New Jersey's Ambient Biomonitoring Network (AMNET)

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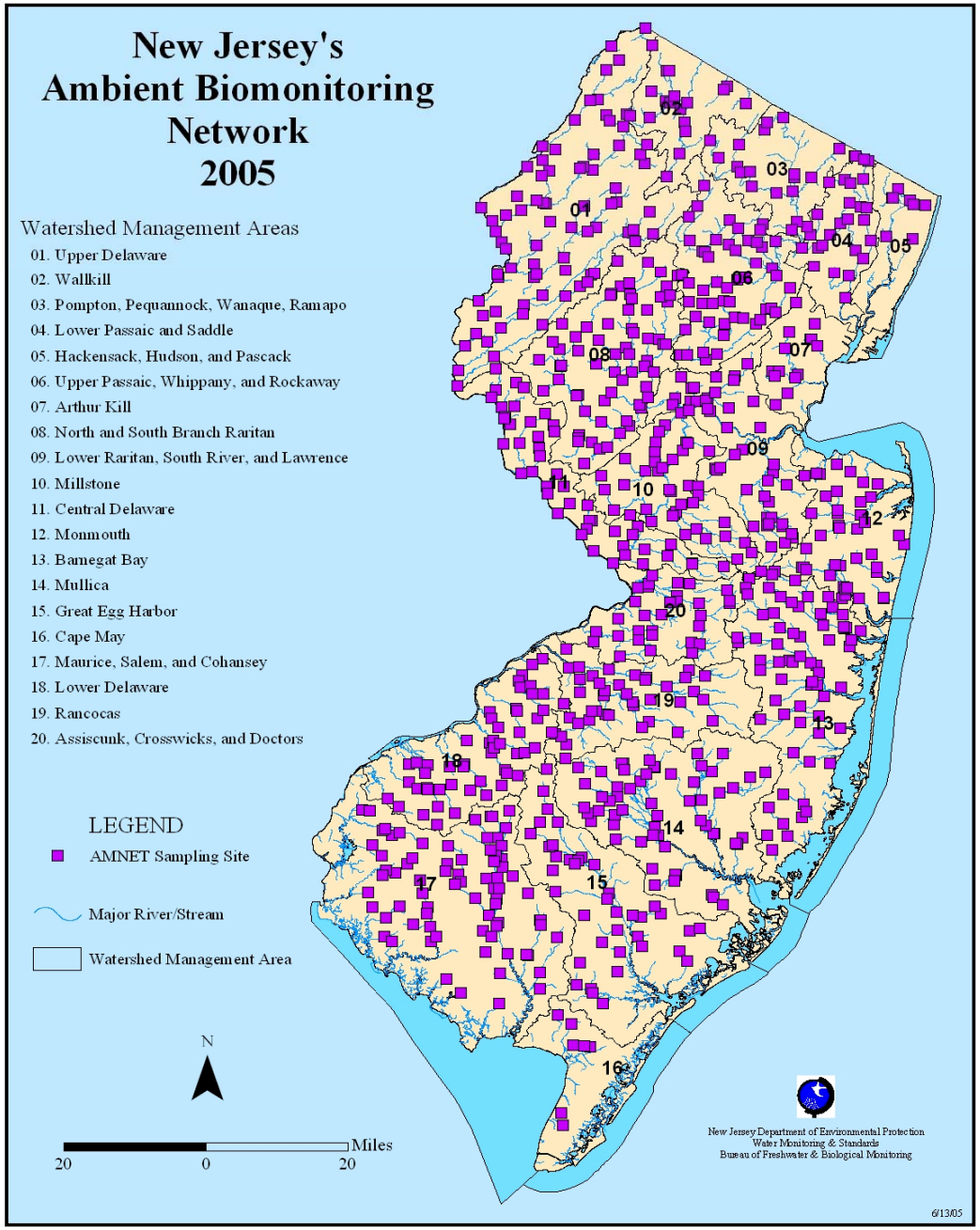
Ambient Biomonitoring Network (AMNET)

- Based on USEPA's Rapid Bioassessmnet Protocols for Use in Wadeable Streams and Rivers (1989, revised in 1999)
- Sample stream benthic macroinvertebrates
  - benthic=bottom-dwelling
  - macroinvertebrates=larger-than-microscopic organisms

AMNET

- Network began in 1992
- 822 sites statewide (freshwater non-tidal)
- Sites sampled once every 5 years by Water Region
- Most sites have been sampled at least 3 times
- Sites located primarily on 2nd order and higher streams of at least 3 miles in length, and then, approximately every 3 miles to head-of tide


New Jersey's
Ambient Biomonitoring
Network
2005
Watershed Management Areas
01. Upper Delaware
02. Wallkill
03. Pompton, Pequannock, Wanaque, Ramapo
04. Lower Passaic and Saddle
05. Hackensack, Hudson, and Pascack
06. Upper Passaic, Whippany, and Rockaway
07. Arthur Kill
08. North and South Branch Raritan
09. Lower Raritan, South River, and Lawrence
10. Millstone
11. Central Delaware
12. Monmouth
13. Barnegat Bay
14. Mullica
15. Great Egg Harbor
16. Cape May
17. Maurice, Salem, and Cohansey
18. Lower Delaware
19. Rancocas
20. Assiscunk, Crosswicks, and Doctors
LEGEND
AMNET Sampling Site
Major River/Stream
Watershed Management Area
N
Miles
20
0
20
New Jersey Department of Environmental Protection
Water Monitoring & Standards
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6/13/05

Examples of Macroinvertebrates

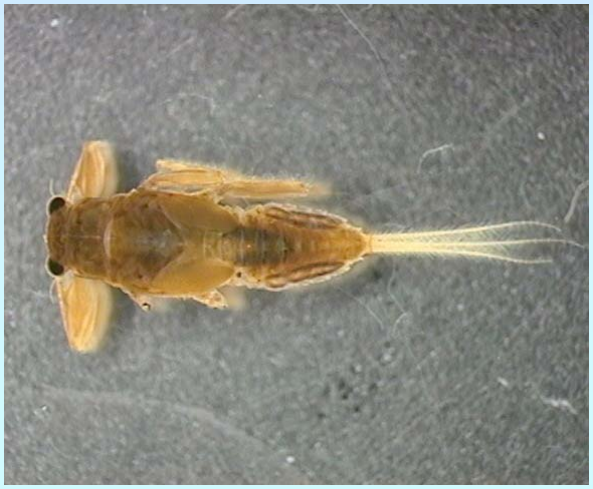
- Aquatic insects (mayflies, stoneflies, caddisflies, blackflies, dragonflies, damselflies, hellgammites, beetles etc.)
- Aquatic worms
- Mollusks (snails, clams, and mussels)
- Crustaceans (crayfish, amphipods, isopods)
- Leeches
- Flatworms

Riffle Beetle

Blackfly

Caddisfly

Mayfly



Snail

Stonefly

Rationale for Biomonitoring

- Presence and relative abundance of organisms in a stream is governed by environmental conditions and by the pollution tolerance levels of the respective taxa
- Overall community is reflective of conditions in its environment
- Assess changes in community structure

Advantages of Benthic Macroinvertebrate Monitoring

- Good indicators of localized conditions
- Relatively easy and inexpensive to sample
- Integrate culmulative effects of different stressors such as excess nutrients, toxic chemicals, and excessive sediment loading
- Sensitive to short-term, episodic events such as spills and intermittent discharges

Sampling Equipment

- Kick Net
- Sieve Bucket
- Sample jars and labels
- Forceps
- Gloves and waders
- Formalin (preservative)
- Meters

Sampling

- High gradient streams (cobble is dominant substrate)

  Riffles are most productive habitat

- Low gradient streams (sand and gravel is dominant substrate)

  Most productive habitats are macrophytes, snags (logs and branch), and submerged banks

Visual-based Habitat Assessment

- Method from Rapid Bioassessment Protocols, 2nd. Ed.
- Evaluations of instream habitat, channel morphology, bank structural features, and riparian vegetation.
- Ten parameters scored on 0-20 scale.
- From total, rating of optimal, suboptimal, marginal, or poor is given.

Optimal Habitat

Lamington River @ Rt. 24, Chester Twp.

Poor Habitat

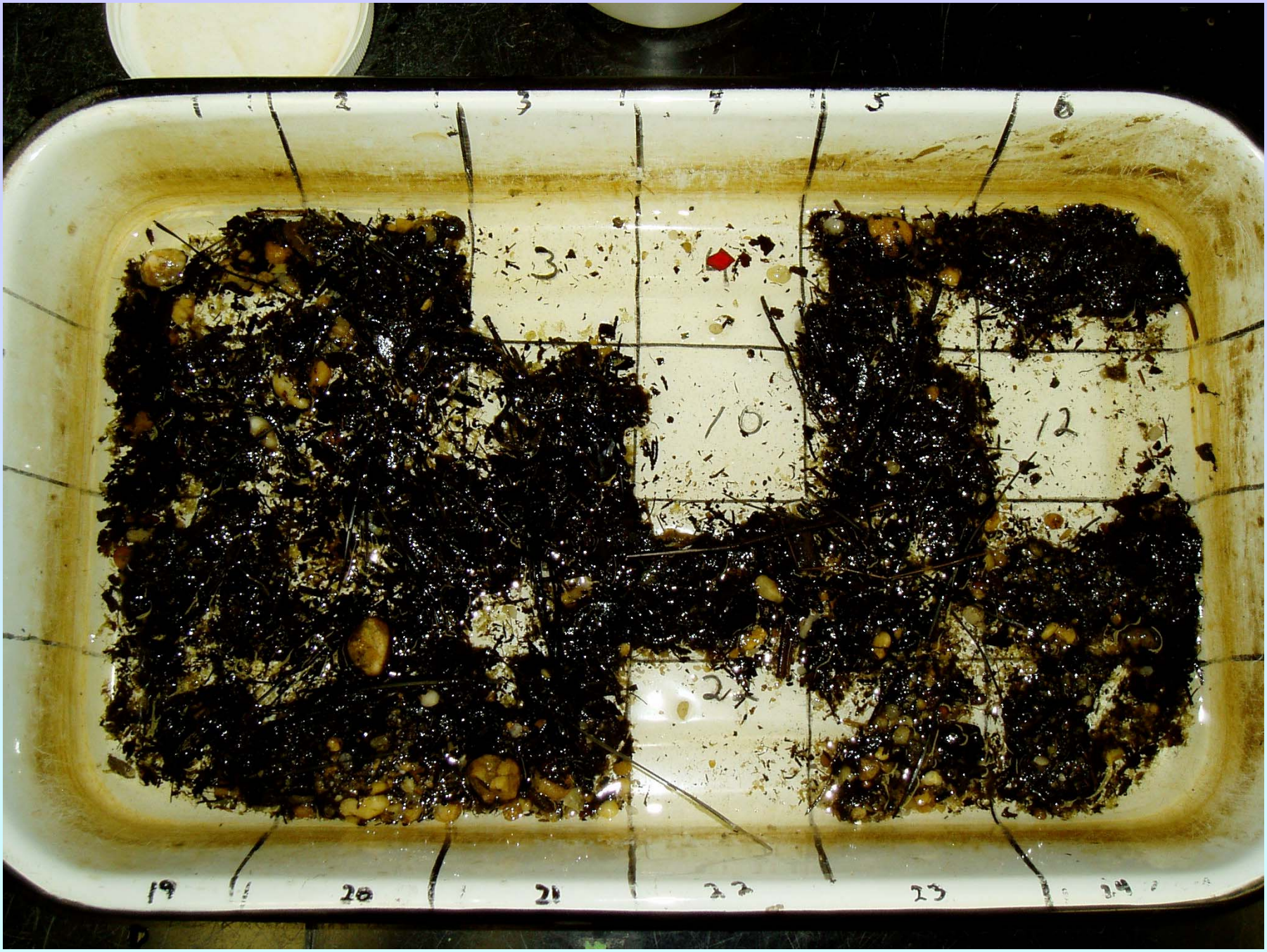
Holland Bk @ South Branch Rd., Branchburg Twp.

Other Data Collected

- Digital photographs taken
- Basic water chemistries (pH, water temperature, dissolved oxygen, and specific conductance)
- Stream observations and measurements
  - stream width and depth
  - water clarity
  - flow
  - presence of stormwater outfalls
  - surrounding land use
  - Canopy
  - Any potential sources of pollution noted

Processing of Sample in Lab

- Sample poured into sieve and rinsed to remove preservative and fine sediment
- Sample transferred to gridded pan
- Material from randomly selected grid examined under stereomicroscope
- All organisms removed until 100 bug sub-sample obtained
- Identifications made to lowest possible taxonomic level, usually genus or species
- Morphological abnormalities noted


1
2
3
4
5
6
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12
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21
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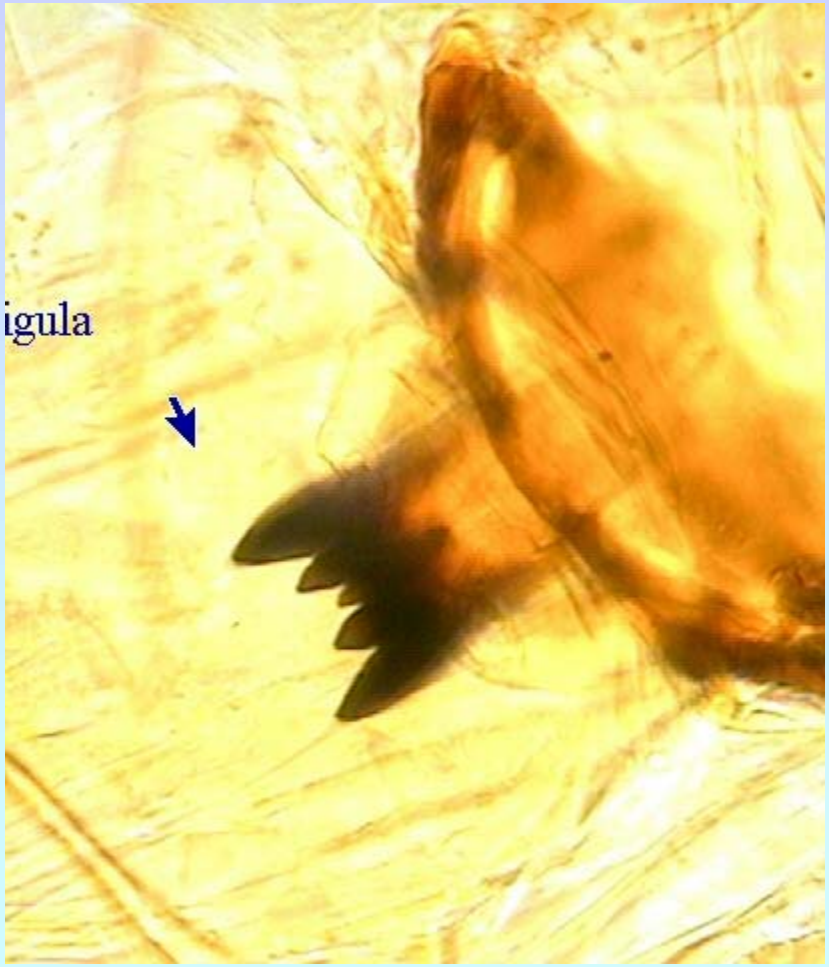
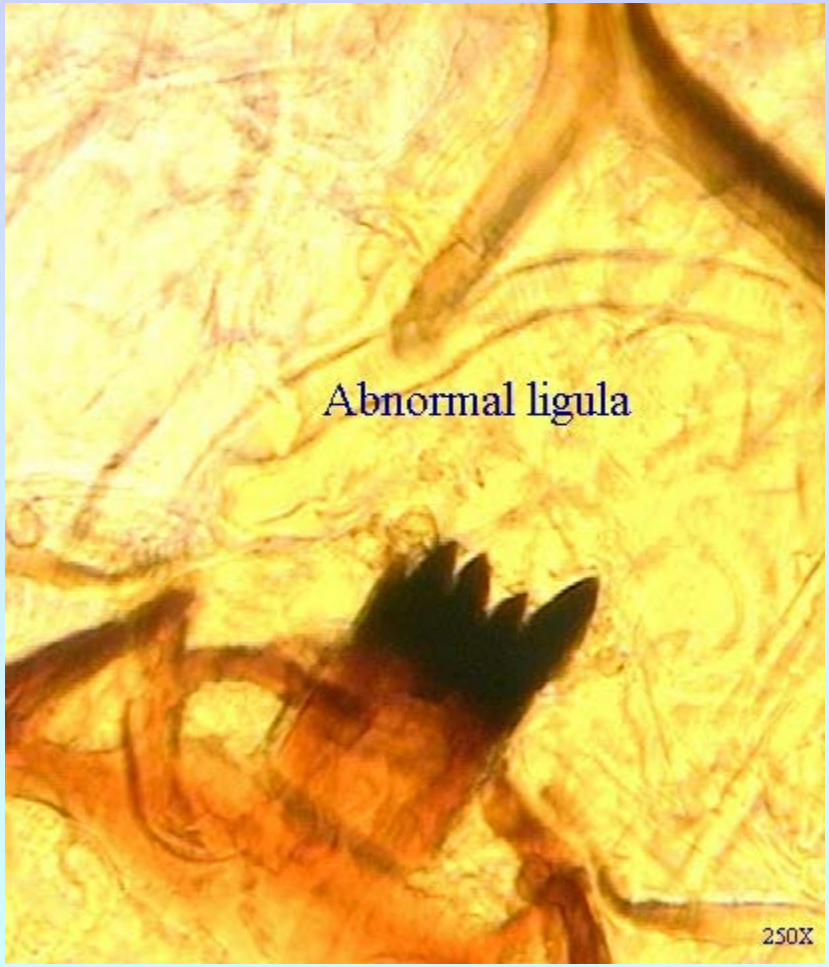
23
24

Example of Morphological Abnormalities





New Jersey Impairment Score (NJIS)

- Calculated using family-level taxonomy
- Five metrics (measurable characteristics of the instream macroinvertebrate community)
  - Total taxa
  - %EPT (mayflies, stoneflies, caddisflies)
  - EPT taxa
  - % Contribution of Dominant taxa
  - Family Biotic Index (based on tolerance scale developed by Hilsenhoff)- 0 to 10 scale

New Jersey Impairment Score

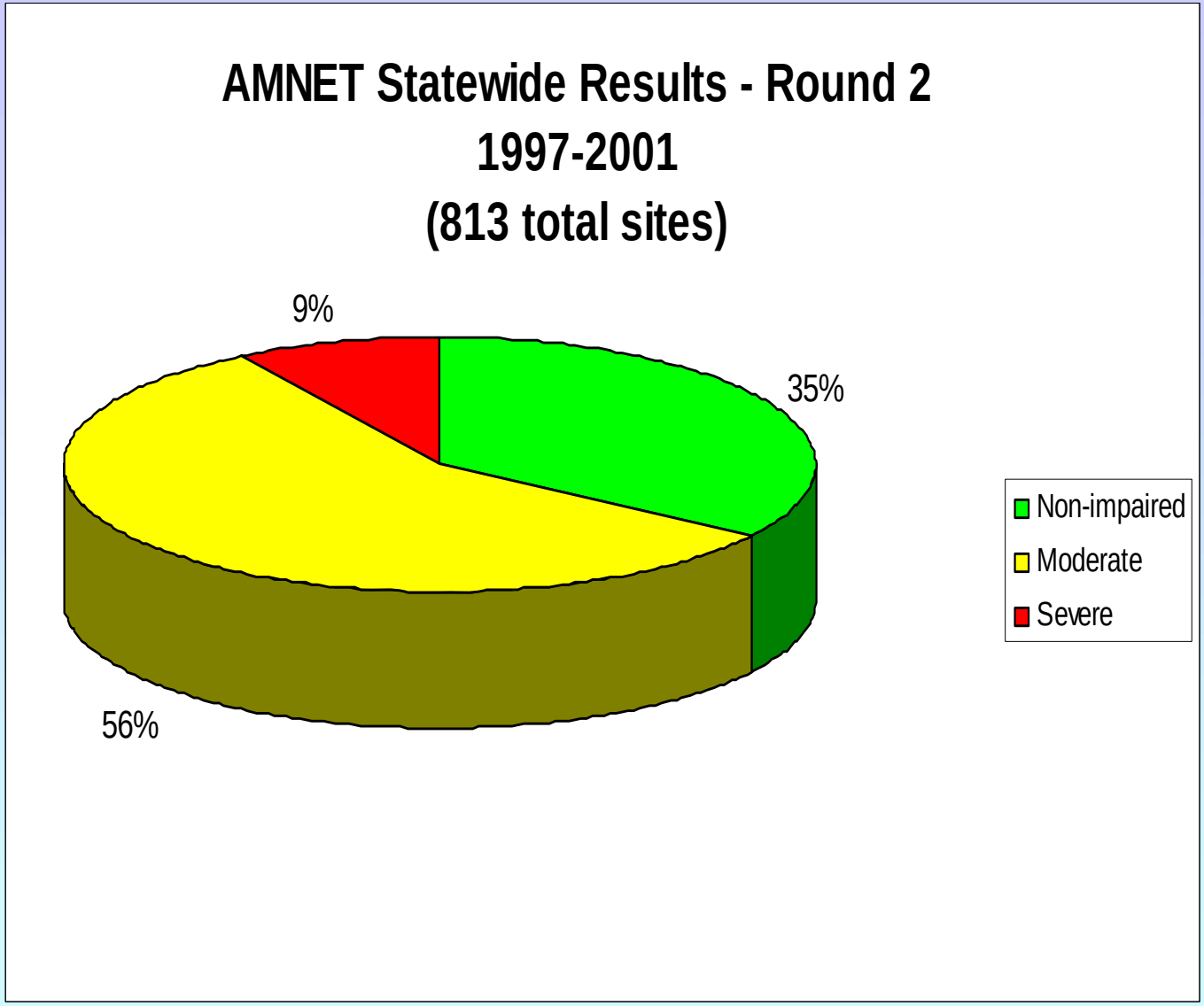
- Sites scored on a 0-30 scale
- Based on score, three ratings applied
  - Non-impaired (24-30)
  - Moderately impaired (9-21)
  - Severely impaired (0-6)

Non-impaired

- Good Taxa richness (many different organisms present in sample)
- Intolerant organisms well represented (abundance and diversity of EPT)
- No one taxa is excessively dominant

Severely Impaired

- Poor taxa richness (few different organisms present)
- Tolerant taxa abundant (such as worms) and intolerant taxa (absent or virtually absent)
- One taxa may be excessively dominant (60% or more of total)


AMNET Statewide Results - Round 2
1997-2001
(813 total sites)
9%
35%
56%
Non-impaired
Moderate
Severe

QA/QC Procedures

- Voucher collection of all organism found is maintained in laboratory
- Annually, 10% of samples are sent to independent lab for identification
- Collection of taxonomic references is maintained in lab and updated as needed
- Training courses on macroinvertebrate identification are taken when available

Data Uses

- Water Region AMNET Reports www.state.nj.us/dep/wmm/bfbm
- Integrated List (303d and 305b)
- Track trends in water quality on site-by-site basis, as well as at the watershed level
- Point to sites where additional monitoring may be needed
- Stressor Identification program

Coordination with other Monitoring Efforts

- Sediment Toxicity Testing
- Fish IBI Network
- USGS-NJDEP Ambient Surface Water Quality Network
- Supplemental Ambient Surface Water Quality Network
- Endangered and Nongame Species Program
- Pinelands Commission

New Indices

- Pinelands Macroinvertebrate Index (PMI)
  - Developed for NJDEP by Tetra Tech
  - Testing and validating
- Coastal Plains Macroinvertebrate Index (CPMI)
  - Multi-state effort (MACS)
  - Begin using for Round 3?
- Refine Index for Northern NJ
  - Genus-level
  - Four impairment categories