Review and Critique of

IFIM / PHABSIM

John G. Williams

Outline:

IFIM is not the issue

A brief history of PHASIM

How it works

What is wrong with it

What to do instead

IFIM :

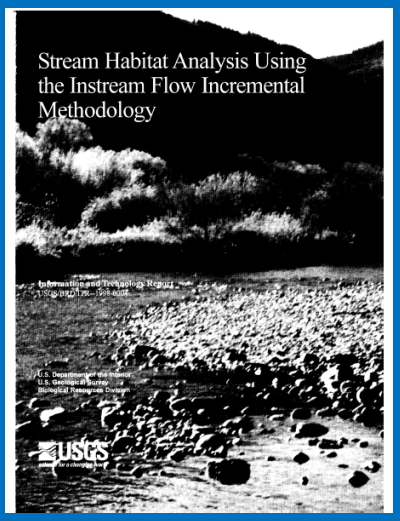
Was an advance in its day:

Includes a lot of good ideas;

Takes a holistic approach;

Deals a lot with negotiations and dispute resolution.

Often turns out to be just PHABSIM in applications!



Early PHABIM study, on the Carmel River.

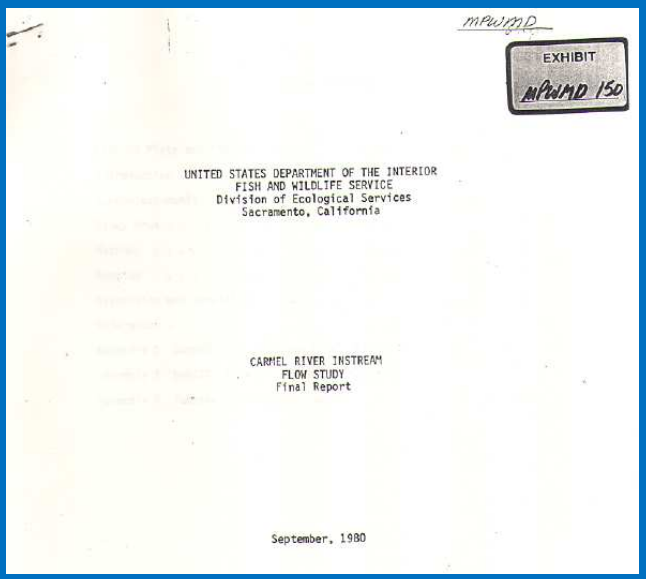
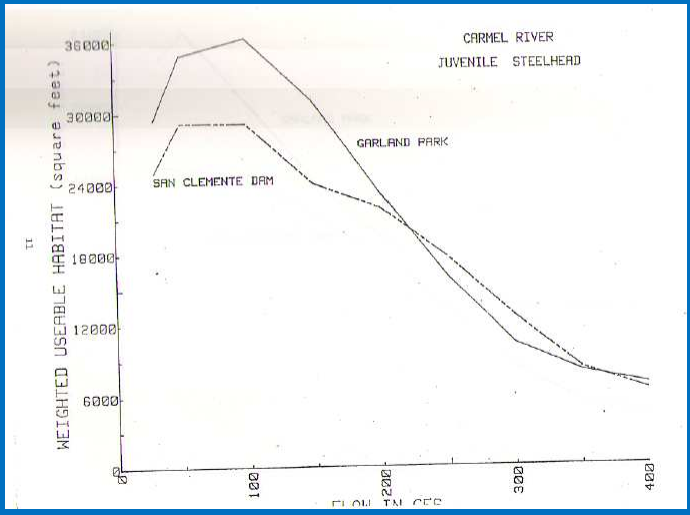

MPWMD

EXHIBIT
MPWMD 150

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Division of Ecological Services
Sacramento, California

CARMEL RIVER INSTREAM
FLOW STUDY
Final Report

September, 1980



Here is a recent study, the Hardy II study on the Klamath River.

Now we have two-dimensional hydraulic models, GIS, fancy graphics, etc., but the guts of the method have not changed.

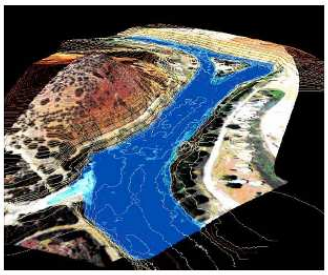
Evaluation of Instream Flow Needs in the Lower Klamath River

Phase II

Final Report

Prepared for:

U.S. Department of the Interior



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July 31, 2006

Figure 90. Suitability of predicted habitat (6180 cfs) versus observed locations (5862 cfs) for Chinook fry at the Brown Bear study site.

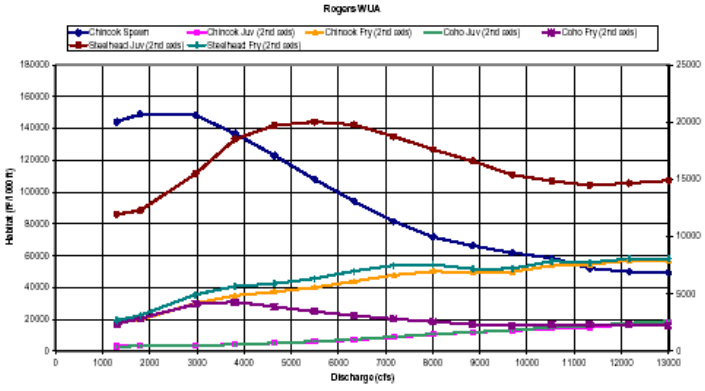


Figure 111. Site-specific weighted useable area versus simulated discharges at the Rogers Creek study site.

So, how does PHABSIM work?

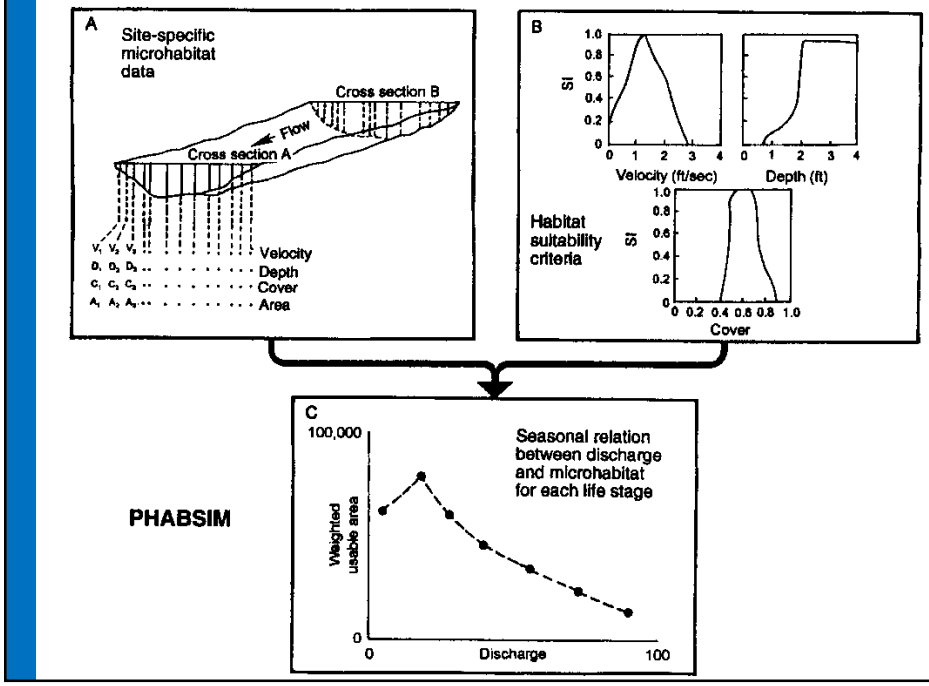
You assume that there is a quality called suitability S that varies continuously over a stream, with which you can weight the area of the stream to get weighted usable area; you want to estimate this.

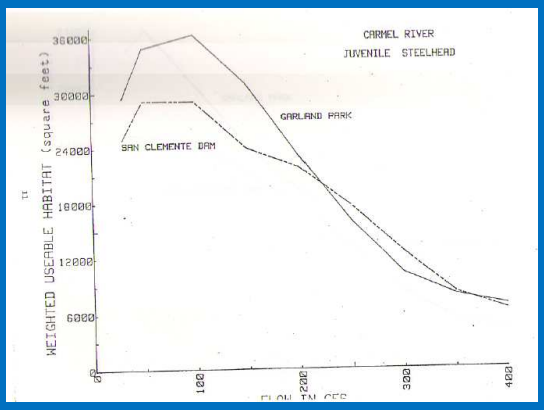
You measure the value of "micohabitat" variables at places where the fish of interest are observed, and perhaps where they are not.

You fit "habitat suitability" curves (HSC) to these data, one for each of the microhabitat values: usually depth, velocity and substrate.

You use a hydraulic model to predict water depth and velocity, usually at transects, and you estimate substrate size in the field while collecting information to set up the hydraulic model.

Then, you estimate water depth and velocity at a number of "cell" across the transect (for which you have substrate data), evaluate the HSC at these values, and weight the area of the cells.





It is really pretty simple-minded, but this gets covered up by a lot of options and jargon, and it gets done on a computer. Back in 1980, this was a big deal, and tended to put agency biologists on a more even footing with hydrologists (engineers).

"PHABSIM is a vehicle for presenting biological information in a format suitable for entry into water resources planning processes. It is not, nor was it ever intended to be, a replacement for population studies, a replacement for basic research into the subtleties of fish or benthic ecology, nor a replacement for biological innovation or common sense." Gore and Nestler (1988) Instream flow studies in perspective.

Unfortunately, as "a vehicle for presenting biological information in a format suitable for entry into water resources planning processes," PHABSIM worked too well. People who used it tended to fall in love with it, and forget its limitations.

As one consequence, PHABSIM did not get properly tested, and , users of PHABSIM fail to follow normal scientific norms for statistical practice, such as random sampling and reporting confidence intervals. Most seriously, PHASIM became "a replacement for population studies, a replacement for basic research into the subtleties of fish or benthic ecology, [and] a replacement for biological innovation or common sense."

What is wrong with it?

- **Problems that can be fixed:**
  - **Poor statistical practice;**
  - **Poor biological modeling;**
  - **Often unsuitable hydraulic modeling.**
- **Problems that can't be fixed:**
  - **Shaky assumptions:**
    - **Occupancy implies quality;**
    - **Habitat selection is not contingent;**
    - **Habitat selection is local.**

Models should help you think; PHABSIM gives you the answer.

What to do instead?

There is not a good answer yet.

Probably the best approach is some kind of structured "demonstration flow assessment" that has a strong adaptive management component. That is, the assumptions upon which the assessments are based should be made explicit so that they can be tested. The tests can use new data from the stream, or information from other studies. Bayesian Belief Networks should provide a way to help structure the assessments. and Bayesian modeling can integrate the assessments with normal science.

So, what does this have to do with climate change?

Not very much. However, we can say that, even if you have future hydrology, PHABSIM won't do much for you.