

TRACKING AN INVASION: HOW
THE DISTRIBUTION AND
ABUNDANCE OF LIONFISH
(*PTEROIS* SPP.) HAS CHANGED
ALONG THE U.S. ATLANTIC COAST

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GSARP Meeting
April 14, 2026





LIONFISH (*PTEROIS VOLITANS/MILES* COMPLEX)



Meristic Differences



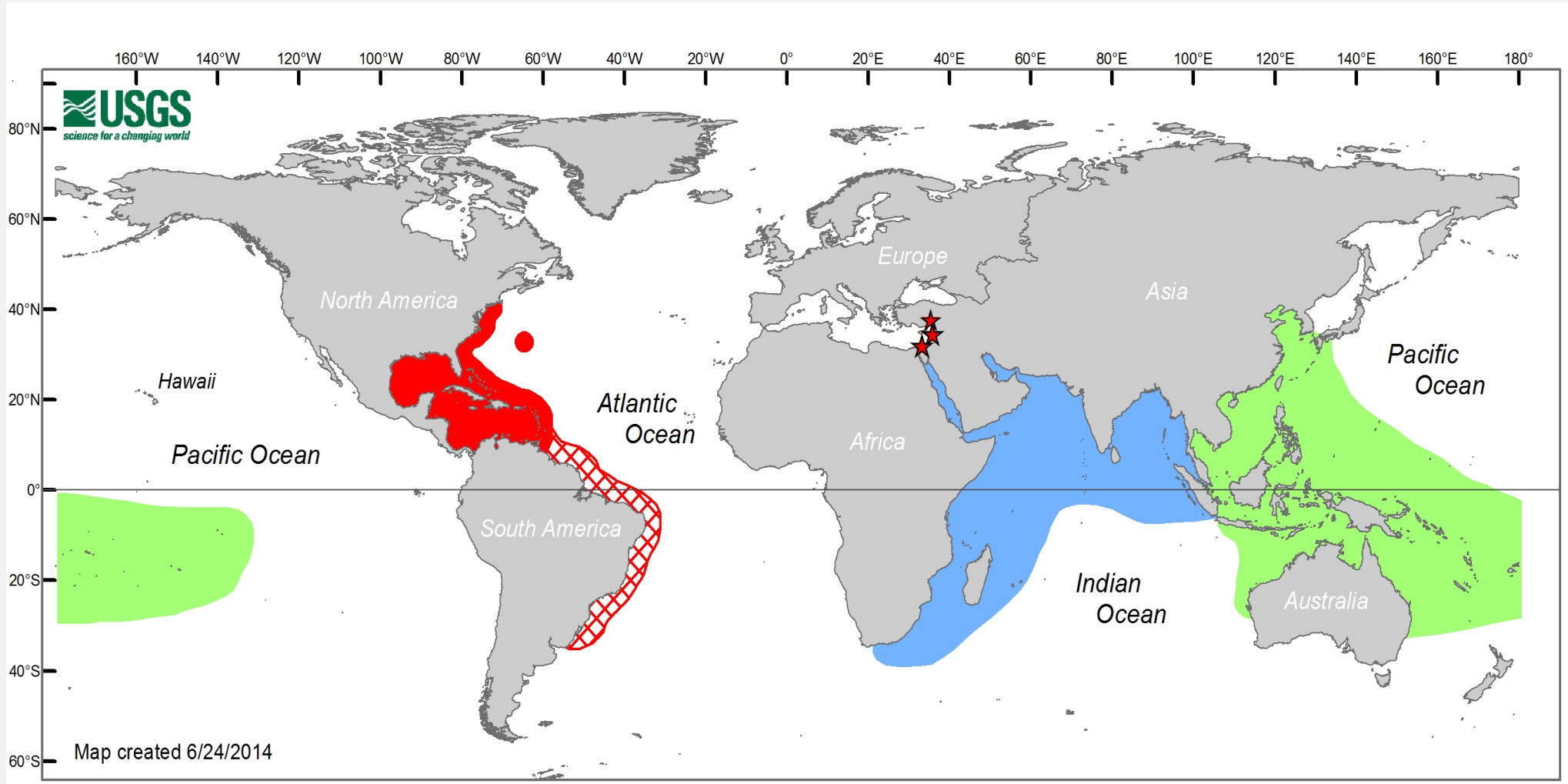
Indian: *Pterois miles*

Pacific: *Pterois volitans*

Dorsal Fin Rays	10	11
Anal Fin Rays	6	7
Pectoral Fin Size	Shorter	Longer
Spot Size	Smaller	Larger
Geographic Range	Africa – Indonesia	Indonesia – W Pacific



LIONFISH (*PTEROIS VOLITANS/MILES COMPLEX*)



■ *P. volitans* native range

■ *P. miles* native range

■ Lionfish invasive range

1985

*Lionfish Distribution
in the
Northwest Atlantic Ocean*



Data Source: U.S. Geological Survey
[Http://nas.er.usgs.gov](http://nas.er.usgs.gov)

January 8, 2020

WHY DO WE CARE ABOUT THE INVASION?

- Lionfish have life history traits that make them successful invaders
- Negative impacts on ecosystem and fisheries resources
- No long-term or large-scale studies of Lionfish abundance or distribution off the U.S.

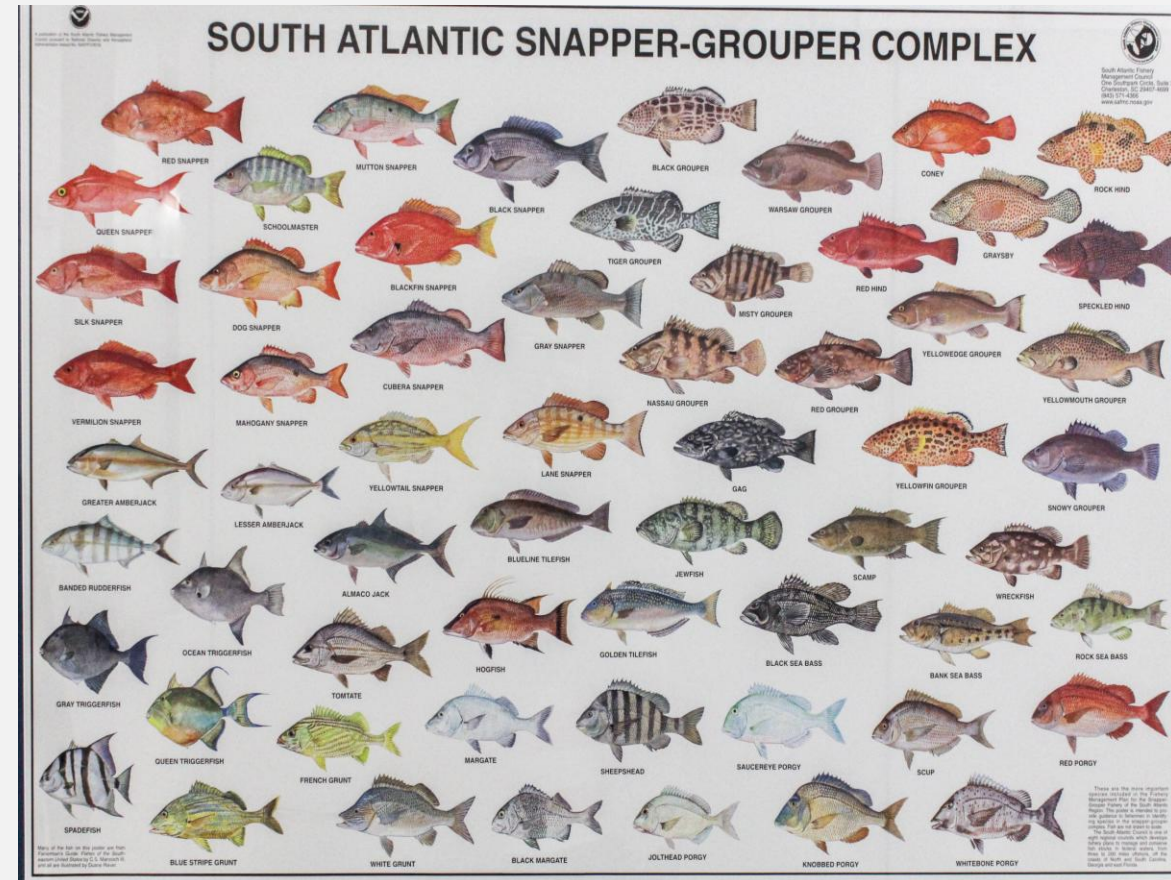




SOUTHEAST REEF FISH SURVEY

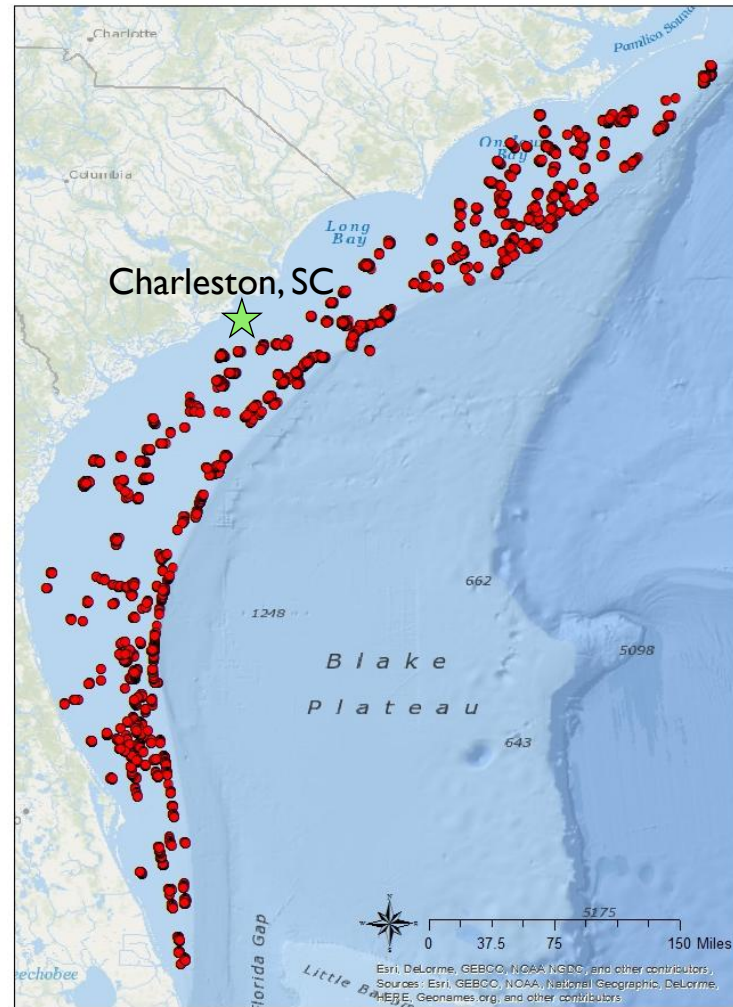
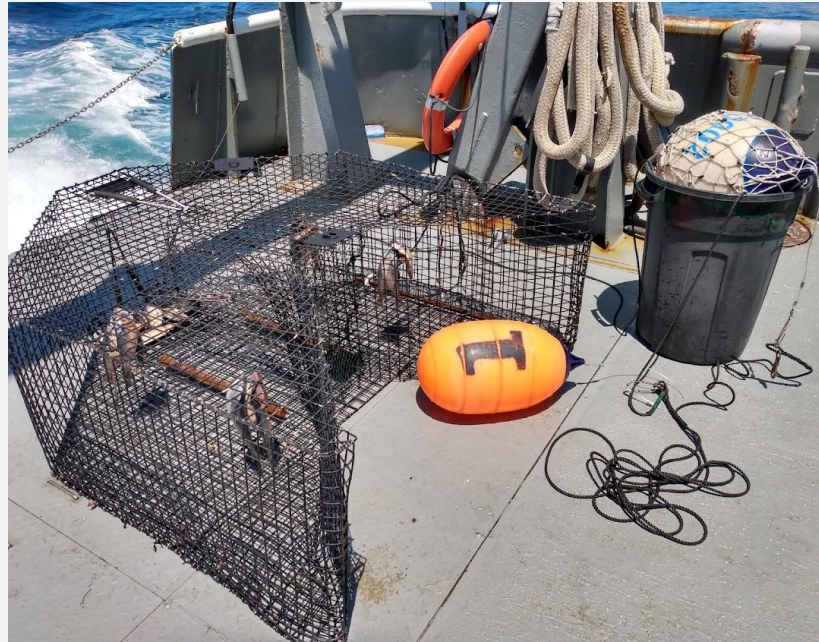


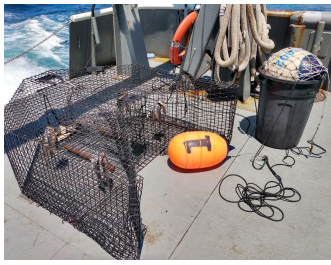
- SERFS- Long-term fisheries independent monitoring program
- MARMAP (1972-Present), SEAMAP-SA (2009-Present), SEFIS (2010-Present)
- Program mission:
 - To determine the distribution, relative abundance, life history, and critical habitat of economically and ecologically important species off the coast of the southeastern U.S. (NC-FL)





CHEVRON TRAP SURVEY (1990-PRESENT)





CHEVRON TRAP SURVEY (1990-PRESENT)

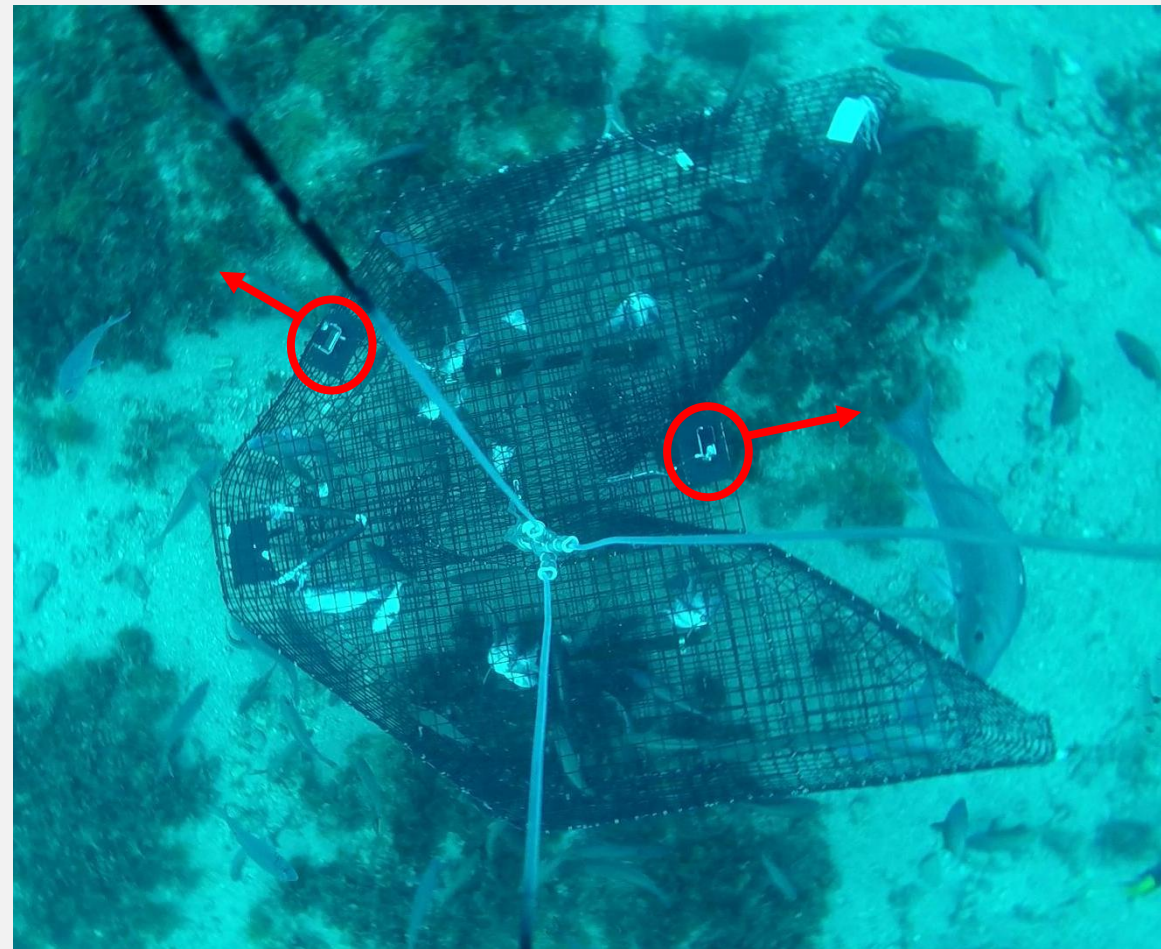
First Lionfish wasn't caught in the traps until 2010



2010-2024: 21,593 chevron traps deployed
Only 83 Lionfish captured!

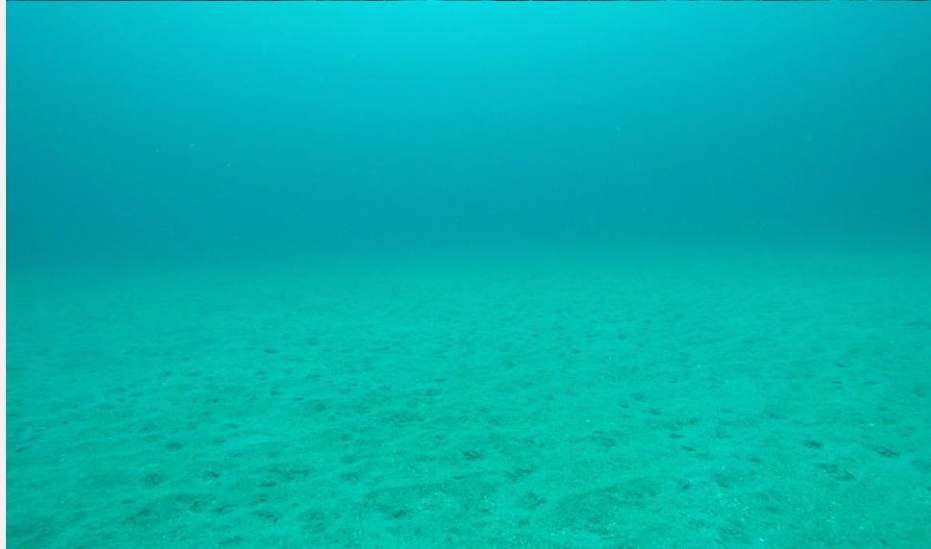


VIDEO CAMERAS (2011-PRESENT)



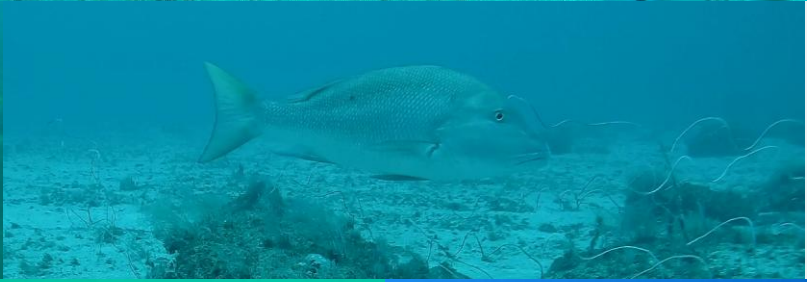
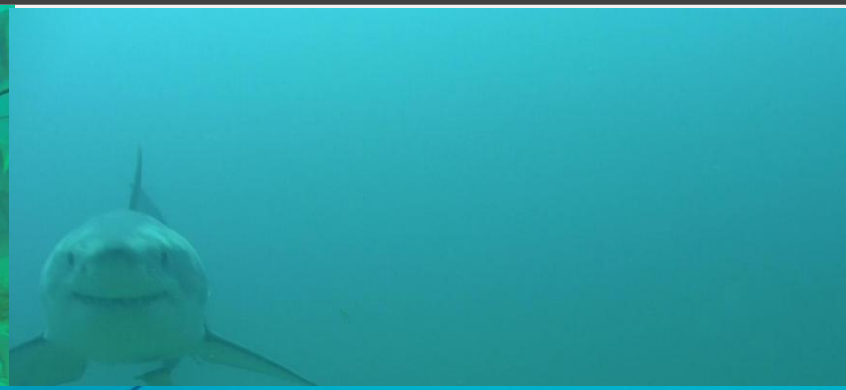


HABITAT CHARACTERIZATION



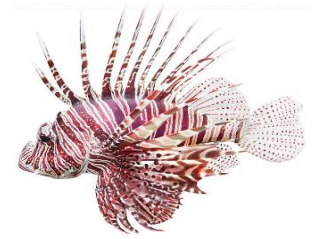


TRAP AVOIDANT SPECIES





TRAP AVOIDANT SPECIES





TRAP AVOIDANT SPECIES



2011
2 lionfish in traps (0.2% positive)
BUT
9.6% positive on videos



SERFS VIDEO TRAP SURVEY



- 12,810 chevron trap deployments with video data from 2011-2021
- Location
- Depth
- Day of Year (DOY)
- Bottom Temperature (CTD)





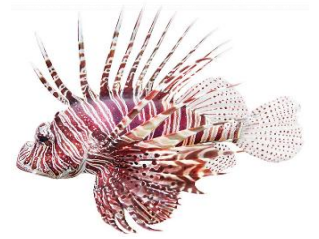
VIDEO DATA

- 20 minutes of video
 - Snapshot every 30 seconds
 - 41 frames





VIDEO DATA



- 20 minutes of video
 - Snapshot every 30 seconds
 - 41 frames
- SumCount Lionfish





VIDEO DATA

- 20 minutes of video
 - Snapshot every 30 seconds
 - 41 frames
- Habitat Data
 - Bottom type (categorical variables)
 - Biota density
 - Water clarity
 - Current

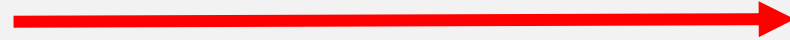




BIOTA DENSITY



0 %

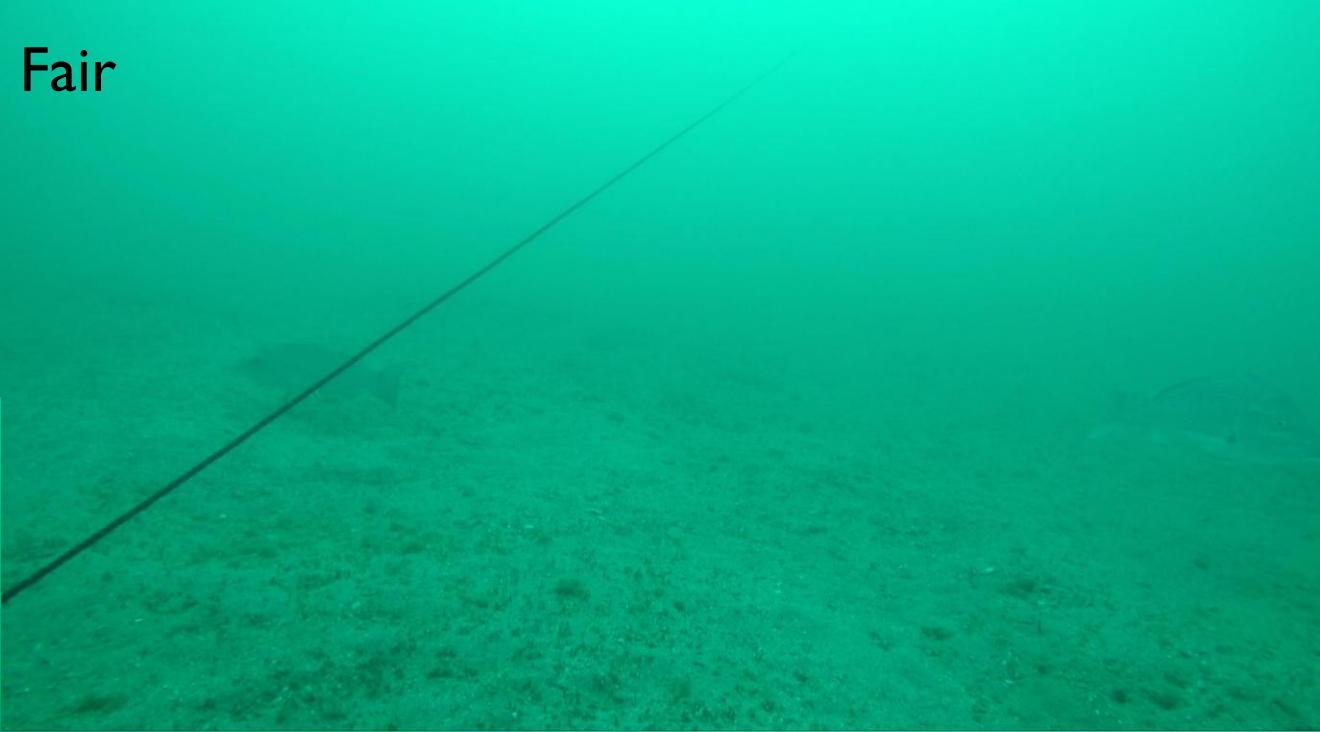


100 %

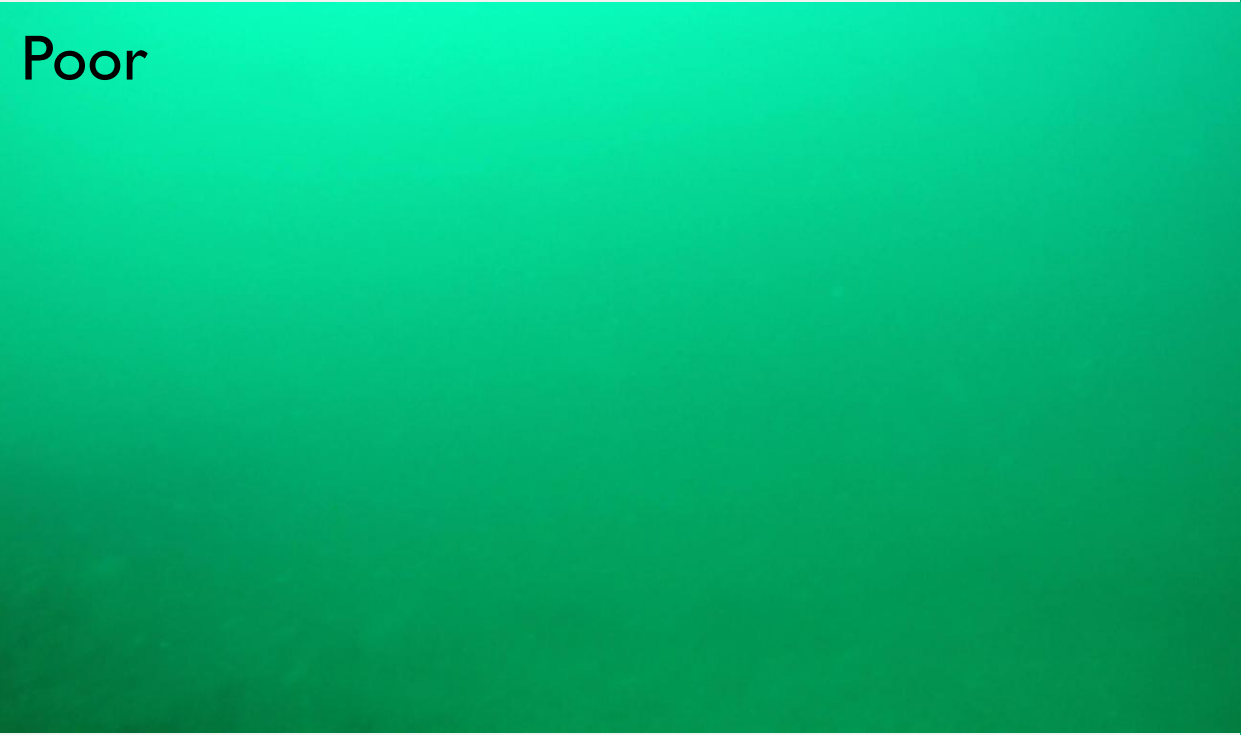


WATER CLARITY

Fair



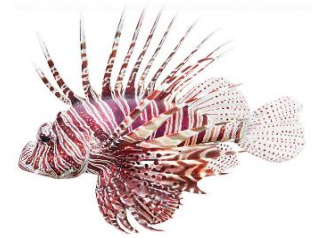
Clear



Poor



METHODS - MODELING



Input Parameters:

Year, DOY, Clarity, Current,
Bottom Type, Depth, Latitude,
Temperature, Biota Density



Two Part Model



Distribution – Where are the lionfish?

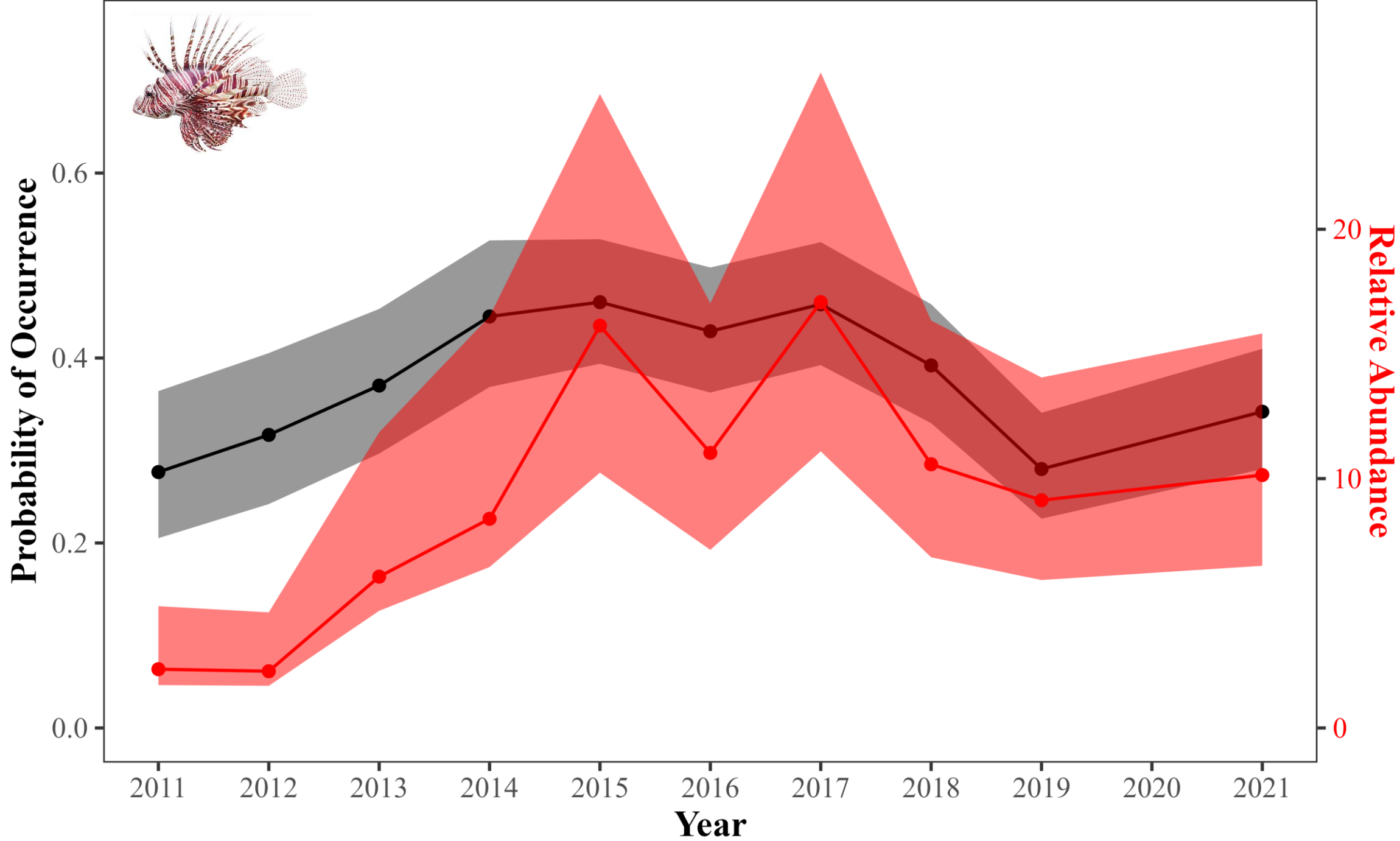
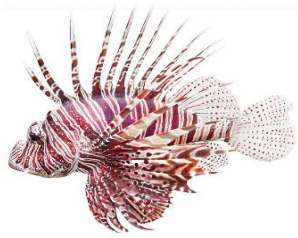
Species Distribution Model

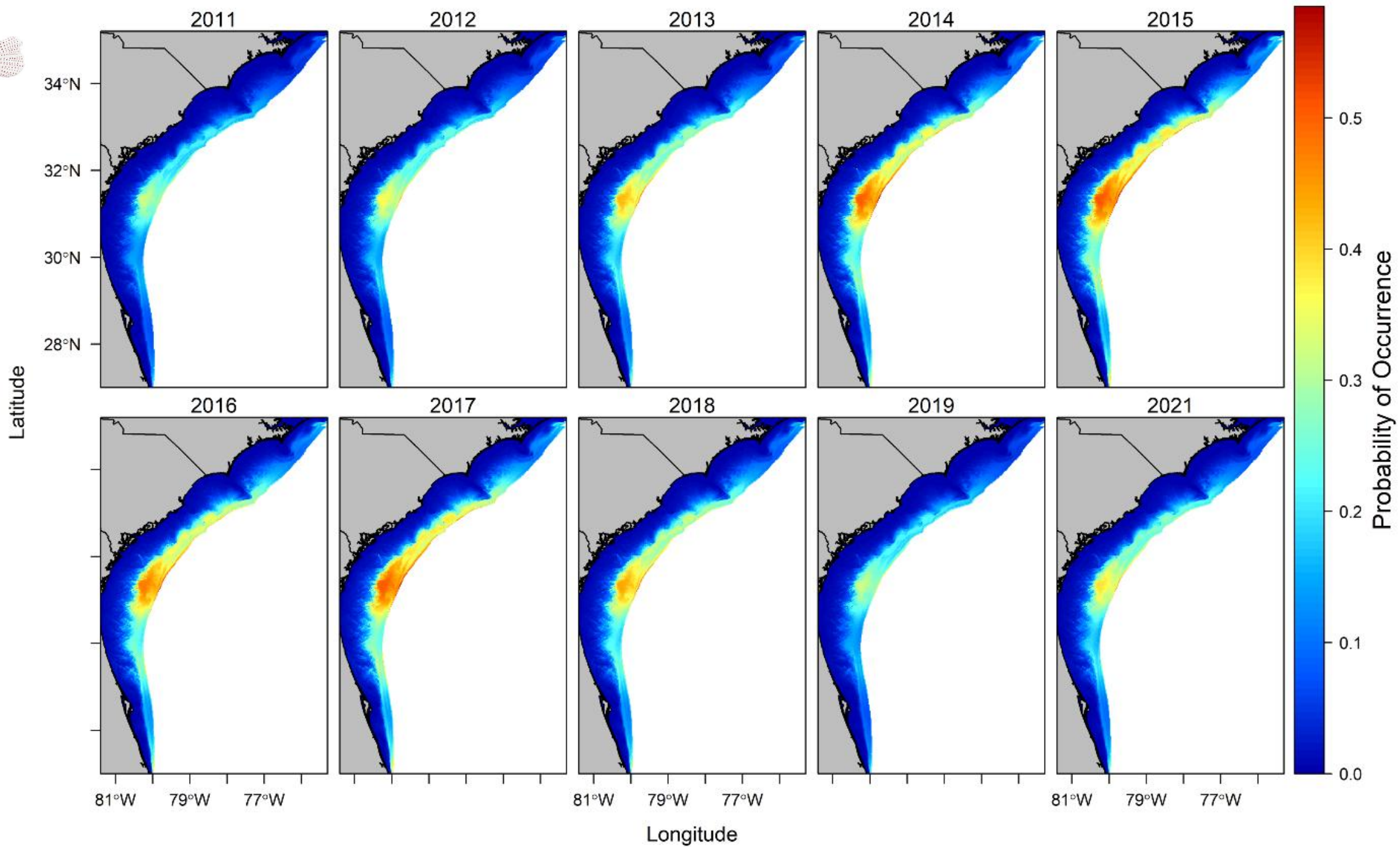
- Binomial logistic regression

Abundance – How many lionfish are there?

Abundance Index

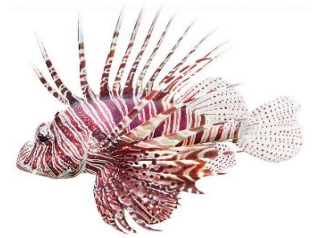
- Zero-inflated negative binomial model



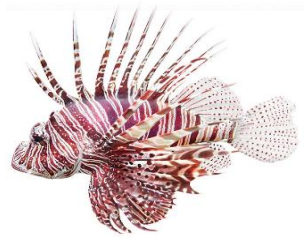




DISCUSSION



- First large-scale temporal and spatial study on lionfish in the invaded range
- Distribution and abundance peaked around 2015 and has stabilized since then

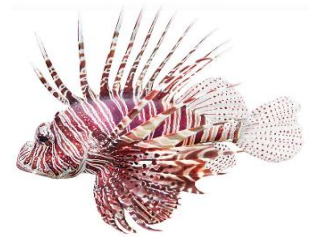


DETECTABILITY

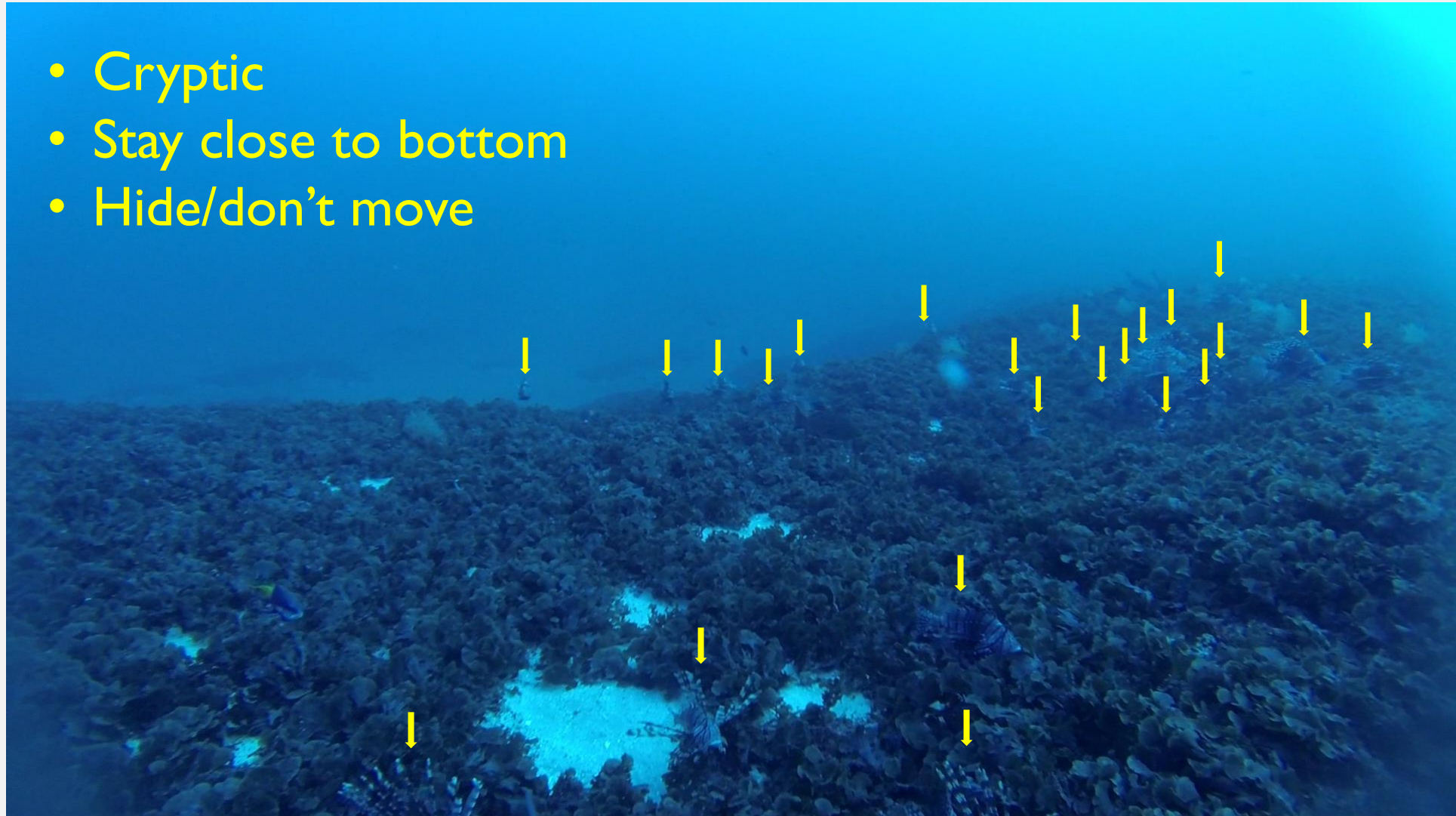




DETECTABILITY

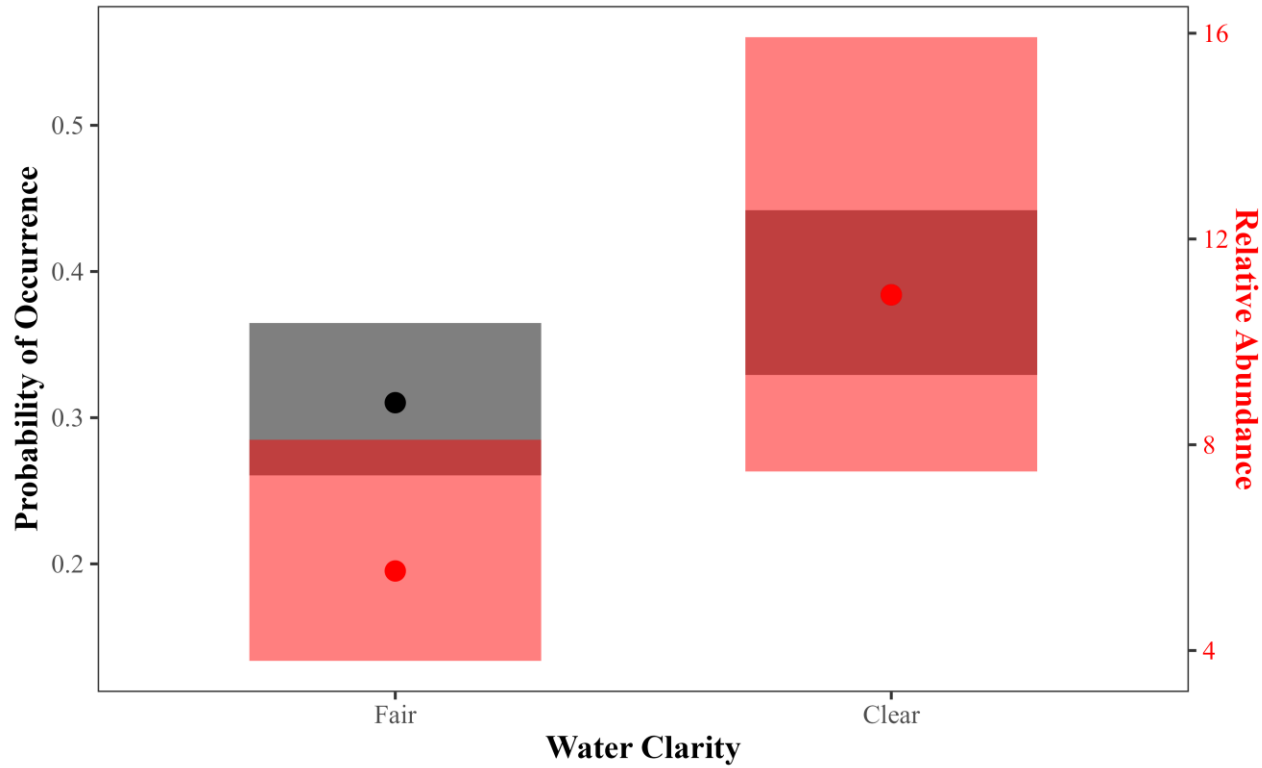
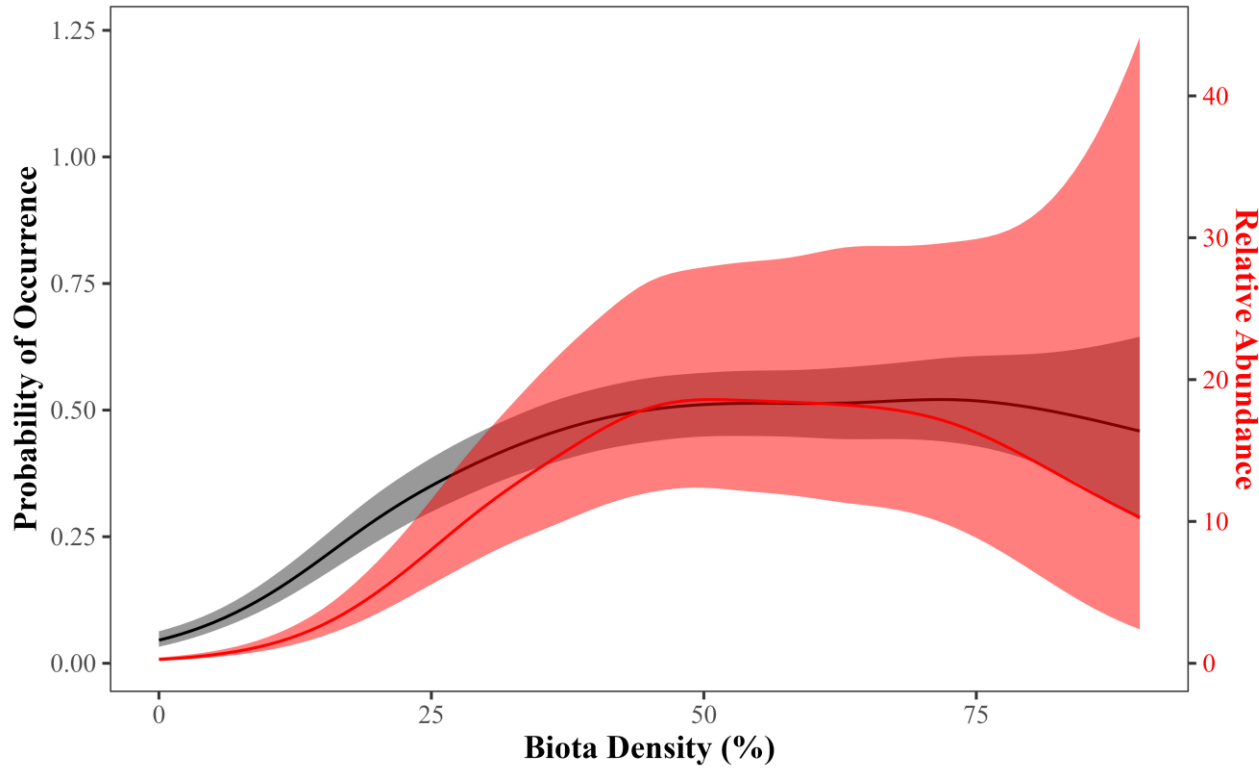


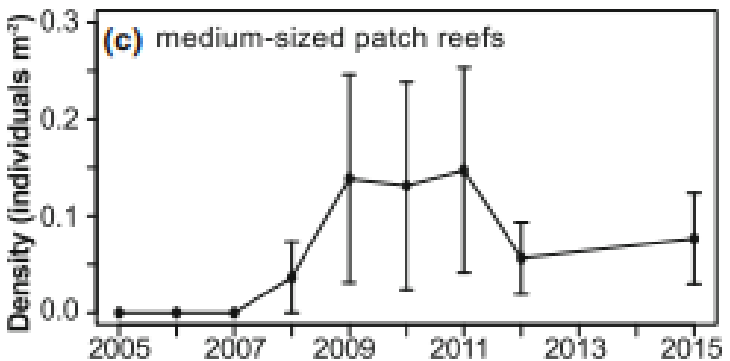
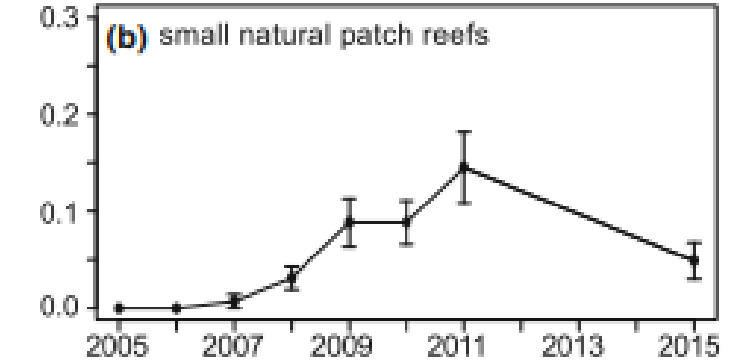
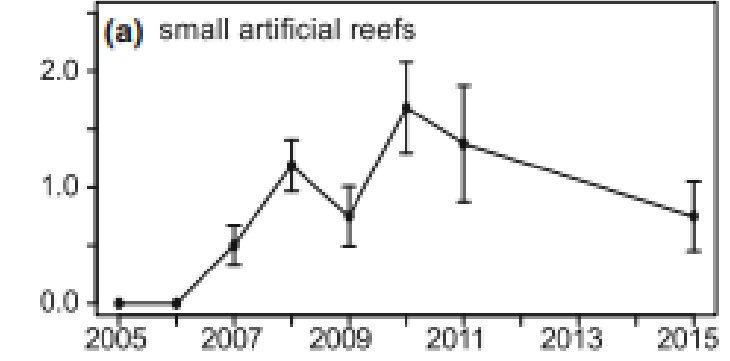
- Cryptic
- Stay close to bottom
- Hide/don't move



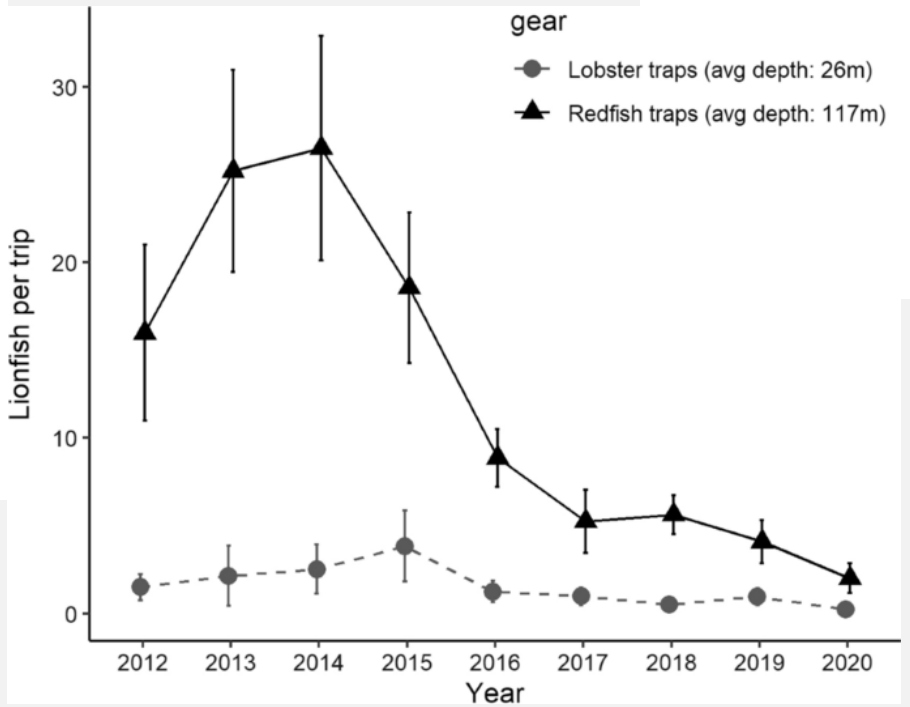
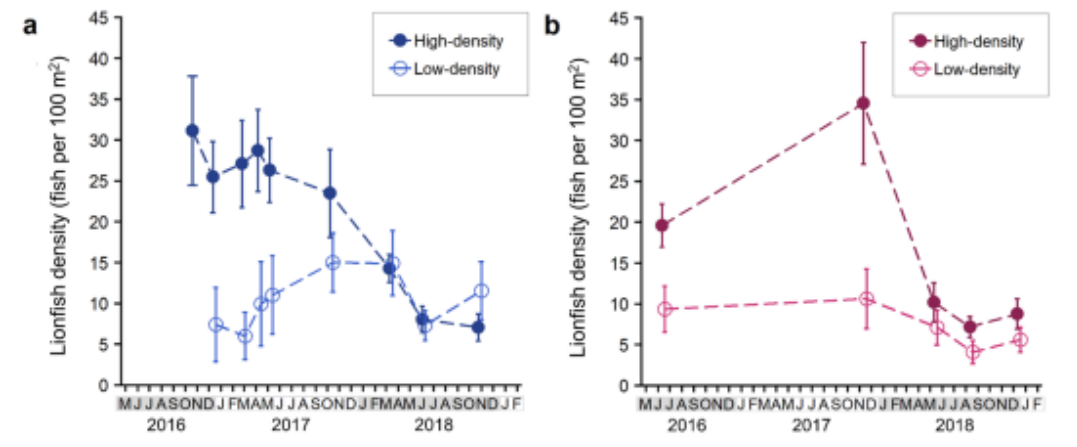


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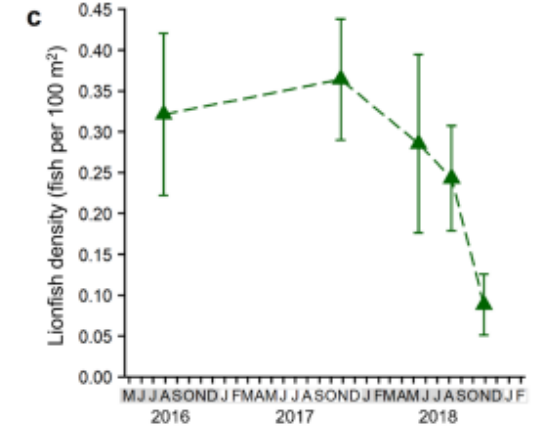




Benkwitt et al. 2017



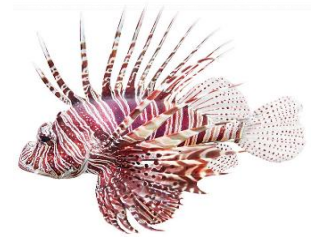
Debrot et al. 2023



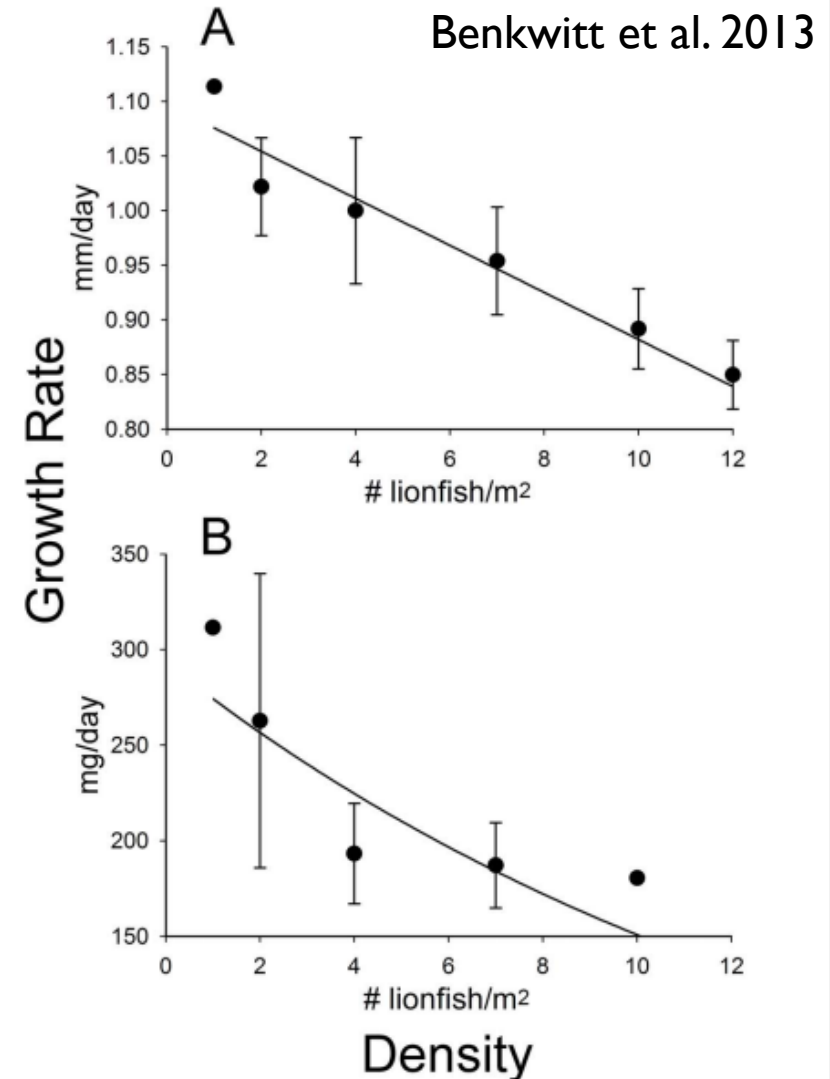
Harris et al. 2020



POTENTIAL REASONS



- Intraspecies competition

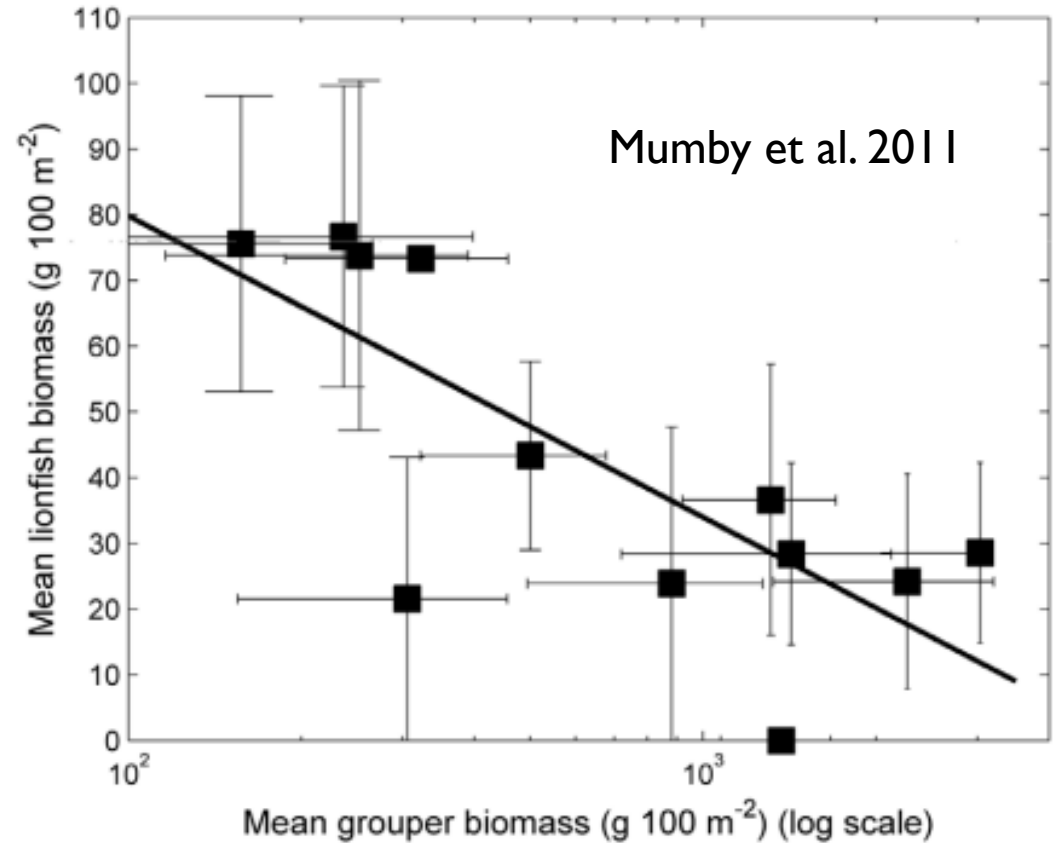




POTENTIAL REASONS



- Intraspecies competition
- Interspecies competition

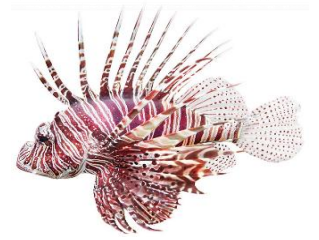




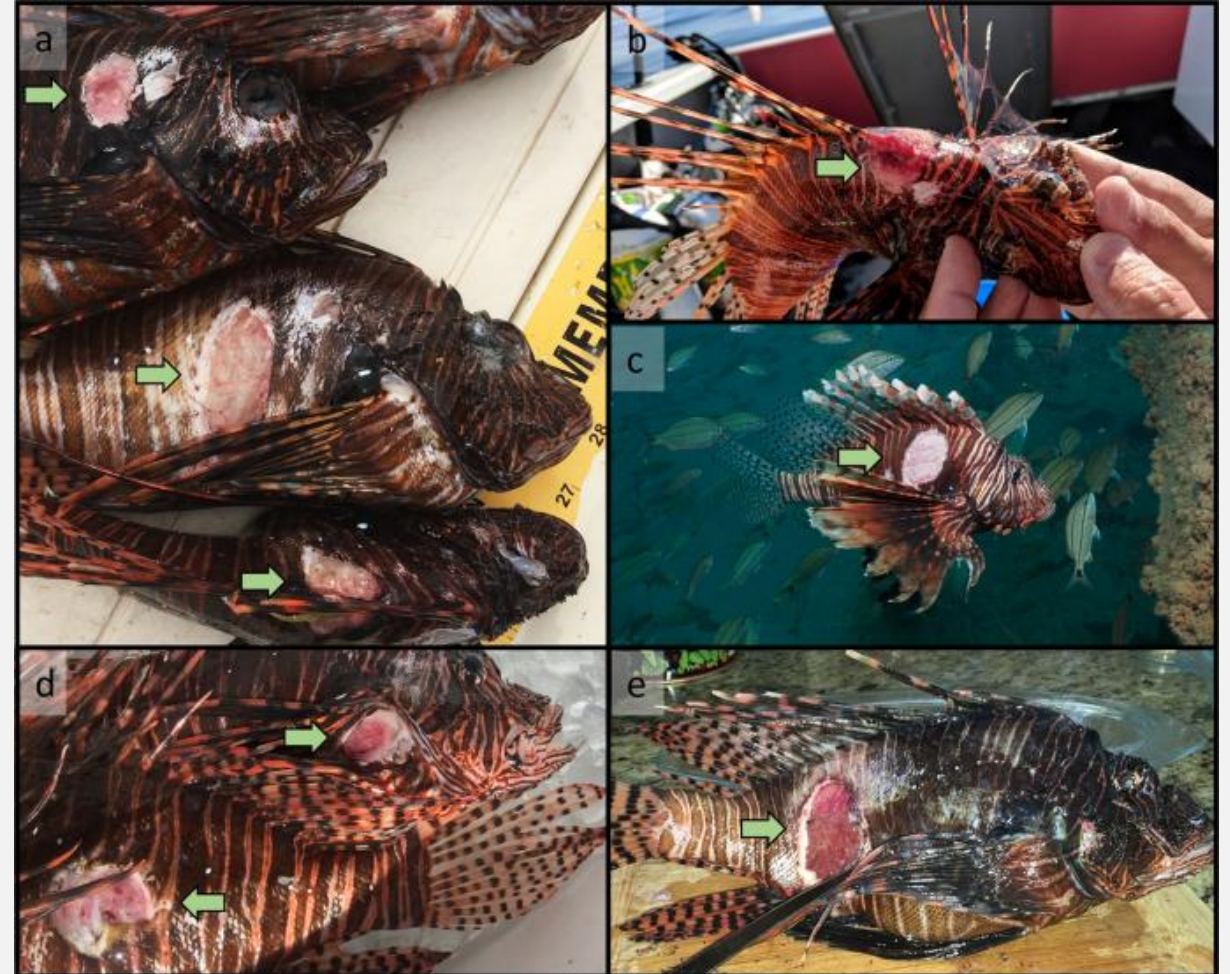




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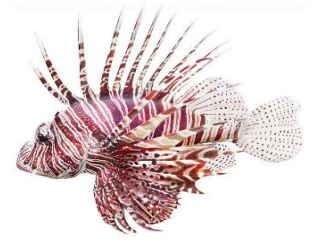
- Intraspecies competition
- Interspecies competition
- Disease



Harris et al. 2020



POTENTIAL REASONS

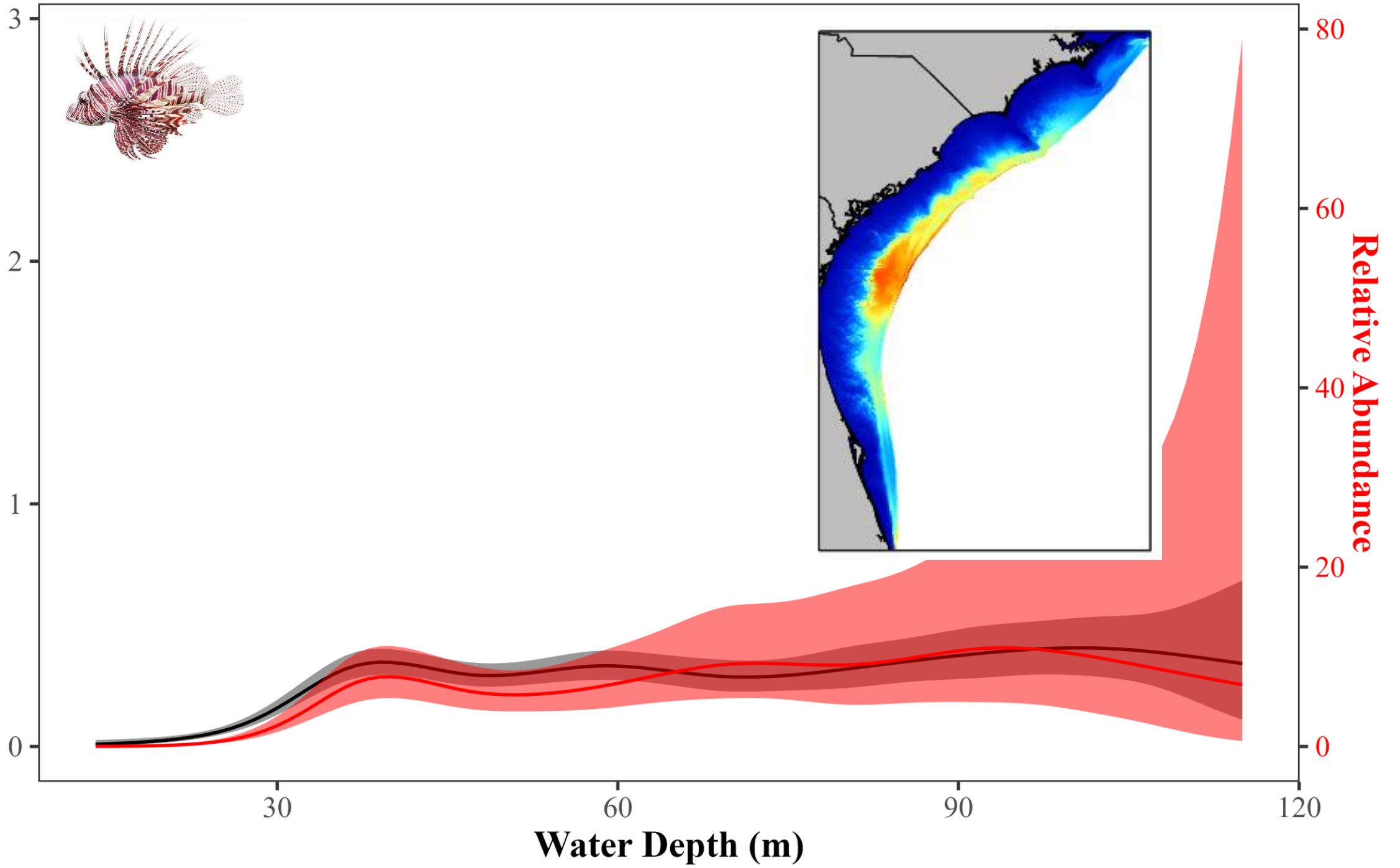


- Intraspecies competition
- Interspecies competition
- Disease
- Control



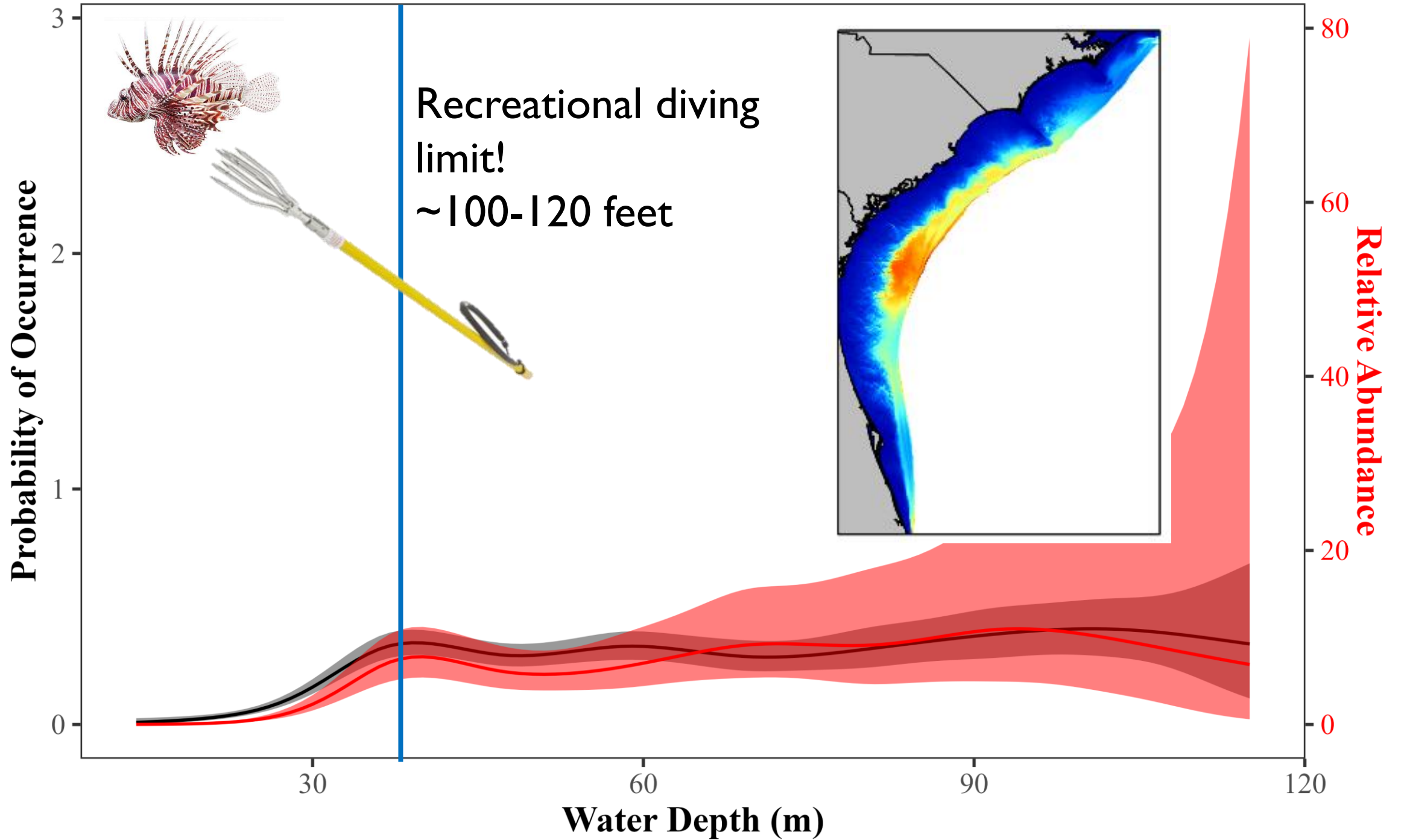
Andradi-Brown 2020

Probability of Occurrence



Relative Abundance

Water Depth (m)

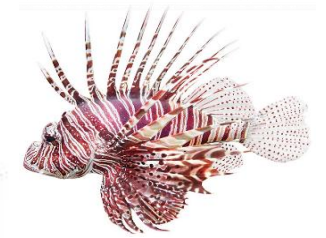




DISCUSSION



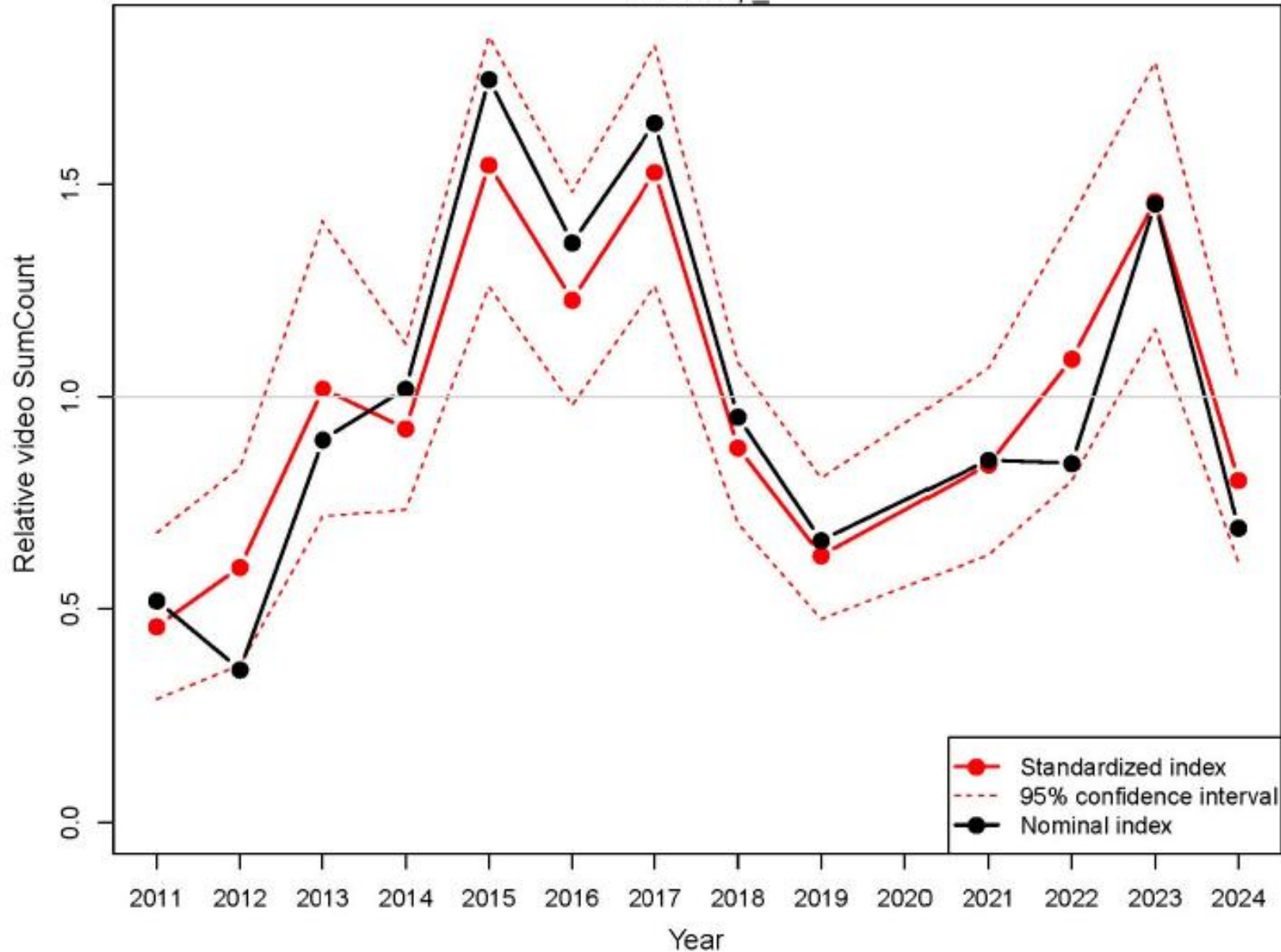
- First large-scale temporal and spatial study on lionfish in the invaded range
- Distribution and abundance peaked around 2015 and has stabilized since then
 - Likely due to natural causes rather than culling



Lionfish (*Pterois* spp.)

Pterois sp.

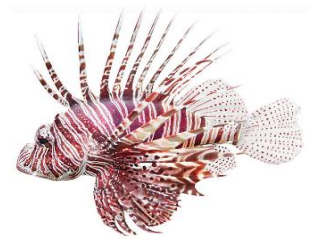
- First in the
- Distribution has s
- Lil



lionfish
5 and
lg



DISCUSSION



- First large-scale temporal and spatial study on lionfish in the invaded range
- Distribution and abundance peaked around 2015 and has stabilized since then
 - Likely due to natural causes rather than culling
- Continue monitoring lionfish especially in the outer shelf hard bottom habitats that are more likely to be negatively impacted



ACKNOWLEDGEMENTS



- MARMAP
- SEAMAP-SA
- SEFIS



Biol Invasions
<https://doi.org/10.1007/s10530-024-03248-y>

ORIGINAL PAPER



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