Vertebrates/Invertebrates (animals)

Breakout session,
MORNING Aug 21, 2007

Jacoby/McKee/Harr

In the breakout:
Thea Edwards
Tom Morris
Kendall Harr
Rob Mattson
Jim Kraus
Jim Stevenson
Dawn Jennings
Jim Valade
Catherine Wolden
Jerry Krummrich
Stephen Walsh
Heather Hamlin
Chris Zajac

Slides presented by Chuck after the Breakout:

Slide 1

- What are the important unknowns (Chuck's rearranged interpretation)
  - status of populations of key springs fauna
  - "causal" link Δ nutrients to Δ flora & fauna
  - effects of short-term "cycling"
  - impact of exotics
  - "limitations" of exotics
- What are the important unknowns (what group said in session)
  - (13 votes) Status of population of "Key" spring fauna
  - (10 votes) Proof of causation of nutrient change and causation of change in flora/fauna.
  - (9 votes) Effects of exotic plant treatment (mechanic / herbicide)
  - (5 votes) Impact of introduction of exotics – tilapia, catfish (asian), snails

Slide 2

- What are the most important management issues related to nutrients & springs?
  1. costs:benefits of exotic species & their mgt
  2. costs:benefits of restoration and recovery activities
  3. adaptive management
  4. historical perspective of changes (↑ nutrient loads)
  5. place-based mgt v mission based mgt
  6. $$

Slide 3

- How might these management issues be addressed?
    1. springs working groups
    2. legislation, regulation, planning
    3. education/outreach (incl. syntheses of info)

Slide 4

- What are the most important future springs research initiatives ? (not ranked)
    - Topics on slide 1
    - springs research facility – *in situ* if possible
    - standardized methods (incl. QA/QC)
    - effects of reverse flow
    - physiological mechanisms of toxicity
    - numeric criterion for NO3 in groundwater that protects system
    - "role" of exotics and the process of their removal
    - Is Gore right?

Notes taken by Kendall Harr on flipchart in the session

What do Nutrients do in Springs?

1. direct
2. indirect
    a. literature on processes needed; interaction – habitat/ecosystems

More nutrient (N)

- Affects diversity and biomass
- Apple snail, crayfish, elimia, horn snail, troglobytes, okeefenokee sunfish
- Other threatened
- Filamentous algae

More micronutrients

- Filamentous algae

More tox/pesticides/hormone mimics
Effects on recruitments of inverts (snails)
More mercury uptake in algae → eaten →
More toxins in biomass

Ichetucknee
Fewer snails? Not proven => fewer musk turtles => more plant bottom cover

Wakula
Fewer snails

Need life history and repro phys info on snails or other inverts/verts
Phil Darby – lit on snails
Tom Morris – blind crayfish; dairy impacst on caves
Thea Edwards nitrate/nutrient

More filament algae

Research study design
Mesocosm design
Intermed bet lab and field
Possible made river/other backflow
Low flow – diff in hydrostatic pressure
Effects on springs/caves/dieoffs

Minimal flow Levels
Define signif harm – very important
No ecol change = SWFWMD
Models based around droughts etc.

- withdrawals? Effects

Gary Williams - withdrawal - gray lit.

Manatees – effects of nutrients
Quantity and qual of Forage
Lower quality => Cold stress mortality

Manatees
Nuisance plants
Manatees eat hydrilla

Res. Needs

- Dedicated Springs Research Facility to access spring water, setup mesocosms
  - SWFMD rec.
  - Multiple locations preferable
  - Multiple vents
  - Siver springs good for geo and current facilities
  - Fanning – tox
- Hydrobias
  - Pop assessments
  - Habitat assessments
  - Sensitive to change - canary
  - Endemic to specific sections of springs
- Ref. **Doug Shelton** – gray lit?
- Water Clarity
  - Effects on trophic levels
  - Sinkholes collapse

        - Springs flow milky
        - Particulates; clay vs bacteria vs precipitate (S or other)?
    - **Joe Braham**
        - Video of Bugg spring
        - Navy sonar cal. Facility
        - Potential dataset
- Inegration in Comprehensive Plans
- Public Ed.
- Politics
    - Revenues, Recreation, Development
    - Costs of cleaning up drinking water
- Need for scientists to attend public meetings
    - Ongoing communications w/ managers
- Need info, research on longterm (likely) changes in nutrients effect flora/fauna.

Research / Management

- Adaptive Res
    - Need monitoring after and during regulatory process!
    - Change research with management and vice versa
    - Integral

Direct effects
NO3 – affects adult sturgeon more than larval
Species specific! NO3 has direct effects on some fish, not on others (**T. Edwards**)
Heather Hamlin (lit.)
    NO metabolites
Toxicity on crayfish?
    Cave ecosystem – **Bill Streever**

UNKNOWNS ranked by importance

1. (1 votes) Co-occuring contaminants – toxic interactions
2. (4 votes) Cycling dynamics of NO3 and others with time, e.g., diurnal etc
3. **(13 votes) Status of population of "Key" spring fauna**
4. (1 votes) Development of standardized and QC of sampling and lab analysis
5. **(10 votes) Proof of causation of nutrient change and causation of change in flora/fauna.**
6. (5 votes) Impact of introduction of exotics – tilapia, catfish(asian), snails
7. (2 votes) impact of loss of species
8. **(9 votes) Effects of treatment of exotic plants**
    a. Treatment of hydrilla killing crayfish – Ichet
    b. Death of inverts, loss of habitat
    c. Change in DO
    d. Change in light
    e. Mechanical removal as well as herbicide

9. (3 votes) change of groundwater hydrology
10. (0 votes) lower uptake
11. (6 votes) what level of control of aquatic weeds is ideal to health and preserve habitat
12. (4 votes) what are rate limiting factors for growth of species of invasive plants , e.g. micronutrients – how have they changed.

Research Faciltiy at Spring

"Standard" methods

Reverse flow effects

Physical mech toxicity

Was Gore Right?

Exotics

Numeric criterion NO3 system

Management
Cost:Benefit restoration

Adaptive Approach

Historical perspective

Place-based (WGs) management vs. Mission management

$$

WGs

Legln

Planning

Ed/Outreach

Synthesis