

Aquatic Macroinvertebrates



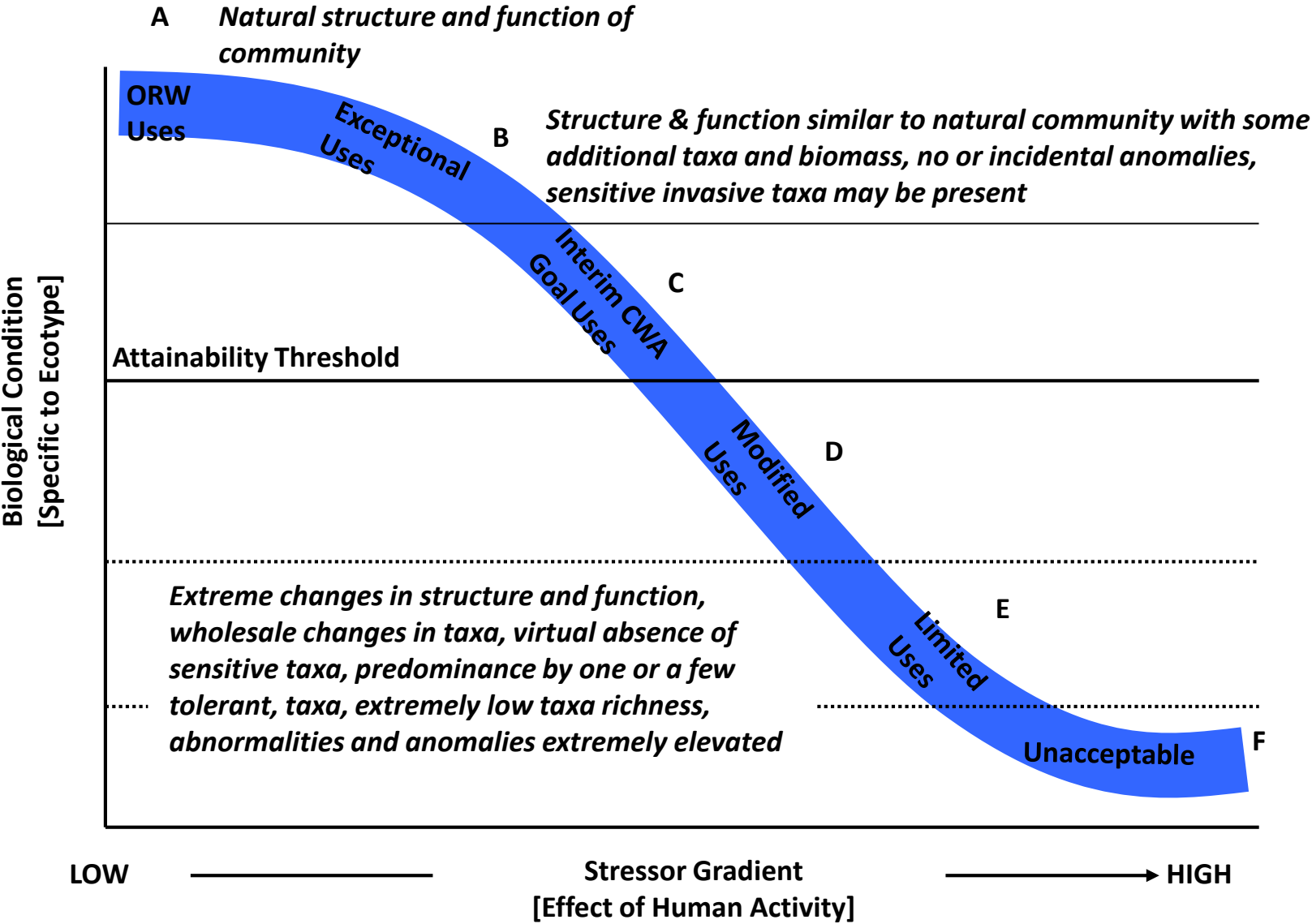
Jeremy Williamson

Water Quality Specialist

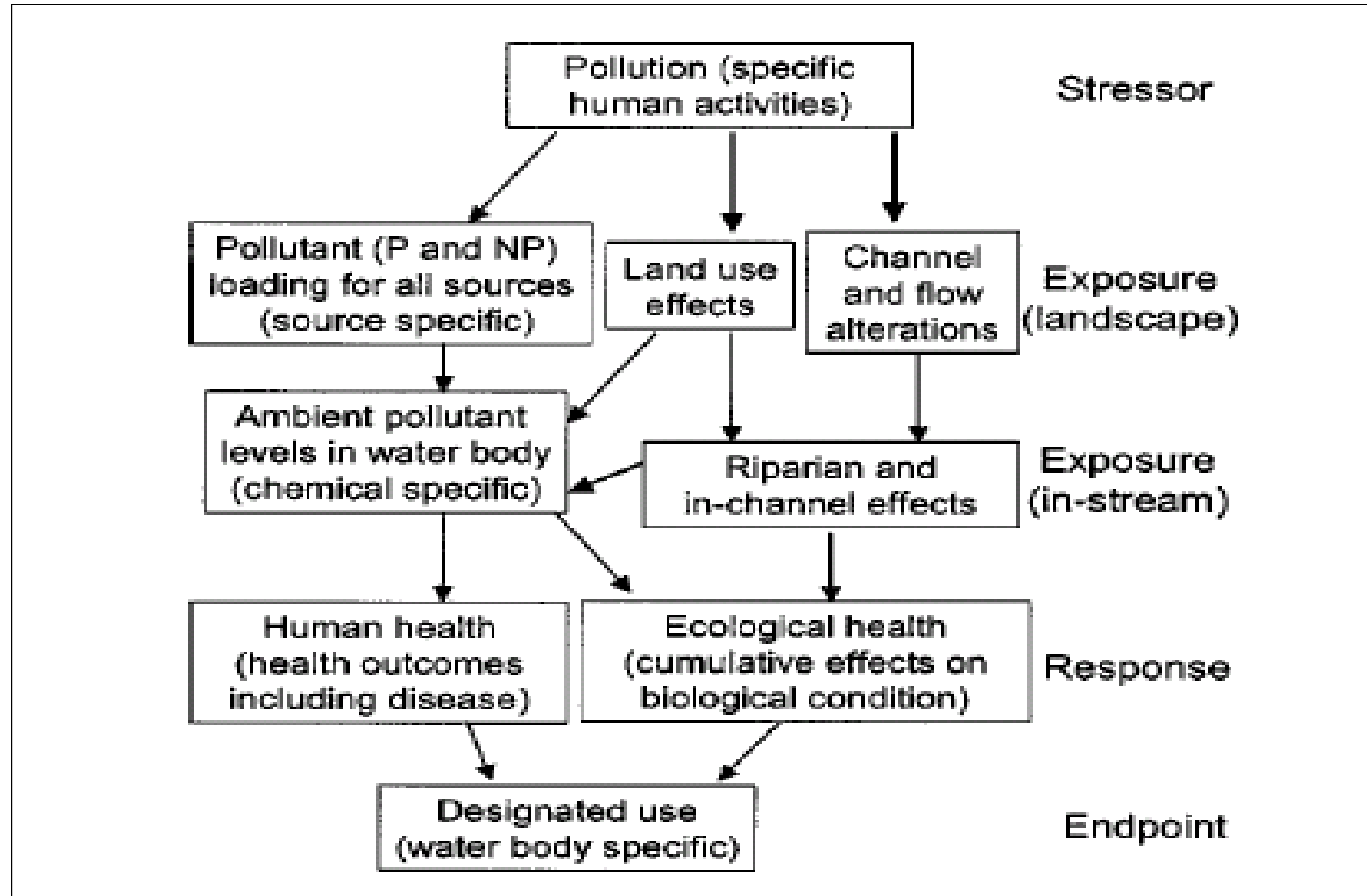
Invasive Species Biologist

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Rational



General Approach



Macroinvertebrates

- They are long term indicators of environmental quality
- They integrate water, sediment, and habitat qualities
- They have sensitive life stages that respond to stress
- They integrate both short-term and long-term environmental stressors



Chemical Factors

- Dissolved Oxygen
- Acidity & Alkalinity
- Hardness
- Nutrients



Respiratory systems

- Open Systems

- Spiracles
- Air Stores



- Closed Systems

- Diffusion through skin
- Gills
- Both



Some insects supplement O_2 within their body by chemical means



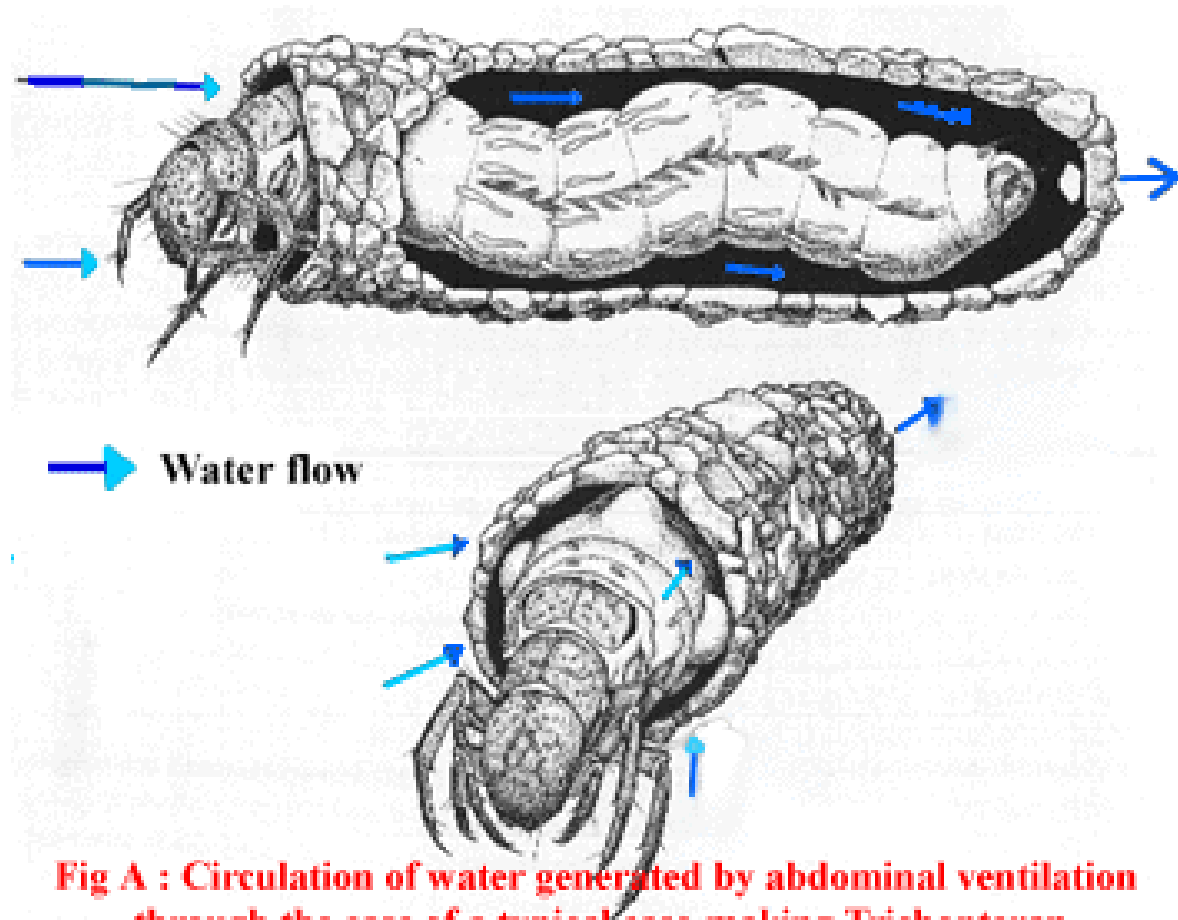
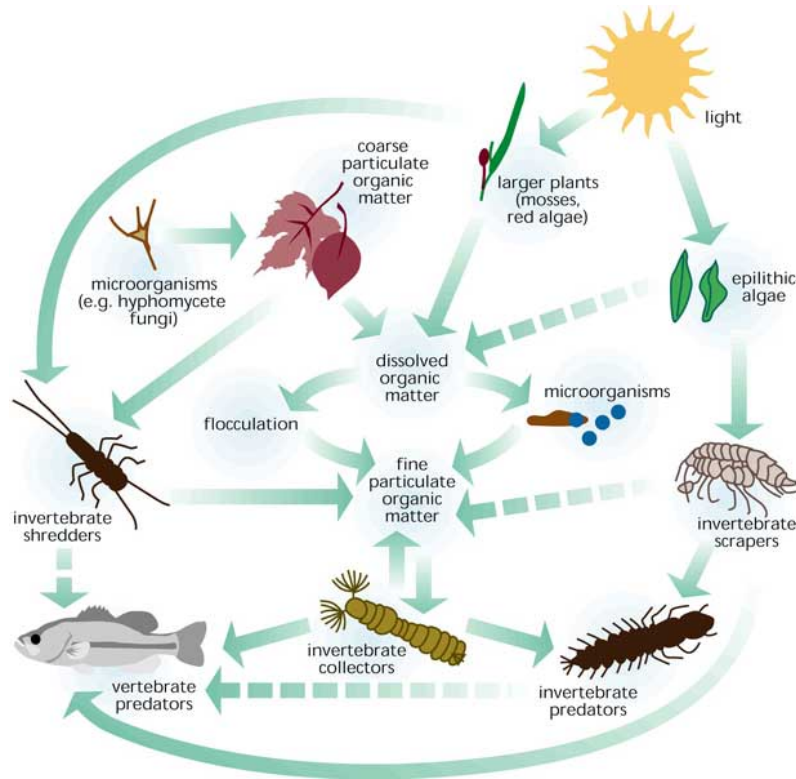


Fig A : Circulation of water generated by abdominal ventilation through the case of a typical case-making Trichopteran

Biological Factors: 3 major influences



- Organic substrate
- Food
- Relationships with other species



Functional Feeding Groups (FFG)



Shredders, Scrapers, & Collectors

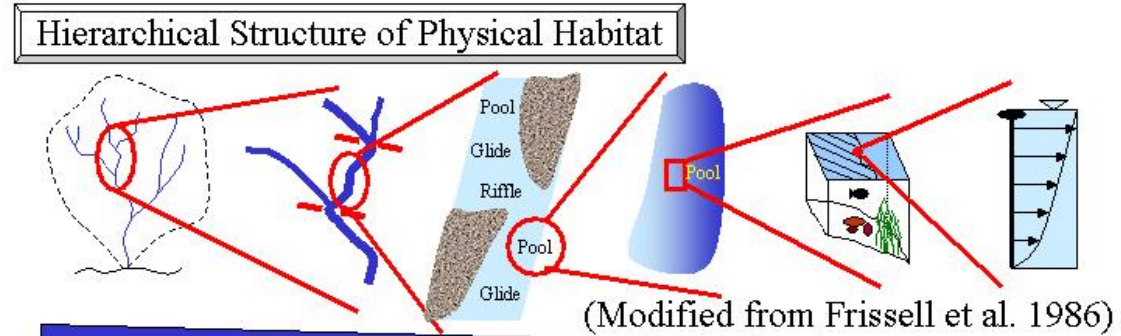


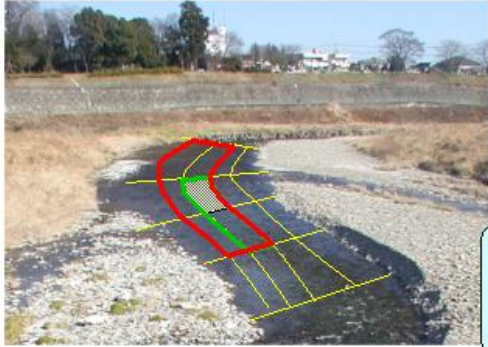
Piercers, Engulfers



Habitat

- Physical conditions
- Chemical conditions
- Organic substrates



Stream System	Reach System	Micro Habitat System	
Segment System	Pool/Riffle System	Subunit Scale	Local Point
	Unit Scale Evaluation	Evaluation	Evaluation
	Surrounding conditions of depth and velocity	Conditions of riverbed and bank vegetation	Local value of depth and velocity
Evaluation on point scale is insufficient. We need to evaluate more factors on inherent scales.			





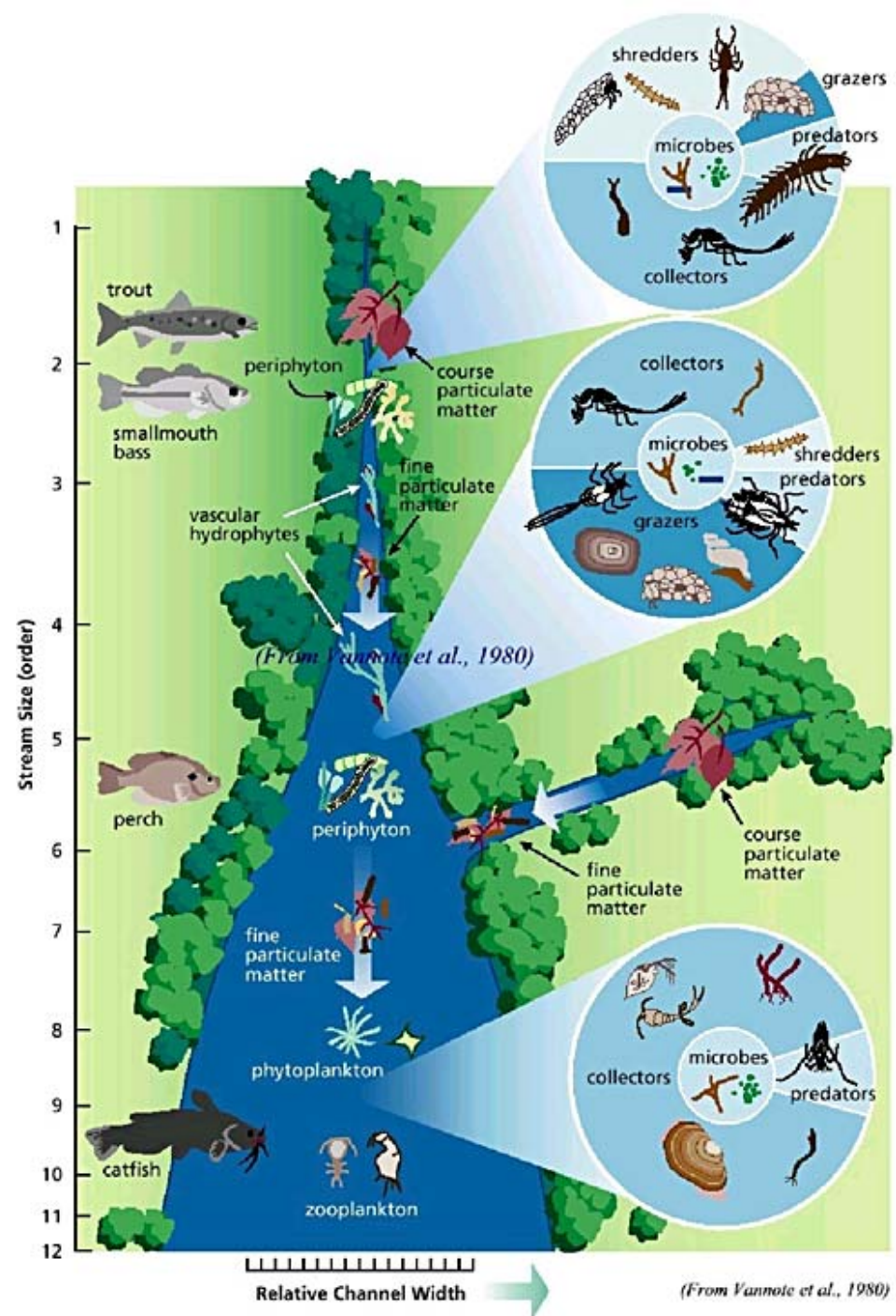
Functional Habitat Groups

- Clingers
- Climbers
- Crawlers
- Sprawlers
- Burrowers
- Swimmers
- Skaters
- Planktonic



River continuum concept

Vannote et al 1980



Biotic Indexing - Hilsenhoff Index

$$\bar{d} = \frac{N \log_2 N - \sum n_i \log_2 n_i}{N}$$

- Diversity index (not all species identifiable)

$$B.I. = \frac{\sum n_i a_i}{N}$$

- Biotic Index (ranking 0-5)

$$r_1 = 1 - \frac{6(\sum d^2)}{n(n^2 - 1)}$$

- Rank correlation analysis (B.I. correlated with chemical parameters)

Family Biotic Indexing (FBI)

- Family Biotic Index (Modified Hilsenhoff biotic index)
- Takes into account the sensitivities of all macroinvertebrates
- Low values show non-impacts
- High values show severe impacts
 - $FBI = \sum(x_i t_i) / N$
 - X is number of individuals in family i
 - T is the tolerance value
 - N is total number of organisms in a sample
 - Higher numbers indicate samples without intolerant organisms therefore impacted

FBI

An example:

$$\text{FBI} = \sum(x_i t_i) / N$$

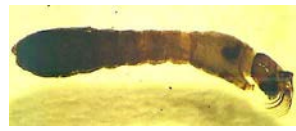
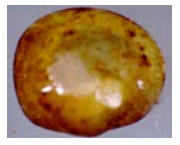
- $((12 * 4) / 52) + ((12 * 4) / 52) + ((8 * 4) / 52) + ((1 * 3) / 52) + ((1 * 1) / 52) + ((15 * 3) / 52) + ((2 * 6) / 52) + ((1 * 6) / 52) = 3.75$

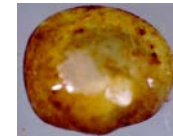
WAV Citizen Monitoring Index

	<u>E</u>	<u>F</u>		
Group1	___	x4	___	3.6 & up Excellent
Group2	___	x3	___	2.6-3.5 Good
Group3	___	x2	___	2.1-2.5 Fair
Group4	___	x1	___	1.0-2.0 Poor

F/E _____ / _____

Index Score _____





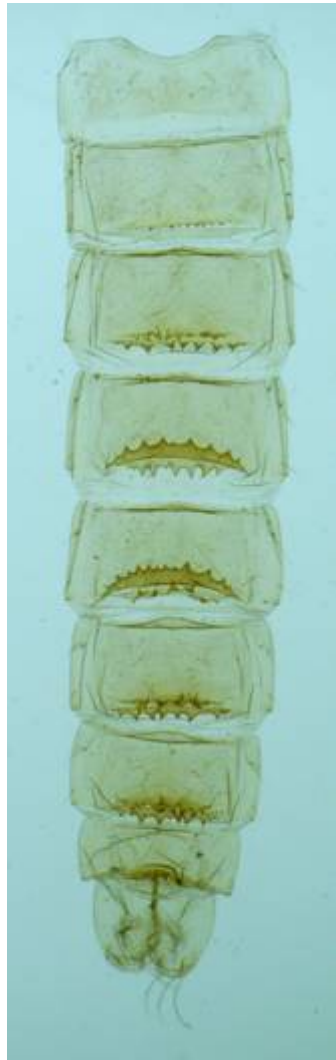
Dead Bodies Everywhere!

Surface-Floating Pupal Exuviae for Rapid Bioassessment

- First suggested by Thienemann in 1910
- Can overcome difficulties and objections to other macroinvertebrate collection methods
- Passive collection technique offers little opportunity for operator influence
- 50 – 100% efficiency when compared to total species richness
- The average time to sort and identify samples can be as low as 52.7 min. for a traditional method time averages 190.1 min.





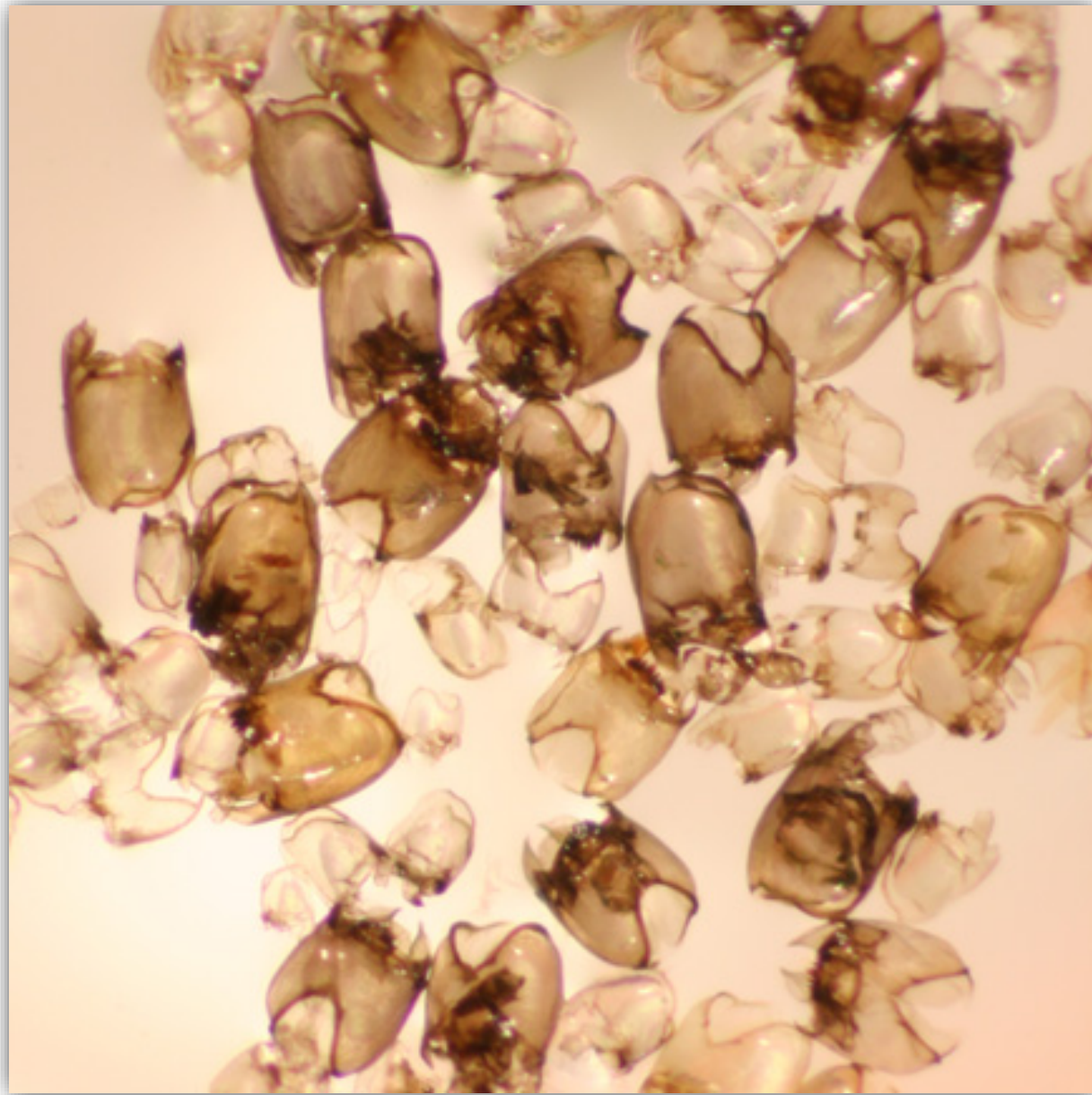


All photos by R W Bouchard

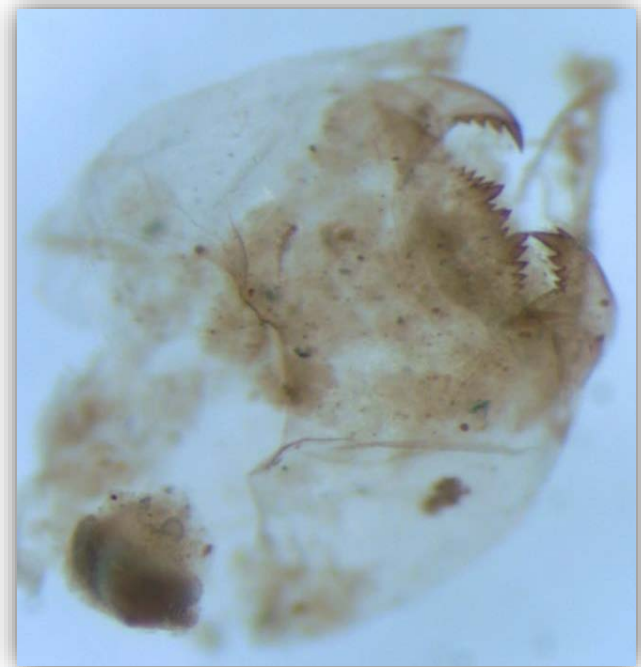
Dead Heads: Paleolimnology

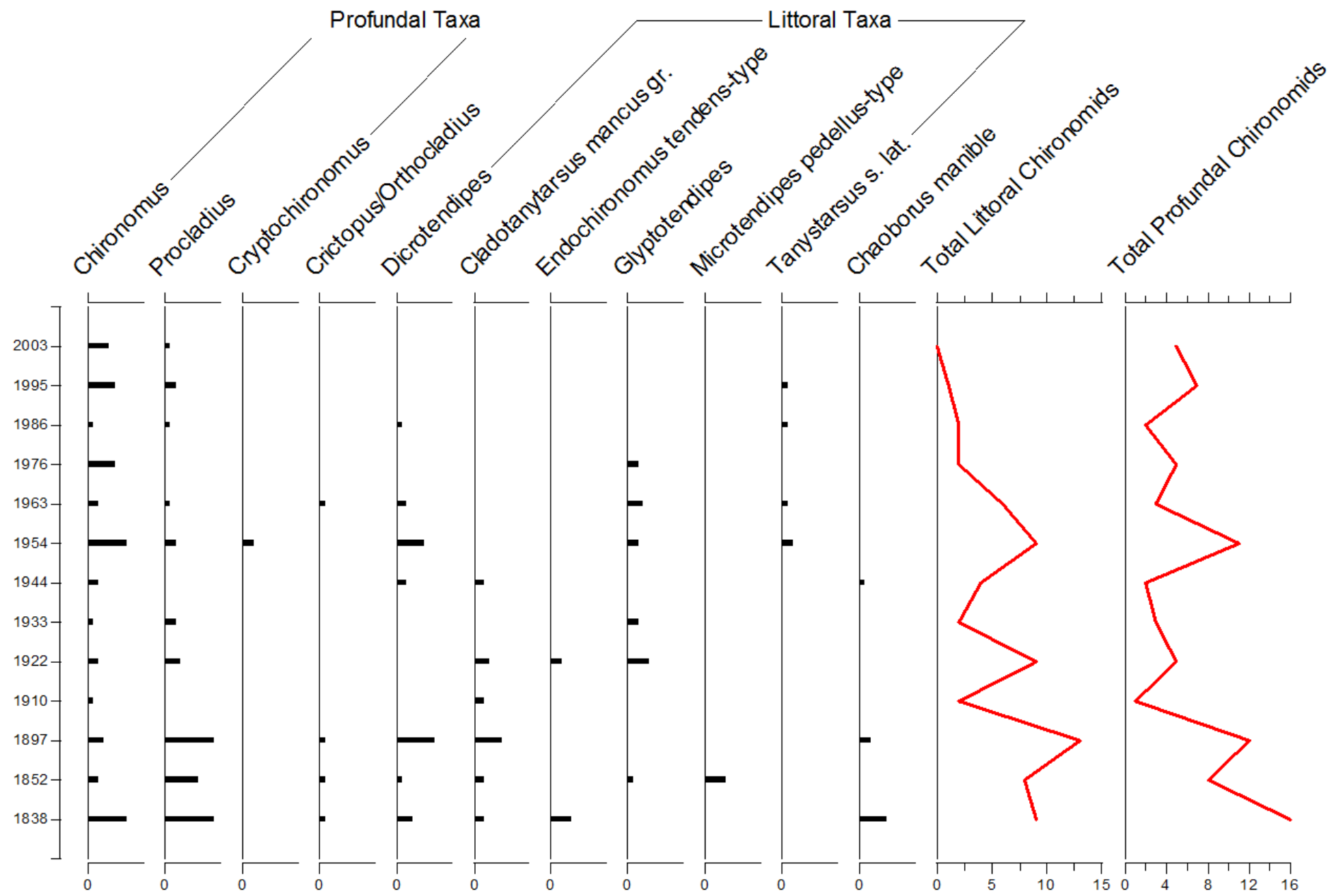


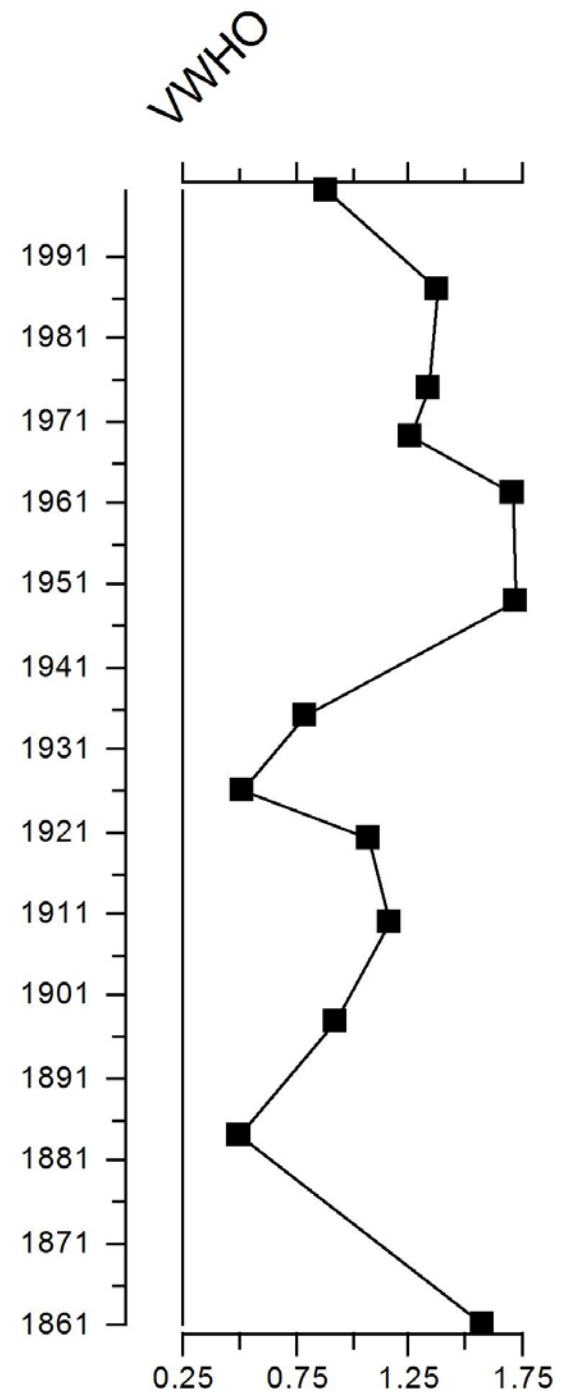
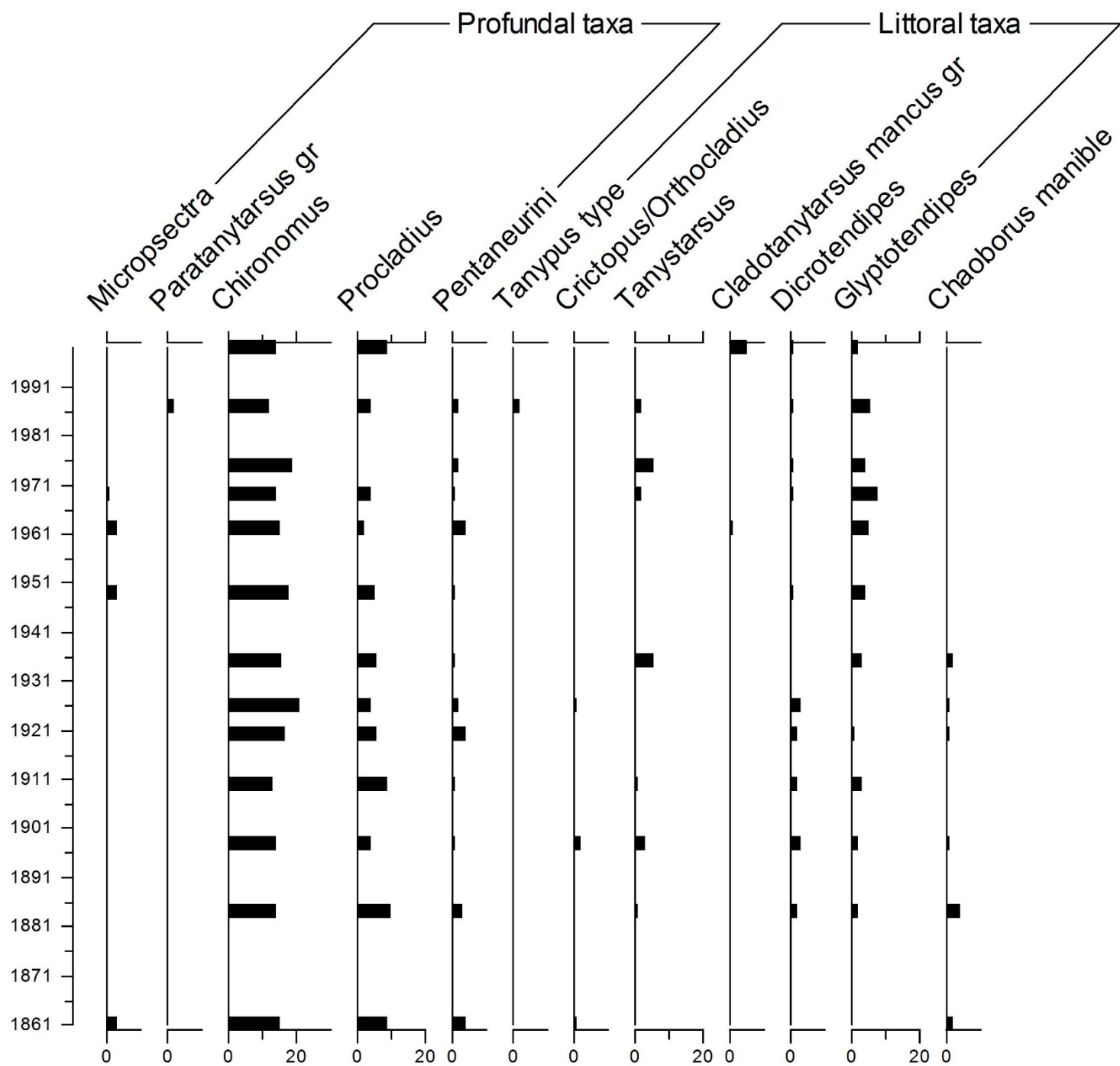












Questions?

