MID-ATLANTIC
FISHERY MANAGEMENT COUNCIL

MAFMC Climate Science Workshop Overview February 11, 2014

Richard Seagraves

Fisheries Forum

March 19, 2014

Washington, DC

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

MAFMC Ecosystem Approach to Fisheries Management

- Council currently developing an Ecosystem Approach to Fishery Management Guidance Document (PFMC approach)
- A non-regulatory umbrella document intended to guide Council policy with respect to ecosystem considerations across existing FMPs

Ecosystem Workshops Purpose

- Bring together technical experts, managers and stakeholders to evaluate science and policy aspects of ecosystem level issues
- Develop recommendations for best practices to be incorporated into Council's EAFM operational guidelines

Climate Science and Fisheries Workshop (Feb 11)

- Focus on physics related to climate change – what do we know and identify key information gaps
- Discuss where in the process climate change related issues should be handled including stock assessments, BRPs, ABC control rules, OY specification
- Climate velocity concept

Climate Science Workshop (cont.)

- Fishing Fleet Dynamics
- Incorporation of variable and changing environmental conditions into essential fish habitat designations
- Overall: identify where/when in the assessment – management continuum climate considerations should be integrated

State of climate science and identification of range of responses of environment / fisheries / ecosystem to climate change over next 5-20 years

Climate Science and Fisheries Workshop
11 February 2014
New Bern, North Carolina

Jon Hare – Northeast Fisheries Science Center
Paula Fratantoni – Northeast Fisheries Science Center
Charlie Stock – Geophysical Fluid Dynamics Laboratory

Climate Workshop Summary Physics

- Distinguish between climate variability and climate change
- The East Coast marine ecosystem(s) includes a wide range of habitats with large scale climate variability and significant regional differences
- The extent of climate change is not constant over the whole ecosystem

Climate Workshop Summary
Most traditional stock assessment models…..

- have not incorporated environmental covariates and assume that the only major external factor affecting a stock is fishing mortality
- integrate climate effects in model estimates of population parameters (R, G, Ma, M)
- assume climate effects are stationary over hindcast and forecast (likely violated over decadal/century time scales)
- **Major need/opportunity to develop SA models which incorporate climate effects on population dynamics**

Past/Future Climate States
First regional climate change projections

- Shelf-wide temperatures warming since 1960 (projected to continue)
- Ocean acidification measurable and PH decreasing
- Precipitation and stream flow increasing (salinity decreasing)
- Sea level rising (infrastructure impacts)

Impacts on Fishery Resources

- Changes in stock productivity (recruitment, growth, maturity, fecundity)
- Changes in species interactions (natural mortality)
- Changes in species distribution (stock definition; availability to fisheries and surveys)

Incorporating climate science information into fisheries management

Jason Link
Sarah Gaichas, Jon Hare
NMFS

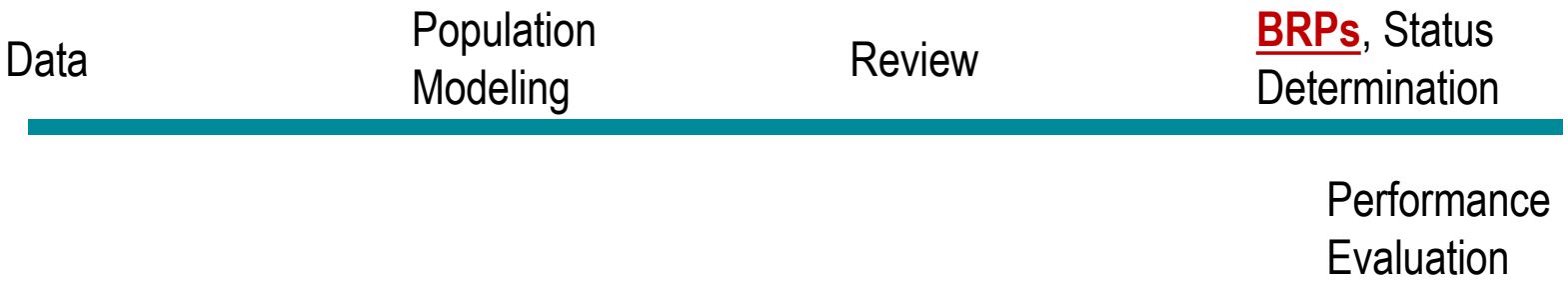
Mid Atlantic Fisheries Management Council
Climate Science and Fisheries Workshop
New Bern, NC

Feb 11, 2014

Take Away messages

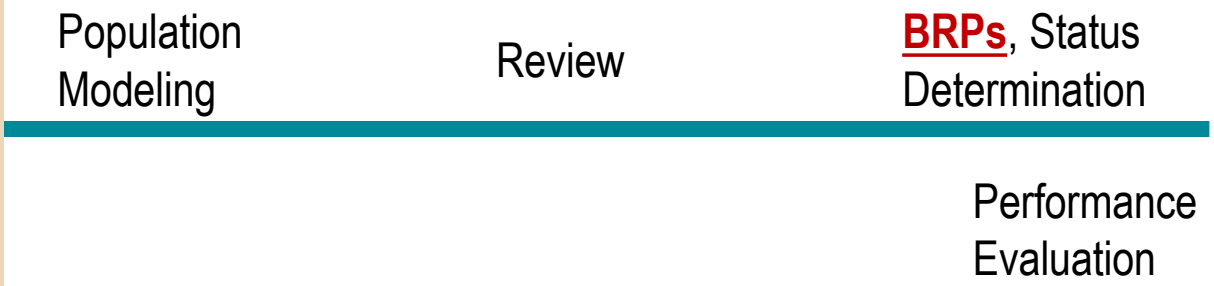
- CC is impacting marine ecosystems and living marine resources, now
- There are a lot of ways we can have climate savvy fisheries science and fisheries management
- But we need to, and we can, act now

Generic LMR Management Process

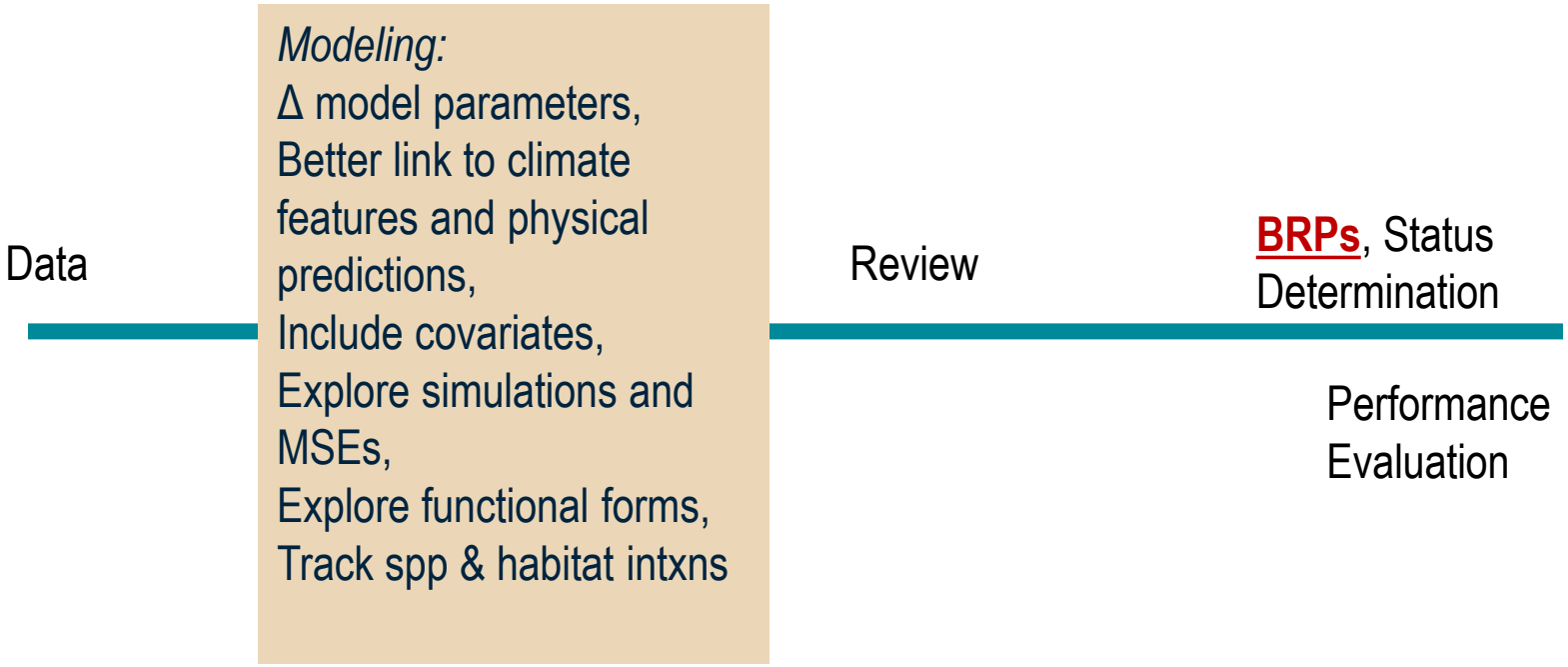


Climate-Savvy LMR Mgt Process

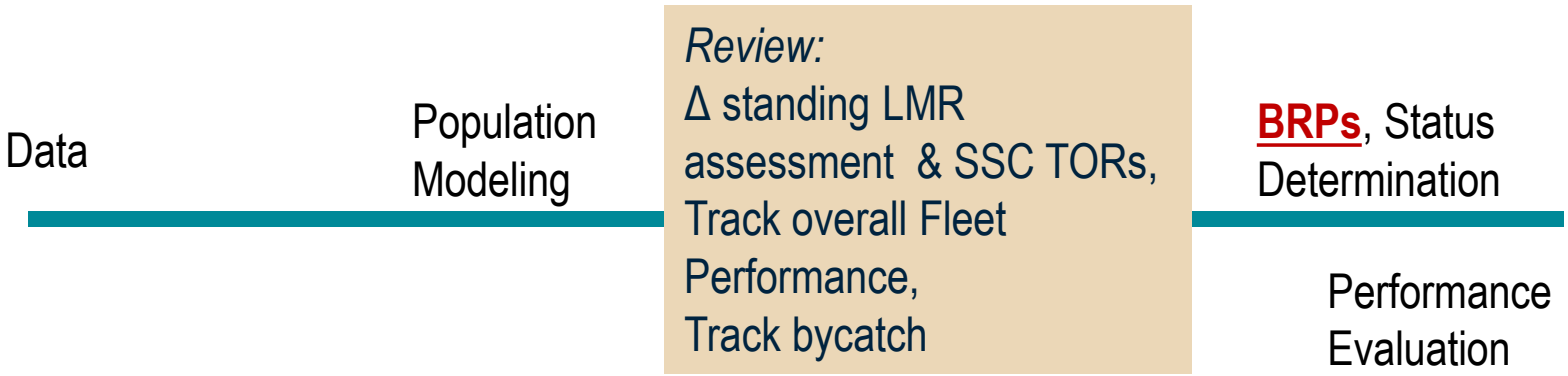
Data:
Δ Data Inputs
for distribution, Δ Stock ID, Δ stock unit area, track fleet dynamics,
Δ vital rate estimates,
Δ to Monitoring programs



Climate-Savvy LMR Mgt Process



Climate-Savvy LMR Mgt Process



Climate-Savvy LMR Mgt Process

Mgt Advice:
Track overall Ecosystem Productivity,
Explore Portfolio Approaches,
Risk analysis
Emerging-exiting spp & FMPs

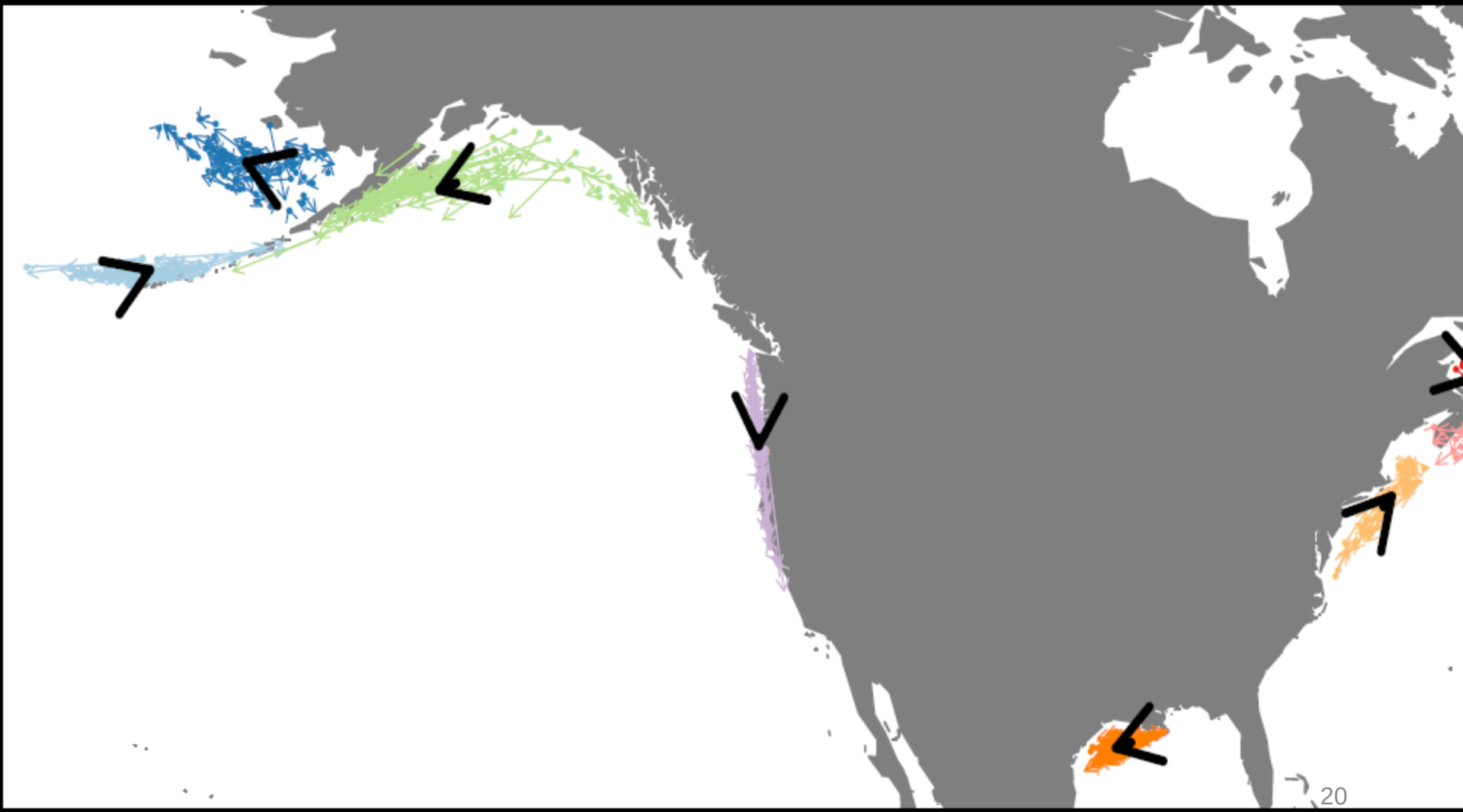
Effects of climate velocity on fish and fisheries

Malin Pinsky

Pinsky et al (2013) *Science*

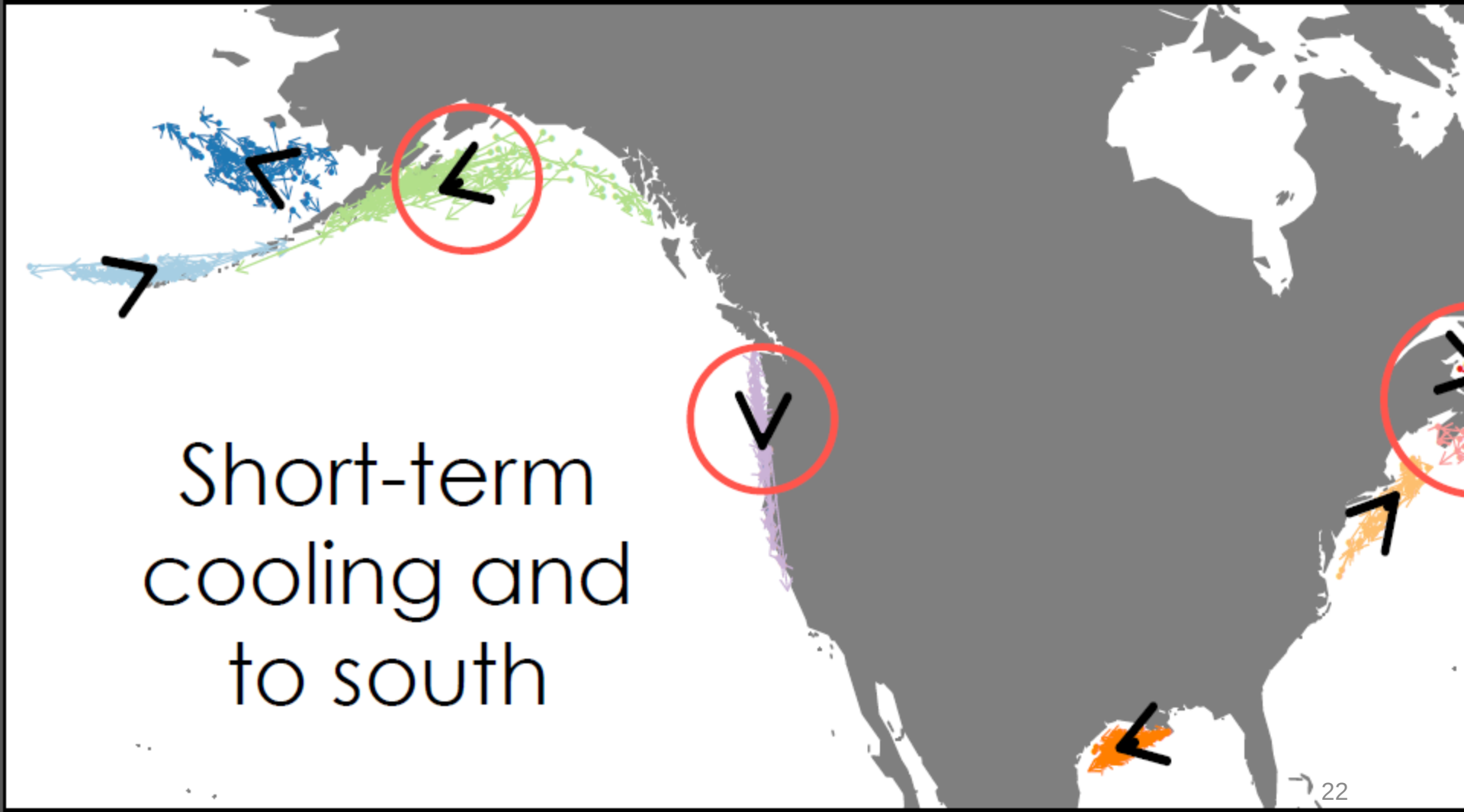
- Hypothesis: differences in climate velocity—the rate and direction that climate shifts across the landscape—can explain observed species distributional shifts.
- Compiled a database of coastal surveys around North America from 1968 to 2011, sampling 128 million individuals across 360 marine taxa.
- Climate velocity explained the magnitude and direction of shifts in latitude and depth much more effectively than did species characteristics.
- Demonstrated that marine species shift at different rates and directions because they closely track the complex mosaic of local climate velocities.

Fish follow climate velocity

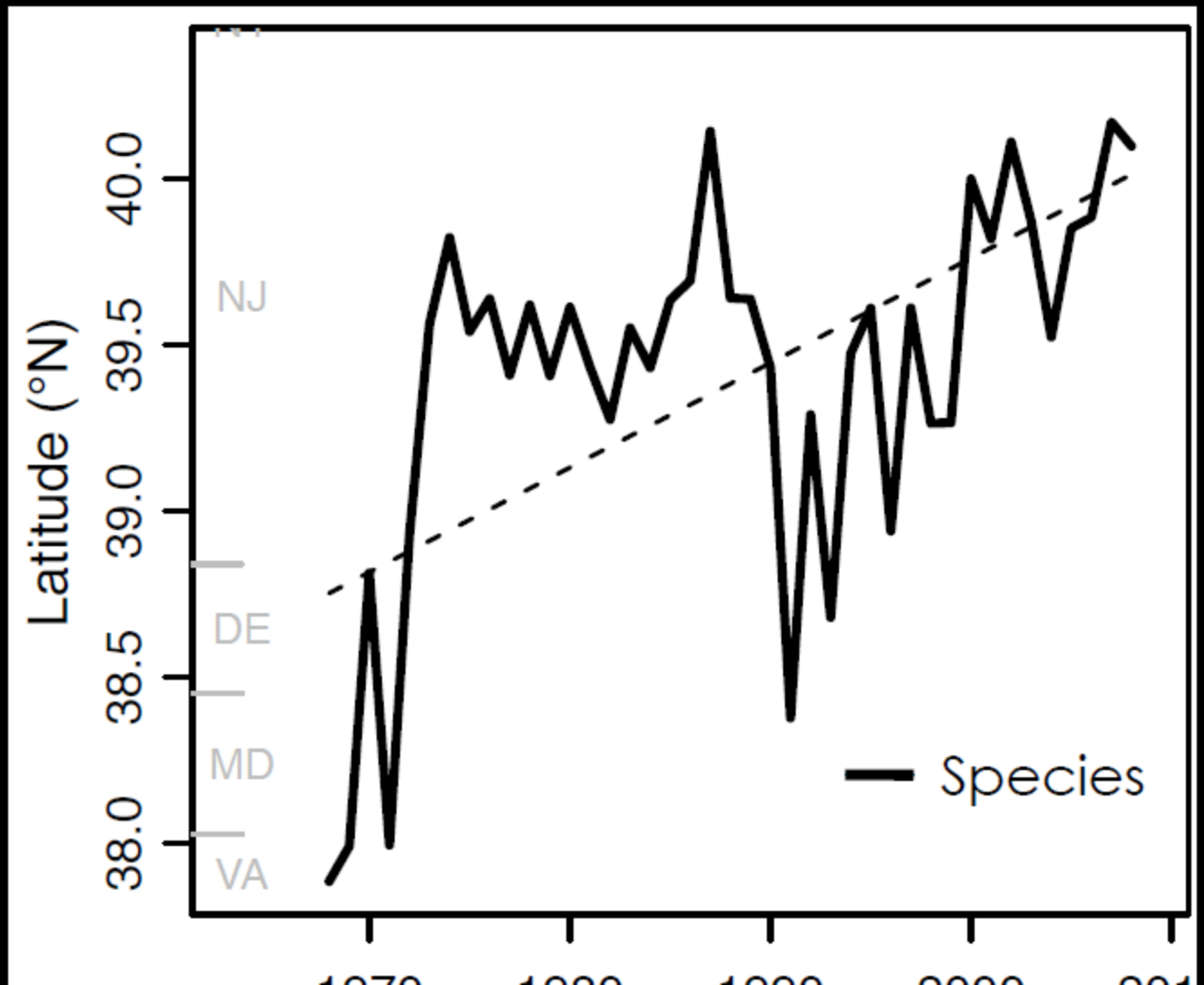


Fish follow climate velocity

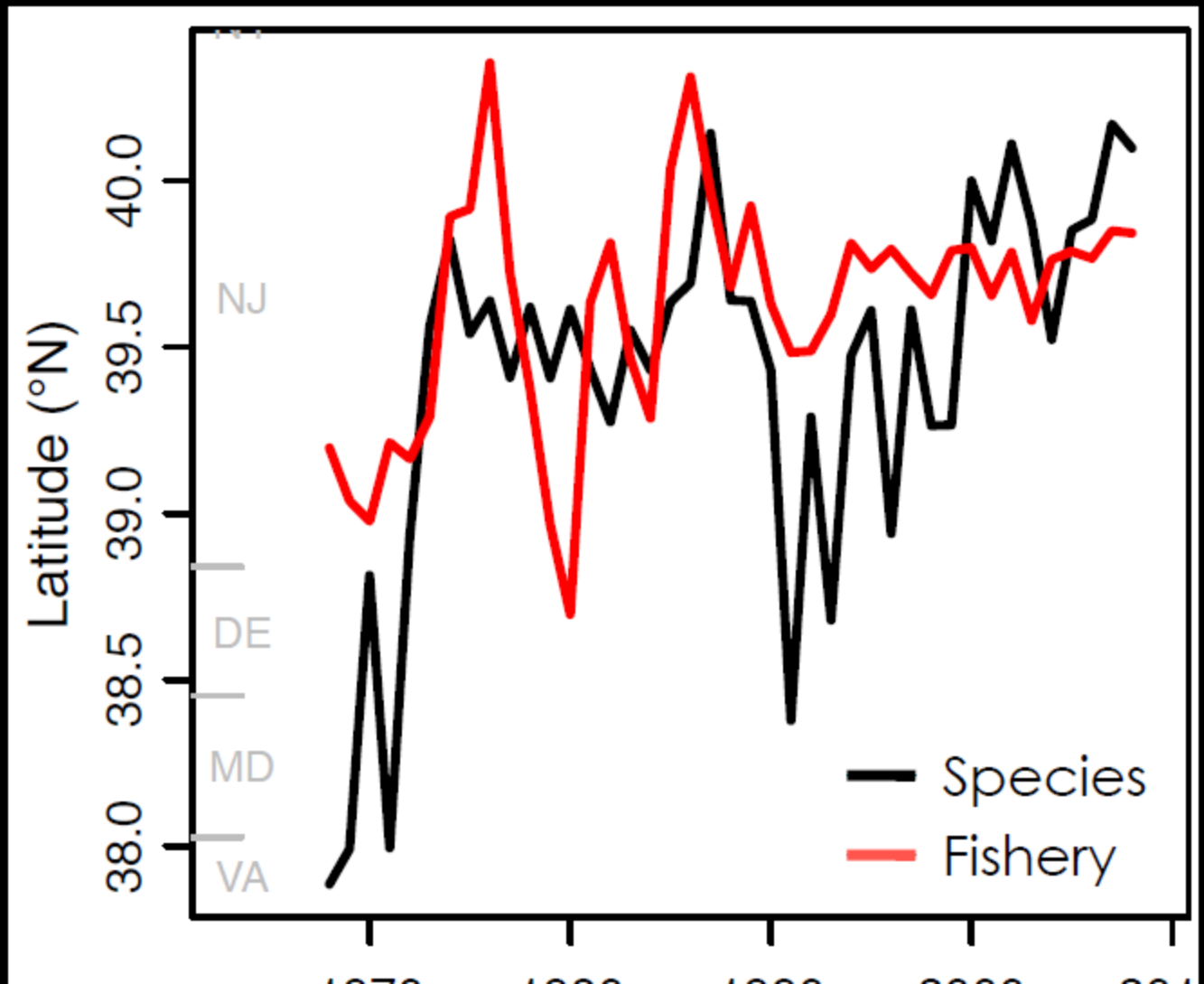
Fish follow climate velocity



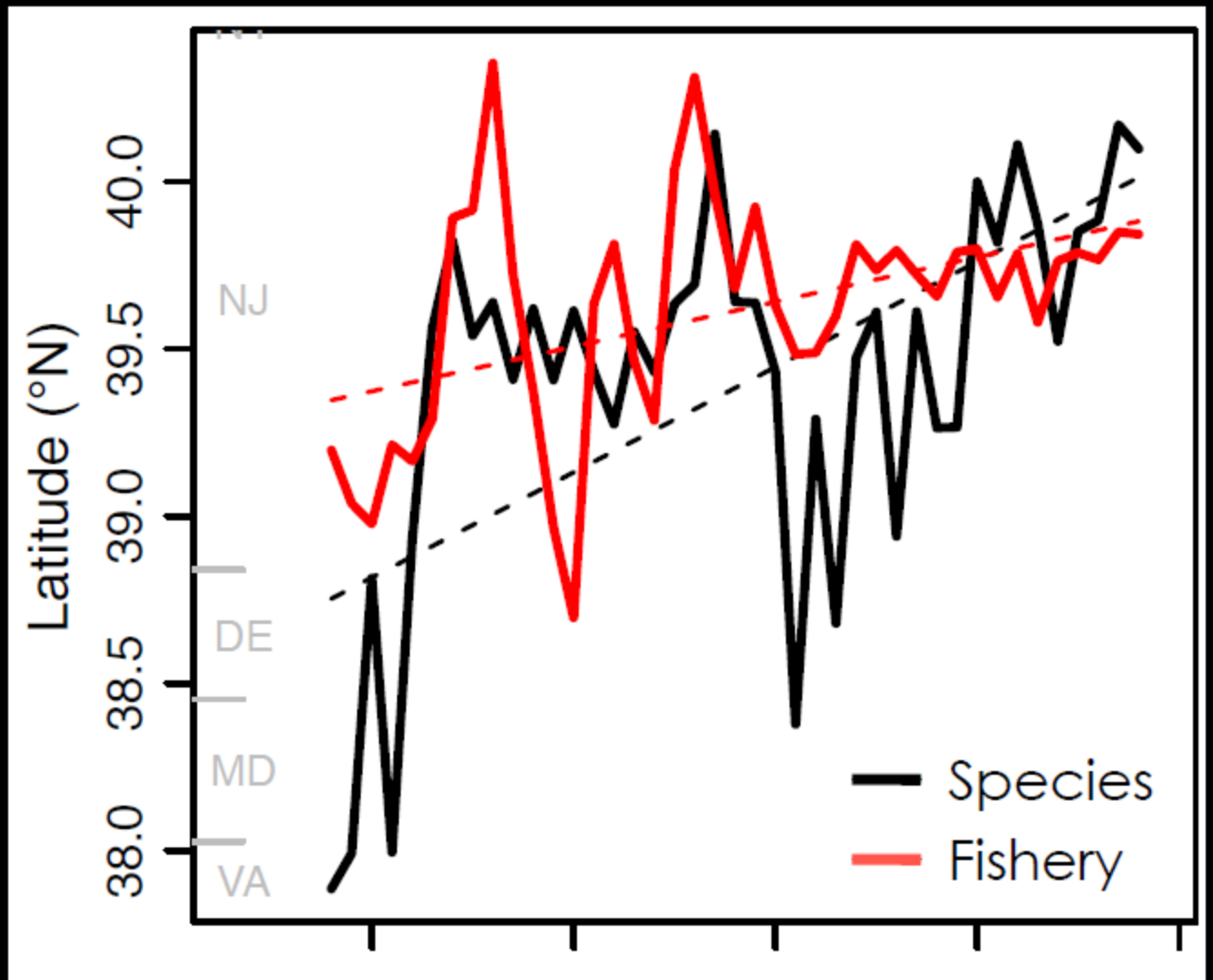
Poleward shift of summer flounde



Fishery landings shift as well

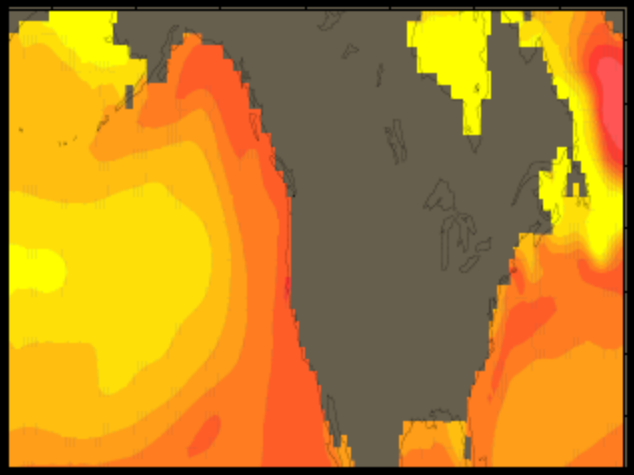


Fishery landings shift more slowly



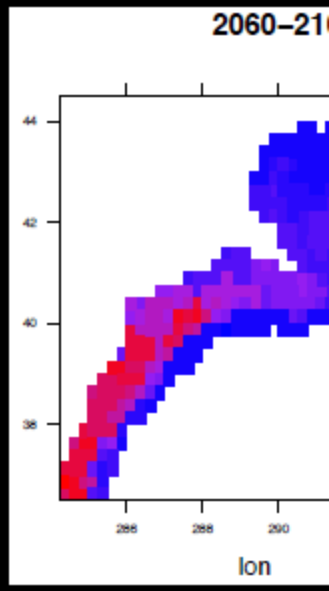
68
slov

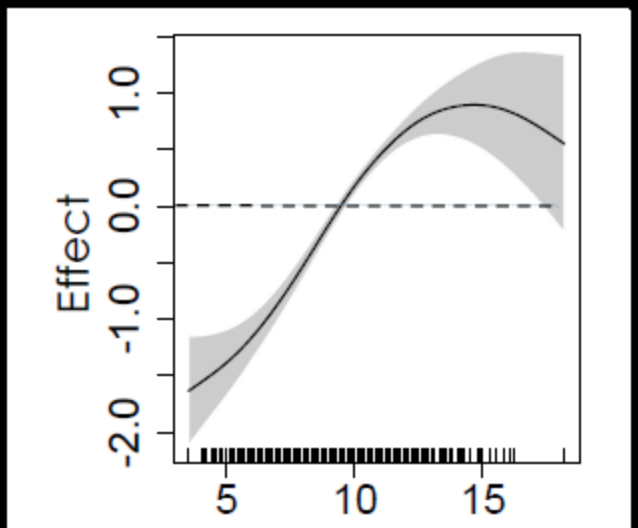
Projecting species distributions



Downscale climate projections

Speci
Distribu
Project

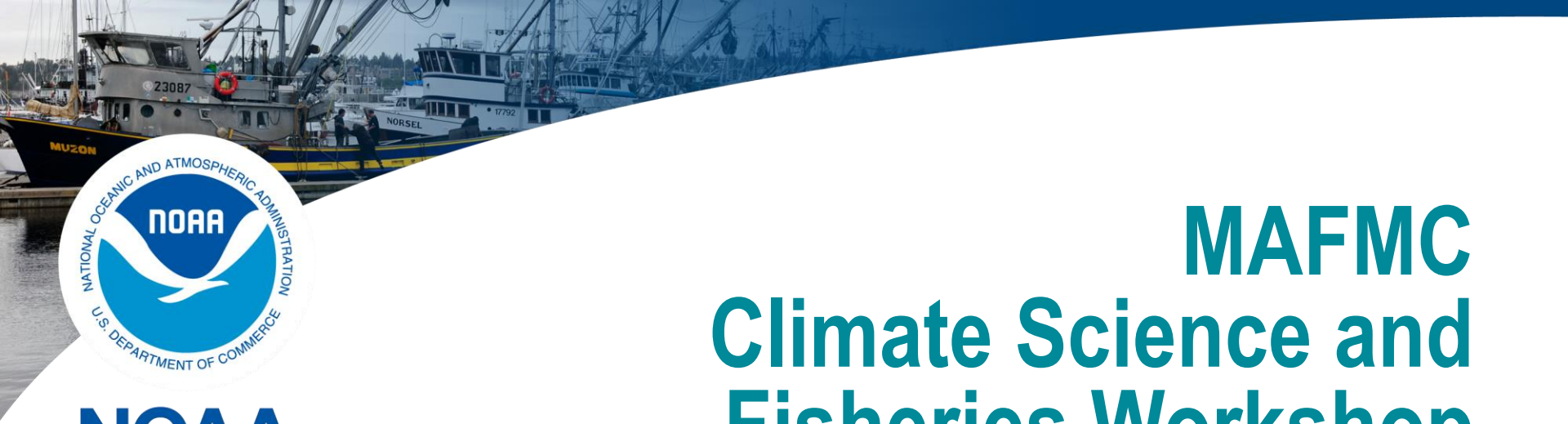




Thermal envelope

Summary

- Climate does not change uniformly
- Fish follow climate velocity
- Fisheries follow shifting fish when poss
- We have many tools to begin adapt now



MAFMC Climate Science and Fisheries Workshop

Geret DePiper

NEFSC

Social Sciences Branch

Doug Lipton

NMFS Senior Scientist for Economics

February 11, 2014

How will climate change impact fishing fleets?

- Current social/economic studies/data designed to meet short term management decisions
- Climate change represents transition to new state(s) over longer time scales (gradual and abrupt)
- Need studies/data to model fleet dynamics on longer time scales (budget challenges)

Incorporation of climate information and uncertainty into stock assessments, biological reference points and ABC specifications

Olaf Jensen
Rutgers University
olaf.p.jensen@gmail.com

Climate and fish productivity

- Oceanographic conditions matter a lot
- Unexplained variability in fish population dynamics often greater than the explained
- Ocean observing systems and new & improved climate models probably won't allow us to forecast fish productivity any time soon

Meanwhile….continue

- incorporation of environmental covariates in stock assessments (hindcast S/R relationships)
- environmental standardization of survey abundance estimates
- development of ecosystem models which illuminate complex interactions to understand changing productivity

BRPs and ABC Control Rules

- For climate sensitive stocks which are at high risk due to climate effects - consider increasing uncertainty buffers and/or modify BRPs (cod)
- Some stocks may be “winners” so buffer might decrease and/or change BRPs; may increase sustainable yields (croaker)

EFH Issues

- Explore and develop EFH designations from ecosystem perspective
- Habitat in the ocean includes the fluid within which organisms exist (v two dimensional terrestrial habitat concepts)
- Need to demonstrate links between habitat dynamics and population dynamics
- Environmental standardization of survey indices (Manderson butterfish work)

Science Issues
Distribution shifts

- Utility of NEFSC survey data will be affected due to differential availability (fraction of population within survey area may change or become more variable – spatial availability issue)
- Survey abundance estimates will be affected because timing of migrations will change (temporal availability for synoptic surveys)
- NEFOP sampling frame will have to adapt to changing patterns of species/fisheries overlap and subsequent changes in discard patterns

Science Issues
Changes in Productivity

- Manifested at both ecosystem and species level
- Species level productivity changes result from changes in natural mortality, survival, growth and recruitment
- Need to be addressed at stock assessment level (TOR through NRCC process)
- Manifested at level of BRP specification (OFL/ABC)

Management Issues

- Allocations by area based on historical catch distribution problematic (e.g., fluke)
- Seasonal allocations (e.g., scup)
- Trip limits by season/area need to re-evaluated and made more adaptive
- Allocation among directed v incidental fisheries affected due to changing species assemblages and discarding patterns
- Inter-jurisdictional mgt. issues will become more acute both between neighboring Councils and internationally (e.g., Canada – gadoids, mackerel and dogfish)

Management Issues
What's needed?

- An adaptive management approach that will allow Council's to detect and react to changing environmental conditions which affect ecosystems and fisheries (on same time scale)
- A more plastic system of allocation that allows Council management system to adapt to changing climate conditions and ecosystems
- Active engagement of mgt. partners to review which fisheries require closer cooperative management across jurisdictions/FMPs

Summary Points

- Science more robust relative to understanding and mitigating distributional changes than predicting productivity changes
- MAB exhibits greatest inter-annual variation in temperature of any ocean environment om the planet
- Climate change likely to increase that variance (at least uncertainty about future oceanographic states)

Policy Challenge

Mid-Atlantic Council faces major challenge in reconciling tension between…..

Visioning Project goal of achieving greater harvest stability across MAFMC managed fisheries and…..

the greater uncertainty and instability likely due to future climate change impacts on ecosystems, individual fish stocks and fisheries

MID-ATLANTIC
FISHERY MANAGEMENT COUNCIL

Questions?
(the reception awaits…..)