Preliminary Update to TWG November 16, 2010

Grand Canyon Monitoring and Research Center – USGS

Ecosystem Modeling Workshop

Mesa, AZ

October 13-15, 2010

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Workshop Objectives/Focus

- Review of recent development in native and nonnative fish population and food production assessments
- Update and evaluate Lees Ferry reach model (Korman et al.)
- Update and evaluate LCR reach model (Walters et al.)
- Evaluation of LCR model fits, hypotheses (Walters et al.)
- Policy gaming: use of the models to explore alternative water management and non-native fish control policies (Walters & TWG)
- Development of recommendations for monitoring and experimental policy tests based on the policy gaming results (Walters et al.)

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Food Web Presentations

- Discussion about basal resources of food web and energy flows to native & nonnative fish (Rosi-Marshall, Kennedy, Cross, Baxter)
- Discussed New Papers on New Zealand Mudsnail (Cross et al., 2010) and 2008 HFE response (Cross et al. in review)
- New Production estimates from team were incorporated into ecopath modeling (Walters et al.)
- Discussions about Native and Non Native fish interactions & competition for 3 high quality food items

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Lees Ferry Rainbow Trout Model Previewed (Korman et al. in prep)

OBJECTIVES : Lees Ferry RBT Modeling

- Estimate Inter-annual Trend in Recruitment in Lees Ferry
  - Relate to GCD operations and other factors (e.g., basin hydrology, density, etc.)

- Estimate extent of outmigration from Lees Ferry to Marble Canyon
  - evidence for outmigration
  - # of fish that leave
  - size and season when outmigration occurs
  - Inter-annual variation in outmigration (what causes it)

- Estimate Inter-annual trend in recruitment in Marble Canyon
  - Is there evidence of substantial local recruitment?

- Estimate inter-annual trend in total abundance in Lees Ferry and Marble Canyon
  - Relate to management objectives (100 k in LF, 0 in MC)
  - Support other research objectives (evaluation of LF food limitation hypothesis)

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Main findings from workshop

- Severe food limitation in both LF and LCR reaches limit total fish abundances
- Food production strongly linked to flow in LF and downstream turbidity/tributary inputs in LCR
- Downstream food resources are variable mix of allochthonous and autochtonous

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Main findings from Modeling

- Upstream RBT control options strongly impacted by compensatory responses in growth and survival (as per 2003-2005 RTELSS results)

- Downstream non-native control of RBT alone would not prevent HBC decline; control of BNT would; this is based on observation that about 50% of predation is by each predator species, resulting in about 50% total mortality rate on juvenile HBC when trout are near 2003-5 levels

- Impacts on native fish involve both ***competition*** and ***predation*** with trout

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Where & when to control trout?

	Above Lees Ferry	**Lees Ferry to Badger**	**Little Colorado**
Eggs and fry	Ineffective due to compensatory survival (when by 0_2, flow)	NA	NA?
Juveniles (100-200 mm)	Might be ineffective, 30 days for 75% removal	2011 experiment	Effective, and for BNT
Larger fish	Would be ineffective (increased compensation)	NA	Effective, and for BNT

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How to control rainbow trout?

- Mechanical removal variants OR Translocation
- Harvest netting, contract fishing, weirs
- Flow controls, e.g. fast downramping, more severe e.g. 2,500 cfs trout suppression low flows and/or load following (pre-MLFF style operation)
- Sediment curtain (operate dam to enhance natural turbidity OR import fines)

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TAKE HOME #1 - It would be hugely valuable for informing future policy **not to control rainbow trout at the Little Colorado (LCR) in 2011-12**.

Adaptive Strategy Concept: We now have two years of reference data from the Nearshore Ecology (NSE) research study showing very high juvenile survival rates of native fish in the mainstem (preliminary finding), during a period when trout abundances have been the lowest in decades.

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TAKE HOME #2 - Our (ecopath) models now predict that the arrival of large numbers of rainbows **will NOT result in substantial reduction in survival rates of native fish** (as measured by NSE sampling already scheduled), because: (1) turbidity below LCR will reduce rainbow numbers and efficiency; and (2) rainbows have low rates of piscivory due to factors including warm water. This prediction will fail, i.e. survival rates will be lower than in last two years of NSE, if (1) water is clear (and/or cold) so many rainbows move down and feed below LCR, and (2) predation-competition interactions lead to higher predation rates than predicted.

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TAKE HOME #3 - Further, a High Flow Experiment (HFE) **before summer 2011 would impair our ability to interpret survival estimates**, since it is possible that negative effects of sand filling along rocky shorelines may lead to reduced carrying capacity of these habitats for juvenile humpback chub (HBC). Even if there is a poor survival rate in 2011, long term impacts on the HBC population would not be severe (high proportion of HBC recruits produced in LCR, natural variation in HBC juvenile survival and recruitment, long lived species for which high recruitment variation is “normal”).

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NOTE: A Presentation by Josh Korman on the Progress of Lees Ferry RBT Modeling is Proposed for the January 2011 Annual Reporting Meeting in Phoenix, AZ

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