Giant Gartersnake Ecology and Management

Brian J. Halstead, Glenn D. Wylie, Shannon Skalos, and Michael L. Casazza

U.S. Geological Survey
Western Ecological Research Center
Dixon Field Station

30 October 2013
California Department of Fish and Wildlife
Overview

- History
- Research Methods
- Identification
- Biology
- Management
  - All interspersed with research results

Photo by Carly Broaddus
History

- Described by Fitch (1940) as *Thamnophis ordinoides* (later *couchii*) *gigas*
- Elevated to full species (*Thamnophis gigas*) in 1987
- State listed as Threatened in 1971
- Federally listed as Threatened in 1993
Historic Range

- Endemic to Central Valley
- Tule marsh habitat
- Extirpated from much of range with conversion of wetlands to agriculture
USGS Giant Gartersnake Research

- Est. 1995
- Detection/non-detection
- Capture-mark-recapture
USGS Giant Gartersnake Research

- Est. 1995
- Detection/non-detection
- Capture-mark-recapture
USGS Giant Gartersnake Research

• Est. 1995
• Detection/non-detection
• Capture-mark-recapture
Sampling Protocols

- Survey conditions affect detection probability
  - Abundance
  - Number of traps
  - Water temperature
  - Date
- Must be accounted for when interpreting negative survey results
USGS Giant Gartersnake Research

- Est. 1995
- Detection/non-detection
- Capture-mark-recapture
Trap Design

![Trap Design Graph]

- **VIOS**, **VIOE**, **VIVA**, **VIVS**, **GO**, **GOE**, **GVS**, **GVE**
- **Gilsizer Slough canal**
- **Gilsizer Slough marsh**
- **Colusa NWR canal**
- **Colusa NWR marsh**

Photo by Margaret Mantor
USGS Giant Gartersnake Research

- Est. 1995
- Detection/non-detection
- Capture-mark-recapture

Photo by Margaret Mantor
USGS Giant Gartersnake Research

• Est. 1995
• Detection/non-detection
• Capture-mark-recapture
Phenotypic Variation
Sympatric Gartersnakes

Common (Valley) Gartersnake

Terrestrial (Mountain) Gartersnake
Length

• Can reach lengths > 1.2 m
Mass

- Can weigh more than 1 kg
Prey

- Fish
Prey

- Fish
- Tadpoles
Prey

- Fish
- Tadpoles
- Frogs
Growth and Body Condition

- Growth slows with size
- Differing patterns of growth
  - Males exhibit retarded growth in early spring
- Sexual size dimorphism
  - Females larger sex
- Differing patterns of body condition
  - Greatest difference in spring; female condition greater than males
Reproduction

• Mean litter size = 17 (13 – 21)
• Litters usually born mid July – mid September
• Neonate size
  – SVL = 209 (197 – 221) mm
  – Mass = 4.9 (4.1 – 5.7) g
Reproduction

![Graph showing relationship between Maternal SVL (mm) and Neionate SVL (mm)]

![Graph showing relationship between Snout-vent length of mother (mm) and Relative mass of litter per offspring)]
USGS Giant Gartersnake Research

- Est. 1995
- Detection/non-detection
- Capture-mark-recapture
- Radio telemetry
Adult Female Survival

- Annual probability of survival = 0.61 (0.41 – 0.79)
- Substantial among-site variation in risk of mortality
- Substantial among-year variation in risk of mortality
- Lower risk of mortality when in terrestrial habitat
- Sites vary in riskiness of linear habitats
Predators

- Raptors
- Wading birds
Predators

- Raptors
- Wading birds
- Otters
Predators

- Raptors
- Wading birds
- Otters
- Bullfrogs
- Fish
Other Sources of Mortality

- Parasites
- Disease
Other Sources of Mortality

- Parasites
- Disease
- Introduced Prey
Other Sources of Mortality

• Humans
Habitat Suitability

- More likely to be found
  - Near rice
  - Near open water
  - High density of canals
  - (Near wetlands)
- These conditions primarily occur on floor of Sacramento Valley
Probability of Occurrence

Probability of occurrence ($P$)

Distance to historic freshwater marsh (km)

Legend
Mean probability of occurrence
High: 0.756
Low: 0.122

California Department of Fish and Wildlife
Macrohabitat Selection

• Context-dependent
• In general,
  – Permanent marsh most positively selected
  – If permanent marsh not available, rice positively selected
  – Open water and linear waterways also important
  – Positive response to edge of water
Microhabitat Selection

![Graph showing odds ratio for different microhabitats including bare ground, water, litter, terrestrial vegetation, emergent vegetation, submerged vegetation, and rice.]
Vegetation Selection

- Tules most strongly selected
- Cattails, forbs, and grasses positively selected
- Individual selection for primrose and terrestrial vegetation types variable
Active Season Habitat

• Marshes
Active Season Habitat

• Canals
Active Season Habitat

• Rice
Winter Habitat

• Banks
Winter Habitat

- Uplands
Winter Habitat

- Roadsides
Winter Habitat

• Riprap
Abundance and Density

- Sex ratio = 0.93 (0.75 – 1.15)
- Abundance and density vary with context
  - Lowest in managed seasonal marshes (dry in summer, flooded in winter)
  - Greatest in natural marshes
  - Rice intermediate
- Body condition follows similar patterns
Habitat Management

- Water management
Habitat Management

- Invasive plant control
Thermal Ecology

- Snakes don’t use thermal environment at random
- Males and females use thermal environment differently
  - Males elevate body temperature in late winter/early spring
  - Females elevate body temperature in late spring/early summer
Habitat Management

- Timing of mowing important
  - Cold, overcast days during inactive season
  - Hot afternoons during active season
  - AVOID warm sunny mornings, especially in spring
Habitat Management

• Spoil piles from dredging can entomb snakes at any time of year
Habitat Management

- Debris piles near canals and wetlands attract giant gartersnakes
  - Best to leave them
  - Alternative is to move debris away as it is removed from water control structures
Habitat Management

• Avoid ground-disturbing activities during hibernation
Summary

• Greatly increased knowledge about giant gartersnakes

• Many information gaps remain
  – Response to management practices
  – Restoration ecology
  – Relative value of different habitat types
  – Effects of invasive species (prey, predators, plants)
  – Male and juvenile survival
  – Many more
Acknowledgments

- California and U.S. Wildlife Refuges/Areas
- Numerous Biological Technicians
- Numerous Landowners
- Numerous Water Districts

- Funding
  - CALFED
  - California Department of Water Resources
  - California Waterfowl Association
  - The Natomas Basin Conservancy
  - Solano County Water Agency
  - U.S. Army Corps of Engineers
  - U.S. Bureau of Reclamation
  - U.S. Fish and Wildlife Service
  - Yolo Resource Conservation District
Questions?

Photo by Carly Broaddus
For more information...


