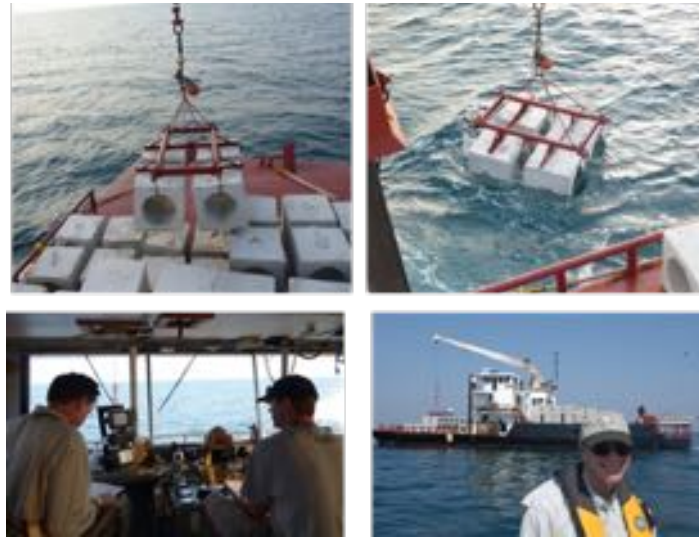
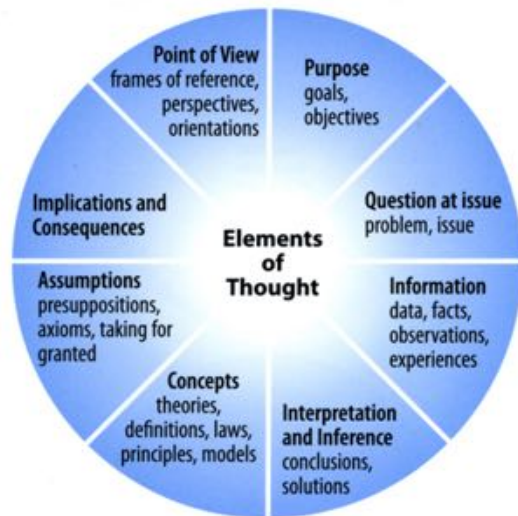


Ecological Functioning of Artificial Reefs with Fisheries Management Implications



Beyond Attraction-Production: Philosophical Basis of a Protracted Debate

Critical Thinking



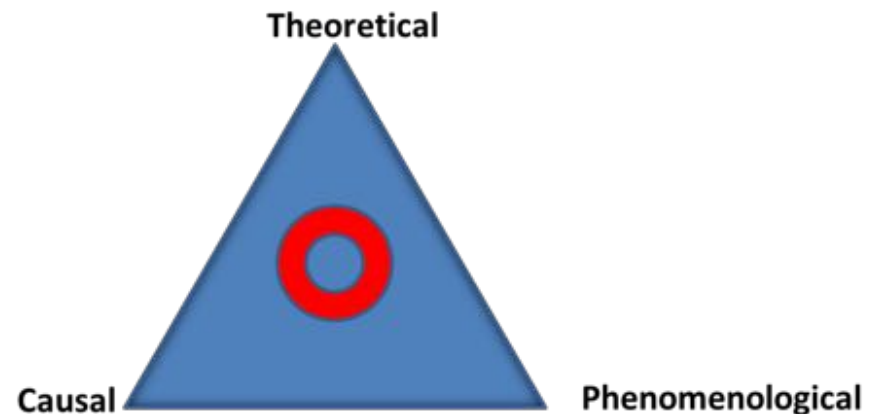
Used With Sensitivity to Universal Intellectual Standards

Clarity → Accuracy → Depth → Breadth → Significance
Precision
Relevance

Excerpted from "The Thinker's Guide to Critical Thinking: Concepts and Tools", page 5.

Foundation for Critical Thinking
www.criticalthinking.org

Conceptual Space of Ecology



Adapted from Cooper, G.J. 2003. *The Science of the Struggle for Existence: On the Foundations of Ecology*. Cambridge University Press. 319 pp.

Application of Habitat Selection Theory

- Ideal Free Distribution, **IFD** (Fretwell & Lucas 1970, Fretwell 1972)
- Density-Dependent Habitat Selection, **DDHS** (Rosenzweig 1981, 1985)
- Ontogenetic Habitat Shifts, **μ/g** (Werner & Gilliam 1984)
- Spatial Scaling in Ecology (Wiens 1989)
- Basin Model of Dynamic Geography (MacCall 1990)
- Foraging Arena Theory (Walters & Juanes 1993, Walters & Korman 1999)
- Life History Bottlenecks (Caddy 2007, 2011, 2013)

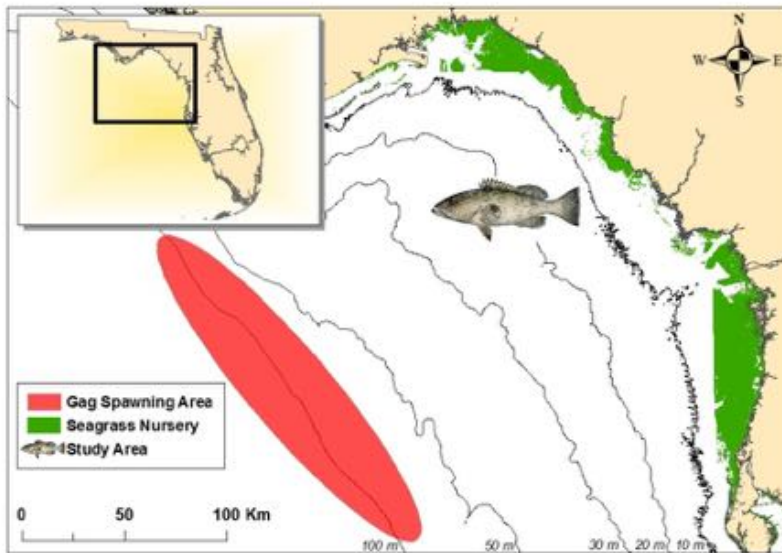
Habitat selection affects growth, survival and reproduction.



Gag, *Mycteroperca microlepis*

Gag as a Model System:

Spatially Structured Life History
Density Dependent Habitat Selection
Intrinsic Habitat Quality
Fishing Effects
Hypothesized Bottleneck



Lindberg et al. 2006. *Ecol. Appl.* 16:731-746

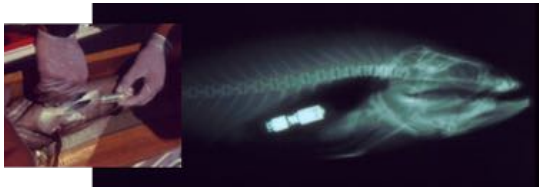
Kiel. 2004. M.S. thesis, UF

Larsen. 2005. M.S. thesis, UF

Biesinger et al. 2011. *Ecol. Modeling* 222:1448-1455

Biesinger et al. 2013. *JEMBE* 443:1-11

Biesinger et al. *submitted*. *Mar. Biol.*



Video credit: L. Kellogg ca. 2000

Steinhatchee Fisheries Management Area

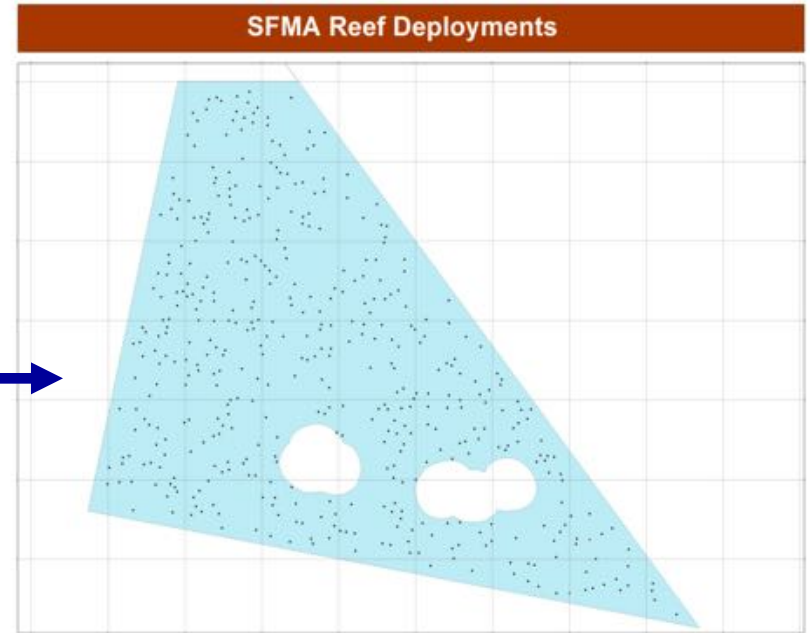
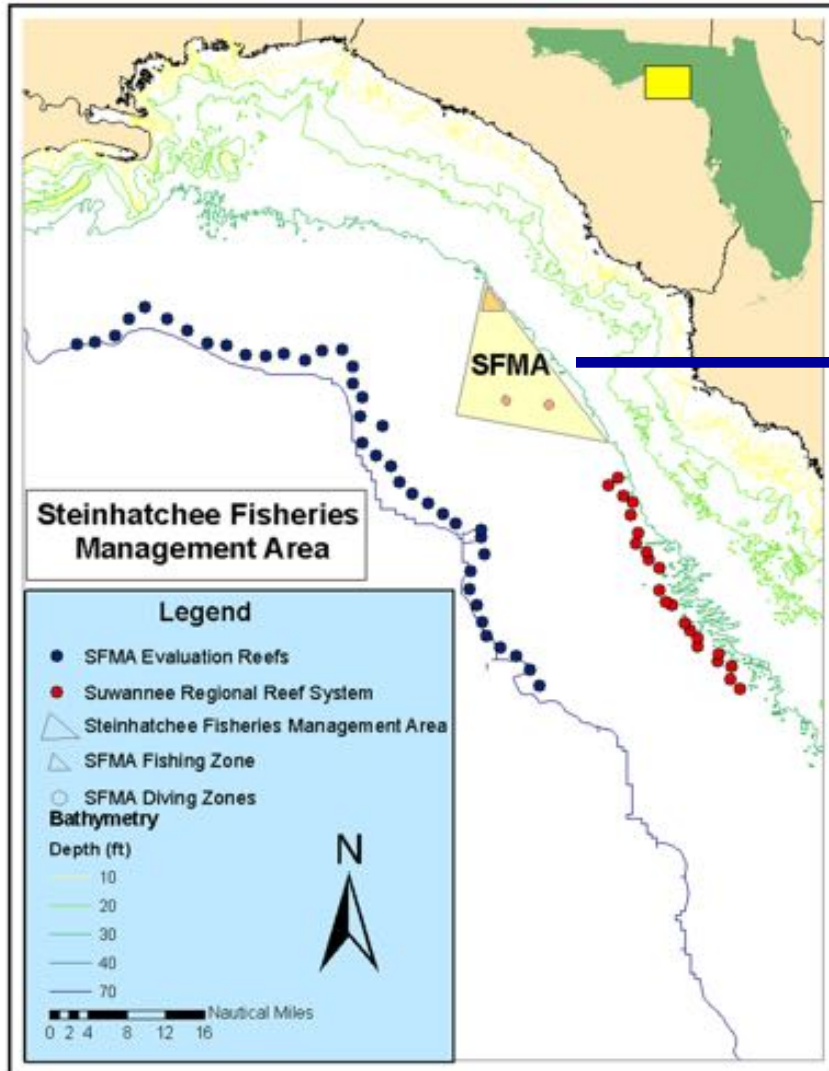
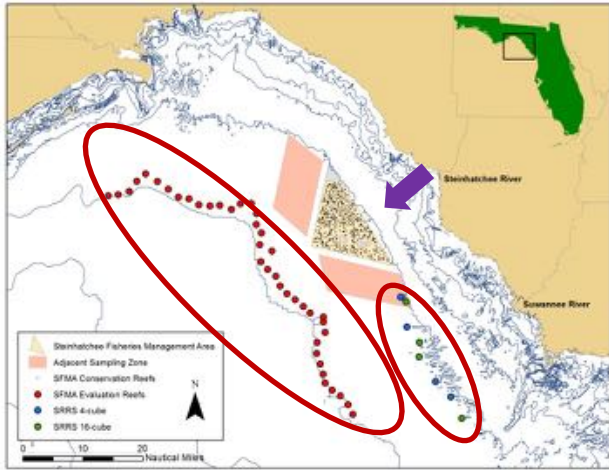
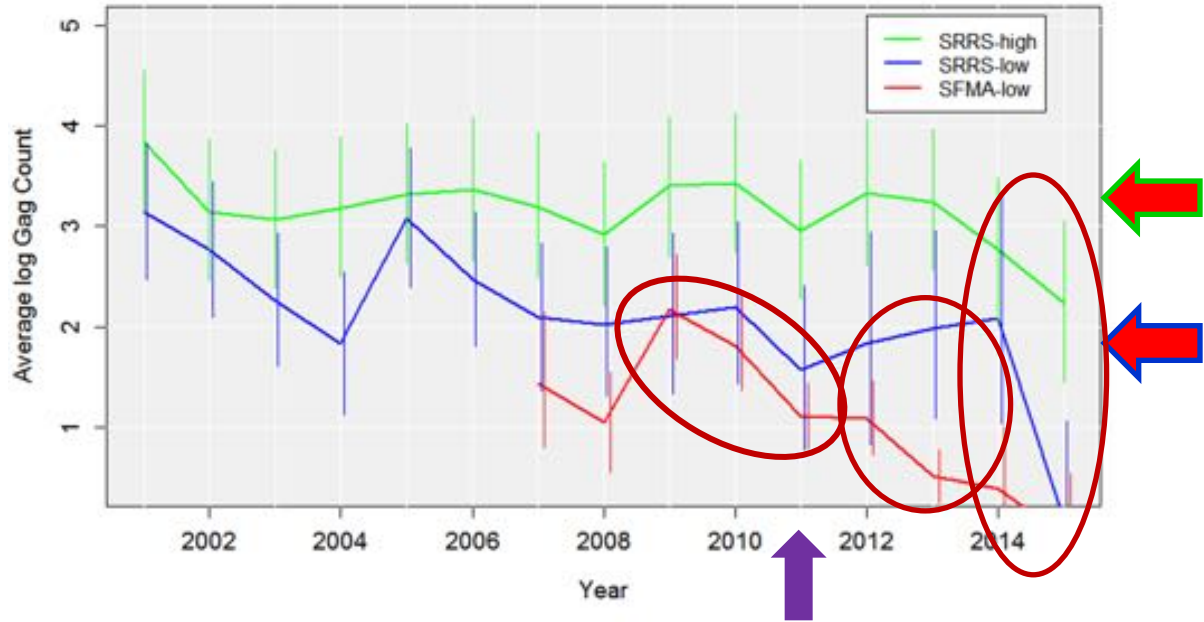


Photo Credits: Keith Mille (FWC)

Testing Expectations from MacCall's Basin Model



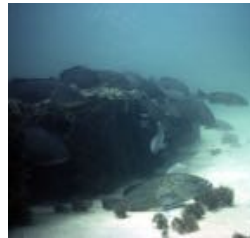
Mean (log) Gag Counts and 95% Credible Intervals by Year for Three Artificial Reef Types
SRRS-high, SRRS-low and SFMA-low



4-Cube Reefs
“Lower Quality”
(from perspective of the fish)



16-Cube Reefs
“Higher Quality”
(from perspective of the fish)



n = 24 or 40 per reef type

Implications for artificial reefs in fisheries management?



1. Indices of abundance are a function of intrinsic habitat quality
2. Hyperstability in CPUE is to be expected
3. Spatial equilibria “all other things equal”
4. Spatial “perturbations” matter!
 - Red tides (or hypoxic zones or oil spills)
 - Changes in habitat availability
5. Spatially explicit modeling needed; socio-ecological and management strategy evaluation (MSE)



Jon Dodrill, FWC (retired)



Gag, *Mycteroperca microlepis*

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Kai Lorenzen, Ed Camp, Rob Ahrens, Jynessa Dutka-Gianelli

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