

National Biological Assessment  
and Criteria Workshop

Advancing State and Tribal Programs



Coeur d'Alene, Idaho  
31 March – 4 April, 2003

**RFC 202**

# *Development of Reference Conditions for Reservoir Aquatic Communities*

---

*Presented by*

Tyler Baker, Tennessee Valley Authority (TVA)

*Also Contributed*

Gary Hickman & Don Dycus, TVA

# *Reservoir Fish Assemblage Index (RFAI)*

Validity of the index depends on:

- Obtaining samples representative of existing fish assemblages,
- Selecting biological attributes (metrics) that reliably reflect human disturbance over the possible range of degradation,
- And specifying reference conditions against which sites can be evaluated.

# *What are reference conditions?*

- Reference conditions represent the best biological conditions that can be found in a body of water that has not been impacted by humans.

# *Reservoirs are artificial systems*

- They lack natural reference sites for determining characteristics that would be expected in waters unaffected by human impacts.
- On a geological time scale, reservoirs have had little opportunity to evolve an adaptive fish community.
- Reservoir fish communities are often intensively managed to maximize recreational angling.

# *Methods for Determination of Reference Conditions*

- Historical (pre-impoundment) conditions

Inappropriate because of the significant habitat alterations resulting from impoundment.

# *Methods for Determination of Reference Conditions*

- Historical (pre-impoundment) conditions
- Predictive models

Not enough information available to model community dynamics in reservoirs.

# *Methods for Determination of Reference Conditions*

- Historical (pre-impoundment) conditions
- Predictive models
- Best observed conditions

Assumes a wide range of conditions (good-poor) for each community characteristic or metric. Not met in our case due to the low number of reservoirs within each group.

# *Methods for Determination of Reference Conditions*

- Historical (pre-impoundment) conditions
- Predictive models
- Best observed conditions
- Professional judgment

**Knowledgeable biologists set expectations.**



# *TVA's Approach*

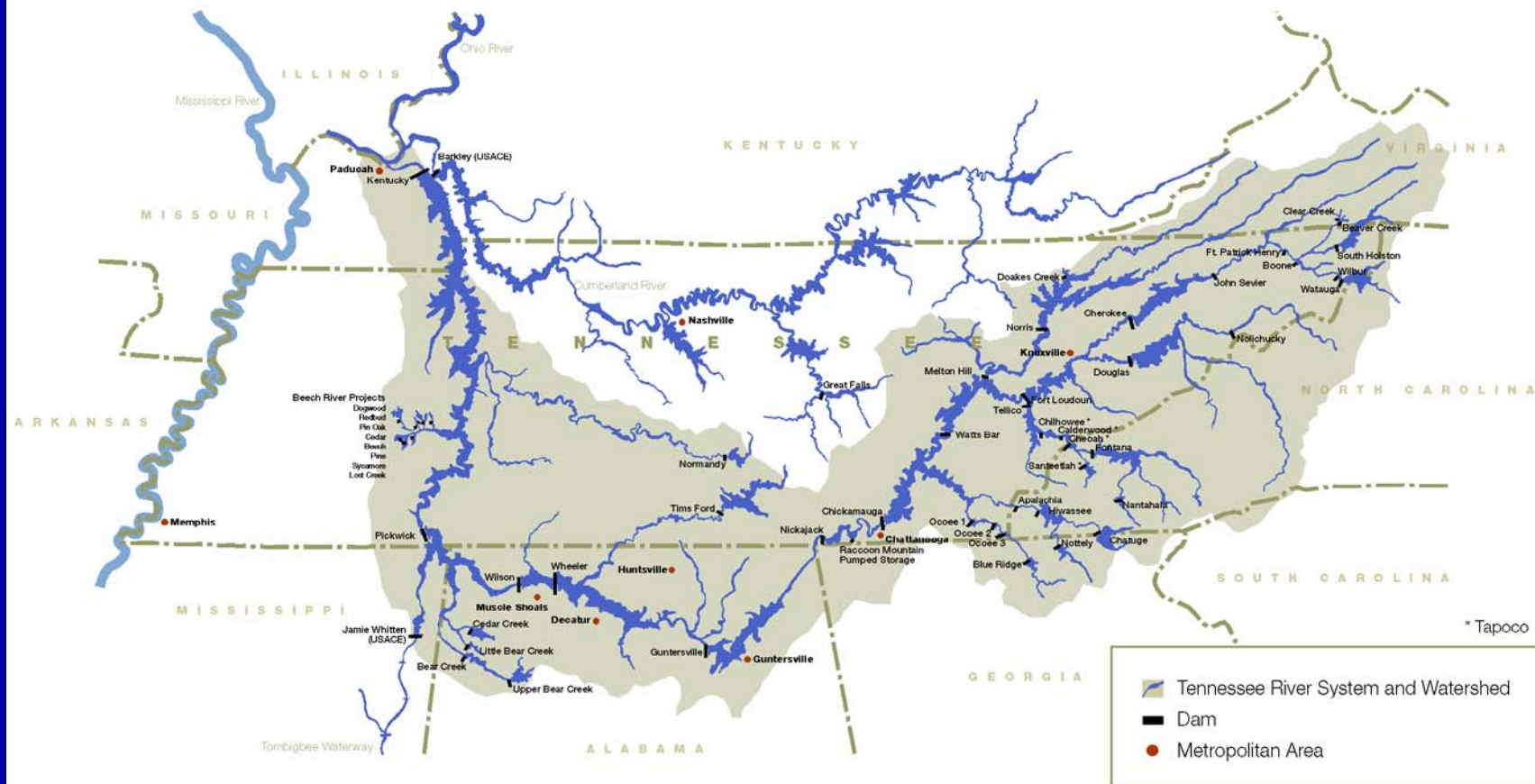
Best Observed Conditions adjusted using inferences of experienced biologists

Biologists were knowledgeable of:

- the reservoir system,
- resident fish species,
- susceptibility of individual species to electrofishing and gill netting, and
- effects of human-induced impacts on these species.

This approach results in higher expectations than would be obtained using maximum observed species richness based on individual samples.

# Tennessee River System



# *Reservoir Classification*

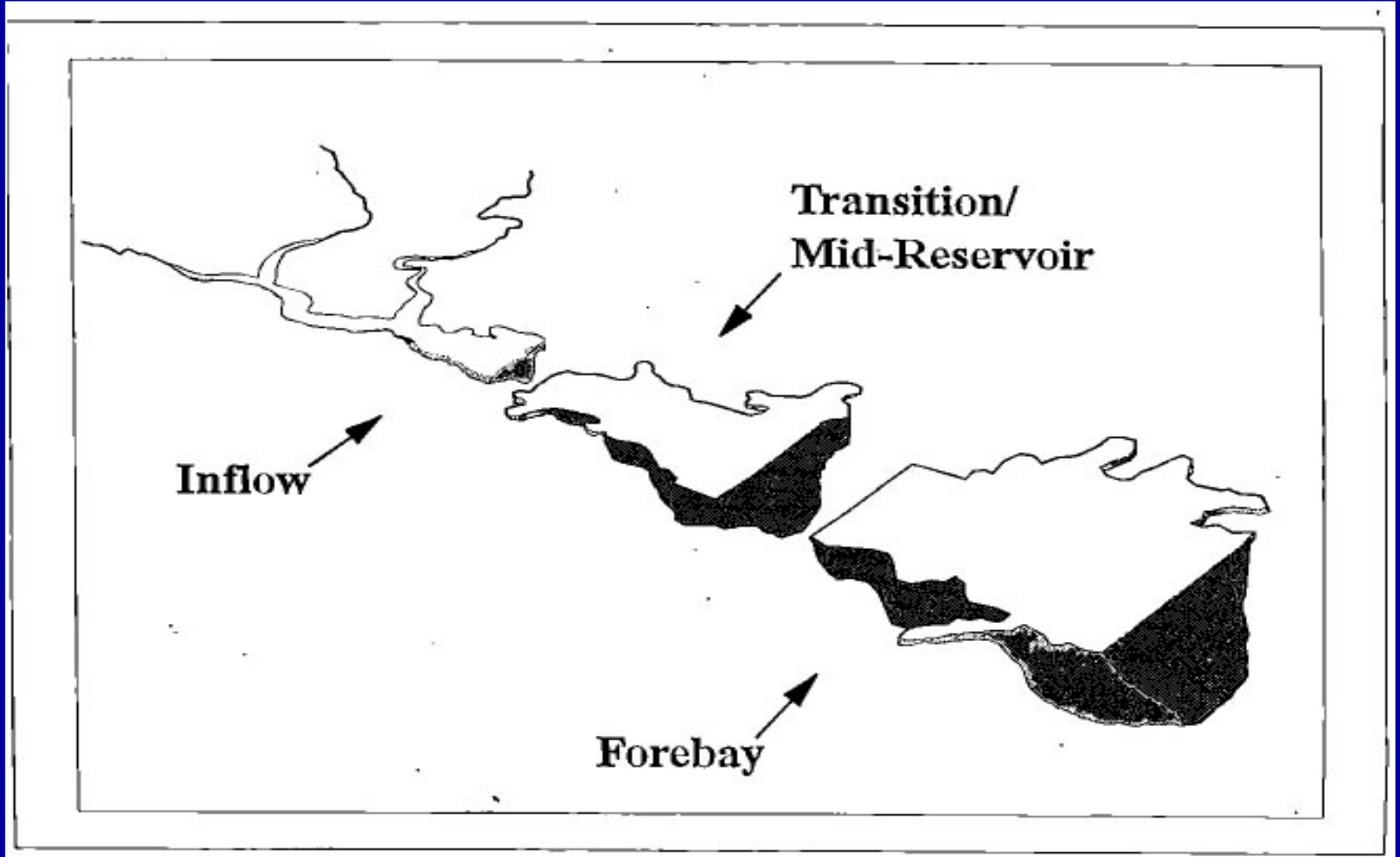
Separation of reservoirs into similar groups is a critical initial step in developing reference conditions.

- Geographic region
- Reservoir morphometry
- Watershed morphometry
- Water chemistry
- Operational characteristics

# TVA's Reservoir Classification



# *Reservoir Zones*



# *Categories of TVA's RFAI Metrics*

- Species Richness and Composition
- Trophic Composition
- Abundance
- Fish Health

# *Metrics Used to Evaluate Fish Assemblage Results*

## **Species Richness and Composition Metrics**

1. Total number of species
2. Number of centrarchid species
3. Number of benthic invertivore species
4. Number of intolerant species
5. Number of top carnivore species
6. Percent tolerant individuals (excluding Young-of-Year)
7. Percent non-native species
8. Percent dominance by one species

## **Trophic Composition Metrics**

9. Percent individuals as omnivores
10. Percent individuals as top carnivores

## **Abundance Metrics**

11. Average number per run

## **Fish Health Metrics**

12. Percent individuals with anomalies

# *Procedures Used to Establish TVA's RFAI Reference Conditions*

## Metric Category

Species richness

Abundance/proportional

Fish health

## Procedure

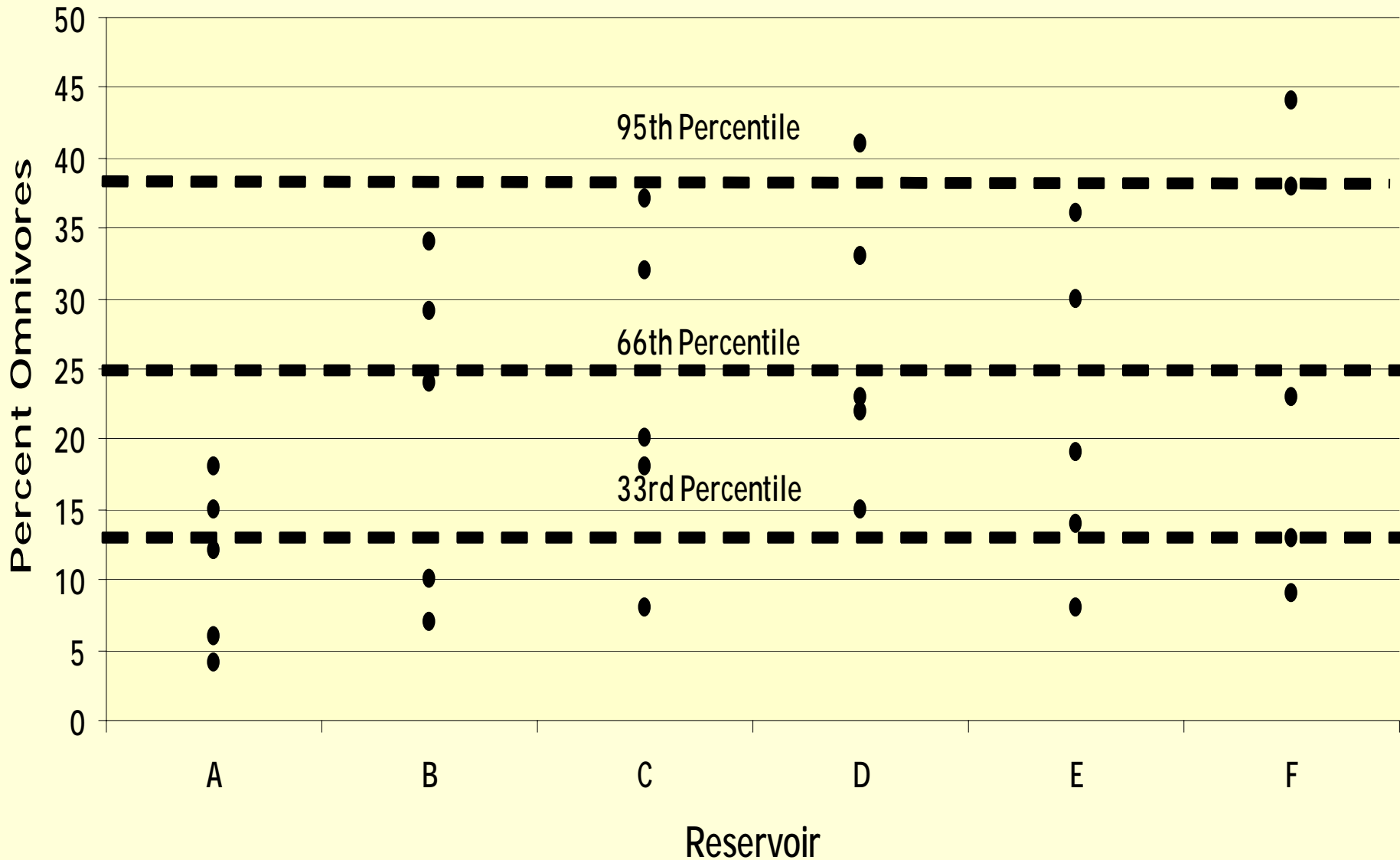
Expected species based  
on historical information

Best observed conditions -  
professional judgment

Stream IBI criteria



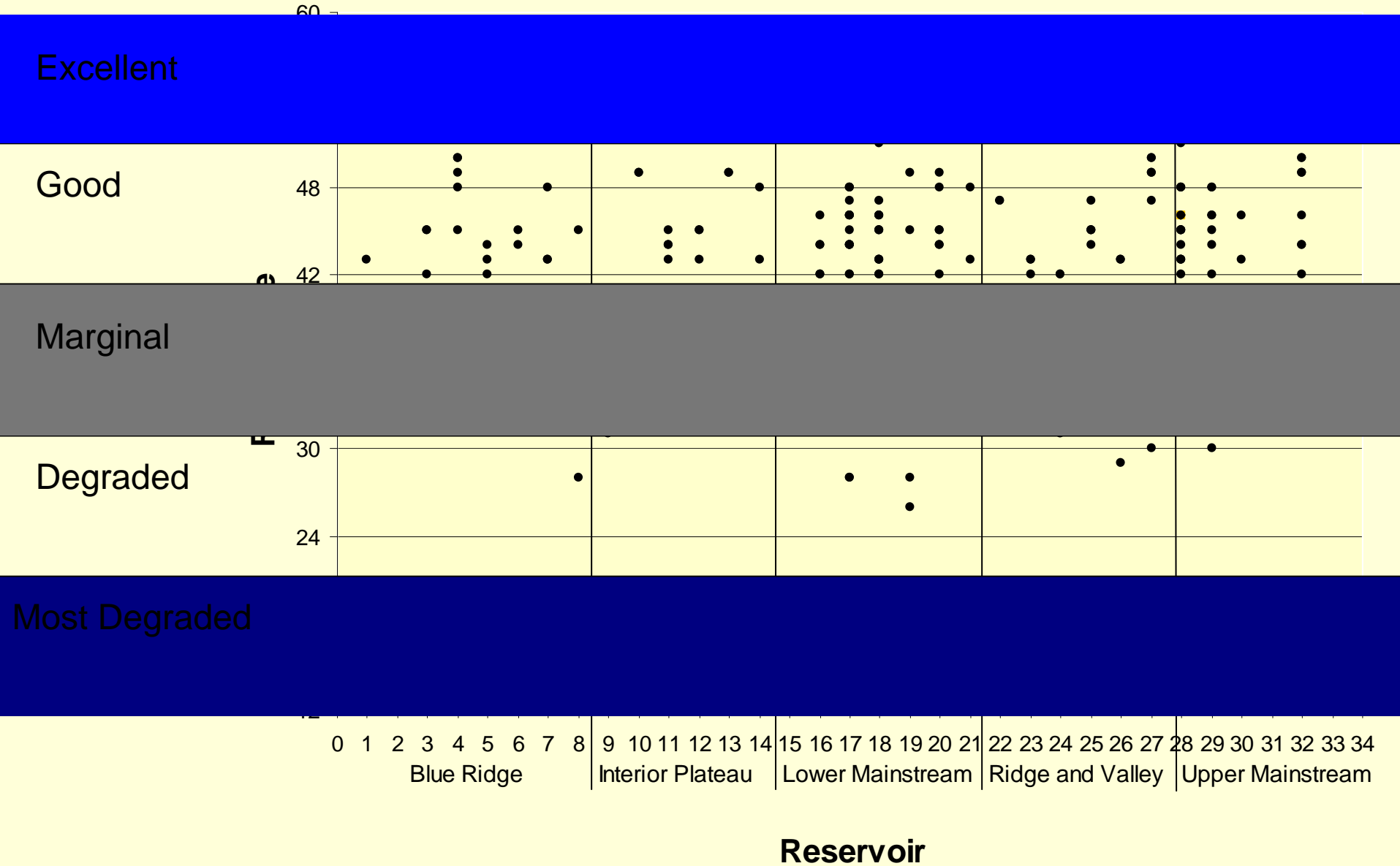
# Trisection of the Percent Individuals as Omnivores to obtain scoring criteria



# *RFAI Ratings*

- 52 – 60 Excellent
- 42 – 51 Good
- 32 – 41 Marginal
- 22 – 31 Degraded
- 12 – 21 Most Degraded

# Distribution of RFAI Scores 1999-2002



# *Concerns about using an IBI approach to develop a community health index for reservoirs*

- No natural reference conditions
- Is use of “least disturbed” appropriate as a reference condition?
- Is development of more conservative reference conditions using “best observed” conditions and increased through use of professional judgment adequate?

