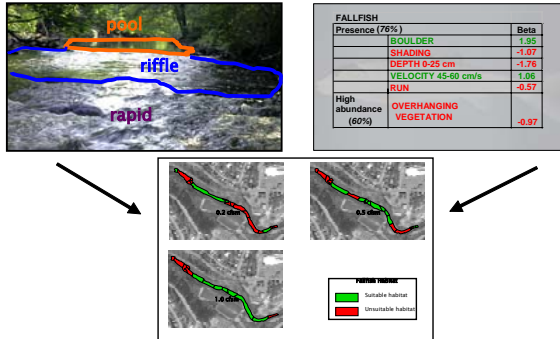


RESEARCH APPROACH

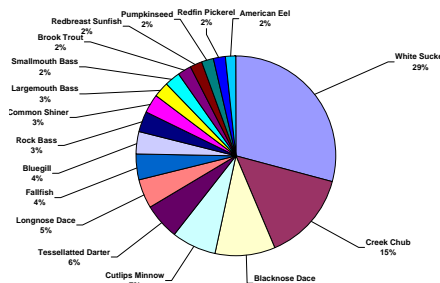
MesoHABSIM addresses the complex relationships inherent to watershed studies and their management. MesoHABSIM modifies the data-acquisition technique and analytical approach of standard physical habitat models by increasing the scale of resolution from micro- to meso-scales. Over the past six years MesoHABSIM has evolved from a concept to a valuable watershed management tool. This poster illustrates this advancement by describing our approach and highlighting some of the watershed management tools provided by the MesoHABSIM software program.



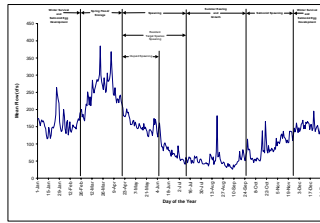
Mesohabitats roughly correspond with functional habitats for adult fish, and are described by their hydromorphological units (HMUs) (e.g. riffles and pools), their hydraulic characteristics, and cover conditions. Mesohabitats are intensively mapped under multiple flows at representative sites. Fish and invertebrates are sampled to develop habitat suitability criteria, allowing for the evaluation of habitat suitability at a range of flows by our modeling software, MesoHABSIM.

HMU Mapping

Habitat Availability

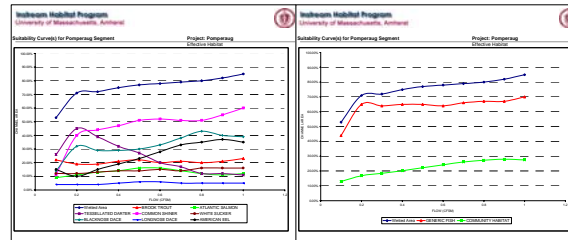


We develop a **Target Fish Community (TFC)**, a model of the fish fauna assemblage expected under natural, or un-impacted conditions, to serve as a biological template and provide indicator fish species for the MesoHABSIM model. The habitat suitability preferences of these species are used to determine the flow conditions necessary to provide sufficient habitat to support such a community.



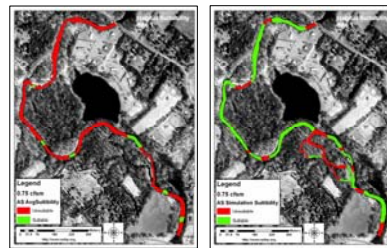
Seasonal bioperiods can be derived from life histories of key organisms and annual flow patterns. For each bioperiod, a number of species are selected to guide the determination of critical habitat/flow requirements.

Rating curves represent changes in the relative area of suitable habitat in response to flow. We develop rating curves for all species (below left), and for the entire community (below right). There are two types of community rating curves, generic fish and community habitat, these can be examined together to determine habitat availability. Generic fish sums suitable habitat available for all species and is a measure of habitat quantity. Community habitat is a measure of quality and is a sum of suitable habitats weighted by the expected proportions of species. The closer together the curves, the better the habitat conditions.

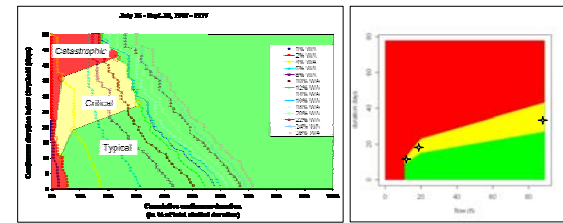


PREDICTIVE MODELING

Using **model simulations** we are able to evaluate the river's restoration potential to study impacts on the Target Fish Community. MesoHABSIM allows us to simulate dam removals and channel improvements (see below).



The figure (above left) shows Atlantic salmon habitat suitability under present conditions, where red indicates unsuitable and green suitable habitats. Through the simulated modification and introduction of substrate types, riffle habitats and woody debris, along with a re-connection to the floodplain in the form of sidearm channels, we are able to significantly increase Atlantic salmon habitat suitability (above right).



In combination with hydrologic time series, rating curves are used to create **Uniform Continuous-Under-Threshold (UCUT) curves** for the analysis of frequency, magnitude and duration of significant habitat events for a given bioperiod (above left). **ACTograms** (above right) visually represent common (green), critical (yellow) and catastrophic (red) durations of continuous low-flow events, providing managers with a tool to identify the time (number of days) at which common flow event becomes critical or catastrophic. Managers may then take action to prevent such events from occurring.

Location Type	Pomperaug		Nonnewaug		Weekapeema	
	Persistent	Catastrophic	Persistent	Catastrophic	Persistent	Catastrophic
Rearing & Growth July 15 - Sept. 30						
Common flow (cfs)	176%	174%	222%	233%	2%	0%
Critical flow (cfs)	211%	125%	122%	122%	3%	3%
Rare flow (cfs)	195%	192%	94%	72%	7%	6%
Salmon Spawning Oct. 1 - Nov. 30						
Common flow (cfs)	118%	61%	82%	0%	2%	0%
Critical flow (cfs)	129%	110%	69%	0%	3%	3%
Rare flow (cfs)	84%	108%	70%	66%	7%	6%
Shad Spawning May 1 - June 14						
Common flow (cfs)	36%	0%	166%	250%	18%	0%
Critical flow (cfs)	0%	0%	123%	111%	0%	0%
Rare flow (cfs)	0%	0%	64%	44%	41%	0%
GRAF Spawning June 15 - July 14						
Common flow (cfs)	116%	210%	108%	100%	42%	42%
Critical flow (cfs)	152%	288%	116%	0%	88%	100%
Rare flow (cfs)	491%	420%	122%	70%	96%	91%

We compare various **flow scenarios** for their impact on fish fauna. For each scenario we count the number of stress days. This table shows the number of stress days under present conditions relative to reference conditions for the Pomperaug River, CT.



NEIHP developed MesoHABSIM Software to facilitate the predictive modeling of river management strategies. It is now available at www.RushingRivers.com.

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