CALIFORNIA RED-LEGGED FROG WORKSHOP

Norman Scott & Galen Rathbun

Acknowledgements

California Department of Transportation

U. S. Fish and Wildlife Service

U. S. Geological Survey

California State Parks

Elkhorn Slough Coastal Training Program

Grey Hayes

Virginia Guhin

Granite Rock Sand Plant

Dana Bland

Marvin Brandt

TODAY'S SCHEDULE

0800-1200	Lecture
1200-1230	Lunch
1230-1400	Lecture & Demonstrations
1400-1800	Field Demonstrations
1800-2000	Dinner Break
2000-2400	Night Work

TOPICS

CLASSROOM

DEMONSTRATION

FIELD

WEB SITE

DOCUMENTS

IMPORTANT POINTS

- Water regimes – Mediterranean climate
- Population dynamics
- Agriculture -- cattle and ponds
- Manage larval survival
- Manage populations, not individuals
- Clear management objectives

Identification

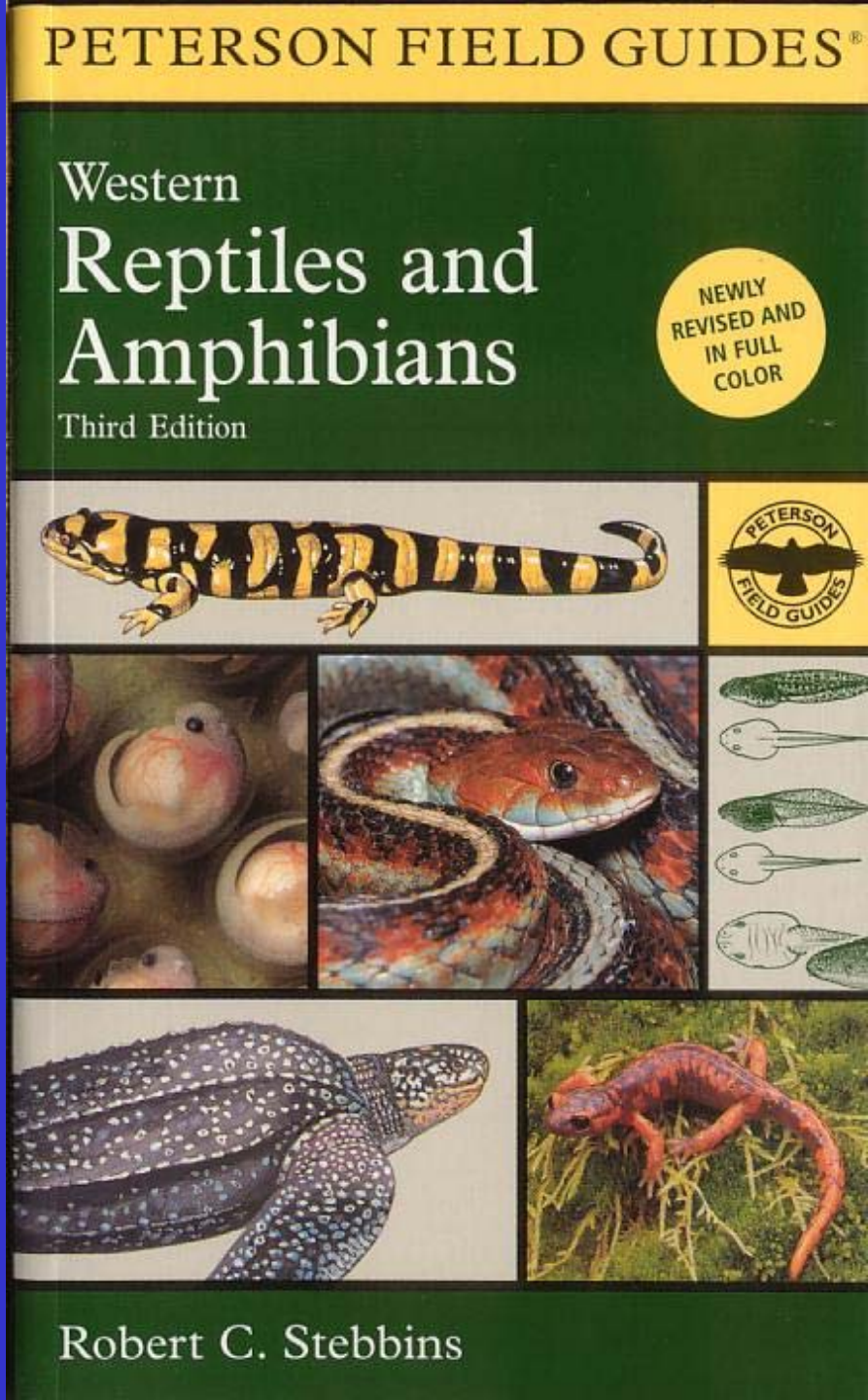


Plate 8. a, *Western Spadefoot Toad;* b, *Western Toad;* c, *Yellow-legged Frog* (d, *ventral surface*); e, *Red-legged Frog* (f, *ventral surface*); g, *Bullfrog;* h, *Pacific Treefrog in brown phase* (i, *green phase*).

Foothill Yellow-Legged Frog

Rana boylii

Sierra Nevada Yellow-Legged Frog

Rana sierrae

Pacific Chorus Frog

Pseudacris regilla

Bullfrog

Lithobates catesbeianus

Bullfrog

California
Red-Legged Frog

California Red-Legged Frog

California Red-Legged Frogs

Variation

Light and Dark Colorful Individuals


Colorful With
Little Pattern
9/12/2000

Male vs. Female

Egg Masses

Bullfrog Egg Mass

Bullfrog Egg Mass

Chorus Frog Egg Mass

Chorus Frog Egg Mass

GOSNER EMBRYO/TADPOLE STAGING SYSTEM

Stage 1 = Undivided fertilized egg

Stage 26 = Hind leg bud apparent

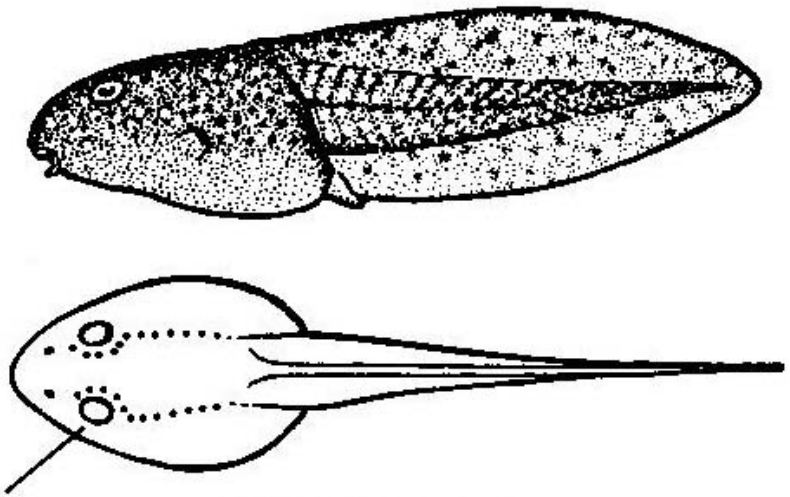
Stage 46 = Metamorphosis complete

Gosner 1960. Herpetologica 16:183-190.

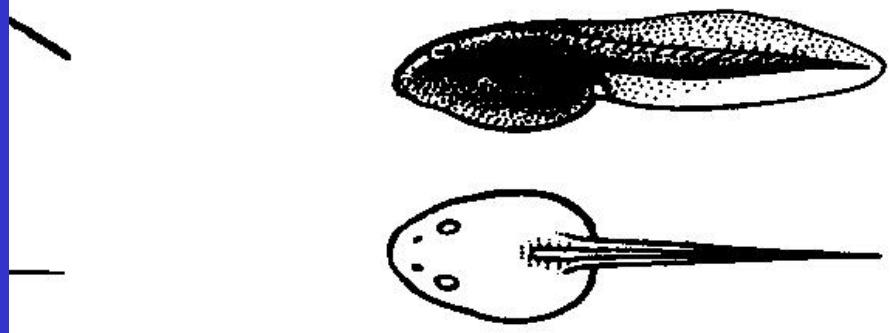
California Red-Legged Frog

California Red-Legged Frog

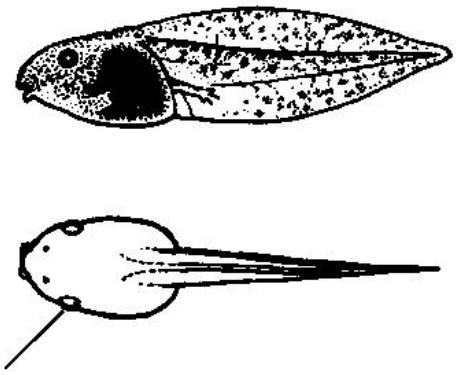
Tadpole Identification



RED-LEGGED FROG



WESTERN TOAD



PACIFIC TREEFROG


BODY PROFILES
Tree Frog
Red-Legged Frog

Bullfrog Tadpole

MAR 18 2007

BULLFROG TADPOLES

Hatch April to September

Probably overwinter at least once

Are usually greenish or yellow

Always have dots or “freckles”

Are almost never the same size as contemporaneous red-legged frog tadpoles

Red-Legged Frog and Bullfrog Tadpoles

Bullfrog

CALL IDENTIFICATION

(Davidson 1995)



RECENT TAXONOMIC CHANGES

Pacific Chorus Frog (Tree Frog)

Hyla regilla >> Pseudacris regilla

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

TERMINOLOGY

Age

Egg

Embryo

Tadpole

Larva

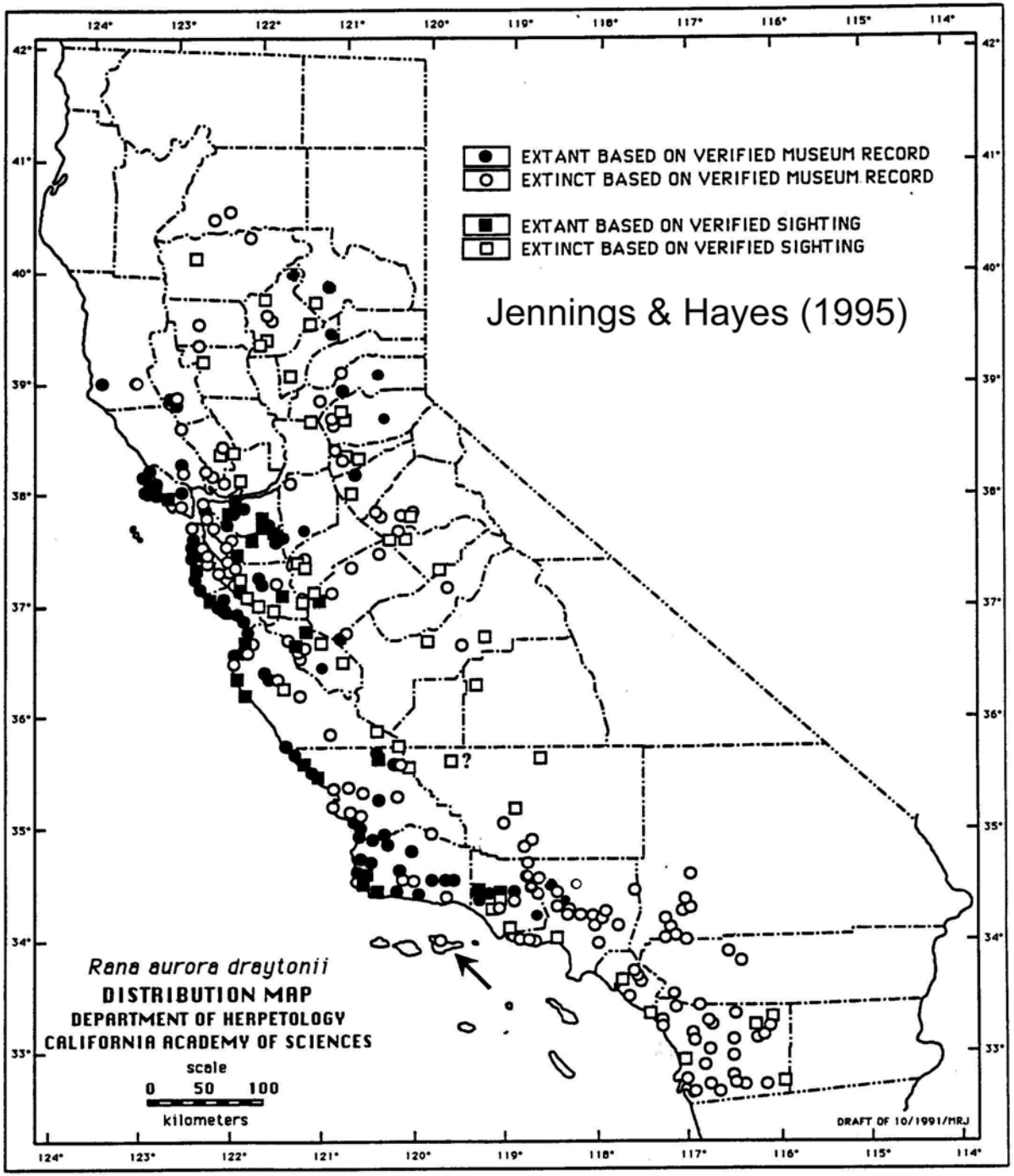
Metamorph

Froglet

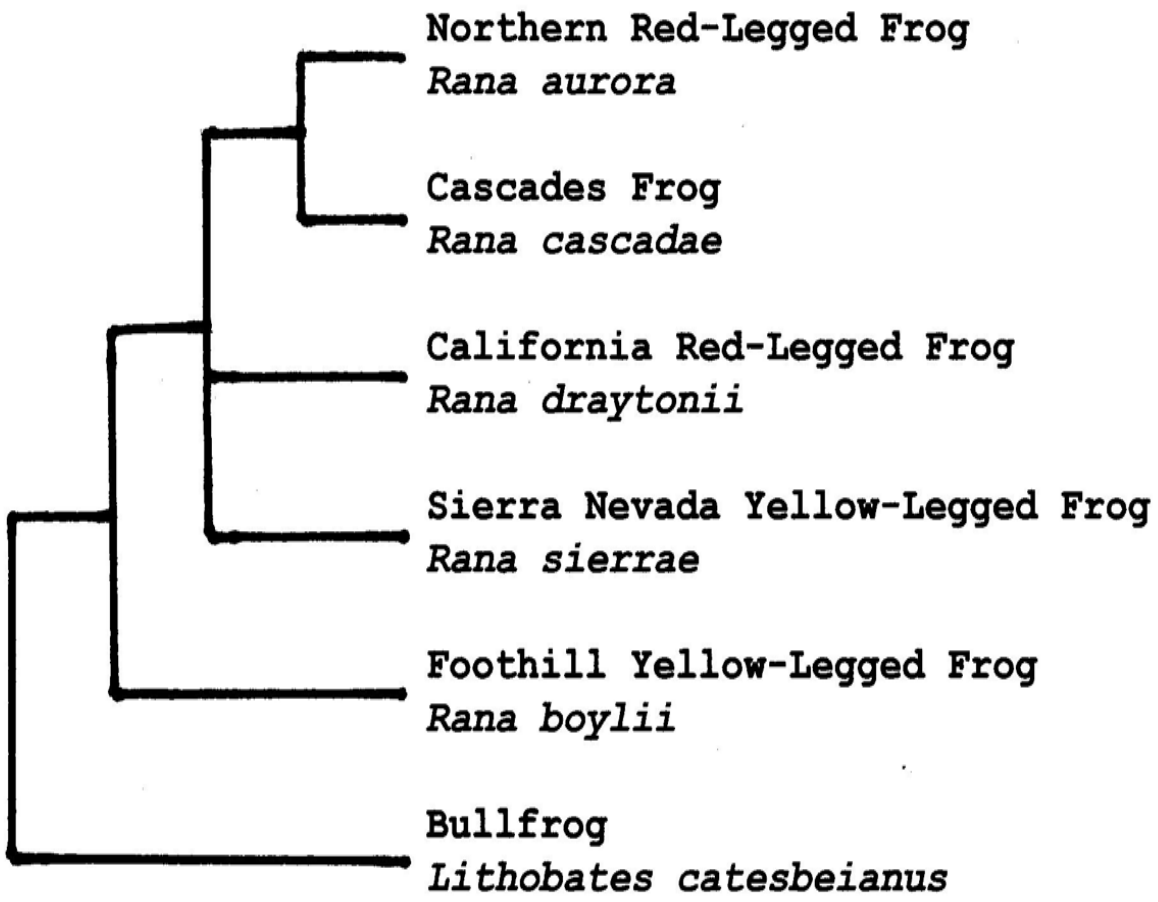
Juvenile

Adult

DISTRIBUTION


EXTANT BASED ON VERIFIED MUSEUM RECORD
EXTINCT BASED ON VERIFIED MUSEUM RECORD
EXTANT BASED ON VERIFIED SIGHTING
EXTINCT BASED ON VERIFIED SIGHTING
Jennings & Hayes (1995)
Rana aurora draytonii
DISTRIBUTION MAP
DEPARTMENT OF HERPETOLOGY
CALIFORNIA ACADEMY OF SCIENCES
scale
0 50 100
kilometers
DRAFT OF 10/1991/HRJ

RANA DRAYTONII PHYLOGENY



Rana aurora

- males to 65 mm, females to 93 mm
- males lack vocal pouches
- often calls underwater
- eggs often placed deep

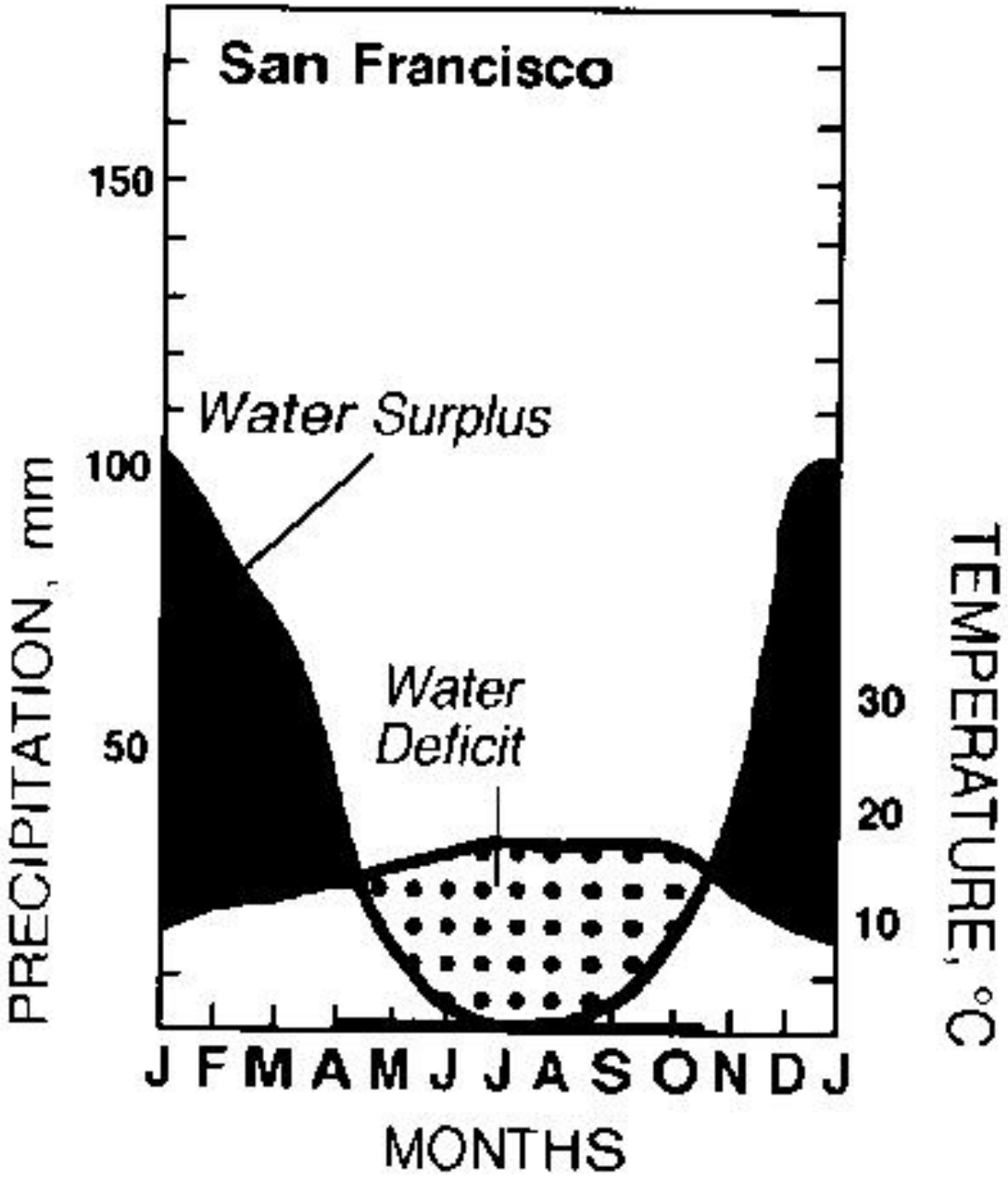
Rana draytonii

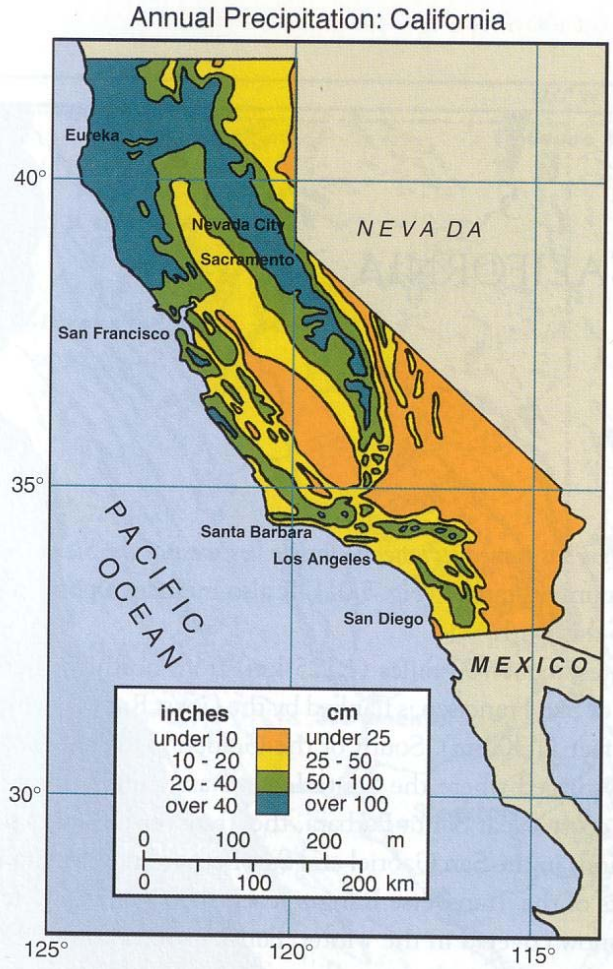
- males to 116 mm, females to 138 mm
- males with vocal pouches
- never calls underwater
- eggs placed near surface

MEDITERRANEAN

CLIMATE

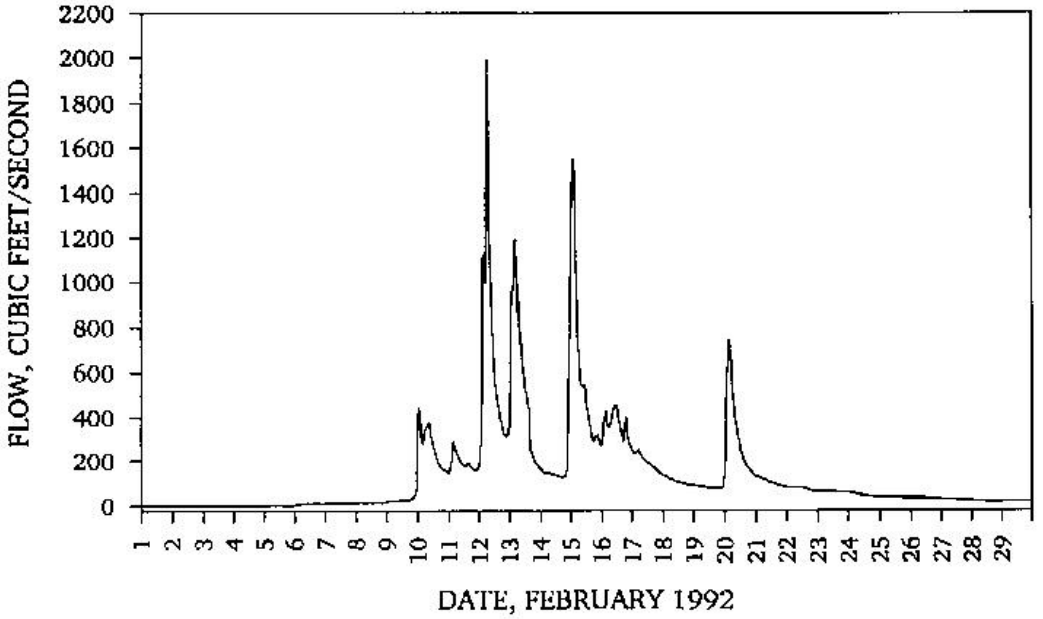
Mediterranean Climate

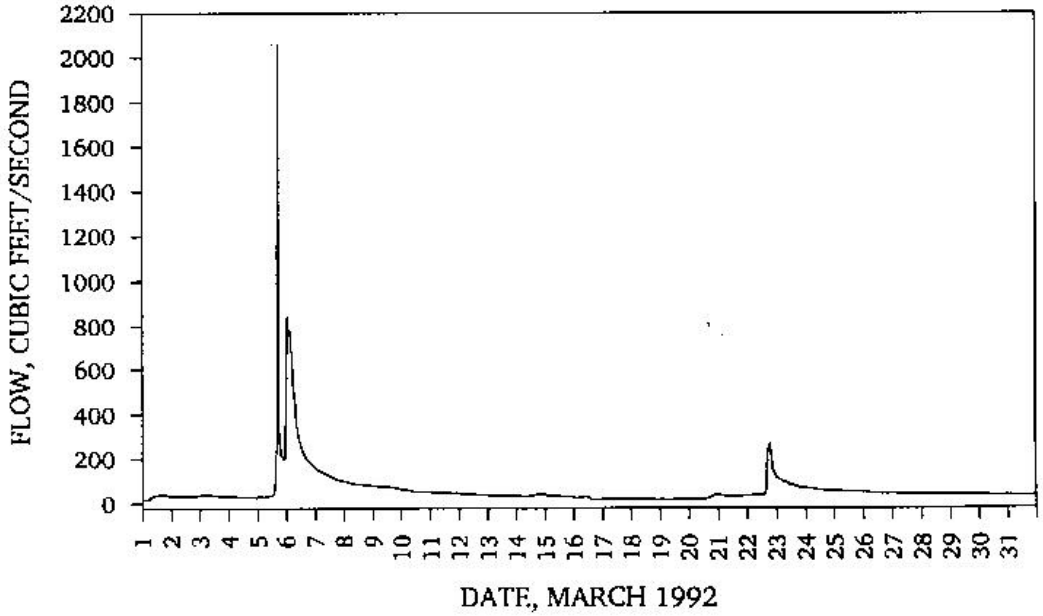




Stream Flow Extremes

FIGURE 9. Instantaneous stream flow at segment 72 on San Simeon Creek. Data were recorded hourly by automatic gage, which was maintained by the Engineering Department, San Luis Obispo County.





Flow Extremes

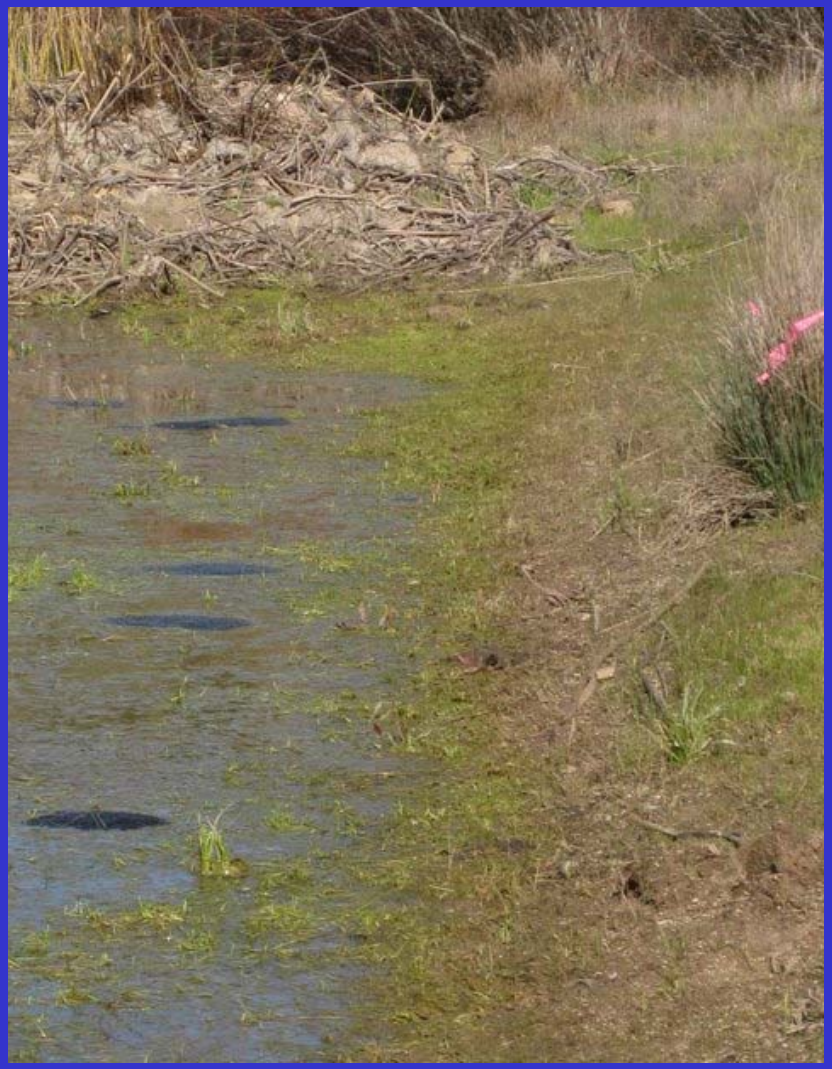
San Simeon - Summer

San Simeon - Fall

San Simeon - Winter

San Simeon - Spring

Calm and Stable Water for Egg Laying




BIOLOGY

ANNUAL CYCLE

Year 1

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

January-September.....Tadpole Stage*

June-September.....Metamorphs Appear*

June-November.....Juvenile Period

Year 2.....Juvenile Period

Year 3

December-April.....First Breeding

(males and some females)

AMPLEXUS

EXTERNAL FERTILIZATION

Fresh Egg Mass

Egg Clusters

Newly Hatched Tadpoles

California Red-legged Frog

Metamorphosis

Juvenile


Adult

TADPOLE FOOD

“Aufwuchs”
Algae, fungi
Microscopic animals
Carrion

FROG FOOD

Arthropods

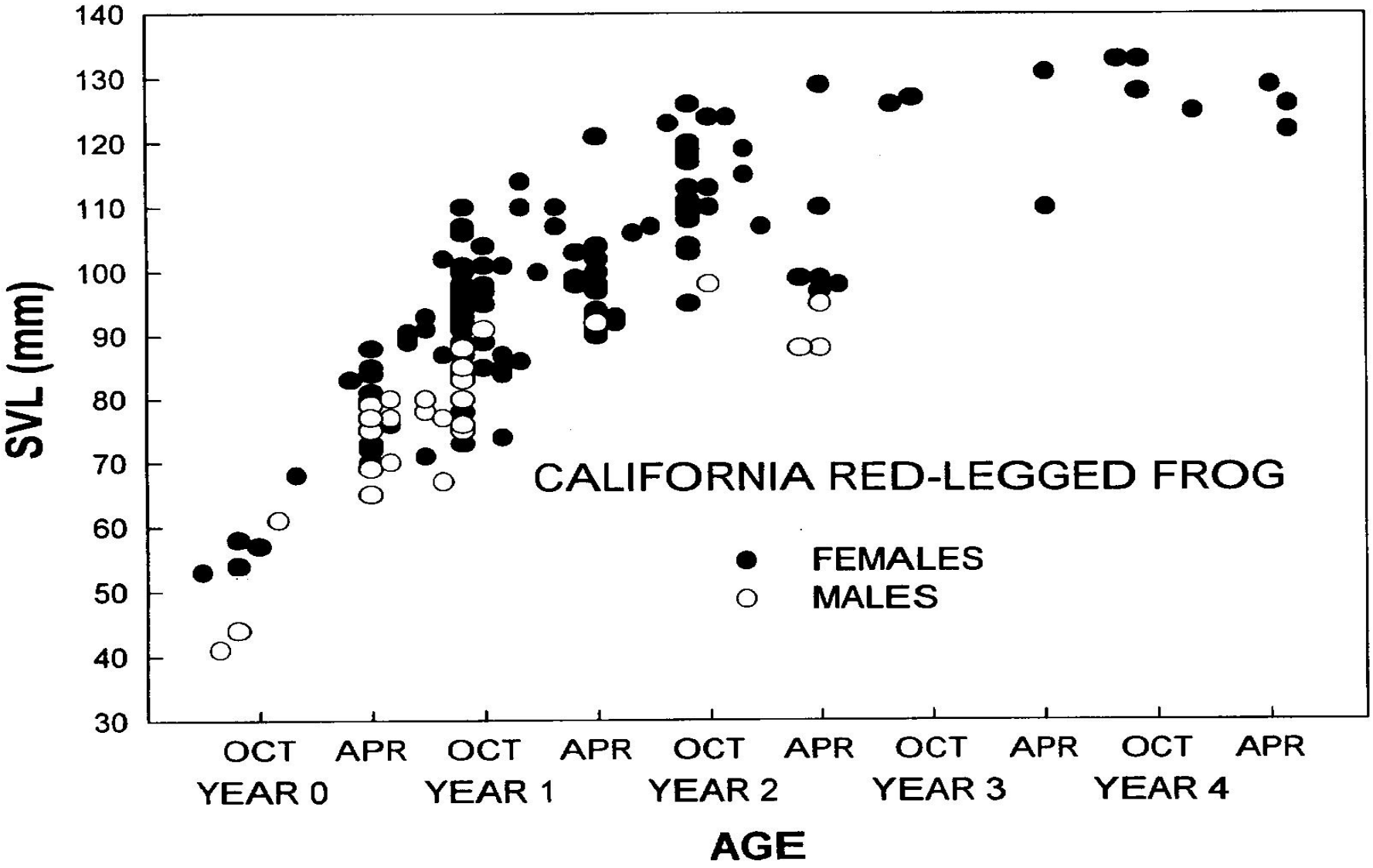
Molluscs

Annelid worms

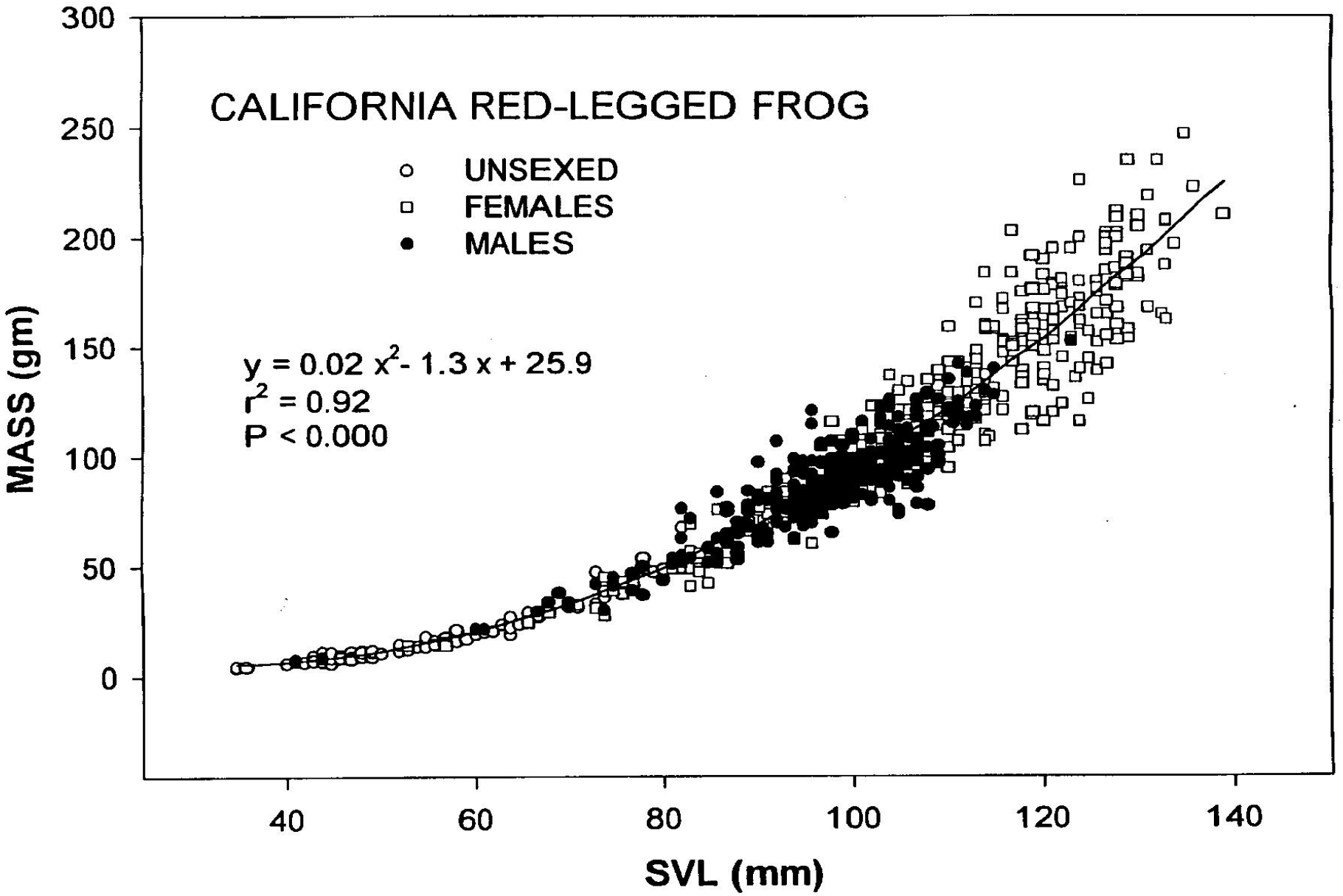
Largest frogs include fish, other frogs, mice

SIZE AND WEIGHT

Age - Size


SVL (mm)
140
130
120
110
100
90
80
70
60
50
40
30
CALIFORNIA RED-LEGGED FROG
FEMALES
MALES
OCT
APR
OCT
APR
OCT
APR
OCT
APR
OCT
APR
YEAR 0
YEAR 1
YEAR 2
YEAR 3
YEAR 4
AGE

Weight - Length



POPULATION

DATA

EIGHT-YEAR STUDY

Populations in four coastal streams

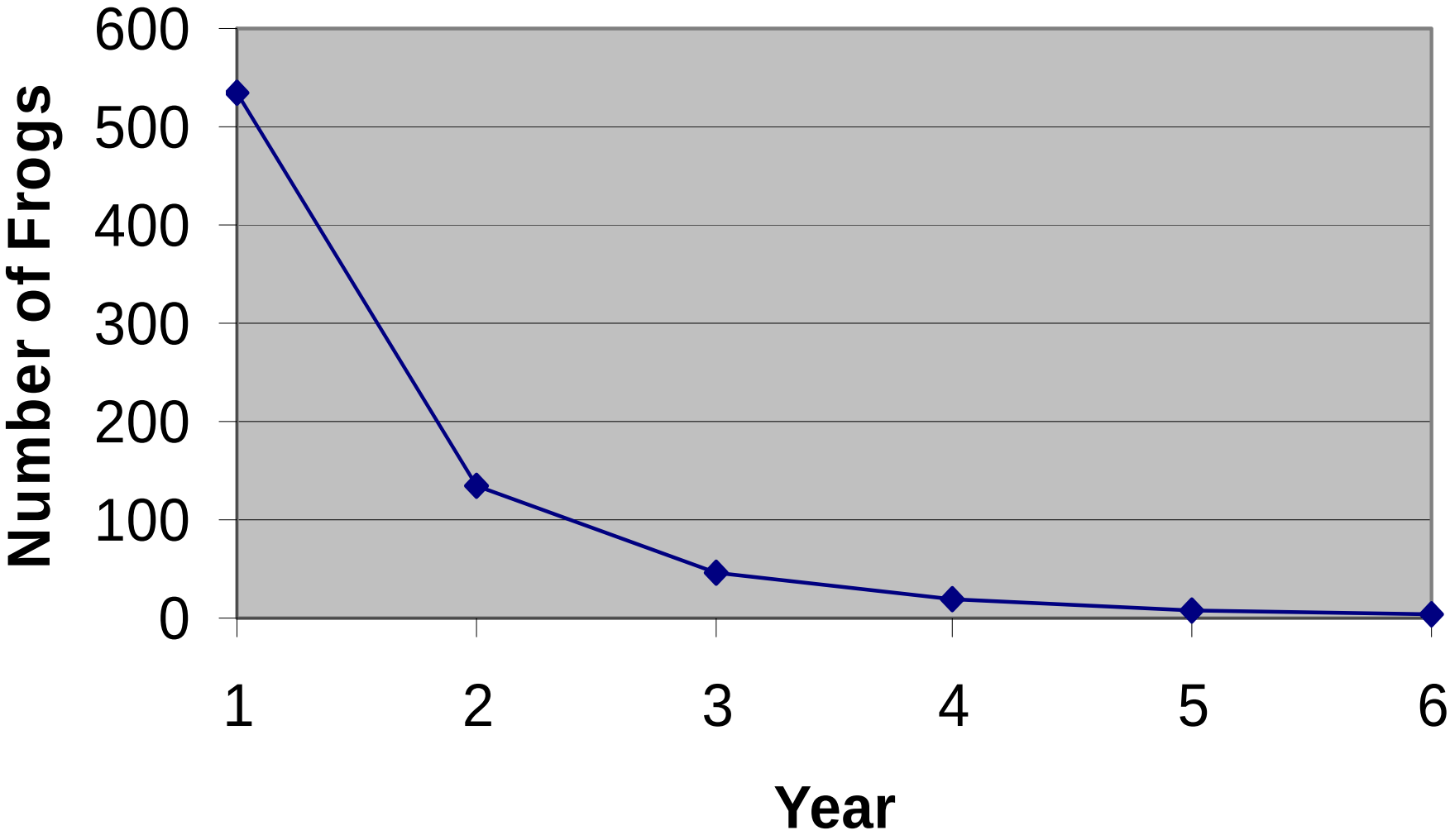
San Luis Obispo County

> 700 marked frogs

SURVIVORSHIP

Stage	Age (months)	Survival
•Egg>>metamorph	0-5	1-5%**
•Metamorph>>juvenile	5-12	10%
•Juvenile>>adult	12-24	25%
•Adults	24-80+	~33%/year

Rana draytonii Survivorship



Roughly.....

The average female (~66%) only breeds once

and

One egg mass (1000-4000 eggs) will produce ~1 breeding pair


HABITATS

Habitats – Cattle are Important

Habitat – Dams are Important

Cattle and Dam

Cattle and Dam

Stock Pond

Stock Pond

Spring Box

Treated Wastewater Storage

Percolation Pond

Dunes Pond – No Cattle No Dam

Riparian Upland Habitat

SCORING PONDS AND SMALL STREAMS AS BREEDING HABITAT

MOVEMENTS

MOVEMENT STUDIES

Personal Observations (1993-9) San Luis Obispo Co.

Bulger et al. (2003) Santa Cruz Co.

Fellers & Kleeman (2007) Marin Co.

Tatarian (2008) Contra Costa Co.

INTERPRETING MOVEMENT STUDIES

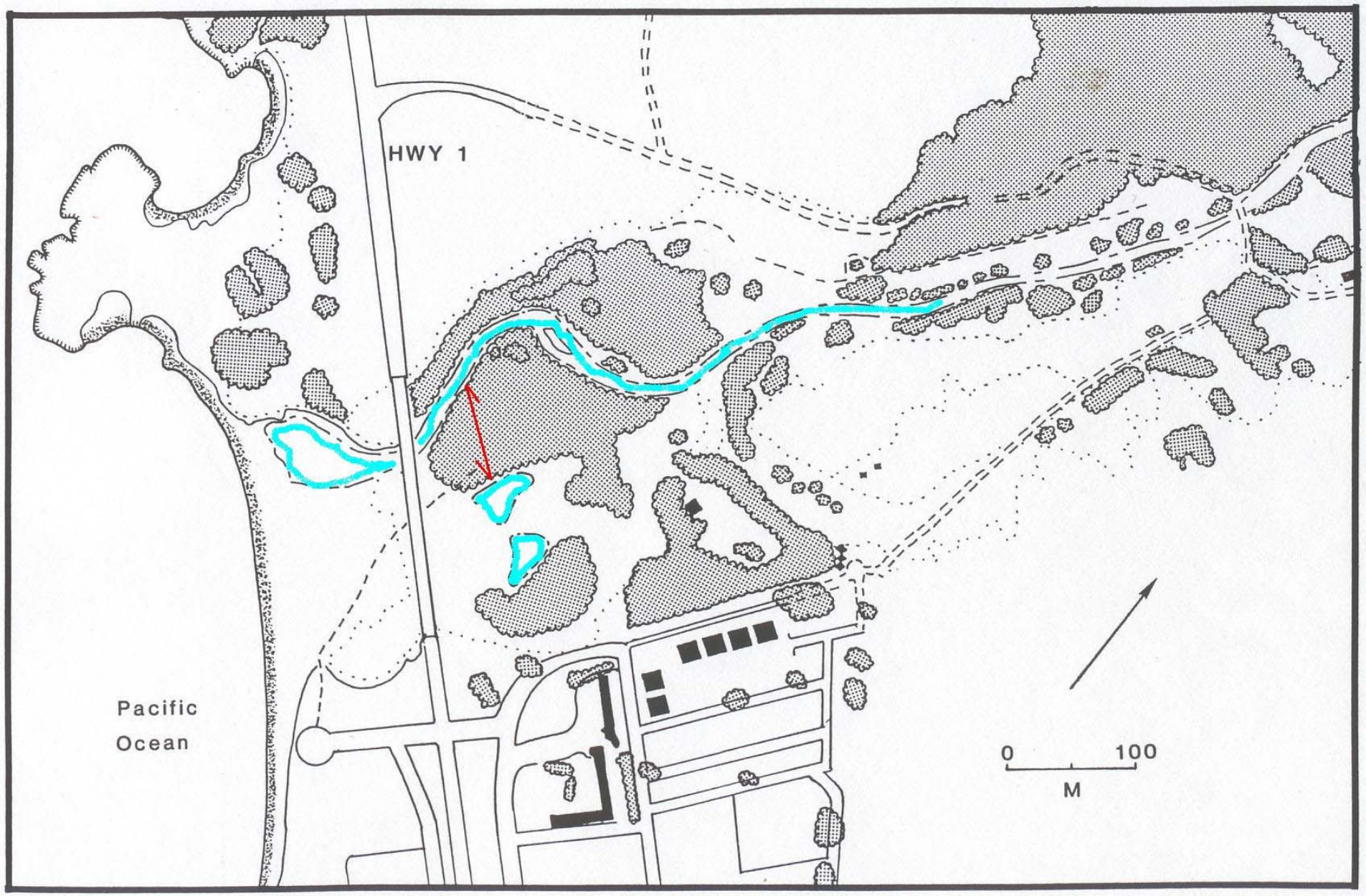
Length & seasonality of study

Habitat characteristics

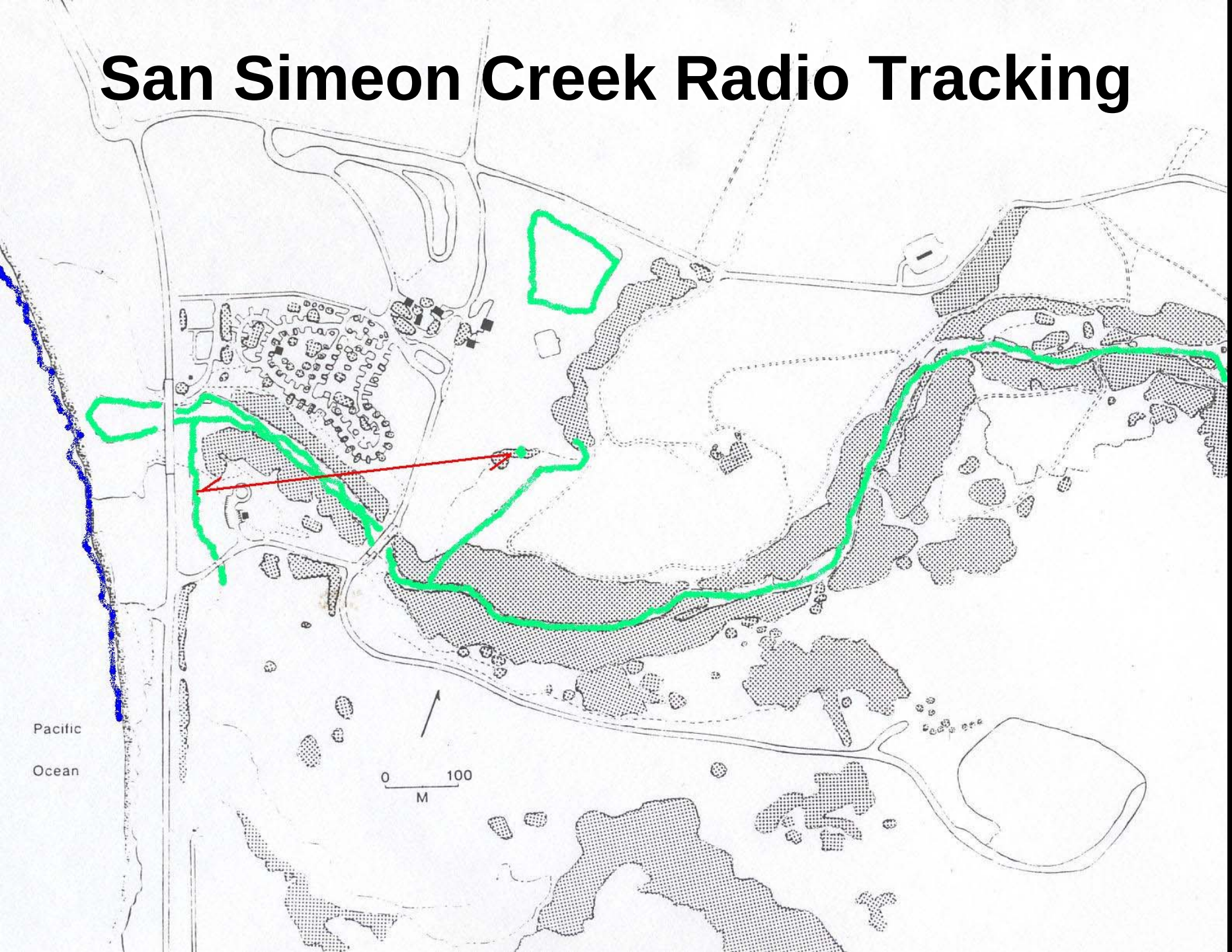
Movements

Breeding, Dispersal, and Avoiding Adversity

Pico Creek Radio Tracking



San Simeon Creek Radio Tracking

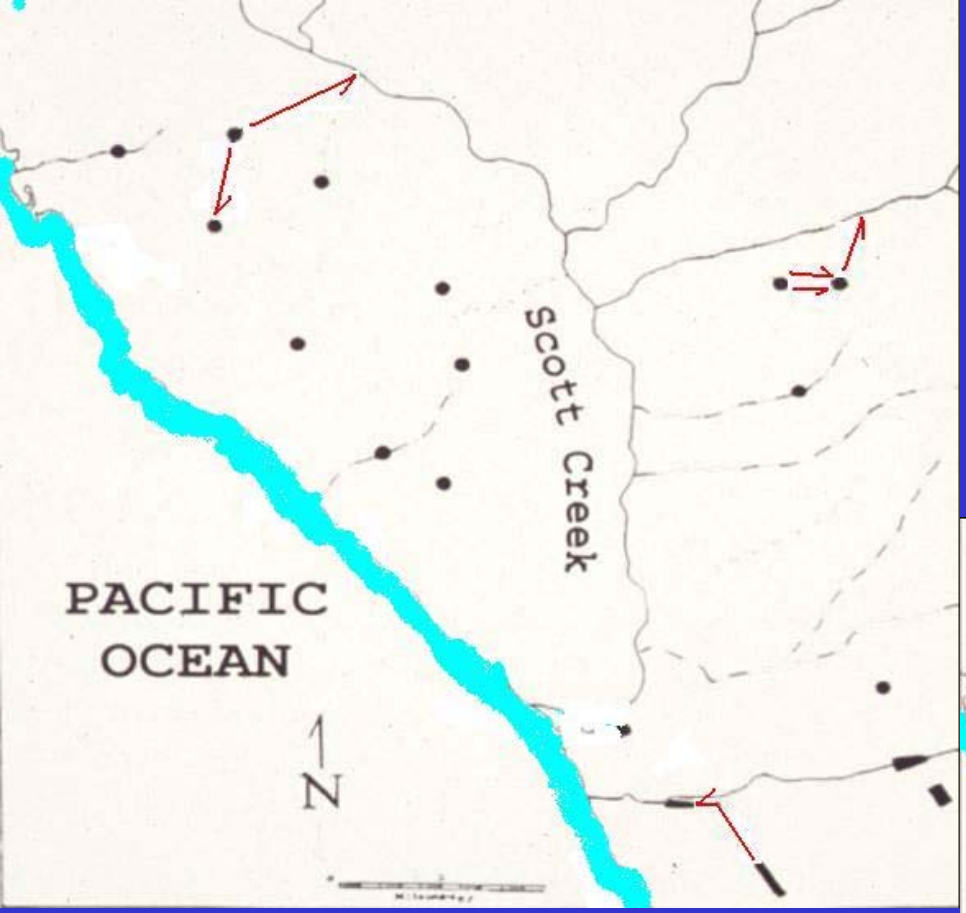


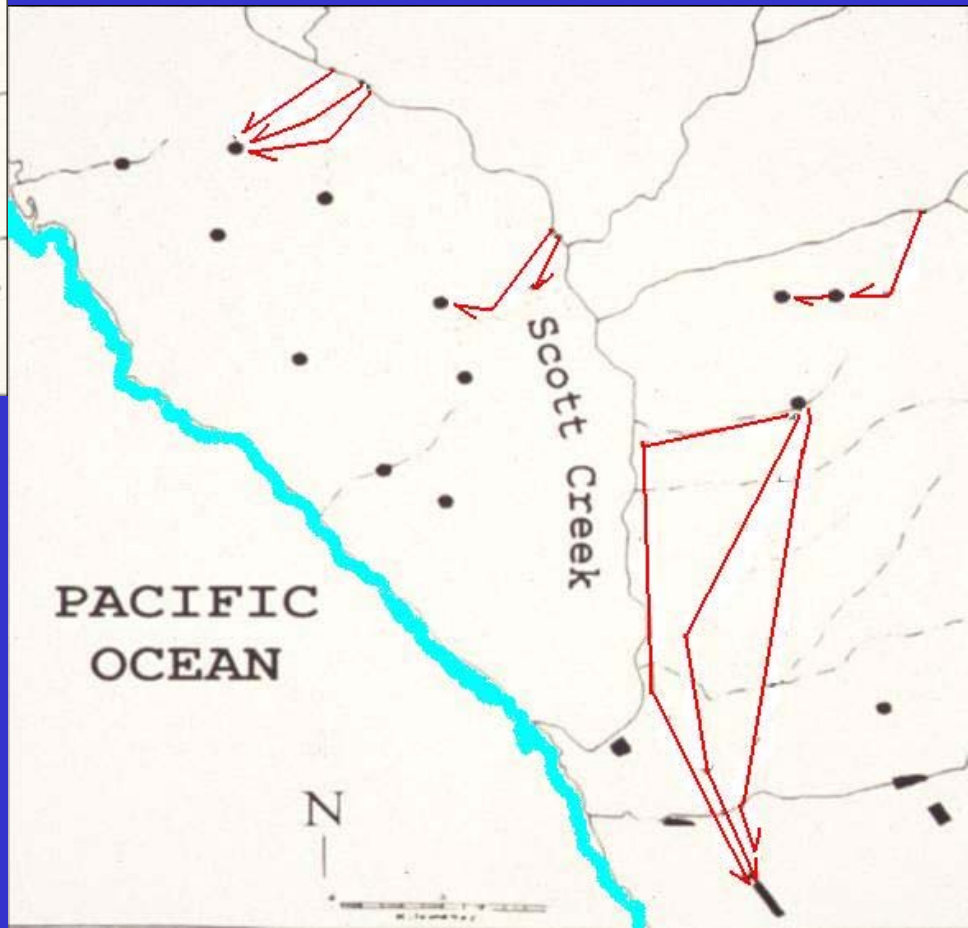
Dispersing Juvenile Frogs

???

Establishing a Pattern?

SCOTT CREEK RADIO TRACKING



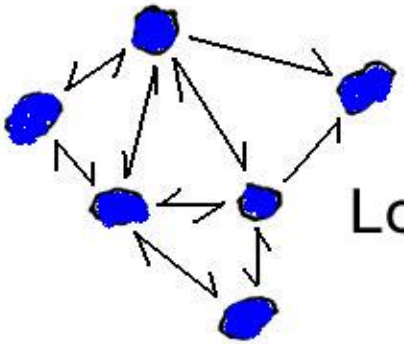


Scott Creek Valley

POPULATION BIOLOGY

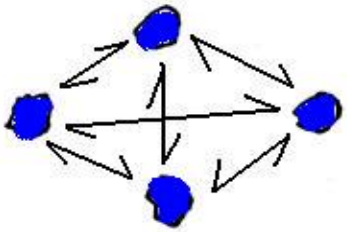
POPULATION TERMINOLOGY

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



Local Population

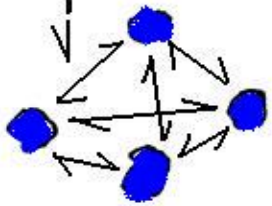
Many exchanges per year



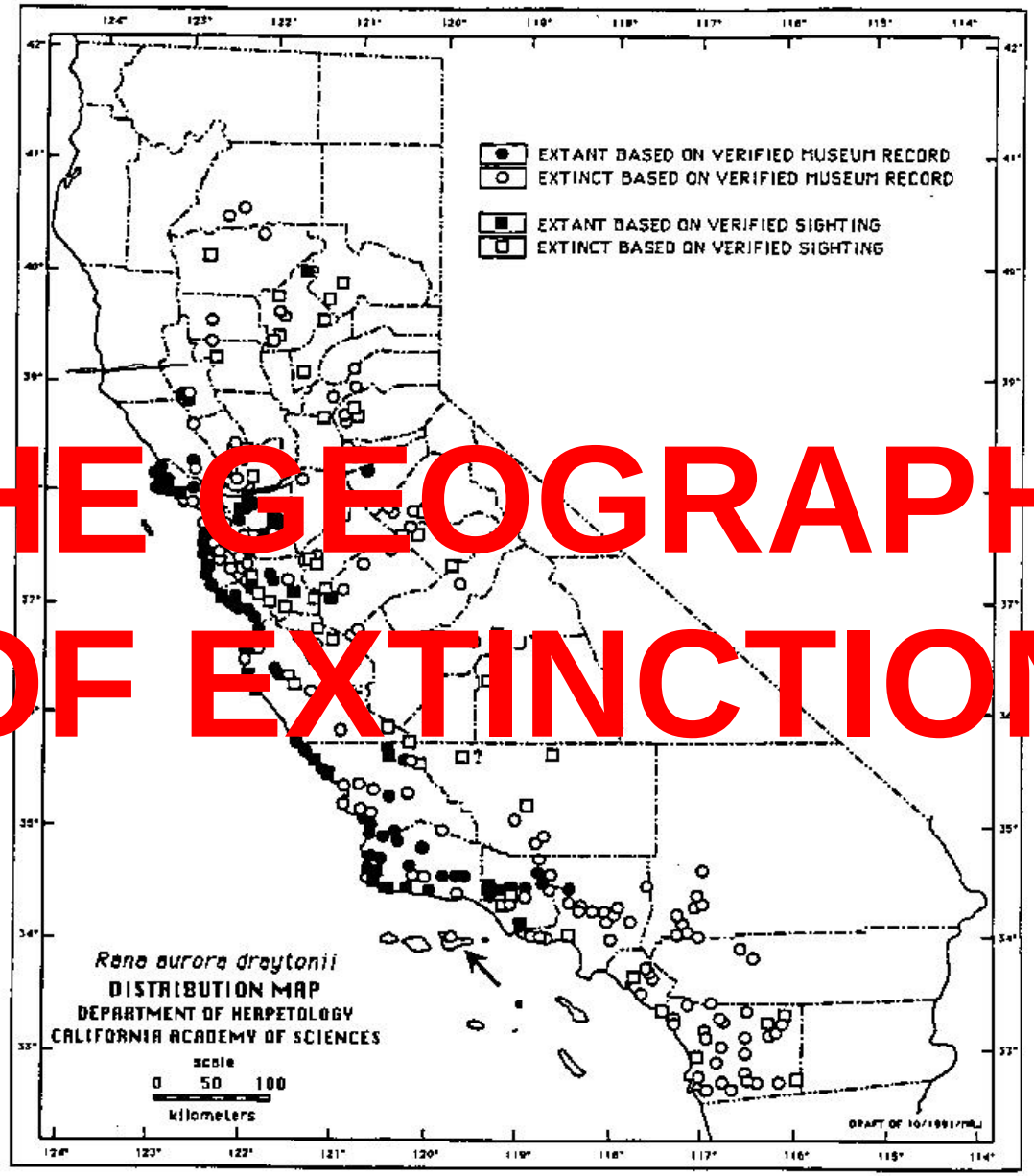
Isolated Population

Metapopulation

1-2 frogs/year



Local Population

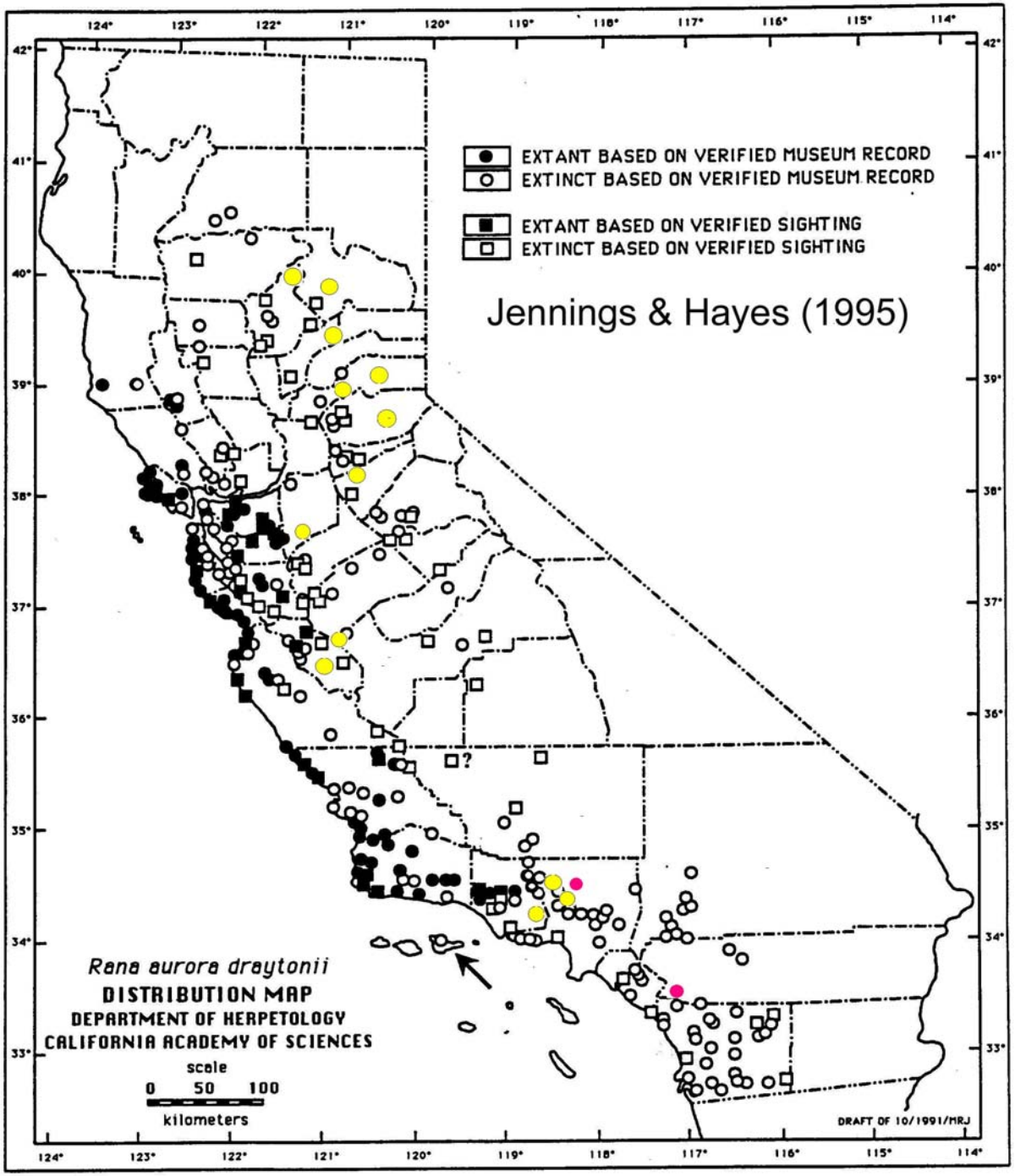


THE GEOGRAPHY OF EXTINCTION

Figure 17. Historic and current distribution of the California red-legged frog (*Rana aurora draytonii*) in California based on 762 locations from 1229 museum records and 291 records from other sources.

Extinction Sequence

- Metapopulation linkages are broken, creating isolated local populations
- Local populations lose mosaic of local habitats
- Local populations go extinct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EXTANT BASED ON VERIFIED SIGHTING
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Jennings & Hayes (1995)
Rana aurora draytonii
DISTRIBUTION MAP
DEPARTMENT OF HERPETOLOGY
CALIFORNIA ACADEMY OF SCIENCES
scale
0 50 100
kilometers
DRAFT OF 10/1991/MRJ

Isolated populations will not persist without management

THREATS

Threats

- Urban Influences
- Agricultural Influences
- Exotic Predators
- Natural Predators
- Disease


37.03333° N
37.01667° N
Springs
Molino
El Jarro Pt
Davenport Landing
BM 100
89 Winter Road Surveys
1994, 1995, 1997
39 Frogs, ~ 90% dead
R. Seymour & M. Westphal unpubl. data

Urban Impacts

Bridges & Culverts

Water Regimes & Barriers

Disappearing Water

Barrier Mortality

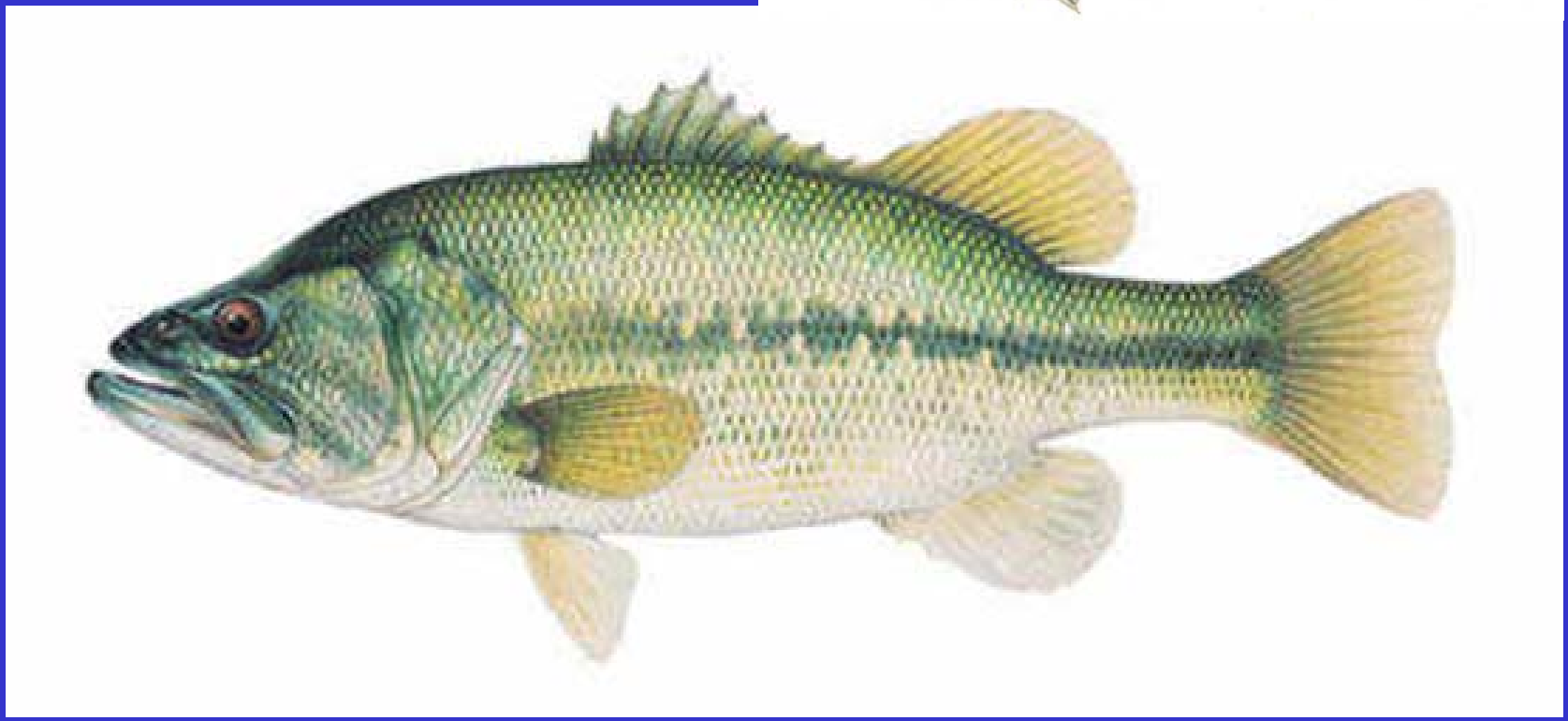
BARRIERS

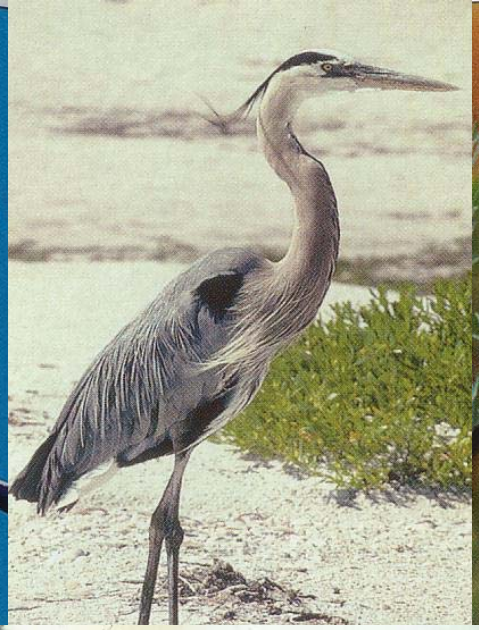
Agricultural Impacts

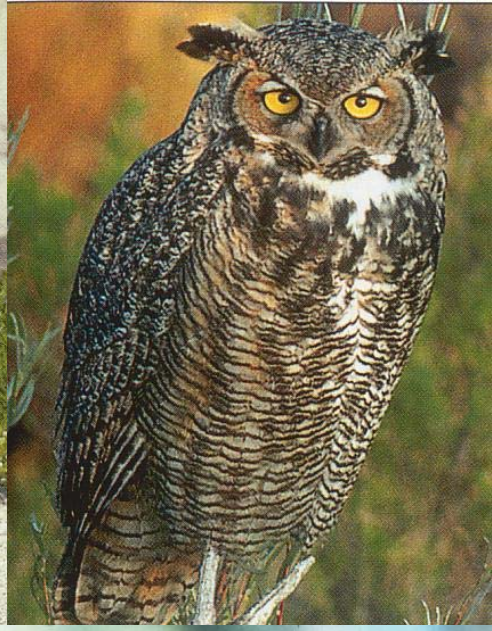
Cattle & Vegetation

Exotic Predators

Introduced Centrarchid Fishes – Bluegill & Largemouth bass







AGRICULTURAL CHEMICALS

www.epa.gov/espp/litstatus/effects/redleg-frog/

CHYTRID FUNGUS

RANAVIRUS

MANAGEMENT

U.S. Fish & Wildlife Service

Recovery Plan for the California Red-legged Frog

(Rana aurora draytonii)


FISH & BULLFROG
CONTROL

“Skinny legs!...I got skinny legs!”

“Skinny legs! . . . I got skinny legs!”

D’Amore et al. (2009)

38-42 ponds; Monterey County

Factor	Bullfrog	Red-Legged Frog
Higher temperature	0	+
Higher pH	0	+
Manmade pond	0	+
Pond not isolated	0	+
Close to agriculture	0	-
Percent cultivated	0	+

CONSTRUCTION AND MANAGEMENT OF HABITATS

STOCK POND MANAGEMENT

See handout for web site address

Managing Frog Ponds

Cattle Fence

Constructed Breeding Pond - Failed

Constructed Pond – Successful Breeding

Constructed Summer Habitat

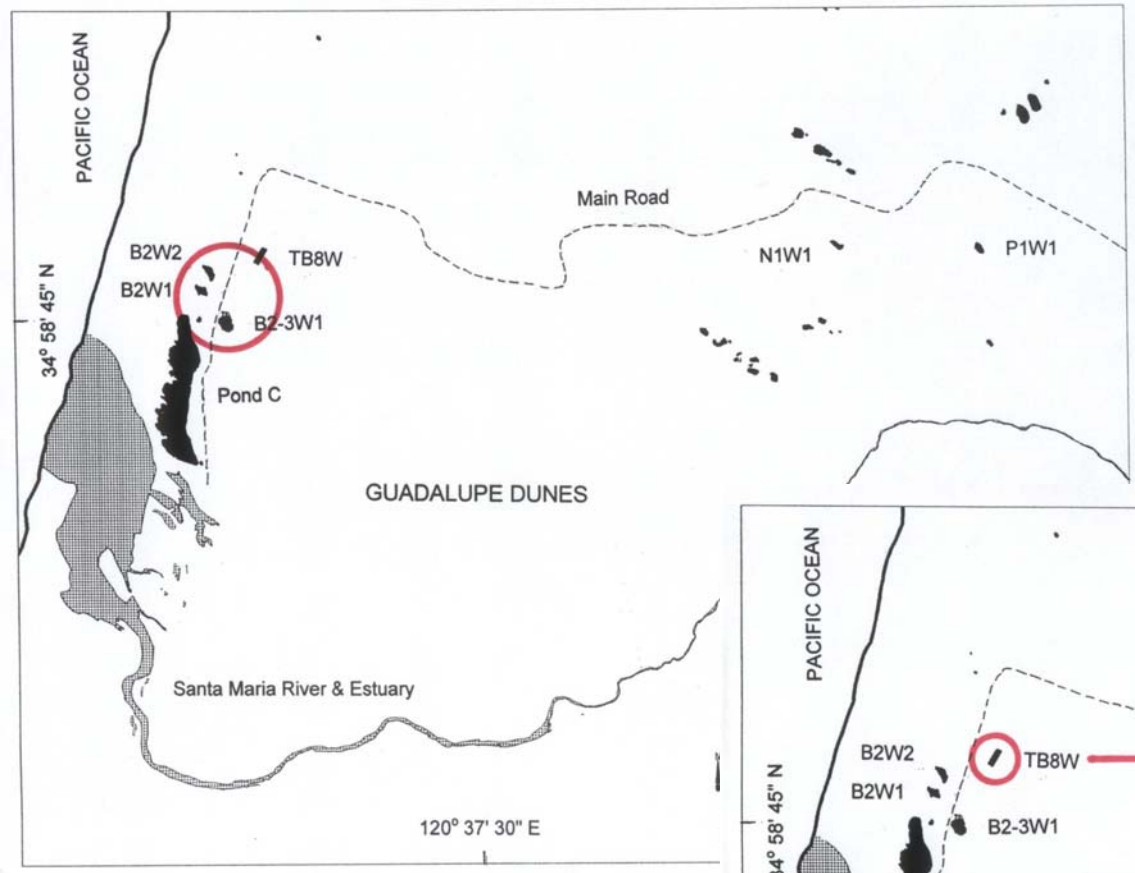
Golf Course Ponds

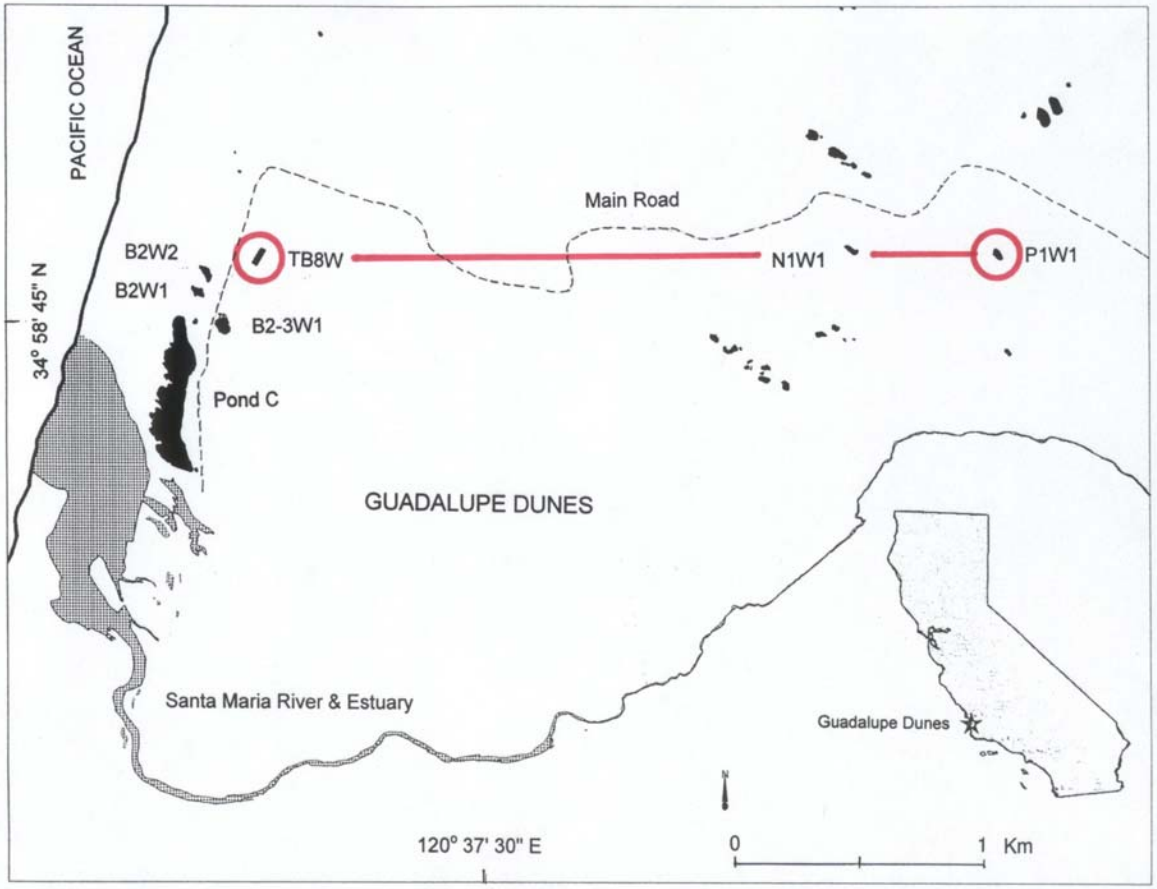
Buffer Zones

TRANSLOCATION

Guadalupe Oil Field

Homing


PACIFIC OCEAN
34° 58' 45" N
Main Road
B2W2
B2W1
TB8W
B2-3W1
N1W1
P1W1
Pond C
GUADALUPE DUNES
Santa Maria River & Estuary
120° 37' 30" E


PACIFIC OCEAN
34° 58' 45" N
Main Road
B2W2
B2W1
TB8W
B2-3W1
N1W1
P1W1
Pond C
GUADALUPE DUNES
Santa Maria River & Estuary
Guadalupe Dunes
120° 37' 30" E
0
1 Km

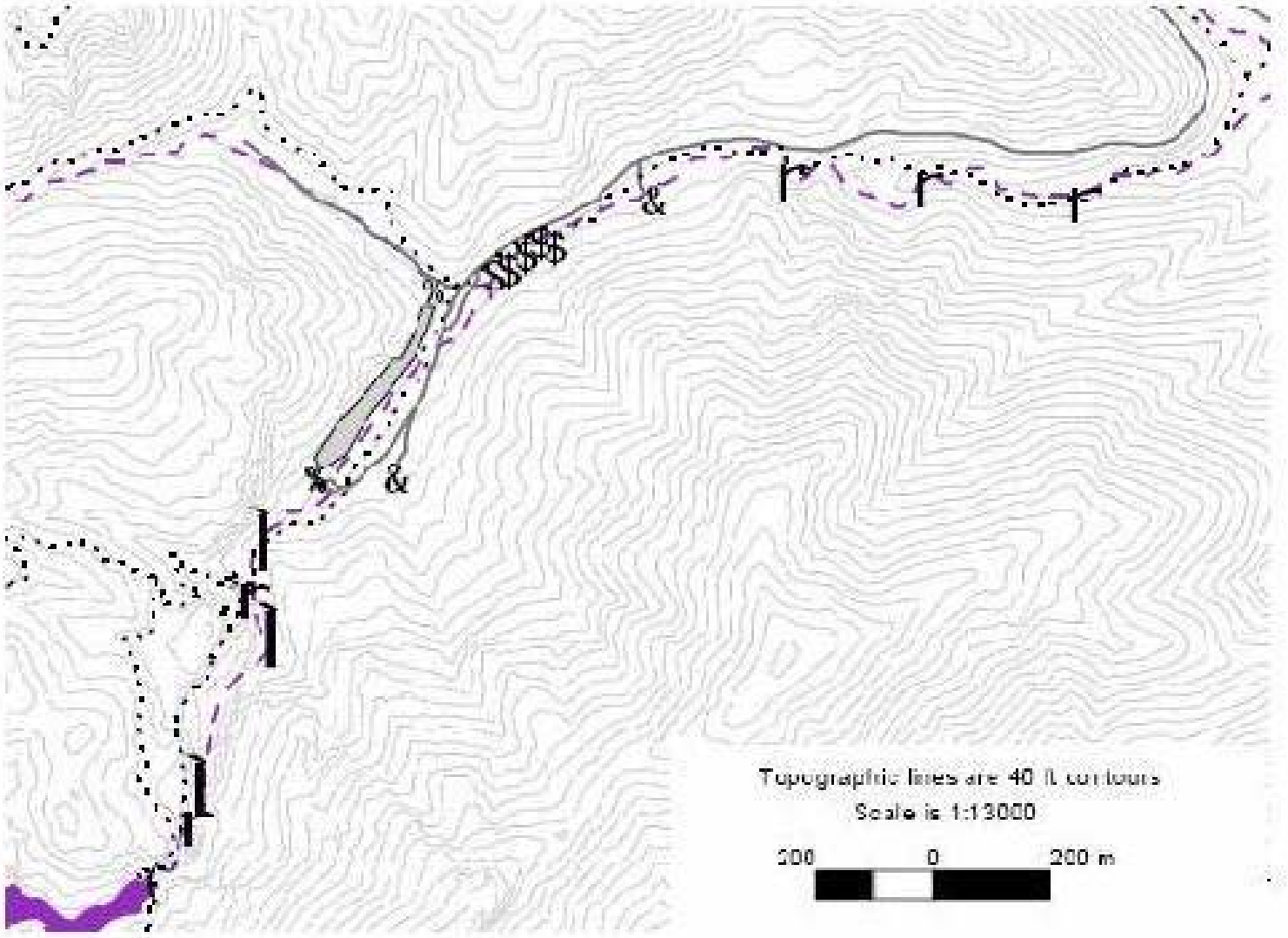
No Home


RE-ESTABLISHING
A POPULATION
Pinnacles National Monument

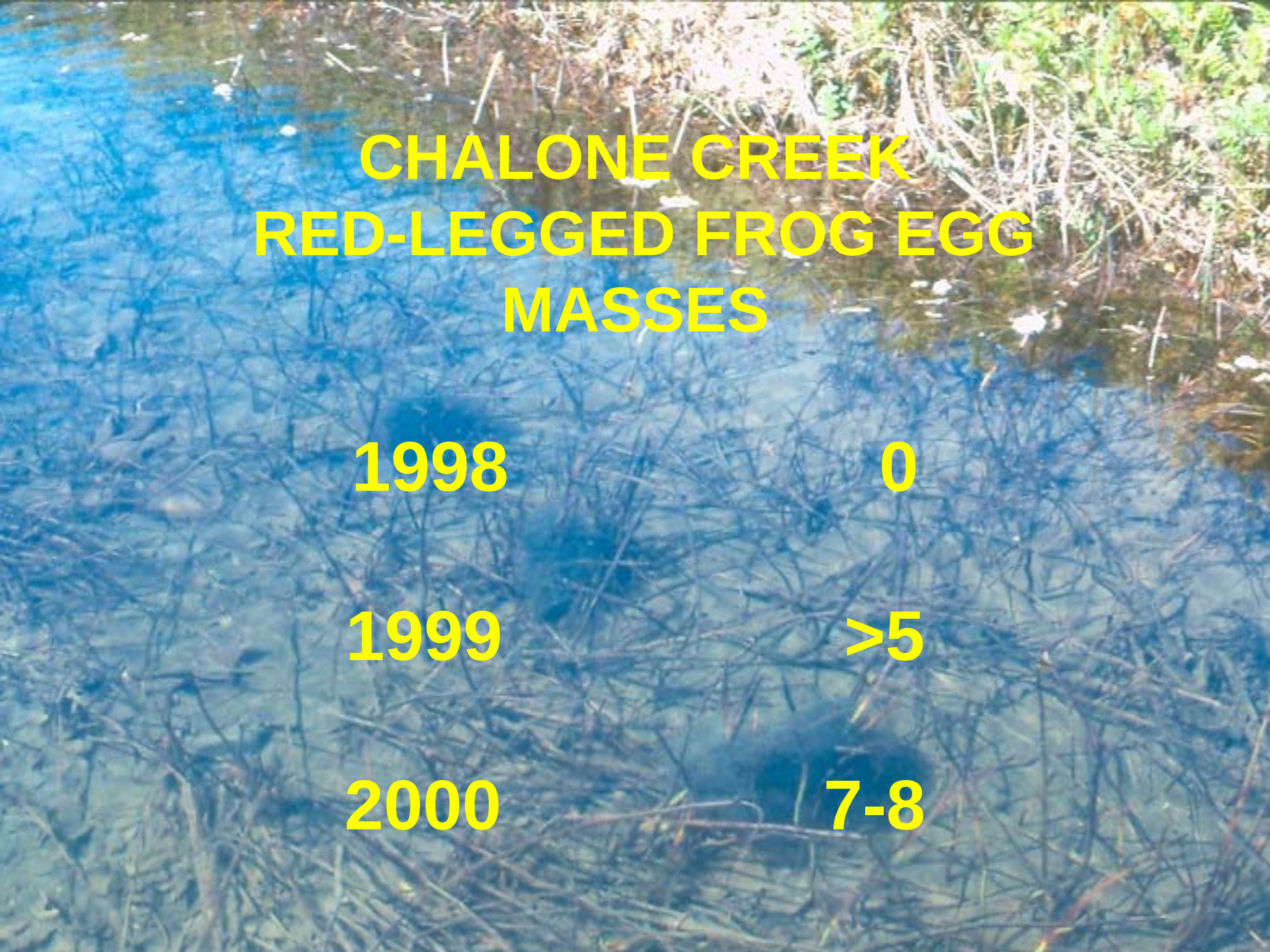

Bear Gulch Reservoir

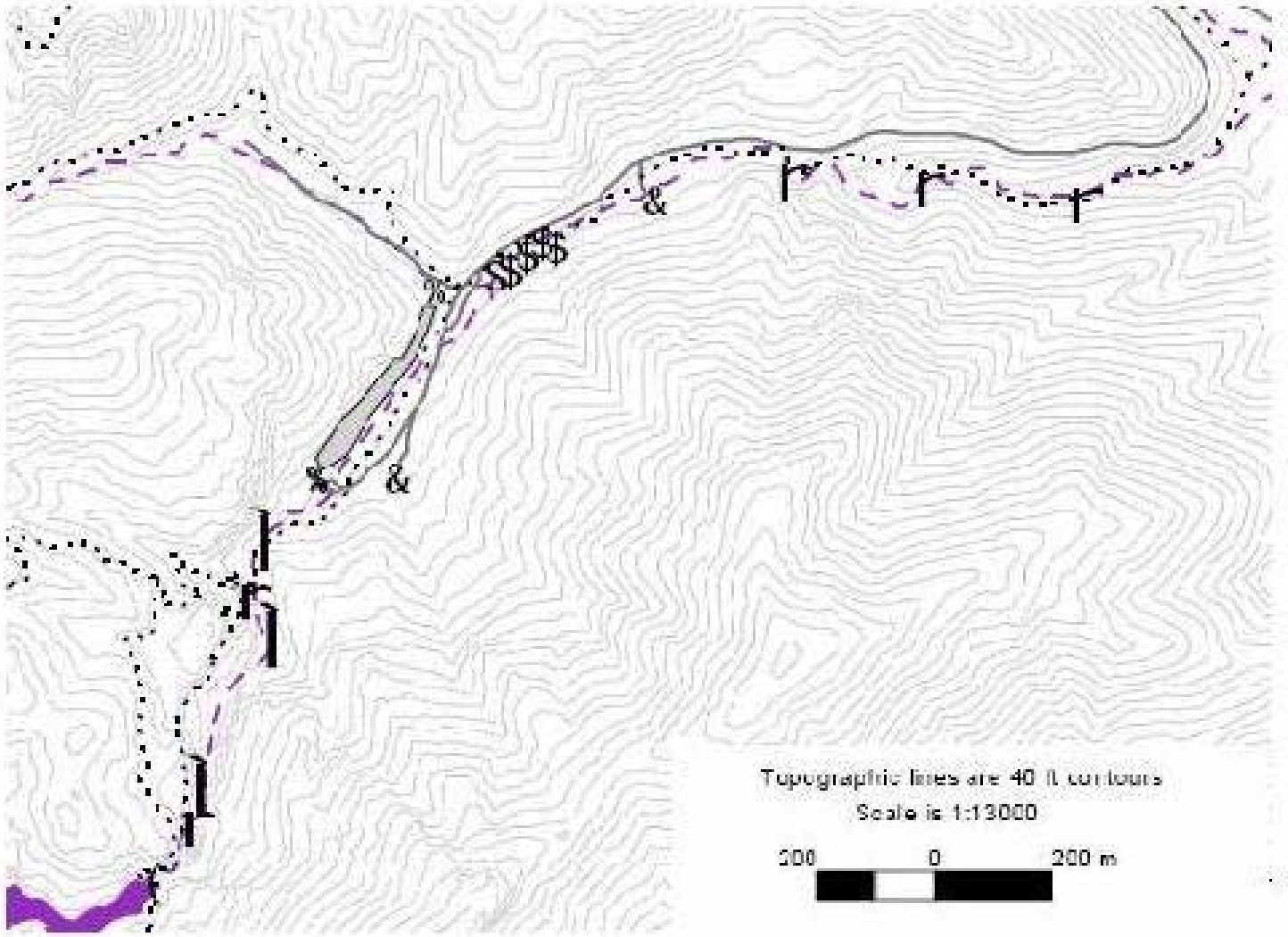
BEAR GULCH RESERVOIR HISTORY

1934	Reservoir completed
1960s-70s	Red-legged frogs present
~1980	Catfish introduced
1985	Drained, catfish removed
198?-2000	Frogs absent
2001	Re-establishment started


Topographic lines are 40 ft contours
Scale is 1:13000
200
0
200 m


CHALONE CREEK
Wet Season


CHALONE CREEK
RED-LEGGED FROG EGG MASSES
1998 0
1999 >5
2000 7-8


Topographic lines are 40 ft contours
Scale is 1:13000
200
0
200 m

RE-ESTABLISHMENT PROGRAM

- COLLECT 20% OF EGG MASSES FROM CHALONE CREEK
- HOLD TADPOLES IN HEADSTART BOXES IN RESERVOIR
- RELEASE TADPOLES INTO RESERVOIR

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++

RESULTS (1)

YEAR	TADPOLES RELEASED	METAMORPHS	ADULTS AND JUVENILES
2001	116++	17	0
2002	914	154	12
2003	841	427**	29

RESULTS (2)

YEAR	METAMORPHS	ADULTS AND JUVENILES
2001	17	0
2002	154	12
2003	427	29
2004	485	20
2005	317	12
2006	329	22
2007	68+	15+
2008	206	14

BIBLIOGRAPHY

IMPORTANT POINTS

- Water regimes -- Mediterranean climate
- Population dynamics
- Agriculture -- cattle and ponds
- Manage larval survival
- Manage populations, not individuals
- Clear management objectives

U.S. FISH AND WILDLIFE SERVICE

Site Assessment & Survey Protocol

Recovery Plan

Critical Habitat

TECHNIQUES

BIBLIOGRAPHY

SURVEY EQUIPMENT

MOST SURVEYS

Chest Waders

Headlamps

Dip Nets

Data Recorder

SPECIAL CIRCUMSTANCES

Float tubes

Spotlights

Binoculars

Tadpole Traps

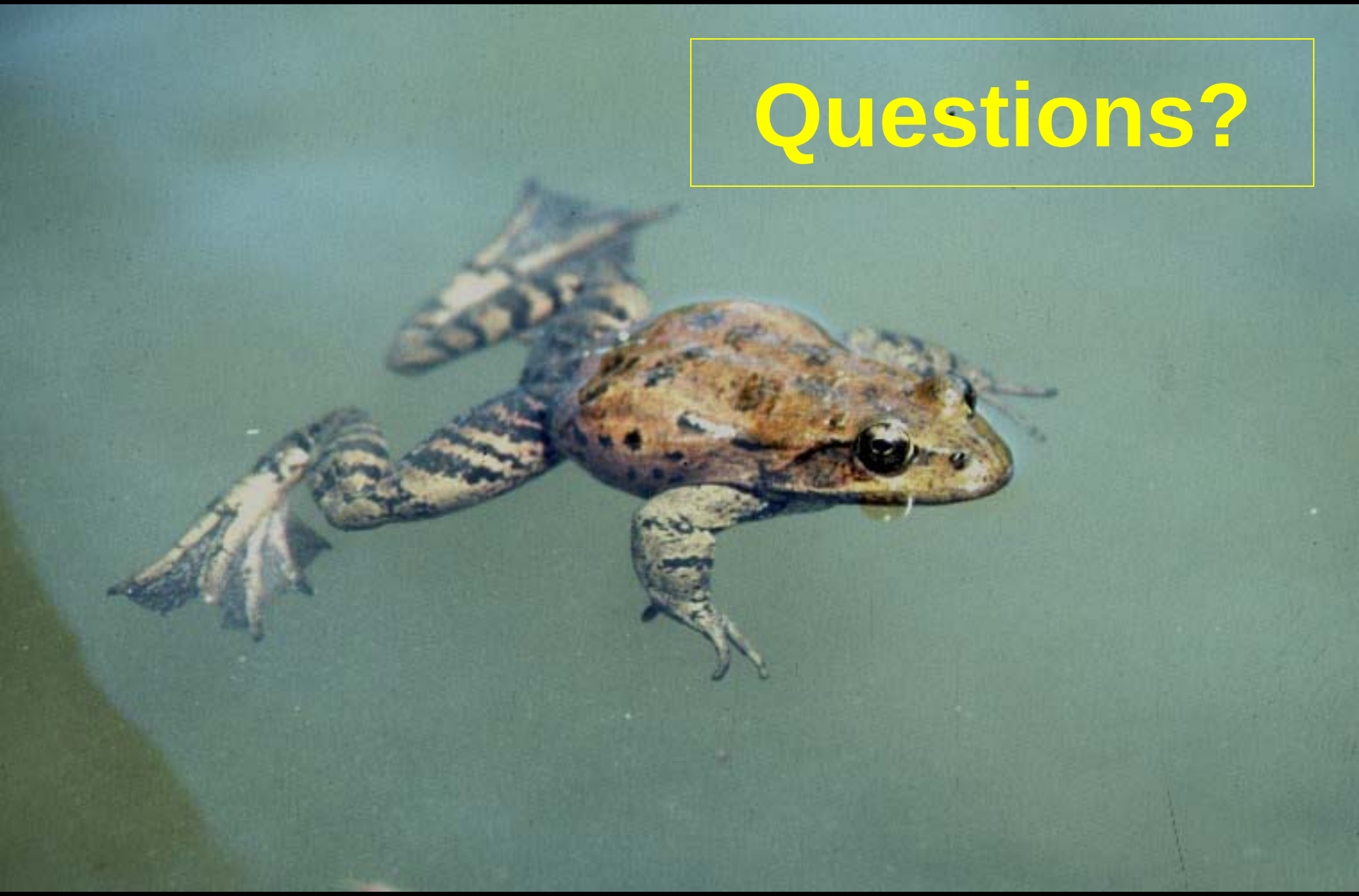
“See, Frank? Keep the light in their eyes and you can bag them without any trouble at all”

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

LIGHT SOURCES FOR EYE-SHINE SURVEYS

EQUIPMENT

SUPPLIERS


Questions?