PACIFIC (WESTERN) POND TURTLE WORKSHOP

David J. Germano & Galen B. Rathbun

ACKNOWLEDGMENTS

R. Bruce Bury (USGS)
California Department of Transportation
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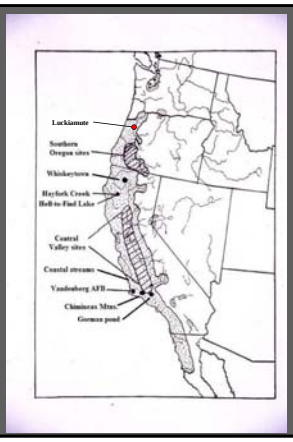
U. S. Fish and Wildlife Service
U. S. Geological Survey

Study Areas

Germano
Rathbun
Bury
with others



IMPORTANT POINTS

- Size does not equal age
- Growth rates & reproduction vary by region
- Water regimes – Mediterranean climate
- Agriculture – cattle and ponds
- Define objectives clearly
- Manage for nest and female survival
- Manage populations, not individuals
- Publish results

Outdoor California, May/June 1998

Bob Garrison

"Over 90 percent of the freshwater ponds, marshes and year-round streams where the turtles once lived have been drained, diverted or developed. Where the turtles can still be found, many populations no longer produce offspring, the result of disturbed nesting grounds and the predation of young turtles by non-native bullfrogs and black bass. With a life span of over 40 years, the presence of turtles may be a false indication that populations are healthy. As a result, western pond turtles have been classified as a species of special concern and require careful monitoring."

You Can't Follow The Game Without A Score Card!

Clemmys marmorata

is now

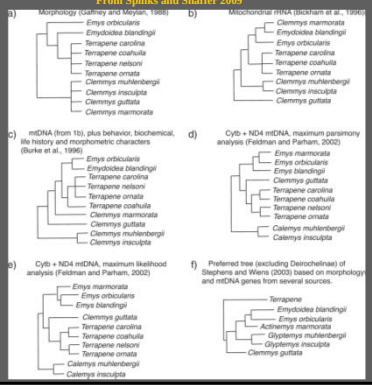
Actinemys marmorata

or

Emys marmorata

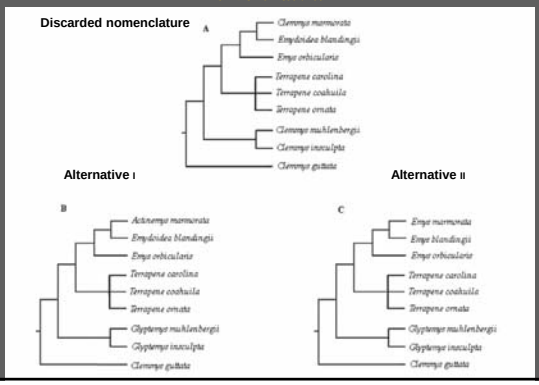
TAXONOMY

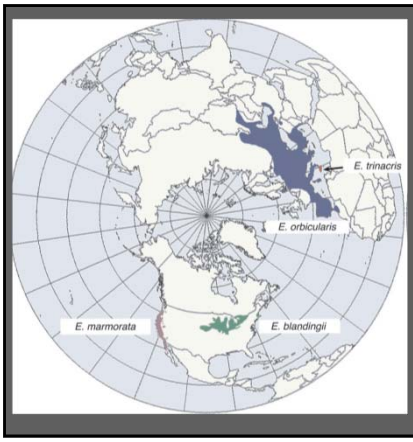
From Spinks and Shaffer 2009



TAXONOMY

From Bickham et al. 2007





From
Spinks and Shaffer 2009

TAXONOMY

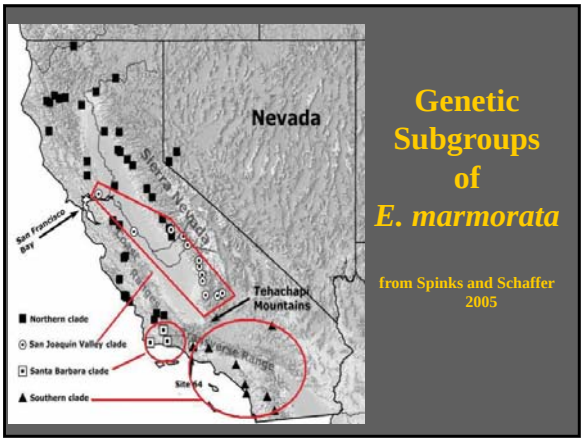
From Fritz et al. 2011

DISTRIBUTION

- Sea Level to about 5500 feet
- Baja California to Washington
- Sierra Nevada / Cascade Mtn. to Coast
- In Southern California, Peninsula / Transverse Ranges to Coast
- Small Populations along Mojave River
- Truckee River Population may be Introduced

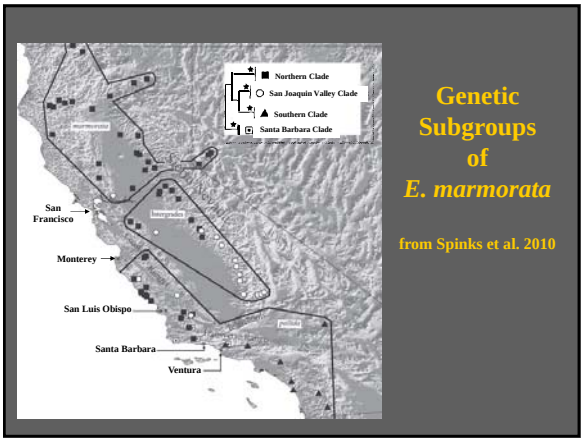
Range-wide Distribution

(from Bury and Germano 2008)



Genetic Subgroups of *E. marmorata*

from Spinks and Schaffer 2005

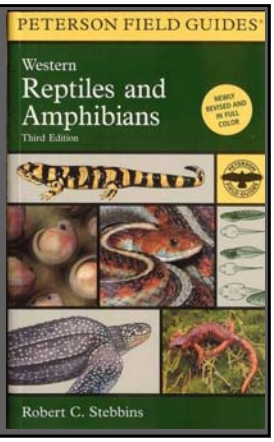


Genetic Subgroups of *E. marmorata*

from Spinks et al. 2010

Identification

Only native freshwater turtle in California, and only western painted turtle in northern Oregon / Washington



Variation

Male – Vandenberg AFB, CA

Female – Yoncalla, OR

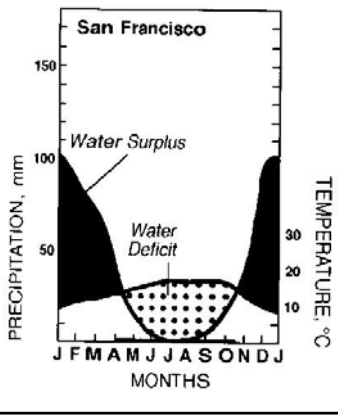
Female – Fresno, CA

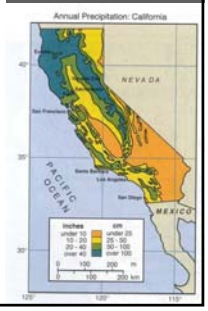
Male – Goose Lake, Kern County, CA

SEXUAL DIMORPHISM

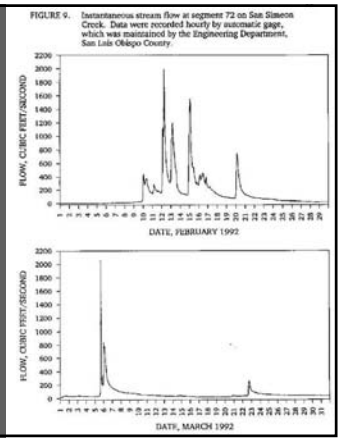
MEDITERRANEAN CLIMATE

Rainfall & Temperature





Stream Flow Extremes



Low & High Flows

San Simeon Creek

Annual Creeks

Natural Ponds Are Rare

Dune (Slack) Pond

Rarity of Ponds in
Pre-European California

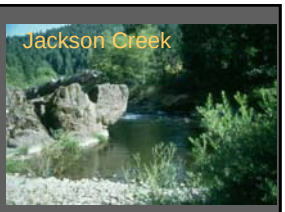
Impacts of Creek Versus
Pond Living
on Life History

HABITATS

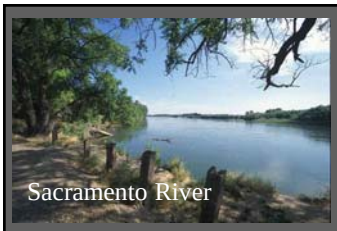
Coastal Lagoons

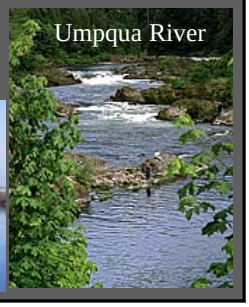
Lagoon – salt water intrusion

Perennial Creeks

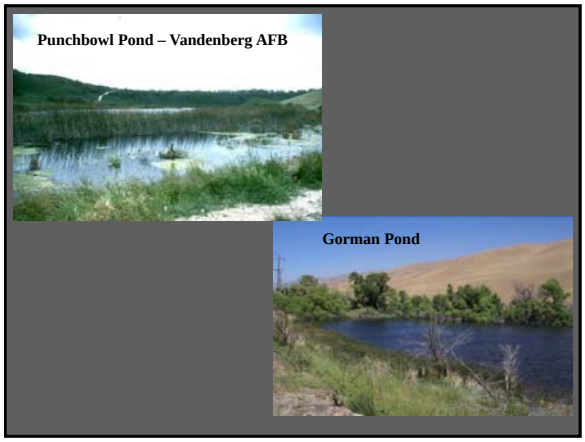


Perennial Rivers





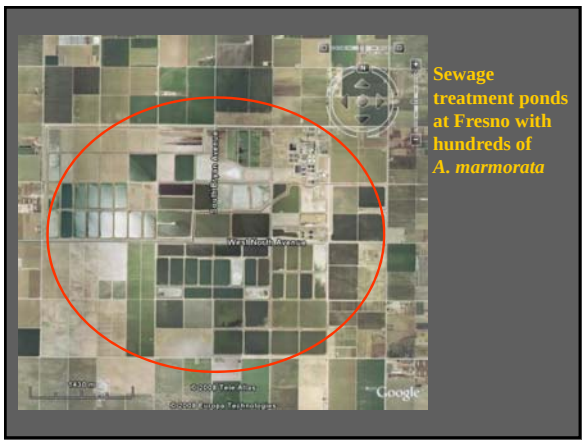

Goose Lake (Kern Co.)
Central Valley "Natural" Wetlands
Sacramento Valley Marsh


Punchbowl Pond – Vandenberg AFB
Gorman Pond


Roadside ditch – Klamath Basin
Whiskeytown Reservoir


Man-made Ponds Are Common
Agricultural and Urban Development


Sierra Ponds (man-made)


Sewage treatment ponds at Fresno with hundreds of *A. marmorata*

Percolation Pond

Cows Are Important

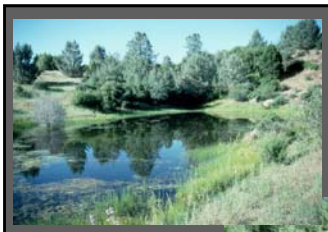
Cattle Bring Stock Ponds (reliable water)

Cattle Create Open Water (= warm water)

Cattle Fertilize Ponds (dung)

Diet

- Feed in water only; neustophagia (modified gap-and-suck feeding)
- Omnivorous – dietary generalist
- Larvae of dragonflies, stoneflies, mayflies, caddisflies, midges, beetles, other insects
- Crayfish, other aquatic invertebrates
- Fish and anurans minor (< 10%) – probably as carrion
- Some filamentous green algae, tule and cattail roots, water lily pods, alder catkins (perhaps when eating animals)



Sierra Ponds
(man-made)

Although humans have destroyed and altered much natural habitat, they have also created habitat

Net Gain or Loss?

Habitats Summary

- Most areas with water – habitat generalist
- Annual & perennial aquatic habitats
- Natural rivers, creeks, streams, lakes, marshes, ponds, and mud holes
- Man-made stock ponds, sewage storage and percolation ponds, canals, and reservoirs
- Pond structure, including depth, basking sites, vegetation and upland habitats important
- Creek structure, including pools, flow, depth, temperature, vegetation, and upland habitats important
- Nutrients to support rich food base (mostly small invertebrates, carrion, and algae)

CAPTURE METHODS

The Need To Identify

Individuals Through

Time

Trapping and Hand Capture

Trapping Protocols

Calm Water in Streams

Air Pocket (trap on bottom)

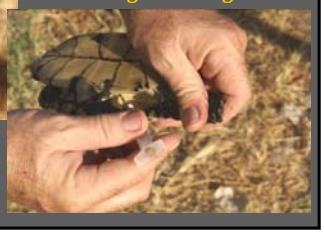
Air Pocket

(float in trap)

Marking for Subsequent Individual Identification

Filing marginal scutes

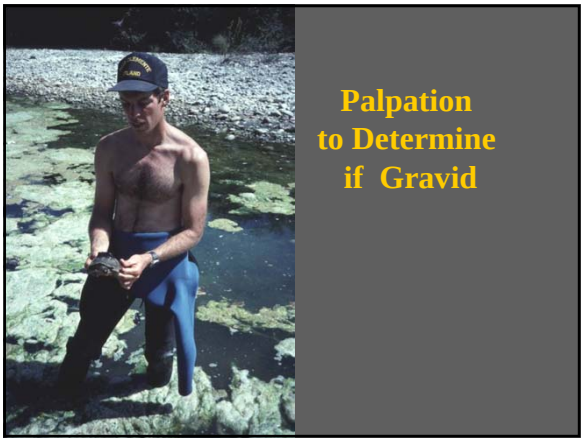
Inserting a PIT tag



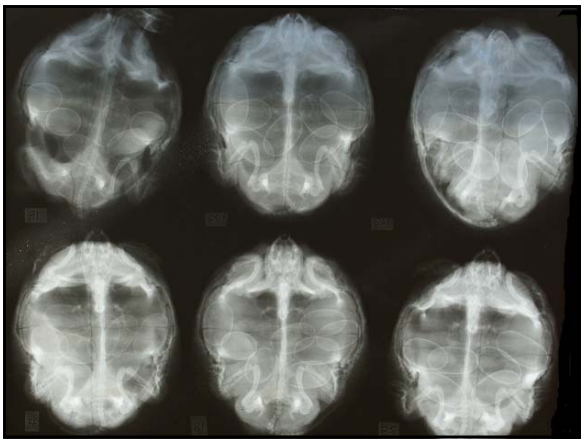
Laboratory Break

- Identification
- Sex determination
- Marking
- Age determination
- Traps

REPRODUCTION



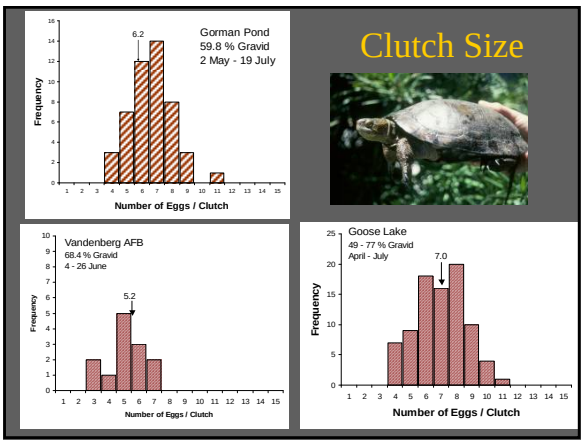
X-Radiographs to Count Eggs

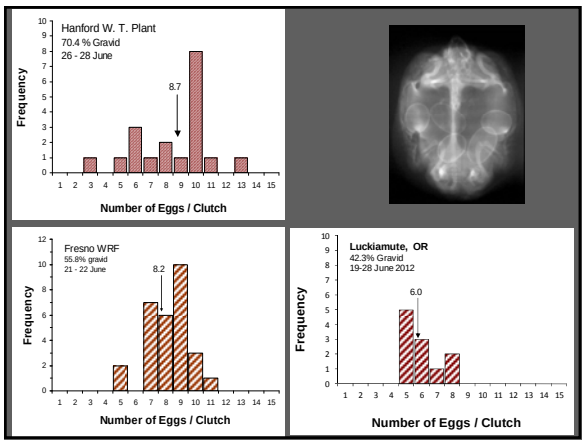


Regional Comparison of Reproduction

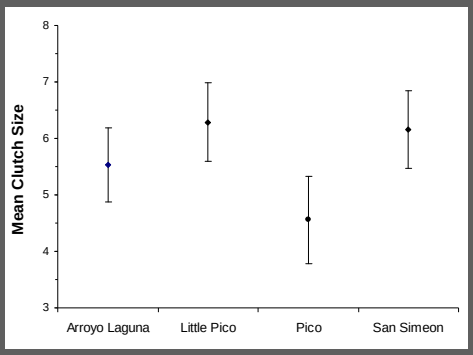
- Greater clutch size in north, smaller to south

- Oregon/Washington: means of 6.0 – 10.0 eggs/clutch
- Central Valley: 7.0 – 8.5 eggs/clutch
- Coastal California: 4.9 – 5.7 eggs/clutch
- Southern California: 4.5 – 6.5 eggs/clutch

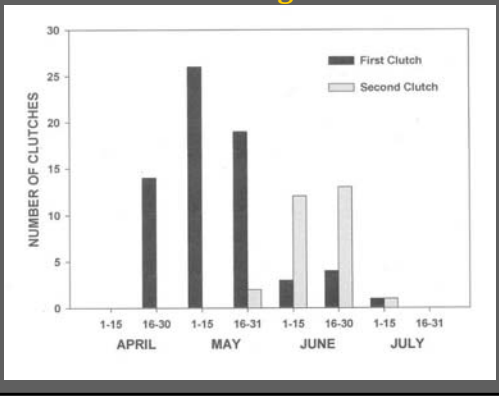




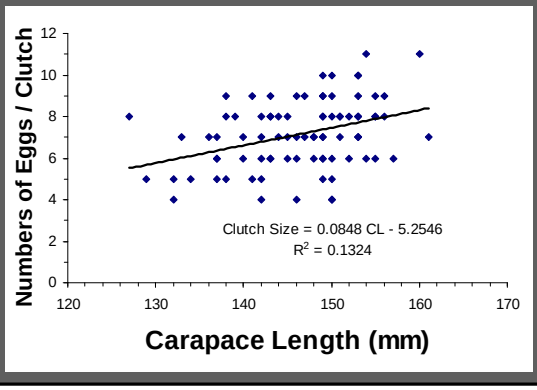
Local Variation in Clutch Size



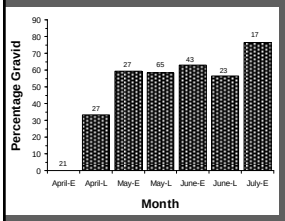
Double Clutching Per Year

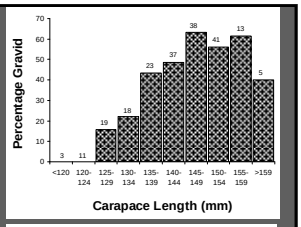


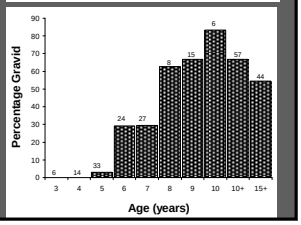
Goose Lake



Example of Month, Size, and Age of Reproduction

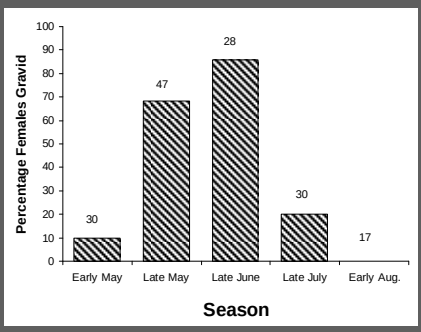






Goose Lake
(400' elevation)

High Elevation Delays Start of Reproduction



Gorman pond
(3700' elevation)

Temperature Dependent Sex Determination

TABLE 1. Sex ratios (%male) as a function of incubation temperature in hitherto unreported species of turtles (Ewert 1994).

	Constant incubation temperature (°C)						
Species	22.5	25	27	28	**30**	**31**	32
Kinsternon hirtipes	100 (6)	100 (7)	100 (6)		17 (9)		
Clemmys marmorata		**100 (9)**	**100 (8)**		**42 (6)**	**0 (6)**	
Graptemys versa		100 (5)			86 (7)		0 (8)

Reproduction Summary

- Sexual maturity at 5–6 years (Central Valley), probably older in north
- Reproductive in late April-July in low elevation/southern areas, late May-June in high elevations/northern part of range
- Double or even triple clutching for some females
- Clutches can be produced every 2–3 weeks
- Nest in sunny areas within 5–100 m (sometimes up to 2 km) of water
- Incubation times 75–100 days
- Young hatch in late Fall or overwinter and hatch in early spring of following year

POPULATION BIOLOGY

Size Classes

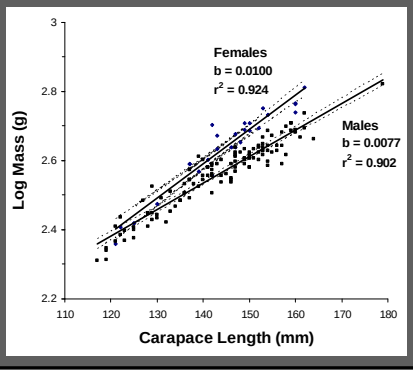
(These are not age classes!)

Adult - ≥ 120 mm Carapace Length

Juvenile - < 120 mm CL

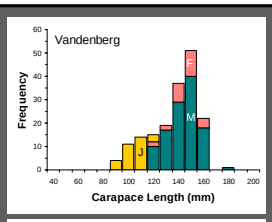
Hatchling – just hatched (25–35 mm CL)

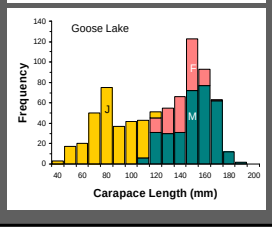
Weight – Length: Vandenberg



Scute Annuli Used to Estimate Age of Juveniles

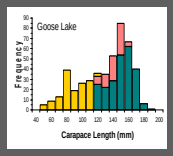
Size Structure

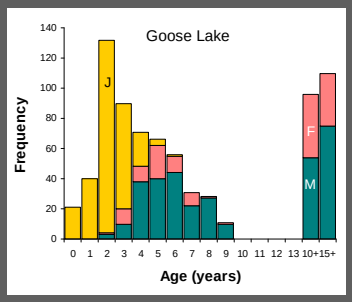




Age Structure

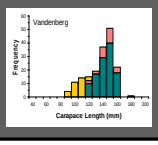
Goose Lake

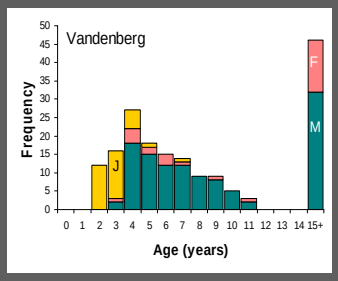




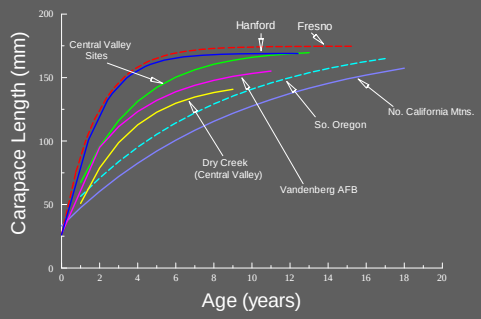
Age Structure

Vandenberg AFB



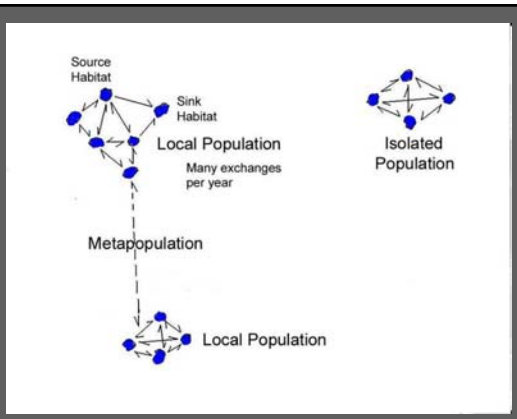


Growth Comparison



POPULATION MODEL

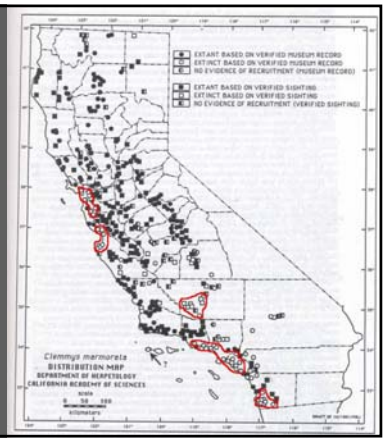
- METAPOPULATION--Two or more local populations rarely linked by migrating individuals
- ISOLATED POPULATION--A local population not exchanging individuals with any other local population
- LOCAL POPULATION--Turtles in habitats linked by the regular exchange of individuals



Extinction Sequence

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

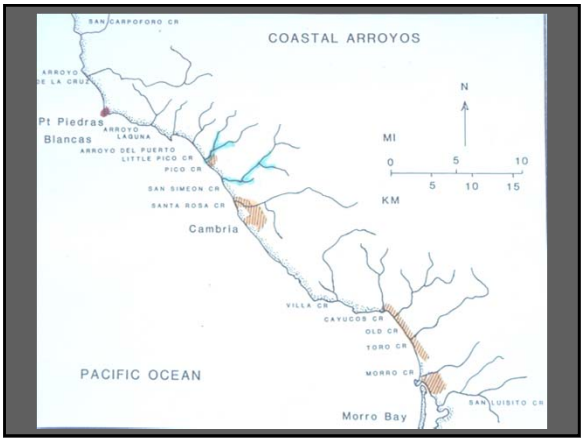
Local Extinctions



Isolated populations will not persist without management

MOVEMENTS

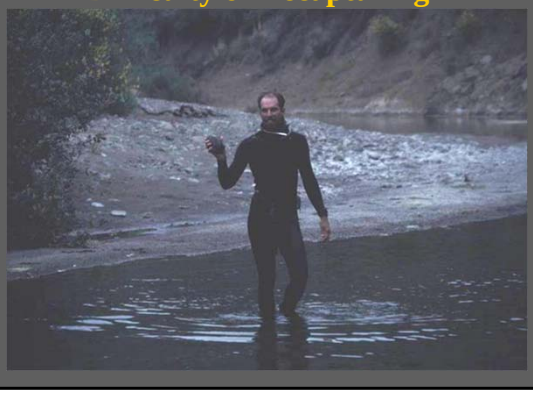
Basking, Nesting, and Refuging



Radio Transmitter Attachment

One of Several Possible Configurations

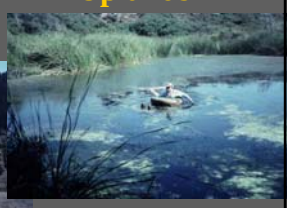
Difficulty of Recapturing



The Stealth Move…

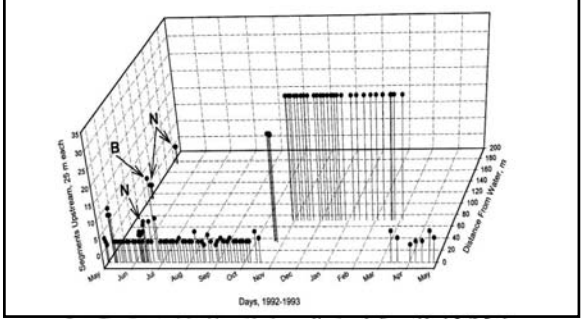
Why Did Solar Transmitters Fail?

Radiotracking – Creeks Ponds Uplands



Female Use of Uplands in Time & Space

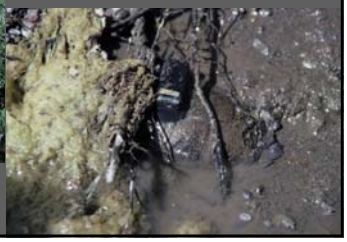
Basking, Nesting, and Avoiding Adversity



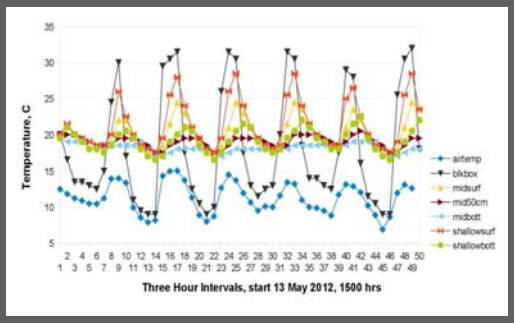
Typical Solar Basking Site

Typical Basking Site in Central Valley

Basking in Floating Algae in Creek



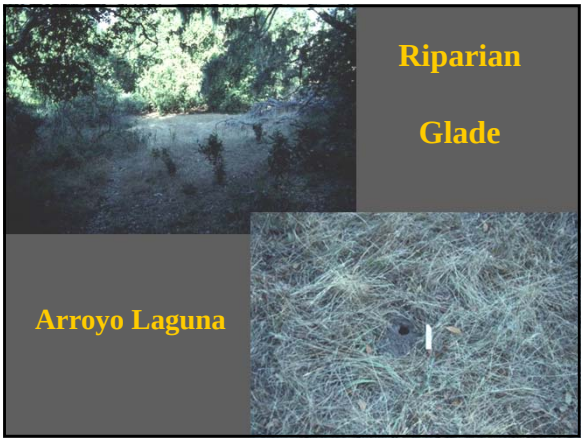
Basking: Water Temperatures Matter



Terrestrial Basking

Movements to Uplands for Nesting

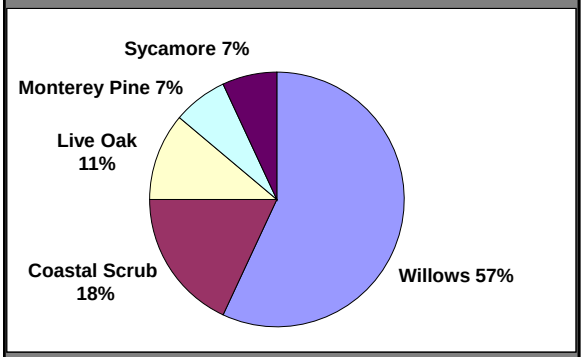
- Open Sun
- Low Vegetation
- South Facing Slope

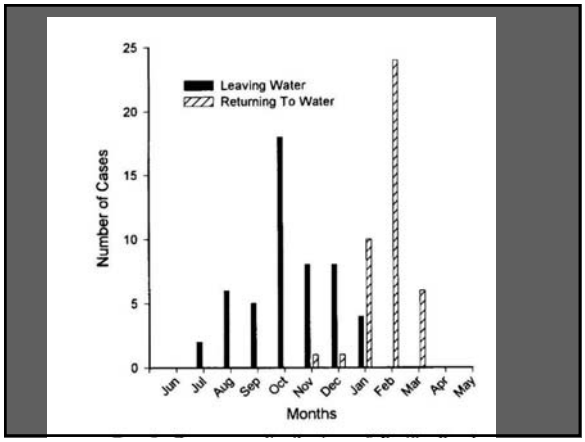


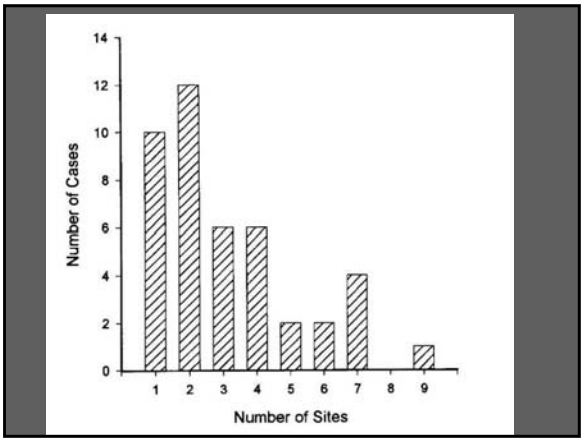
Movements to Uplands to Escape Adversity (Refuging)

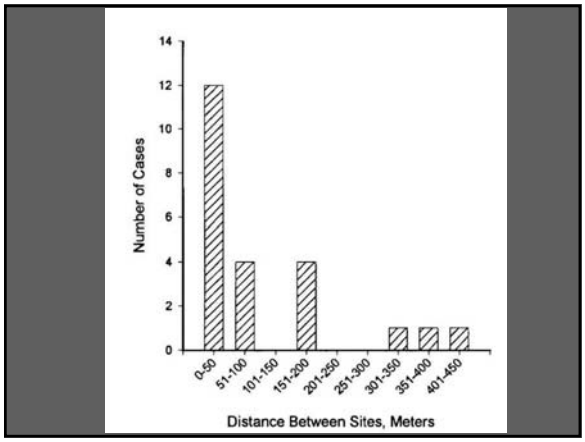
- Avoiding too much or too little water
- Not near water
- North-facing slope
- Well vegetated

Habitat at Refuge Sites









Upland Use Summary Statistics

Upland Use	No. Individuals	No. Sites	Mean (+/- S.D.) Distance to Water, m	Range Distance to Water, m	Range or Mean (+/- S.D.) at Site, days	Maximum Elevation from Creek, m
Basking	9	28	4.5 (3.0)	0.5-12.0	1-5	4.5
Refuging	28	43	49.7 (54.8)	8.0-280.0	111.0 (44.3)	38.0
Nesting	8	12	28.3 (18.9)	9.5-80.0	1-3	17.5

Movement Corridors

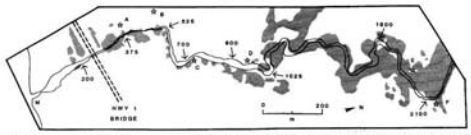
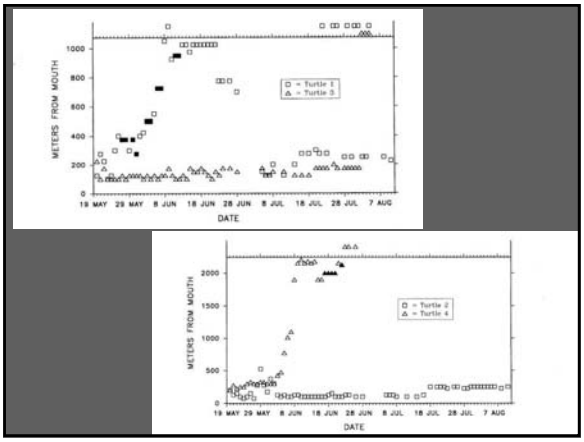


FIG. 2—Arroyo Laguna-Oak Knoll Creek, illustrating path of stream bed (parallel solid lines) and extent of closed-canopy riparian woodland (shaded). Distances from mouth of arroyo (M) are in meters (arrows). Stars show turtle overnight sites outside the stream bed: A = turtle 1, 26 May 1989; B = turtle 1, 2 June 1989; C = turtle 1, 5 June 1989; D = turtle 1, 10 June 1989; E = turtle 4, 16 and 18 June 1989; F = turtle 4, 21 June 1989.



BUT,
Most Turtles in Ponds

DO NOT

Make Long Moves
Into Uplands

THREATS

- Urban Influences
- Agricultural Influences
- Contaminants & Disease

Road-killed Turtles

Urban Impacts

Bridges & Culverts

Water Regimes & Barriers

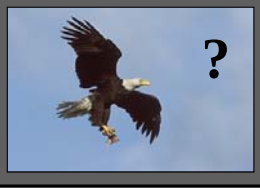
Agricultural Impacts

Cattle & Vegetation

PREDATION

- Native Predators
- Exotic Predators

Native Predators



?

Native Predators

(mostly of small turtles)

Nest Predation

Raccoon or Skunk?

Exotic Predators

(bullfrogs - really?)

Introduced Centrarchid Fishes – Bluegill & Largemouth bass

Hatchling eastern turtles not eaten in experiments:

Semlitsch and Gibbons. 1989. Copeia 1989:1030-1031.
Britson and Gutzke. 1993. Copeia 1993:435-440.

Laboratory Break

- X-ray technology
- Radio telemetry

MANAGEMENT

Chemical Effects

- Agriculture

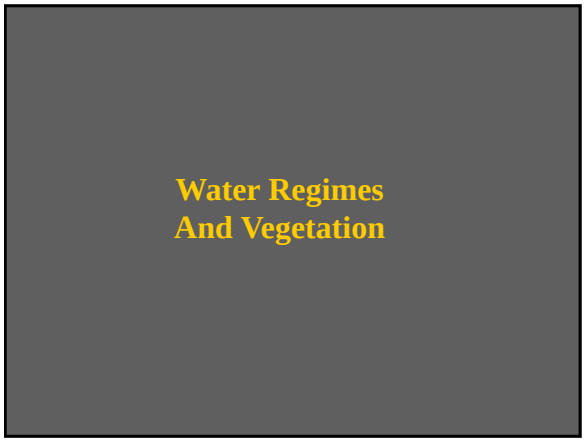
- Sewage

Perhaps?

Predator Control

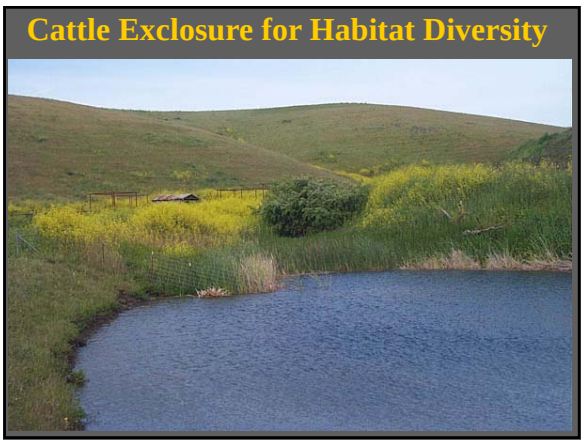
Nest Site Exclosures


Mesh Size

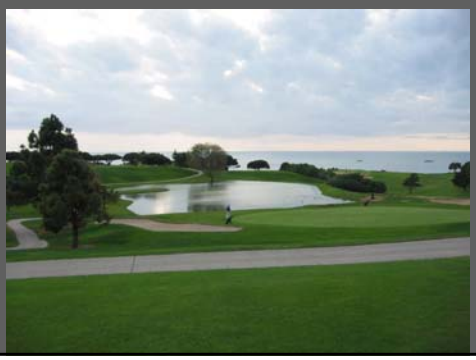

Water Regimes
And Vegetation


Managing
Ponds
for Turtles


Constructed Pond - Failed


Cattle Exclosure for Habitat Diversity

Golf Course Ponds – Missed Opportunities?

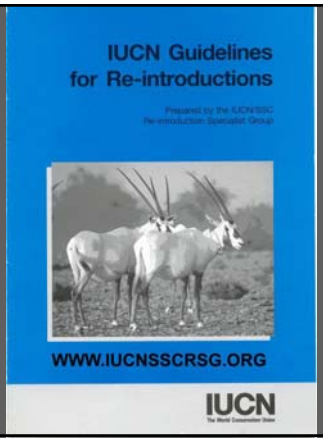


Uplands

Buffer Zones

MOVING TURTLES - DEFINITIONS

- Translocation
- Re-introduction (including head-start)
- Re-enforcement (including rescue)
- Introduction



Planning Turtle Translocations

- Aims & Objectives
- Multidisciplinary Approach
- Pre-project Activities
- Socio-economic & Legal Requirements
- Planning, Preparation, & Release Stages
- Post-release Activities

Head Start Programs

- In theory, raising turtles until they are large enough to avoid predation by most numerous predator should increase numbers of turtles.
- Turtle eggs either obtained from captive adults or nest dug up, or hatchlings found in wild.
- Accelerate growth of turtles by feeding rich diet.
- Release large-sized juveniles to natural site.

Examples of Head Start Programs

- Washington - 3 sites with releases since 1991:
  - 296 turtles released at Klickitat sites (64% recaptured in 2003)
  - 141 turtles released at Skamania site (40% recaptured in 2003)
  - 137 turtles released at Pierce NWR (43% recaptured in 2003)
- Oregon – turtles released near Corvallis in 1994.
- Oregon – Army Corps released turtles near reservoir west of Eugene 1993 - 2002.
- California – UC Davis, 33 turtles released into arboretum waterway from 1996-1998: 21 recaptured by 2001.
- California – Kern River Preserve project started in 2006.
- California – CSU Sonoma project started in 2007.

"With strong efforts from Sonoma State, The Oakland Zoo and San Francisco Zoo, there is a fight against time to help establish Western Pond Turtles throughout California to help keep the Western Pond Turtle from going extinct. Over the past century, the WPT has taken a huge decline in wild populations due to loss of habitat, introduction of alien species and becoming a food source for other native animals."

http://tortoiseforum.org/thread-14683.html
July 2012

Critique of Head Starting Turtles

- Is there really a problem for hatchling survival? Bullfrogs and bass probably not an issue.
- Are any diseases being introduced into native population?
- Reducing populations of nest predators may be more beneficial.
- Habitat protection and enhancement may be more cost effective.

Site Assessment Survey Protocol

Site Assessment

- **Western Pond Turtles may occur in any body of water, but:**
- **Size: smaller bodies of water contain proportionally more turtles than large bodies**
- **Depth: shallower (1-2 m) better habitat than deep (> 2 m) water**
- **Structures: logs and rocks provide good basking sites, although shoreline and vegetation mats are also used as basking sites**

Survey Protocols

- Presence/Absence: visual surveys for 15 min. recording number seen every 5 minutes.
- Trend Assessment: visual surveys for 35 min. recording maximum number seen every 5 min. Report maximum number seen in 35 min. Visit site 3 times a year.

BIBLIOGRAPHY

We included only published, peer-reviewed works, with a couple of exceptions.

We list links to sites that list non-published (unreliable) works.

RESEARCH NEEDS

- **Where do Hatchlings Live for First Year?**
- **Effect of Exotic Predators**
- **Translocation & Head Start Success**
- **Success of Nest Exclosures**
- **Reproductive Traits**
- **Movement Studies using Radio-tracking is trendy, but not a high priority in most cases (Ponds should be studied)**

EQUIPMENT

- **Waders, Wet suit, Float tubes, Binoculars, Traps & nets, Radio receivers & transmitters, Marking & tagging equipment, Calipers, Balances**

EQUIPMENT SUPPLIERS

- **General:**
  Cabela's, Ben Meadows, Forestry Suppliers, Bass Pro
- **Traps:**
  Memphis Net & Twine, Nylon Net Company
- **PIT Tags:**
  Biomark
- **Radio Transmiters:**
  Holohil Systems
- **Radio Receivers / Antennae:**
  Wildlife Materials, Communications Specialists

IMPORTANT POINTS

Do not take as fact that WPT are going extinct (definitely not), that bullfrogs and non-native fish impact turtle populations (no data, probably not), and that many populations are made up of old adults (NO - remember, size does not equal age).

- **Growth rates & reproduction vary by region**
- **Water regimes – Mediterranean climate**
- **Agriculture – cattle and ponds**
- **Define objectives clearly**
- **Manage for nest and female survival**
- **Manage populations, not individuals**
- **Publish results**

REGULATORY ISSUES


QUESTIONS?