

Assessing Ecosystem Restoration using Coupled Modeling:

Necessary, Messy, Doable

Kenneth Rose
Horn Point Laboratory



Background

- Chesapeake Bay modeling is looking forward
- I am new to the community
- Experience
 - Ecological and fisheries modeling
 - Experience with large-scale restoration efforts
- Asked to give a inspiration talk

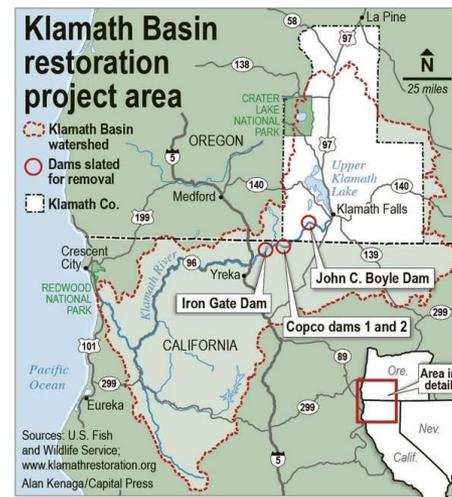
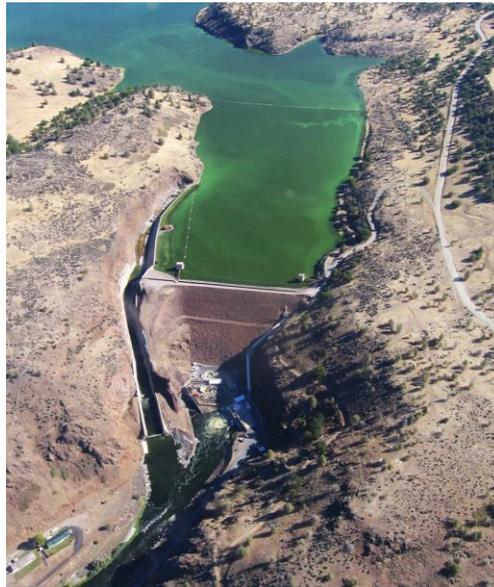
*Evaluation of the Predictive Ecological Model for the
Edwards Aquifer Habitat Conservation Plan:
An Interim Report as Part of Phase 2*

Committee to Review the Edwards Aquifer Habitat Conservation Plan

Water Science and Technology Board

Division on Earth and Life Studies

The National Academies of
SCIENCES • ENGINEERING • MEDICINE





Emergent Patterns

- Tightening resources (diminishing bang for the buck) and reality of tradeoffs
- Convolution of hypoxia, warming, acidification, and habitat
- Increasing knowledge and savvy of stakeholders

Emergent Patterns

- Increasing demands for linkage to living resources
 - Dragged, pushed, pulled
 - Habitat
 - Stages
 - Population
 - Food web
- Critical (controversial) role of increasingly complex models

My Perspective

- Good news: impressive progress and cooperation
Bad news: some others have gone off the tracks
- The people here know the questions, models, etc.
- Outside-insider
 - Naïve view
- Offer my observations:
 - Quickly on some of the technical issues
 - Discuss some non-technical issues

Technical Issues (cautions)

- Which models to use (looks arbitrary or convenient)
- A lot of work on coupling models (loss of information)
- Validation (physics people need to relax)
- Uncertainty (I prefer certainty)

Technical Issues (cautions)

- Multiple and ensemble modeling (confusion)
- Domain of application (not defined)
- {Active/passive} Adaptive Management (delay difficult decisions)
- Coupled human-natural systems (disappointing except dollars)

ERDC/EL TR-12-18

ital Laboratory



US Army Corps of Engineers

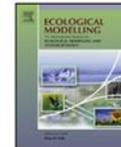
Ecological Modelling 300 (2015) 12–29



Contents lists available at ScienceDirect

Ecological Modelling

journal homepage: www.elsevier.com/locate/ecolmodel



Proposed best modeling practices for assessing the effects of ecosystem restoration on fish

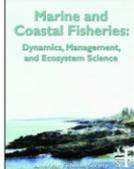
Kenneth A. Rose^{a,*}, Shaye Sable^b, Donald L. DeAngelis^c, Simeon Yurek^d, Joel C. Trexler^e, William Graf^f, Denise J. Reed^g

Available online at www.sciencedirect.com
SCIENCE @ DIRECT®
Environmental Modelling & Software
Volume 23 (2006) 602–614
www.elsevier.com/locate/ensoft

Protection and Restoration Authority
Baton Rouge, LA 70804 | coastal@la.gov | www.coastal.la.gov

Water Plan

Selecting Fish Modeling Approaches



Marine and Coastal Fisheries

Dynamics, Management, and Ecosystem Science



ISSN: (Print) 1942-5120 (Online) Journal homepage: <http://www.tandfonline.com/loi/umcf20>

Recommendations on the Use of Ecosystem Modeling for Informing Ecosystem-Based Fisheries Management and Restoration Outcomes in the Gulf of Mexico

Arnaud Grüss, Kenneth A. Rose, James Simons, Cameron H. Ainsworth, Elizabeth A. Babcock, David D. Chagaris, Kim De Mutsert, John Froeschke, Peter Himchak, Isaac C. Kaplan, Halie O'Farrell & Manuel J. Zetina Rejon

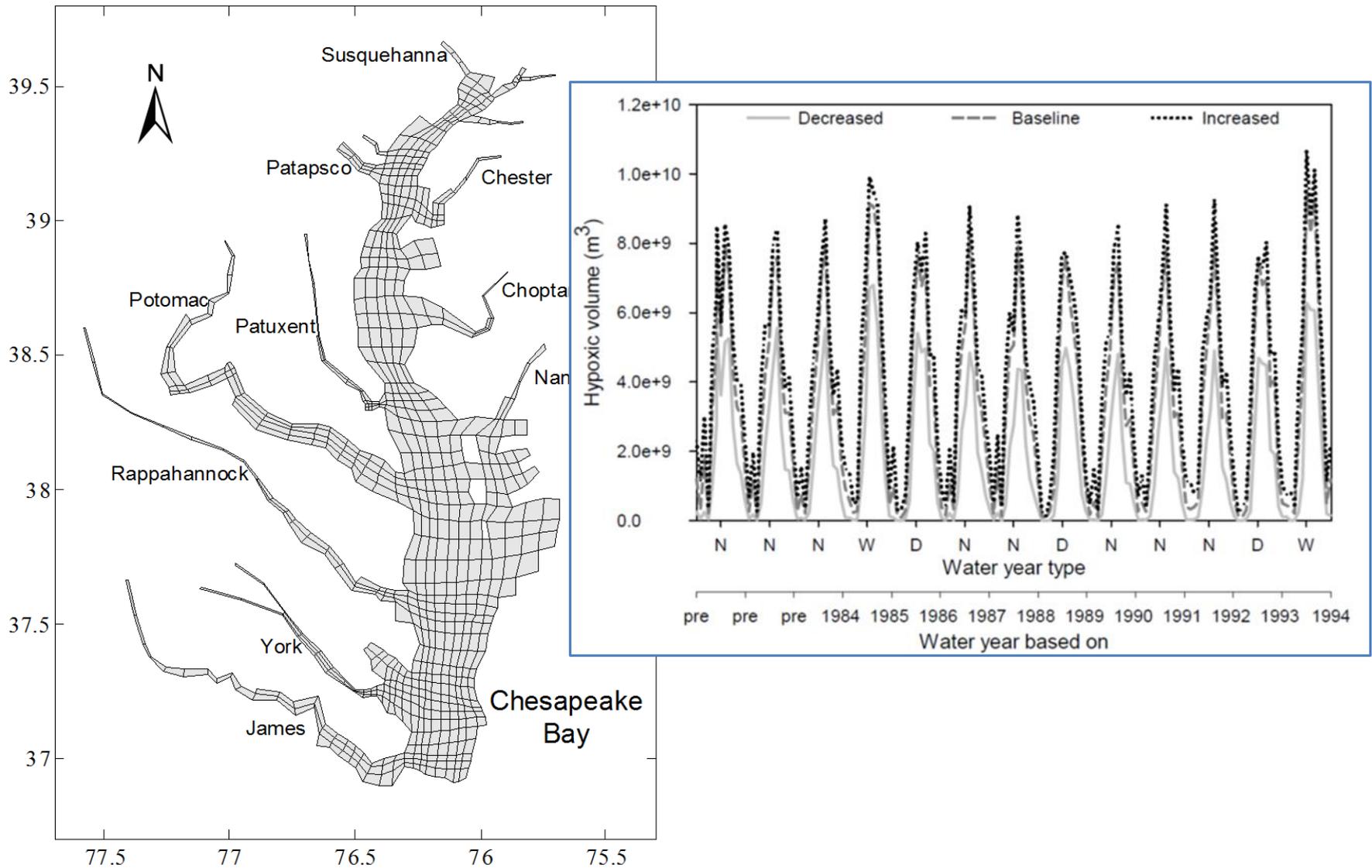
D. Holzworthⁱ, J. Mysiak^k, J. Reichl^l, R. Seppelt^m, T. Wagenerⁿ, and P. Whitfield^o

Report: Version I
Date: October 31, 2013
Prepared by: Kenneth A. Rose, Shaye Sable



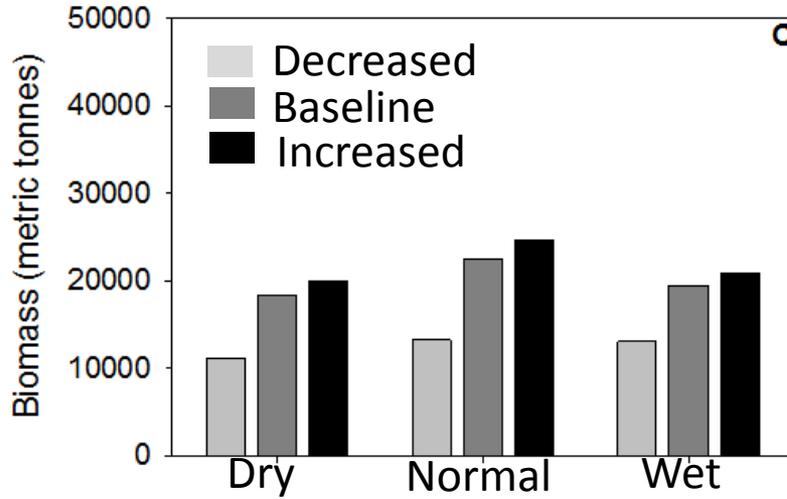
Some Examples (Doable)

- Bay anchovy in Chesapeake Bay
- Croaker in Gulf of Mexico (ongoing)
- Mention two simpler models:
 - Larval fish (life stage)
 - 3D movement (exposure)

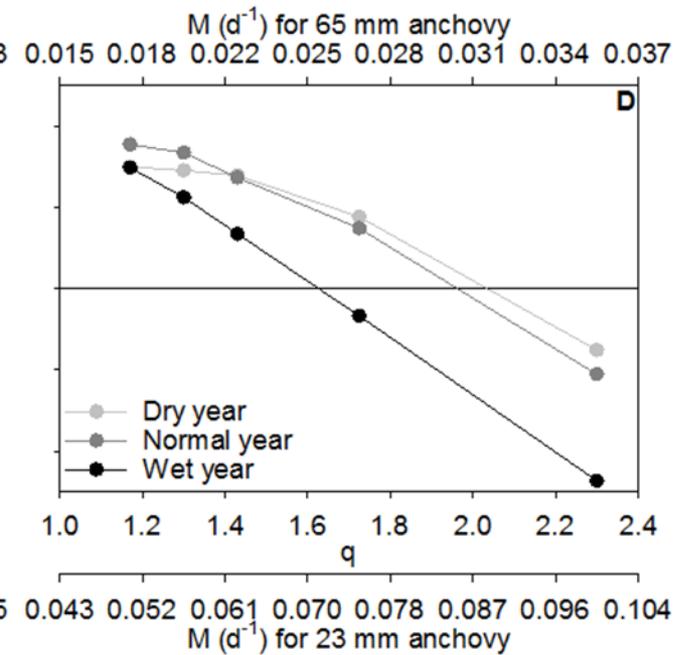
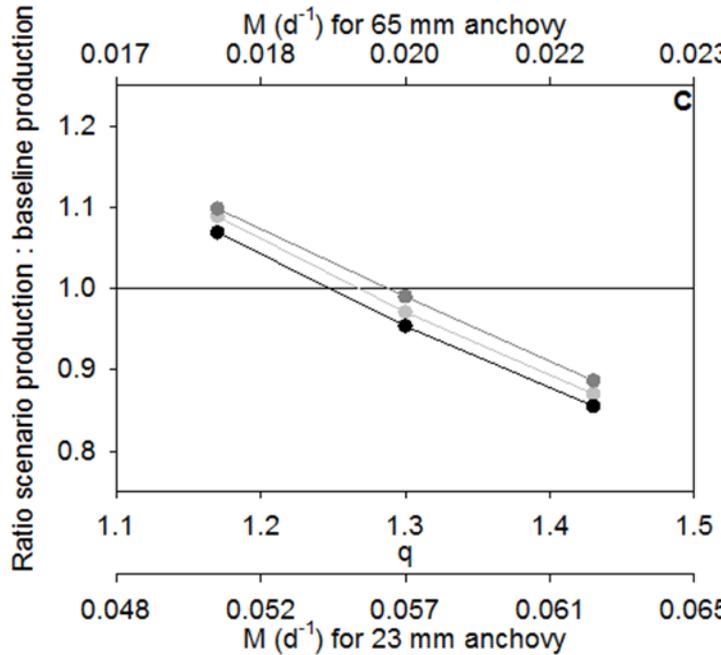
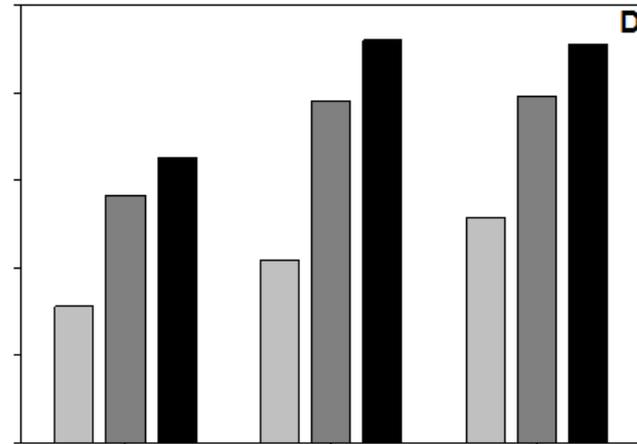


Adamack, A.A., K.A. Rose, and C. Cerco. 2017. Simulating the effects of hypoxia on bay anchovy in the Chesapeake Bay using coupled hydrodynamic, water quality, and individual-based fish models. In: *Modeling Coastal Hypoxia*, Springer, New York, NY

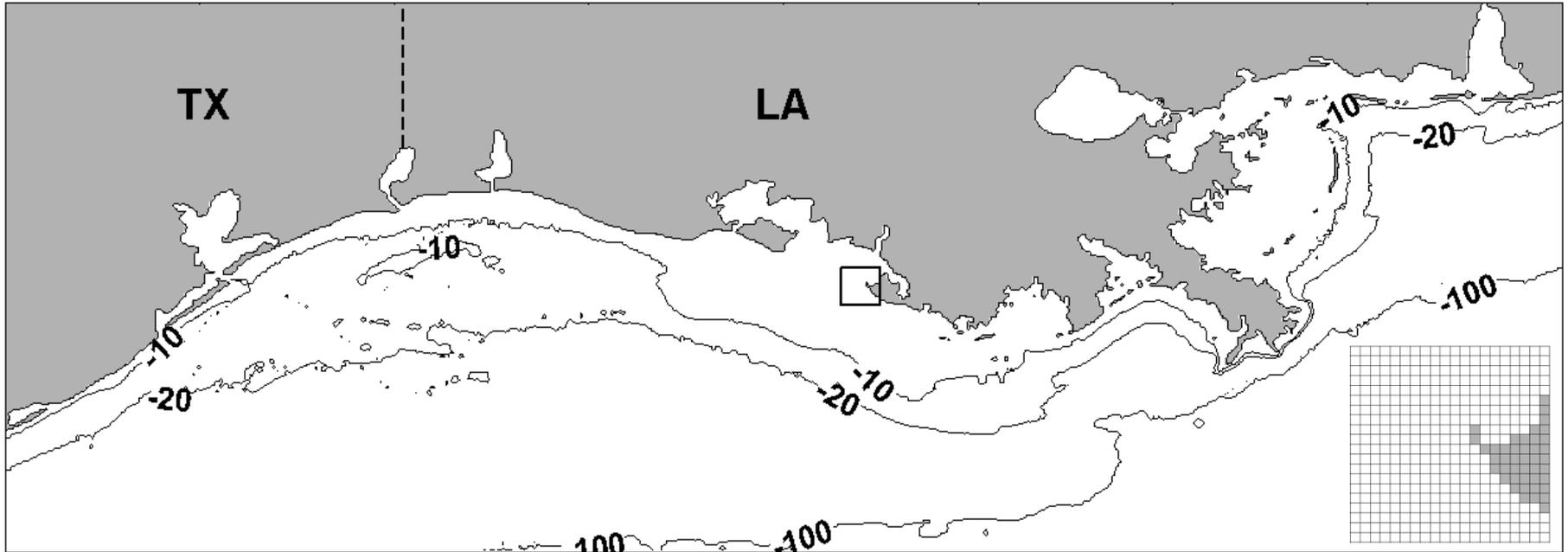
Low Recruitment



High Recruitment



Model Grid



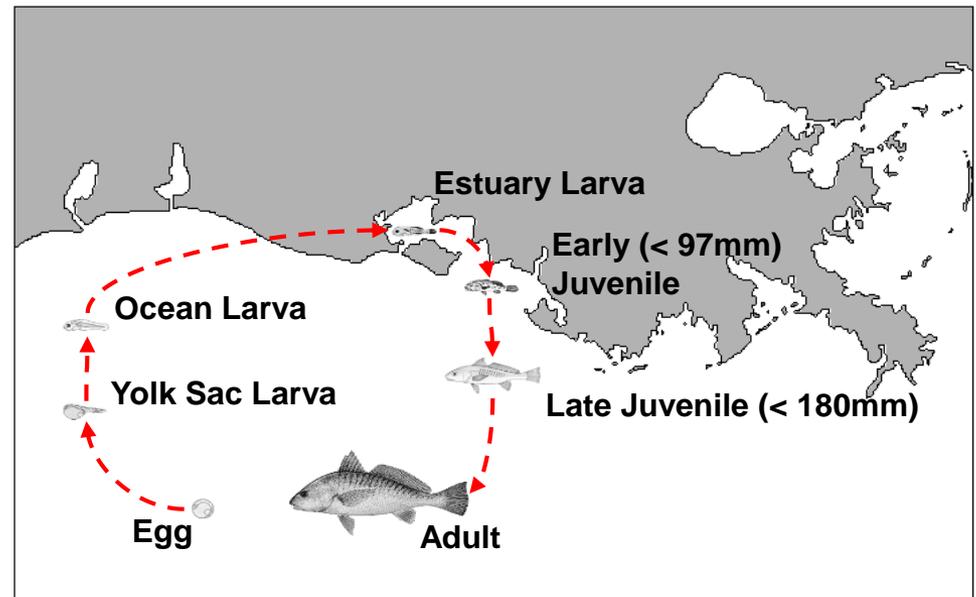
- Idealized 300 x 800 cell grid (1 km resolution)
- Bottom elevation for each cell is truncated beyond 100 m

Rose, K.A., Creekmore, S., Justić, D., Thomas, P., Craig, J.K., Neilan, R.M., Wang, L., Rahman, M.S. and Kidwell, D., 2018. Modeling the population effects of hypoxia on Atlantic croaker (*Micropogonias undulatus*) in the northwestern Gulf of Mexico: part 2—realistic hypoxia and eutrophication. *Estuaries and Coasts* 41: 255-279.

Model Overview

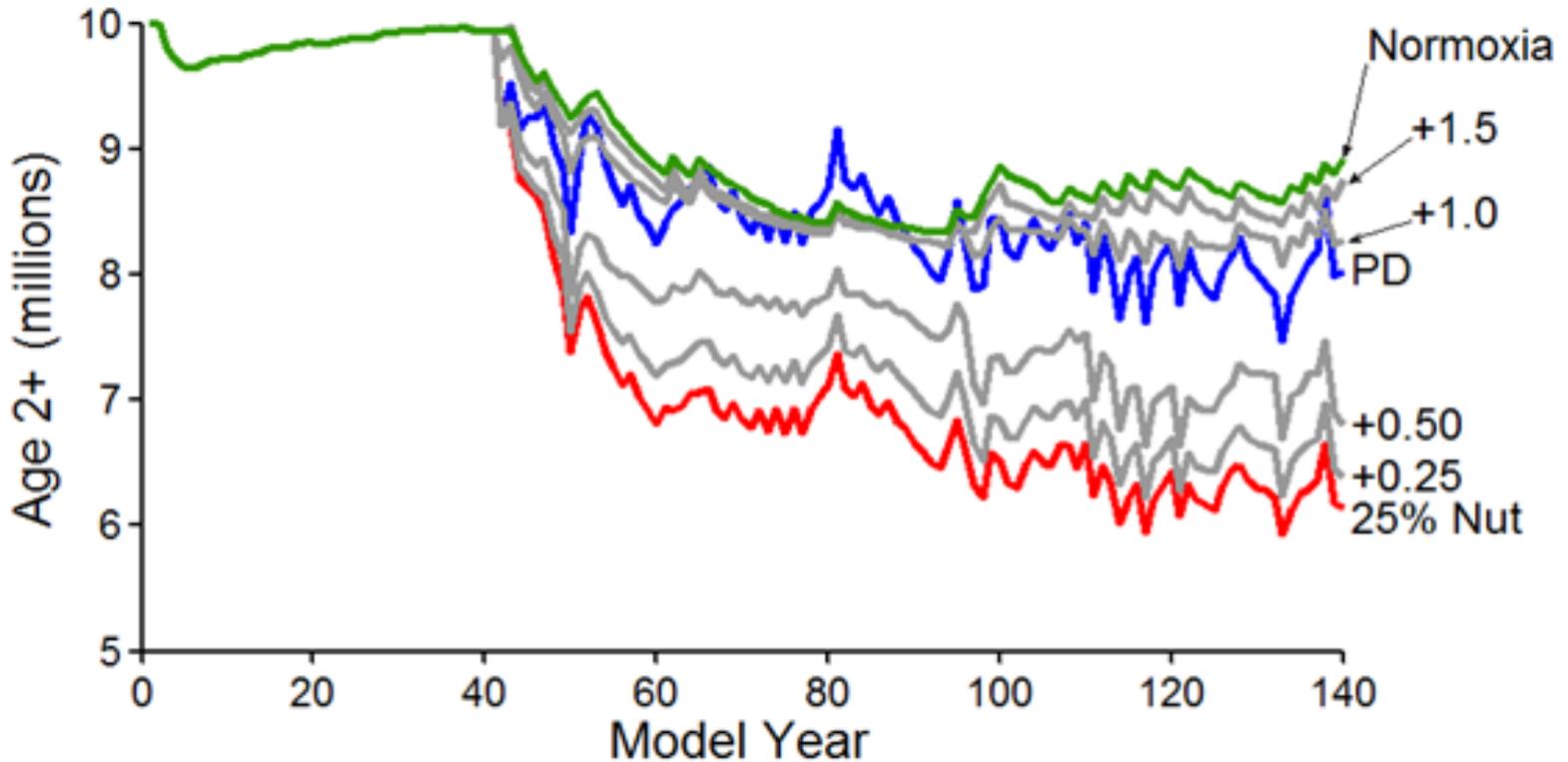
- Spatially explicit, IBM
 - Follows 7 stages to age 8
 - September 1 birthday
 - Model year begins Sept. 1
 - Each year 365 days long

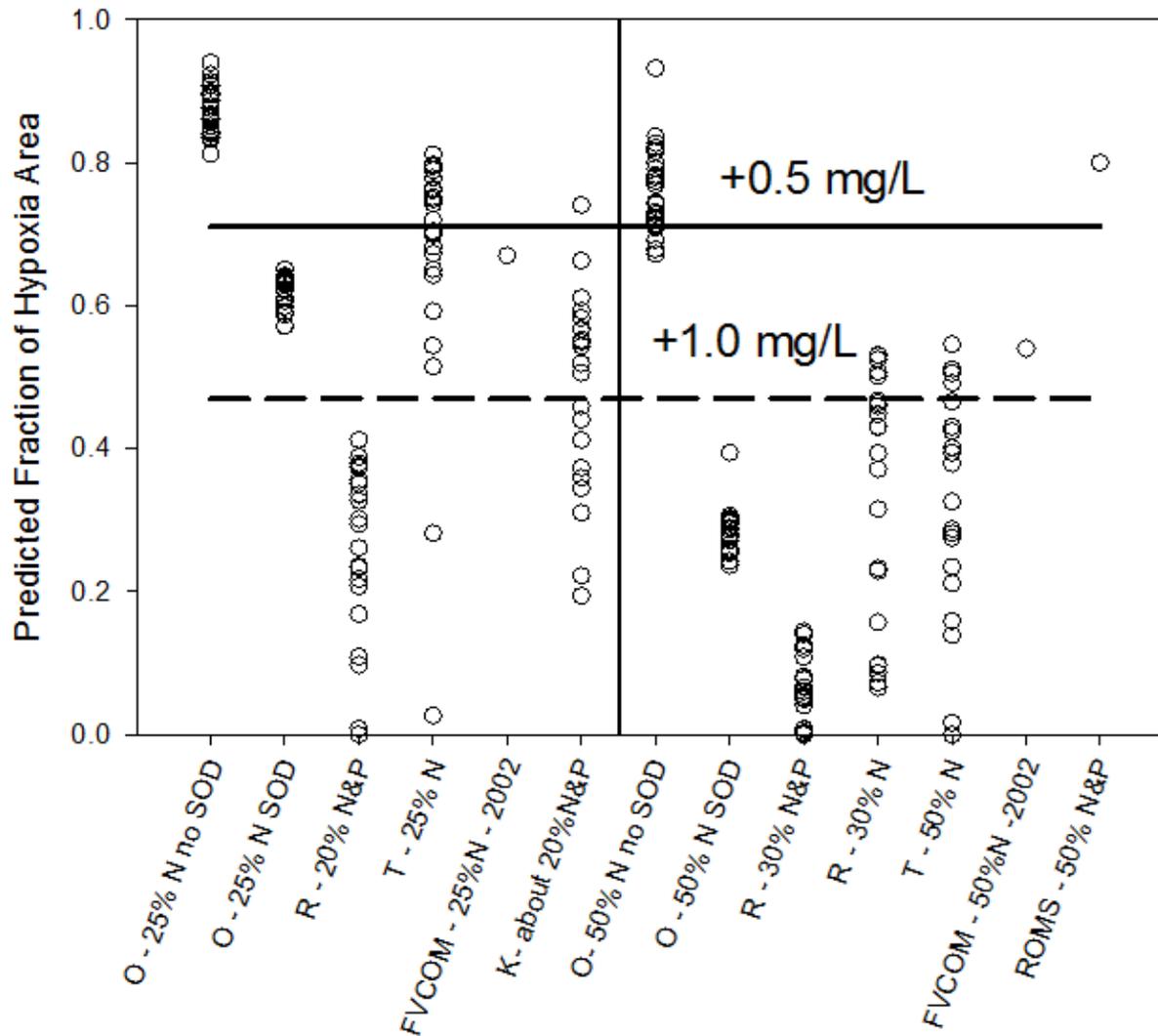
- Hourly processes
 - Growth
 - Mortality
 - Reproduction
 - Movement



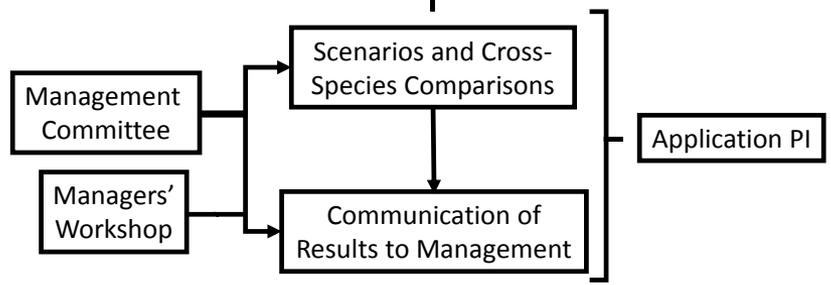
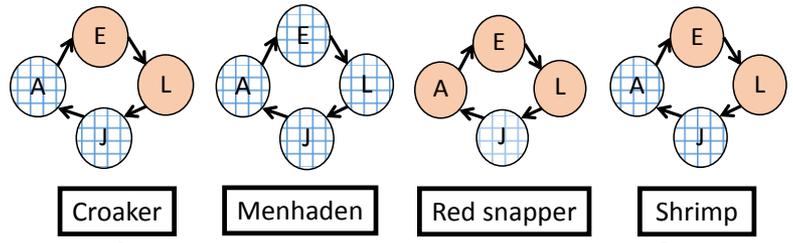
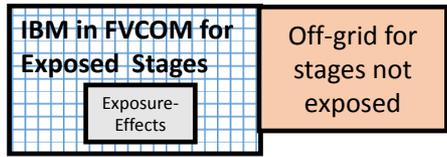
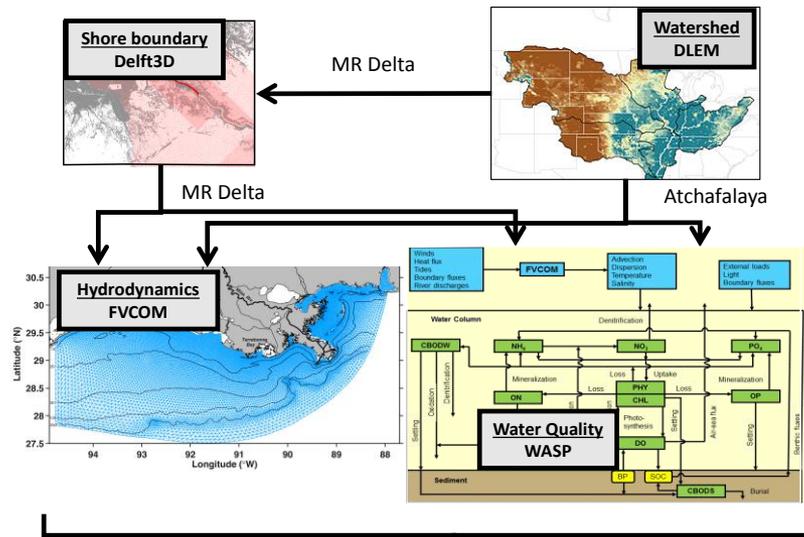
25% Reduction in Nutrients

PD: benefit?; Normoxia: best can be expected

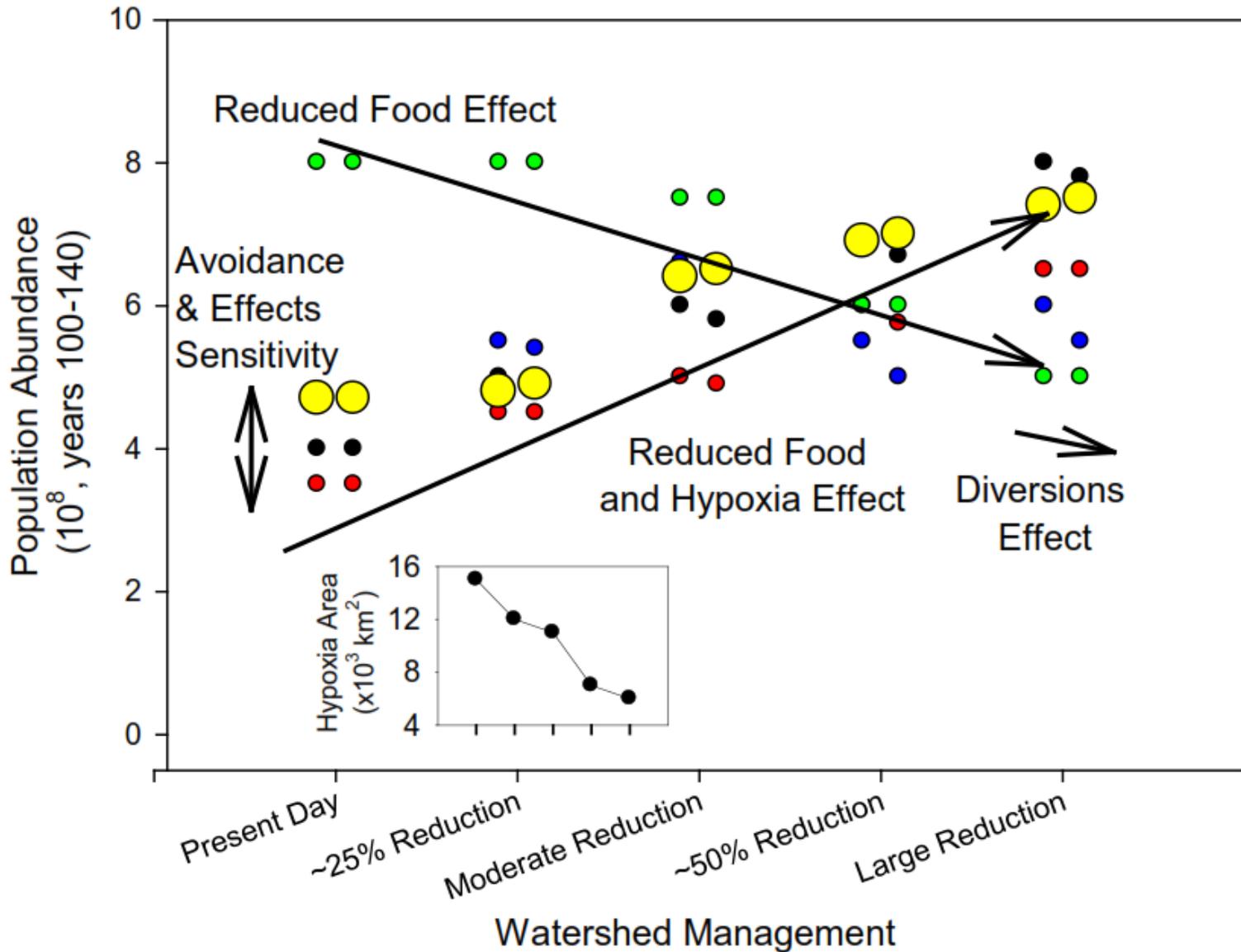


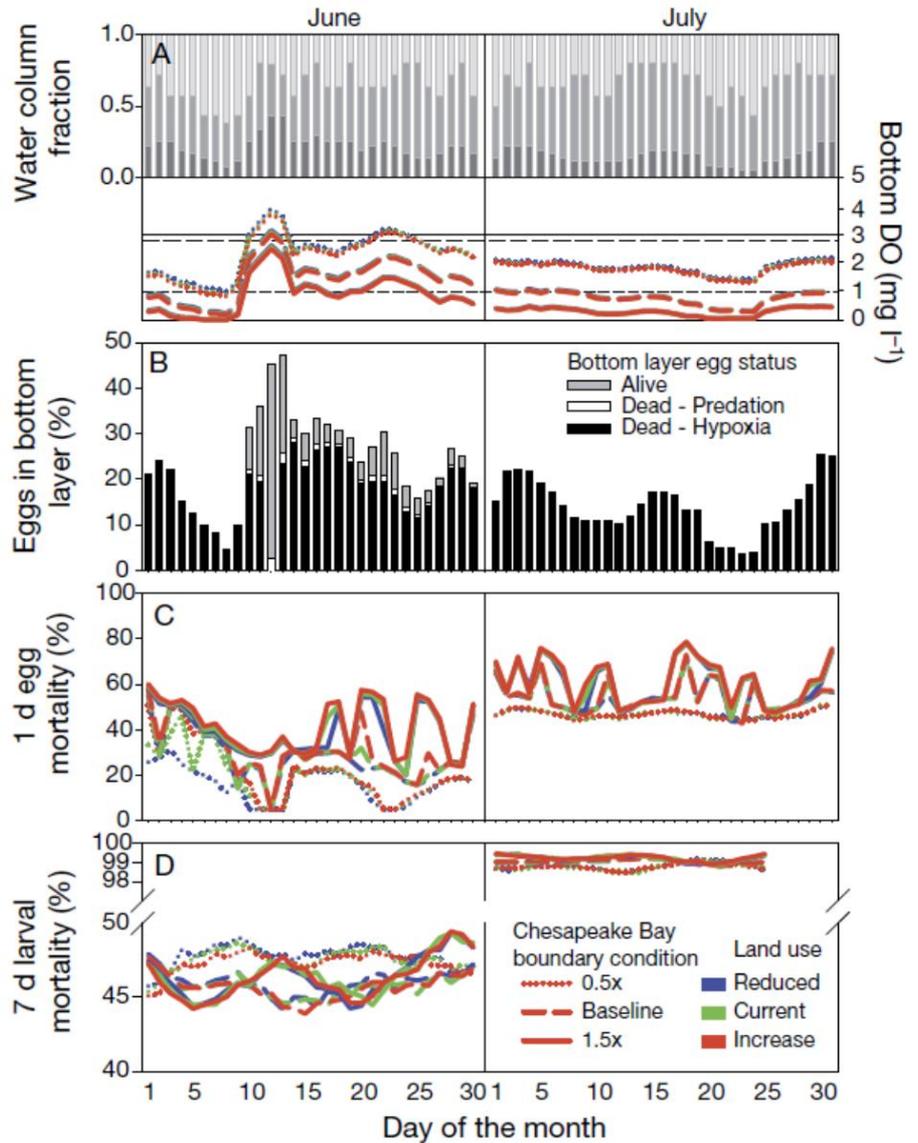
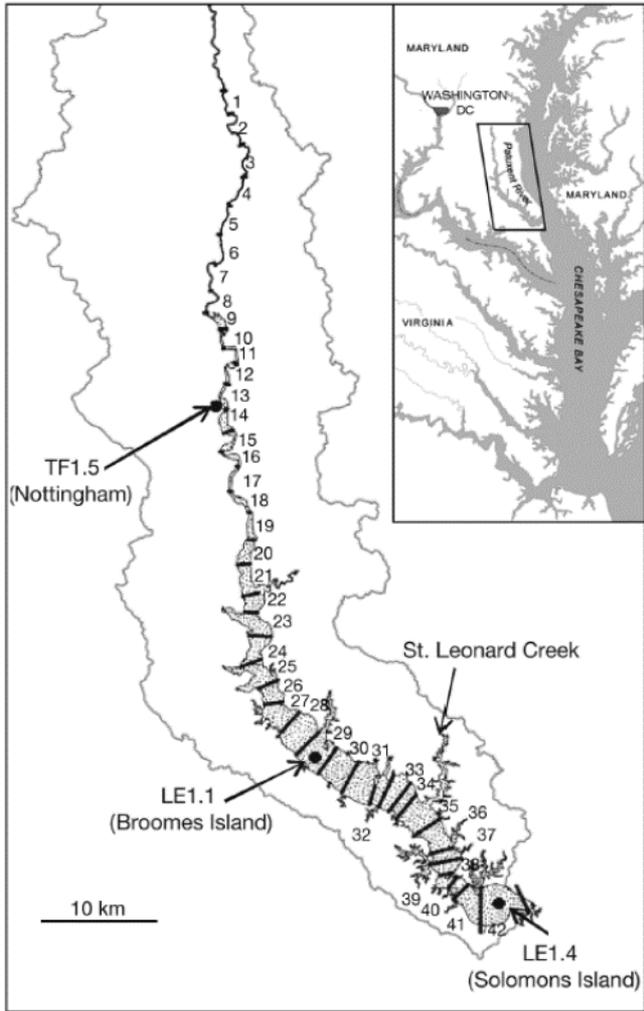


O = Obenour et al. (2012); R = Rabotyagov et al. (2014); T = Turner et al. (2012);
 K = Kling et al. (2014); ROMS = Laurent and Fennel (2014)

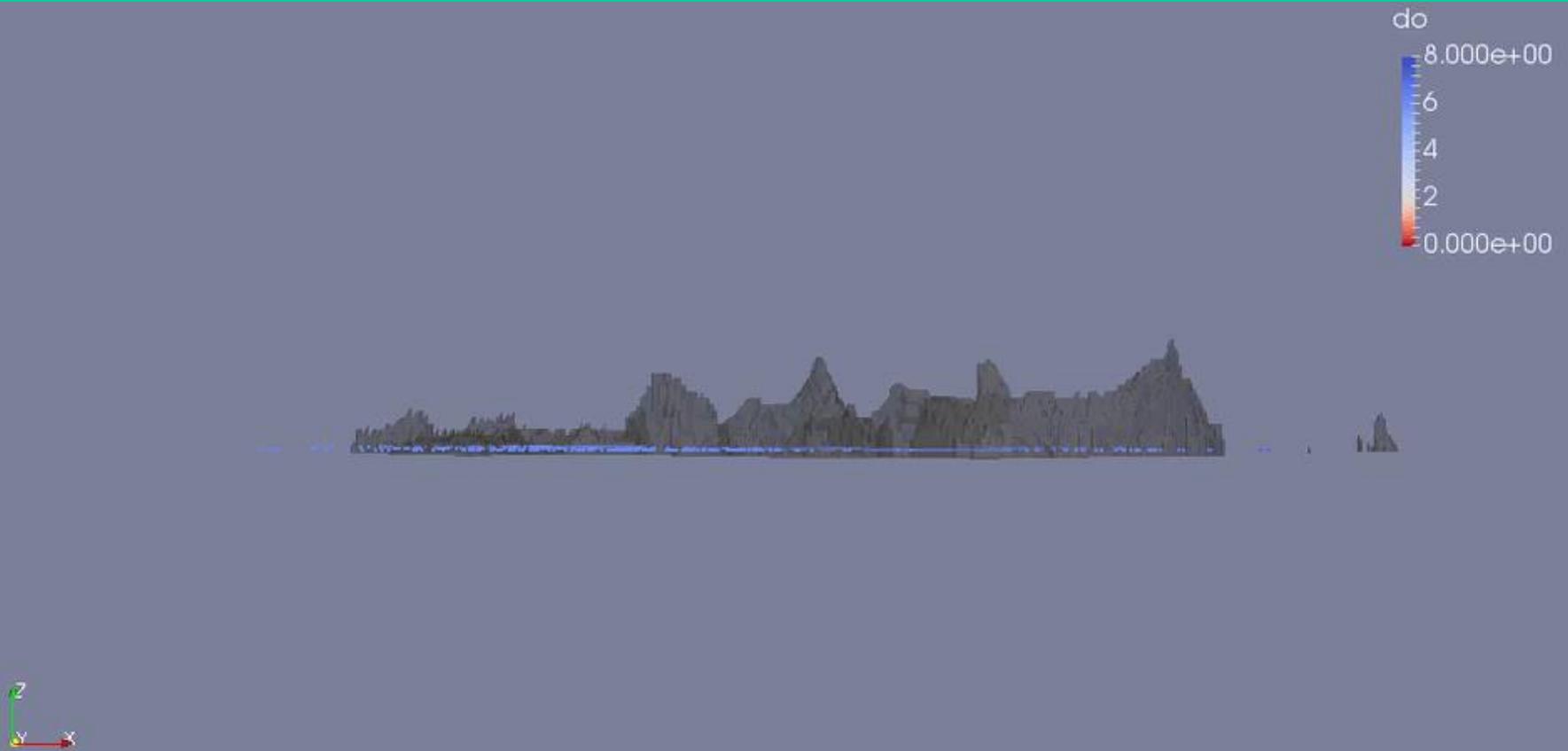


Is the GOM ahead of CB?





Adamack, A.T., K.A. Rose, D.L. Breitburg, A.J. Nice, and W.S. Lung. 2012. Simulating the effect of hypoxia on bay anchovy egg and larval mortality using coupled watershed, water quality, and individual-based predation models. *Marine Ecology Progress Series* 155: 141-160.



LaBone, E., D. Justic, K.A. Rose, and H. Huang. almost. Exposure of fish to hypoxia in the northern Gulf of Mexico: Effects of allowing fish to move vertically....

Non-technical Issues

- Terms: fish, fisheries, habitat
 - Hindcast, forecast, prediction, projection,
 - Relative vs absolute
 - Sustainable, resilience
 - Uncertainty, sensitivity, validation
- Answers to simple questions
- Managing expectations

Non-technical Issues

- Role of stakeholders
- Communication of models, uncertainty, risk
- Unified voice
- Ultimately, trust

Terms

- Fishing or fisheries is “the industry or occupation devoted to the catching, processing, or selling of fish, shellfish, or other aquatic animals”
- Habitat – always say what aspects and processes
- Prediction, projection, forecasting
 - Look at the x-axis and y-axis

Terms

- Sustainable, etc.
 - Always give units and scales
- Uncertainty
 - We love the methods
 - Issue is proper interpretation of the “error bars”
- Validation
 - Dilemma

Simple Questions

Hale, C. et al. (2015)



Blue Crab and Eastern Oyster in the Gulf of Mexico: Commercial Landings (millions of pounds), 1991-2013

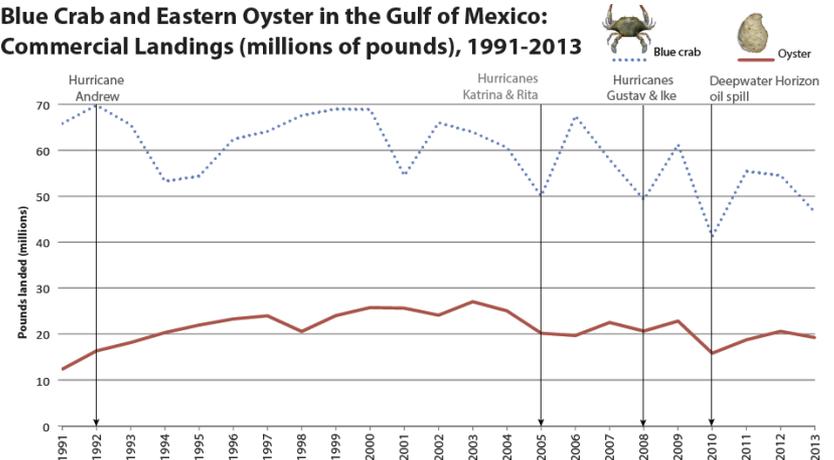
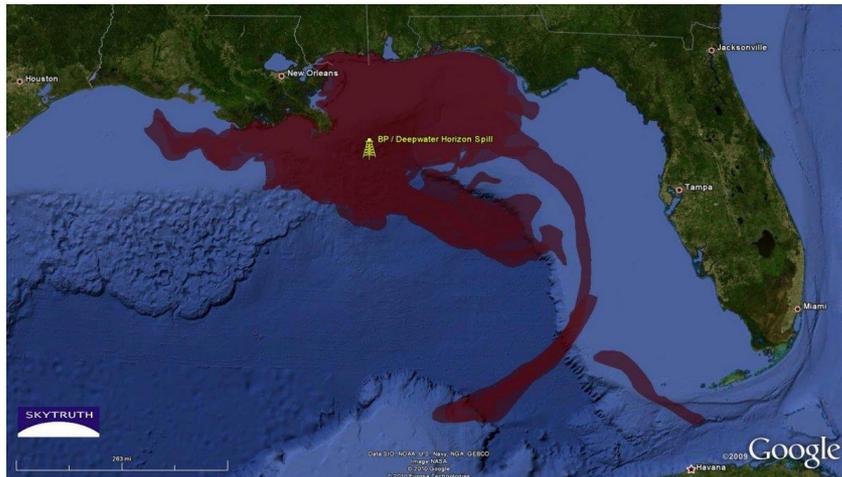


FIGURE 1. Recent disasters show some relationship to landings of blue crab and oysters, but the picture is incomplete. Managers must depend on additional indicators when assessing the health of the fisheries.⁶ Images credit: Gulf FINFO⁶



Red Snapper in the Gulf of Mexico: Commercial and Recreational Landings (millions of pounds), 1991-2013

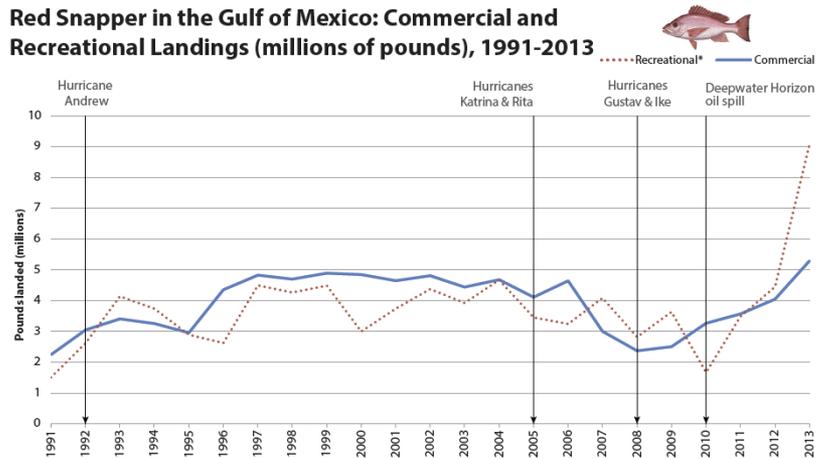


FIGURE 2. Both commercial and recreational red snapper landings are influenced by disasters, but managers must consider other factors influencing fish population numbers, such as management actions.^{6,7} Image credit: Gulf FINFO⁶

⁶Amount harvested, defined by NMFS as catch brought back to the dock in a form that can be identified by trained interviewers, plus catch used for bait, released dead, or filleted.⁷

Managing Expectations

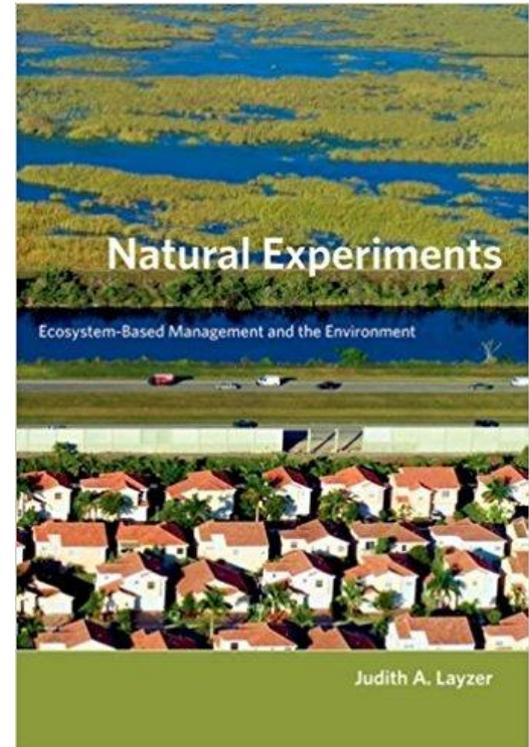
- Lags in water quality, LAGS in living resources
- Costs a lot of money, 4-year political cycle
- Detection challenge within the variation caused by other factors
- Interpreting modeling products



Stakeholders

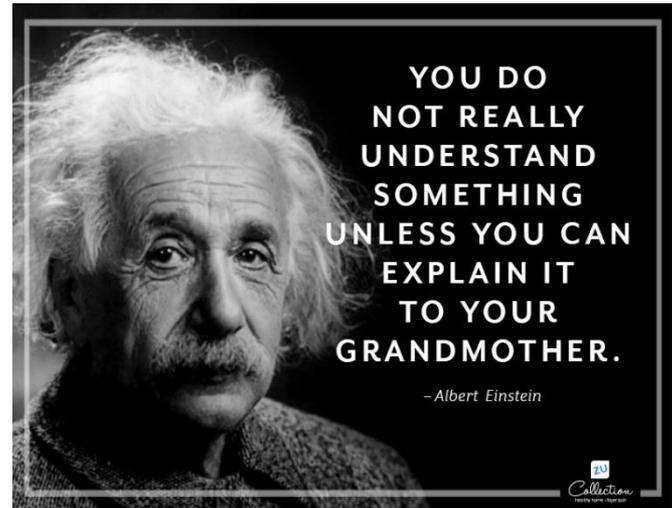
**TRIGGER
WARNING**

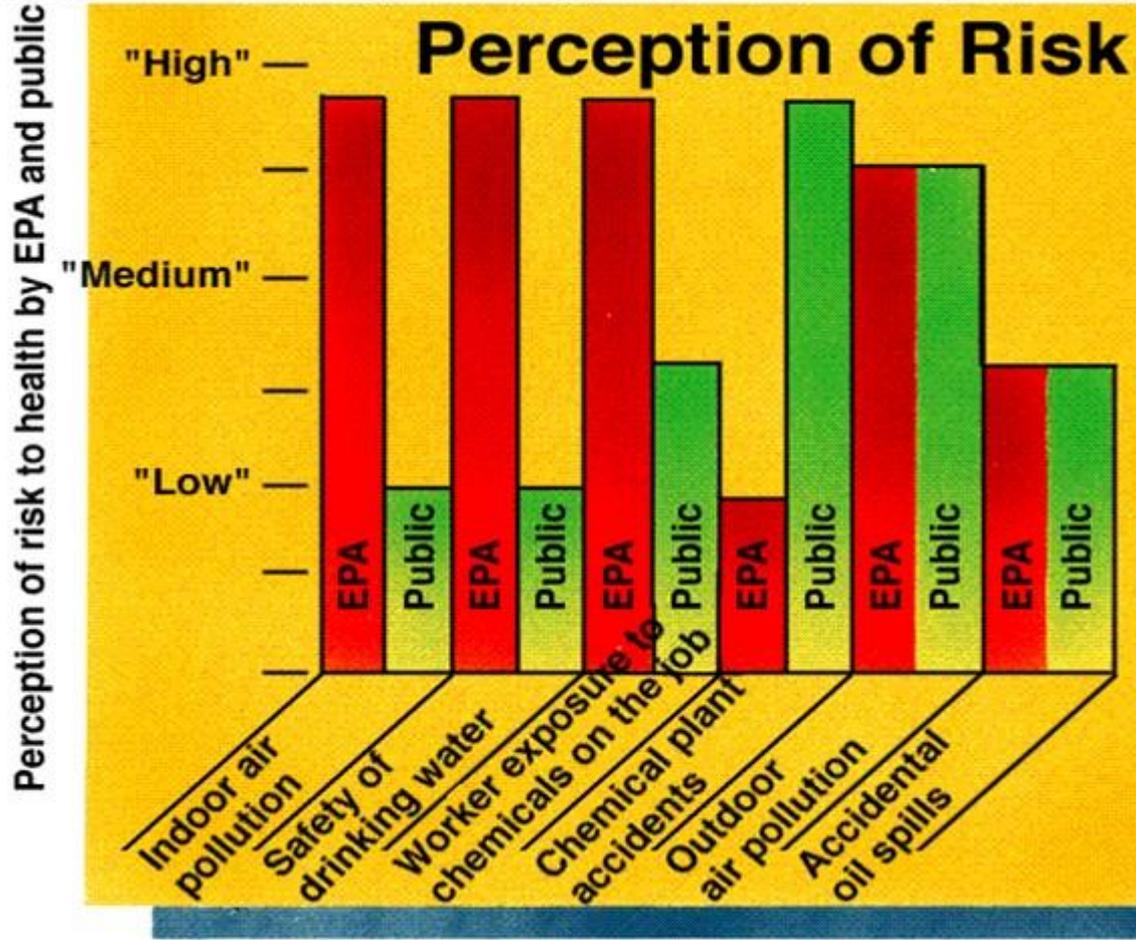
- Consensus constrained the environmental effectiveness of the restoration
- “Participatory modeling”
- Caution:
 - “Something for everyone”
 - OK until do not like results
- Very clearly stated impregnable firewall



Communication

- Do not use simplified versions of models
- Do not dumb down
- Uncertainties
- Mix of philosophies of scientist and attorney
 - Balance what we do and do not know
 - Public and risk

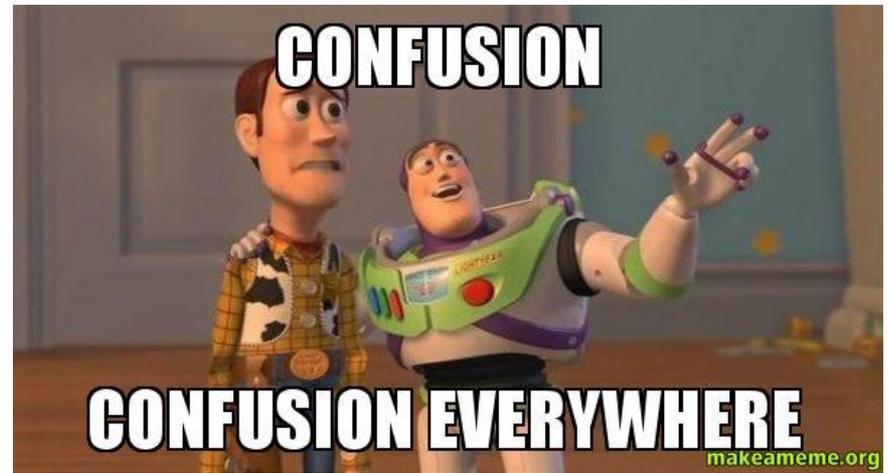






Voices

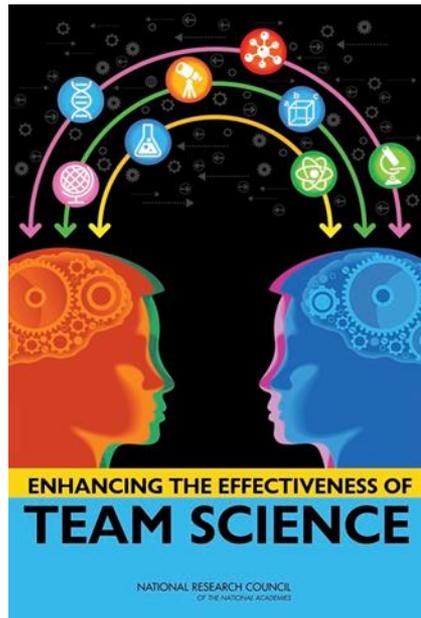
- Single voice (not person) and balance are critical for a complicated message





Trust

- Team science
- Stakeholder and public



TRUST IS A FRAGILE THING. EASY TO BREAK, EASY TO LOSE AND ONE OF THE HARDEST THINGS TO EVER GET BACK.

- Unknown

ProGood.me



Trust

“Your willingness to embrace the advice of a group of strangers because you believe they

(a) know the truth

(b) will tell you the truth as they know it;

(c) have your best interest at heart,

all of which depend on:

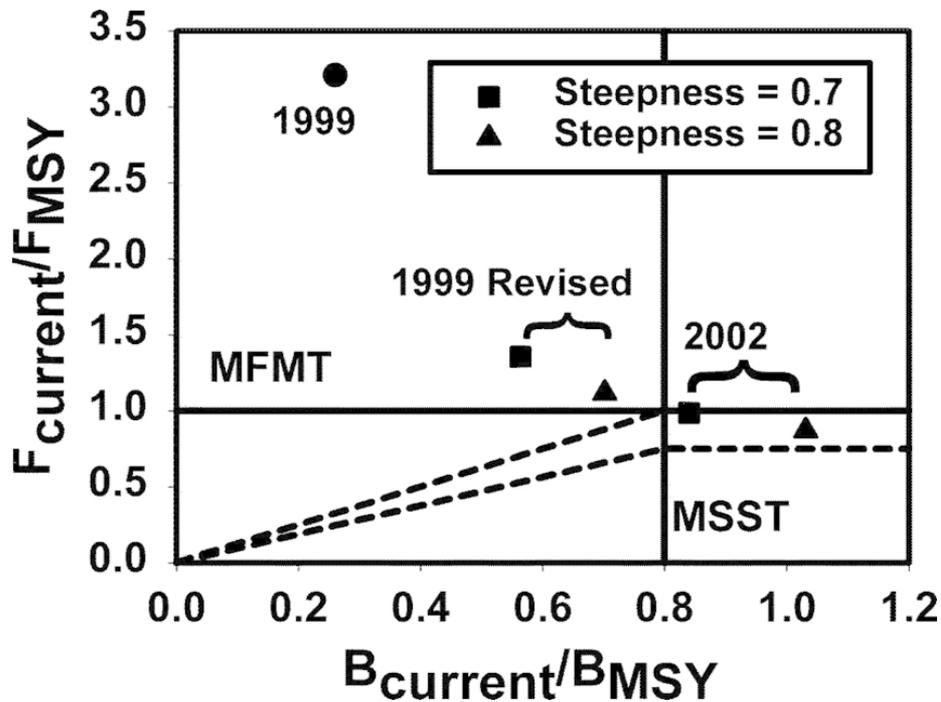
(d) who you are

(e) who they are

(f) what you’re talking about.”

Neeley, L., “What the Science Tells Us About ‘Trust in Science,’” *COMPASSblogs*, August 12, 2013, <http://compassblogs.org/blog/2013/08/12/trust-in-science/>.

Red Grouper



“I used to think you were a greenie and knew what you doing and now I realize you are sincerely trying to be objective and you have no idea what you are doing”

Stakeholder at a coffee break

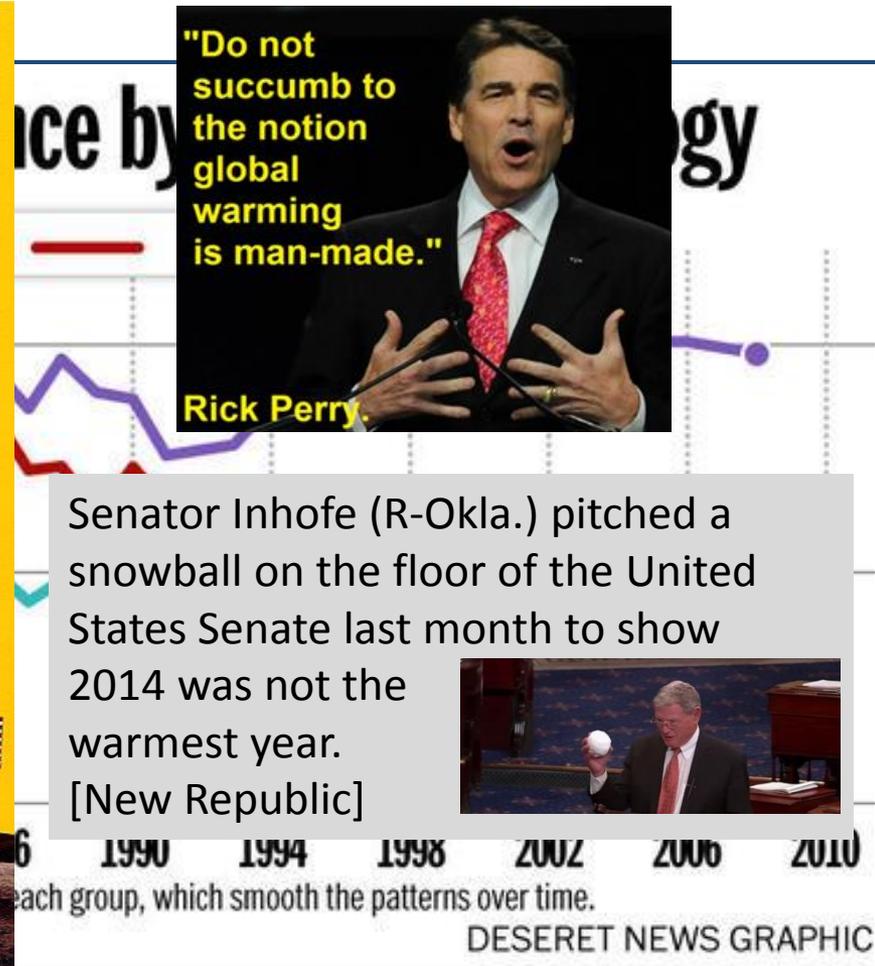
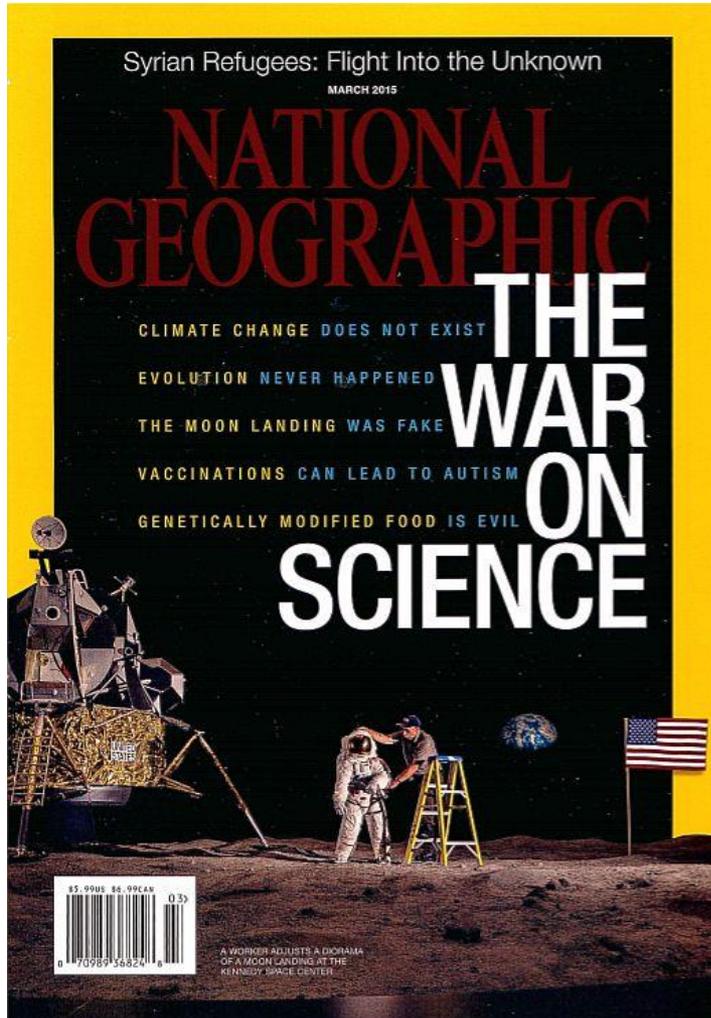


“At the root of every seemingly technical problem is a human problem.”

~ Taiichi Ohno

Taiichi Ohno was a Japanese industrial engineer and businessman. He is considered to be the father of the Toyota Production System.

Growing distrust of science (US)



FOOD

Why Chocolate Is Good for Us **Chocolate health myth dissolves**

By GRETCHEN REYNOLDS APRIL 24, 2014 12:01 AM

Health-enhancing flavanols that end up on the shelf will likely appear in form other than chocolate

By Kelly Crowe, CBC News Posted Jan 05, 2015 11:00 AM ET | Last Updated: Jan 05, 2015 11:01 PM ET

Eating egg yolks is as 'bad as smoking' in speeding up coronary heart disease

Effects of egg ingestion on endothelial function in adults with coronary artery disease: A randomized, controlled, crossover trial

We found no evidence of adverse effects of daily egg ingestion on any cardiac risk factors

Daniel L. Fazio, MD, ~~Tasosman Kizilek, PhD, Yohannes Teklehaimanot, MD, MPH~~ ~~John M. Teasdale, MD, PhD~~

Prevention

10 Reasons To Stop Eating Red Meat

10 Reasons To Stop Eating Red Meat

It's time to rethink the hamburger

Hurrah - eating red meat is good for you! After all the warnings, Sunday roast not linked to heart disease

By JENNY HOPE FOR THE DAILY MAIL
UPDATED: 03:04 GMT, 19 February 2011

Red wine antioxidants don't improve heart health

Health benefits of red wine don't pan out

By Dr. Mark Crowe, CBC News Posted May 15, 2011 11:47 PM ET | Last Updated May 15, 2011 11:51 PM ET

Eating bacon lowers sperm quality, study shows

Protein-rich diet may harm sperm



The Telegraph

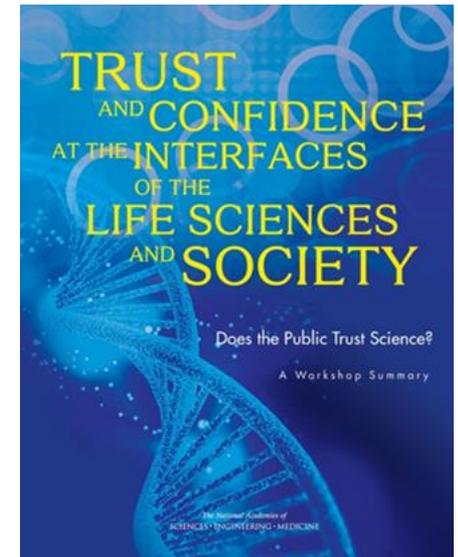
Tuesday 04 August 2015

Red wine: the unexpected health benefits

Red wine could prevent tooth decay, new research suggests.

EDMONTON JOURNAL

News
Ice cream, bacon new superfoods



post-truth

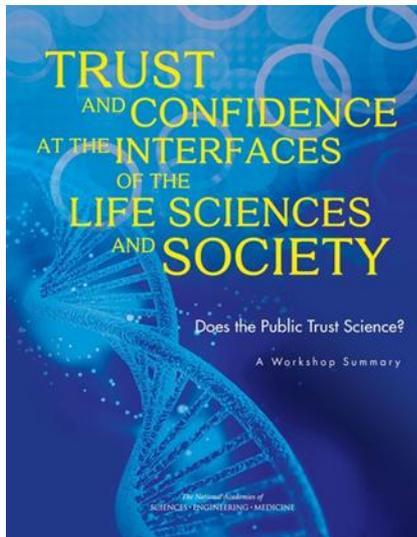
adj. Relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief:

'in this era of post-truth politics, it's easy to cherry-pick data and come to whatever conclusion you desire'

'some commentators have observed that we are living in a post-truth age'

PA

“... public trust in science suggested a complex landscape in which personal characteristics like culture, religion, values, and personal histories—when combined with science’s own shortcomings like inconsistent findings and conflict of interest—can promote lack of trust in both scientists and the scientific enterprise.concept of ethos...”



“When you talk about trust you have to know the way a group thinks, how they interact, how they communicate, how they educate. You have to know what their roles and relationships are. What are their values? Their practices? What are the expected behaviors?”

Phyllis Pettit Nassi

Individual: Some Progress

Creating and maintaining high-performing collaborative research teams: the importance of diversity and interpersonal skills

Kendra S Cheruvilil^{1,2*}, Patricia A Soranno², Kathleen C Weathers³, Paul C Hanson⁴, Simon J Goring⁵, Christopher T Filstrup⁶, and Emily K Read^{3,4}

...interpersonal skills...
...teamwork training....
...high-performing teams....

Background.....
Starting to Think About Team Science
Preparing Yourself for Team Science.....
Building a Research Team
Fostering Trust.....
Developing a Shared Vision.....
Communicating About Science
Sharing Recognition and Credit
Handling Conflict
Strengthening Team Dynamics
Navigating and Leveraging Natural and I Systems
Challenges.....
Fun and Games
A Few Parting Thought
About the Authors.....
References and Additional Resources
Appendix: Collaborative

Collaboration & Team Science:

A Field Guide



Todd Trumbull / The Chronicle

Klamath controversy continues

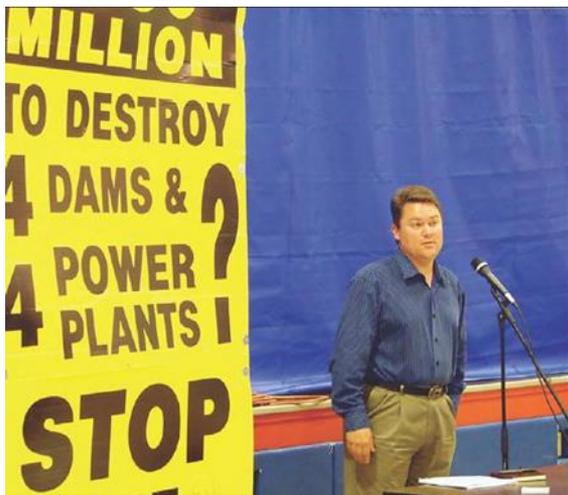
An agreement to remove four dams has been reached, but barriers remain

Klamath Propaganda: Who do you believe?

Independent Peer Review Says Klamath Dam Removal Science “Sound” and “Reliable”

Klamath River: A Big Dam Controversy Finally Resolved

Whistleblower is taking his case to the public



Paul Houser, the Bureau of Reclamation’s former scientific integrity adviser, says he was fired for voicing concerns that the decision to remove four Klamath River dams is being based on politics and money not science. He spoke at a Tea Party meeting Sunday in Klamath Falls.

Klamath Dam Removal Overview Report for the Secretary of the Interior

Klamath River Expert Panel

FINAL REPORT

Scientific Assessment of Two Dam Removal Alternatives on Chinook Salmon



Photo provided by W.L.

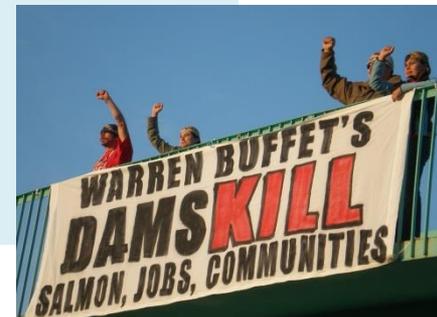
Prepared for the U.S. Department of the Interior

Peer Review Panel Report on Draft Klamath Dam Removal Overview Report for the Secretary of the Interior (2012)

March 2012

Prepared by:

ATKINS



Preparation documents sent to review panel members for the Gulf of Mexico Red Snapper stock assessment



1 EDGAR B. WASHBURN (CA SBN 34038)
 2 *EWashburn@mofo.com*
 3 CHRISTOPHER J. CARR (CA SBN 184076)
 4 *CCarr@mofo.com*
 5 WILLIAM M. SLOAN (CA SBN 203583)
 6 *WSloan@mofo.com*
 7 CORINNE FRATINI (CA SBN 259109)
 8 *CFratini@mofo.com*
 9 **MORRISON & FOERSTER LLP**
 10 425 Market Street
 11 San Francisco, California 94105-2482
 12 Telephone: 415.268.7000

13 KAREN L. TACHIKI (CA SBN 91539)
 14 General Counsel
 15 LINUS MASOUREDIS (CA SBN 77322)
 16 *LMasouredis@mswsh2o.com*
 17 Senior Deputy General Counsel
 18 **THE METROPOLITAN WATER DISTRICT OF**
 19 **SOUTHERN CALIFORNIA**
 20 1121 L Street, Suite 900
 21 Sacramento, California 95814-3974
 22 Telephone: 916.650.2600

Attorneys for Plaintiff
 THE METROPOLITAN WATER DISTRICT
 OF SOUTHERN CALIFORNIA

UNITED STATES DISTRICT COURT
 EASTERN DISTRICT OF CALIFORNIA

THE DELTA SMELT CASES,
 SAN LUIS & DELTA-MENDOTA WATER
 AUTHORITY, *et al.* v. SALAZAR, *et al.*
 (Case No. 1:09-cv-407)

STATE WATER CONTRACTORS v. SALAZAR,
et al. (Case No. 1:09-cv-422)

COALITION FOR A SUSTAINABLE DELTA,
et al. v. UNITED STATES FISH AND WILDLIFE
 SERVICE, *et al.* (Case No. 1:09-cv-480)

METROPOLITAN WATER DISTRICT v.
 UNITED STATES FISH AND WILDLIFE
 SERVICE, *et al.* (Case No. 1:09-cv-631)

STEWART & JASPER ORCHARDS, *et al.* v.
 UNITED STATES FISH AND WILDLIFE
 SERVICE, *et al.* (Case No. 1:09-cv-892)

1:09-cv-407 OWW GSA
 1:09-cv-422 OWW GSA
 1:09-cv-631 OWW GSA
 1:09-cv-892 OWW GSA
 PARTIALLY CONSOLIDATED
 WITH: 1:09-cv-480 OWW GSA

**REPLY DECLARATION OF DR.
 RICHARD B. DERISO IN
 SUPPORT OF MOTION FOR
 INTERIM
 RELIEF/PRELIMINARY
 INJUNCTION**

Date: January 20, 2010
 Time: 9:00 a.m.
 Crm: 3
 Judge: Hon. Oliver W. Wanger

Reply Declaration of Dr. Richard B. Deriso In Support of Motion for Interim Relief/Preliminary Injunction
 Case No.: 1:09-cv-00407-oww-GSA
 of 278648

BALTIC OVERFISHING: WHO'S TO BLAME?

Country	Minister/Representative	Quota set above scientific advice
1st  Poland	 Mr Marek Sawicki	10,862 TONNES
2nd  Denmark	 Mr Dan Jørgensen	9,727 TONNES
3rd  Sweden	 Mr Sven-Erik Bucht	8,976 TONNES
4th  Germany	 Mr Robert Kloos	4,444 TONNES
5th  Latvia	 Mr Jānis Dūklavs	4,097 TONNES

Species fished above scientific advice in the Baltic



**"BEST PRACTICES" FOR
FISHERIES MANAGEMENT**

Trust occurs 26 times



Building Trust in
Fisheries Science

Wrong ICES but a Code of Ethics!



2017 ANNUAL SCIENCE CONFERENCE

18-21 September
Greater Fort Lauderdale / Broward County Convention Center
Fort Lauderdale, Florida, USA

www.ices.dk/asc2017
#ICESASC17

Invited speakers

Kenneth Rose
Louisiana State University
Multi-disciplinary team science and engaged stakeholders:
two often neglected aspects of coupled human-natural systems

Tundi Agardi
Forest Trends
Promoting uptake of marine science in management
both on the supply and demand side

Lionel Guidi
University of Hawaii
The planktonic social network of the biological carbon pump



 **International Cake Exploration Societé**
To preserve, advance and encourage exploration of the sugar arts

Home ▾ Membership ▾ Events ▾ Programs ▾ Reps ▾ **Resources ▾** Contacts ▾

DOWNLOAD THE ICES NEWSLETTER & ICES APPS

 Download on the App Store

 ANDROID APP ON Google play

 Available at amazon

 Member Login

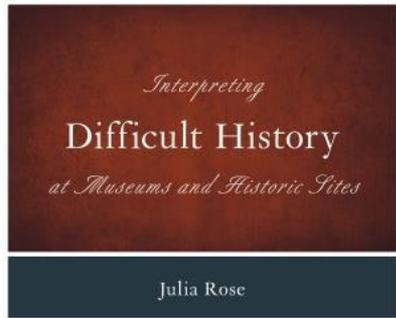
 Signup for ICES News

 ICES Store

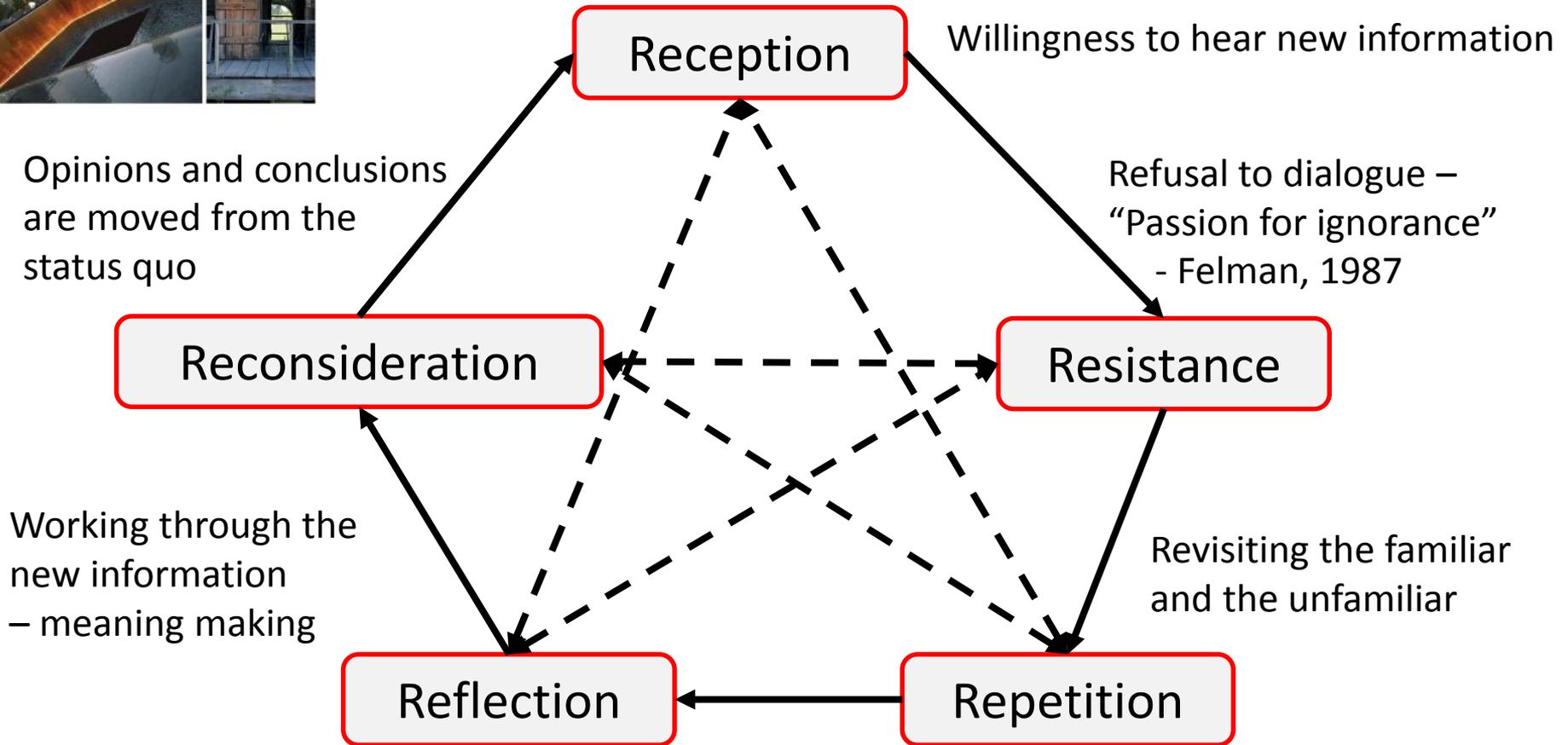
 Facebook Posts

Ethics

- [ICES Code of Ethics Policy \(PDF\)](#)
- [ICES Conflict of Interest Policy \(PDF\)](#)
- [ICES Grievance Procedure \(PDF\)](#)
- [ICES Procedure in Handling Situations \(PDF\)](#)
- [ICES Whistleblower Policy \(PDF\)](#)

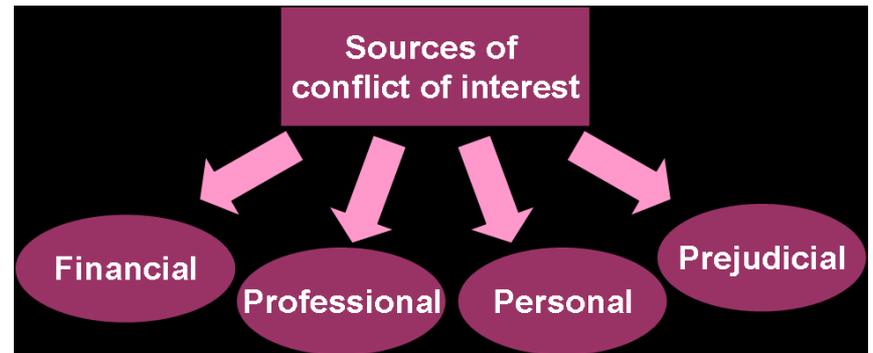


Five R's of Working with People



Conflict of Interest

- Very difficult because of perceptions
 - If yes, then easy



- Attempts to codify
 - NSF asks a series of precise questions (e.g., co-author within 48 months)
 - Note last category- “anything else?”

Advocacy



- Should you be an advocate?
- Does it conflict with being a scientist?
- Even if different topic, you get undue credibility?
- At public meetings or in editorials, how do you present yourself?

Advocacy

Essay

On Advocacy by Environmental Scientists: What, Whether, Why, and How

MICHAEL P. NELSON*‡ AND JOHN A. VUCETICH†‡

- Conflicting moral obligations
- Their conclusion-scientists should be advocates
- Being a citizen overrides the loss of trust and credibility with the science
- I am not sure

Concluding Remarks

- I hope some of these personal observations resonate with the CB modeling community
- The opinions expressed are mine alone but I am not responsible for them
- Necessary, messy, and doable