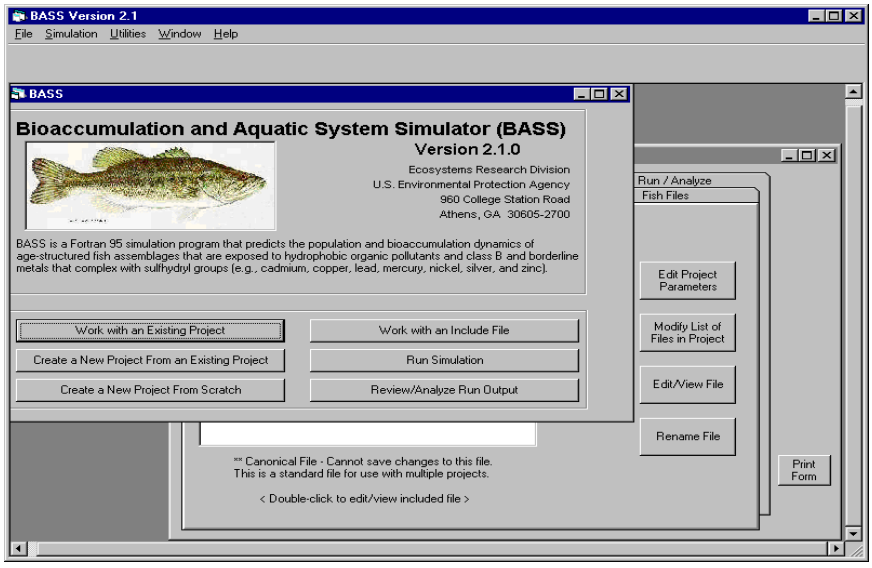
BASS: Bioaccumulation and Aquatic System Simulator

What is BASS?

The Bioaccumulation and Aquatic System Simulator (BASS) is a computer model that simulates the population and bioaccumulation dynamics of age-structured fish communities. Although BASS was specifically developed to simulate the bioaccumulation of chemical pollutants within a community or ecosystem context, it can also simulate population and community dynamics of fish assemblages that are exposed to a variety of non-chemical stressors such as altered thermal regimes associated with hydrological alterations or industrial activities, commercial or sports fisheries, and introductions of non-native or exotic fish species.

Basic Model Structure

BASS's model structure is generalized and flexible. Users can simulate both small, short-lived species (e.g., daces and minnows) and large, long-lived species (e.g., bass, perch, sunfishes, and trout) by specifying either monthly or yearly age classes for any given species. The community's food web is defined by identifying one or more foraging classes for each fish species based on body weight, body length, or age. The dietary composition of each of these foraging classes is then specified as a combination of benthos, incidental terrestrial insects, periphyton/attached algae, phytoplankton, zooplankton, and/or other fish species including its own. There are no restrictions on the number of chemicals that can be simulated, the number of fish species that can be simulated, the number of cohorts or age classes that fish species may have, or the number of foraging classes that fish species may have.



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Model Output

- Summaries of all model input parameters and simulation controls.
- Tabulated annual summaries for the bioenergetics of individual fish by species and cohort.
- Tabulated annual summaries for the chemical bioaccumulation within individual fish by species and cohort.
- Tabulated annual summaries for community structure and function by species and cohort.
- Plotted annual dynamics of selected model variables as a function of time and age or size class.

Significance for Agency Decision Making

The ability to predict accurately the bioaccumulation of chemicals in fishes is an essential component in assessing the ecological and human health risks of chemical pollutants. Accurate bioaccumulation estimates are needed not only to predict realistic dietary exposures to humans and fish-eating wildlife but also to assess more accurately potential ecological risks to fish assemblages themselves. Although the bioaccumulation of many chemicals in fish can often be predicted accurately using simple bioaccumulation factors and measured or predicated chemical water concentrations, such calculations frequently fail to predict accurately concentrations of extremely hydrophobic chemicals and metals such as mercury that are often the chemicals of greatest concern. Process-based models like BASS that simulate the toxicokinetic, physiological, and ecological processes of fishes provide scientifically defensible tools that can be used to overcome many of the limitations and uncertainties associated with the use of bioaccumulation factor approaches.

Because BASS also simulates the growth and predatory-prey dynamics for individual fish and the productivity, recruitment/reproduction, and mortalities of their associated populations, BASS provides a tool that can be used to evaluate various dimensions of fish health associated with non-chemical stressors.

Current Applications

BASS is currently being used to investigate methylmercury bioaccumulation in the Florida Everglades and to predict population and community dimensions of fish health for a regional analysis of the ecological sustainability of the Albemarle-Pamlico drainage basin in North Carolina and Virginia.

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