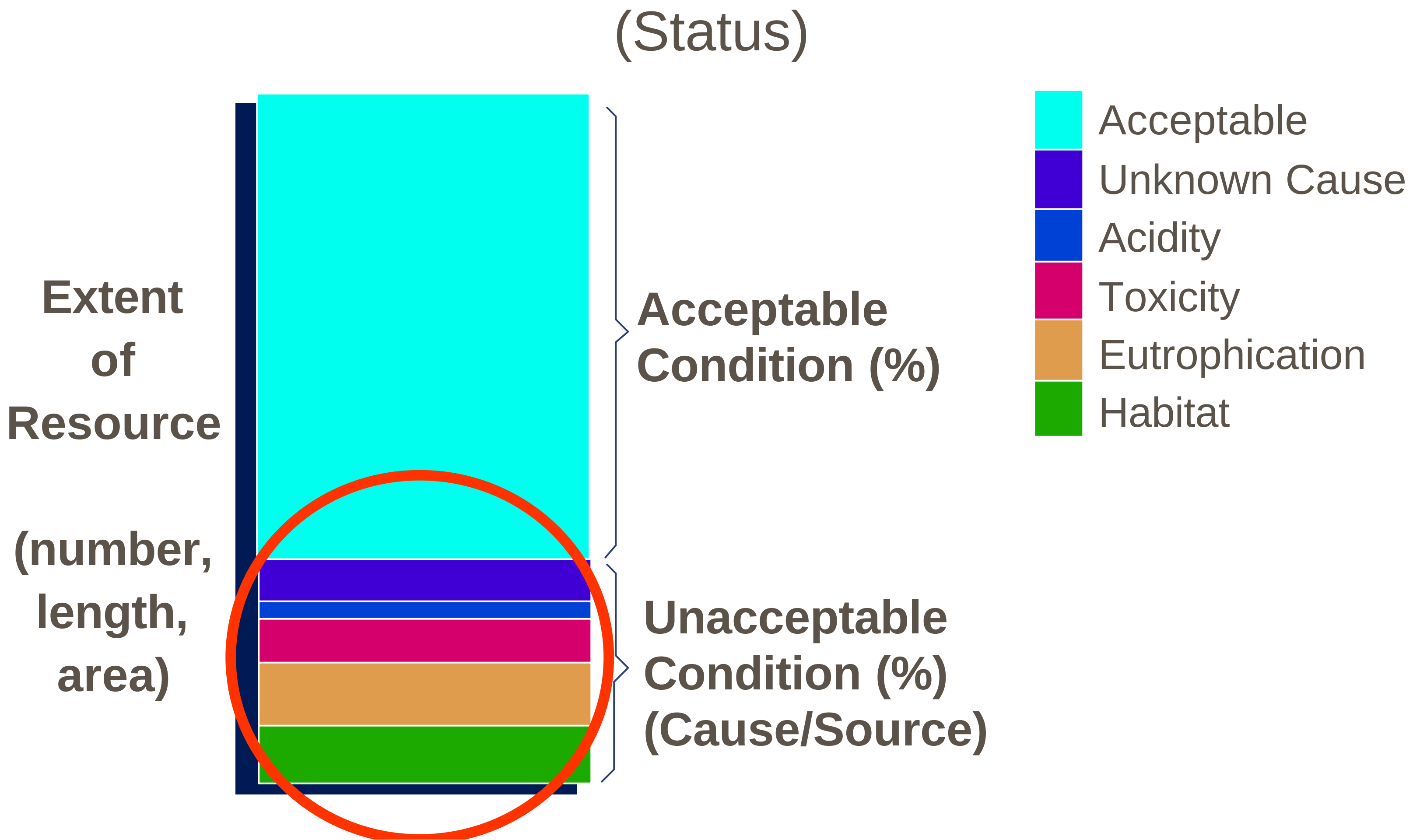
Ranking Stressors to Streams

John Van Sickle
John Stoddard
Steve Paulsen

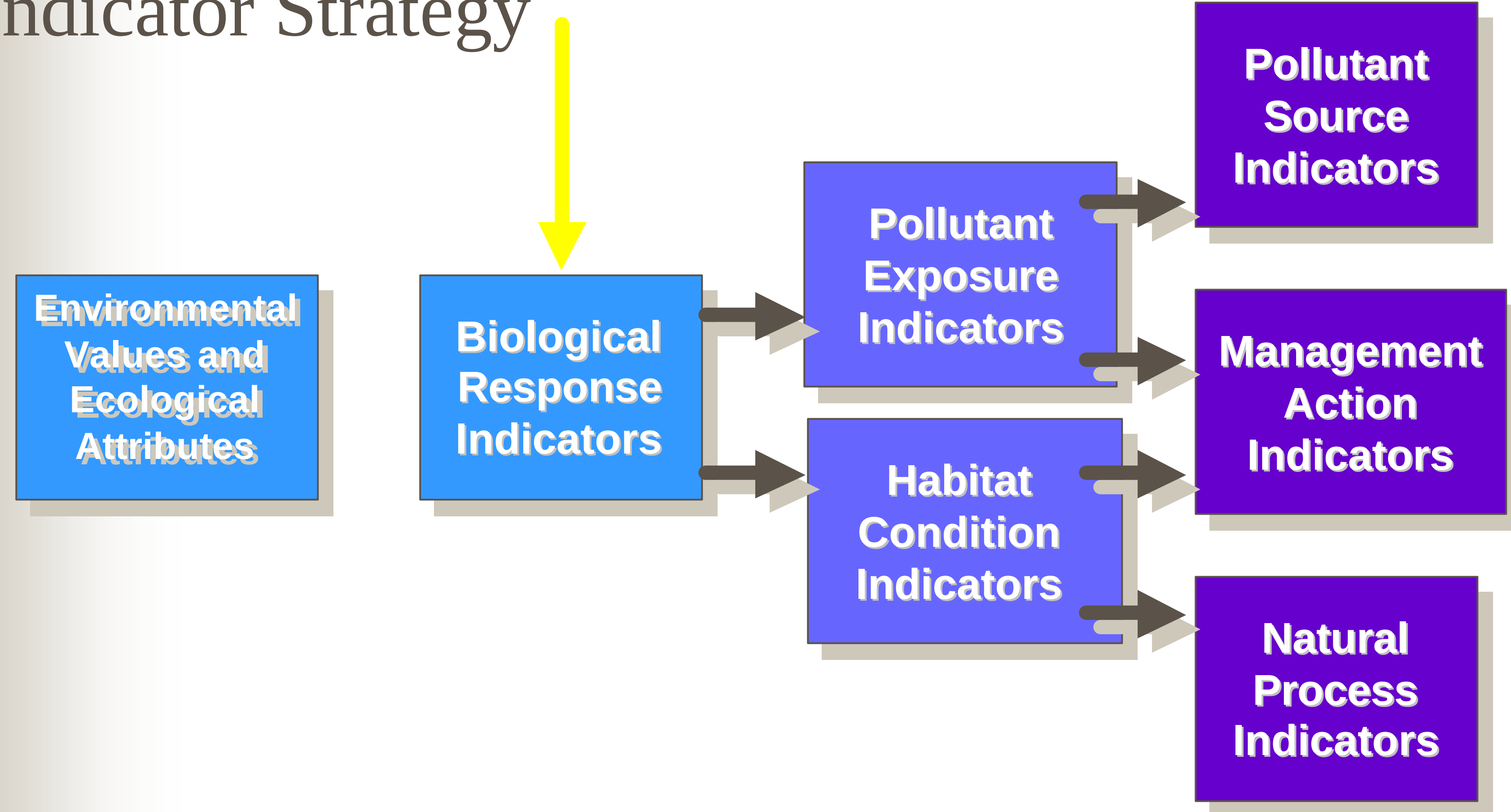
EMAP Symposium 2004

Status & Associations Questions



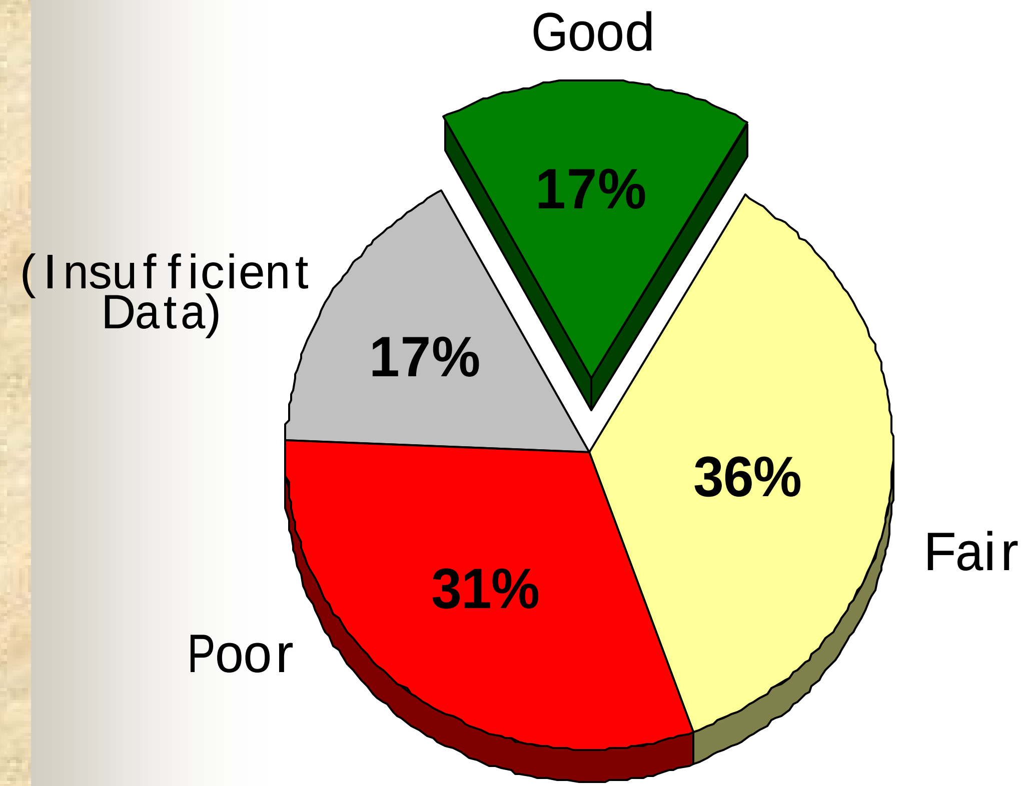
Increase Use of Direct Measures

Indicator Strategy



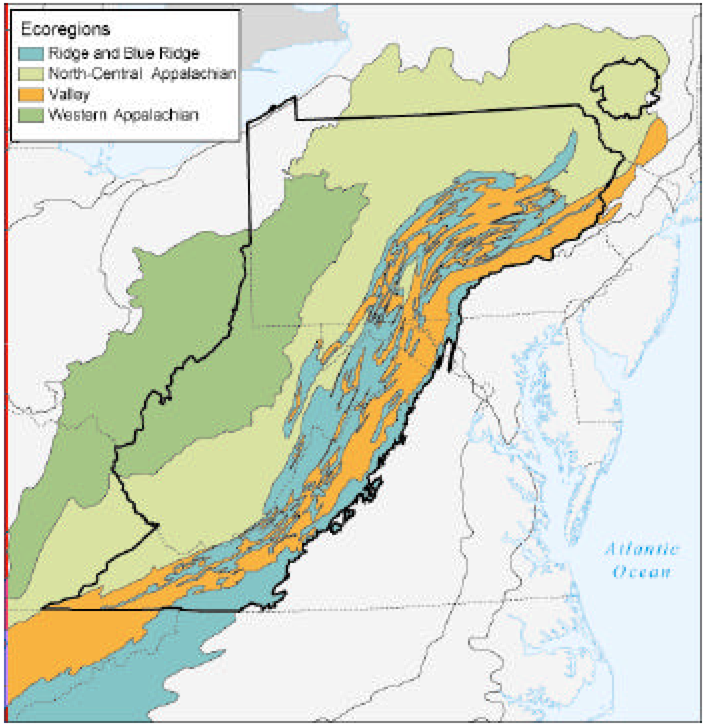
Mid-Atlantic Region

Regional Demonstration: Example EMAP Assessment: Answering OW 305(b) Questions



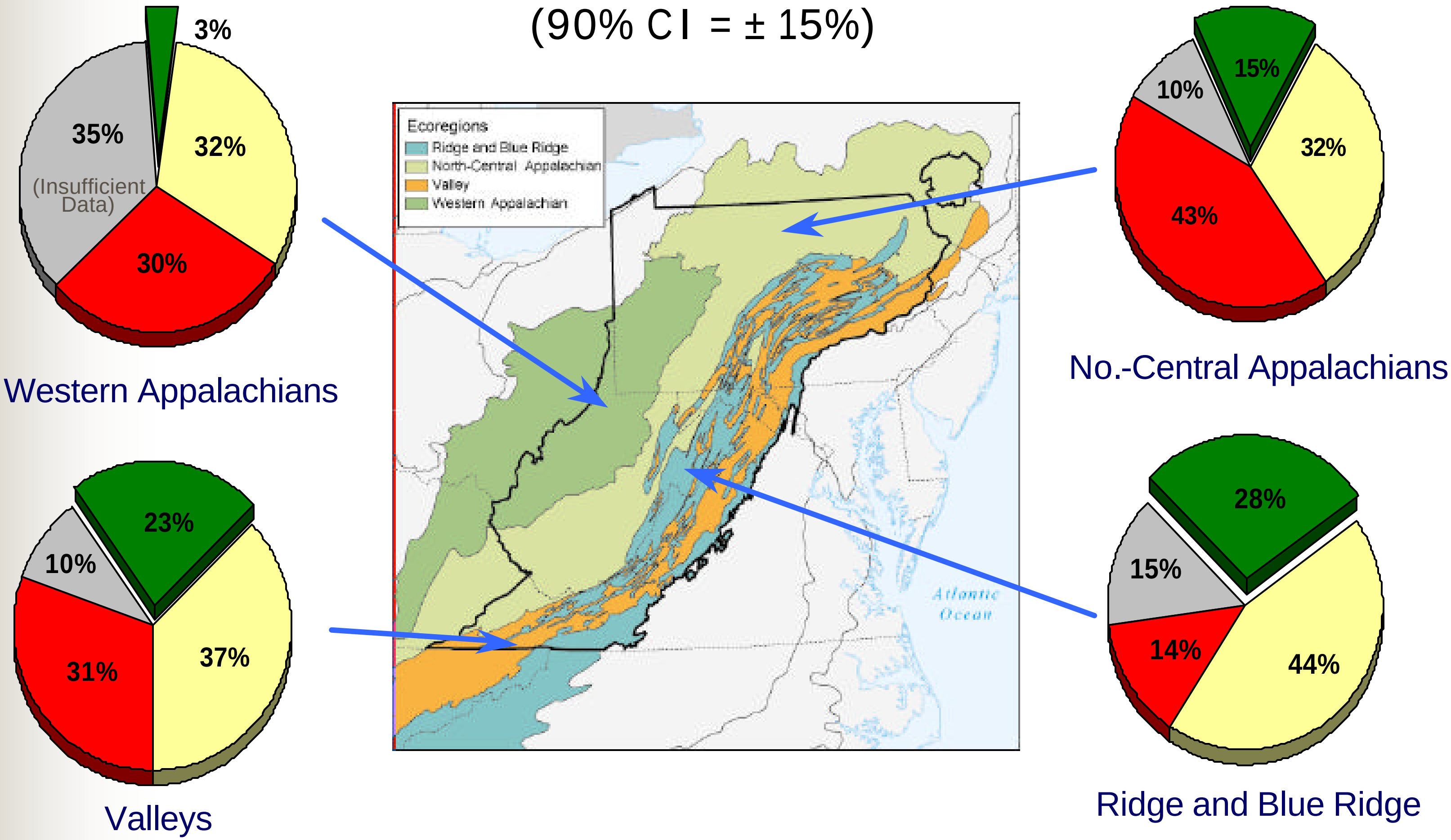
Proportion of Stream Length

Fish Index of Biotic Integrity example from Mid-Atlantic (90% CI = ± 15%)



Regional Demonstration: Example EMAP Assessment

Fish Index of Biotic Integrity
example from Mid-Atlantic
(90% CI = ± 15%)



What Stressors to Focus On?

- The next step is to help understand which stressors should be the major focus for remediation, restoration, or protection?
- If the goal is to produce the greatest improvement in miles of stream with good biological integrity, on which stressors should we focus?
- How do we rank the stressors?

Problem:

Assessing the relative importance of multiple stressors.

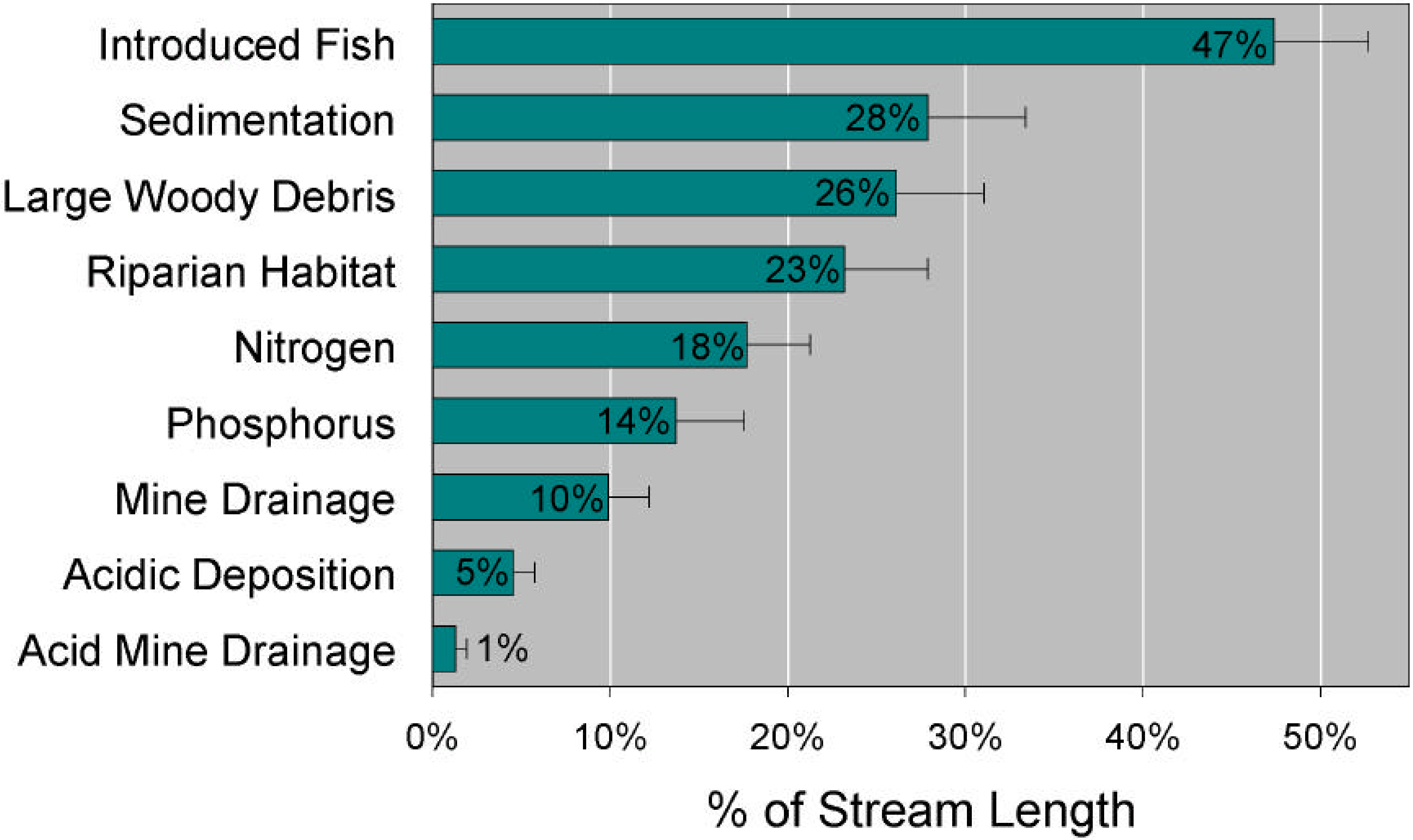
Initial Approach:

Compare regional prevalence of each stressor.

Define "Poor" condition for each stressor.

Estimate percent of stream miles in poor condition.

Ranking of Stressors



Limitations of previous approach:

1) Stressor "importance" should also be based on the severity of its effects on biological endpoints.

2) Definitions of "Poor" and "Good" condition may be poorly defined, either for stressors or endpoints.

To move forward:

1) Assess the strength of association between stressors and endpoints, as a surrogate for "effect severity".

2) Explore association methods for continuous, as well as class-based, stressors and endpoints.

Stressor Ranking: Risk

Goal:
-- To rank stressors, based on their strength of association with biological response indicators.

Approach:
-- Use stressor and response <u>classes</u> (MAHA report).

Responses: EPT Richness and Fish IBI and Periphyton IBI

Stressors:

- Excess sediment
- Riparian condition
- Acid mine drainage
- Acid deposition
- Total P
- Total N

Basic tool -- 2-way table

Example: EPT Richness vs. Excess Sediment, ("Base grid" sites, n=80)

Site counts

	SED GOOD	SED MARG	SED POOR	Total
EPT GOOD	14	8	0	22
EPT MARG	13	18	5	36
EPT POOR	2	8	12	22
Total	29	34	17	80

Percent of Stream Length

	SED GOOD	SED MARG	SED POOR	Total
EPT GOOD	17	12	0	29
EPT MARG	15	21	7	43
EPT POOR	3	7	18	28
Total	35	40	25	100

Association strength:

Calculate the Relative Risk of "Poor" EPT richness, in streams having "Poor" sediment, versus streams having "OK" sediment.

$$RR = \frac{\Pr(\text{Poor EPT, given Poor SED})}{\Pr(\text{Poor EPT, given OK SED})}$$

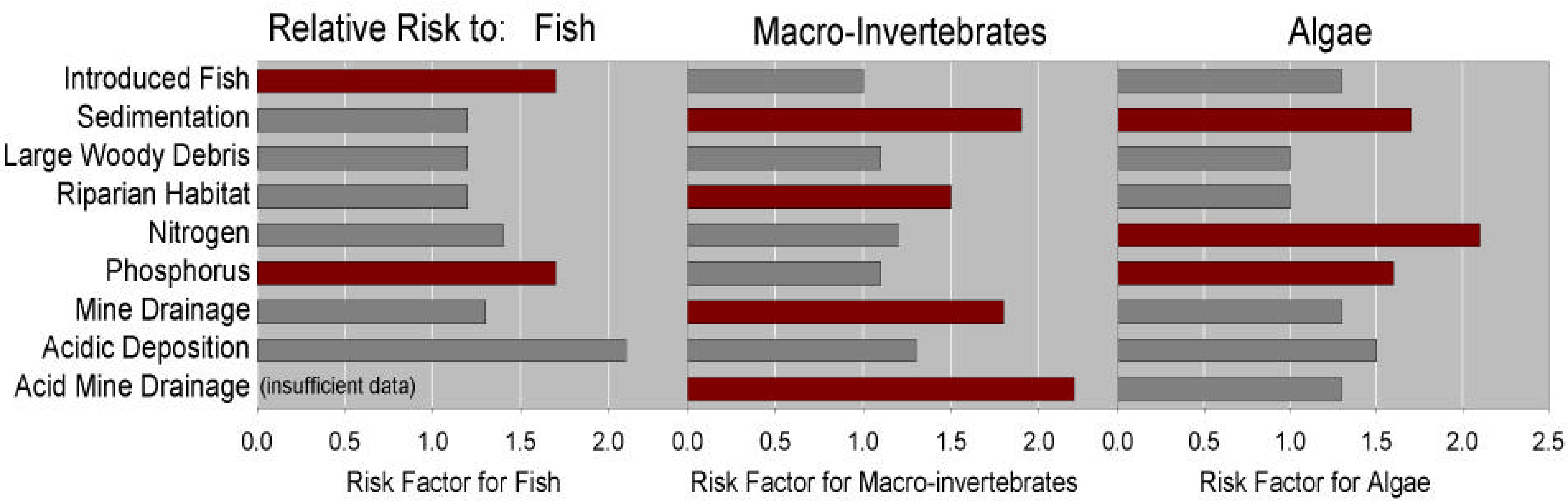
$$RR = \frac{.18/.25}{.10/.75} = 5.4$$

Proportion of stream length
(Pearson $X^2 = 24.7$)

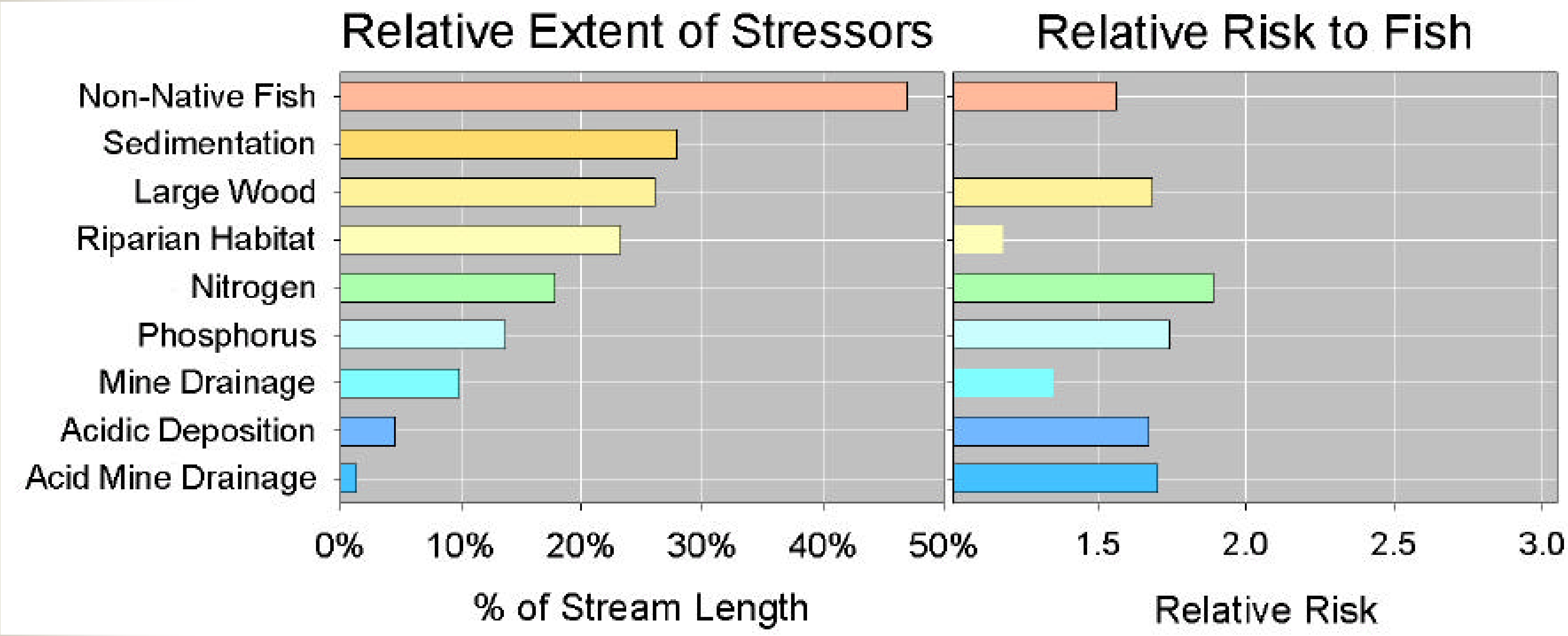
	SED OK	SED POOR	Total
EPT OK	.65	.07	.72
EPT POOR	.10	.18	.28
Total	.75	.25	1.00

So: **"The risk of Poor EPT is 5.4 times greater in streams with Poor SED than in streams with OK SED."**

Relative Risk of Stressors

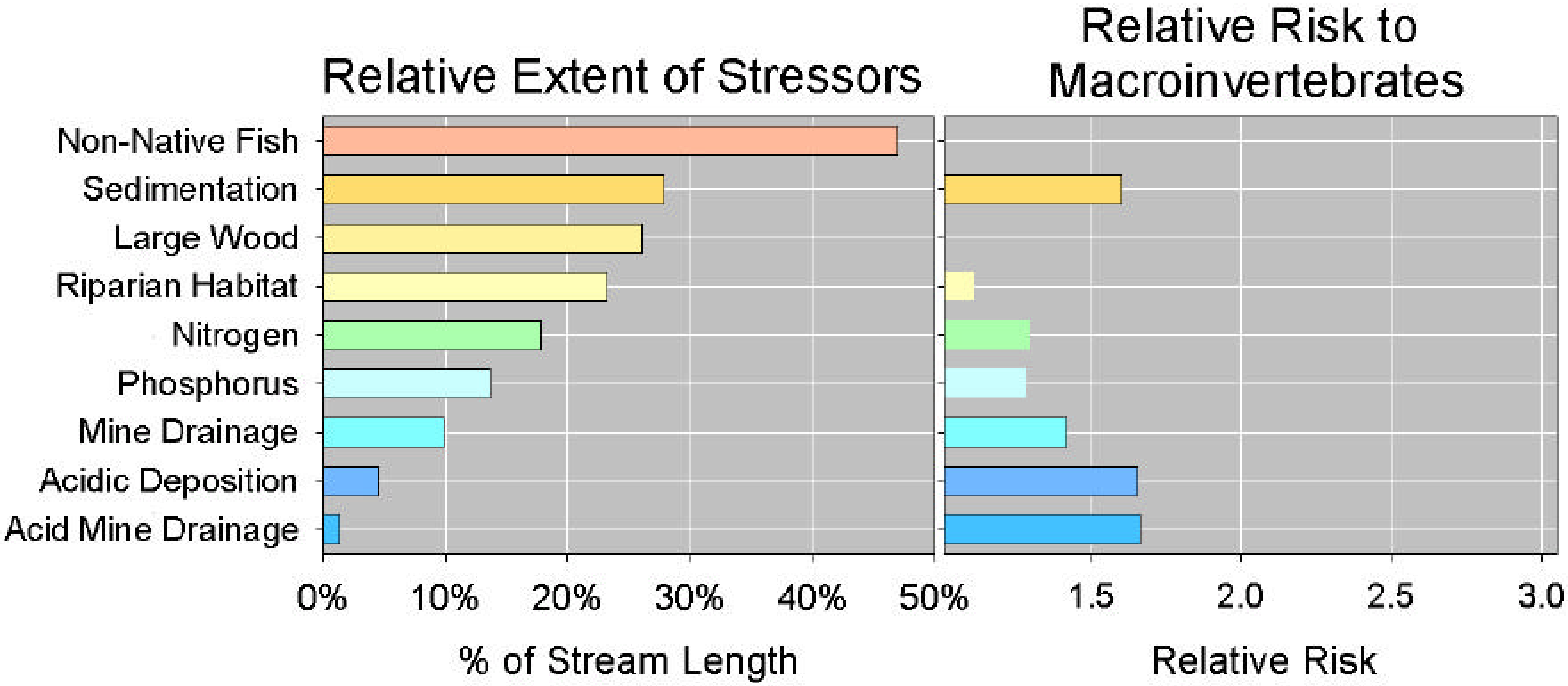


Fish

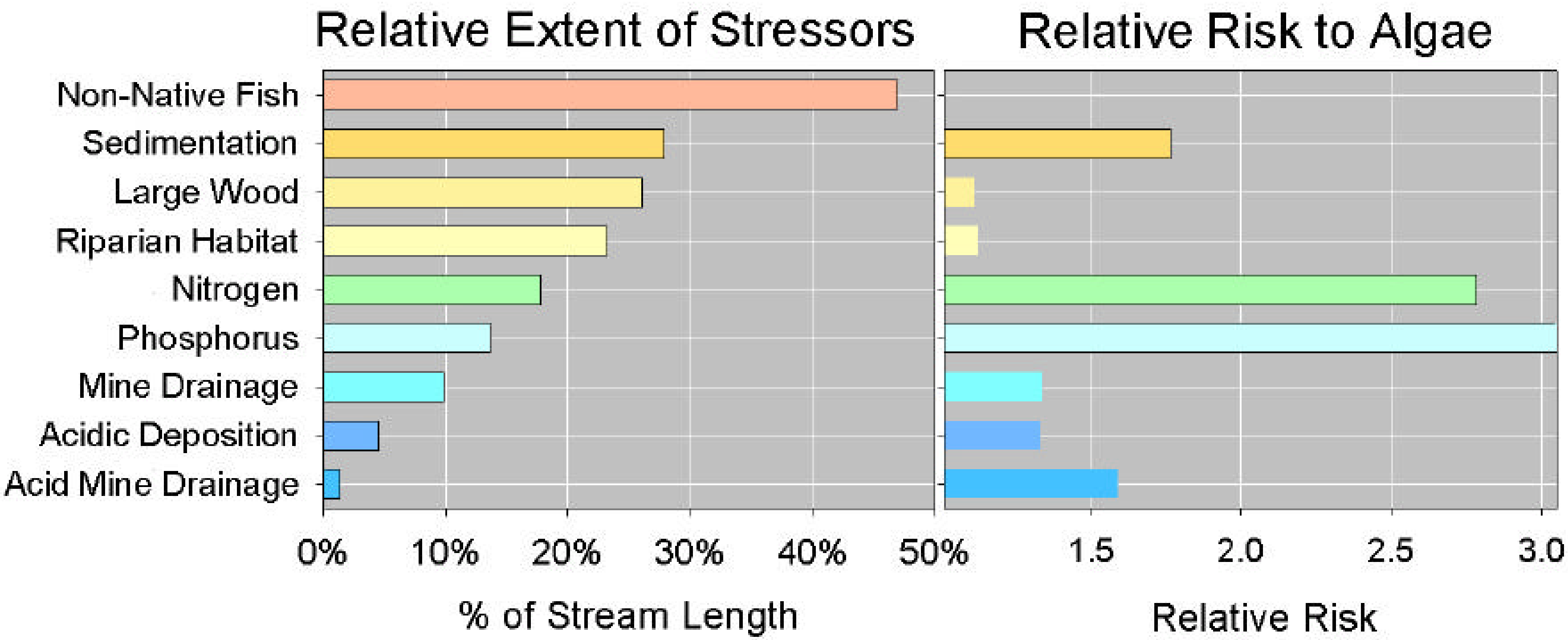


Relative Extent of Stressors
Relative Risk to Fish
Non-Native Fish
Sedimentation
Large Wood
Riparian Habitat
Nitrogen
Phosphorus
Mine Drainage
Acidic Deposition
Acid Mine Drainage
0%
10%
20%
30%
40%
50%
1.5
2.0
2.5
3.0
% of Stream Length
Relative Risk

Macroinvertebrates



Algae



Relative Extent of Stressors
Relative Risk to Algae
Non-Native Fish
Sedimentation
Large Wood
Riparian Habitat
Nitrogen
Phosphorus
Mine Drainage
Acidic Deposition
Acid Mine Drainage
0%
10%
20%
30%
40%
50%
1.5
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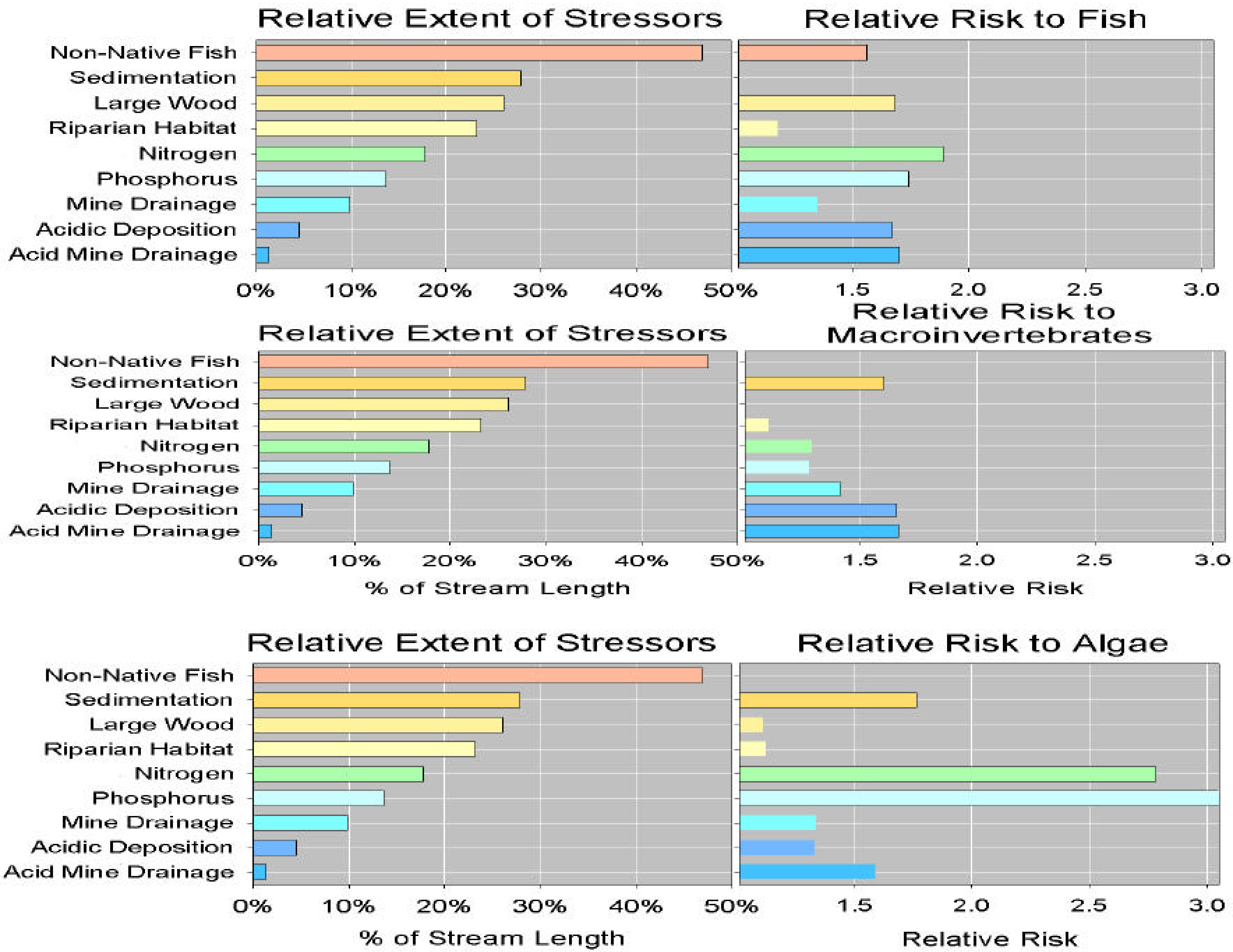
% of Stream Length
Relative Risk



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Relative Risk

Issues for class-based associations and "Relative Risk"

"Risk" language – Should we use it?

Sample sizes
-- Strong constraint on estimates and their uncertainty.
-- Separate analyses unlikely, for subbasins, ecoregions.

Defining classes.
-- Strive for only 2 classes per variable.
-- Avoid rare classes.

How best to communicate results?