Intro/Overview: Molly O'Toole – O'Toole and Associates, Lime Lake

- Watersheds & Water Focuses
  - Past = quantity of water
  - Present = quantity AND quality of water
  - Future = quantity and quality of water as well as aquifer recharge
- All of Leelanau County has watershed management plans now
- Small problems add up – “Death by 1,000 cuts”? “That’s just a band aid solution!”?
  - Who says 1,000 band aids can’t heal 1,000 cuts?
- New research suggests that the gloom & doom approach is not an effective motivator for communities/people
  - What does work:
    - Showing/telling people what to do instead of what not to do
    - *People seeing others take action*
    - Good, locally tailored programs work
      - The objective is to change behavior
  - Positivity
    - The same information coming from multiple & different sources consistently

Leelanau Conservancy Long Term Monitoring Results: M. Megan Woller-Skar, Professor, Grand Valley State University

- Lakes & Nutrients
  - Nutrients = nitrogen (N, NOx) or phosphorus (P, TP)
  - Sources common for this county
    - Fertilizer runoff (commonly N)
    - Leaking septic tanks (commonly P)
- Leelanau Conservancy water monitoring program
  - c. 1988 – 5 lakes, 8 stations of monthly N + P samples
  - Utilizing Principle Components Analysis (PCA)
    - Identifying trends in complex datasets, summarized in 2D
- Graph Examples:
  - Graph explanation
    - Small angles = closely related
    - Farther from label = lower in nutrients
    - Larger ellipse = older & more nutrients
    - Smaller ellipse = recent & less nutrients
  - 1st Graph, All Lakes
    - 73% = percent original data represented in plot aka more accurate
• Right angle = NOx & TP are unrelated
  • Surprising – you would think N & P would be related
    o 2nd Graph, Lime Lake
      ▪ N surge in spring
      ▪ P surge in late summer/fall
    o 3rd Graph, S. Lake Leelanau
      ▪ N surge in spring
      ▪ P surge in late summer/fall
• Conclusion for all lakes
  o Lower nutrient trend (slight decrease since 1990’s)
  o Seasonal variation in all 5 lakes
  o If we wanted to target nutrient influxes...
    ▪ Can target N in spring & P in fall/summer
• Fielding questions/comments
  o Q: What is your or the leading theory for why nutrients are overall decreasing in the county?
    ▪ A: Lake associations are helping limit nutrient input in the lakes
    ▪ This is a rare (but positive!) trend, the opposite from downstate – unsure
  o Comment: The last 5 years fertilizers have taken P out of regular fertilizers (now only in starter fertilizers)
    ▪ Can use forms of N that are resistant to leaching if you want to fertilize lawn near water – Nitrous Ammonia

Leelanau Clean Water Website & Database: Cal Killen
• Goal = to measure all water quality efforts in county from all organizations
  o So you can visualize, compare & discover
• Example 1: Secchi transparency for 6 lakes
  o You can ask questions based on comparison
  o Why did Big Glen have better transparency than North & South Lake Leelanau?
• Example 2: N. Lake Leelanau conductivity
  o The graph is an interactive cube you can rotate
• Watermeasures.com
  o This is all free to the public & volunteer made

Swimmer’s Itch Research & New Technologies: Ron Reimink, Freshwater Solutions
• Quantitative Polymerase Chain Reaction (qPCR) technology
  o “Real time PCR” – it amplifies target organism’s DNA
  o Goes through cycles:
    ▪ Split double helix has AT & CG paired
    ▪ Primers attach to DNA looking for quantity – how many “insert organism” are in the water?
- Can multiply DNA of what we want so we can count it
- Probes opposite DNA have fluorescent molecules attached
  - Simply put... you take a water sample, pick out the DNA, count how many organisms are there with specific primer
    - Incredibly accurate = +/- .4 organisms
- qPCR in Leelanau
  - CuSO4 (Copper Sulfate) is typically used to reduce snails and thus swimmers itch (in theory)
    - S. Lake Leelanau stats show there are more worms (swimmer’s itch - cercarial dermatitis) after application of CUSO4
  - Questions tested:
    - Does the time of day matter?
      - Stats show higher percentage in water in the morning & drops off throughout the day
    - Where are they in the water column?
      - Stats show higher percentage in the top 1 foot of water
    - Two theories on safer swim areas
      - Barrier/baffle in top 1 foot of water & collect snails
        - marked reduction inside barrier
      - Vacuum top water layer with “smasher” filter that will deconstruct DNA of worms for 30 mins
        - Also reduction in worms present
    - Can we refine qPCR to include individual species?
      - Working on new technology called rhAmp SNP genotyping currently
  - Unanswered questions
    - Will stirring up the bottom of the lake make it worse or is that an old wives tale?
    - How far can the wind blow these worms?
    - Does the risk of swimmer’s itch decrease with distance from shore?
    - Does the Leland River transmit swimmer’s itch?
    - Will relocated mergansers work?
    - Do enteric bacteria come from faulty septic systems?
    - Could we potentially have landowners do smartphone sampling into one database?

Protecting & Preserving Our Water: Rob Karner, Biologist, Glen Lake Association

- Guardian Program: grassroots free, positive program
  - Builds positive peer pressure and provides education to 200+ people
  - Encourages homeowners to have a healthy buffer between their uplands and shorelines
- Watershed Protection Program Objectives
  - For Townships & Local Governments to have the same theme in their goals so that there is full coverage
- Emphasis on species richness, biodiversity, and ecological integrity
  - Monitoring performed
    - Water chemistry, inlets (once a year), drone surveys, aquatic plant surveys, plankton surveys, cooperative lakes monitoring program (statewide)
- Graph: Oxygen Depletion – Little Glen
  - Sequestered P at bottom – released after November
- Shoal survey – can eliminate erosion on shorelines
- Special Projects
  - qPCR
  - Hatlem Pond Drainage
  - Discovery Boat tour highlights
    - Geologic history of watershed
    - Physical characteristics and chemistry of the water
    - Biota
    - Political Influences & partnerships