NOAA FISHERIES

Southeast Fisheries Science Center, NOAA Beaufort Lab

Beaufort Assessment Model (BAM): Lessons Learned From Twenty Years of Software Development

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Outline

- Background
- History of BAM
- Advances in BAM system
- Lessons learned from BAM's evolution
- Important things to consider for NexGen Models

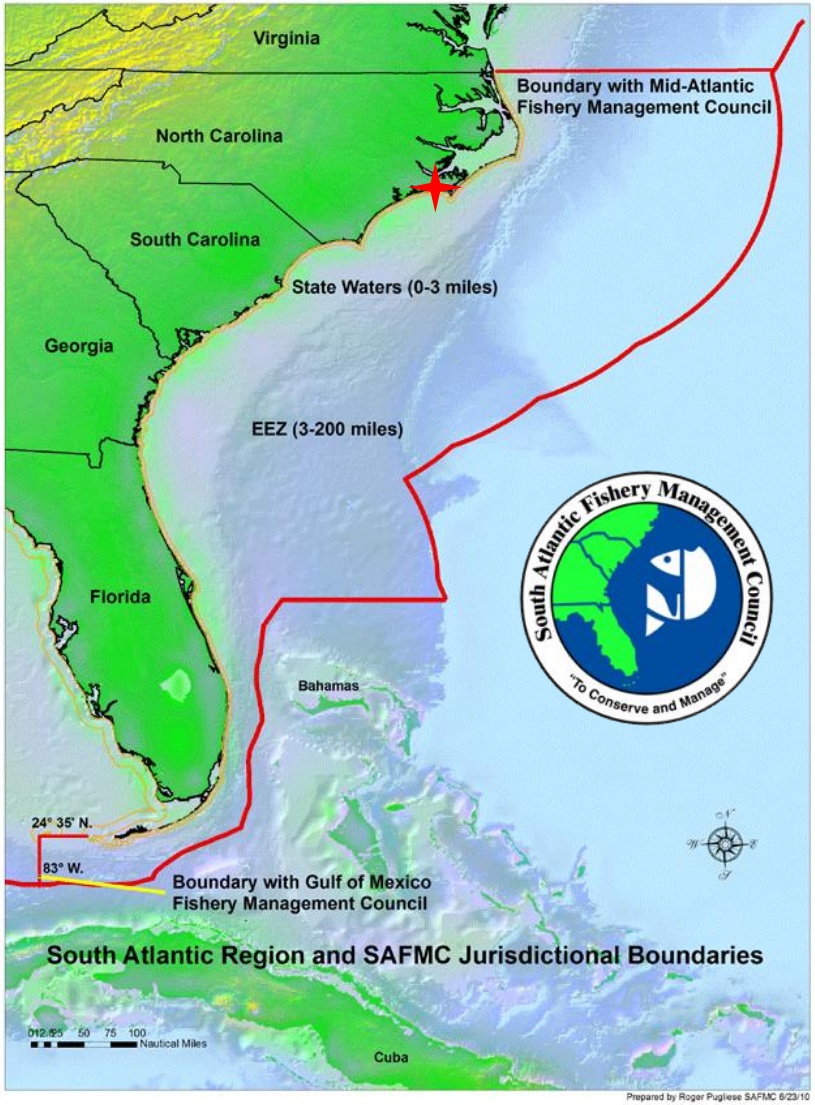
Background

- NMFS Southeast Fisheries Science Center provides stock assessments for seven management entities
  - Gulf of Mexico Fisheries Management Council
  - South Atlantic Fisheries Management Council
  - Caribbean Fisheries Management Council
  - International Commission for the Conservation of Atlantic Tunas
  - Atlantic States Marine Fisheries Commission
  - Gulf States Marine Fisheries Commission
  - Highly Migratory Species (Sharks)
- 400+ fish stocks needing assessments
  - Wide array of fish and fishery types
- Large geographic footprint

Southeast Fisheries Science Center

Southeast Fisheries Science Center

U.S. South Atlantic



Characteristics:

Climate – tropical, dominated by Gulf Stream

Fish Stocks – 80+

Species – snappers, groupers, porgies, coastal pelagics

Fisheries – commercial (30%), recreational (70%)

Stock Assessment Data:

Age, length samples by fleet – n=0-400

FI data – limited to shelf area, trap/video gear

FD data – discards poorly measured

Spatial data – very limited

Stock Assessment Models:

Surplus-production models

Age-structured production models

Age-structured models (Integrated Analyses)

U.S. South Atlantic – Assessment History

Prior to 2000 – VPA and per-recruit models (2 assessment scientists)

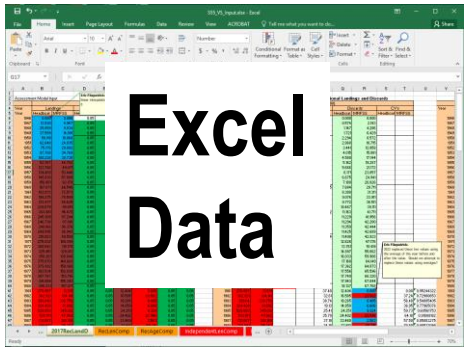
2000 – Shift to ADMB and Integrated Analysis (3 assessment scientists)

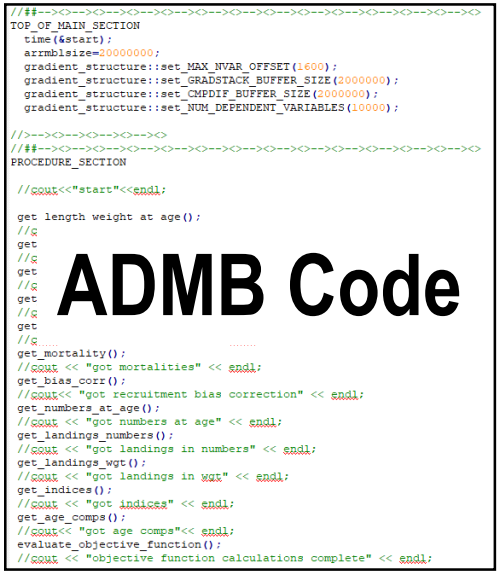
2001 – Suspicion of new models and error in data query lead to Southeast Data, Assessment and Review (SEDAR) formation

2002-2006 – SEDAR becomes increasingly bureaucratic (4 assessment scientists), BAM becomes the preferred assessment model

2006-present – Staff grows to 5-6 assessment scientists, 2 support staff

A Brief History of BAM (2000-2002)



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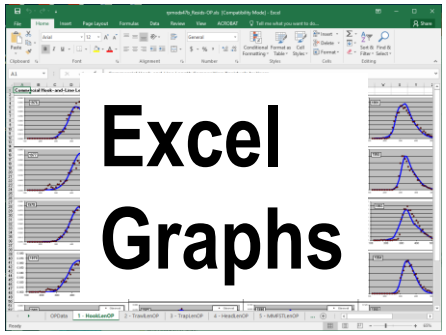
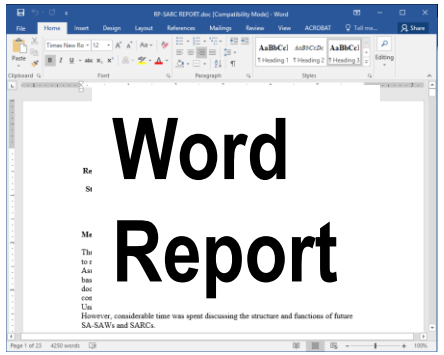
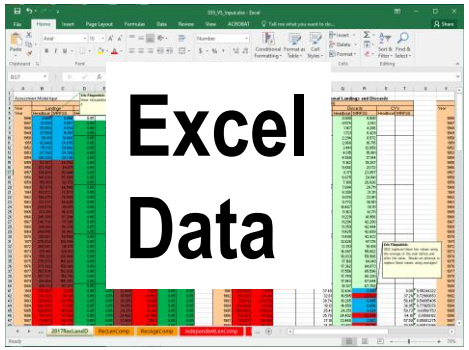




Advances in BAM System (2003-2008)

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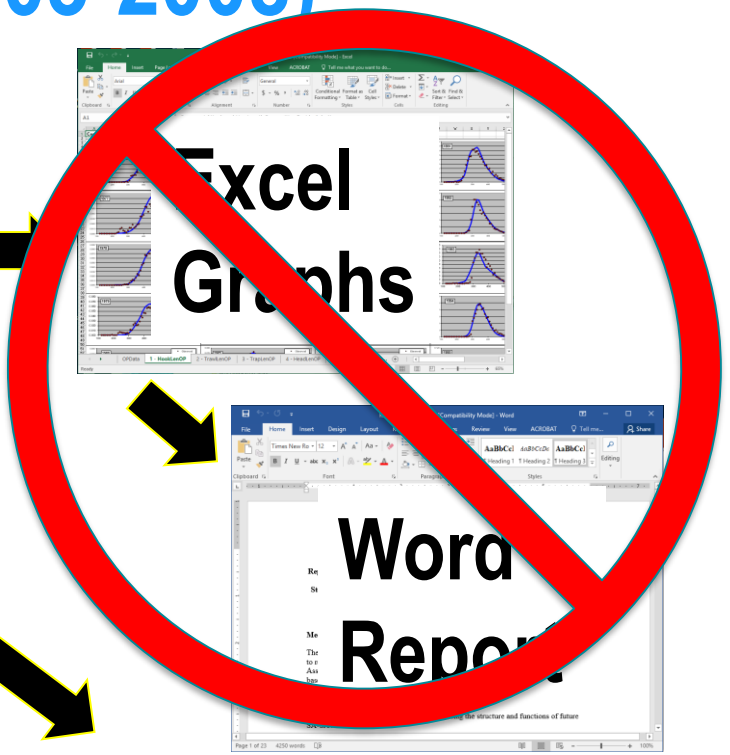
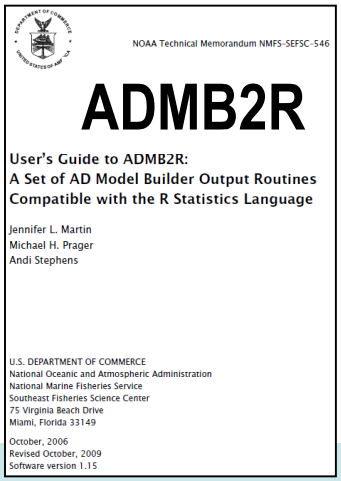
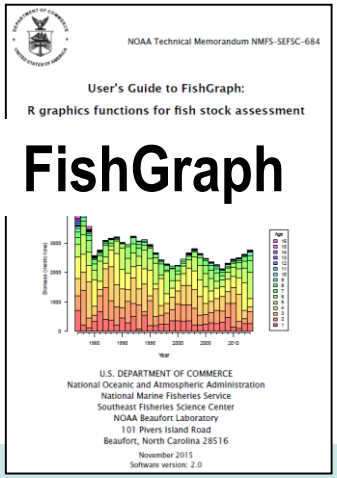
ADMB Code







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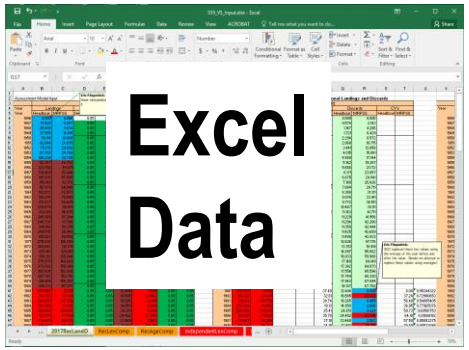

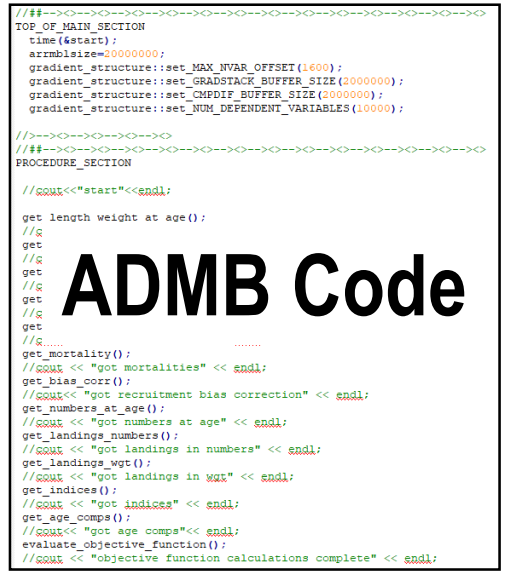


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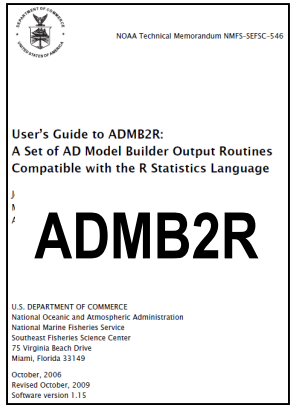
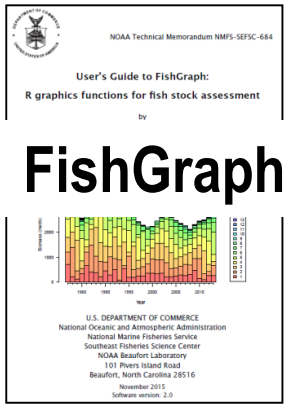
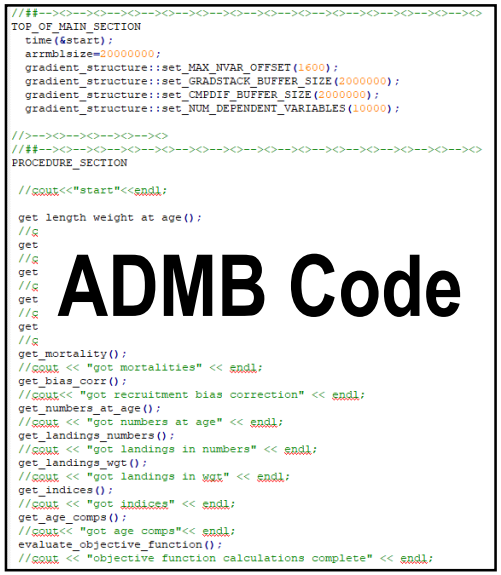
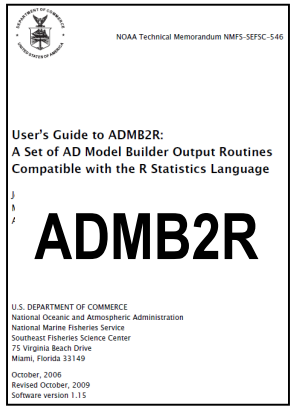


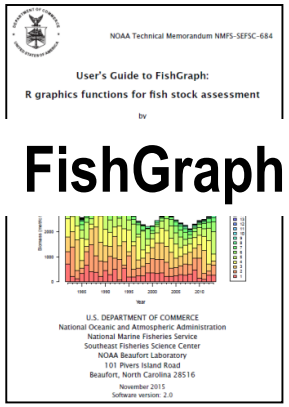


ADMB code advances:
- use of more functions
- standardized subroutine structure
- latest advances in science incorporated

Advances in BAM System (2019-future?)







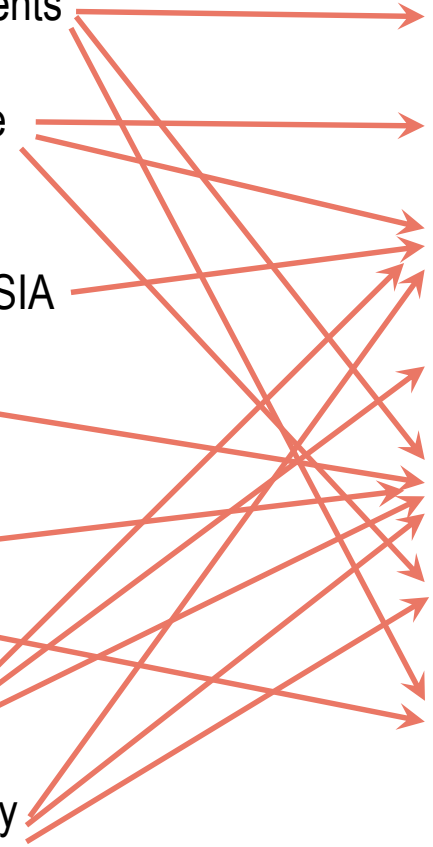
BAM System – evolutionary forces

Pressures:

- Demand for more stock assessments
- Keep up with assessment science advances (Golden Age)
- Tougher reviews, bar raised for BSIA
- SEDAR and public pressure for consistency
- Tighter budgets
- Call for increased transparency
- Skepticism from fishing community

Effects:

- Increase stock assessment staff
- Hire PhD level, programming skilled staff
- More thorough stock assessment analyses
- Longer reports and ancillary documentation
- Standardized approach
- Flexible modeling system
- Cheaper assessments (free software, easy advances)



MARCO RUBIO
FLORIDA

COMMITTEES:
COMMERCE, SCIENCE, AND TRANSPORTATION
FOREIGN RELATIONS
SELECT COMMITTEE ON INTELLIGENCE
SMALL BUSINESS AND ENTREPRENEURSHIP

United States Senate

WASHINGTON, DC 20510

June 27, 2016

Mr. David Smith
Acting Inspector General
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, D.C. 20230

. . .

Coupled with a stock assessment that was not shared prior to the closure being announced, public distrust is at an all-time high. In order to bring transparency and to ensure these important decisions are not being made without taking into account all aspects of this fishery, especially reliable data, I formally request the Office of Inspector General review the Department's decisions and assessment modeling, especially the Beaufort Assessment Model, as it relates to the South Atlantic red snapper fishery.

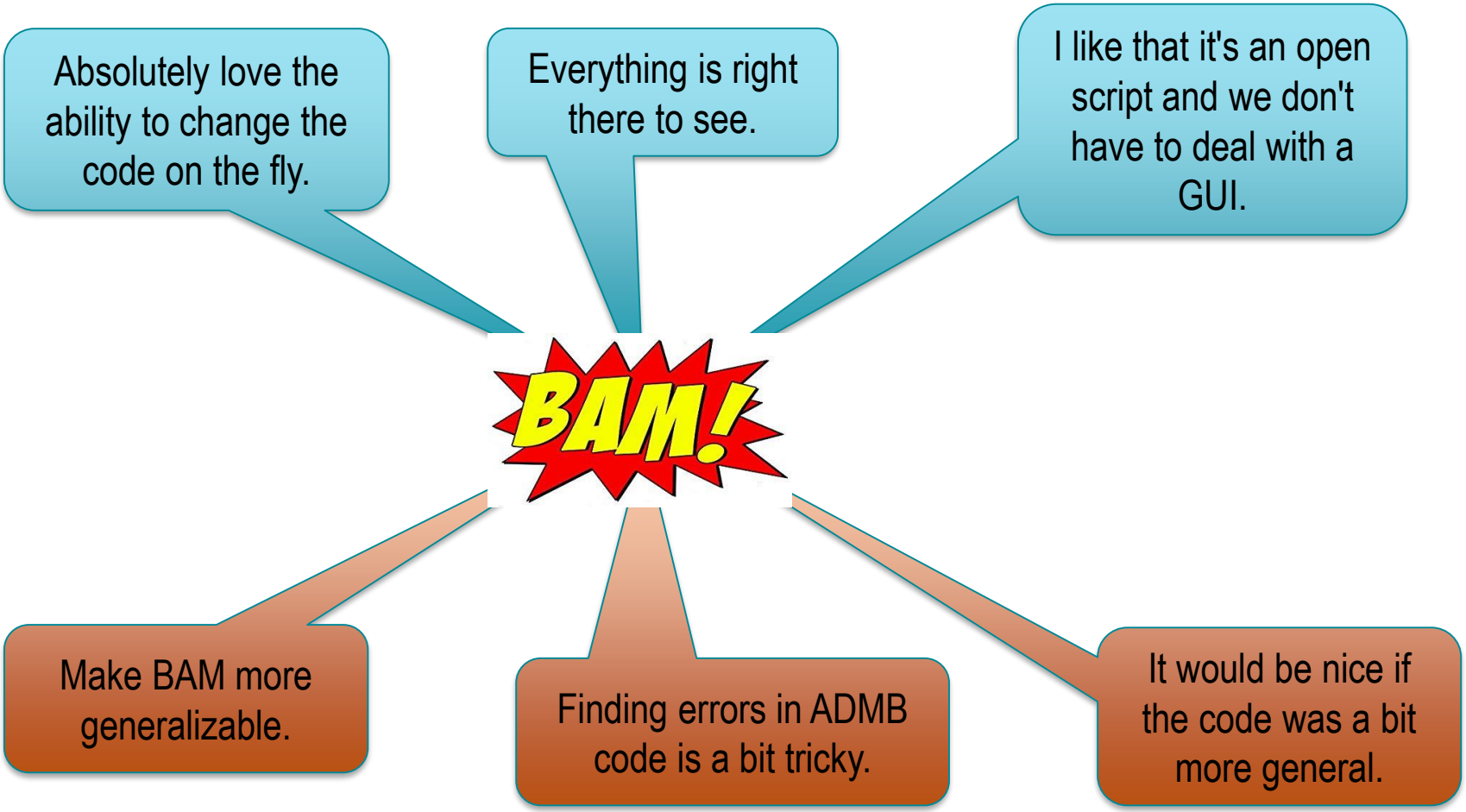
Respectfully,

Marco Rubio
United States Senator

BAM System

Pros	Cons
Flexible. Customizable to each stock's details. Able to code latest advances in stock assessment science. Constantly improving and adding new graphical output. Operates like open source software.	Steep learning curve. Has required the hiring of staff with advanced skills (e.g. programming, statistical modeling).
Cheap, both in terms of monetary and time costs.	Error probability increased, as users work directly with the ADMB source code. Little time devoted to generalizing the code.
Thorough understanding of inner workings by staff. Higher review success.	Complicated system, not easily portable.

BAM System – comments from staff



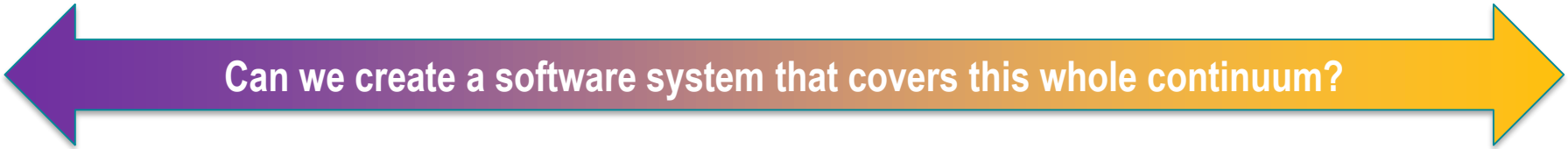
Stock Assessment Software Continuum

Benefits:
- Flexible
- Open Source
- Forefront of Science

Drawbacks:
- Steep Learning Curve
- Knowledge Base Required
- Error and Bug Prone

Drawbacks:
- Rigid
- Version Control, Software Support
- Lagging Behind State-of-the Art

Benefits:
- Easy to Use
- Minimal Base Knowledge Needed
- More Error and Bug Proof



Users:
- Doctoral level

Output:
- Fewer, more costly assessments
- Thorough, best available assessments

Users:
- Technician level

Output:
- More, cheaper assessments
- Simpler assessments

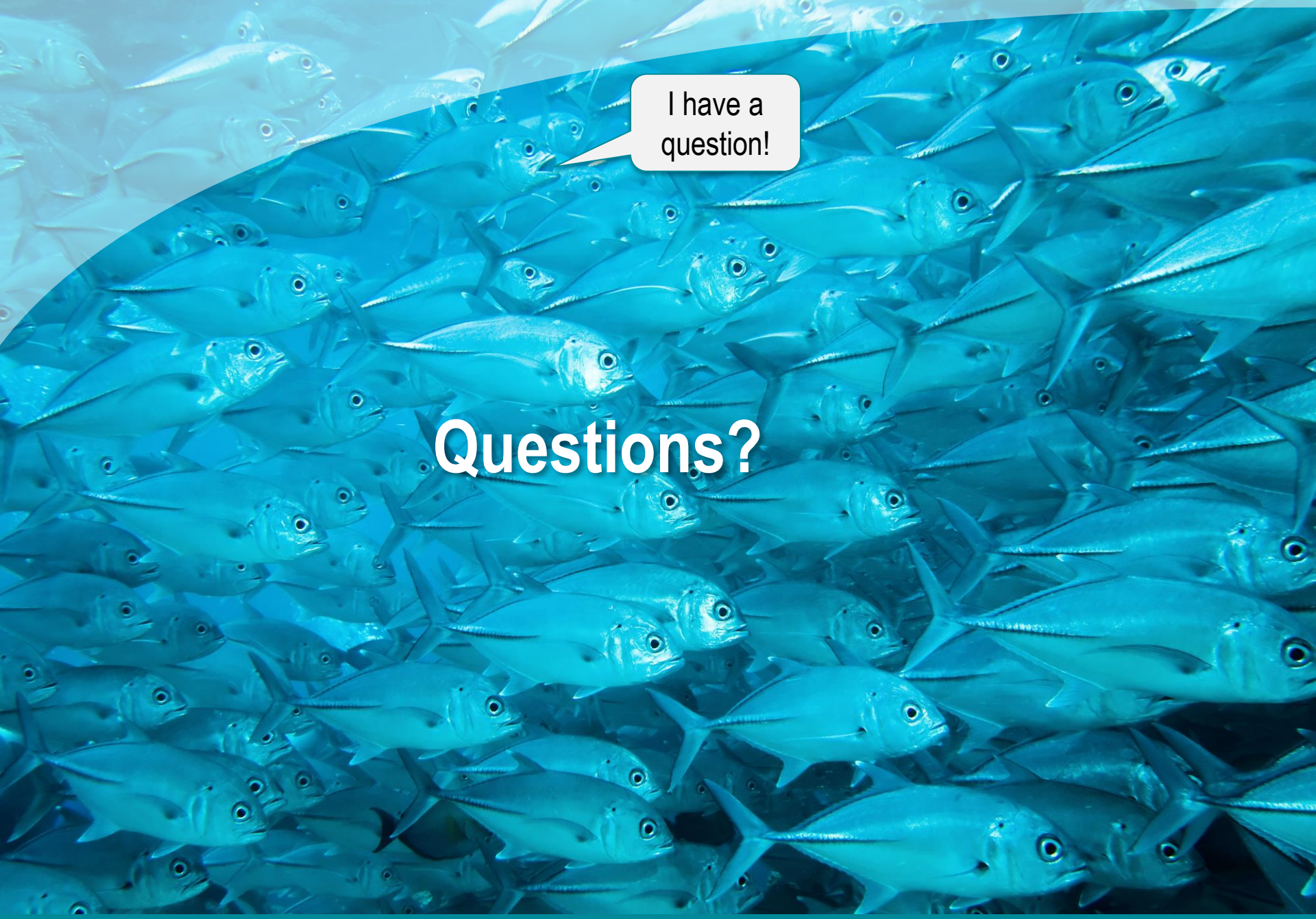
Software Systems

Usability/Flexibility

Performance/Reliability

Portability

Maintenance



Questions?