# Implications of movement behavior and local density on nonnative fish detection

Joe Parkos[1], Jeff Kline[2], Joel Trexler[1]

[1] Florida International University, Southeast Environmental Research Center, Dept. Biological Sciences

[2] Everglades National Park, South Florida Natural Resources Center

# Information content

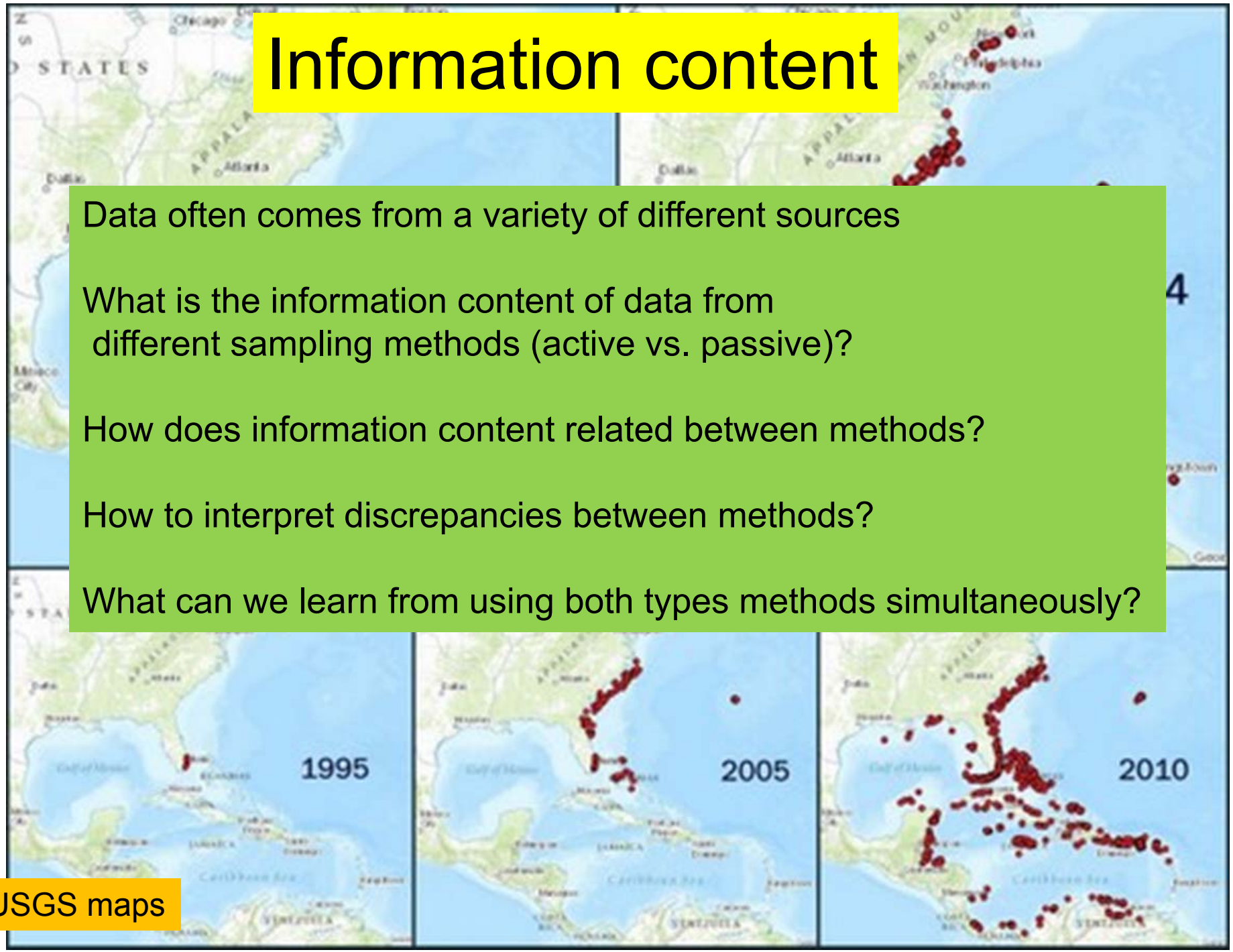
Data often comes from a variety of different sources

What is the information content of data from different sampling methods (active vs. passive)?

How does information content related between methods?

How to interpret discrepancies between methods?

What can we learn from using both types methods simultaneously?




USGS maps

# Approach

Simultaneous use of active and passive sampling methods to sample fish assemblage interior Everglades

**Occupancy modeling** (PRESENCE)
Repeated sampling: detection history used to develop detection prob.'s and refined occupancy estimates


Model by individual sampling method
Compare results among species
Explore sources of discrepancies

Synthesize information from both methods: **GS Encounter Model**
Generates estimates of fish movement speed

**Local density and movement → Method-specific detections → Occupancy**

# Active sampler (enclosure)

## Throw-trap

Each sample (throw):
Fish, invertebrates, vegetation
1-$m^2$ area

Standardized protocol for
clearing trap (bar seine, dip nets)

5-7 replicate throws
Randomly located within
fixed sites

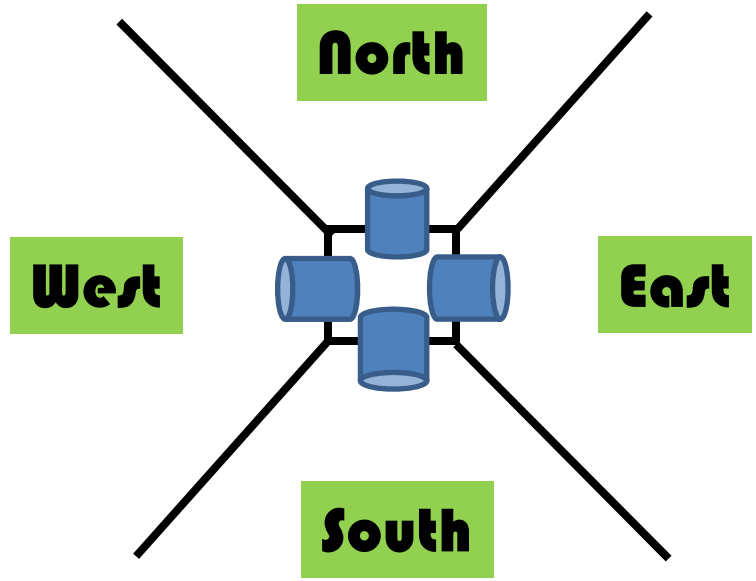
# Passive sampler

## Drift-fence

Unbaited, 3-mm wire-mesh minnow-traps

Four 12.m-long, 1.5-m high plastic ground-cloth arms attached to central 2.25m$^2$ square

24-hour soak time; 3 replicate arrays



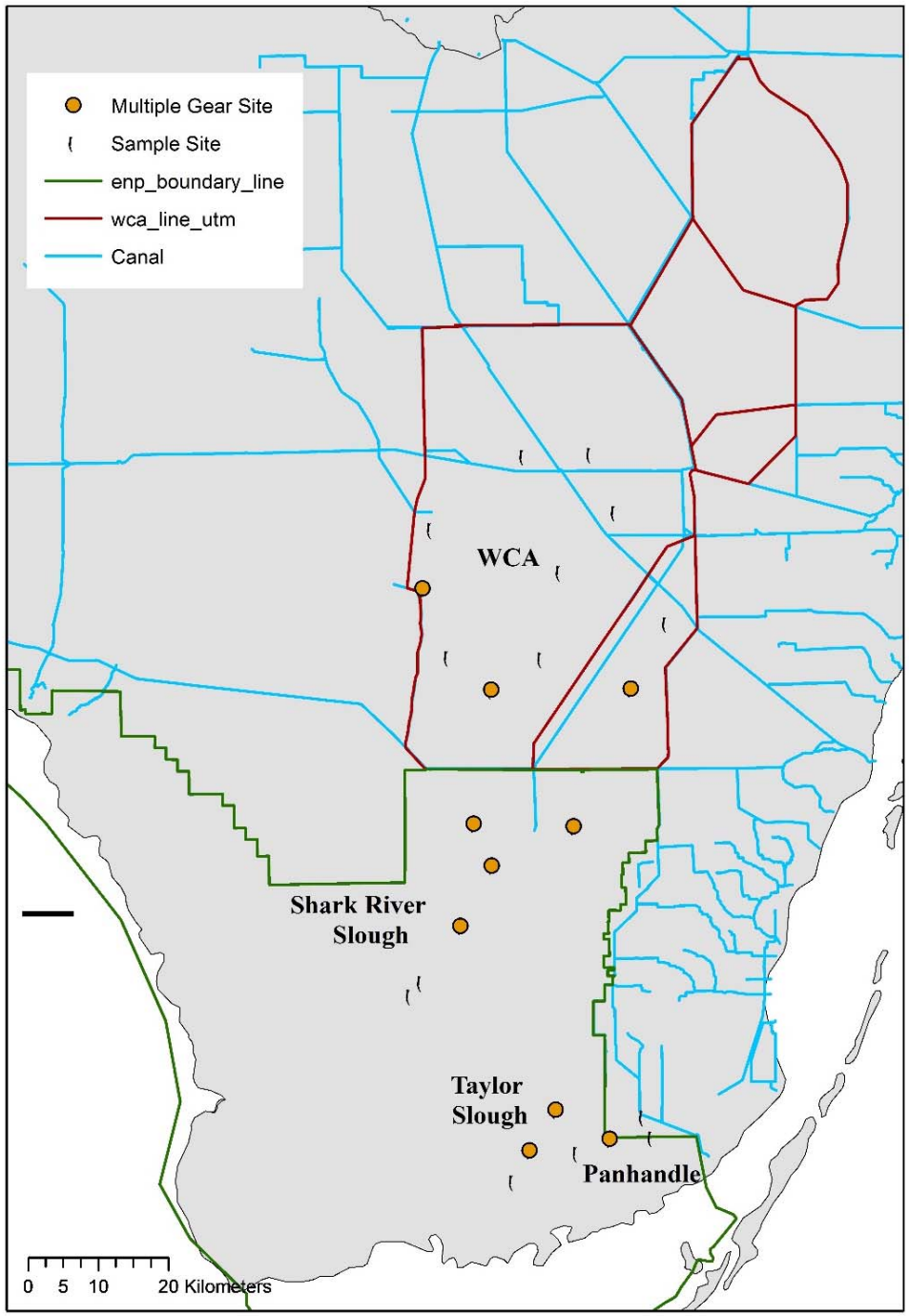


# Sampling

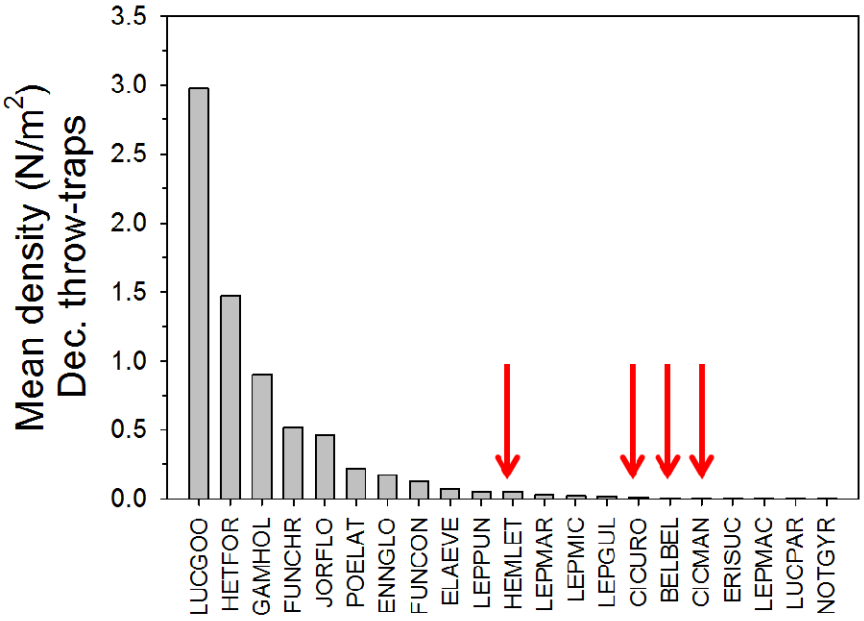
From late wet-season
to early dry-season
(Oct., Dec. Feb.)

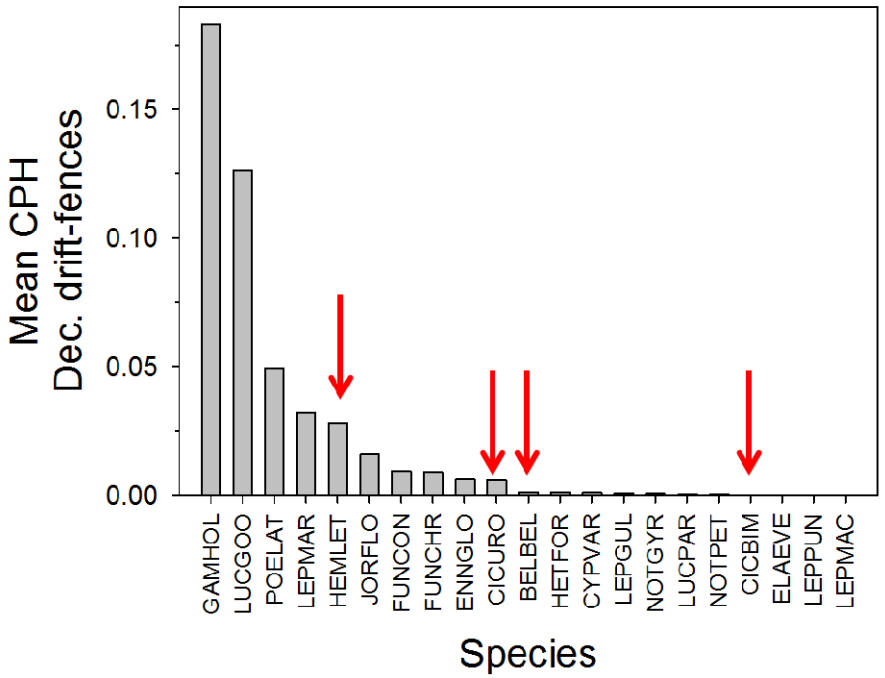
**Enclosure sampler**
throw-trap

**Activity samplers**
drift-fence
solo minnow-traps



# Veil line

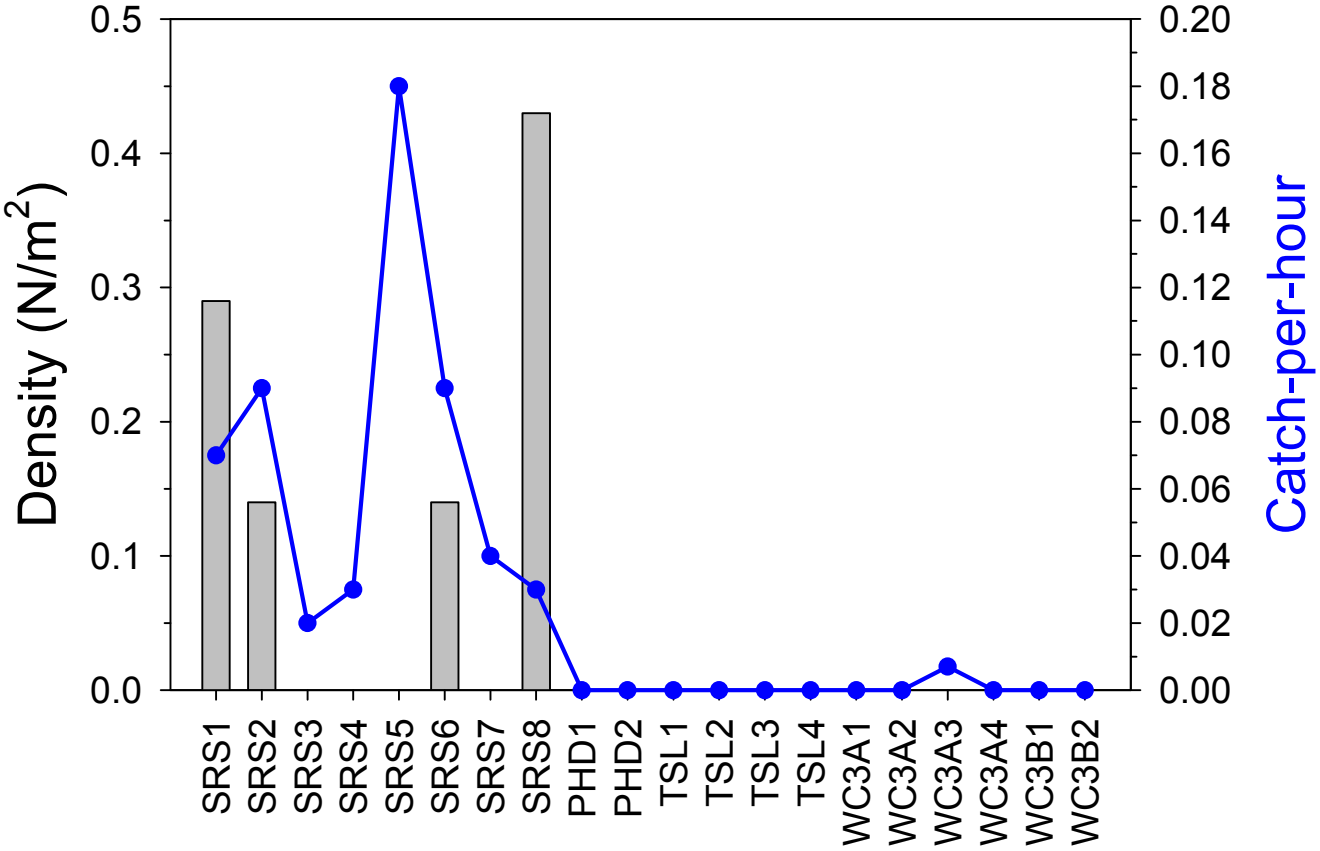


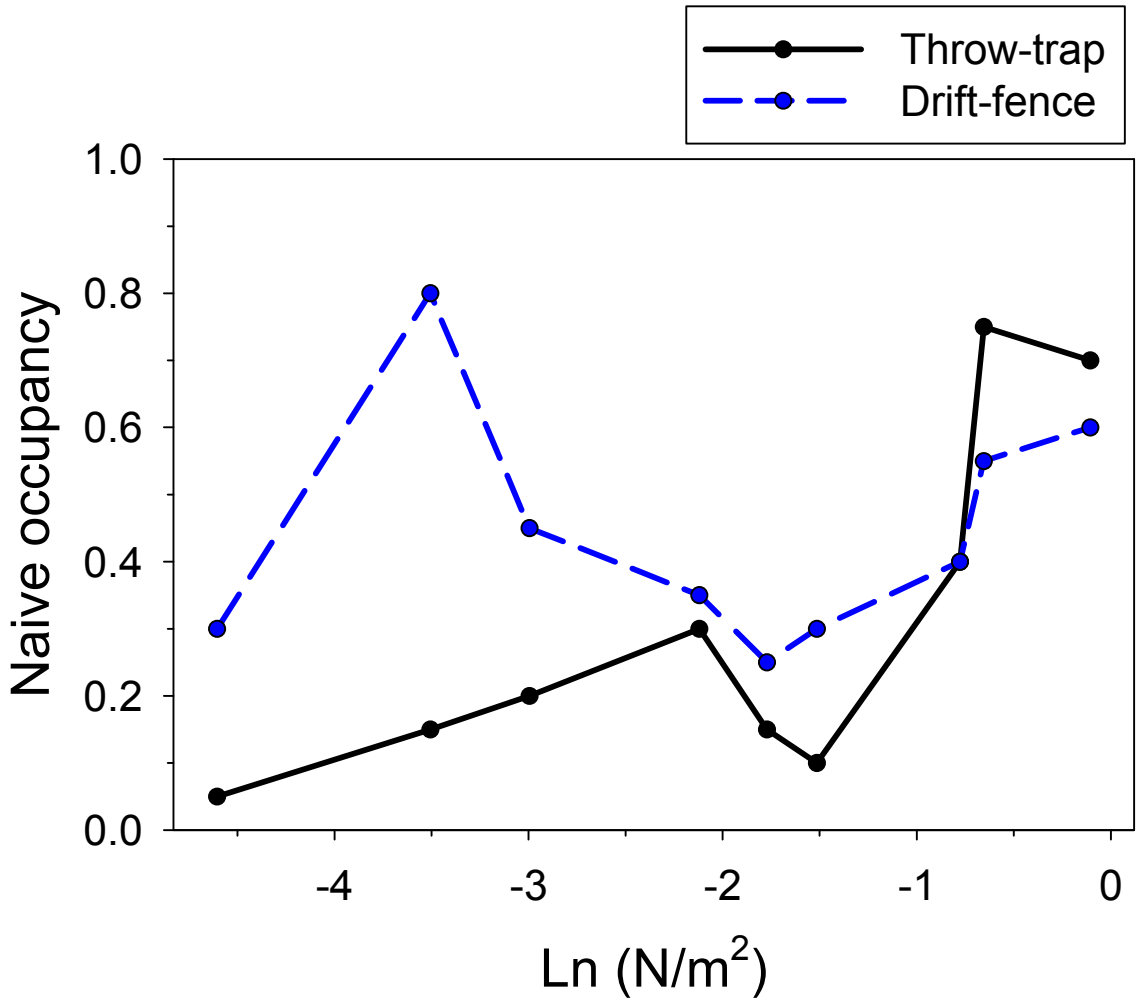

Nonnative species often found at low densities (detection issues)

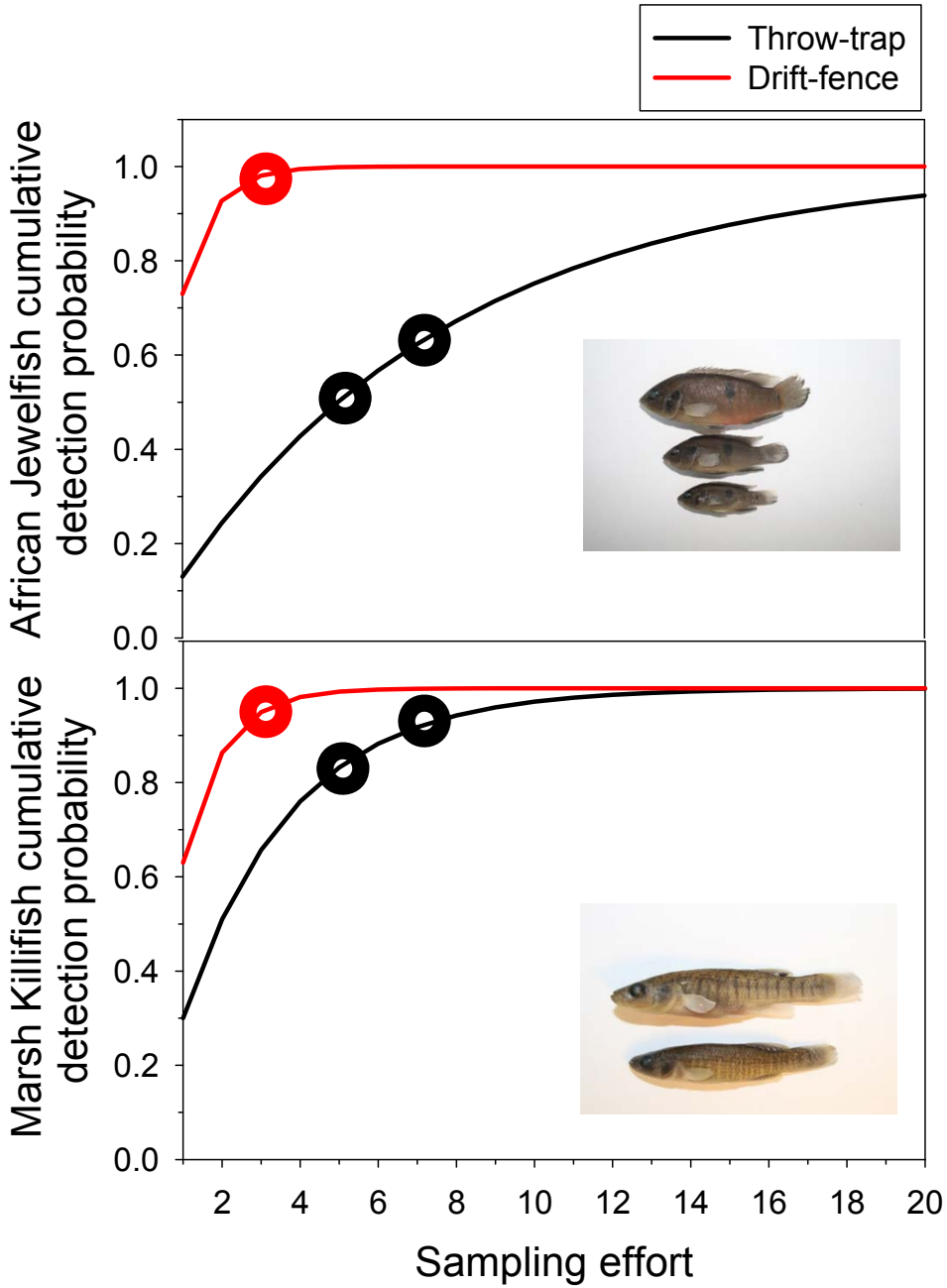
Shift in relative abundance rankings between sampling methods

*Hemichromis letourneuxi*

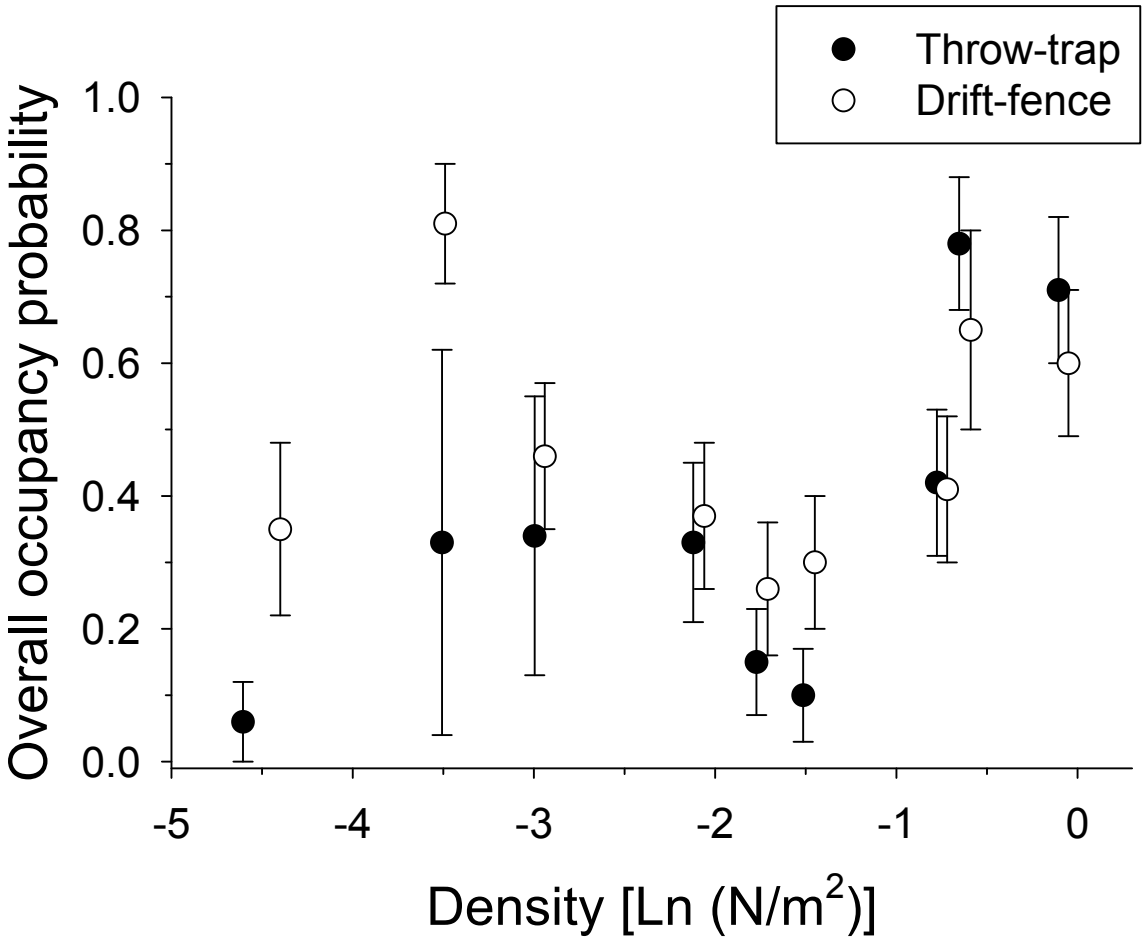


# Incidence

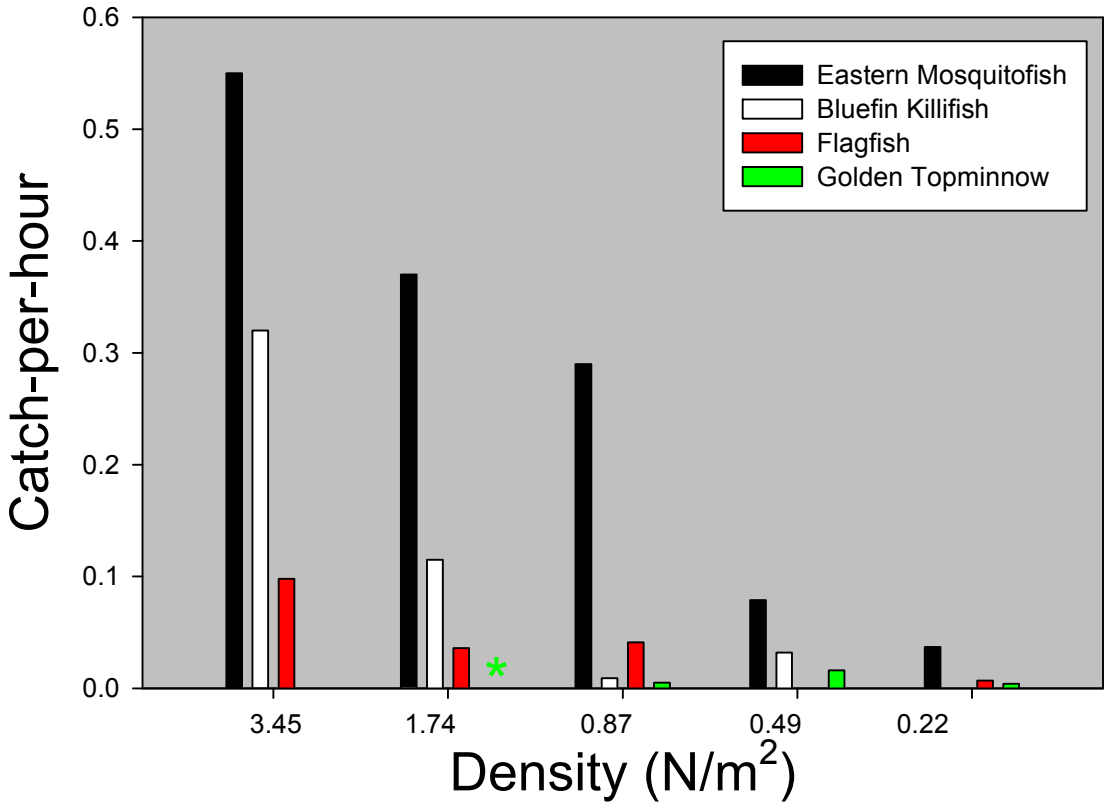

Throw-trap
Drift-fence
Naive occupancy
1.0
0.8
0.6
0.4
0.2
0.0
-4
-3
-2
-1
0
Ln (N/m2)

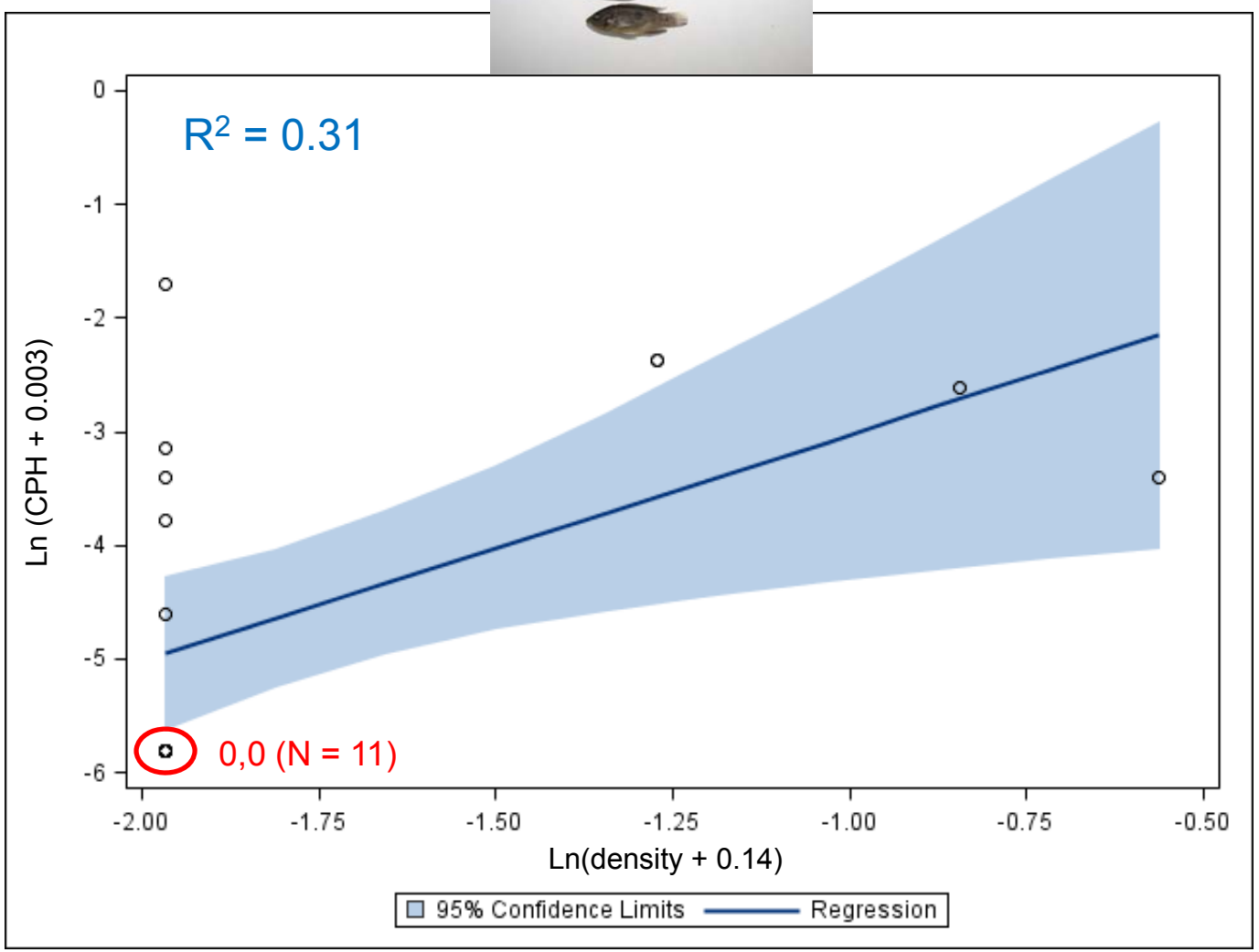

Throw-trap
Drift-fence
African Jewelfish cumulative detection probability
Marsh Killifish cumulative detection probability
0.0
0.2
0.4
0.6
0.8
1.0
2
4
6
8
10
12
14
16
18
20
Sampling effort

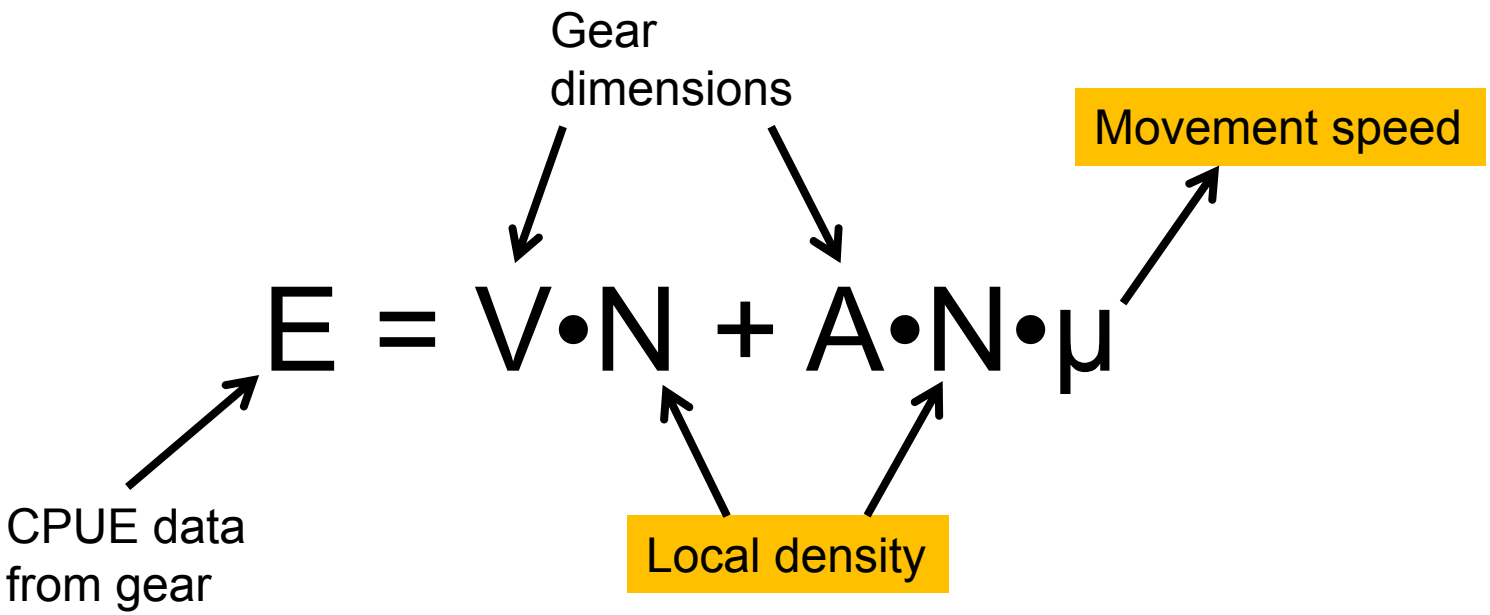
# Modeled occupancy

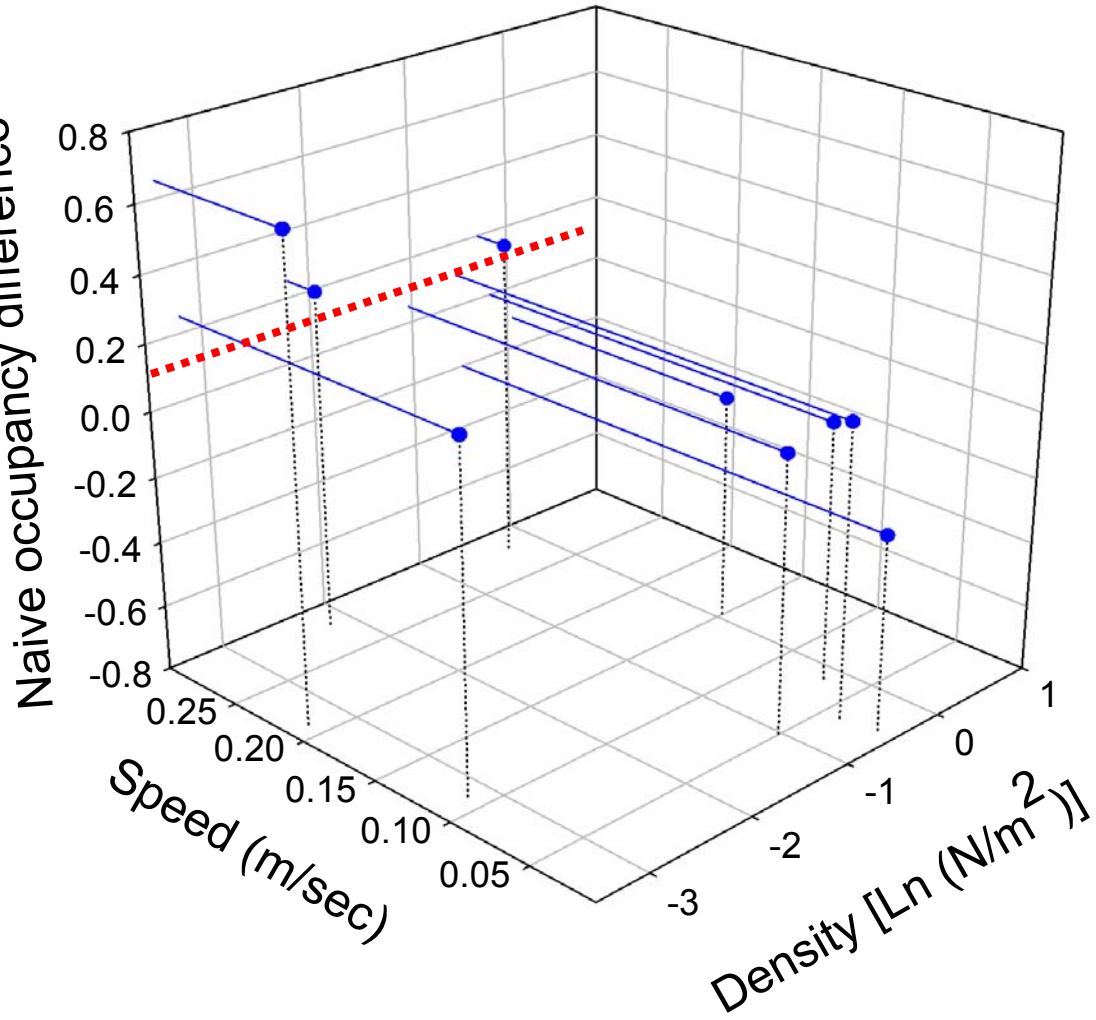



# Relative activity




$R^2$ = 0.31
0
-1
-2
-3
-4
-5
-6
Ln (CPH + 0.003)
0,0 (N = 11)
-2.00
-1.75
-1.50
-1.25
-1.00
-0.75
-0.50
Ln(density + 0.14)
95% Confidence Limits
Regression


Gear
dimensions
Movement speed
E = V•N + A•N•μ
CPUE data
from gear
Local density


Naive occupancy difference
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.25
0.20
0.15
0.10
0.05
Speed (m/sec)
1
0
-1
-2
-3
Density [Ln (N/m 2 )]

# Parting thoughts

Can you just combine data from different sampling methods?

**Differences will arise:**

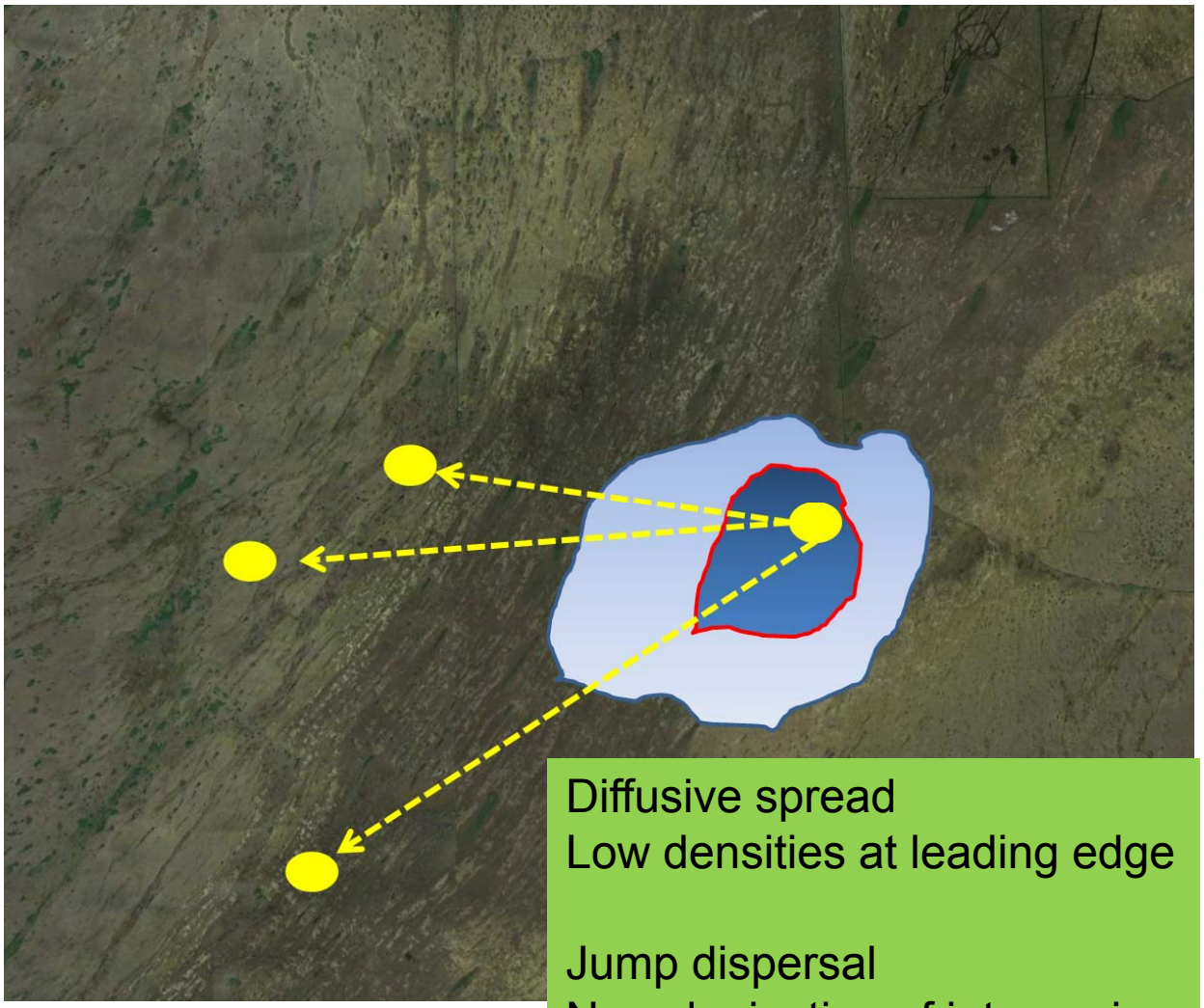
encounter rates with activity samplers
low density species

**Issues**

When is non-detection really absence (enclosure sampler)?
When is high catch rate indicate locally high density (activity sampler)?

Many internal and external factors affect movement:
how will this affect data from different samplers?

# How to interpret non-detections?

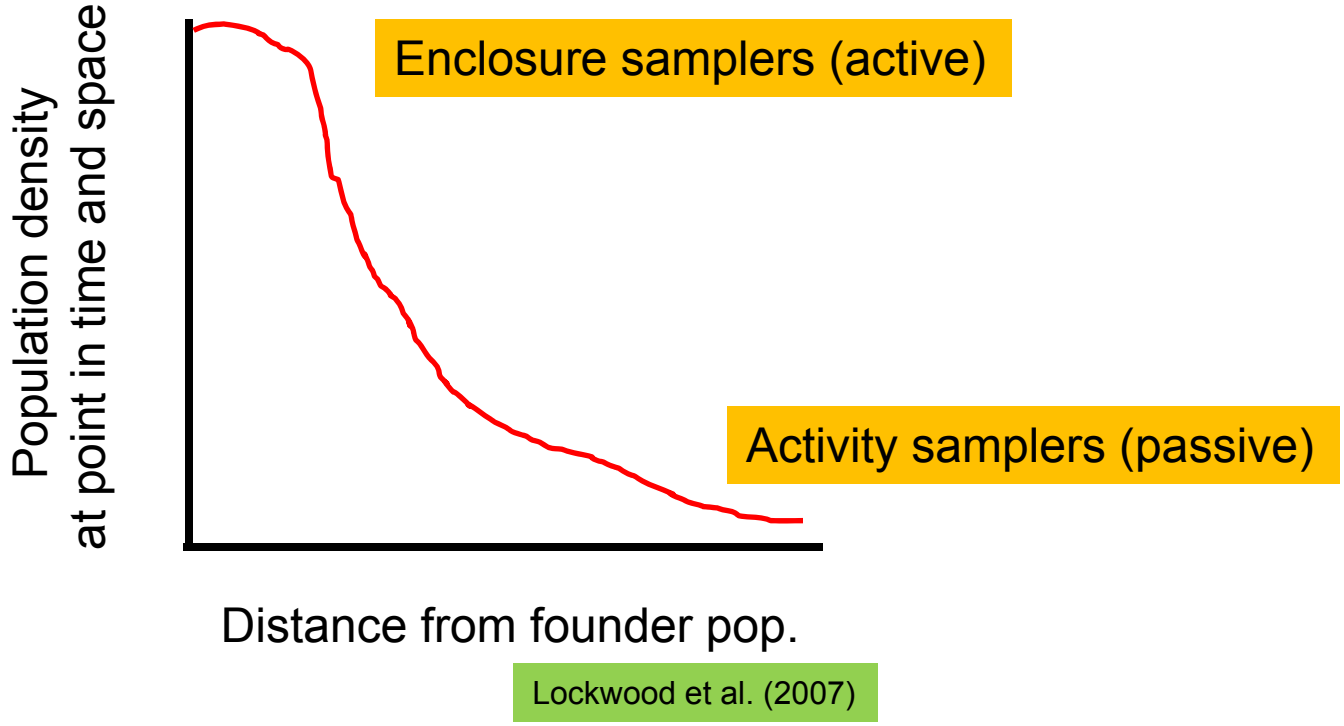


Diffusive spread
Low densities at leading edge

Jump dispersal
No colonization of intervening area

# Parting thoughts

Match sampling method to project objectives:
Functional understanding of population and assemblage changes?
Detection and spread?




Lockwood et al. (2007)

# Acknowledgements

**Field and laboratory personnel of:**

South Florida Natural Resources Center
(Z. Fratto, E. Crandall)
*and*
Joel Trexler's research group at FIU
(J. Herrin, J. Dummitt, L. Huselid, N. Orozco,
S. Schneider, A. Ontkos, J. Martin, J. Gatto,
K. Weisenborn, H. Mallikarachchi, S. Bornhoeft )

Coop.Agreements
P06AC0026/P11AT10022
P06AC00043/P12AC10563


*Lepomis marginatus*