Wetland Monitoring to Inform Marsh Management

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Monitoring

- has been described as the financial equivalent of accounting, and is critical for evaluating management actions (Lee 1993)
- Provides information to assess effectiveness of management actions
- for land managers to help make decisions

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Types of Monitoring (Holthausen et al. 2005)

Status & Trends Monitoring

- What, When, Where
- Tracking populations or habitat over time. Detecting changes, identifying patterns

Effect Monitoring

- Why and How
- Did managements actions work? Why or why not?
- Identifying the drivers of species response habitat features to inform actions.
- Science framework

Context Monitoring

- Management for Waterfowl and diving duck may also benefit other wildlife (salt marsh harvest mouse, fish, etc)
- Landscape mosaic (clubs, restorations)
- Multiple spatial scales: pond, parcel, region, Marsh, Delta, Flyway

Modified from Barbara Harmon

How can management enhance productivity?

Modified from Barbara Harmon

Monitoring can inform management for

Habitat for Ducks

- Waterfowl movements habitat use (surveys and telemetry (Fiona McDuie, Cory Overton)
- Habitat types and amount (Chris Potter, Steve Andrews)
- Threats to Habitat
  - SLR (John Takekawa, Karen Thorne)
  - Predators (Sarah Peterson, Shannon Skalos)
  - Invasive weeds (Karin Kettenring)

Habitat Quality: Food Production

- What and how much food is being produced?
  - Food plants (Dan Smith)
  - Invertebrate prey (Isa Woo, Susan De La Cruz)

Wildlife Benefit

- Where are birds feeding
- What are they eating (Jackie Satter and Mason Hill)
- Seasonal changes in diet. USGS, UCD
- Body condition. USGS, UCD
- Bioenergetics. USGS, UCD

USGS: Mike Casazza, Josh Ackerman, and Susan De La Cruz
UCD: John Eadie.

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Invertebrates:

Under-represented and under-appreciated waterbird prey

Non-biting Midges (Chironomids)

Are abundant

- have wide distribution and high diversity
- can be indicators of water quality

Are nutritious

- 56% protein by dry weight (Sugden 1973)
- 4.1-6.1 Kcal/g (Armitage 1995)
- high digestibility (De la Noue and Choubert 1985)

Digest quickly (<10-20 minutes) after force feeding in Blue Winged Teal (Swanson and Bartonek 1970

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Use "Go Back" On your Browser to return to species page)

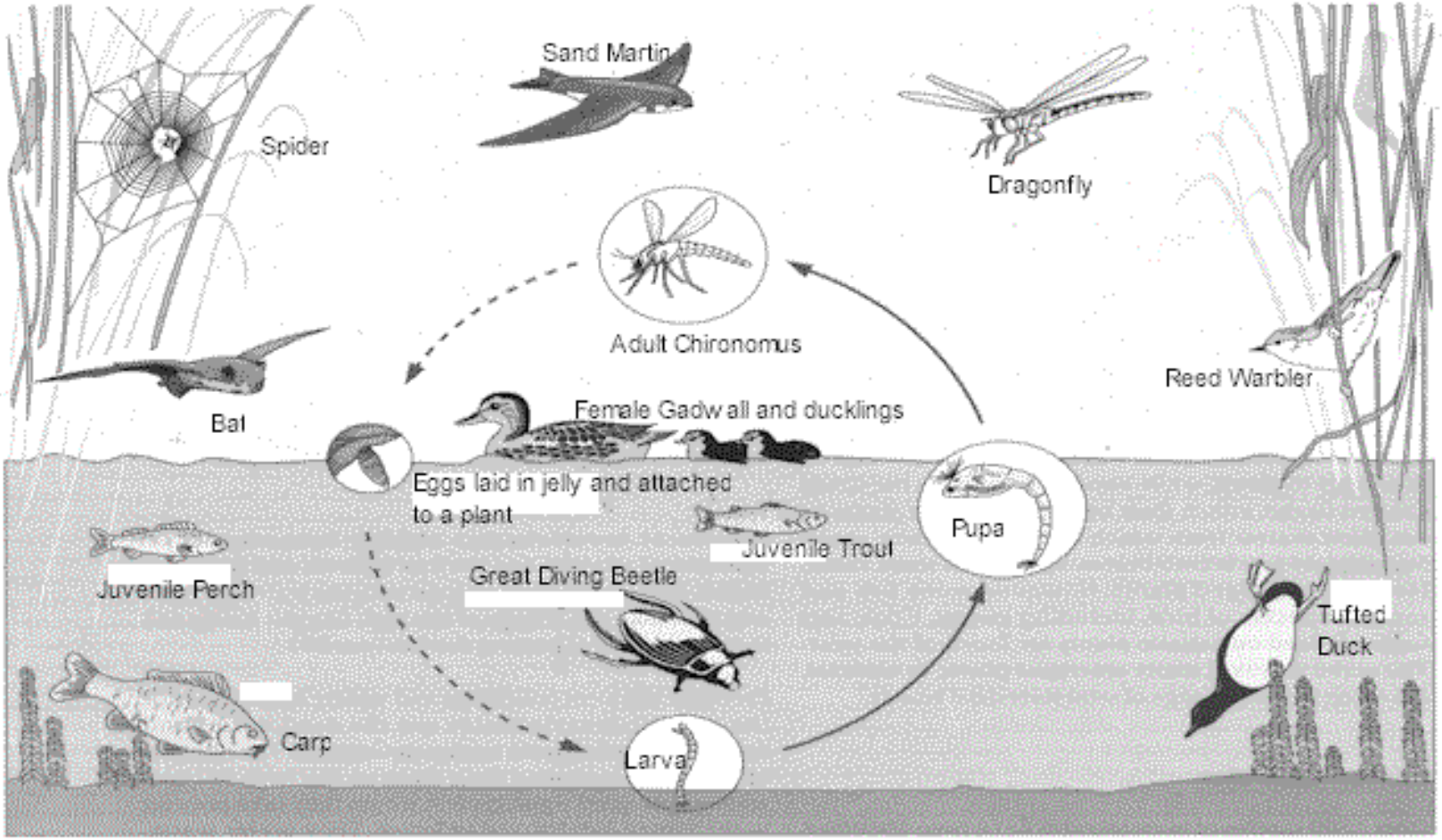


Figure 4-4 Diagram illustrating the diversity of life that can be supported by chironomids. (Adapted from Ref. 16)

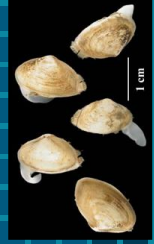
Invertebrates in Dabbling & Diving Duck Diets

Dabblers

- Several studies in Suisun point to the importance of invertebrates in dabbler diets (Euliss 1984, Euliss and Grodhaus 1987, Batzer and Resh 1992, Batzer et al. 1993, deSzalay and Resh 1997)
- May be particularly true in late winter/spring (migration prep, pre-breeding; Miller 1987) and summer (broods; Swanger 1992)

Divers

- Previous SFB work has been in open bays where diet is dominated by clams (De La Cruz 2010, Lovvorn et al. 2013)
- Recent work in restoring and managed wetlands in North and South Bay suggests diets can include soft bodied invertebrates and numerous seeds
- Mason's talk



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Prey Availability: proposed research

We hope to collect invertebrate prey alongside with existing seed collections (Dan)

1) Evaluate spatial and temporal differences in invertebrate prey availability
2) Determine invertebrate contributions to fall, winter and spring diets of dabblers and divers
3) In combination with seed collection(Dan), assess overall food availability for ducks

Invertebrates

- Benthic
- Terrestrial
- Aquatic emergence

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Prey Availability: upcoming study

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Habitat variables to associate with invertebrate & seed productivity

- Plant cover
- Water and pore water salinity
- Soil (organic matter, texture, pH)
- Elevation (RTK GPS, LiDAR)
- Inundation duration (water management)
- For methods see: www.tidalmarshmonitoring.org

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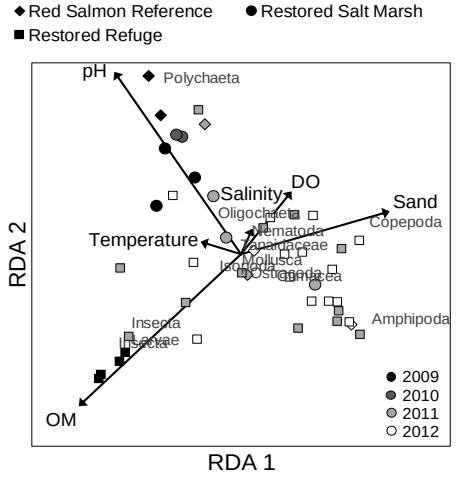
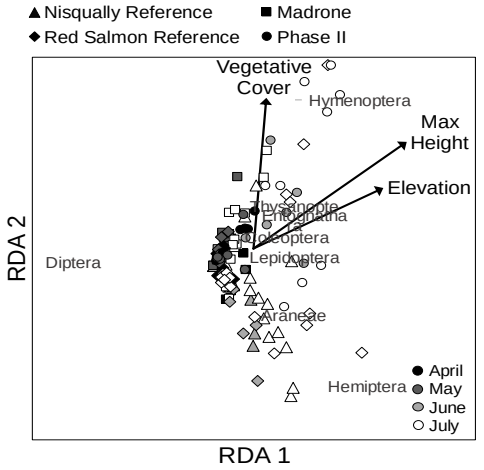
Invertebrate Habitat Associations

for benthic, terrestrial insects as in Woo et al. 2018

- Ultimately we hope to relate invertebrate (and seed) productivity to habitat variables, to inform management
- This type of information may be useful in trying to optimize food productivity for a variety of ducks





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THANKS!

For more information: visit:
www.tidalmarshmonitoring.org
Any questions?

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AND TABLES TO COMPARE DATA

	Habitat	Habitat Quality: Food Production	Wildlife Benefit
Status & Trends	• Habitat Use (Telemetry)	• Seed production • Invertebrate production	• Body Condition • Bioenergetics
Effect	Habitat association models or habitat suitability models	Identify ways to maximize food production	Variety of food available throughout each life stage and throughout migration or reproductive seasons
Context: Suisun Marsh	Diversity of habitat	24	16