	Stays the same	Stays the same or decreases
Larval survival	Stays the same or decreases	Decreases
Metamorph survival	Dependent on larval stage	Decreases
Adult	Stays the same	Decreases

MANAGEMENT

MANAGEMENT

Tools

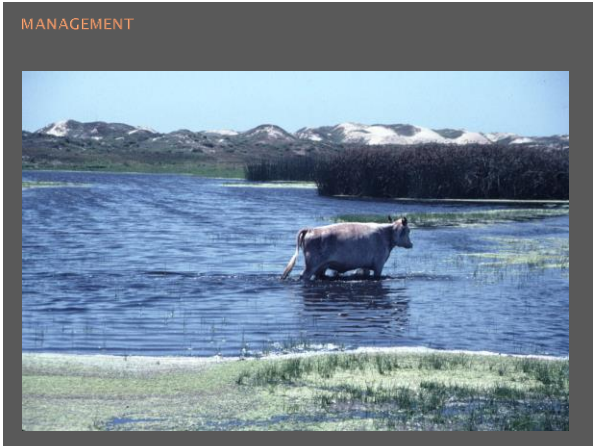
- ❖ Control of exotic predators
- ❖ Pond construction
- ❖ Vegetation and silt removal
- ❖ Buffer zones
- ❖ Translocation
- ❖ Population re-establishment

MANAGEMENT



MANAGEMENT





MANAGEMENT

Use Stock Ponds to Manage CRF Populations
(Caution: rarely maintenance free)

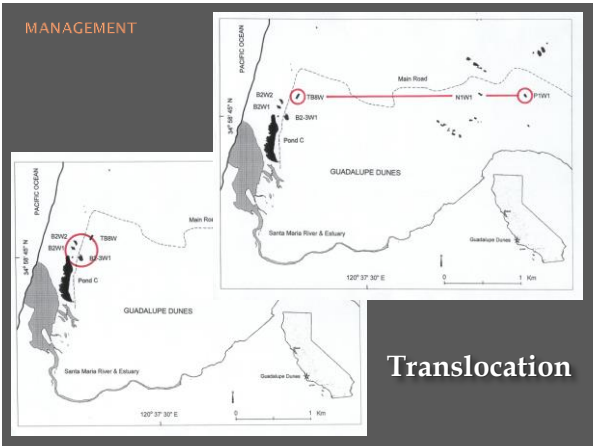
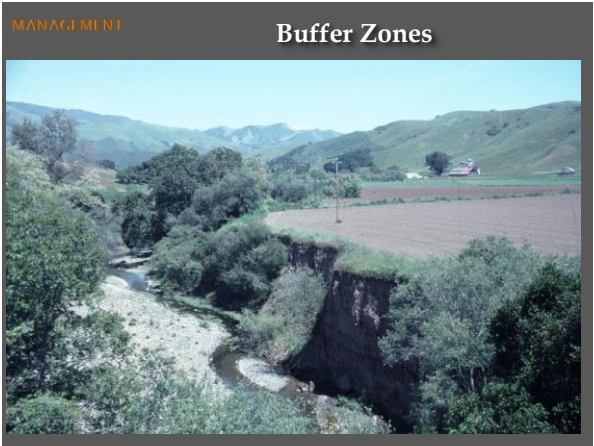
- ❖ Manage for soil accretion/aquatic biomass accumulation, even with weirs for water control
- ❖ Prevent individual loss

MANAGEMENT

Creating Frog Ponds


A collage of three photographs illustrating the creation of frog ponds. The top-left photo shows an orange tractor with a backhoe attachment digging a hole in a dry, grassy field. The bottom-left photo shows a person in a red shirt and blue jeans digging a hole in the ground. The right photo shows a finished, shallow pond with a person standing in the grass next to it. In the background of the pond photo, there are some small structures and a body of water.





MANAGEMENT


Translocation




MANAGEMENT

Translocation

San Pablo Dam



April Creek Barn



MANAGEMENT

Translocation - Egg Deposition



March 3 - Frog mass:
148g

March 18 - Egg mass
observed

March 26 - Frog mass:
106g

RE-ESTABLISHING AN
HISTORIC
POPULATION:
Pinnacles National
Monument



POPULATION RE-ESTABLISHMENT

BEAR GULCH RESERVOIR HISTORY

1934	Reservoir completed
1960's-70's	Red-legged frogs present
~1980	Catfish introduced
1985	Drained, catfish removed
1987-2000	Frogs absent
2001	Re-establishment started

POPULATION RE-ESTABLISHMENT

POPULATION RE-ESTABLISHMENT

CHALONE CREEK

Wet Season

POPULATION RE-ESTABLISHMENT

Chalone Creek

YEAR	NO. OF EGG MASSES
1998	0
1999	>5
2000	7-8

POPULATION RE-ESTABLISHMENT

PROGRAM

- ❖ Collection - 20% of egg masses from Chalone Creek
- ❖ Headstart - held tadpoles in mesh boxes in reservoir
- ❖ Release - placed tadpoles into reservoir

POPULATION RE-ESTABLISHMENT

NUMBER OF EGG MASSES AND TADPOLES RELEASED

YEAR	CHALONE CREEK EGG MASSES	TADPOLES RELEASED
2001	5	116++
2002	9	914
2003	3	841
TOTALS	17	1871++

POPULATION ESTABLISHMENT

Reservoir - Results

YEAR	RELEASED	OBSERVED	
	Tadpoles	Metamorphs	Adults and Juveniles
2001	116++	17	0
2002	914	154	12
2003	814	427**	29
2004		485	20
2005		317	12
2006		329	22
2007		68+	15+
2008		206	14

Reintroduction of a Population
Upper Las Virgenes Canyon
Open Space Preserve,
Los Angeles

[illegible]

NPS - Katy
Delaney, Mark
Mendelsohn
USGS - Adam
Backlin, Liz
Gallegos
MRCA - Chris
Trumpy
CDFW - Laura
Patterson
USFWS - Chris
Dellith

- Mediterranean climate - water regimes
- Habitat types used by frogs
- Population dynamics
- Threats
- Population-level management
- Clear objectives for species management

REGULATORY

REPORTING

- ❖ Habitat Assessment
- ❖ Site Assessment (USFWS 2005)
- ❖ Biological Assessment
- ❖ Habitat Conservation Plan

REGULATORY

PERMITTING

Unpermitted Activities:

- ❖ Site Assessment
- ❖ Protocol-level surveys (VES)
- ❖ Construction monitoring - upon approval by USFWS

Permitted Activities:

- ❖ Section 7 - federal nexus
- ❖ Section 10 - no federal nexus

REGULATORY

PERMITTING

USFWS wants more data than protocol survey

Individual 10(A)(1)(a) Permit IS required for dip-netting

Entire pond must be dip-netted to prevent a false negative of occurrence in a pond



REGULATORY

INDIVIDUAL 10(A)1(A) PERMIT

Minimum requirements to obtain a permit:

See: Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog (USFWS 2005)

Minimum requirements for Service-approval:

REGULATORY

SITE ASSESSMENT AND
FOCUSED SURVEYS

Results are valid for two (2) years, unless the following has occurred:

- ❖ Appropriate Service Fish and Wildlife Office was not contacted to review the results of the site assessment prior to field surveys being conducted;
- ❖ Field surveys were conducted in a manner inconsistent with the Guidance or with survey methods not previously approved by the Service;
- ❖ Field surveys were incomplete;
- ❖ Surveyors were not adequately qualified to conduct the surveys;
- ❖ Reporting requirements, including submission of CNDDDB forms, were not fulfilled.

REGULATORY

SITE ASSESSMENT

1. Is the site within the current or historic range of the CRF?
2. Are there known records of CRF at the site or within a 1.6-km (1-mi) radius of the site?
3. What are the habitats within the project site and within 1.6 km (1-mi) of the project boundary?

REGULATORY

SITE ASSESSMENT
Site Evaluation:

- ❖ Ponds - size, max. depth, vegetation components, substrates, hydrologic duration
- ❖ Streams - bank full width, max. depth, stream gradient, pools present, depth of pools, characteristics of non-pool habitat, vegetation components, substrate, hydrologic cycle, hydrologic connectivity

REGULATORY

PROTOCOL SURVEYS

	Surveys	
	Diurnal	Nocturnal
Non-breeding	1	1
Breeding	2	4
Intervals (min.)	7 days	7 days

Decontamination guidelines must be used between each separate hydrologic site for all equipment. (USFWS 2005)

REGULATORY

PROTOCOL SURVEYS

- ❖ Listen
- ❖ Visual scan (Visual Encounter Survey)
- ❖ Day survey
- ❖ Night survey
- ❖ Lights and binoculars

TECHNIQUES

TECHNIQUES

SURVEY EQUIPMENT

- MOST SURVEYS:*
- Decontamination gear
 - Chest waders
 - Headlamps and Lights
 - Binoculars
 - Dip nets (permit required)

- SPECIAL CIRCUMSTANCES:*
- Float tubes or boat

“See, Frank? Keep the light in their eyes and you can bag them without any trouble at all!”



“See, Frank? Keep the light in their eyes and you can bag them without any trouble at all.”

TECHNIQUES

LIGHT SOURCES FOR
EYE-SHINE SURVEYS

