

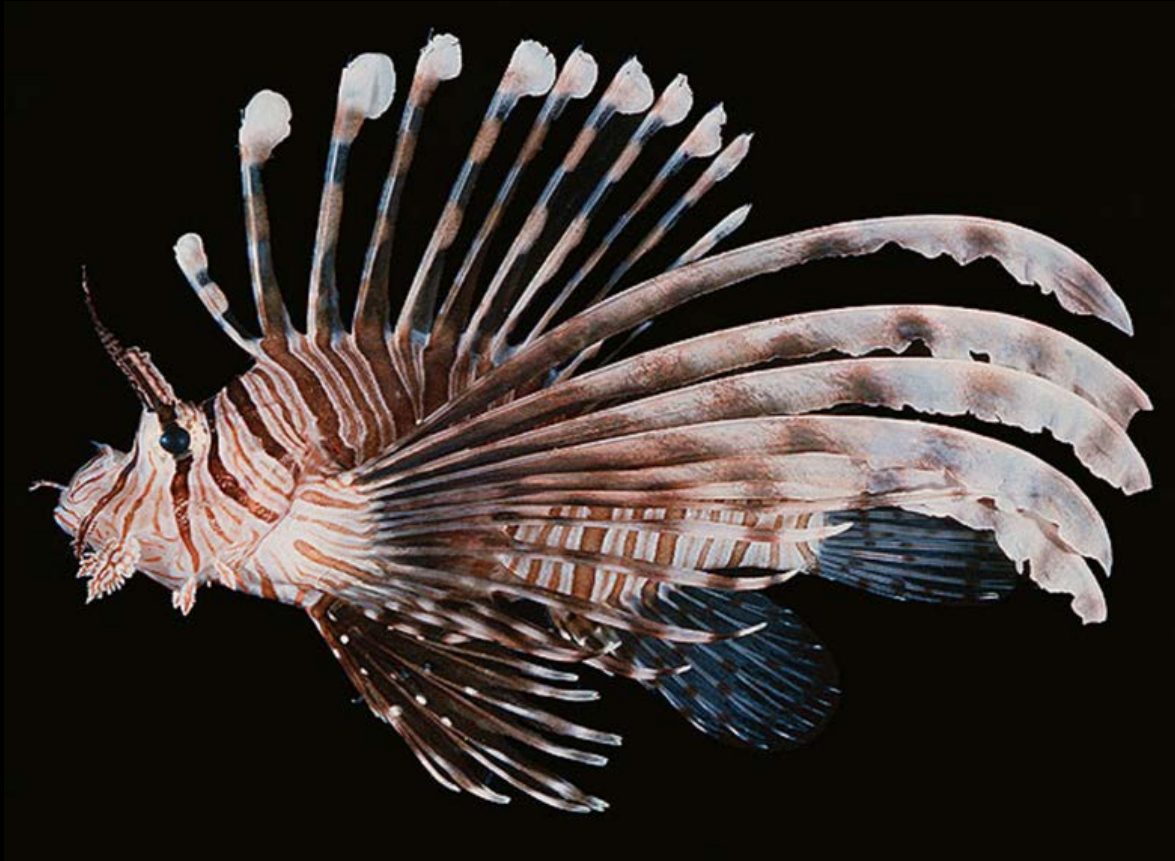
# Invasiveness Risks of The “Other” Lionfish in the Marine Ornamental Trade



Jeffrey E. Hill, Timothy J. Lyons, and Quenton M. Tuckett,

Gulf and South Atlantic Regional Panel, ANSTF, 4-5 October 2017, Raleigh, NC

# Red Lionfish *Pterois volitans*



Red lionfish *Pterois volitans*. Photo: J.E. Randall from Froese and Pauly 2016.  
<http://www.fishbase.org/photos/PicturesSummary.php?StartRow=11&ID=5195&what=species&TotRec=17>

# Pteroinae

## Genus

## Species

*Brachypterois*

*curvispina*\*  
*serrulata*  
*serrulifer*

*Dendrochirus*

*barberi*  
*bellus*  
*biocellatus*

*brachypterus*  
*hemprichi*\*  
*tuamotuensis*\*

*zebra*

*Ebosia*

*bleekeri*  
*falcata*

*saya*\*  
*vespertina*\*

*Parapterois*

*heterura*

*macrura*

*Pterois*

*andover*  
*antennata*  
*brevipectoralis*  
*cincta*

*lunulata*  
*miles*  
*mombasae*  
*paucispinula*\*

*radiata*  
*russelii*  
*sphex*  
*volitans*

# Most Common “Others”

*D. biocellatus*



*D. brachypterus*



*D. zebra*



*D. barberi*



*P. russelii*



*P. radiata*



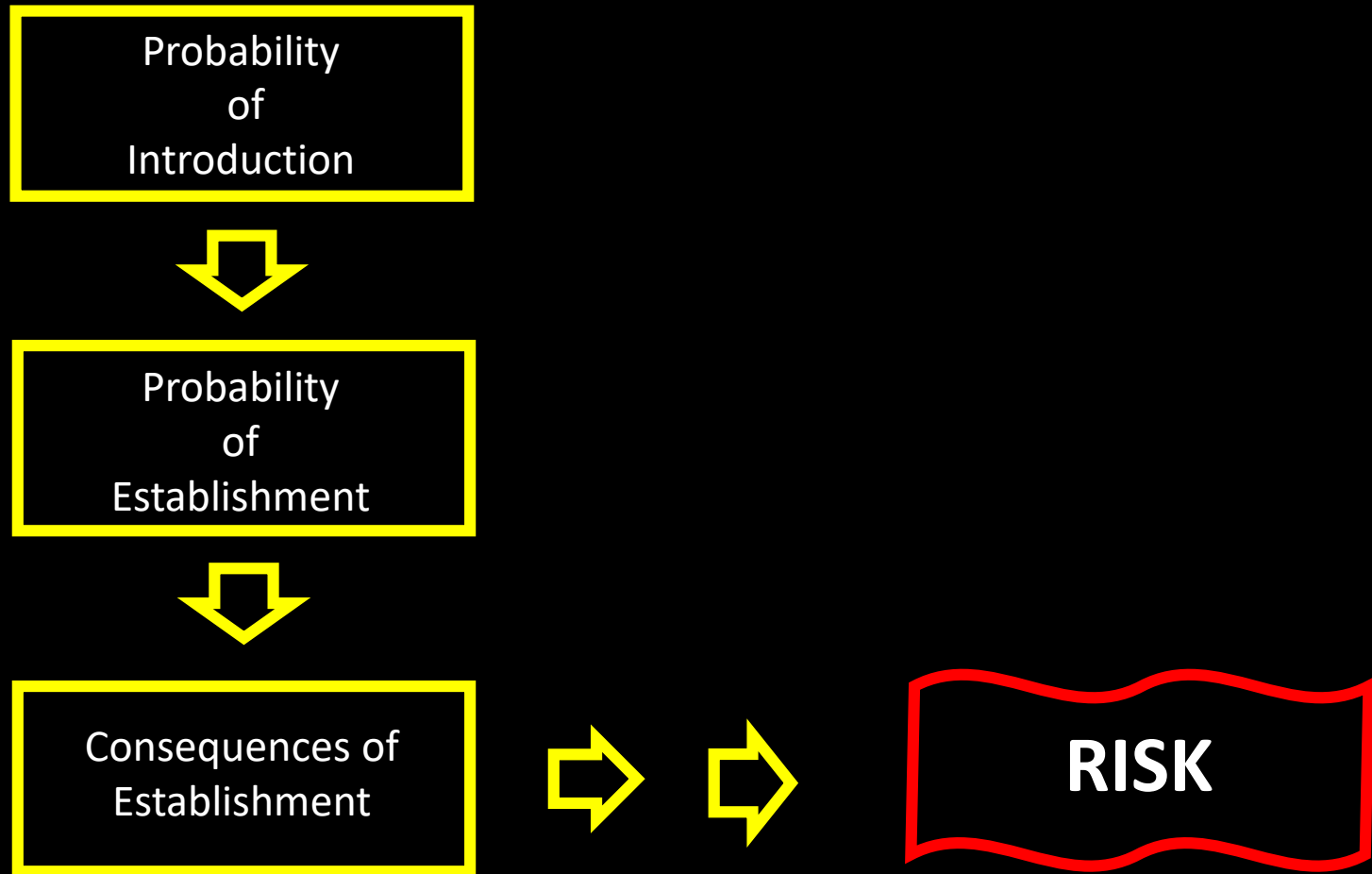
*P. antennata*



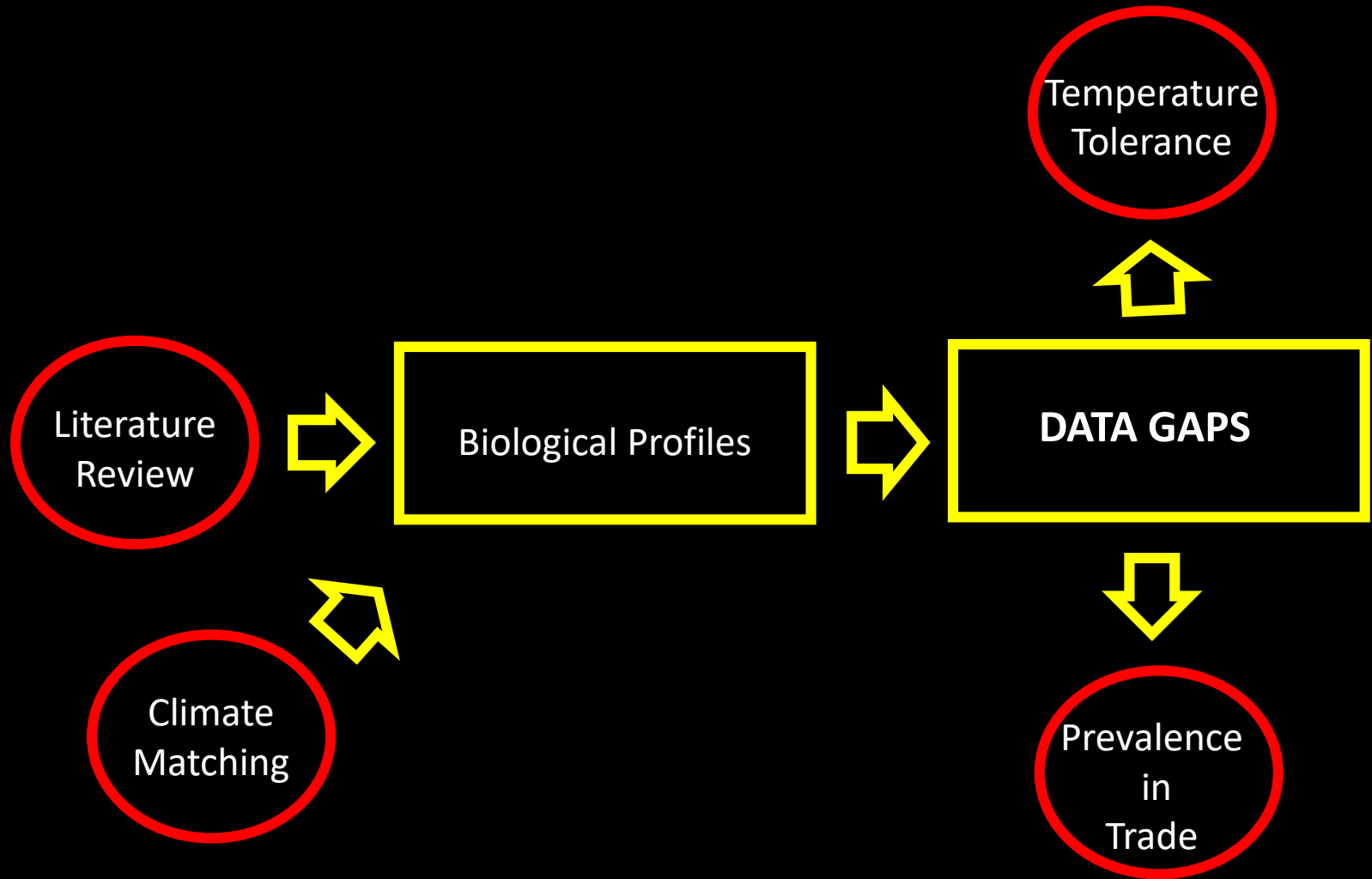
*P. sphex*



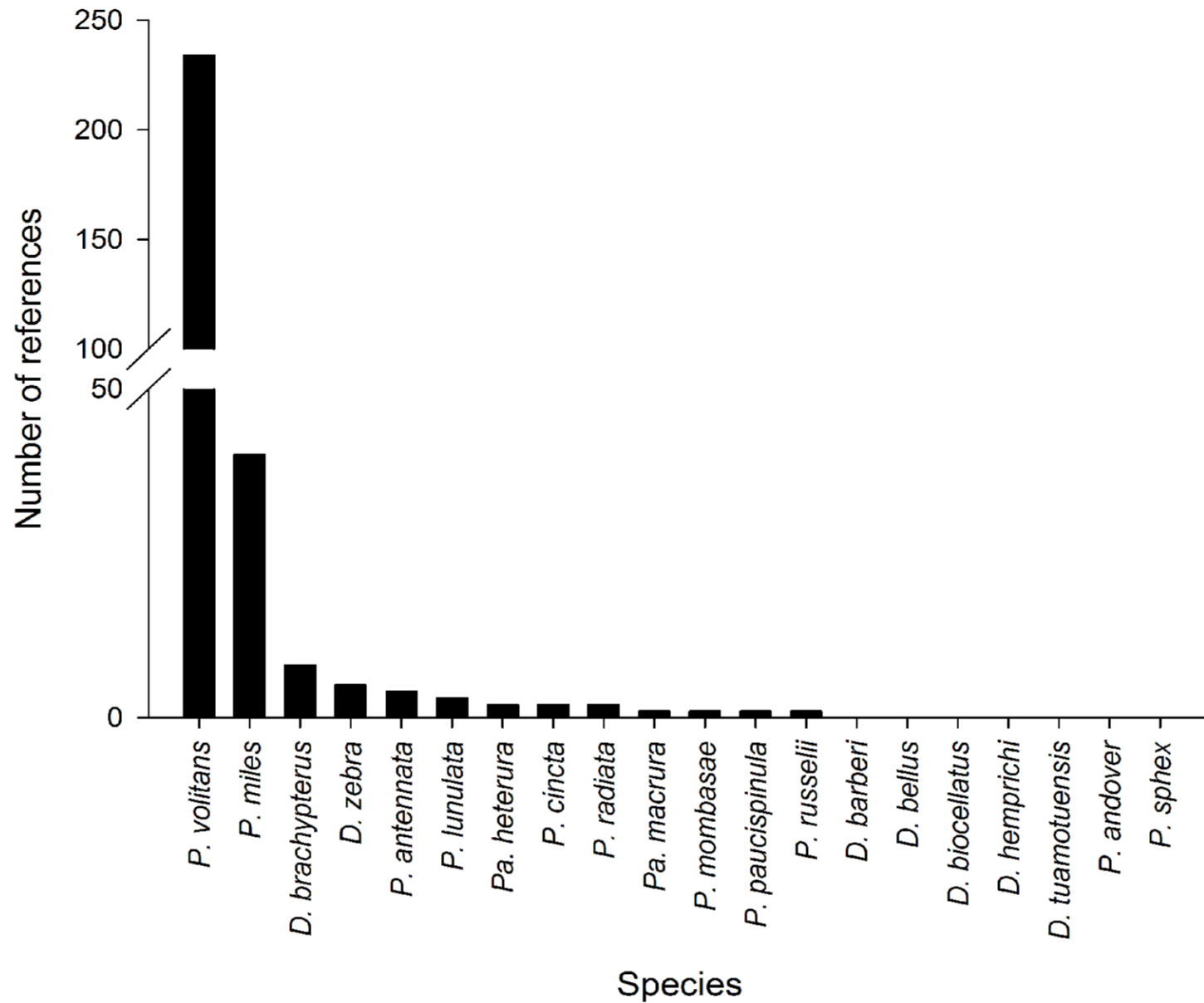
# Conceptual Model: Evaluating Risk



# Evaluating Risk: Literature and Data Gaps



# Standardized Literature Search



# Bioprofile

Major sections:

1. Classification

2. Distribution

3. Biology

4. Control

5. Potential Florida distribution

6. Potential impacts

## Bioprofile of Luna Lionfish *Pterois lunulata* (Temminck and Schlegel 1843)

### 1. CLASSIFICATION

a. Taxonomy, common names, and references

Class: Actinopterygii

Order: Scorpaeniformes

Suborder: Scorpanoidei

Family: Scorpaenidae

Subfamily: Pteroinae

Genus: *Pterois*

*Pterois lunulata* (Temminck and Schlegel 1843)

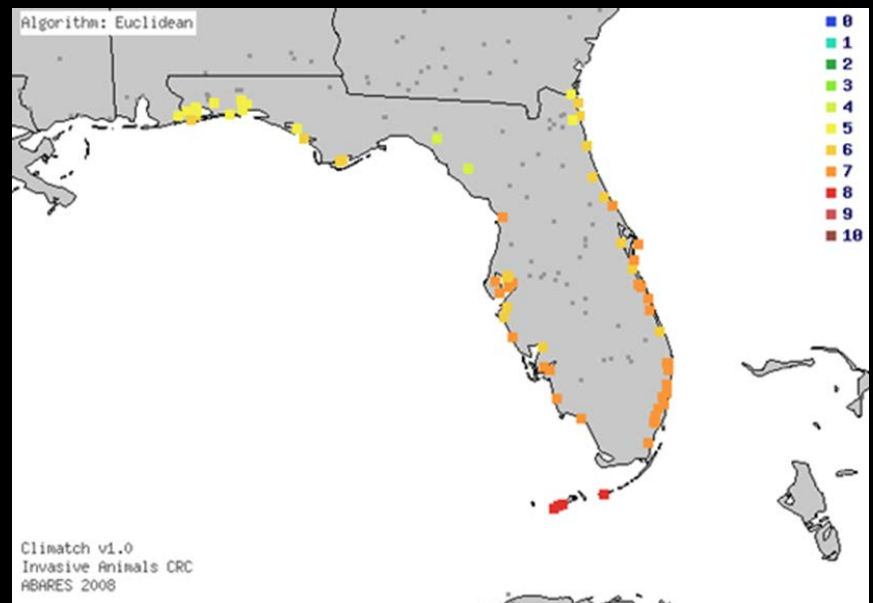
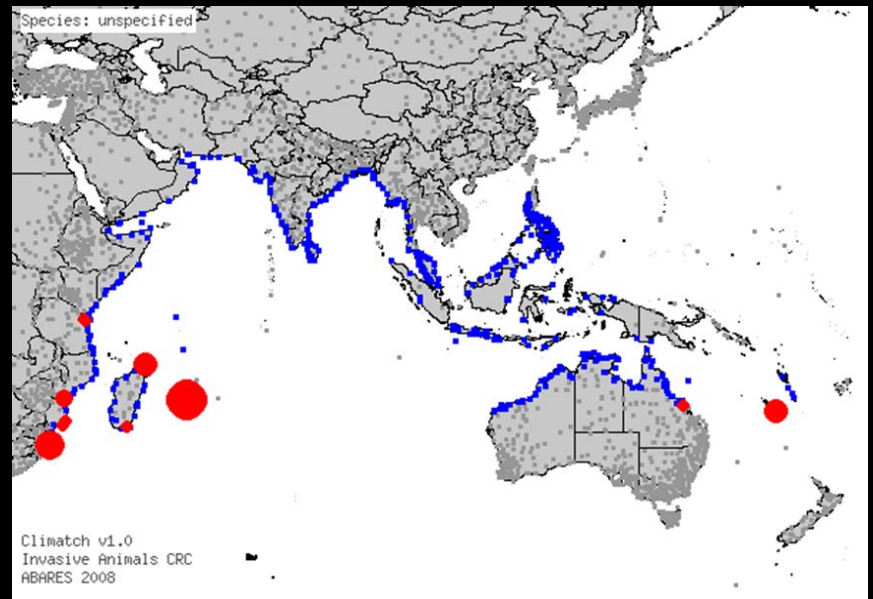
The Luna Lionfish does not have any taxonomic synonyms. It is frequently referred to by other common names, including the Japanese Lionfish and the Dragon's Beard Fish, and is often mistaken for Russell's Lionfish *Pterois russelii* in the aquarium trade due to similarities in appearance (Michael 2001). Evidence suggests these currently recognized species may be conspecifics (Wilcox 2014).



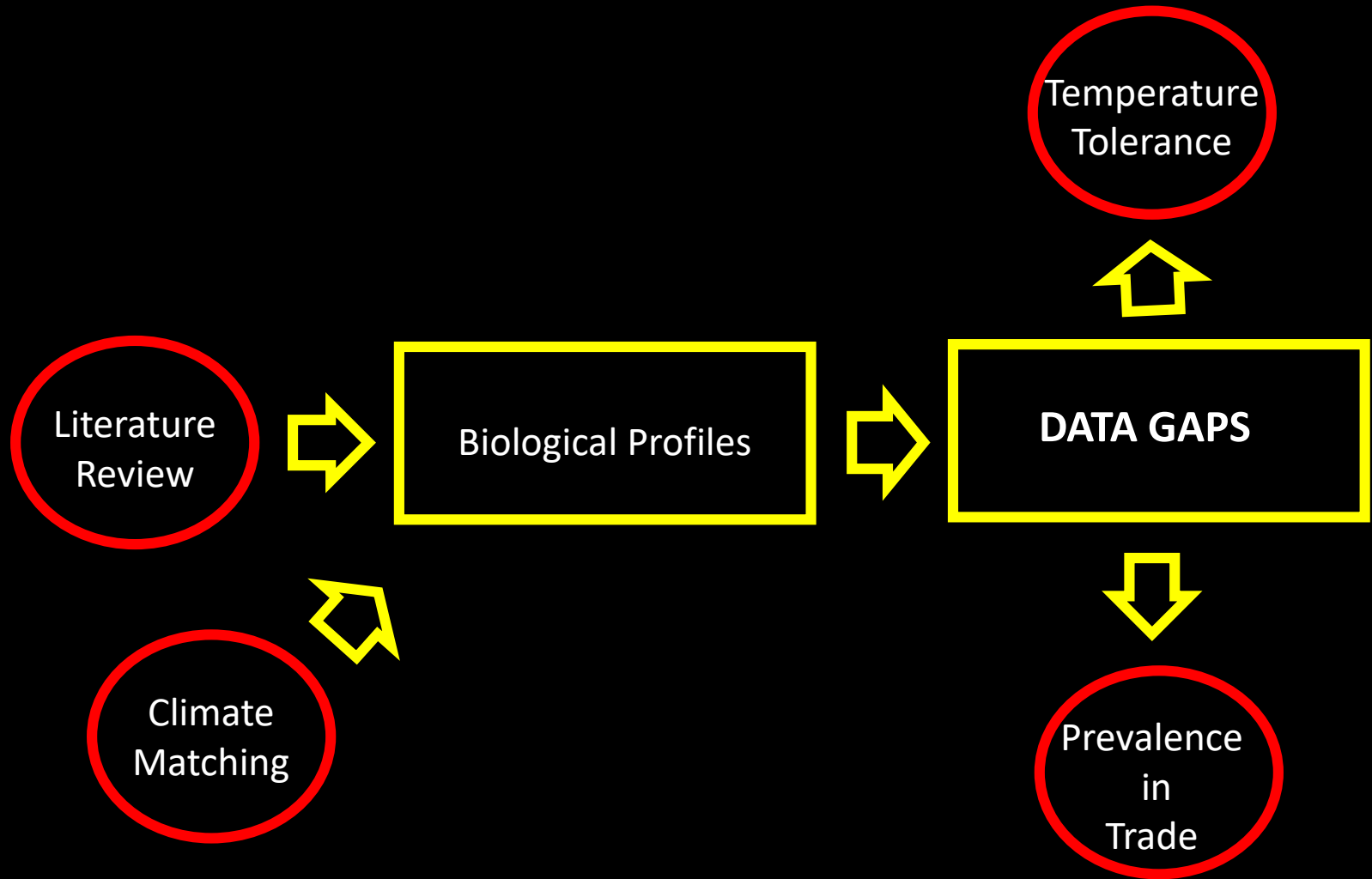
Figure 20: Luna Lionfish at 9 meters off Izu Peninsula, Japan. Photo: <http://fishesofaustralia.net.au/home/species/3649>.

# Climate Match

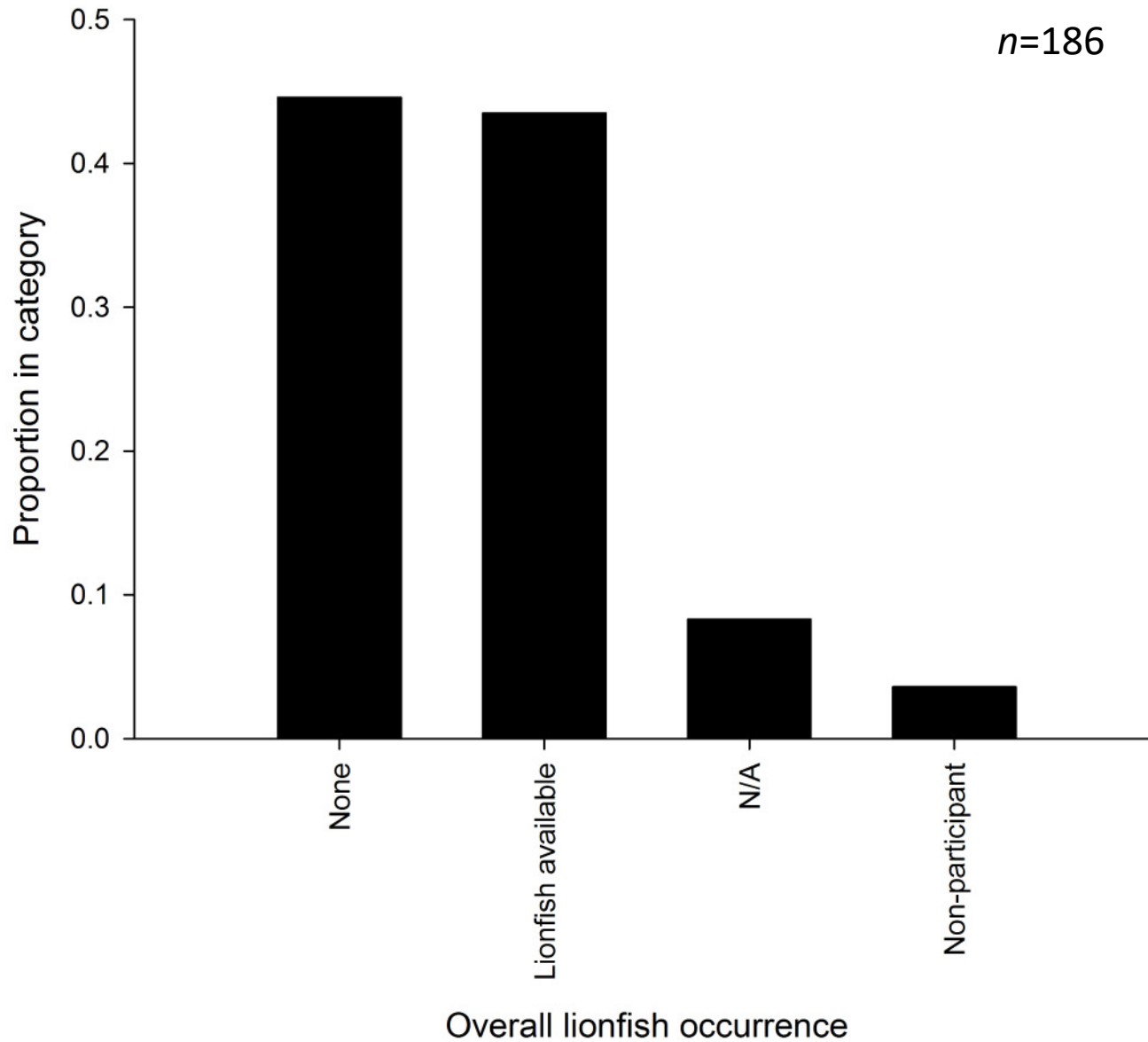
| Species                          | Climate 6 Proportion |
|----------------------------------|----------------------|
| <i>Dendrochirus barberi</i>      | 0.020                |
| <i>Dendrochirus biocellatus</i>  | 0.881                |
| <i>Dendrochirus brachypterus</i> | 1.000                |
| <i>Dendrochirus hemprichi</i>    | 0.791                |
| <i>Dendrochirus zebra</i>        | 1.000                |
| <i>Pterois antennata</i>         | 1.000                |
| <i>Pterois cincta</i>            | 0.000                |
| <i>Pterois lunulata</i>          | 0.493                |
| <i>Pterois miles</i>             | *                    |
| <i>Pterois mombasae</i>          | 0.821                |
| <i>Pterois paucispinula</i>      | 0.970                |
| <i>Pterois radiata</i>           | 0.956                |
| <i>Pterois russelii</i>          | 0.791                |
| <i>Pterois sphex</i>             | 0.020                |
| <i>Pterois volitans</i>          | *                    |



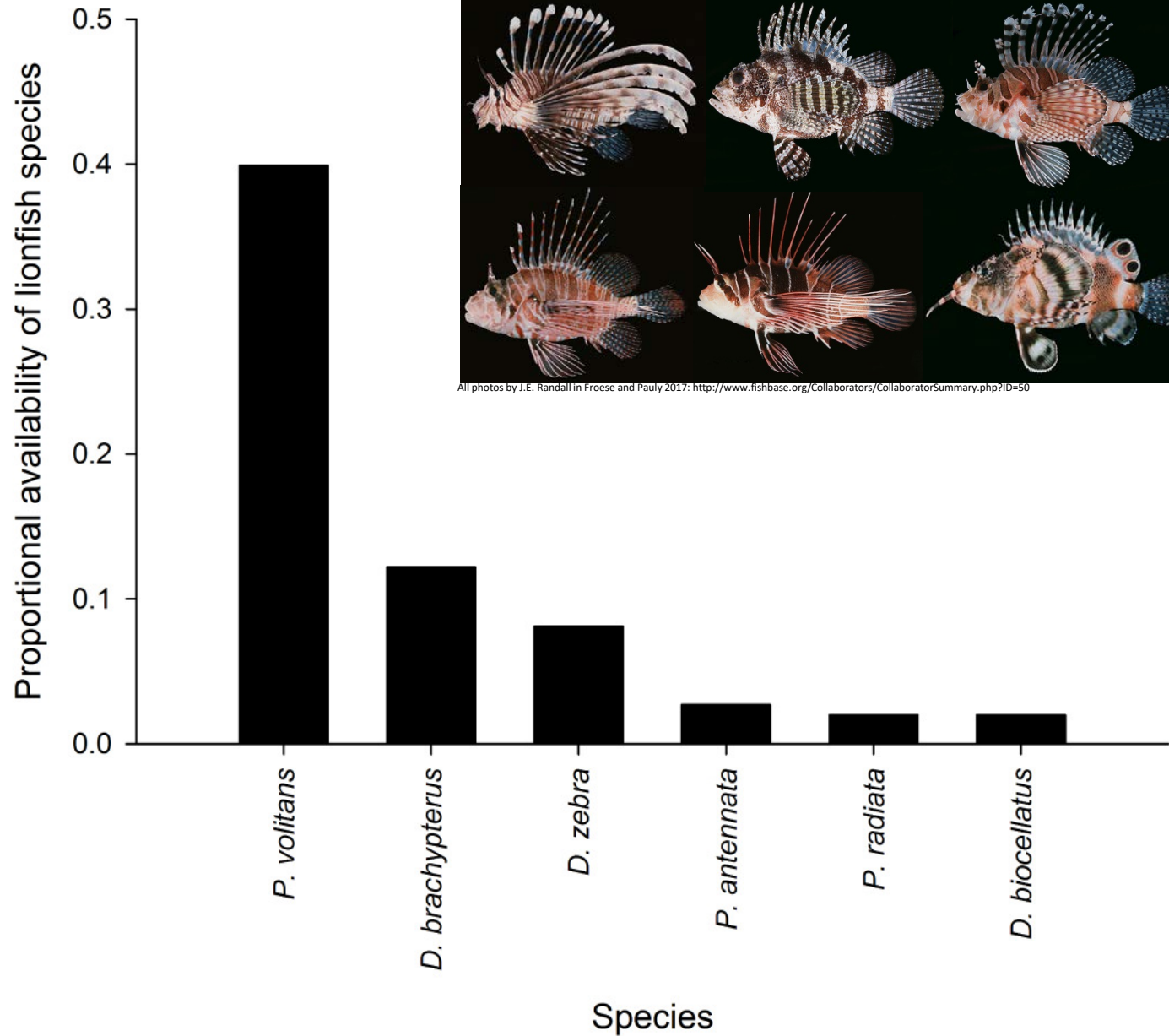
# Evaluating Risk: Literature and Data Gaps



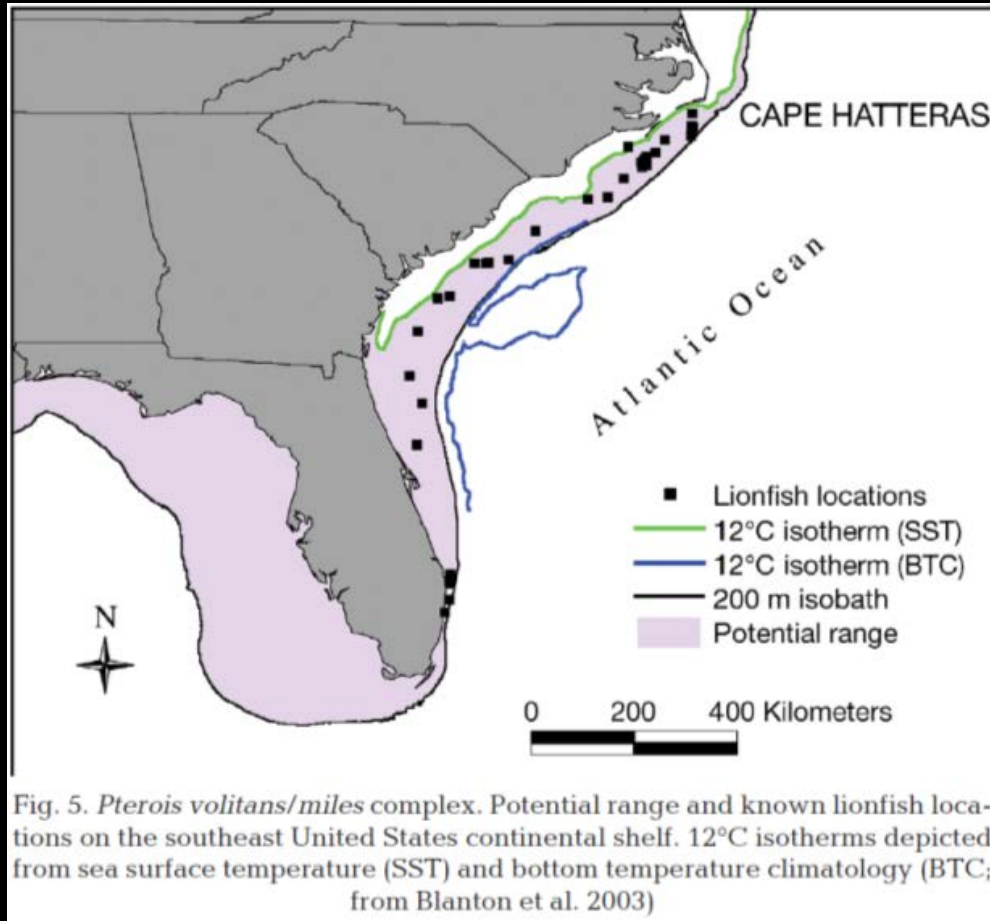
# Retail Surveys



# Retail Surveys



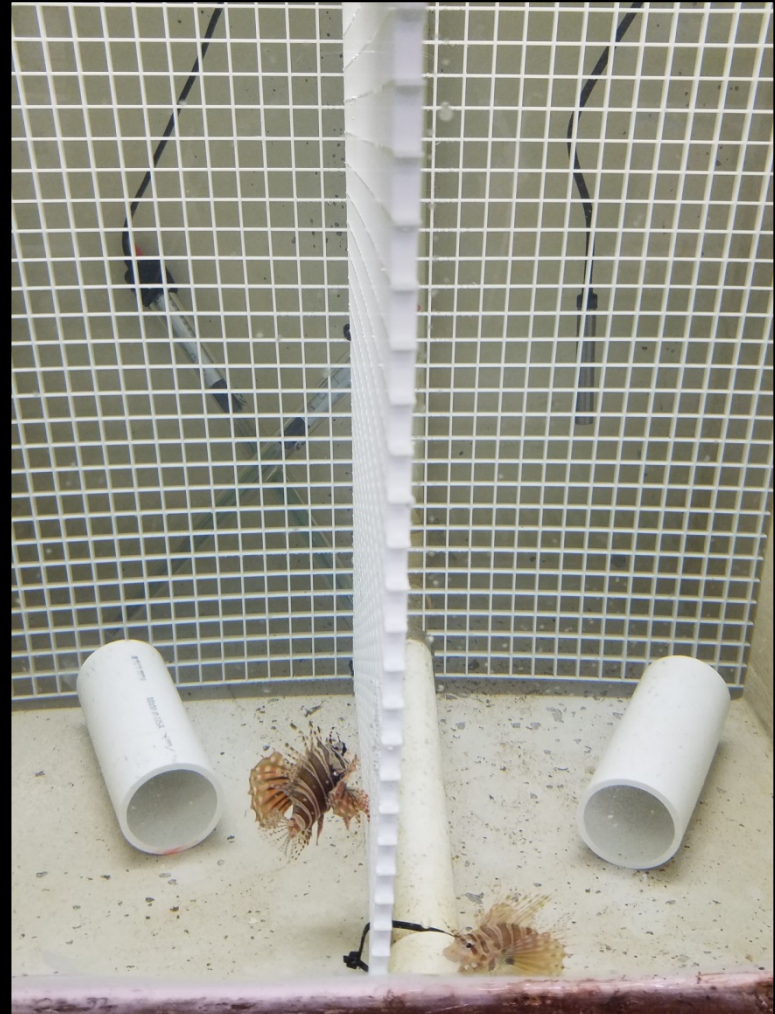
# Cold Tolerance – Potential Range



- *P. volitans*
- Predicted range based on cold tolerance
- Agrees well with observed range
- Kimball et al. 2004

# Chronic Lethal Methodology

- Hold fish until feeding regularly; no morts
- Hold at 25°C (7-14 d)
- Move to system at 25°C
- Drop temp 1°C/d
- Re-acclimation
- Note temperature of:
  - Cessation of feeding
  - Loss of equilibrium
  - Death

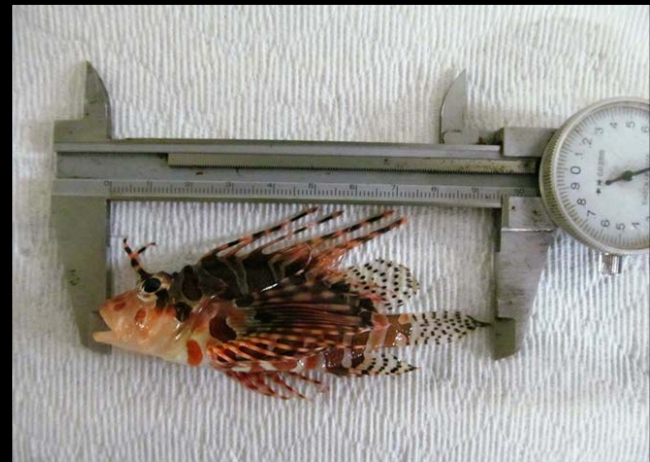


# Experimental System, aka “Mastodon”



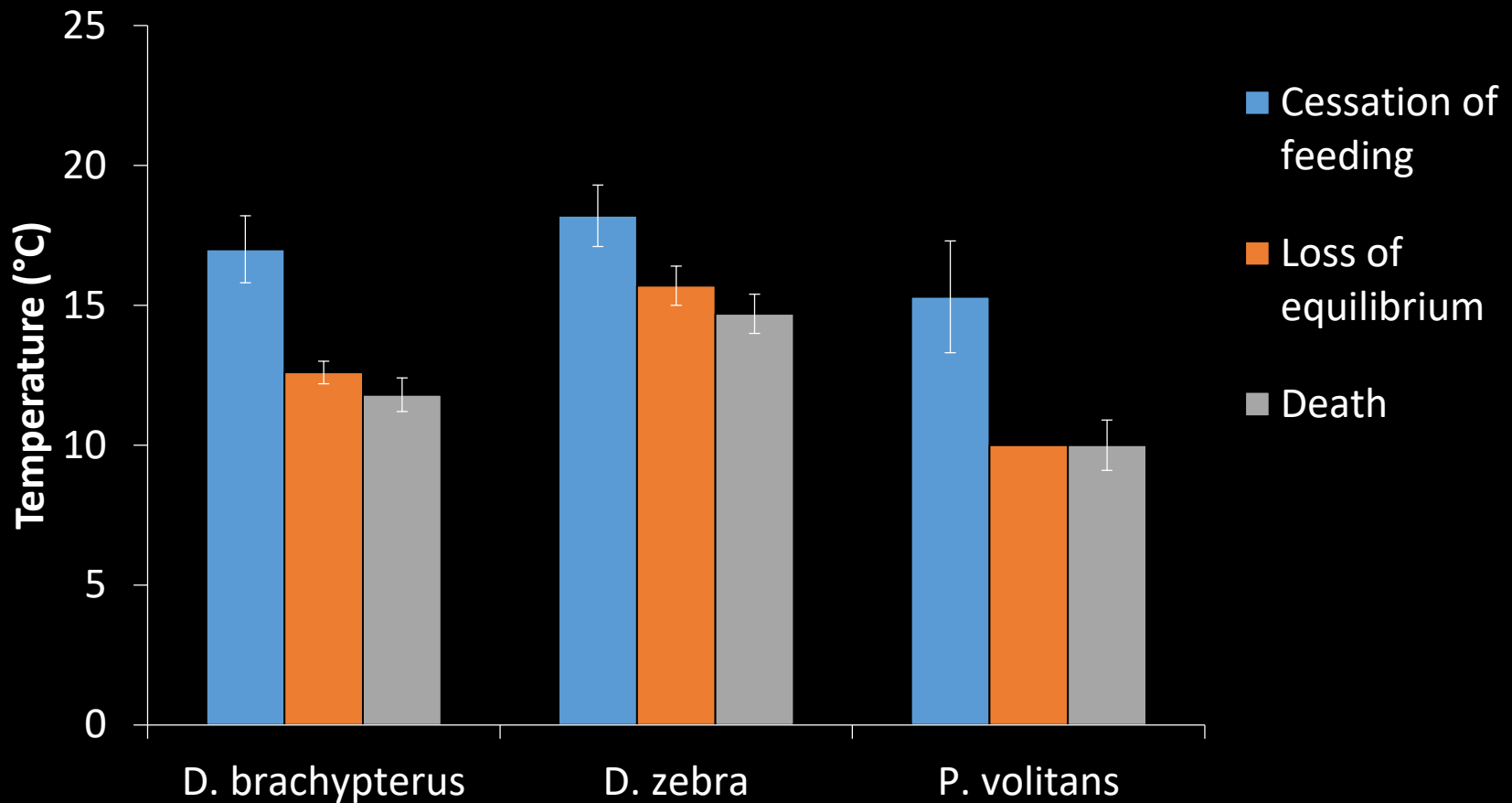
# Species Tested

- *Dendrochirus brachypterus*
- *D. zebra*
- *D. biocellatus*
  - Morts – wholesaler, shipping, TAL
- Other *Dendrochirus* unavailable
- “Other” *Pterois* prohibited



# Critical Lower Temperatures

(Lyons et al. In press. *Copeia*)



# *Dendrochirus* Potential Range?

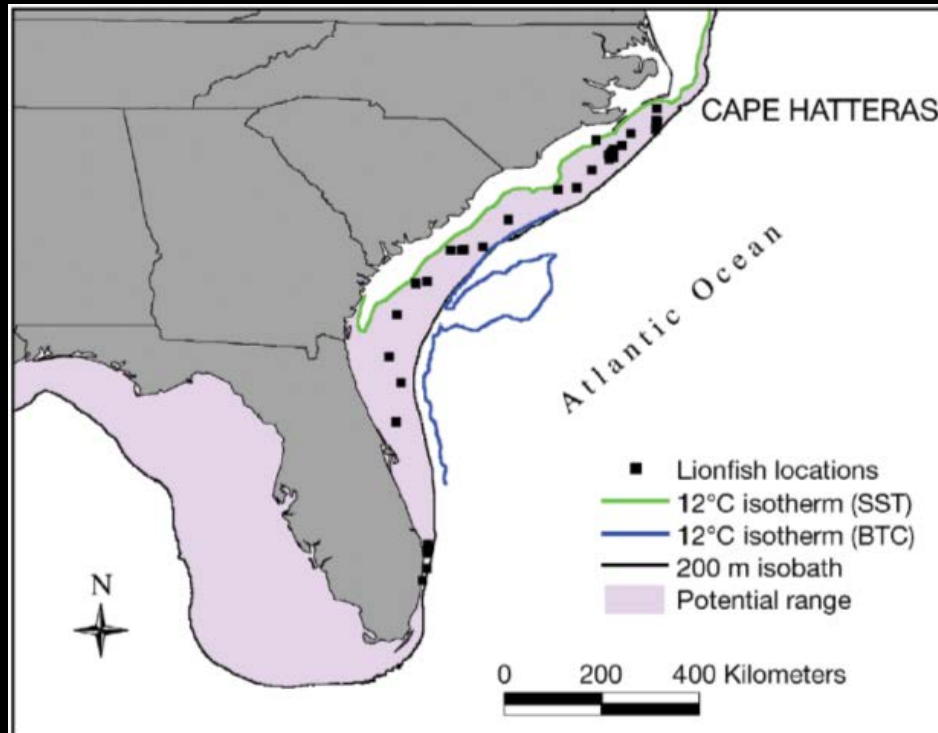
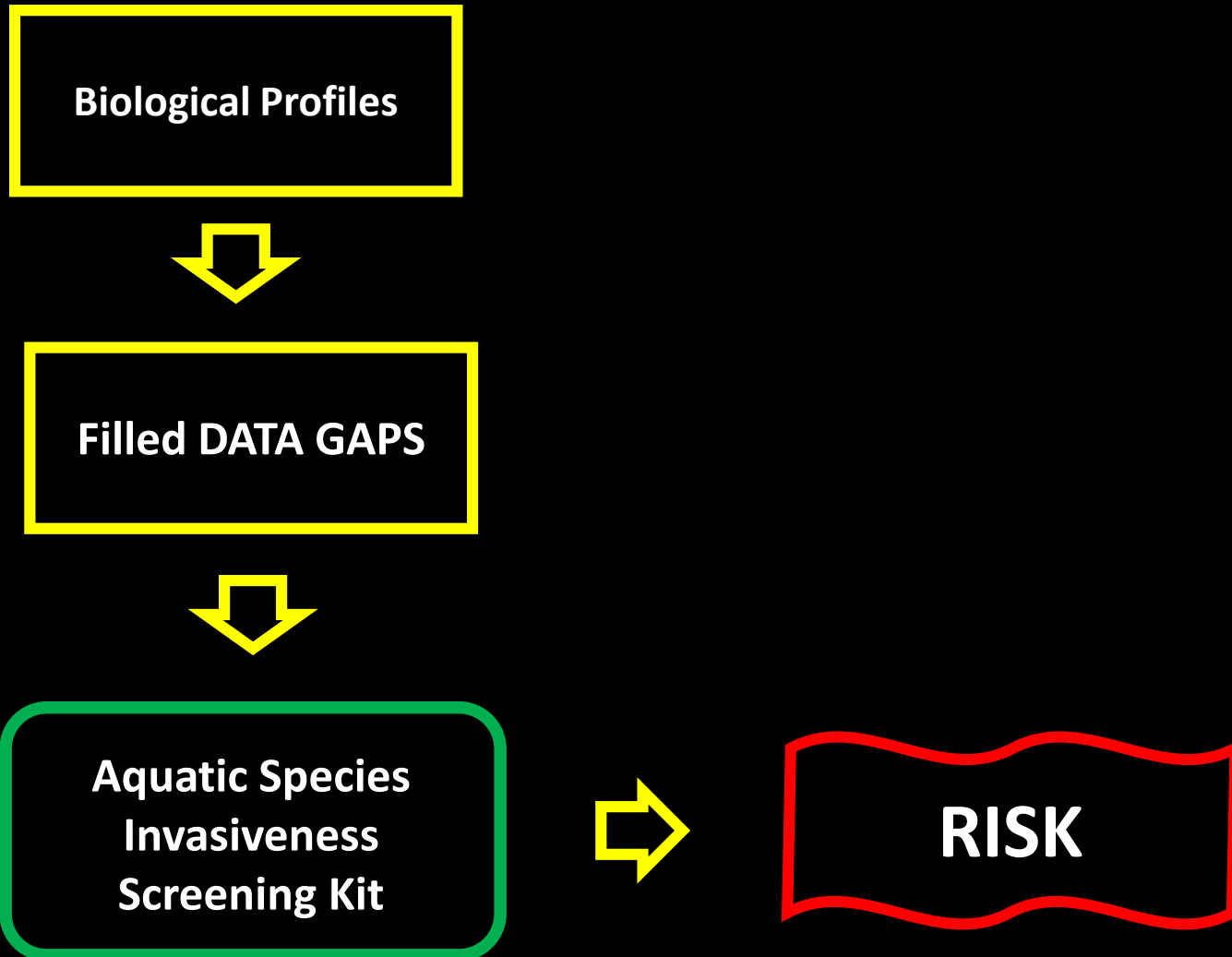


Fig. 5. *Pterois volitans/miles* complex. Potential range and known lionfish locations on the southeast United States continental shelf. 12°C isotherms depicted from sea surface temperature (SST) and bottom temperature climatology (BTC; from Blanton et al. 2003)

- If factors similar to *P. volitans*
- Potential range smaller
- Gulf of Mexico and FL
- Inshore in northern GOM in winter?
- Less range along SE coast
- Modeling

# Procedure: Evaluating Risk



# History of AS-ISK

Weed Risk Assessment



Fish Invasiveness Screening  
Kit



Fish Invasiveness Screening  
Kit v2.0



Aquatic Species  
Invasiveness Screening Kit



Australian Government

Department of Agriculture  
and Water Resources



Cefas

**UF** | **IFAS**

UNIVERSITY of FLORIDA

Tropical Aquaculture Laboratory

# AS-ISK

<https://www.cefas.co.uk/services/research-advice-and-consultancy/invasive-and-non-native-species/decision-support-tools-for-the-identification-and-management-of-invasive-non-native-aquatic-species/>

## Score partition

### **A. Biogeography/Historical**

1. Domestication/Cultivation
2. Climate, distribution and introduction risk
3. Invasive elsewhere

### **B. Biology/Ecology**

4. Undesirable (or persistence) traits
5. Resource exploitation
6. Reproduction
7. Dispersal mechanisms
8. Tolerance attributes

### **C. Climate change**

9. Climate change



# AS-ISK

## Basic Risk Assessment - Question 17 of 55

Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?

## Question Guidance

'Adaptability' refers to the species' ability to overcome physiological or other barriers in order to establish self-sustaining populations, and thus distinguishes itself from 'tolerance' (Section 8 'Tolerance attributes'), which refer to the organism's ability to persist in harsh/extreme conditions. Output from climate matching can help answer this question, combined with the known versatility of the organism as regards climate region distribution.

## Response

Yes

## Confidence

High

## -ISK Q Compatibility

Different

[Help](#)

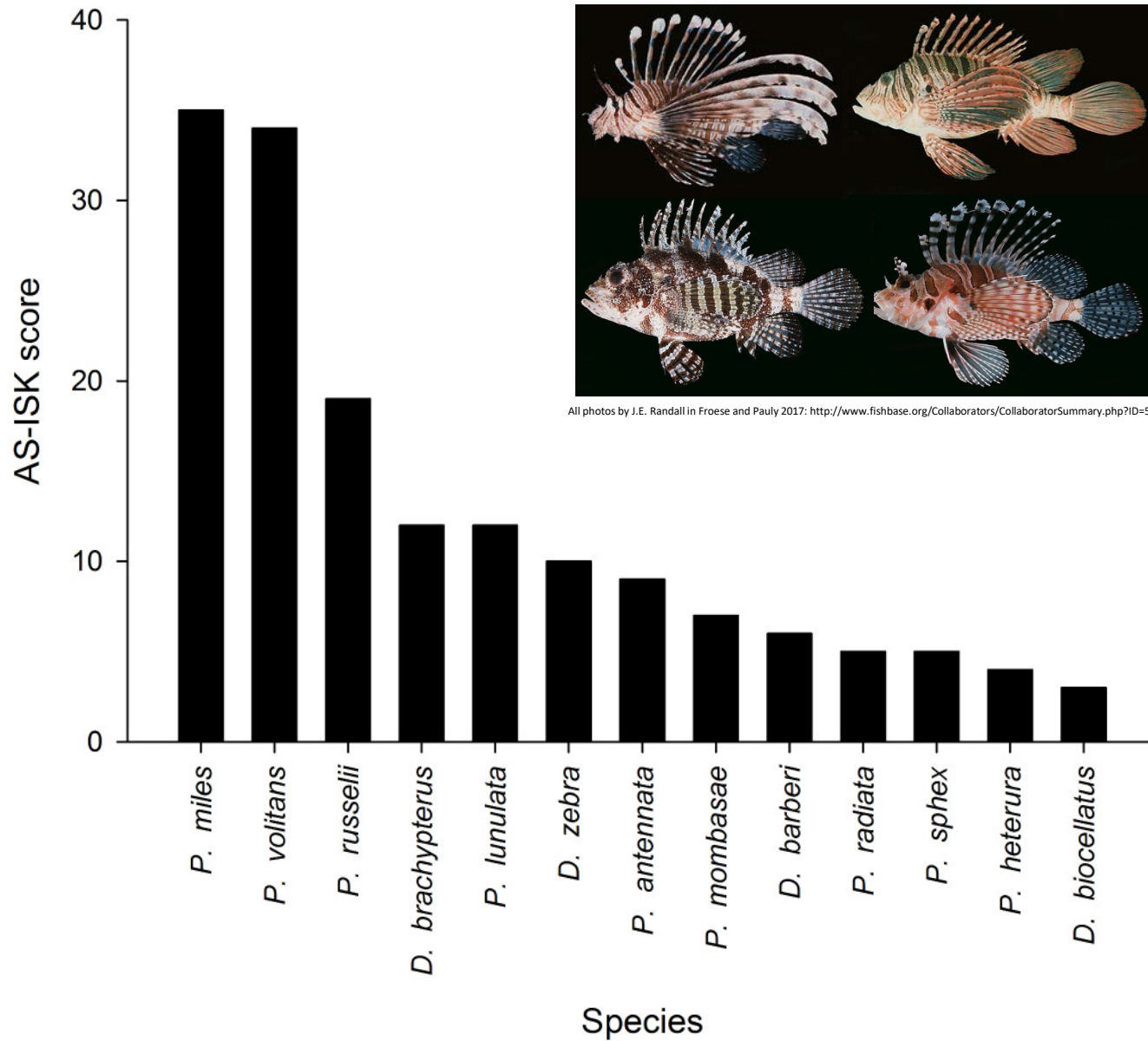
## Justification (references and/or other information)

D. brachypterus is widely distributed across the east Indo-Pacific (Matsunuma et al. 2017). Cessation of feeding occurs at 17.0 celsius, loss of equilibrium occurs at 12.6 celsius, and death occurs at 11.8 celsius (Lyons et al., in press). Given this range, D. zebra will likely establish self-sustaining, permanent populations throughout state waters.

## Jump to Question

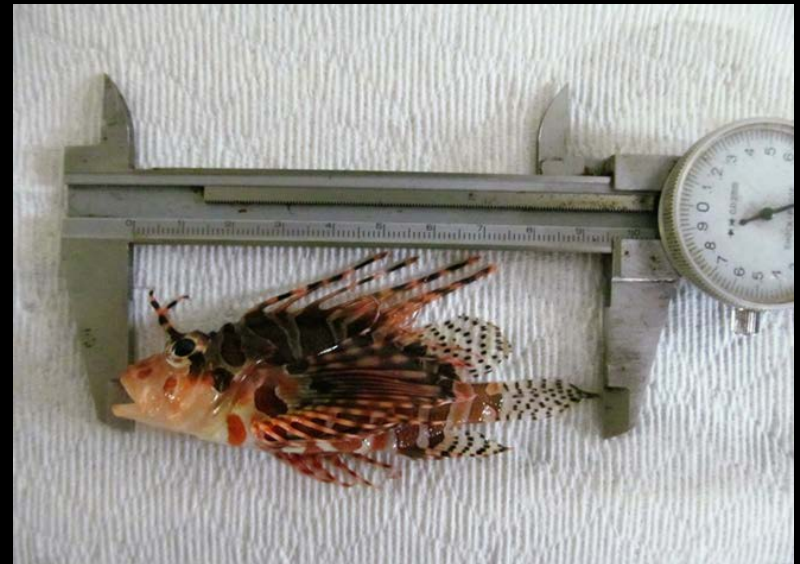
17 - Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade

# AS-ISK



# Takeaways

- Little published on most species
- CLIMATCH suggests most have a HIGH match
- Perceived availability vs realized availability (~6 sp)
- *Dendrochirus* spp. were less cold tolerant than *P. volitans*
- Smaller potential range
- Lower risk scores than *P. volitans*/miles
- No calibration
- Decision-SUPPORT tool
- More comprehensive assessment



# Acknowledgments

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