EARLY DRAFT
NOT FOR DISTRIBUTION
JANUARY 12, 1996 SCW
SACRAMENTO, CA

HABITAT SUITABILITY CRITERIA WORKSHOP NOTES

1. Stream Structure (hydraulic complexity, cover availability)

a. Effect on habitat selection:

If velocity shelter is not available, remaining trout will position themselves in faster water (reflected in Habitat Suitability Criteria).

b. Expected effect on HSC:
Streams with few velocity shelters produce HSC showing **more selection for** ~~preference for~~ higher velocities.

c. HSC Considerations:

The ratio method for constructing preference curves does not work. A need for correcting habitat use for habitat availability is still needed. Gary Smith

Habitat Suitability Criteria for streams dominated by large substrate should have adjacent velocities data collected (where trout are holding in low mean column velocity sites).

Avoid using HSC from sites with different cover availability (Smith and Aceituno 1987).

OTHER STATEMENTS FROM PG&E REPORT
Streams dominated by large substrate size (i.e., more complex structurally and hydraulically) will usually result in selection of slower mean column velocities than streams dominated by small substrate size (this anomaly that can currently best be handled by using adjacent velocity criteria).

Macrohabitat distribution is expected to influence depth and velocity HSC.

Microhabitat selection data collected in riffle-dominated streams are expected to yield HSC that emphasize shallow and swift water use; pool-dominated streams should produce HSC emphasizing deep and slow water use.

2. Season (Temperature)

a. Effect on habitat selection:
Temperature affects the energetic benefits of a feeding site because metabolic rates increase with temperature

b. Expected effect on HSC:
Velocity is the habitat variable most affected by temperature.

HSC developed at higher temperatures show **selection** ~~preference~~ for higher velocities

c. HSC Considerations:
Use separate HSC for different seasons

Avoid using HSC from sites with different temperatures **(Get assistance from Dave Hansen and Wayne Lifton to re-write this statement)**

Use different HSC for depth, velocity, substrate and cover for different seasons (at least recognizing winter and summer) for different activities (particularly winter holding and summer holding positions). Remember that interstitial spaces can be essential for holding and that many species do actively feed in the winter.

The most important diel activity in summer is feeding; the most important diel activity in winter is holding in refuge areas that may well be different locations from summer areas. In rainfall-driven systems, we assume that flows that are "suitable" in spring, summer and fall are suitable for winter as well. Gary Smith In snowpack-driven systems, we assume that there is no water available for out-of-river use because of ice and low flow-caused drought conditions. Gary Smith

OTHER STATEMENTS FROM PG&E REPORT
According to all the research studies reviewed, as water temperatures decline during winter, trout activity and resulting microhabitat use change dramatically.

Significant differences in the mean monthly water temperatures or the distributions of daily maxima between streams (or between seasons) should preclude transfer of HSC.

3. Season (Other)

IN GENERAL THESE ARE SO WHAT?? STATEMENTS THAT HAVE NO FURTHER IMPLICATIONS

a. Effect on habitat selection:
Seasonal variation in photoperiod, food availability, flow, spawning activity, etc. can affect habitat selection

b. Expected effects on HSC:
During spawning, habitat may be selected for spawning instead of feeding

Seasonal reduction in food availability may cause abandonment of marginal feeding sites

Low flows in summer may force use of lower-than-preferred velocities and depths;

High spring flows may force use of higher-than-preferred velocities and depths

c. HSC Considerations:
In general, seasonal effects are poorly understood.

Use HSC developed in the season for which instream flow decisions are most critical (late summer)

4. Fish Size

a. Effect on habitat selection:
Smaller fish are excluded from ~~faster and deeper water (by competition, predation, and energetics)~~ **some fast water areas that large fish can hold in (based on swimming ability (e.g., 3 body lengths per second) and predation). INSTRUCTIONS: Make no statement about depth effects on smaller vs. larger fish.**

b. Expected effects on HSC:

HSC from sites dominated by small fish may indicate selection for lower velocities than HSC from sites with many large fish (in the same life stage), because the small fish cannot handle the higher focal point velocities.

The best habitat may be where the fewest fish are (where a few large adults exclude others)

c. HSC Considerations:
HSC for different age classes (fry, juvenile, adult) account for many size differences

In developing HSC, give more weight to habitat observations of big fish?

Do not assume ~~It should not be assumed~~ that lifestage-specific HSC for two trout populations that differ in length **(and possibly also size-at-age at least for spawning and morphologic changes)** at a given life stage are transferable (i.e., it is best to use HSC from a stream with similar size-at-age for a particular species).

Habitat use by adult and late-juvenile fish of a particular species should be viewed as a continuum based on fish size, with the functional relationship between focal point velocity and size represented by a straight line (see Craig Addley's figure). The size relationship is more useful than the life stage (fry, juvenile, adult) approach in current use. Therefore, HSC should be developed for various size categories. Clair Stalnaker

OTHER STATEMENTS FROM PG&E REPORT
Evidence from behavioral studies indicates that dominance and (interrelated) size control the variation in fish position (within a stream).

5. Competition

HYPOTHETICALLY SPEAKING FOR ALL STATEMENTS BELOW

THIS FACTOR IS NOT USEFUL IN EVALUATING TRANSFERABILITY OF HSC

a. Effect on habitat selection:

Interspecies competition between trout in a population-saturated system may cause some trout to use less suitable habitat.

Different types of predators elicit different habitat use by trout.

b. Expected effects on HSC:

The HSC'S are similar for rainbow and brown trout (except for adults). Rainbow trout HSC in various abundances of brown trout may be different from sites without brown trout.

Sierra brown trout populations typically vary among years due to flood effects on recruitment- so rainbow habitat selection ~~at a site~~ may be affected differently by brown trout in different years

Fish predation should **result in** ~~force~~ smaller fish **using** ~~into~~ shallower stream margins **or cover objects**, while avian predation should result in the **use** ~~selection~~ of deeper water **or cover objects.**

c. HSC Considerations:
Avoid adopting HSC from sites with different species assemblages (especially different trout **species**). **Transferability tests are indicated.**

~~Remember that increased rainbow WUA may be occupied by brown trout.~~
Hypothetically, use "total trout" HSC where both species occur.

Differences in predation risks are rarely known !

6. Food Availability

a. Effect on habitat selection:
High food availability allows trout to use a wider range of habitat

b. Expected effects on HSC:
Sites with high food availability produce HSC with broader range of suitable depth and velocity

c. HSC Considerations:
Food availability is difficult to measure and poorly understood

Avoid adopting HSC from sites with different productivity

GENERAL STATEMENTS

A. IFIM practitioners should use HSC from the local area Sierra Nevada streams and rivers rather than the Bovee (1978) HSC.

B. HSC from Raleigh et al. (1984) and Raleigh et al. (1986) should be used only when no more specific HSC from local Sierra Nevada streams are available.

C. Transferring HSC from one Sierra Nevada stream to another is valid only if the population structure, stream structure, season, and other variables (???) such as water temperature and food source are sufficiently similar (???) between the streams. THIS RECOMMENDATION IS NOT SPECIFIC ENOUGH YET

D. Instead of using general curves (Bovee 1978; Raleigh et al. 1984, 1986) or ~~regional~~ **generalized-local** curves (Smith and Aceituno 1987) at a new PHABSIM study site, you should select HSC that are from a single local Sierra Nevada stream that is similar to the new site in terms of stream structure, season being studied, fish size, competitive conditions, and food availability. WILL MANY STREAMS BE SIMILAR ENOUGH TO MAKE IT THROUGH THIS LONG LIST???

DAY-NIGHT INFLUENCES

GA. Habitat selection and observability (particularly for brown trout) can vary as trout activities change with time of day (e.g., daytime feeding habitat may be different from day resting, night resting or night feeding).

GB. If we can assume that daytime feeding is the most critical flow dependent activity of trout (for all life stages and all year), then the current practice of generating HSC from daytime observations is best.

ENERGY BALANCE REQUIREMENTS

FA. Stream-dwelling salmonids have critical energy requirements that are the result of balancing energy intake with the energy demands of holding a position in a moving-water environment.

FB. Before developing or transferring HSC for a given species/life stage, there should be explicit recognition of the importance of the energy balance that stream fishes must maintain to survive; this balance is achieved by using both holding velocity and feeding velocity, neither of which may be well represented by the mean-column velocity at the position of the fish.

FC. Distance moved from a holding station for drift feeding should be proportional to fish length (for fry and juveniles as well as adults).

IFIM ISSUES

1) Fish have different habitat needs at different times.

2) Low flows/summertime flows are not the main driving time of the year any longer (Clair Stalnaker).

3) How many examples are out there of wintertime HSC? (Ken Bovee's for smallmouth bass; others??)

4) A reality check of cost versus resolution is essential for actual regulatory use of HSC. We cannot require $500K from companies (Gary Smith).

5) We need to concentrate on population-limiting factors (Jeff Thomas) (, at least by season {Clair Stalnaker}).

6) We need to consider historical flows to identify potential habitat problems (Clair Stalnaker).

7) Use regional HSC to evaluate the "potential" of a stream and compare WUA between streams in a region (Tom Studley).

8) Habitat availability definitely affects habitat utilization! Should we develop "Universal or General" HSC (Gary Smith)?

9) "Replicability" is an important issue with HSC. Can the HSC results be replicated (Tom Payne)?

10) The flow at which HSC are collected have a great effect on HSC (Gary Smith and Dave Hansen).

11) HSC may not be describing the fish use but habitat availability in a degraded stream (Jeff Thomas).

12) What do these HSC mean? What do they correlate with? What is the basic meaning of the variables measured? What portions of a fish's selection are based on the items we measured (Craig Addley)?

How do we choose the HSC that are most suitable for the stream of interest?

Are we trying to model what is going on in the stream of interest or are we trying to describe what the fish "really want" whether available in the stream of interest or not?

It is desirable to construct a universal HSC for each region for purposes of comparison at least with HSC for the stream of interest.

Get Ken Bovee's writeup from the IF251 course on correcting habitat use for habitat availability. Circulate this to workshop participants.

There are no "universal" curves that are valid (such as the Raleigh et al. 1984, 1986 curves). But, with appropriate levels of "stratified, genetically similar fish curves", these curves can be extremely helpful and useful to describe use and behavior.

HSC for "critical" activities (e.g., spawning, feeding) are much tighter than for "hanging out" activities.

Issue of controversy: Continuous vs. Binary curves

ROLE PLAYING BY TOM STUDLEY AND GARY SMITH

FIRST
Make the distinction between developing site-specific HSC and use existing HSC
SECOND
For use of existing HSC, make the distinction between HSC developed on-site and HSC transferred

Screening Stage for Transfer of HSC
California Department of Fish and Game's position is that site-specific HSC should be developed. Exceptions include: no fish present, highly degraded habitat, or inability to develop HSC (Gary Smith).

WE WILL CONCENTRATE FIRST ON "USE EXISTING HSC"
Use HSC from literature if validated. Validate using Thomas and Bovee (1993) technology. If impossible to validate, we are in an almost impossible situation. According to Gary Smith, his declining order of preference would then be: same stream-different segment, adjacent stream (with same situations), generic curves (like Bovee 1978), and professional judgment. Get alternative order of preference from Tom Studley.

GIVEN SITUATION
Impossible to collect fish to validate HSC
PROCEDURE
1. List all the available curves
2. Fit a filter to those curves. Convene a panel of experts.
3. Focus down on which of the curves actually fit logically (Tom Payne). (Stream size, stream order, quality of data set from which HSC was derived, elevation, gradient, mean annual flow, flow range, substrate size, population composition, water temperature, ???)
4. Merge the <u>two</u> sets that you chose as a new HSC <u>or</u> run both sets of Q vs. WUA and then take arithmetic mean for WUA at a particular flow (the later suggestion had more support than the earlier one). {Use the range of vales between the two sets as a quasi-confidence interval for sensitivity.}
END OF GIVEN SITUATION

When you have two sets of HSC that seem to fit reasonably, try using HABTAV with both sets.

Use WUA time series not just the flow versus weighted usable area graph. The reason that people are not using time series is because time series generally show that less water (and therefore less habitat??) will be acceptable and recommended.

Why not put together flows based on "health" of the system rather than usable habitat for a species??

Need a written, well-distributed statement of what should no longer be done and what should be done instead (i.e., a paradigm shift).

Need to incorporate in these proceedings a statement about the appropriate use of time series (rather than peak of curve WUA vs. Q relationships).

Recommend (making) paired comparisons of alternatives rather than individual recommendations (that are not compared with any other recommendation).

There are needs for river management that are not handled by calculating WUA for a particular species (e.g., channel maintenance, high spring flows).

Why not manage for habitat types rather than for a particular species? Is a "good" riffle quantifiable in the abstract (generalizable across the local area)?

DEVELOPING SITE-SPECIFIC HSC

1. See Thomas and Bovee (1993) for the approach (Ken Bovee).
2. Map the area for substrate composition, spawning gravel habitat, other.
3. Collect data on water temperature, fish length, fish condition factor, other.
4. Incorporate randomization into the sampling effort.
5. Test your HSC developed on a particular stream on the same stream at a different flow.

SUMMATION

How can HSC taken at one point in time be useful (John Stevens) ??

Availability of habitat has to have an influence on HSC (even if we do not yet agree on a good way to do this) (Gary Smith).

There ought to be some standard guidance for procedures, including sampling strategies (Tom Payne).

Most discussions on food (have) concentrated on feeding stations.

For behavior, we need to concentrate on activity of the fish at time of the observation.

If you do not know the methods (used) for (HSC) development, you cannot reasonably assess their value (Gary Smith).

If two sets both fit, use them both and represent them as the bounds of uncertainty. Testing until they converge may be reasonable and desirable.

Should we always develop new HSC on site, if at all possible?

What does "previously validated" really mean?

What should be done for a stream in which HSC cannot be validated (its impossible to collect fish)?

The index for stream management can be much simpler than is currently employed (like a habitat diversity index for Southeastern streams) (Ken Bovee).

The need for a new Standard Operating Procedure sounds good to Clair Stalnaker but we will need a great deal of help from this group.

There has been a great deal of misuse of IFIM in California (Clair Stalnaker). John Stevens observed that this group agrees with that statement.

Clair Stalnaker asked "Does this group want to recommend a paradigm shift?" For example, (move away from) picking the peak of the WUA versus Q curve (Clair Stalnaker).

You should document the logic for biologically choosing certain HSC (Clair Stalnaker).

Most of the habitat that fish use is <u>not</u> critical while a relative few (habitat needs) that can be chosen biologically are important (spawning, riffles for feeding, pools for overwintering, etc.) (Ken Bovee).

"Local area-generalized" HSC should be constructed, (and then) tested for validity and transferability. Then document when to use and not use the local area-generalized HSC (Ken Bovee).

Agency representative perspectives

Gary Smith would like to see:
Sierra Nevada HSC
Standardization of HSC data collection

Jeff Thomas would like to see:
Proper application of IFIM
Series of "ecotone-specific" curves referred to by Ken Bovee

Mike Henry would like to see:
Standardized curves for the Sierra Nevadas
Conduct sensitivity analyses on these curves to see the differences between HSC

WRAPUP AND ASSIGNMENTS

For documentation of "Proper Use of IFIM" nee "Improvement of Use of IFIM": Develop a Position Statement. NBS writes with help from group (lead is Clair Stalnaker).

For Sierra Nevada "local area-generalized" HSC:
Write a Statement of Need (one paragraph to two pages long).
Lead is Jeff Thomas with help from Jean Baldridge.

For Standardization of Field Data Collection, Documentation and Compilation:
Write a Statement of Need (one paragraph to two pages long).
Leads are Tom Payne with help from Wayne Lifton and Gary Smith.

For Binary versus Continuous Curve Development:
Write a Statement of Need (or a Position Statement??) (one paragraph to two pages long).
Lead is Jeff Thomas.

For Logical Filter for Selecting, Transfer and Application of HSC:
Write a Statement of Need (or a Position Statement??) (one paragraph to two pages long).
Lead is Dave Hansen with help from Tom Studley.

For developing a name for this group:
Lead is Tom Payne with help from Dave Hansen.

No writeups were needed for: sensitivity analyses of different HSC, coding and weighting of spawning areas.

Send writeups to Sam Williamson at email "SAM_WILLIAMSON@NBS.GOV" or fax (970-226-9230) by December 20, 1995.

UPCOMING SESSIONS THAT MAY USE THESE WRITEUPS

March 29, 1996 California-Nevada Chapter of American Fisheries Society in Ventura, CA. Half-day session with Wayne Lifton as chairman (viz., Wayne's World).

March (early part), 1996 National Instream Flow Coordinators scheduled meeting. Clair Stalnaker and Gary Smith are participants.

1996 Terrestrial and Aquatic HSC Symposium. A possibility expressed by Don Orth.

December (early part), 1996 Next workshop held by this group (without the participation of Jeff Thomas, Ken Bovee, and Don Orth). Other possible dates discussed were April, May, and November 1996.