

# How are state freshwater fisheries agencies adapting to climate change?

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# The Challenge

- How do managers make sense of climate and land use change?
- Usually nebulous and/or broad scale.
  - How does this apply to my region?
  - How do I make mgmnt decisions 50 years away?
- But state already have 'base' knowledge to manage in the face of climate change.
  - They know how to regulate fish, harvest



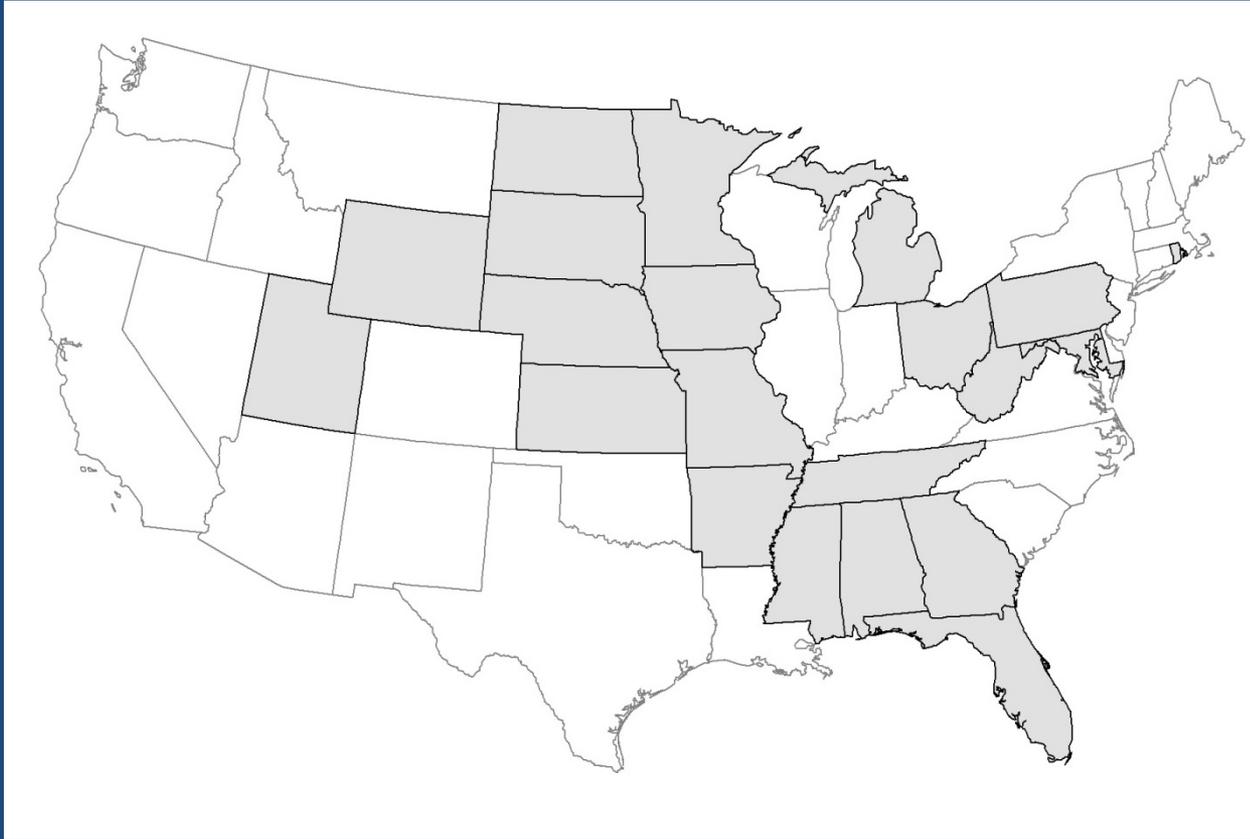
# The Survey

- April 2012: send to 50 states, DC, Guam, Virgin Islands, Northern Mariana Islands, and Puerto Rico
- Reminder sent August 2012
- One person per state (usually state Fish Chief or similar)
- Asked to respond based on agencies views

# The Survey

- **34 Questions**
- **Was state addressing climate change in freshwater fisheries management**
- **What actions are they current using**
  - **Is climate change considered in those actions?**
- **What are your challenges related to CC?**

# Results



**24 responses (including Hawaii and Puerto Rico)**  
**83%: Fish (or Fish/Wildlife) administrators**  
**Rest biologists, biodiversity administrators**

# How Concerned Is Your Agency on How Climate Change May Affect Freshwater Fisheries?

## Very/Extremely Concerned

Extreme climate events (63% ranked very or extremely concerned)

Non native species (58%)

Changes in thermal habitat (58%)

Altered hydrologic regimes (58%)

## Lowest rankings

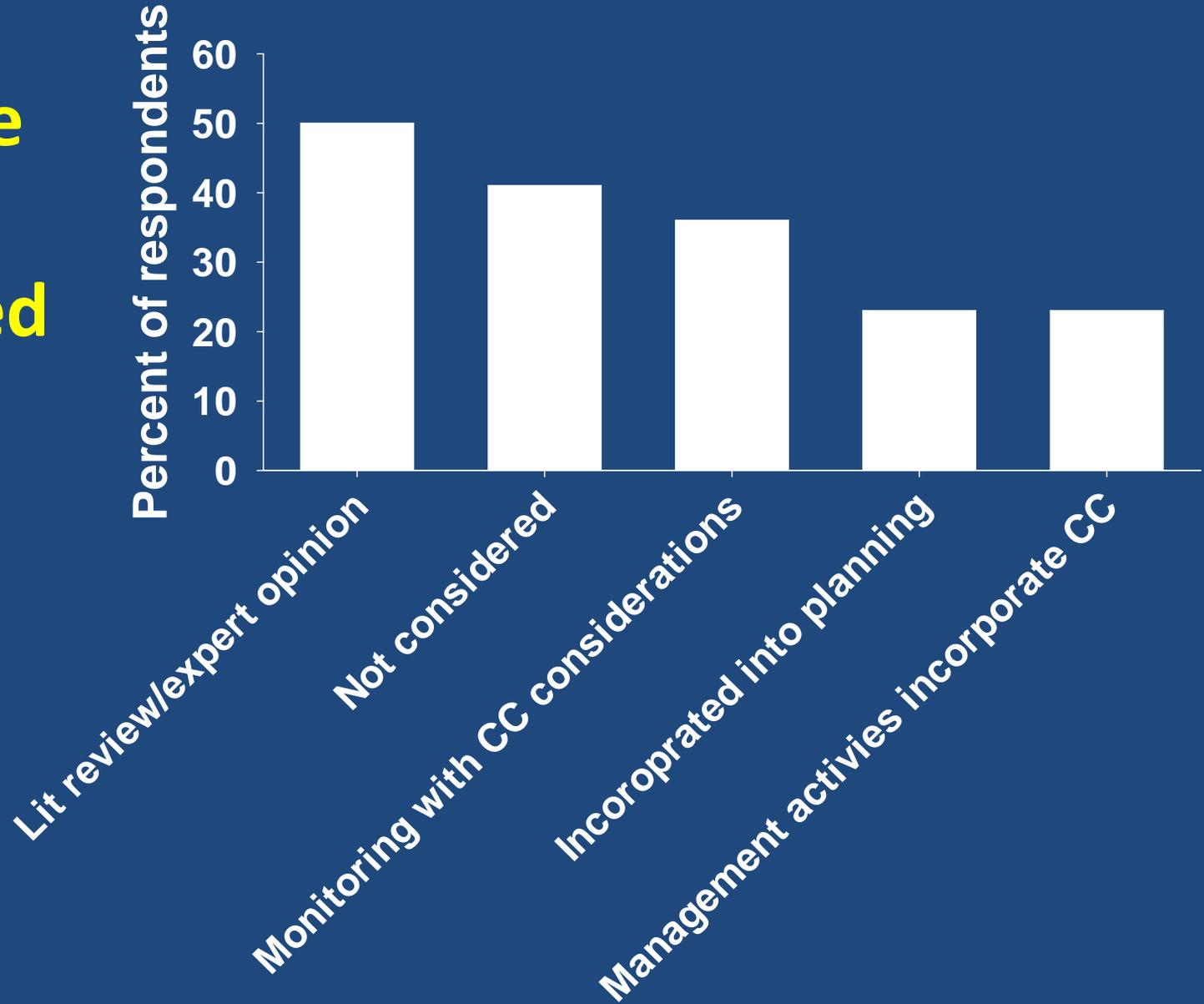
Interactions between temps and pollutants (12%)

Extinction risk (25%)

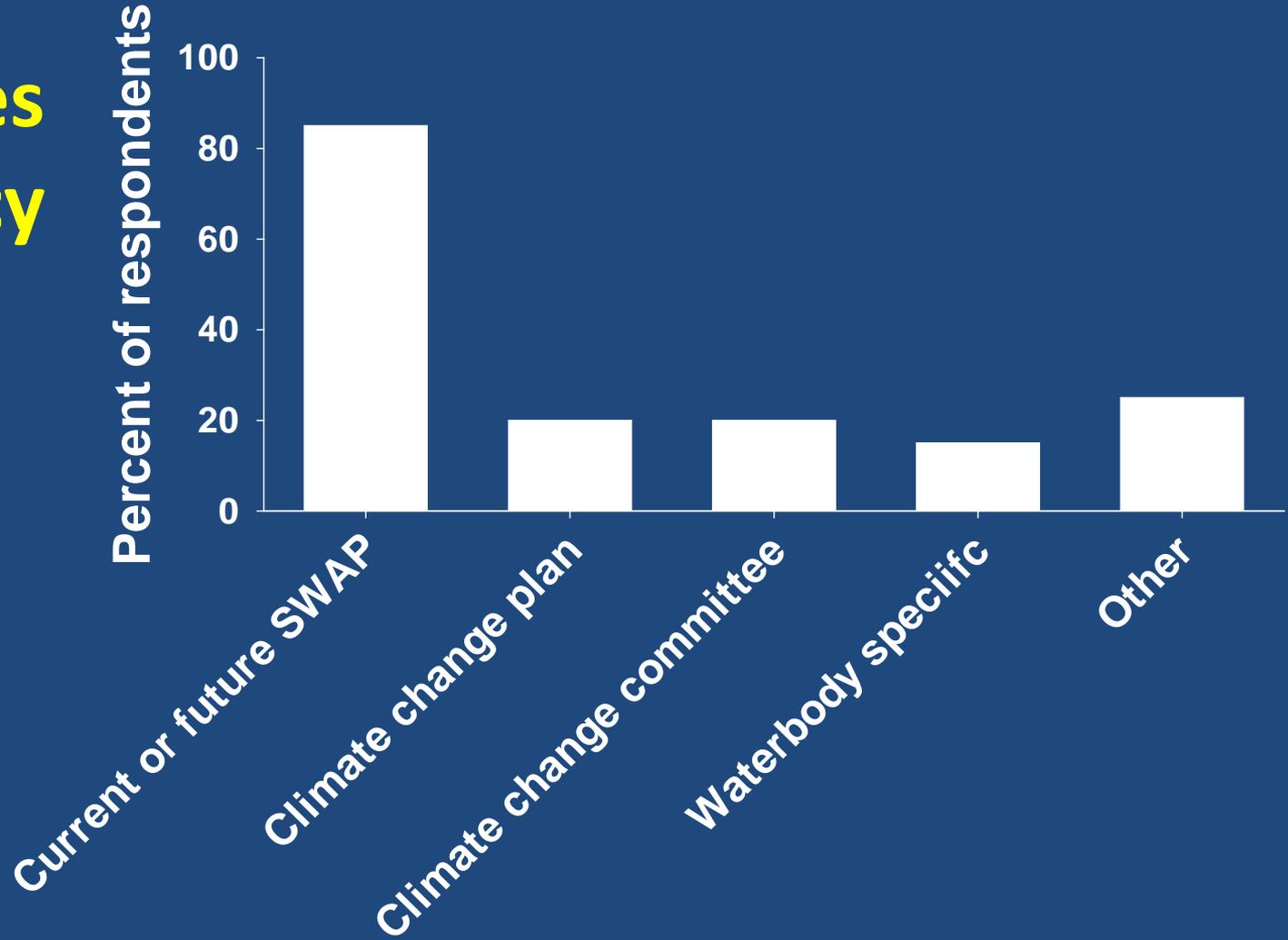
Changes in phenology/trophic mismatch (25%)



# Is Climate Change Considered in Your Agency?



# Where does your agency address climate change?



# What Riparian Management Actions are Used and Do They Account for Climate Change?

Action	% Agencies that use this action	% Agencies that incorporate CC into action
Tree planting	60	16
Livestock exclusion	85	5
Bank stabilization	90	0
Reconnect floodplain	58	16

Other riparian actions:

**dam removal; flow/zoning policy and regs, lake level fluctuations**

**3 states targeted climate change objectives for these**

# What Instream Habitat/Flow/Connectivity Management Actions are Used and Do They Account for Climate Change?

Action	% Agencies that use this action	% Agencies that incorporate CC into action
Channel restoration	76	4
Increased woody debris	67	0
Dam releases	90	0
Water allocation	70	5
Water regulatory policy	86	14
Fish passage/dam removal	86	19
Corridors	61	12
Reserve placement	31	7

31-90% of agencies use these habitat/flow management activities **but 0-19% account for climate change in decisions**

Could barrier removal/channel restoration focus on north-south connectivity to increase access to other latitudes with cooler water?

# What Population/Species Management Actions are Used and Do They Account for Climate Change?

Action	% agencies that use this action	% that incorporate CC into action
Harvest regulations	100	0
Stocking	100	9
Translocation	70	0
Invasive species control	86	9
Non native prevention (e.g., bait regs)	85	10

Many agencies use these tools regularly, but rarely include climate change in decisions

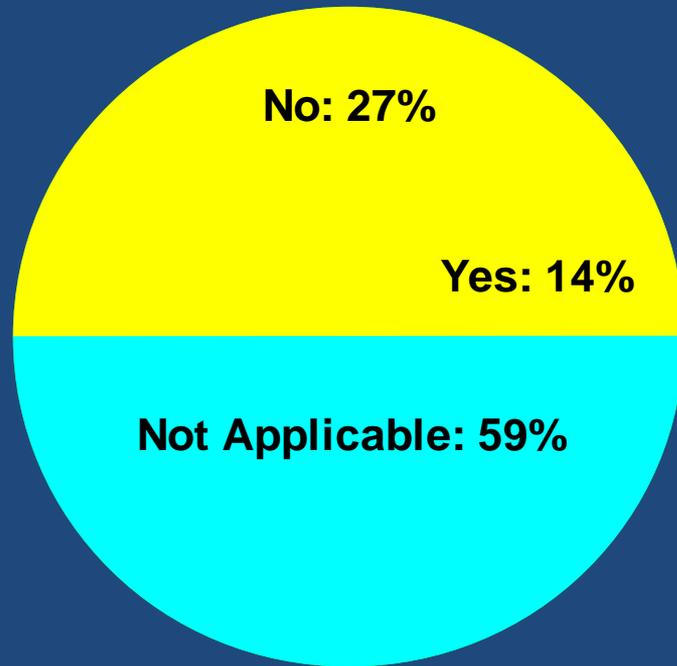
Should we stock coldwater fishes in areas that may likely warm in the future?

Are these decisions too far in the future?

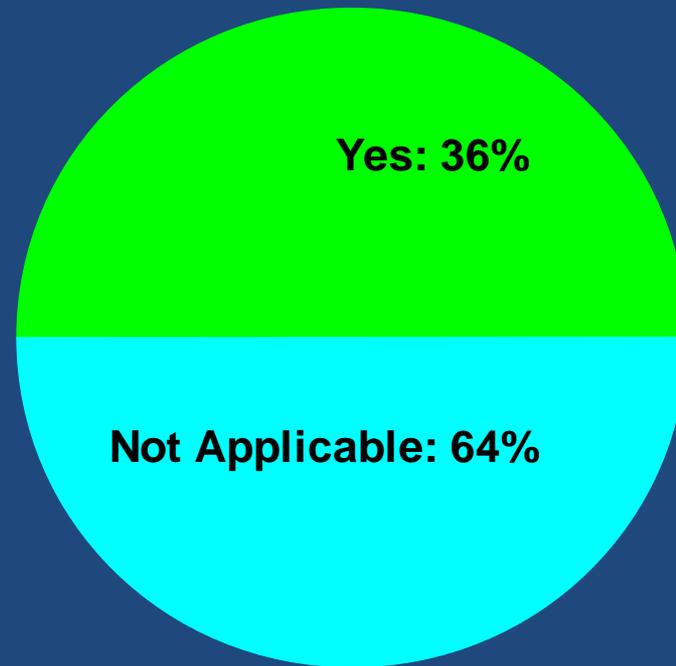


# Are Tools (Downscaled Climate/Land Use Change Models, Species/Landscape Vulnerability Scores) Available?

Tools Are Available



Tools Would Be Useful



Agencies believe tools are often not available or not useful.

Scientists need to do a better job of getting their science to the users

# What Are the Top 3 Challenges to Incorporating Climate Change in Your Management?

Action	% In Top 3 Challenges	Mean Rank (1=most important)
Uncertainty in climate/land use predictions	55	1.9
Staff expertise	50	2.4
Funding	41	2.5
Land base to implement adaptation strategies	18	2.8
Climate change not accepted in agency	41	2.8
Difficulty identifying timeline for thresholds and actions	41	3.1
Uncertainty in biology of species	9	3.5
Institutional regulations/policies	14	3.5
Difficult to make changes on such a slow process	14	4

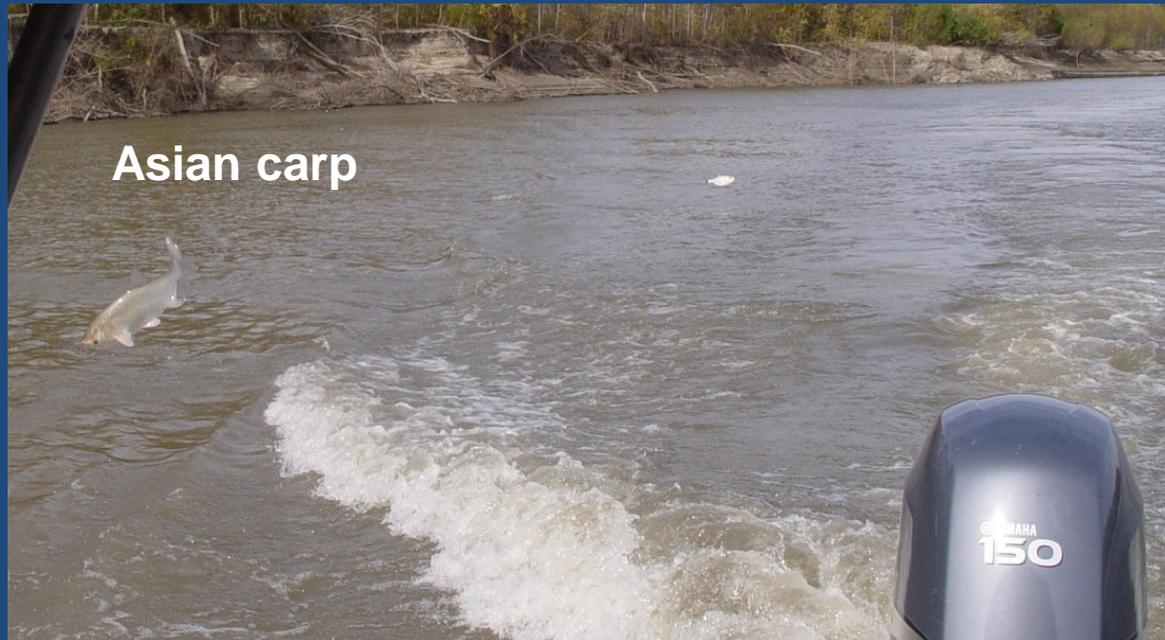
**Agencies concerned because models have much uncertainty**  
**But funding and lack of knowledge also important**  
**41% said climate change not accepted in agency!**

# What Does This All Mean?

States concerned about extreme climate events, invasive species, and altered thermal/hydrologic regimes

40% don't consider climate change in management

Management actions (e.g., reconnect floodplains, barrier removal, stocking) rarely incorporate climate change



Asian carp

# Why Ignore Climate Change?

Not accepted within agency

Not aware of tools available them (and their utility)

Too much uncertainty in climate models

Limited staff expertise and funding



# States Do Good Things.....

Biologists are good at what they do:

- Stocking
- Harvest management
- Habitat/flow management

Just need to think 'big picture' to make decisions based on future warming temps and altered flow.

Easier said than done with the uncertainty



# What Can Scientists/Academics Do To Help

Make science known and applicable to managers

- Only 36% of states think vulnerability assessments, climate models are useful
- 27% of states didn't know they exist

Help biologists understand their management can be used in the face of climate change

- **stocking, fish passage, etc. is not new to them**
- **e.g., decide where to remove barriers based on projected water temps?**

Train future biologists in climate science and fisheries

- Academic courses?
- Workshop to agencies?

# Acknowledgements

## Survey input

- Shawn Carter, USGS National Climate Change and Wildlife Science Center
- Chris Vitello, MO Dept. of Conservation

Gary Whelan-presenting this info at the forum.

