MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Instream Flows TWC Meeting

July 31, 2013

Final KDM 08-20-13

ATTENDEES:

Bill Marshall (SCDNR)
Ron Ahle (SCDNR)
Gerrit Jobsis (American Rivers)
Shane Boring (Kleinschmidt)
Alan Stuart (Kleinschmidt)
Kelly Miller (Kleinschmidt)
Bill Stangler (Congaree Riverkeeper)
Vivianne Vejdani (SCDNR)
Frank Henning (Congaree National Park)
Chad Altman (SCDHEC)
Bill Argentieri (SCE&G)
Milton Quattlebaum (SCANA) via conf. call
Steve Summer (SCANA)
Brandon Kulik (Kleinschmidt) via conf. call
Dick Christie (SCDNR)
Tom McCoy (USFWS)
Byron Hamstead (USFWS)
Rusty Wenerick (SCDHEC)
Fritz Rohde (NOAA)

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

After introductions, Alan opens the meeting by reviewing the agenda. He then turns the meeting over to Brandon and Shane to give an overview of the IFIM recon trip that was held June 18th and 19th. Brandon reviews the notes from the trip, which were provided to the group via email on July 10th, giving a description of each of the ten study sites. Study site 7 was noted by Ron to be a very unique stretch of the river and a very important study area. He said this area has a defined drop with an obvious glide that is highly utilized by fish. Ron says this area of the river is unique because of the size of the drop, but it is also quite representative of the river overall, due to the types of habitats it provides. The group agreed that Site 7 should be evaluated using the DNR's navigation criteria and that other sites should also be considered.

Brandon and Ron then discussed the pool that was located at study site 7 and whether this area was going to be included in the study. Brandon says while pools don't really influence flow decision-making, this area should be documented. Frank H asked if the pool areas need to be studied from a sediment standpoint, to determine if there is enough flow to flush sediment out of the pool, and prevent sediment trapping. Ron and Shane both agree that this shouldn't be an issue, as there is plenty of flow to keep the sediment moving. Ron says the pools will be mapped during the mesohabitat study, and agrees with Brandon that transects aren't needed here.

Brandon then describes how a 2D model works, which is a possible option for study site 9. 2D modeling uses a honeycomb type of data gathering, which fit together to form a picture. This gives a different view of a site versus a straight transect. The group decided that a 2D model should be used at study site 10, at Bookman Island. Gerrit asks how the analysis for the 2D modeling will be conducted, with the flows being at the selected levels. Brandon says that field data will be collected at Bookman and then used to see what flow range makes the most sense for modeling. Alan asks if the entire Bookman Island complex will be used for modeling at Huffman Island, or will just a piece of the complex be used. Brandon says the entire Bookman Island complex will be used. He adds that the two island complexes will not be mathematically linked, but instead an empirical examination will be used to determine similarities between the two (i.e., a field verification, similar to what was done for the Saluda Project) of flow recommendations, to ensure that recommendations developed are based on work at Bookman are applicable to Huffman Island.

Gerrit mentions the importance of determining how the channels at Bookman are linked, and how some of the smaller channels may be isolated during periods of lower flow. Brandon assures Gerrit that the 2D modeling will include the small cross-channels around the islands, so that these areas may be studied as well. Gerrit says he wants to make sure the study plan captures not only the analysis using HSI curves, but also how various flows affect these small channels. He would like to have a site visit to examine Huffman and Bookman Islands during several different flows to ground truth 2D modeling results.

With this, Alan notes that there seems to be concurrence within the group on the study approach, and asks Brandon if he has enough information to develop a study plan. Brandon says he does and will begin developing a study plan to bring back to the group for review.

The group then begins discussing the HSI curves that Brandon sent to the group to review. Brandon proposes that we use the Hightower curves for the American shad. Alan mentions that these curves are the ones sent to the group by Prescott Brownell a month earlier.

Ron then questions some of the guild classifications for the various fish species. He disagrees with some of the guild assignments and Alan and Dick suggest we work through the information until everyone can agree. The group discusses the difference between shallow versus deep and fast versus slow. The group also discusses the addition of other species at various life stages to the list. Ron suggests listing all life stages for the smallmouth bass in the study plan. Ron disagrees with the curve that corresponds to the smallmouth bass spawning, saying that spawning tends to decrease in waters deeper than approximately 4.5 feet. Brandon agrees, recommending the curve be changed to a stair step, with spawning increasing after reaching a depth of approximately 0.5 feet. Shane agrees to do some research on smallmouth bass spawning and work with Brandon to develop a modified curve for this species for discussion within the TWC.

The group discussed brassy jumprock curves and the need to change the guild for adults to Deep Fast and the guild for juveniles to Shallow Fast.

Gerrit recommends that striped bass spawning lifestage be included in the study. Ron agrees. The group discussed applicable curves from the Pee Dee IFIM study and Crance. Gerrit recommended that we bring in DNR striped bass expert Dr. Jim Bulak to help determine/develop appropriate curves.

The group discussed the importance of adding snail bullhead juvenile lifestage to the study and the need to review bullhead and catfish lifestage curves.

Gerrit and Ron ask for clarification regarding the channel index scale. Brandon explains the scale where 0 corresponds to detritus, 1 to fines, 2 to small gravel, 3 to large gravel, 4 to small cobble, 5 to large cobble, 6 to small boulder, 7 to large boulder, 8 to smooth bedrock, and 9 to irregular bedrock. Shane adds that a table from Wentworth will be included in the study plan that describes these substrates. Gerrit observes that the curves use different channel indices and recommends that all curves use the same channel index.

The group then focuses on modifying the guilds and habitat suitability criteria that Brandon provided. These modifications are included at the end of these notes. Gerrit mentions that the original studies should be referenced in the study plan and not just the broader study in which they were last used, such as the Pee Dee River IFIM.

The group discusses the range of operational flows that modeled as part of the IFIM study, as well as what calibration flows would be needed to model that range. Alan mentions that a range of 250 cfs to 2100 cfs was modeled during the IFIM study for the Saluda Relicensing Project. Brandon suggests putting some level loggers out in the river ahead of the study. Gerrit suggests that a dual flow analysis should be evaluated, to determine Project effects. The group decides on the following calibration flows to allow for modeling of the full range of operational flows: low flow of 400 cfs, with a medium flow of 2000 cfs and a high flow of 10,000 cfs.

After lunch, the group discusses the mesohabitat definitions that Shane provided. Tom says he likes the measurements that are included in the Bettinger definitions and the extra details that are included in the Catawba Wateree definitions. He would like to combine these two with the Saluda definitions. Ron says he doesn't want hard lines to be set for each definition with regards to depth as depths change depending on river flow. He would like to see the depths to be used as guides, but not exact measurements. Brandon suggests adding general depths and flows to the definitions for each habitat. Brandon points out that many of these habitats have already been identified on the river by the group during the IFIM recon trip. The group just needs to agree on the wording for each definition. The group discusses the differences between a glide versus a run, deciding that the slope upstream or downstream is a determining factor. The group works to modify the Saluda definitions and these modifications are included at the end of these notes.

SCE&G and Kleinschmidt personnel will begin to develop the study plans for the IFIM study and Mesohabitat Assessment and will have a draft ready for TWC review and approval by the beginning of October. The group plans to meet or have a conference call before the mesohabitat assessment is started. Any action items stemming from this meeting are included below.

ACTION ITEMS:

- Shane will research the smallmouth bass spawning and will work with Brandon develop a new HSI curve for review within the TWC.
- Shane will refine the mesohabitat definitions and distribute to the group for approval.

DRAFT MEMORANDUM

TO: Parr-Fairfield Hydro: Instream Flow/Aquatic Habitat TWC

FROM: Brandon Kulik

DATE: July 9, 2013

RE: **PROPOSED HABITAT SUITABILITY CRITERIA**

On May 7, 2013, the Instream Flow/Aquatic Habitat Technical Working Committee (TWC) agreed upon species and lifestages for which habitat suitability should be evaluated on the Broad River below the Parr-Fairfield Project as a part of AN IFIM study (Table 1)..

Table 1: Evaluation species elected by the TWC

- Smallmouth Bass
- American Shad
- Brassy Jumprock
- Whitefin Shiner
- Robust Redhorse
- Santee Chub
- Striped Bass
- Piedmont Darter
- Snail Bullhead
- Redbreast Sunfish
- Channel Catfish

The purpose of this memo is to recommend potential Habitat Suitability Criteria (HSC) for use in this study that are applicable to the above species. Smallmouth bass and redbreast sunfish criteria were sourced from the Saluda study, as the TWC has already vetted these curves. Although the Saluda study had employed TWC-approved American shad HSC, these criteria have recently been refined, based on the research of Joe Hightower in North Carolina (Hightower, *et. al*, 2012) and provided to us by NOAA Fisheries. We propose that the TWC consider using these updated criteria.

The remaining species do not have well developed, individual HSC. However, the Pee Dee IFIM study addressed habitat suitability for these species by classifying each of them into applicable guilds. This information was provided to the Saluda IFIM TWC during study scoping (Gerrit Jobsis, October 16, 2006). Based this information (Table 2), we classified the remaining Parr-Fairfield evaluation species and lifestages into proposed guild categories (Table 3)

Attachment A displays the coordinates for the resulting HSC proposed for use, based on the source material identified in Table 3.

Kleinschmidt

Table 2. Guild classification for individual species and lifestages, from Pee Dee River IFIM study (2004)

Species and Habitat Guild Assignment Table for the Pee Dee River Instream Flow Study. Revision 2 - July 9, 2004.

Scientific Name	Common Name	Habitat Types and Guilds[1, 2, 3]			
		Shallow Slow	Shallow Fast	Deep Slow	Deep Fast
Petromyzontidae	**Lampreys**				
Petromyzon marinus	sea lamprey		A		
Acipenseridae	**Sturgeons**				
Acipenser oxyrinchus	Atlantic sturgeon				S
Acipenser brevirostrum	shortnose sturgeon				S
Lepisostedidae	**Gars**				
Lepisosteus osseus	longnose gar	A, J		A, J, S	
Amidae	**Bowfin**				
Amia calva	bowfin			A, S	
Anguillidae	**Freshwater eels**				
Anguilla rotstrata	American eel	J		A, J	J
Clupeidae	**Herrings**				
Dorosoma cepidanum	gizzard shad	A, J		A, J, S	
Dorosoma petenense	threadfin shad	A, J		A, J, S	
Alosa mediocris	hickory shad			J, S	
Alosa sapidissima	American shad			J	J, S
Alosa aestivalis	blueback herring			J, S	
Cyprinidae	**Carps and Minnows**				
Cyprinus carpio	common carp	J, S		A, J, S	
Notemigonus crysoleucas	golden shiner	A, J, S		A, J, S	
Hybognathus regius	Eastern silvery minnow	J, S		A, J, S	
Nocomis leptocephalus	bluehead chub		A, S		
Cyprinella analostana	satinfin shiner	A, J, S		A, J, S	
Cyprinella nivea	whitefin shiner	A, J	S	A	
Cyprinella pyrrhomelas	fieryblack shiner	A, J	S	A	
Notropis altipinnis	highfin shiner	J, S		A	
Notropis amoenus	comely shiner	A, J	S	A, J	
Notropis hudsonius	spottail shiner	A, J	S	A, J	
Notropis petersoni	coastal shiner	A, J	S	A	
Notropis scepticus	sandbar shiner	A, J	S	A	
Catostomidae	**Suckers**				
Catostomus commersoni	white sucker	J	S	A, J	A
Minytrema melanops	spotted sucker	J	S	A	
Scartomyzon spp.	brassy jumprock	J	S	A	A
Moxostoma macrolepidotum	shorthead redhorse	J	S	A	A[4]
Moxostoma anisurum	silver redhorse	J	S	A, J	
Moxostoma robustum	robust redhorse		S	A, J	
Moxostoma sp.	Carolina redhorse		S	A, J	
Carpiodes cyprinus	quillback		S	A	S
Erimyzon oblongus	creek chubsucker	S?		A, J, S?	
Carpiodes velifer	highfin carpsucker		S	A	S
Ictiobus bubalus	smallmouth buffalo	J	A	A, S	A
Ictiobus cyprinellus	bigmouth buffalo			A	

Table 2.
Continued

Scientific Name	Common Name	Habitat Types and Guilds[1,2,3] Shallow Slow	Shallow Fast	Deep Slow	Deep Fast
Ictaluridae	**Bullhead catfishes**				
Ictalurus punctatus	channel catfish			A, J	J
Ictalurus furcatus	blue catfish			A, S	A
Ameiurus catus	white catfish			A	A, J
Ameiurus brunneus	snail bullhead			A	
Ameiurus nebulosus	brown bullhead			A	
Ameiurus platycephalus	flat bullhead			A	
Pylodictus olivaris	flathead catfish	J		A, J, S	
Esocidae	**Pikes**				
Esox americanus americanus	redfin pickerel			A, J, S	
Esox niger	chain pickerel			A, J, S	
Umbridae	**Mudminnows**				
Umbra pygmaea	Eastern mudminnow			A, J, S	
Poeciliidae	**Livebearers**				
Gambusia holbrooki	Eastern mosquitofish			A, J, S	
Aphredoderidae	**Pirate perches**				
Aphredoderus saynus	pirate perch			A	
Atherinidae	**Silversides**				
Labidesthes sicculus	brook silverside			A	
Percichthyidae	**Temperate basses**				
Morone americana	white perch	J	S	A, J	S
Morone chrysops	white bass	J	S	A, J	S
Morone saxatilis	striped bass				A, S
Centrarchidae	**Sunfishes**				
Lepomis auritus	redbreast sunfish	J, S		A, J, S	
Lepomis cyanellus	green sunfish			A, J, S	
Lepomis gibbosus	pumpkinseed	J, S		A, J, S	
Lepomis macrochirus	bluegill	J, S		A, J, S	
Lepomis microlophus	redear sunfish			A, J, S	
Lepomis punctatus	spotted sunfish			A, J, S	
Micropterus salmoides	largemouth bass	J, S		A, J, S	
Pomoxis nigromaculatus	black crappie			A, J, S	
Percidae	**Perches**				
Etheostoma olmstedi	tessellated darter	A, J	S	A	
Percina crassus	Piedmont darter		A, S		
Perca flavescens	yellow perch			A, J, S	

[1]Habitat types based on predominant habitat types present in the Pee Dee River derived from the aerial videography study.

[2]Life stages: A = adult, J = juvenile, including young-of-year, and S = spawning.

[3]Classification of species and life stages into habitat types based on Becker (1983), Hamilton and Nelson (1984), Aadland et al. (1991), Jenkins and Burkhead (1994), Rhode et al. (1994), Leonard and Dilts (2003), and Progress Energy (2003).

[4]Foraging adults based on Jenkins and Berkhead (1994).

Table 3. Proposed HSC source data for Parr-Fairfield IFIM study

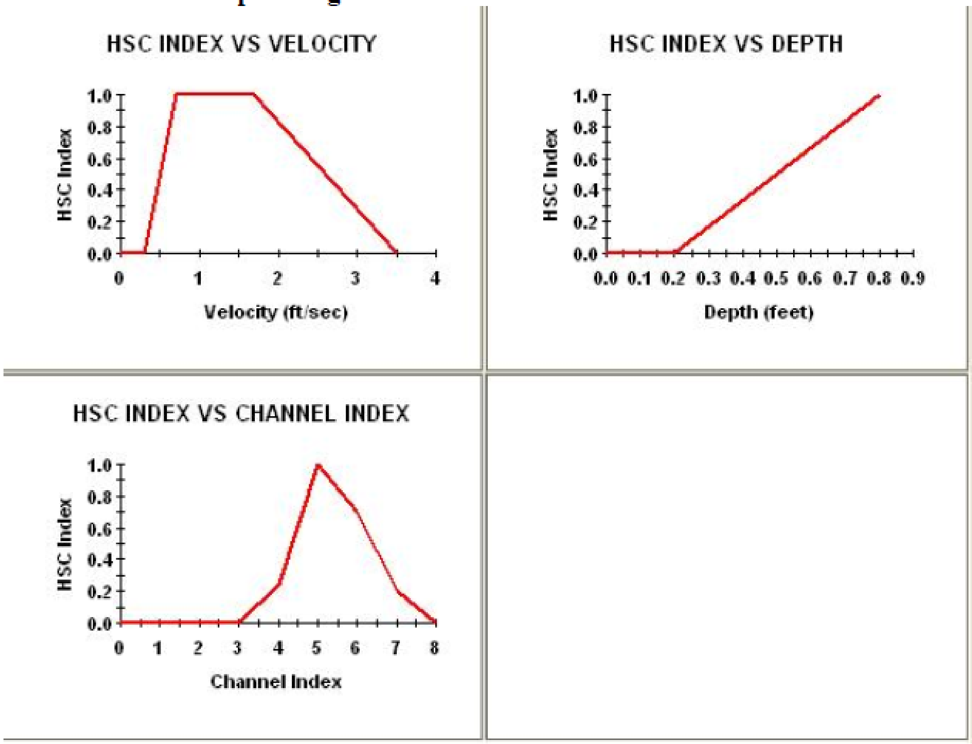
species criteria	lifestage	source	guild
Smallmouth Bass	All (spawning, fry, juvenile &adult)	Saluda	N/A
American Shad	spawning	Hightower, *et al.*, 2012	N/A
Brassy Jumprock	adult	Pee Dee River IFIM	deep ~~slow~~fast
Brassy Jumprock	juvenile	Pee Dee River IFIM	shallow ~~slow~~fast
Brassy Jumprock	spawning	Pee Dee River IFIM	shallow fast
Whitefin Shiner	adult	Pee Dee River IFIM	shallow slow; deep slow
Whitefin Shiner	juvenile	Pee Dee River IFIM	shallow slow
Whitefin Shiner	spawning	Pee Dee River IFIM	shallow fast
Robust Redhorse	adult	Pee Dee River IFIM	~~deep slow~~Stand alone species (Bud Freeman HSI)
Robust Redhorse	juvenile	Pee Dee River IFIM	Stand alone species ~~deep slow~~
Robust Redhorse	spawning	Pee Dee River IFIM	Stand alone species ~~shallow fast~~
Santee Chub	adult	Pee Dee River IFIM	shallow fast
Striped Bass	Adult	Pee Dee River IFIM	Deep slow, deep fast
Striped Bass	Spawning		N/A (Crance, Bulak)
Piedmont Darter	adult	Pee Dee River IFIM	shallow fast
Piedmont Darter	spawning	Pee Dee River IFIM	shallow fast
Snail Bullhead	Adult	Pee Dee River IFIM	deep slow
Snail Bullhead	Juvenile		shallow fast
Redbreast Sunfish	Adult	Saluda	N/A or deep slow?
Redbreast Sunfish	Spawning		Shallow slow?
Channel Catfish	adult	Pee Dee River IFIM	deep slow
Channel Catfish	juvenile	Pee Dee River IFIM	deep slow; deep fast

LITERATURE CITED

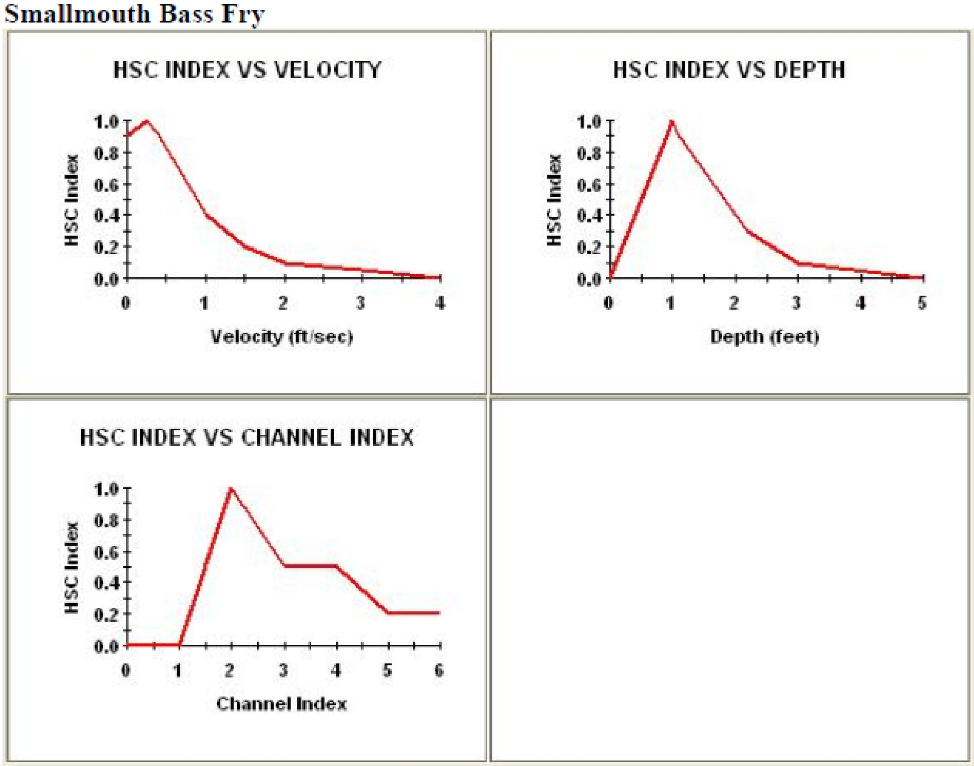
Hightower JE, Harris JE, Raabe JK, Brownell P, Drew CA. 2012. A Bayesian spawning habitat suitability model for American shad in southeastern United States rivers. Journal of Fish and Wildlife Management 3(2):184–198; e1944-687X. doi: 10.3996/082011-JFWM-047

Attachment A
Habitat Suitability Criteria

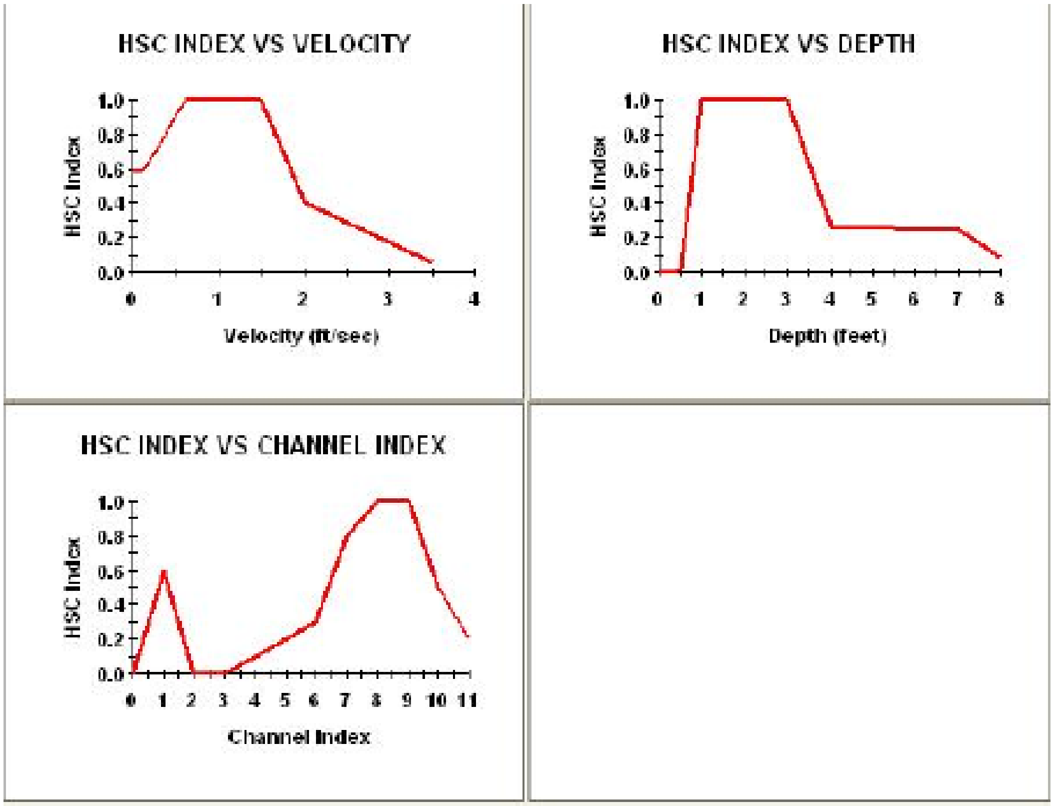
Smallmouth Bass Spawning



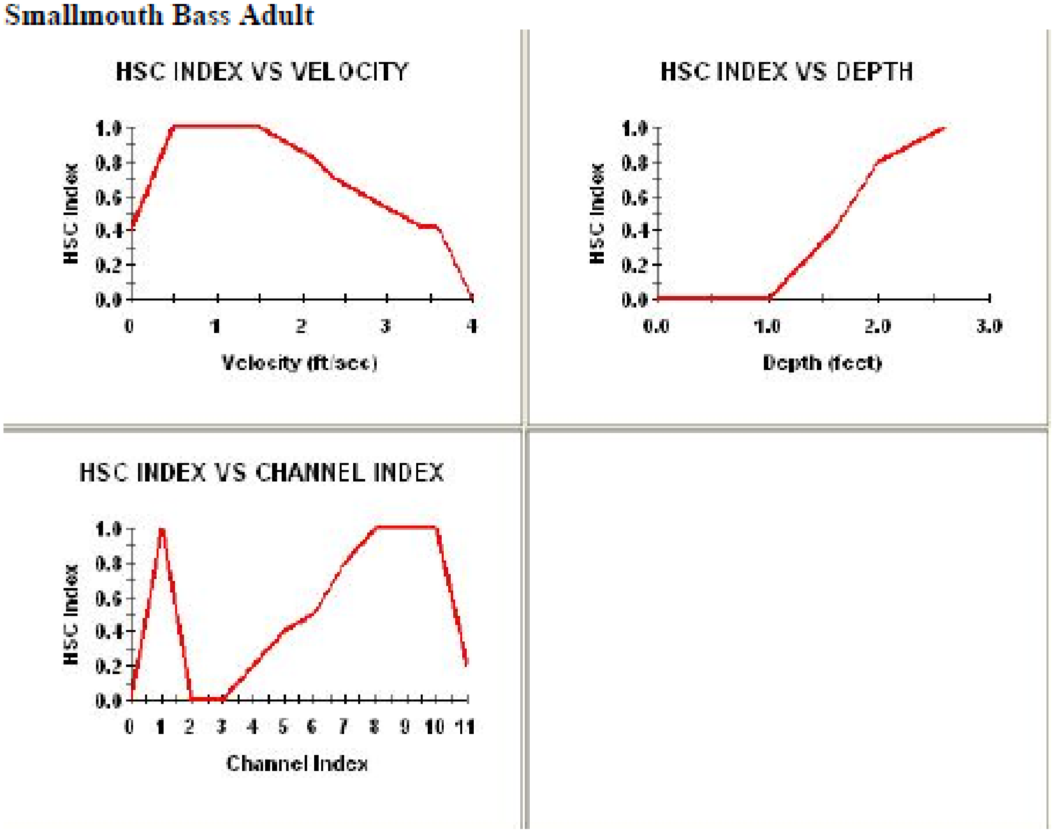
Smallmouth Bass Fry



Smallmouth Bass Juvenile

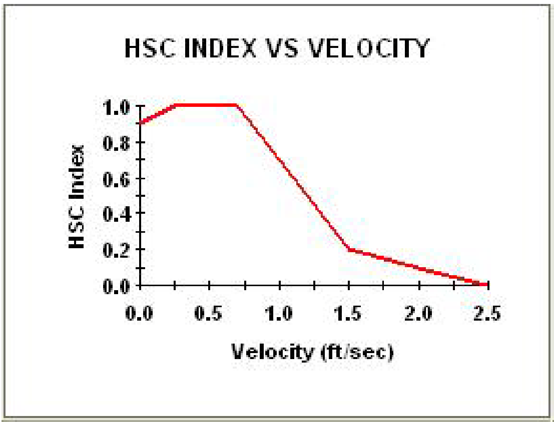


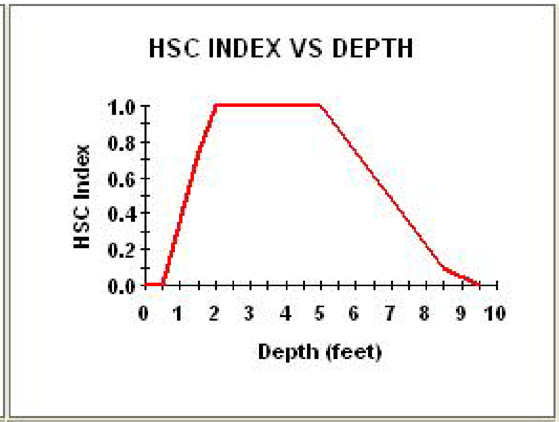
Smallmouth Bass Adult

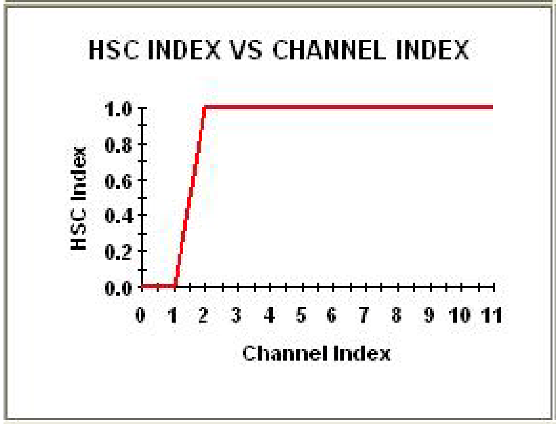


Kleinschmidt

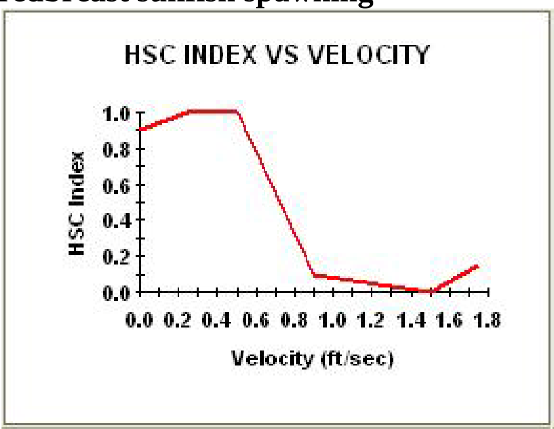
redbreast sunfish adult

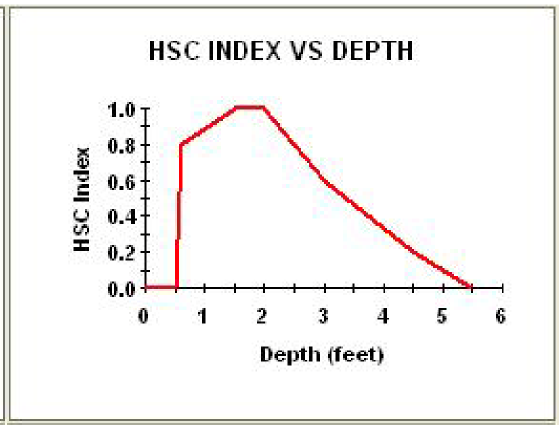


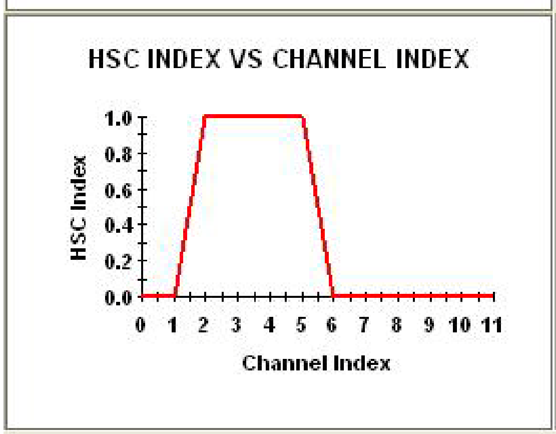




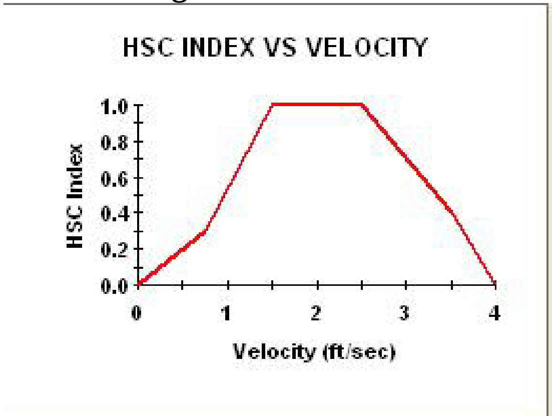
redbreast sunfish spawning

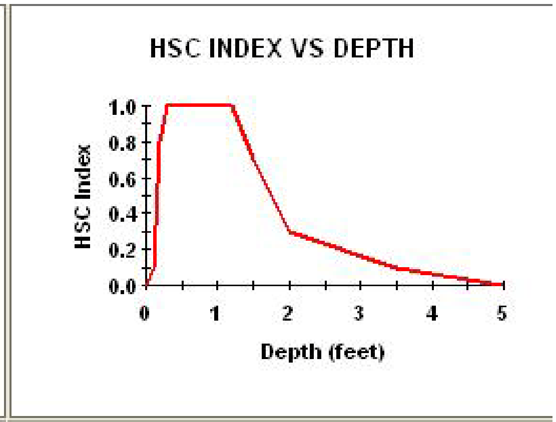


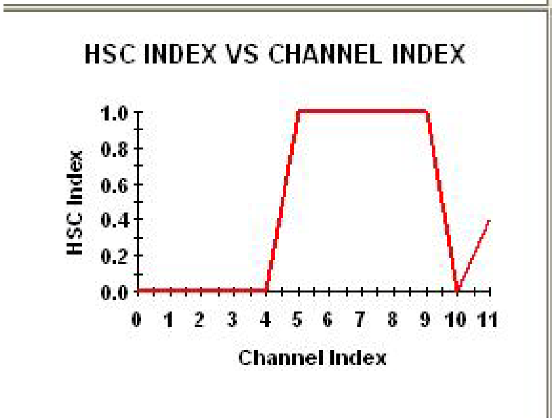




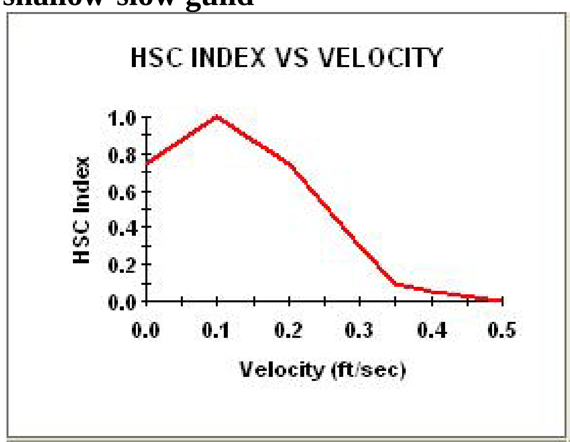
shallow-fast guild

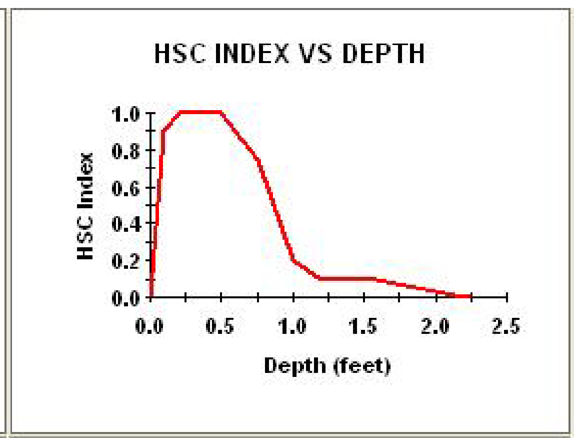


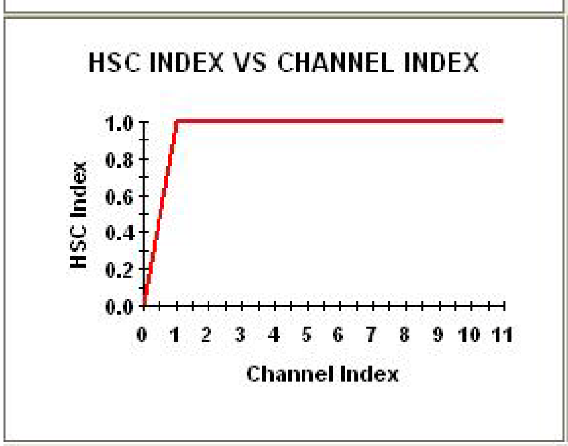




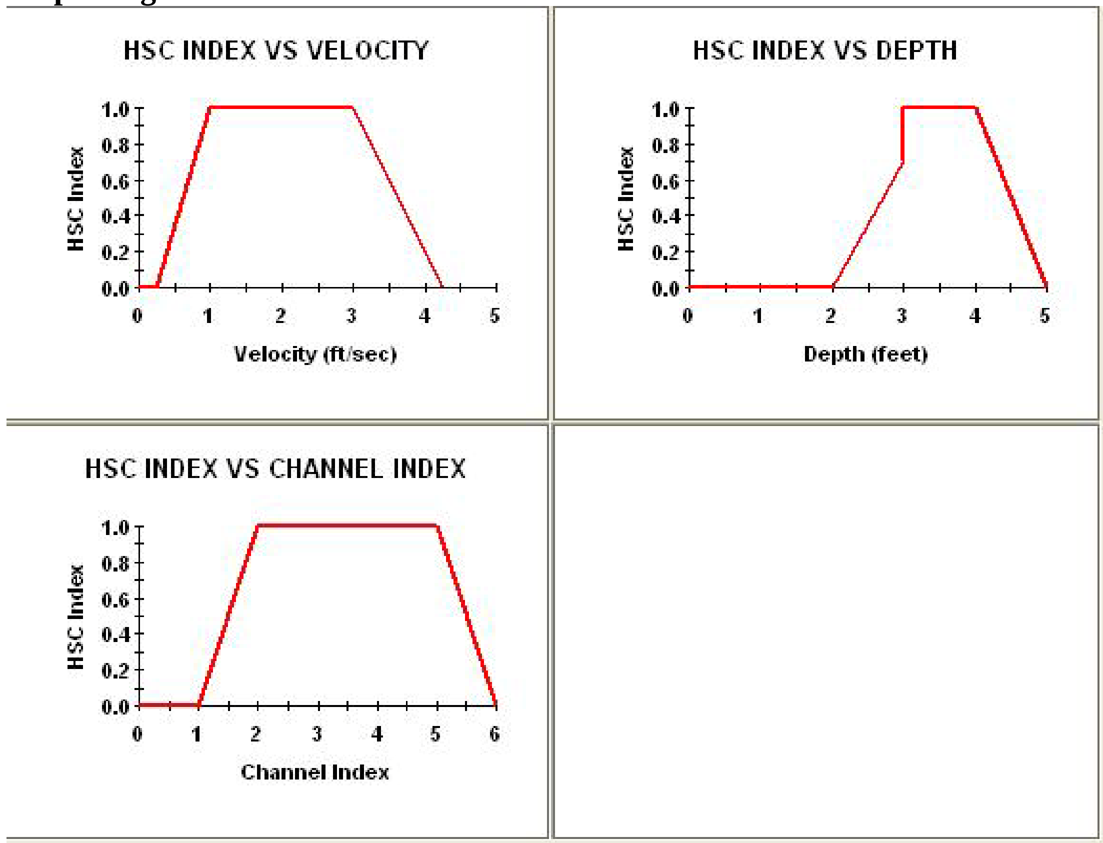
shallow-slow guild





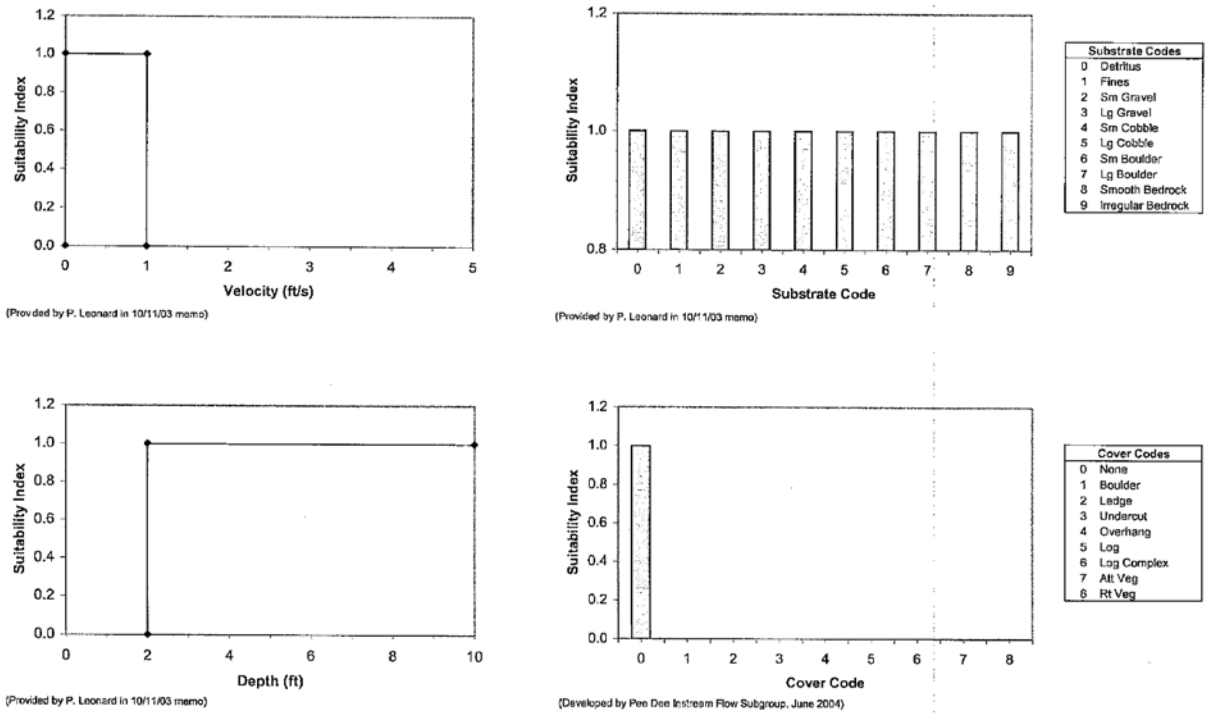


Deep-fast guild

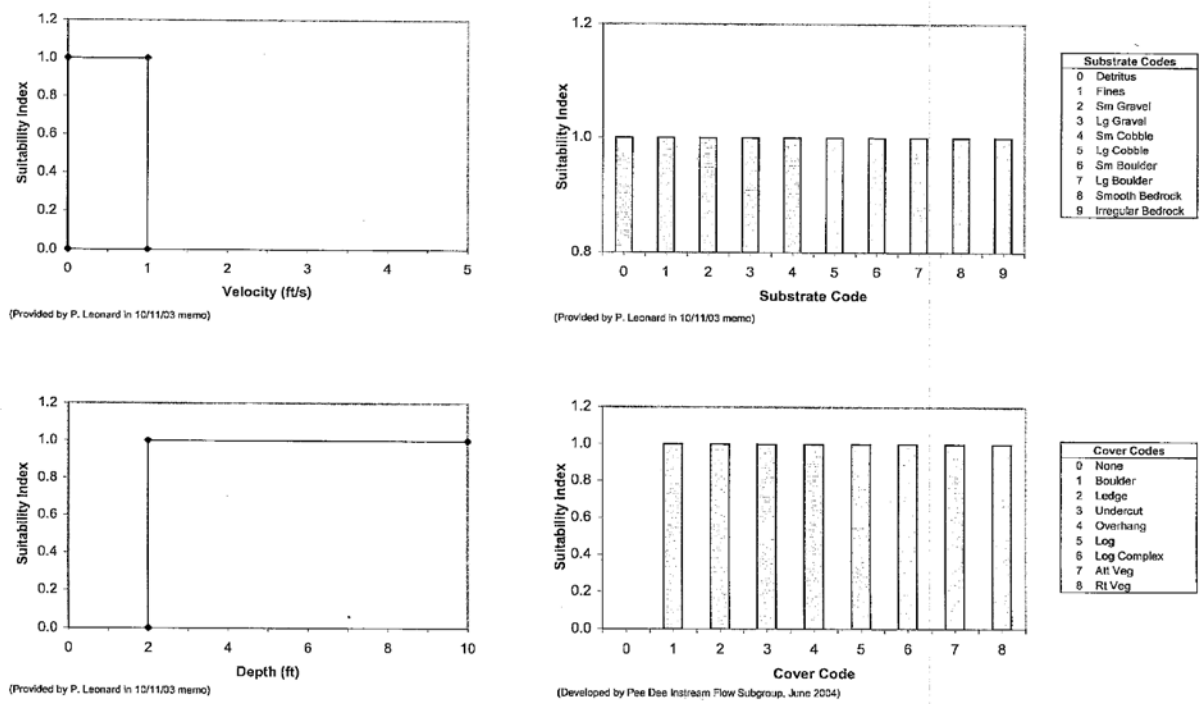


Kleinschmidt

Deep Slow Guild, No Cover
Generic guild habitat suitability



Deep Slow Guild, Cover
Generic guild habitat suitability



AMERICAN SHAD spawning (*Hightower, et al., 2012*).

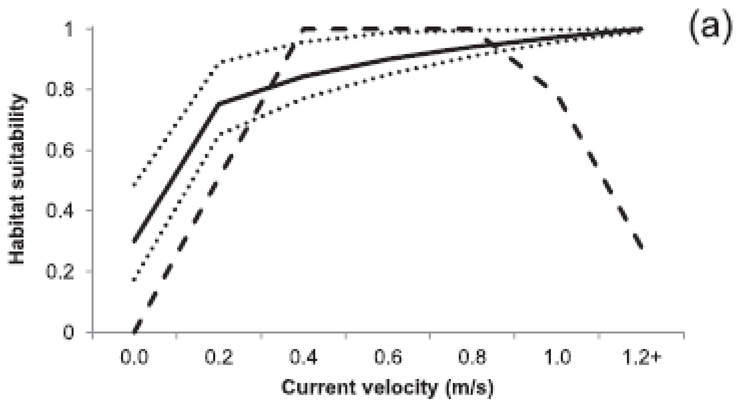


Figure 5. (**a**) Estimated American shad *Alosa sapidissima* spawning-habitat suitability for current velocity (median, with dotted lines indicating 95% CI) in southeastern U.S. rivers, based on a resource selection function fitted to (**b**) data on habitat use vs. availability, by 0.2-m/s velocity bin. The dashed line shows the suitability curve developed by Stier and Crance (1985).

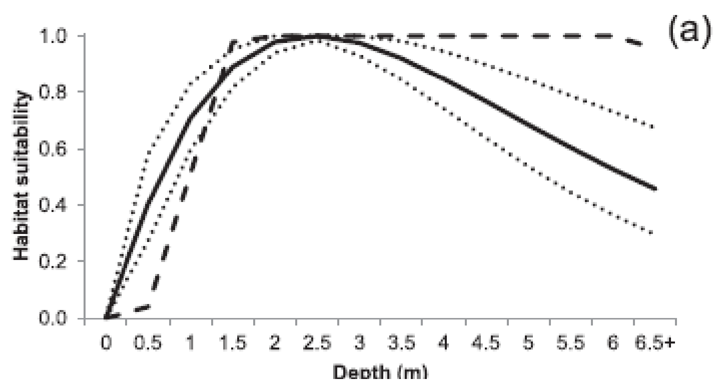


Figure 6. (**a**) Estimated American shad *Alosa sapidissima* spawning-habitat suitability for water depth in m (median, with dotted lines indicating 95% CI) in southeastern U.S. rivers, based on a resource selection function fitted to (**b**) data on habitat use vs. availability, by 0.5-m depth bin. The dashed line shows the suitability curve developed by Stier and Crance (1985).

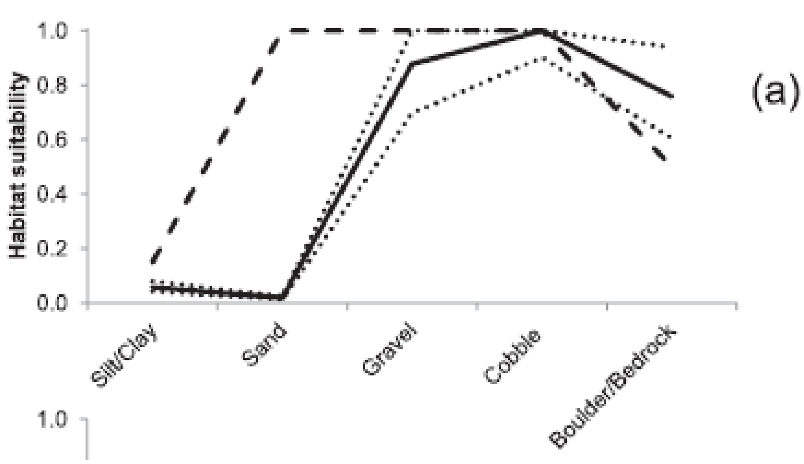


Figure 7. (**a**) Estimated American shad *Alosa sapidissima* spawning-habitat suitability for substrate (median, with dotted lines indicating 95% CI) in southeastern U.S. rivers, based on a resource selection function fitted to (**b** and **c**) data on habitat use vs. availability, by substrate category. The dashed line shows the suitability curve developed by Stier and Crance (1985), using averages for combined categories (silt/clay, boulder/bedrock).

Mesohabitiat Classifications

Bettinger et al 2003

Habitat Type	Description
Riffle	Riffle Relatively shallow (<0.5m), swift flowing section of river where water surface is broken.
Glide	Relatively shallow (<1m); with visible flow but mostly laminar in nature; minimal observable turbulence; relatively featureless bottom
Run	Deep (>1m), swift flowing sections with turbulent flow; surface generally not broken
Pool	Deep (>1m) slow moving sections.
Shoals	Shoal area; which may contain a variety of habitat complexes.

Saluda Hydro IFIM Study

Habitat Type	Description
Riffle	Shallow, with moderate velocity, turbulent, high gradient, moderate to large substrates (cobble/gravel). Typically > 1% gradient.
Glide	Moderately shallow, well-defined non-turbulent laminar flow, transition from low to moderate velocity, lacking a definite ~~well-defined~~ thalweg, typically flat stream geometry, typically finer substrates, transitional from pool.
Run	Moderately deep ~~to deep~~, well-defined non-turbulent laminar flow, range from low to moderate velocity, well-defined thalweg, typically concave stream geometry, varying substrates, gently downstream slope (<1%).
Pool	Deep, low to no velocity, well-defined hydraulic control at outlet.
Rapid/Shoal	Shallow, with moderate to high velocity, turbulent, with chutes and eddies, high gradient, large substrates or bedrock. Typically >2% gradient.
Backwater	Varying depth, no or minimal velocity, off the primary channel flow ~~long backwatered reaches.~~

Catawba Wateree

Habitat Type	Description
Glide	Depending on the strength of the shoal and the bed profile directly upstream of the control, a glide or a pool will be created. A glide is generally defined by slower velocities and a relatively uniform bed profile, but a rough bed profile is not uncommon. Glides will either progress into a more concave bed profile just upstream of the shoal (creating a pool), or maintain their uniform hydraulic and bed features until direct contact with the shoal. Substrates can be large or small but, except at very high flows, do not create turbulence. Due to the slower velocities and increased depths, finer substrates will typically begin to settle in glides.
Run	Immediately downstream of the shoal, there is typically a transition area prior to the water entering the next pool or glide. This unit consists of relatively fast moving, turbulent water and a gradually descending bed profile. When mapping habitat in higher discharges (deeper flow), these areas can be visually identified by an upwelling of water just on the downstream edge of the shoal. This “roiling” effect is created by the sudden drop in water off of the shoal due to the lack of any backwater effect. Substrate composition varies from fine sediments to cobble and boulders. As the water begins to collect and back up further downstream, velocities slow, depths increase, and the transition into a glide or pool occurs.
Pool	If the bed profile upstream of the shoal is more concave or possesses significant undulations, a pool will be formed. Pools are visually represented by the slowest velocities of the four main habitat types and the most extreme depths. Steep banks and narrow channels relative to the rest of the reach can often be associated with pools. The stronger or more defined the downstream control (shoal), the more defined the pool. Substrate composition in pools generally consists of a layer (thick or thin) of finer substrates over boulder or bedrock.
Shoal	Shoals are relatively shallow, submerged ridges that occur with a consistent frequency down the longitudinal profile of the river. Shoals act as downstream controls to pools and glides and create the hydraulic conditions necessary to form runs immediately downstream. Substrate composition in shoals is typically bedrock, boulders, and coarse substrates. The “strength” of each hydraulic control dictates the magnitude to which it influences the upstream habitat types. Each shoal will create a unique situation upstream in which pools, glides or both may be identified.

AFS Aquatic Habitat Assessment Methods (Bain and Stevenson, 1999)

Habitat Type (macrohabitats)	**Description**
Glide	Nonturbulent, low-moderate velocity; gravel, cobble, sand substrate; slop 0-1%. Wide channel lacking a definite thalweg; usually at the transition between a pool and riffle; no major flow obstructions; lacks features associated with pools; moderately shallow (10-30 cm)
Run	Nonturbulent, swift velocities; gravel, cobble, boulder substrate; low slope. Occurs over a defined thalweg flat plane with a uniform channel form; no major flow obstructions; moderately shallow; deeper than riffles.
Pool	Formed from lateral construction of channel or sharp drop in water surface profile. Features: bend in channel, large-scale obstructions (e.g. boulder, log). Concave in shape; direction of flow varies widely; depth greater than riffle or runs.
Riffle	Moderate turbulence; little to no whitewater; high turbulence at points of channel construction. Moderate velocity (20-50 cm/s). Gravel, pebble, cobble substrates (totally or partially submerged). Slope <4%. Channel profile usually straight to convex.
Rapid	Considerable turbulence and whitewater. High velocity (>50 cm/s). Course, exposed, cobble, gravel substrate. Slope of 4-7%. Steps and pocket pools common; planar longitudinal profile.