Habitat Suitability Criteria for Fishes of the South Fork of the Shenandoah River

Valley Regional Water Resources Policy Committee Meeting

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USGS
science for a changing world

Instream Flow Study: ![USGS: science for a changing world]

Goal is to link discharge to fish habitat:

Discharge = volume of water (ft^3/s, m^3/s)

-How does habitat availability change in response to discharge?

-What discharge is required to support species A? The community?

-What might be the response of species A to discharge Q? The community?

Habitat Suitability Criteria

Physical habitat parameters: depth, velocity, substrate, cover

Based on observations of fish habitat use

- Undisturbed fish

- All mesohabitat types

- As many species and life stages as feasible

Habitat Suitability Criteria, cont.
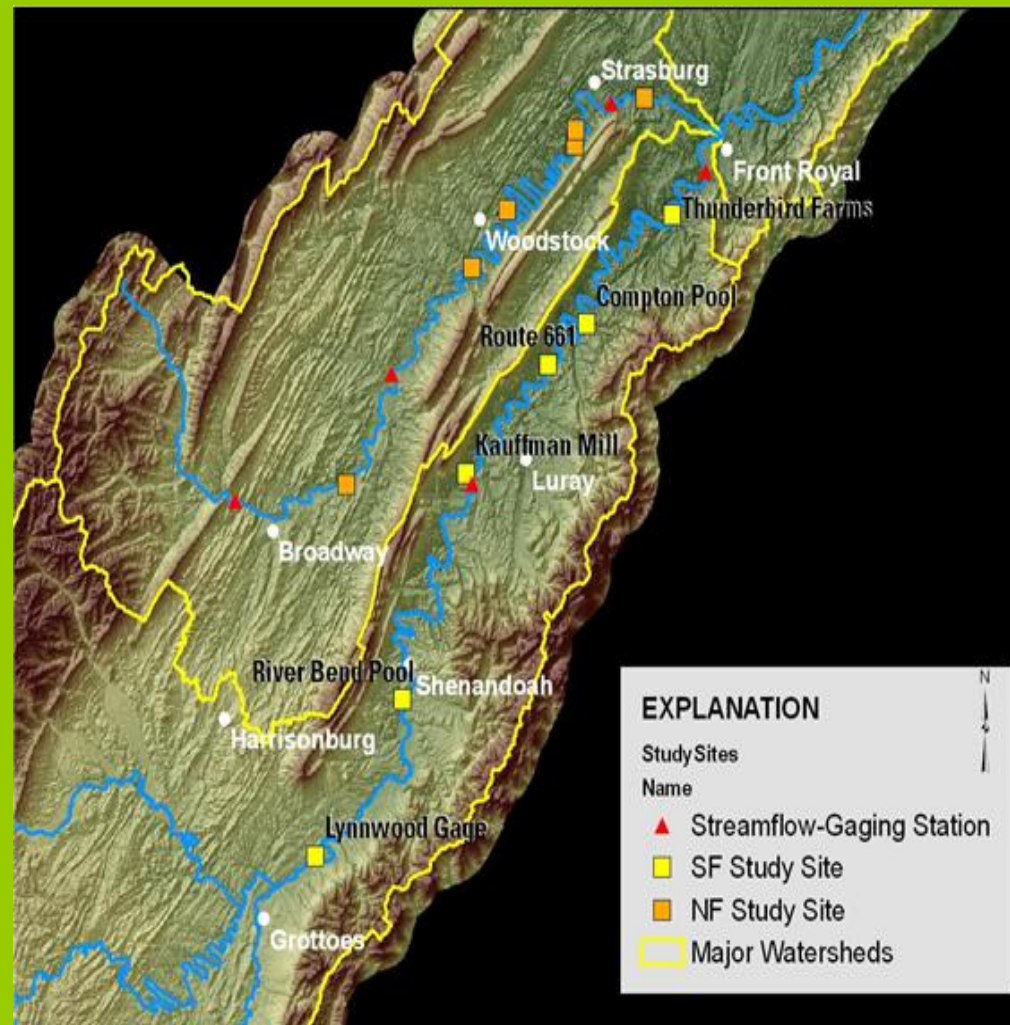
(Engbretson Underwater Photo. 2009)

Data Collection Sites

Randomly selected transects from USGS sites:

Kaufman's Mill, Thunderbird Farms, Lynnwood, River Bend Pool, Compton, Rte. 661
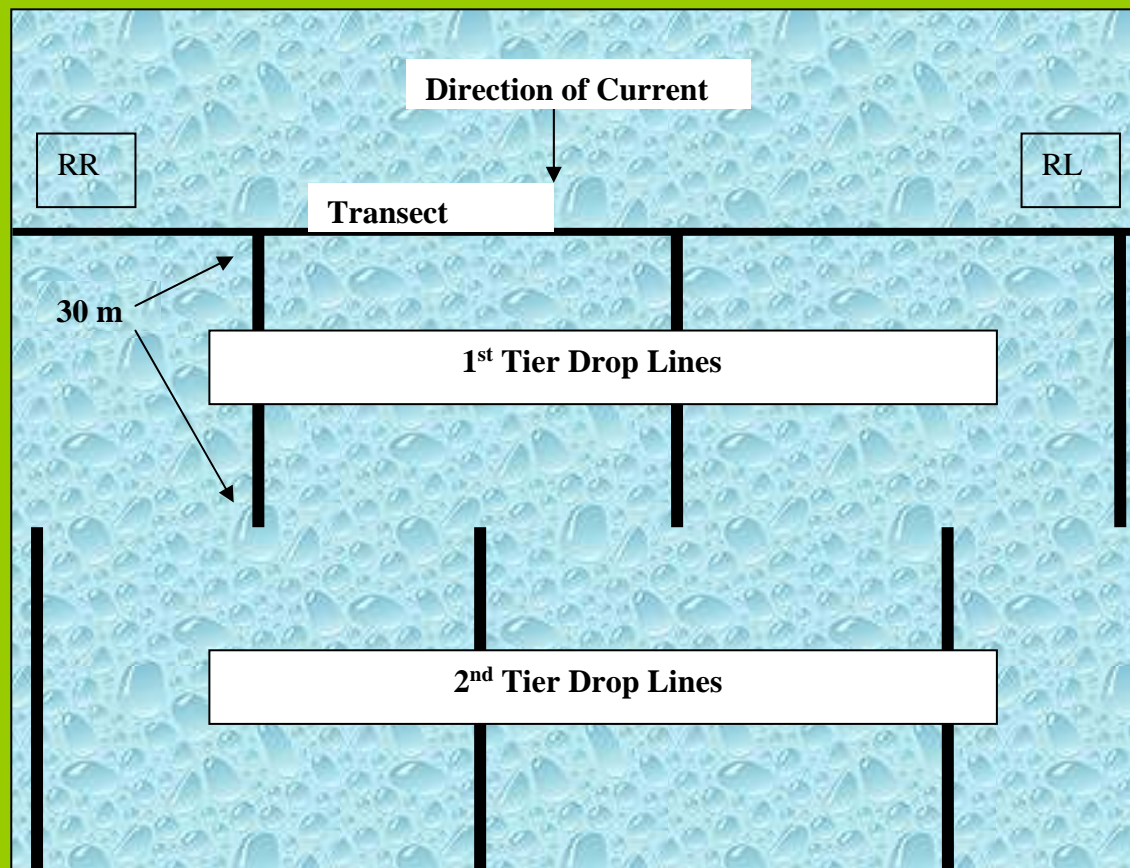
~ from Grottoes to Front Royal
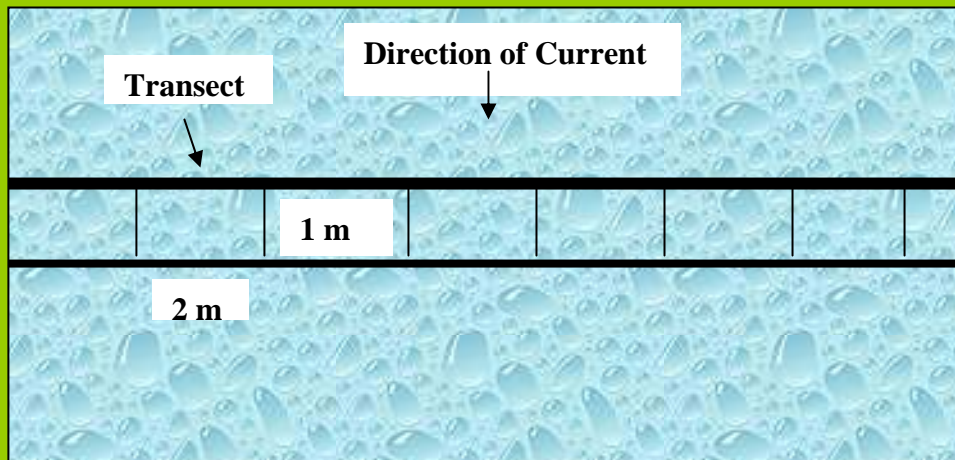
(Map from Krstolic 2009)

Methods

Snorkeling:

Roving Observer:

Snorkeling, cont.

Stationary Observer:

Methods, cont.

Electroshocking component
  -shocked cells with pre-positioned electroshocking devise
 -limited boat shocking

Field Summary

- 31 days in the field
- 495 point measurements of habitat (fish locations + available habitat measurements)
- ~4,455 rocks measured (495*9)
- 909 sampling events
- ~1,629 individual fish
- Representing 46 species and life stages (~28 species)

Habitat Suitability Criteria

Use criteria
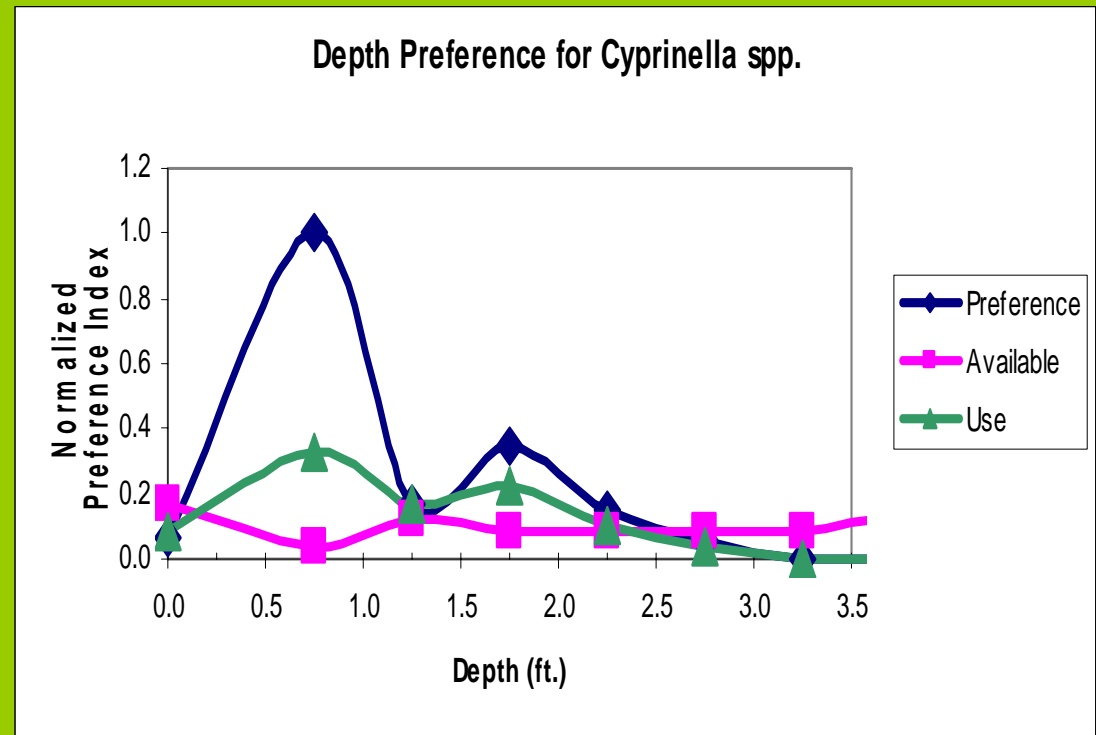
-based on the distributions of observations

Depth Use of Cyprinella spp. n (weighted) = 229
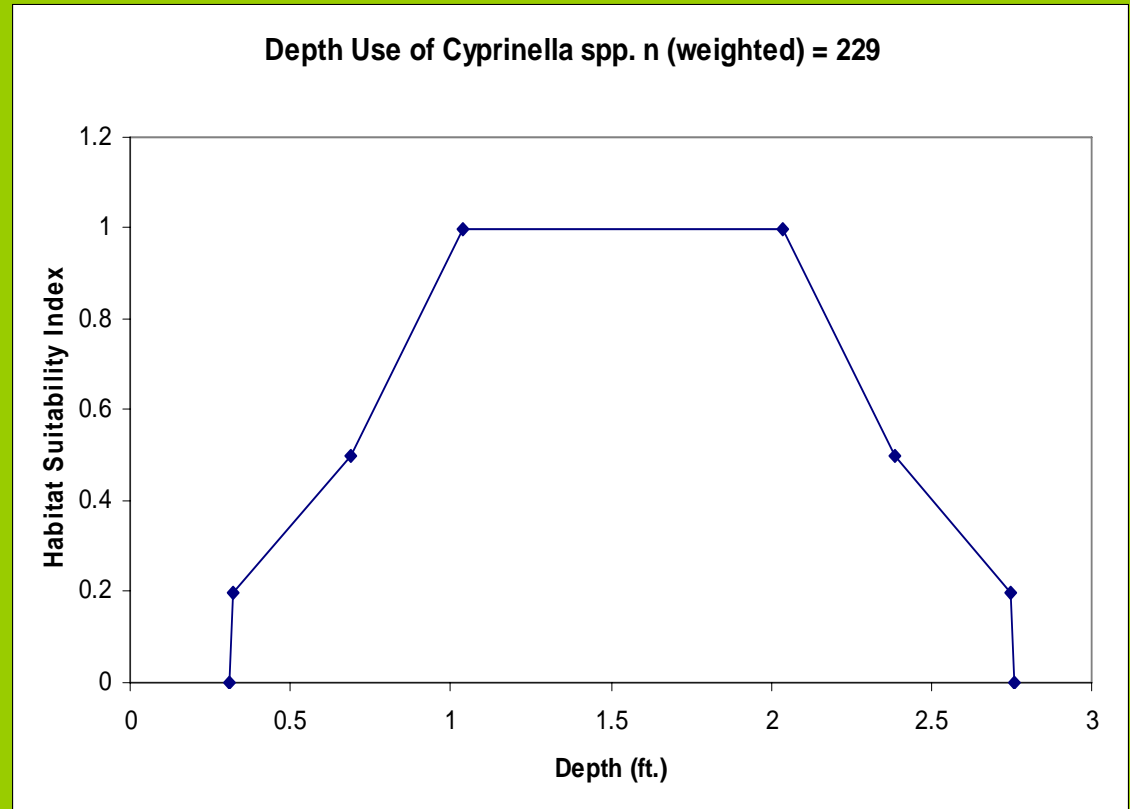
Habitat Suitability Criteria, cont.

Preference criteria

- -accounts for available habitat
- -pref. =
- % use/% avail.

Depth Preference for Cyprinella spp.

Criteria from chi-square tables

A tool to make inferences about the quality of a specific habitat

Multivariate

Optimal vs. useable,

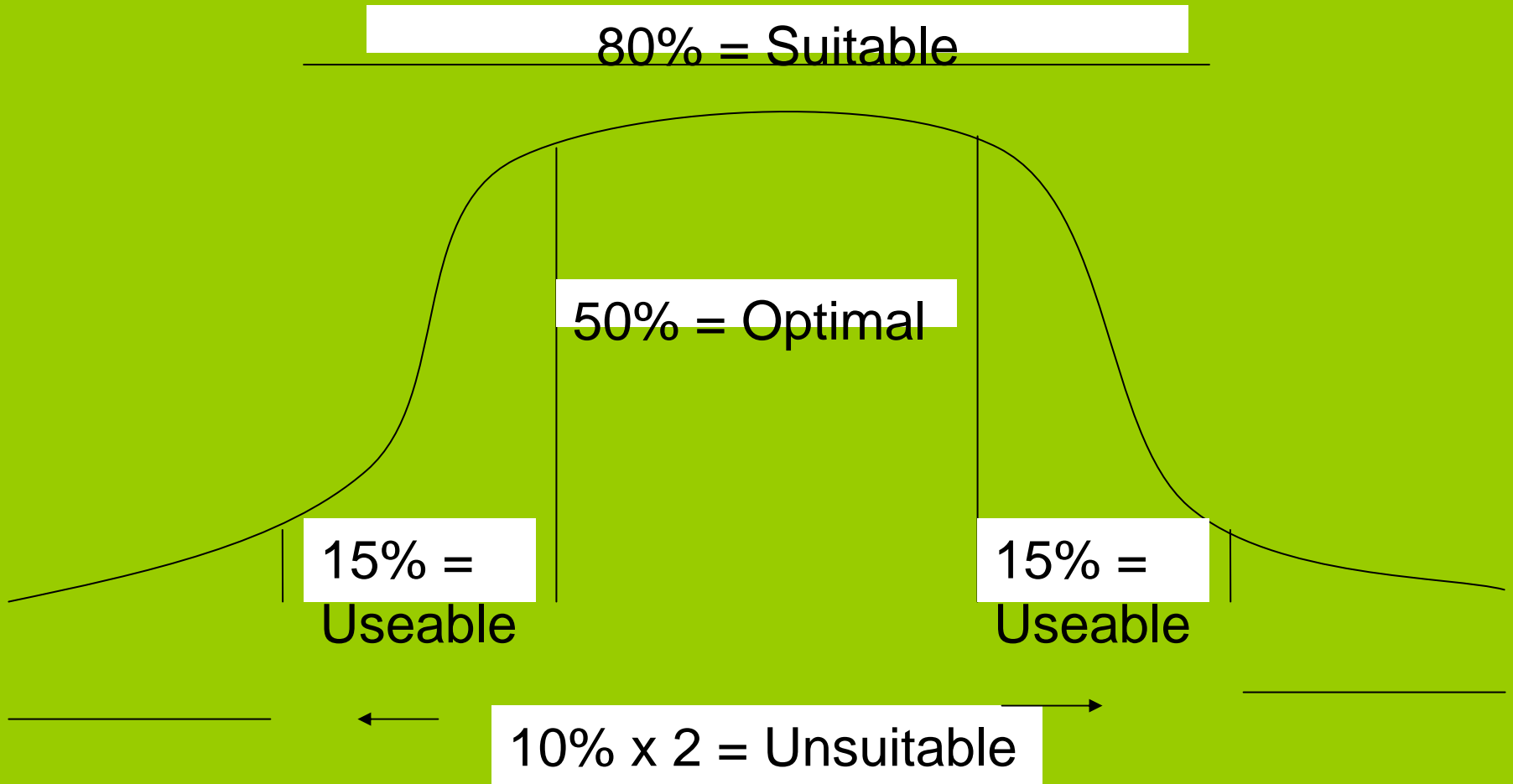Suitable vs. unsuitable

(www.fishbase.org)

Chi-square Tables, cont.

80% = Suitable

50% = Optimal

15% = Useable

15% = Useable

10% x 2 = Unsuitable

Habitat Classification, cont.

- Optimal + Useable

      Suitable   VS.   Unsuitable

Chi-square table for *Cyprinella* spp.

	Composite suitability table		
	SUITABLE	UNSUITABLE	TOTAL
OCCUPIED	40	21	61
UNOCCUPIED	88	116	204
TOTAL	128	137	265
T =	3.0768		

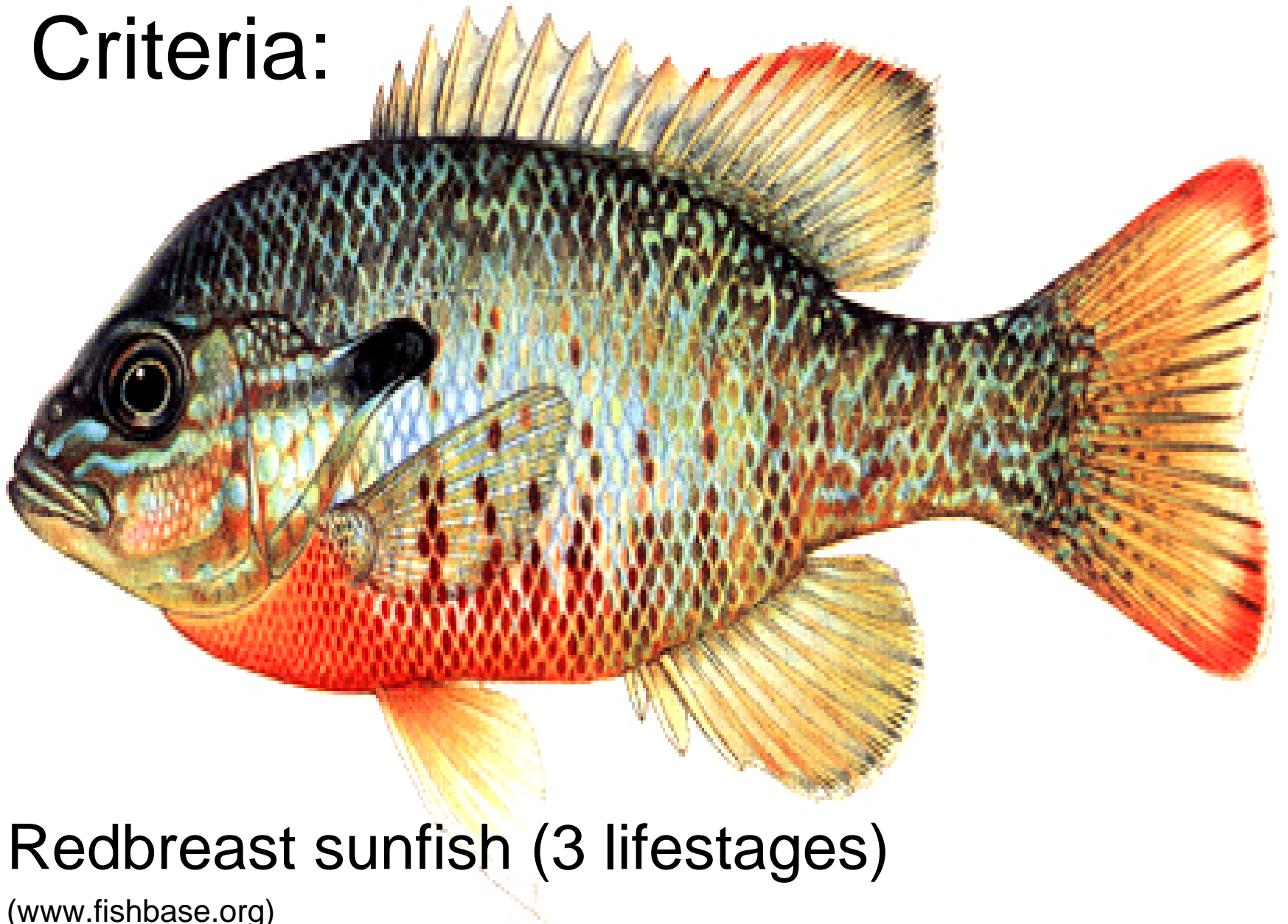Duplicated from Ken Bovee, USGS (2009)

Criteria for the South Fork

smallmouth bass (sub-adult and adult)

(Engbretson Underwater Photo. 2009)

Criteria:

Redbreast sunfish (3 lifestages)

(www.fishbase.org)

Criteria:

Margined madtom

(www.fishbase.org)

Criteria:

River chub

(www.fishbase.org)

Criteria for USGS

| Taxa/Life Stage	n (event)	Suitable Range of Depths (ft.)			
		Lower			Upper
		Useable	Optimal		Useable
SA MDO	61	1.3	1.7	2.9	5.5
MDO	19	2.1	2.8	5.5	6.2
J LAU	31	0.8	1.1	1.9	2.4
SA LAU	31	1.3	1.8	3.6	4.4
LAU	30	0.9	1.6	3.5	4.5
Cyp. spp.	61	0.9	1.1	1.8	2.4
NIN	30	0.7	0.9	1.6	2.9
NMI	54	0.1	1.1	2.1	2.9
YOY**	37	0.9	1.1	2.0	3.7

Findings:

We know that shallow/fast habitats are most affected by low flow:

madtoms, chubs, minnows, arguably sub-adult smallmouth

Deep/slow habitats are more resistant:

smallmouth, sunfish, catfish
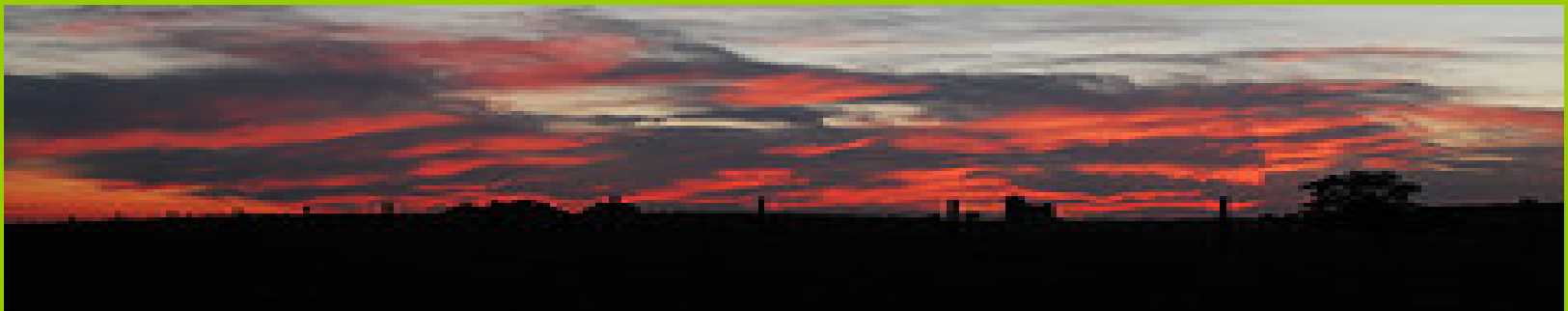
Now what?

USGS will be able to estimate the area of the river that is suitable for each species

- water allocation decision making tool

- provides biologically based rationale for those decisions

Other implications:

Methodological test: roving vs. stationary observers

Using data gathered in the South Fork to explore transferability

-Persinger's *Cyprinella* spp. criteria from the North Fork (2003) transferred, and

-Groshens and Orth (1994) SA MDO, North Anna

-11 other tests, all failed to transfer, more dubious evidence

-Fish kill

In closing . . .

Thank you

Northern Shenandoah Valley Regional Commission

Central Shenandoah Planning District Commission