A Biological Condition Gradient (BCG) Assessment Model for Stream Fish Communities of Connecticut and Southern New England

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Background

The Biological Condition Gradient (BCG) is a model that describes how communities respond to stress placed on a system. The US EPA and Connecticut Department of Energy and Environmental Protection (CT DEEP) Bureau of Water Protection and Land Reuse (WP&LR) have partnered to calibrate a BCG model for freshwater fish assemblages (cold and cool) in navigable streams of Connecticut. The two BCG models have the following benefits for describing fish communities:

- Anchored in the “natural” condition
- Conceptually very easy to understand
- Provides an “interpretation” framework for results generated from different:
  - Sampling or Analytical Methodologies
  - Scenarios
  - Habitat types
  - Community types
- Management goals and objectives

Methods

We followed the BCG calibration process that is summarized in Figure 1 and outlined below:

- Collect fish community data – BCG samples from 676 unique stations, with sample dates ranging from 1999-2010. Sample locations are shown in Figure 2.

- Classify sample locations – Using The Nature Conservancy’s Northeast Aquatic Habitat Classification (Olivero and Anderson 2002), each of the sample locations were classified into either cold, cool, or warm. In addition each was assigned a watershed size subclass, using the following arbitrary thresholds: small = less than 5 square miles, medium = 5 to 10 square miles, and large = greater than 50 square miles.

- Calibrate species attributes – Regional biologists assigned BCG attribute levels based on their knowledge of the species composition of the same samples were counted as separate taxa.

- Assign BCG level to samples – The same biologists were provided fish taxa lists from individual samples without knowledge of sample location, so as not to bias decision making, and asked to assign a BCG level to each (Figure 3). The intent of this exercise was to achieve consensus on BCG level assignments for each sample and to identify rules that the biologists were using to make their assignments. The verbal rules and decisions of the biologists were converted to quantitative decision criteria, for assigning BCG levels for each sample and to identify rules that the biologists used to assign BCG levels.

Results

Regional biologists made BCG level assignments on 41 coldwater samples and 53 cool water samples. Results were used to develop quantitative decision criteria rules for cold and transitional cool stream habitats. When model performance was evaluated, the model matched exactly with the regional biologists BCG level assignments on 78% of the coldwater samples and the cool model matched exactly on 72% of the samples. Although we were able to make progress towards calibrating the BCG models in this phase of work, results indicate that more work needs to be done, particularly on the cool model. Next steps will be to refine and then validate the models. Size and temperature subclasses should also be revisited.

Acknowledgments

The general consensus was that BCG level 1 required absence of non-native trout. Non-native trout are regarded as indicators of good water quality and coldwater habitat, but they do represent an altenate assemblage. The general consensus was that BCG level 1 required absence of non-native trout. No one assemblage is expected to be able to discriminate all BCG levels. So let the debate continue.

Literature cited

- Connecticut Department of Energy and Environmental Protection (CT DEEP). 2007. BCG Fish Long Form and Future Uses of BCG Fish Long Form. US EPA. Office of Environmental and Ecosystems EDUCATION.

Funding for this project was provided by U.S. EPA Office of Science and Technology.

Do BCG level 1 samples exist in the Northeast?

YES! - The participating fish biologists felt that BCG level 1 was attainable for small coldwater streams (rivers). As the definition of BCG “1” natural condition and CT has a very limited list of native fish species, it is very apparent that cold water habitat in streams with large catchments have baselines similar to those found pre-humans disturbances.

NO! - Unlike the fish community, macroinvertebrate communities have hundreds of species to choose from. Therefore macroinvertebrates biologists struggled with the question because many felt there is not enough information to know what the historical assemblage on this stream looked like.

The bottom line – it is still difficult to distinguish between BCG level 1 for the small streams using either assemblage, and not one assemblage is expected to be able to discriminate all BCG levels. So let the debate continue.

Weren't non-native salmonids viewed as a positive or a negative?

It was difficult for the regional biologists to reach a consensus on how to rate samples with non-native trout. Non-native trout are regarded as indicators of good water quality and coldwater habitat, but they do represent an alternate assemblage. The general consensus was that BCG level 1 required absence of non-native trout. Definition of BCG level 1 does not explicitly state that non-natives cannot be present, however it does state that such structure must be preserved. So if non-natives are present, they cannot be discriminated.

were BCG level 1 samples exist in the Northeast?

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