Survey of Select Eastern Oyster (*Crassostrea virginica*) Populations in Lake Worth Lagoon, Palm Beach County, Florida

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Presented to Lake Worth Lagoon Initiative
Habitat Working Group Meeting
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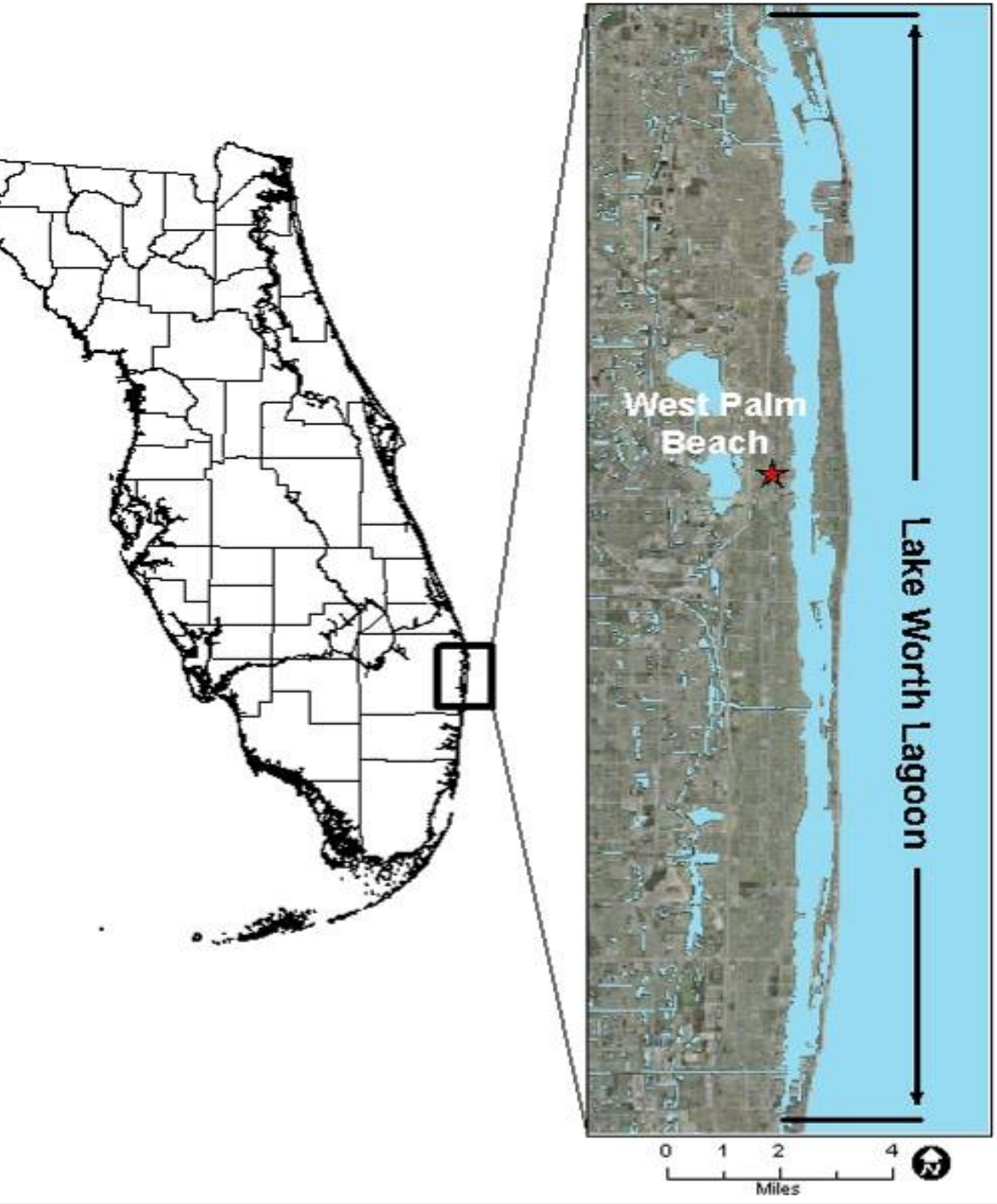

Lake Worth Lagoon Area

- 34 km (21 miles) long
- 1165 sq km (450 sq mile) watershed
- 1.3 million people
- Urban and Ag effects
- Canal (4) drainage
- 65% bulkheaded
- 19% mangrove fringe

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Comprehensive Everglades Restoration Plan (CERP)

Lake Worth Lagoon: provide suitable habitat through the placement of appropriate material on hard bottom currently impacted by muck deposits.

Snook Islands Natural Area

- Planned 1998
- Started 2003
- Completed in 2005
- Restored 100 acres of wetland habitat
- Stabilized mangrove planting areas with 28,000 tons of limestone boulders
- Created 2.2 acres of oyster reefs

www.co.palm-beach.fl.us/erm

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Project Objective

Measure and compare growth, abundance, reproductive effort, and health of the Eastern oyster, *Crassostrea virginica* (Gmelin, 1791) at selected sites in Lake Worth Lagoon.

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WEST PALM BEACH

PALM BEACH

LAKE WORTH

MacArthur (Mac)

Ibis Isle (II)

Snook Island (SI)

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MacArthur

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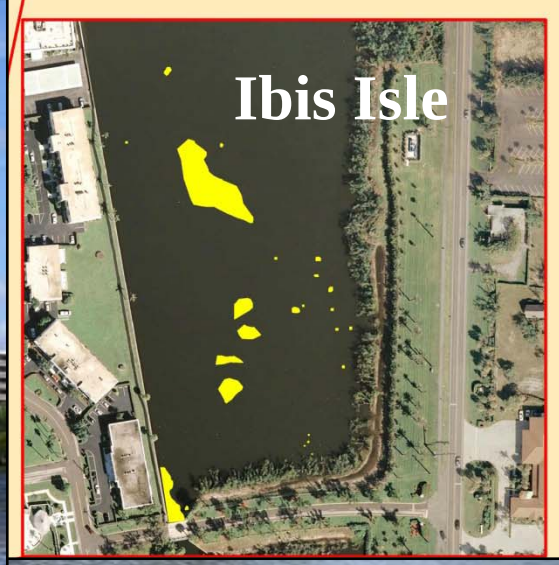

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Methods

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Methods

- Monthly sampling from March 2008 to February 2010
- Surveys in April & October
- Water temperature, salinity, D.O. and secchi depth were measured during sampling
- Five to six adult oysters were collected at each site to determine condition index: (dry meat/dry shell) x 100
- Five to six adult oysters were collected at each site to determine reproductive stage by histology and Dermo infection by RFTM

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Methods

- Six sets of 6 oyster shells each were placed on T-bars to monitor larval recruitment monthly at each site.
- Growth was measured on oysters naturally recruited onto a shell array (25 oyster shells on a 60x60 cm piece of wire mesh) placed at each site.

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Results - Environmental

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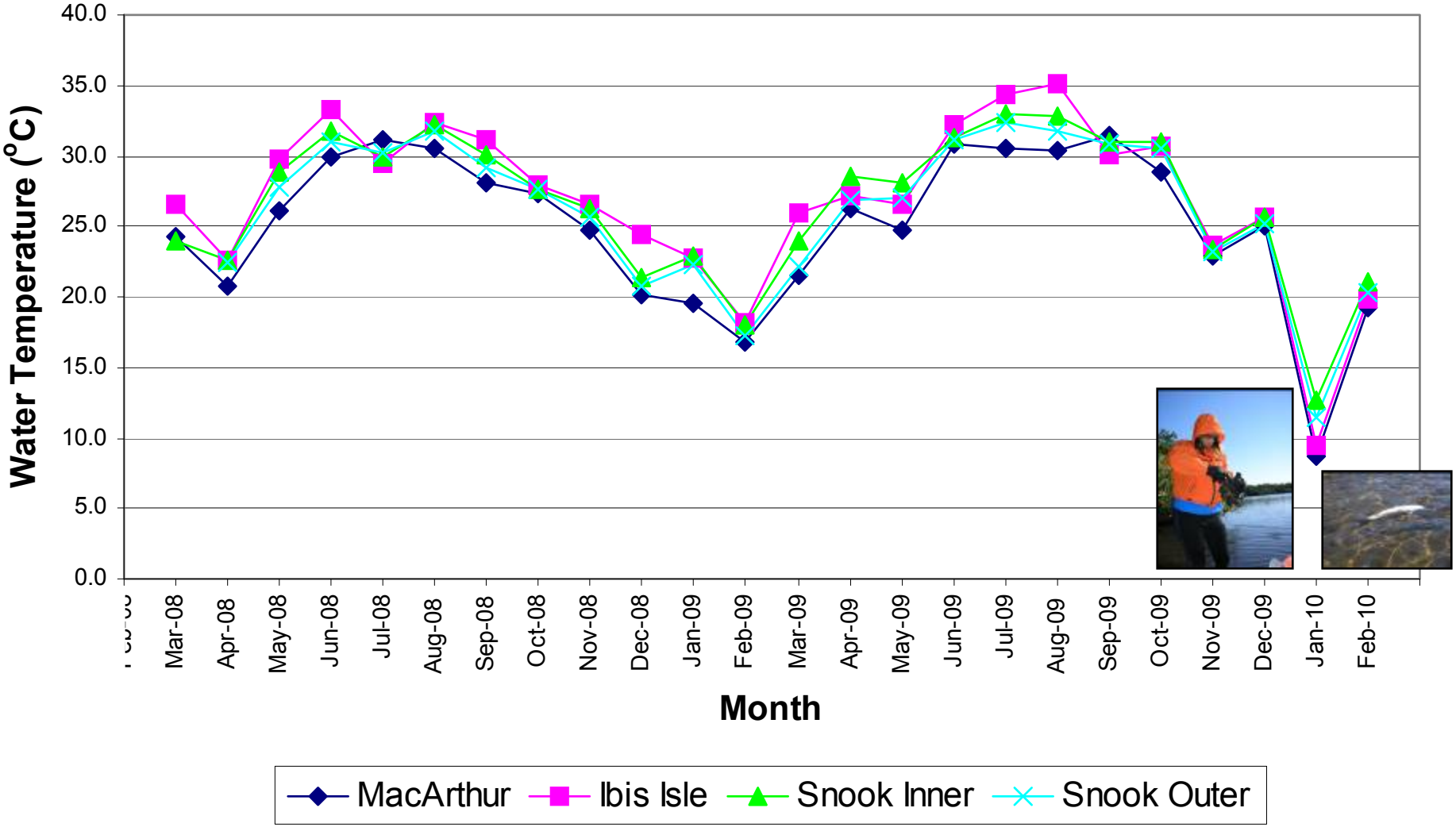
WATER TEMPERATURE



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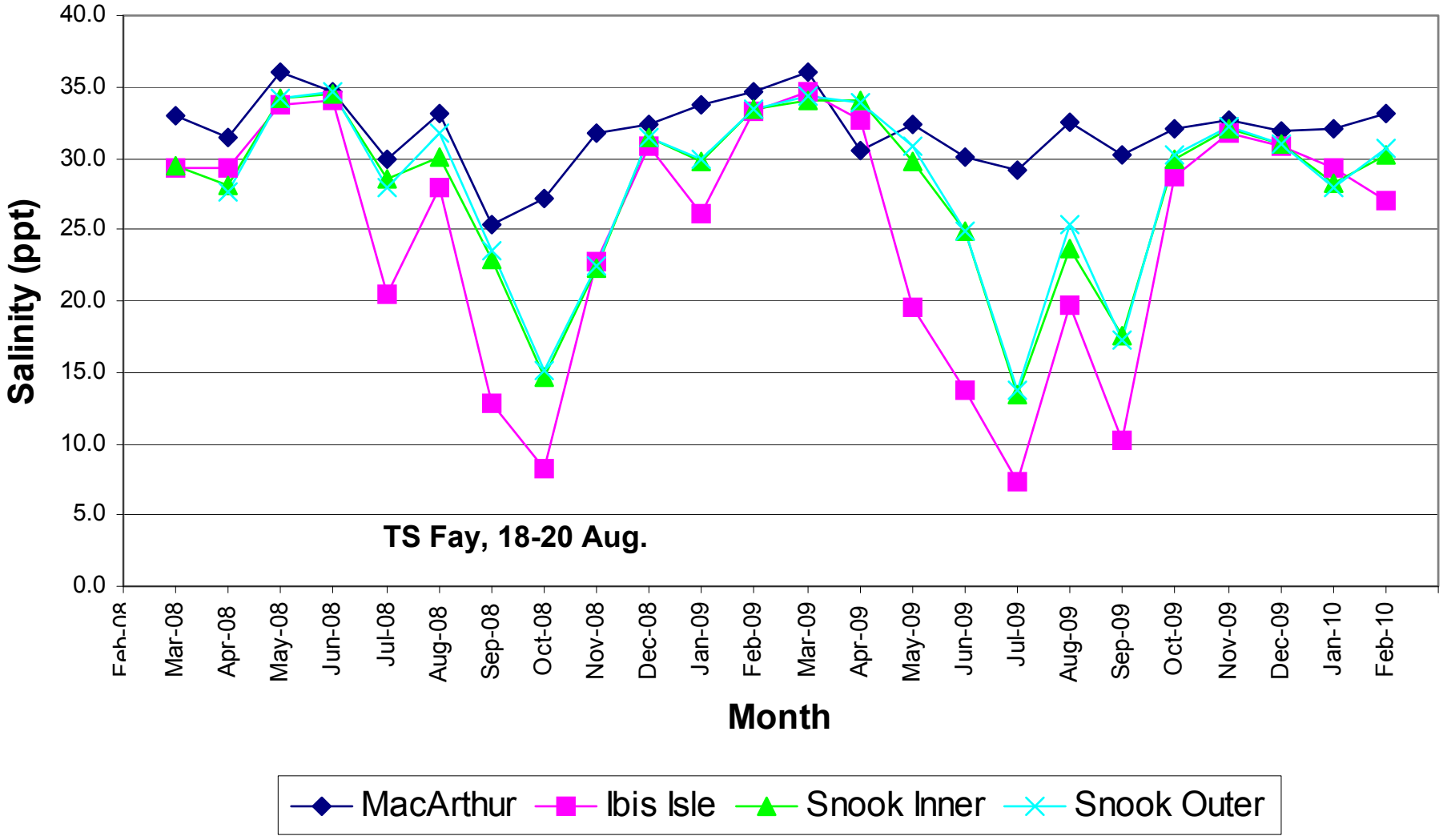
SALINITY



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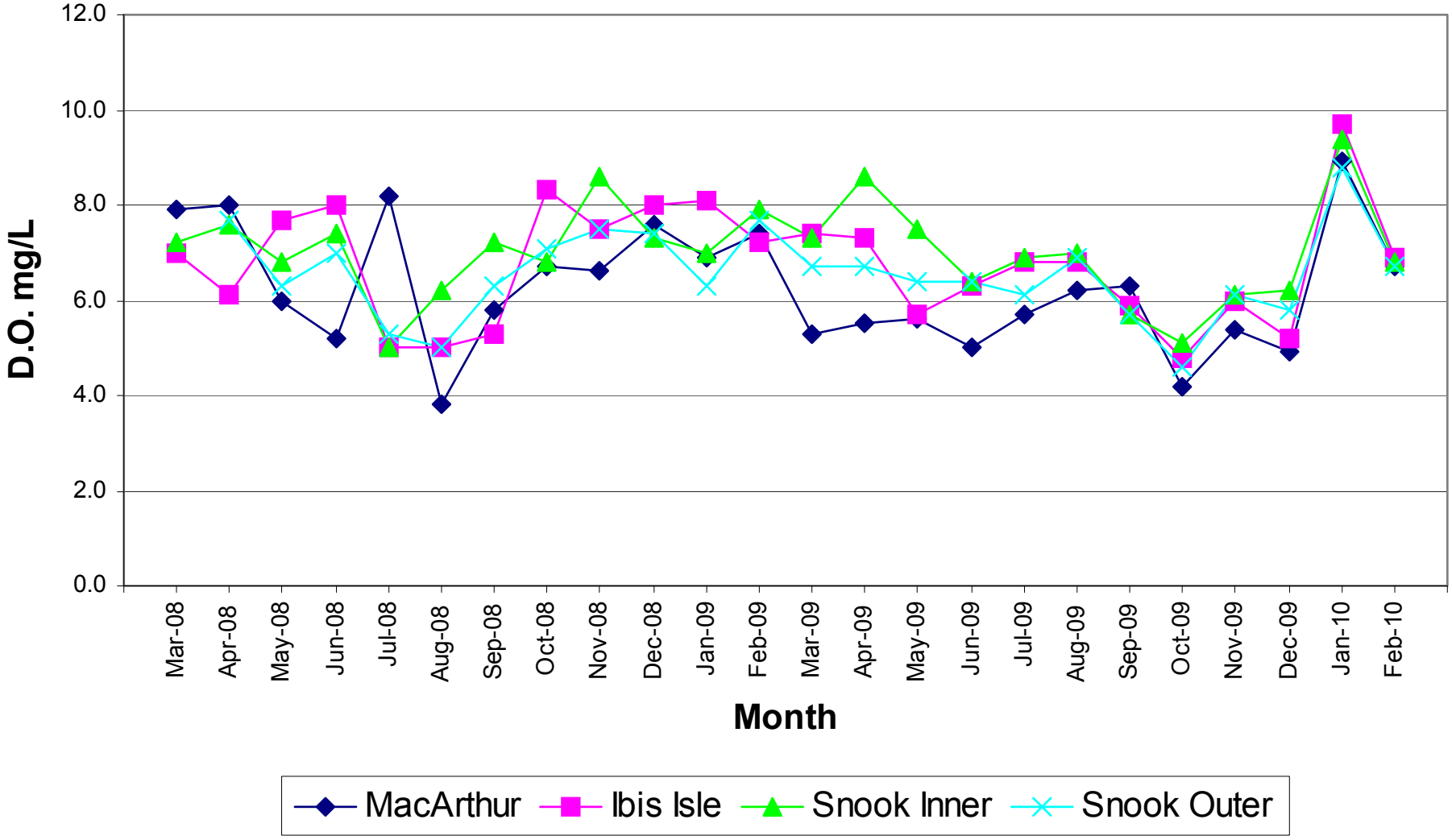
DISSOLVED OXYGEN



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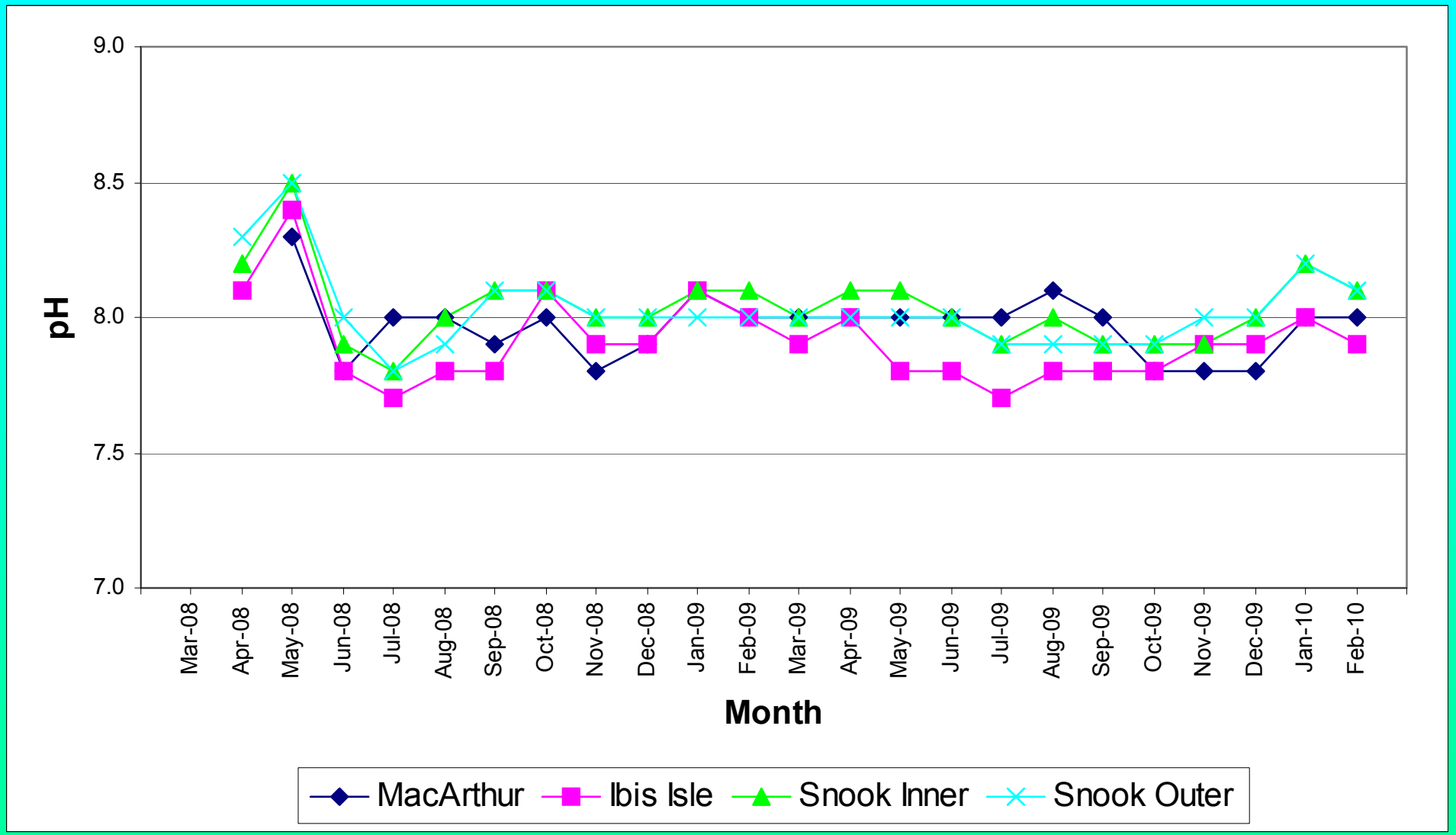
pH



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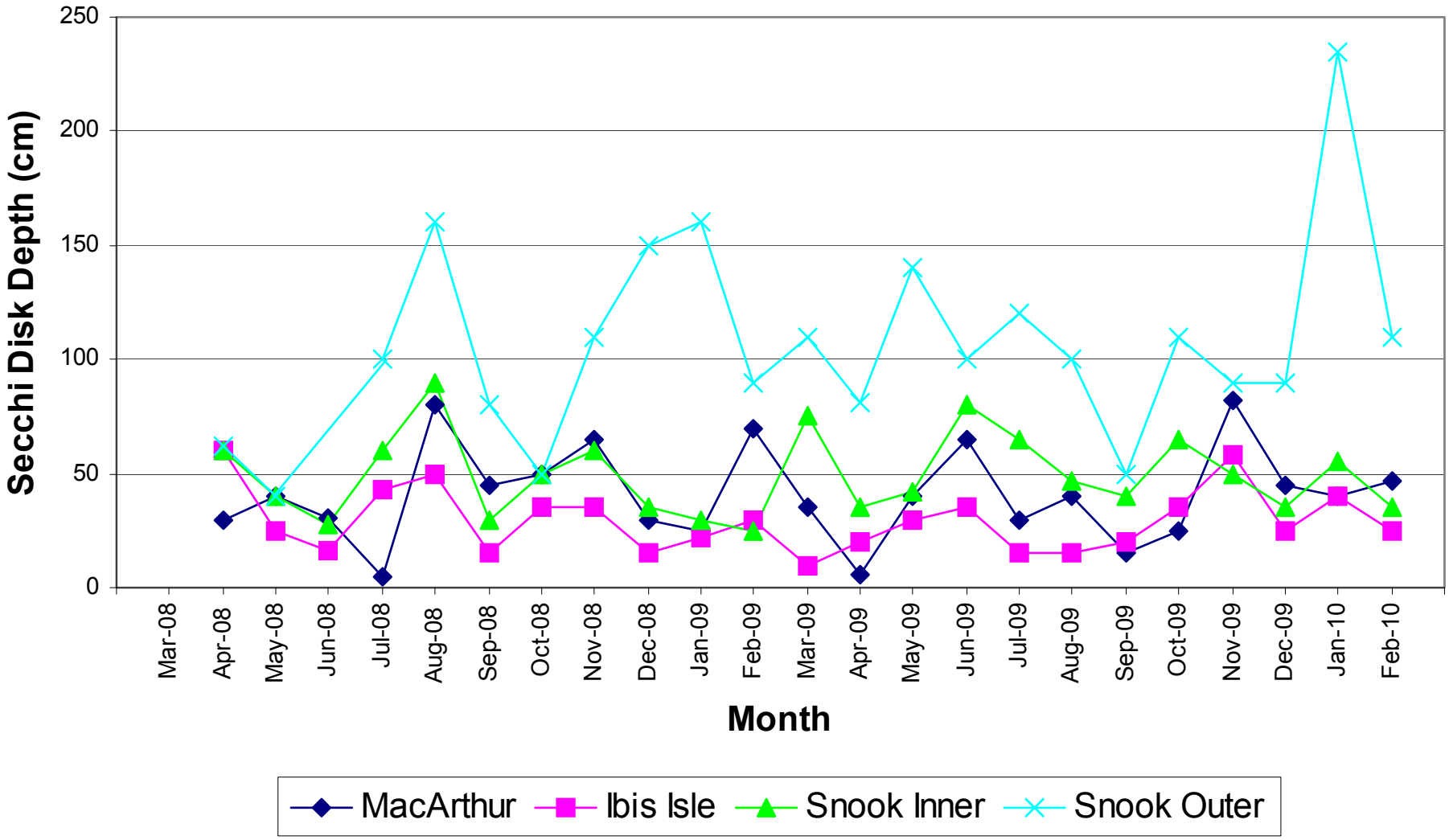
SECCHI DISK DEPTH



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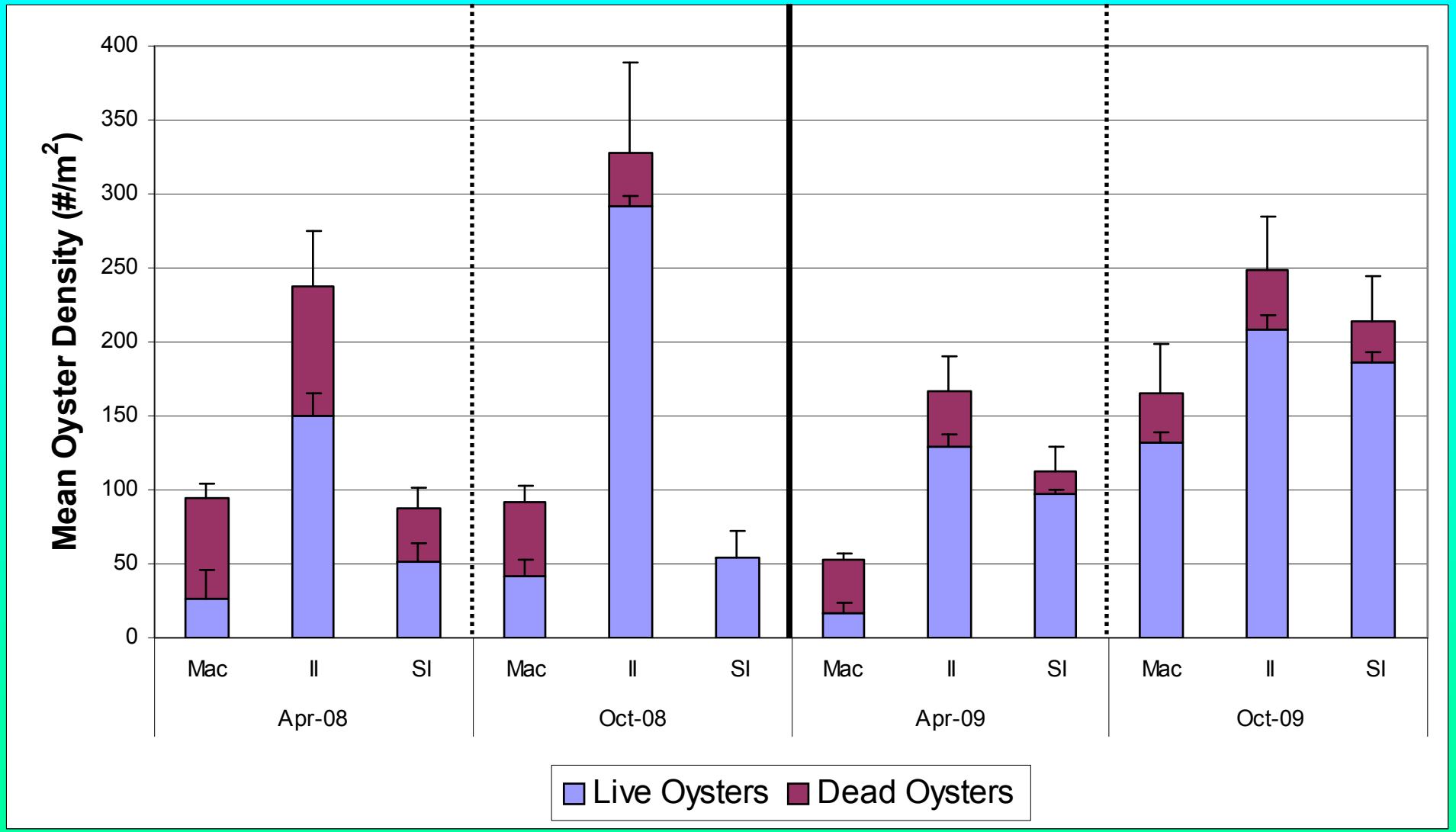
Results – Population Survey

OYSTER DENSITY*



*Quadrat samples that contained no oysters were not used to determine density.
Bars are standard error, throughout presentation.

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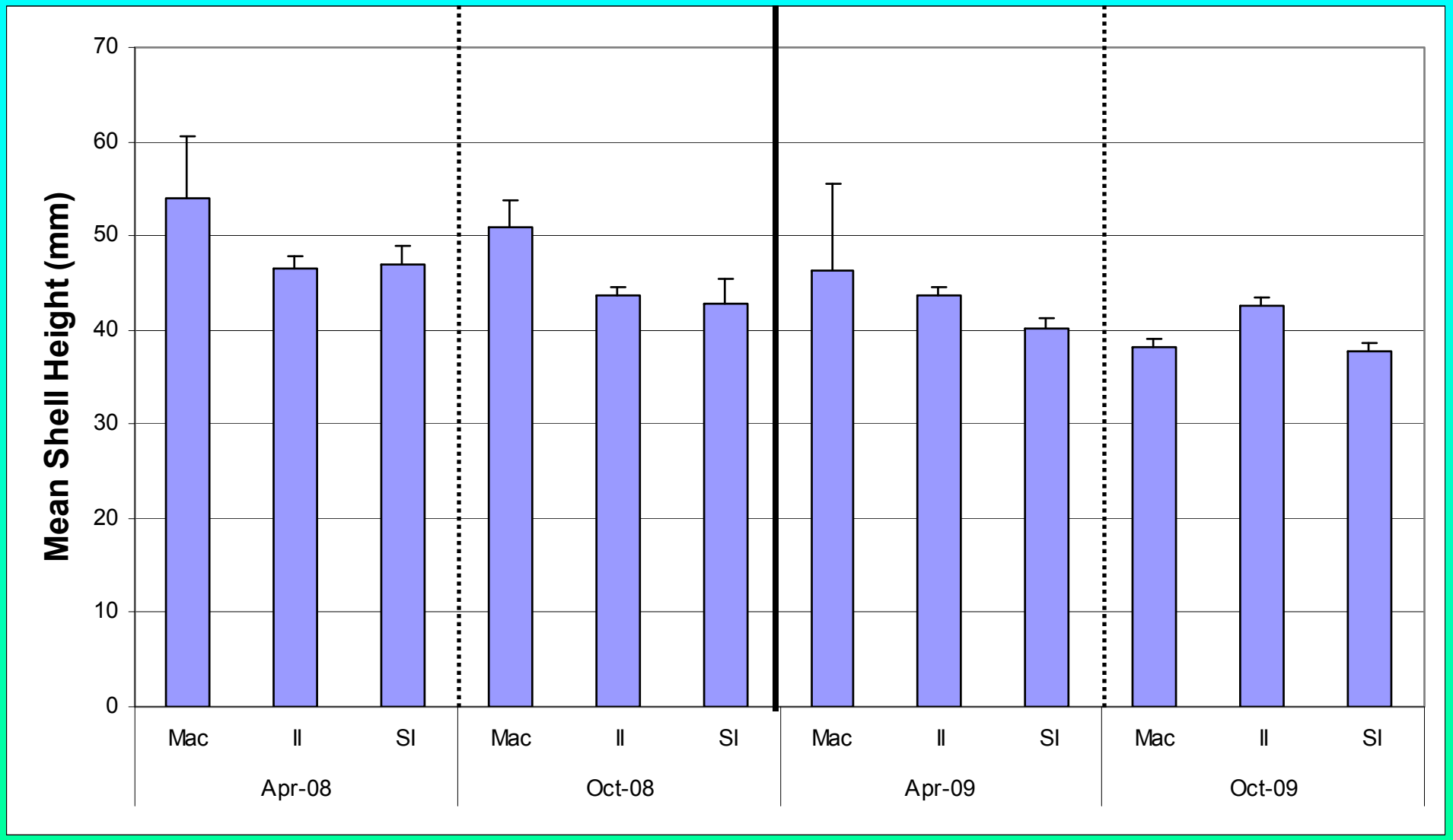
OYSTER SHELL HEIGHT



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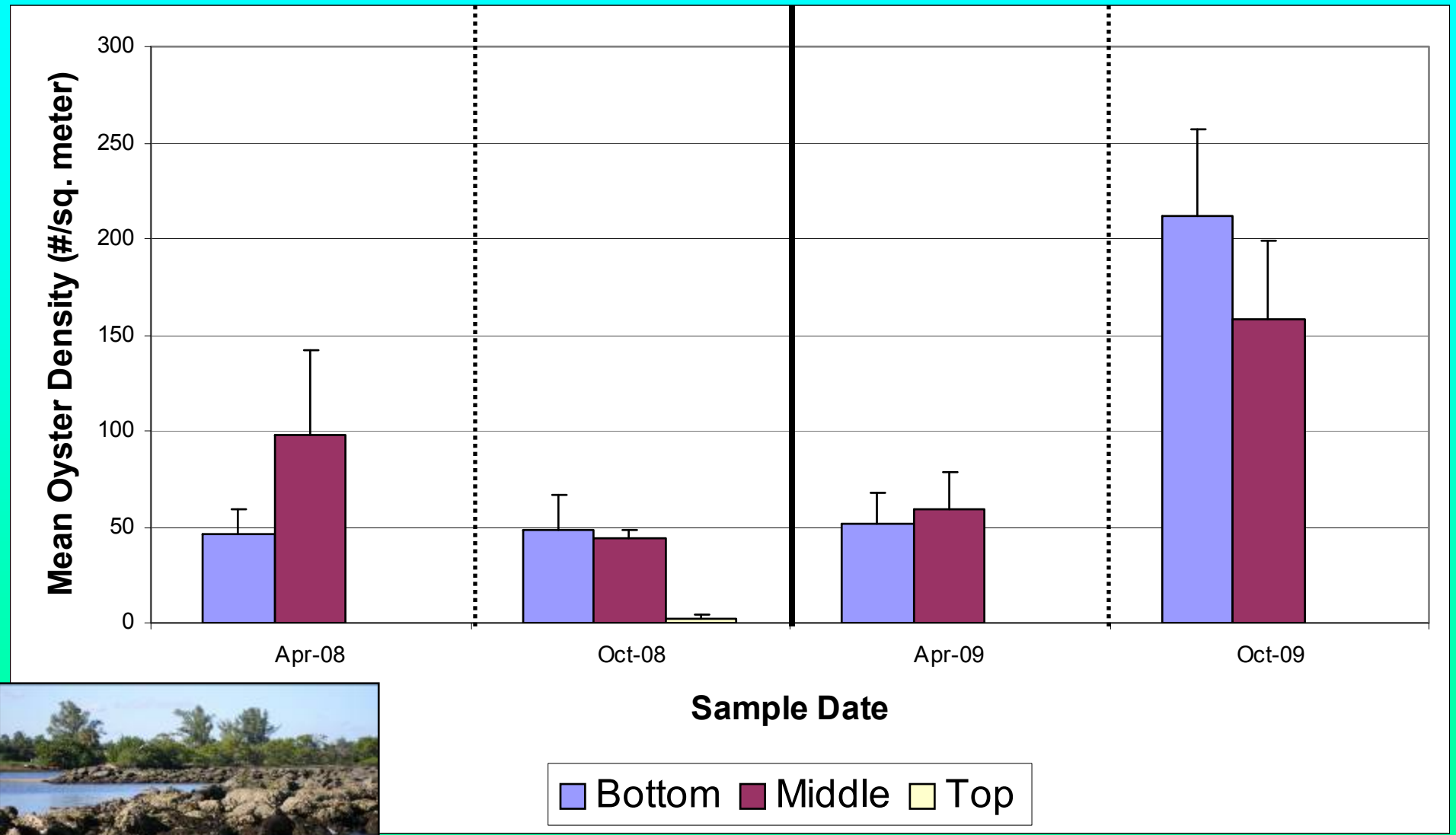
OYSTER VERTICAL DISTRIBUTION – SNOOK ISLAND



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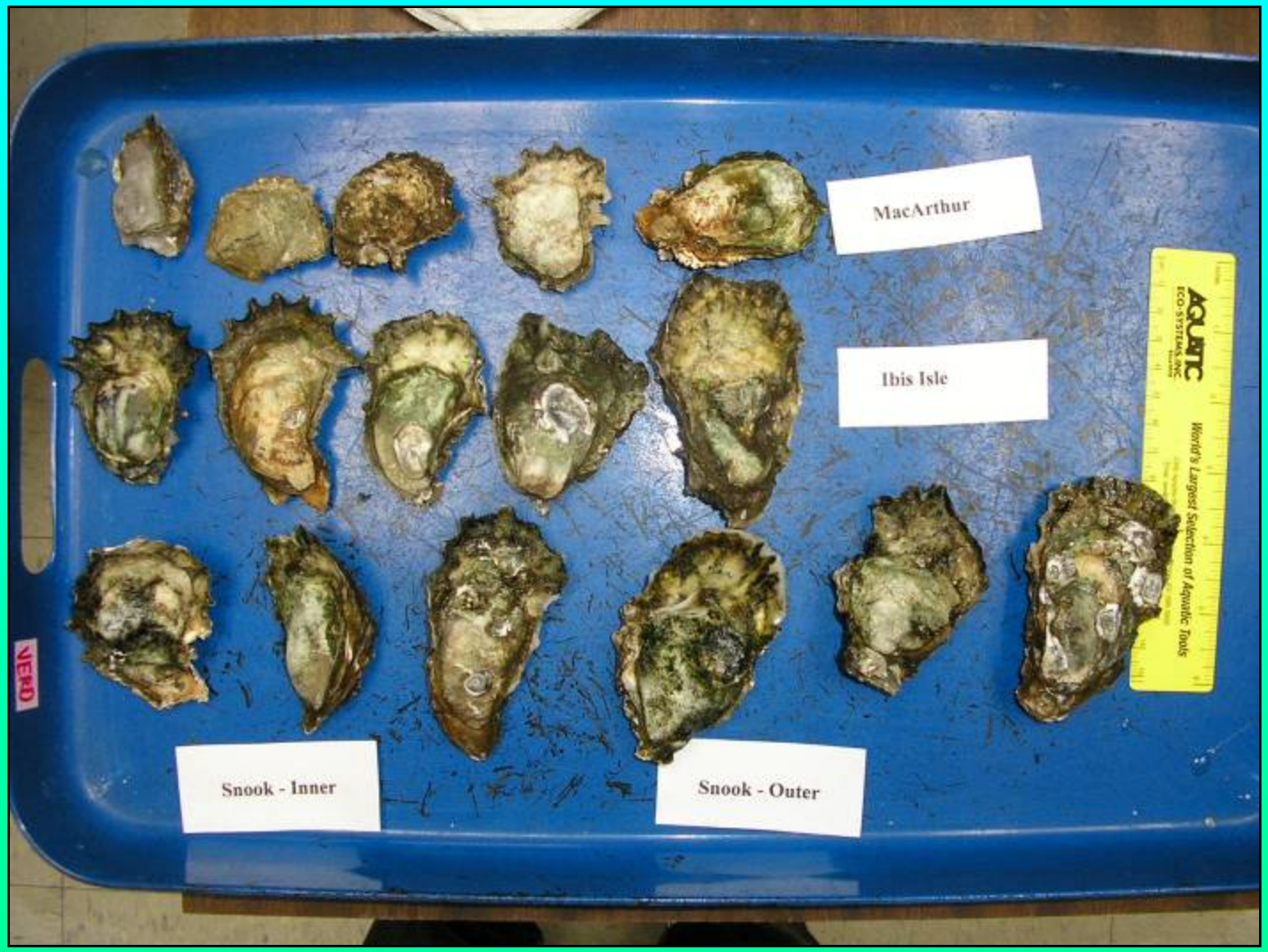
Results – Sampled Oysters



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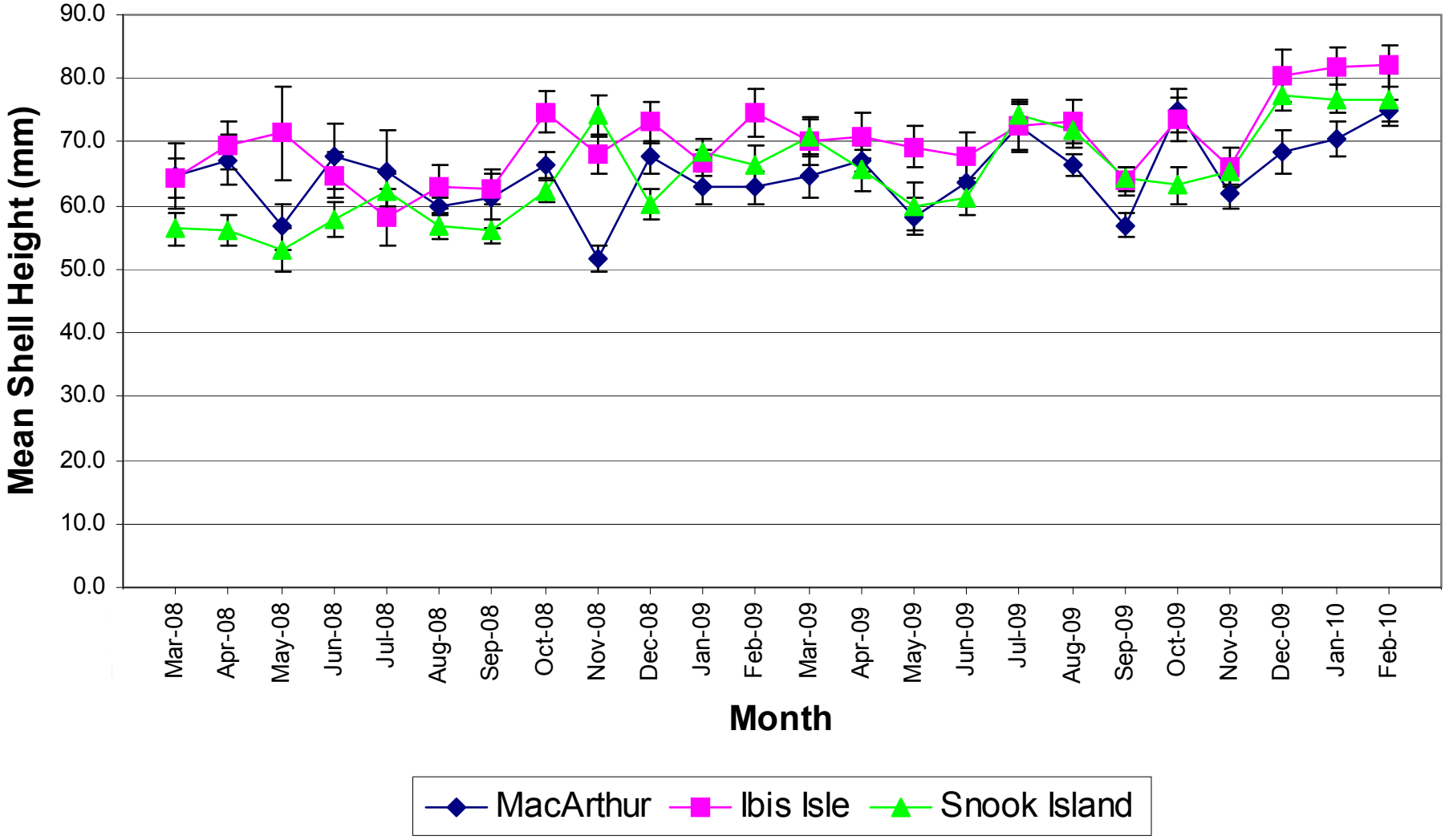
OYSTER SHELL HEIGHT



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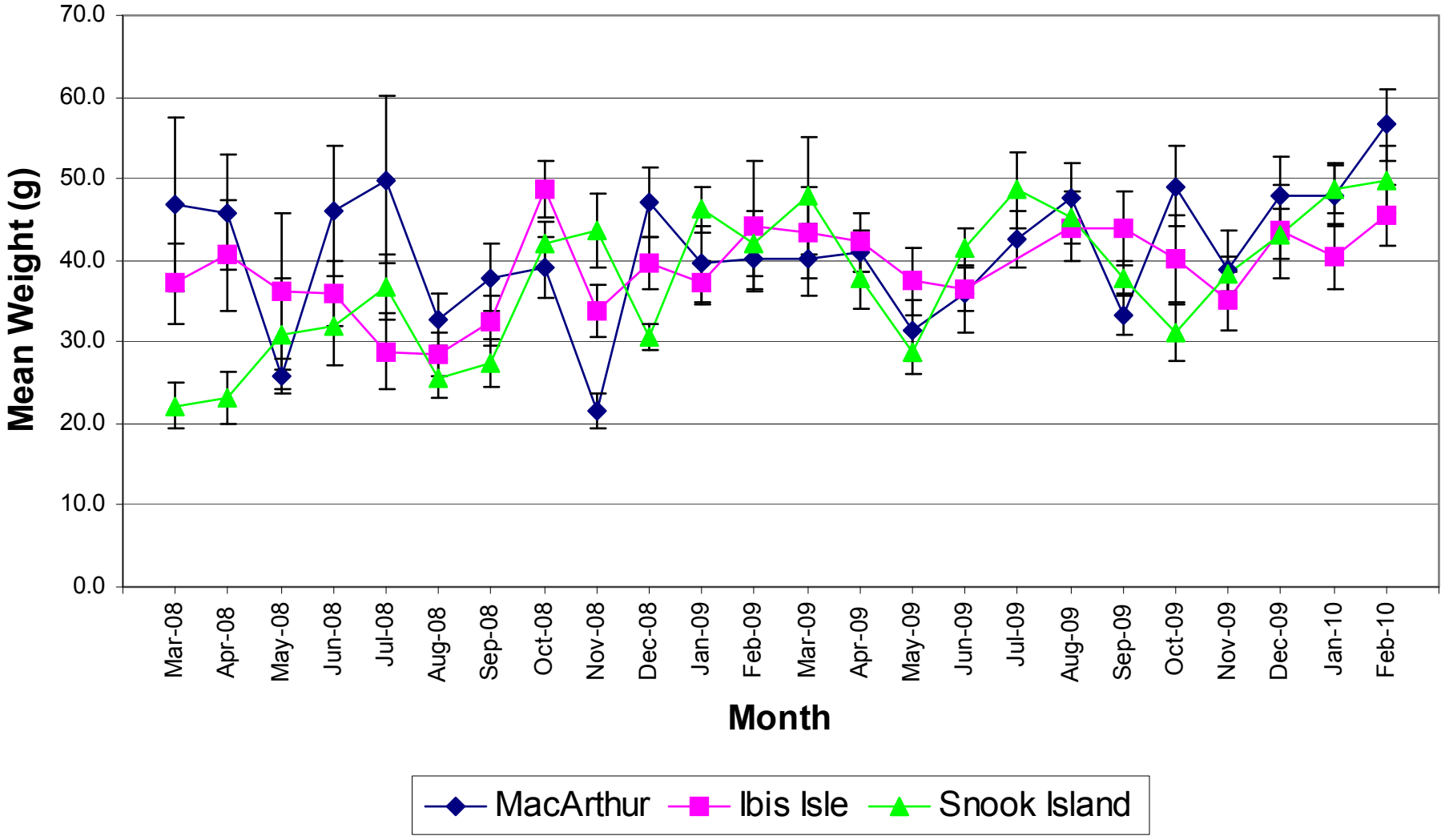
OYSTER WHOLE WEIGHT



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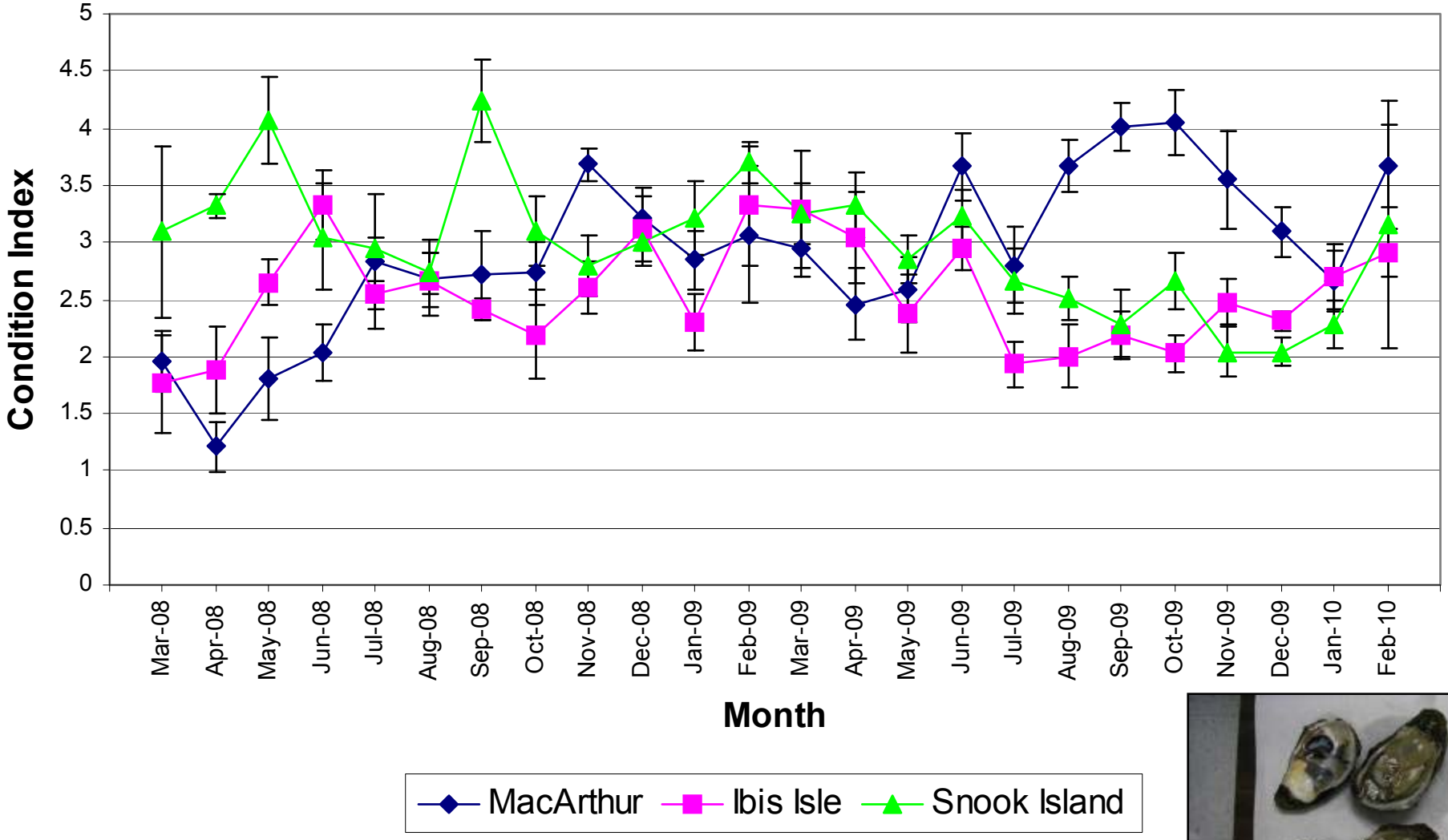
CONDITION INDEX



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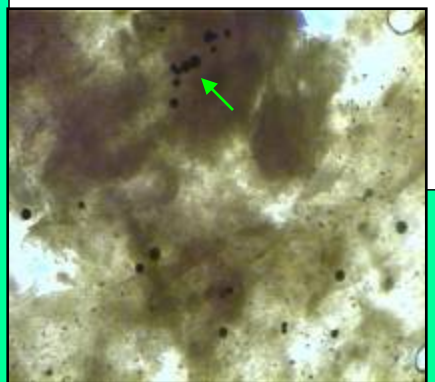
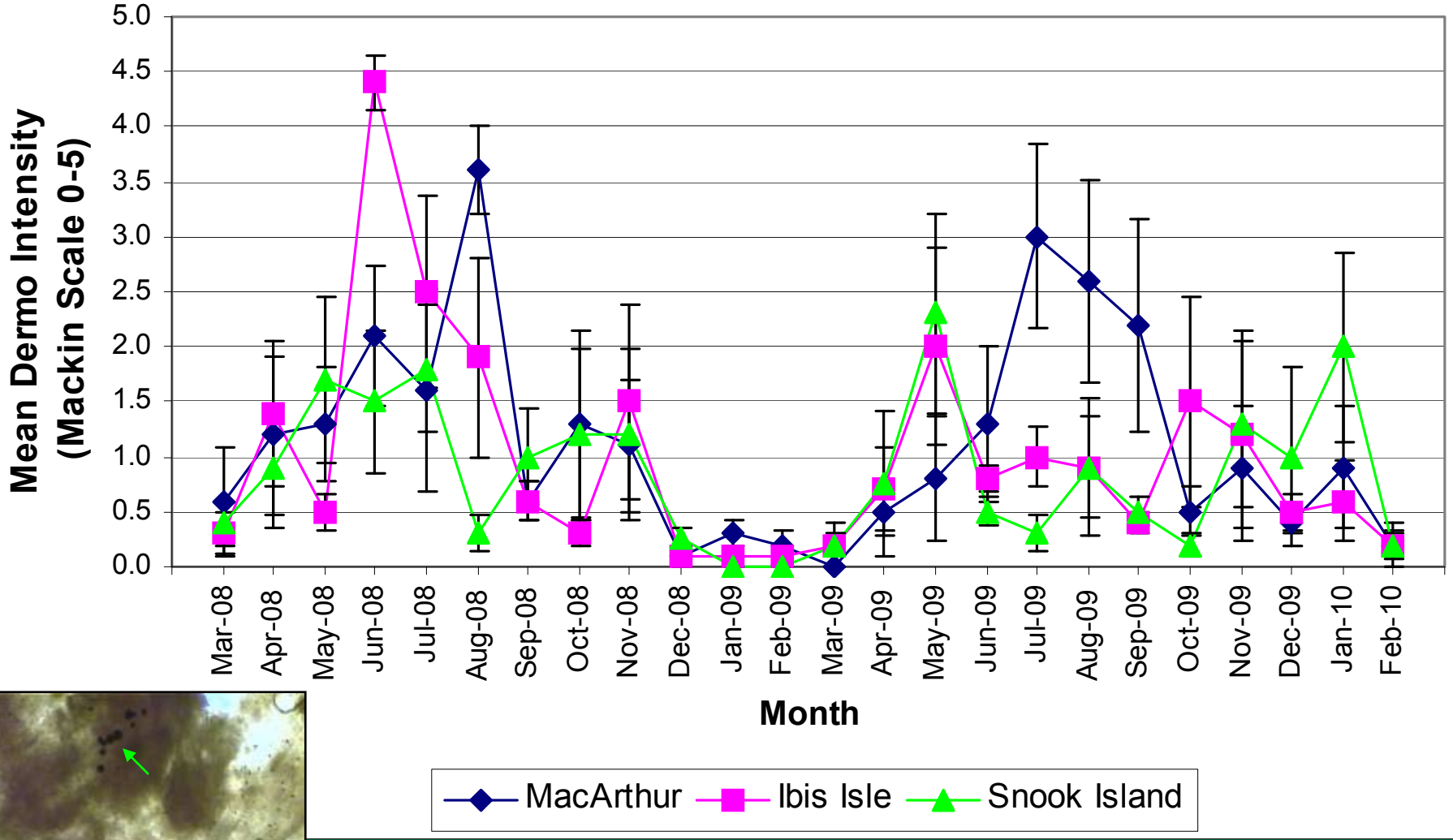
DERMO INTENSITY





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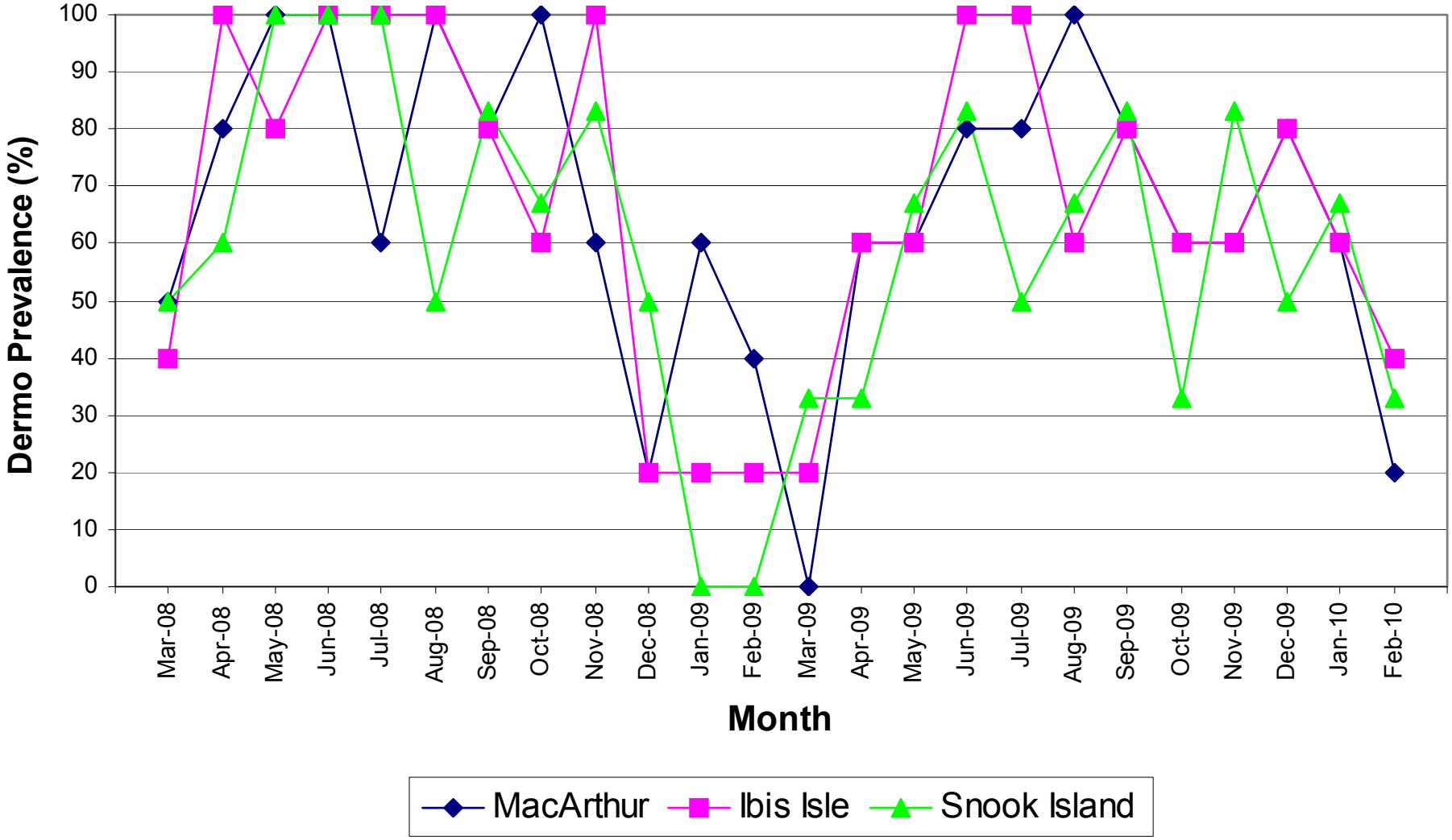
DERMO PREVALENCE



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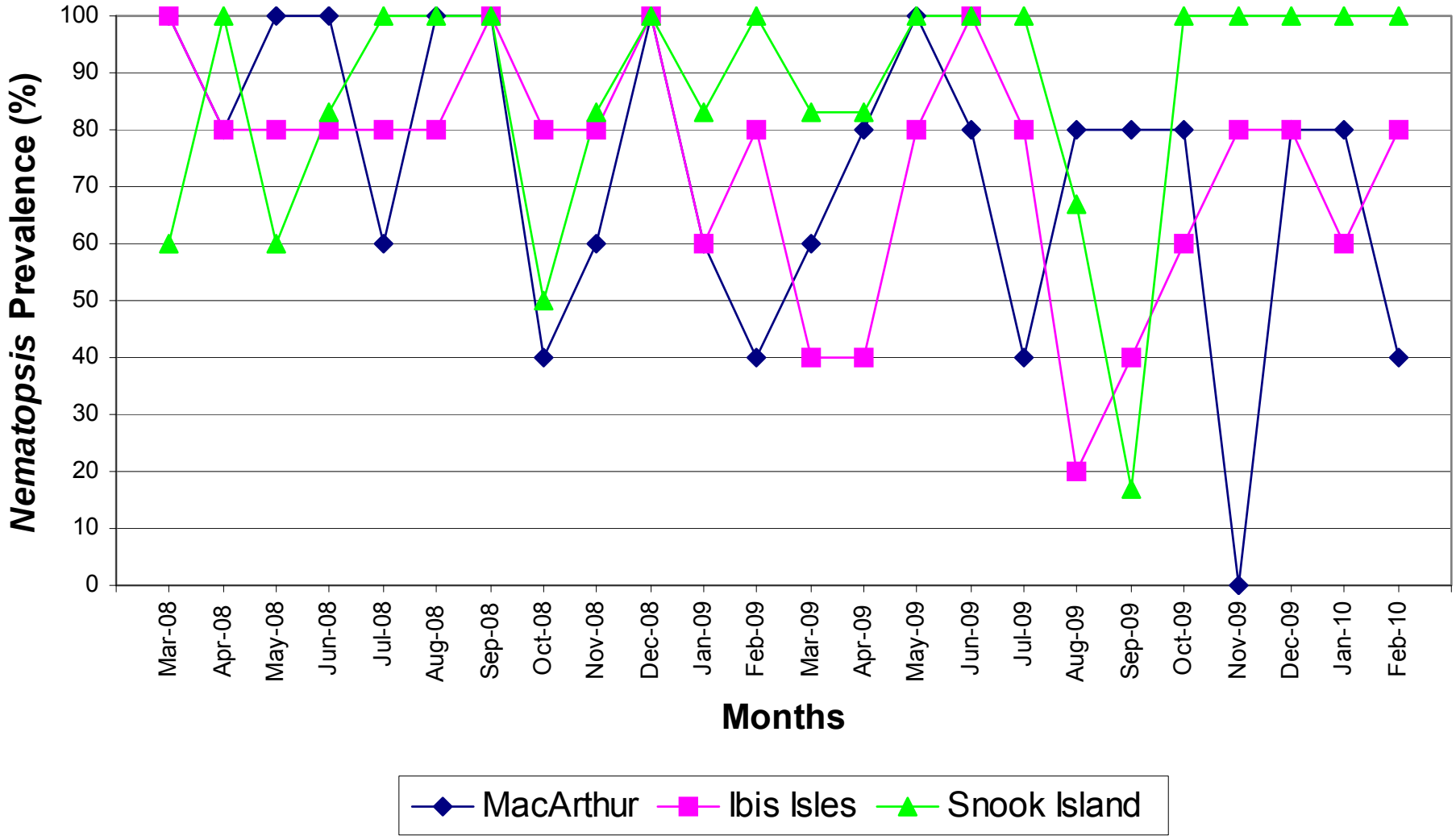
NEMATOPSIS PARASITES



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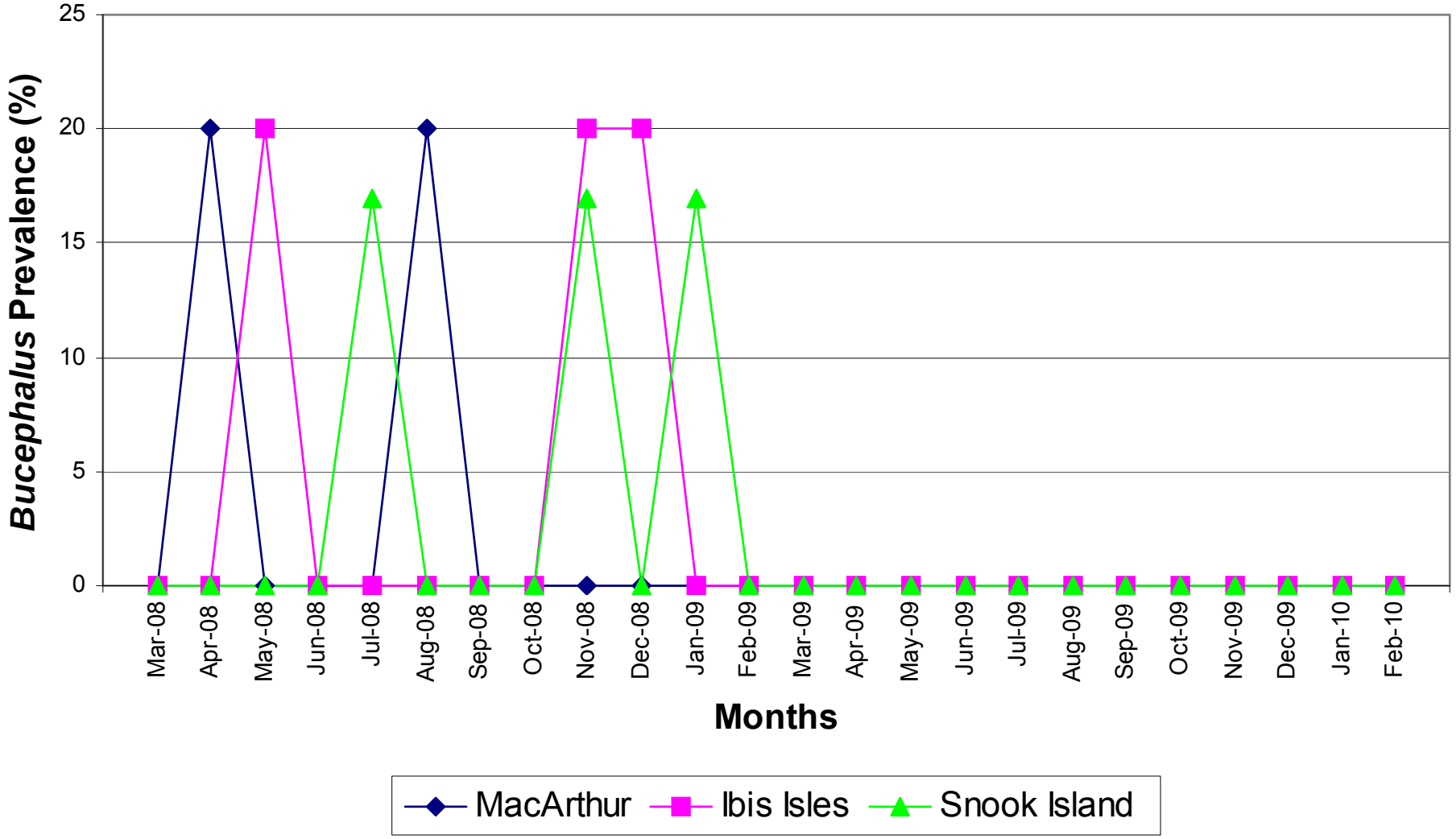
BUCEPHALUS PARASITES



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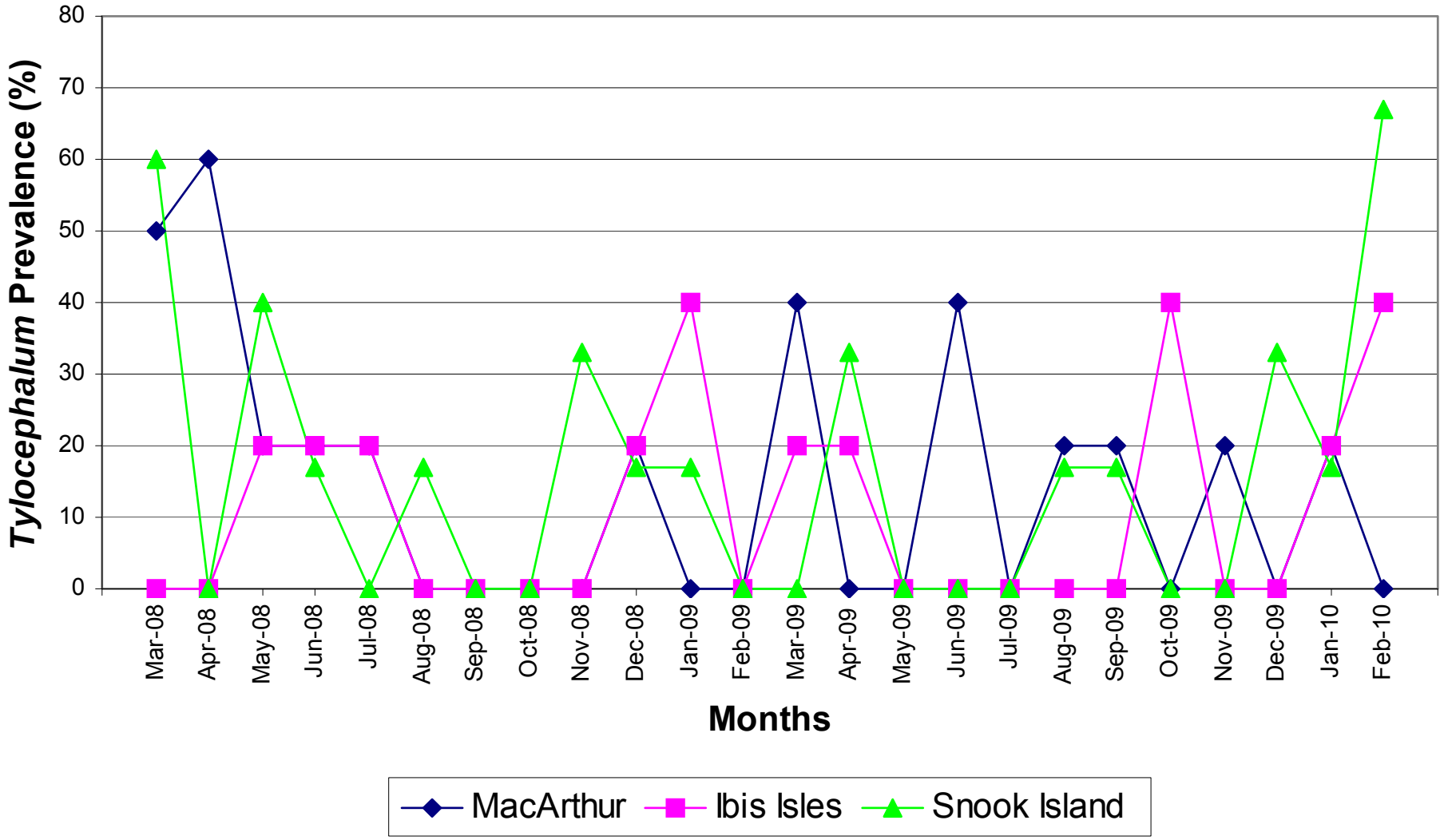
TYLOCEPHALUM PARASITES



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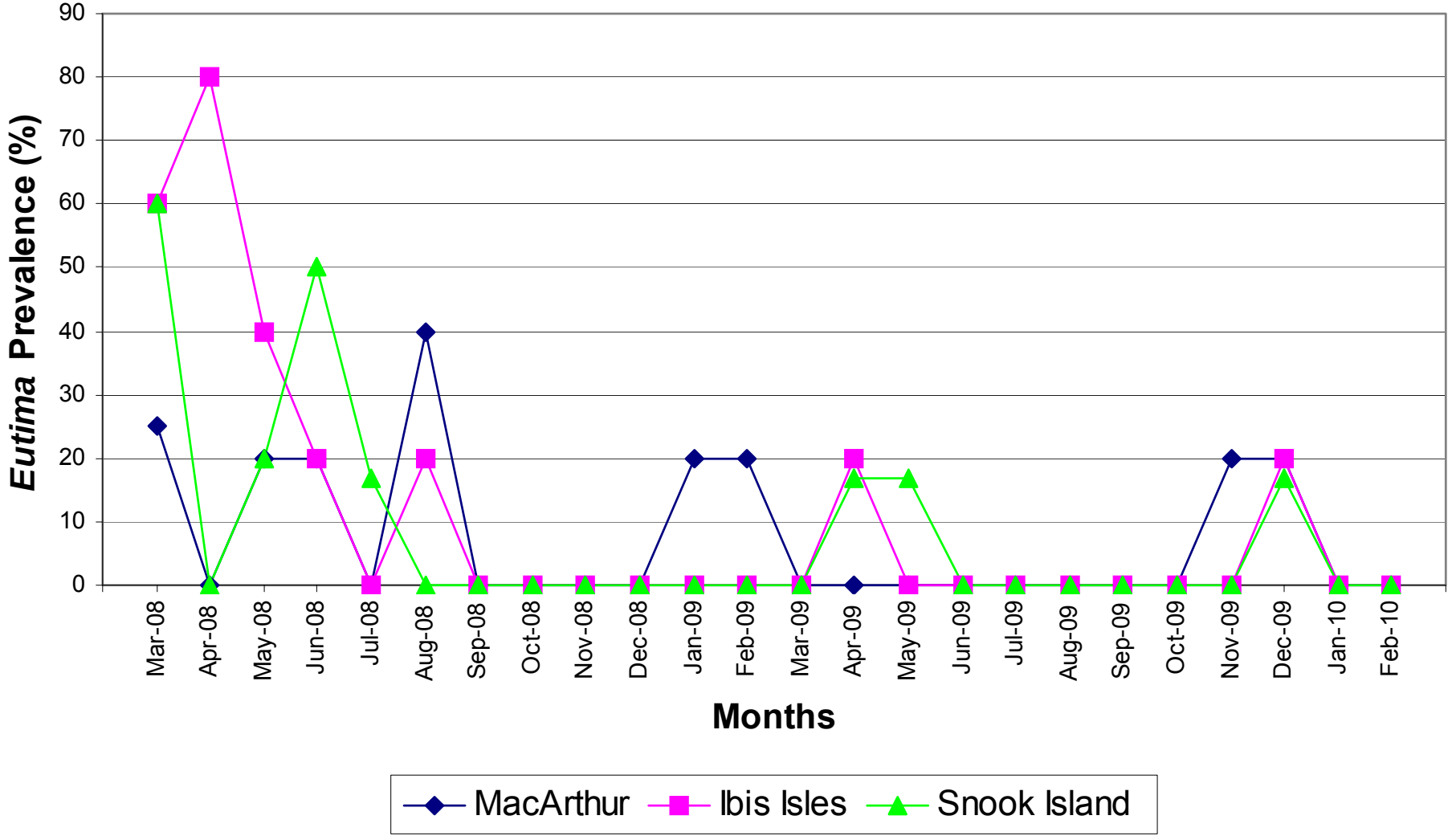
EUTIMA PARASITES



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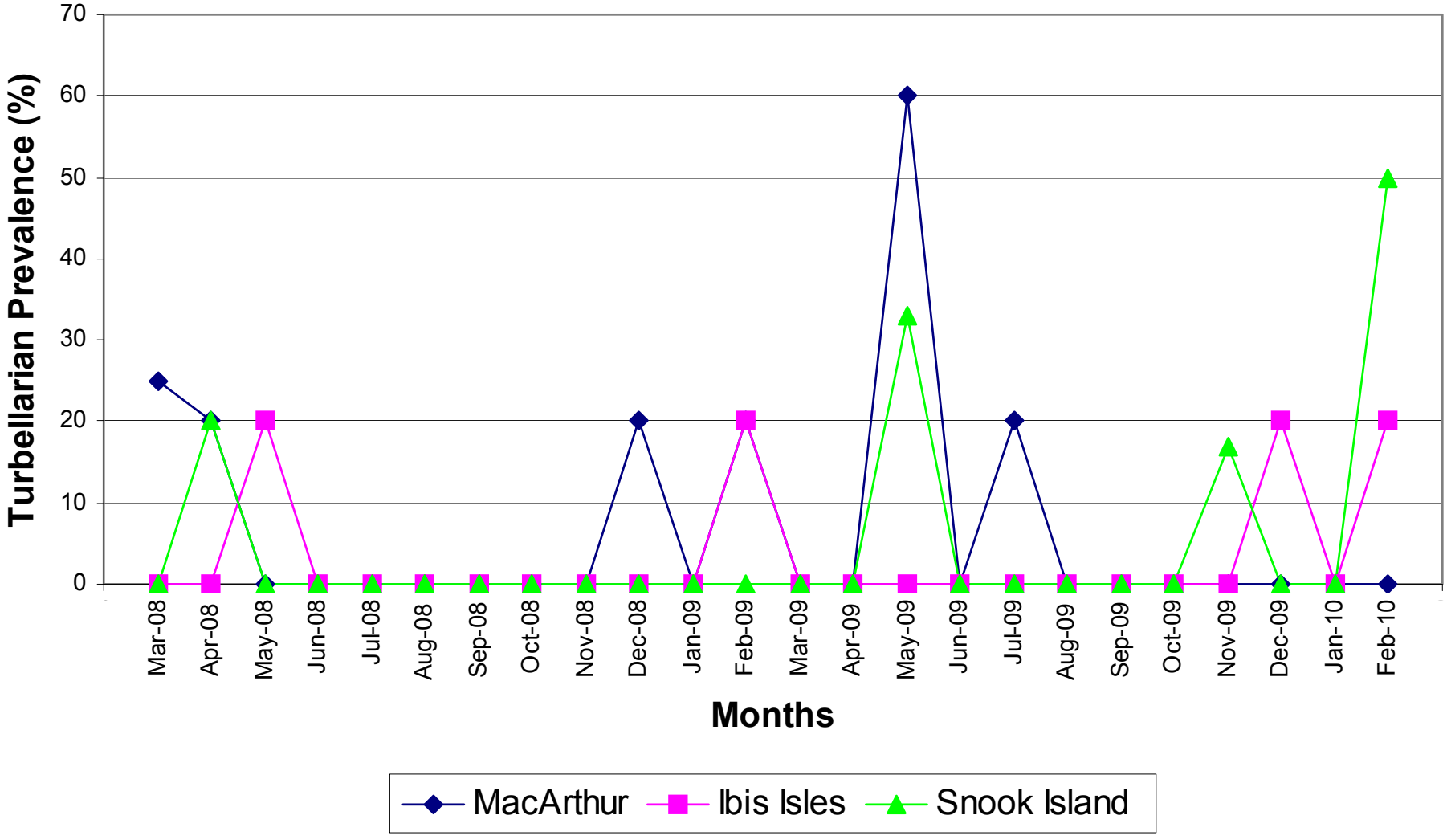
TURBELLARIAN PARASITES



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OTHER PREDATORS AND PARASITES

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OTHER PREDATORS AND PARASITES

Stylochus

Pea Crab

Fish eggs on shell

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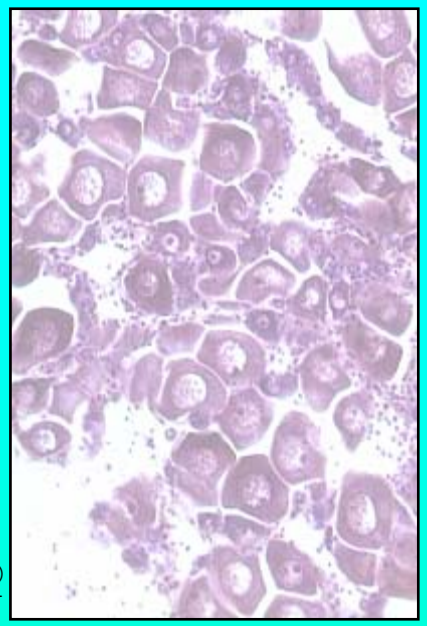

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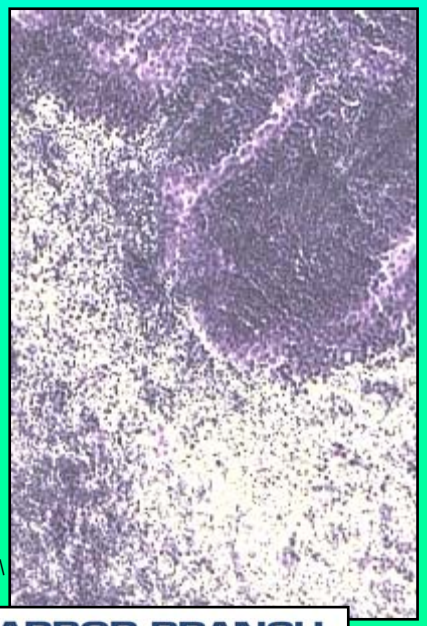

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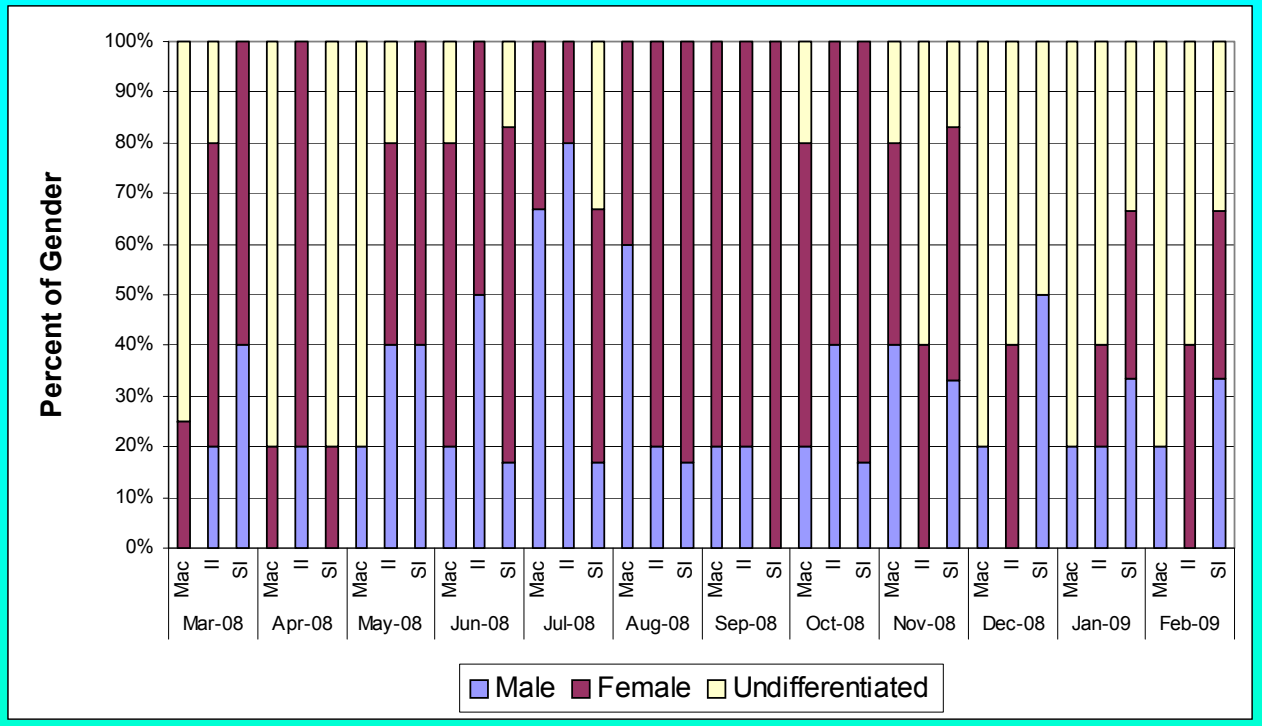

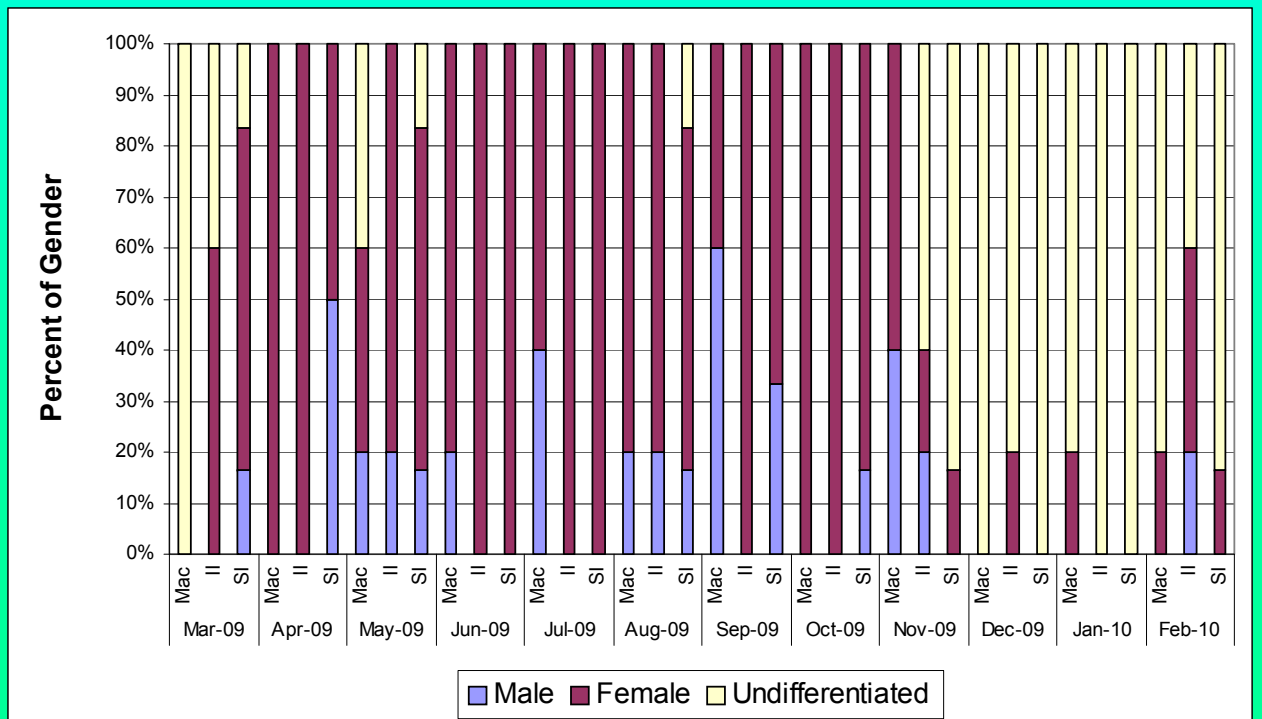

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SEX RATIO PROPORTIONS
(Male: Female: Undifferentiated)

- **MacArthur: 0.21:0.40:0.39 (n=119)**
- **Ibis Isle: 0.17:0.58:0.25 (n=118)**
- **Snook Island: 0.19:0.53:0.28 (n=141)**

- ***n.b.*: 2-3x more females, expected**

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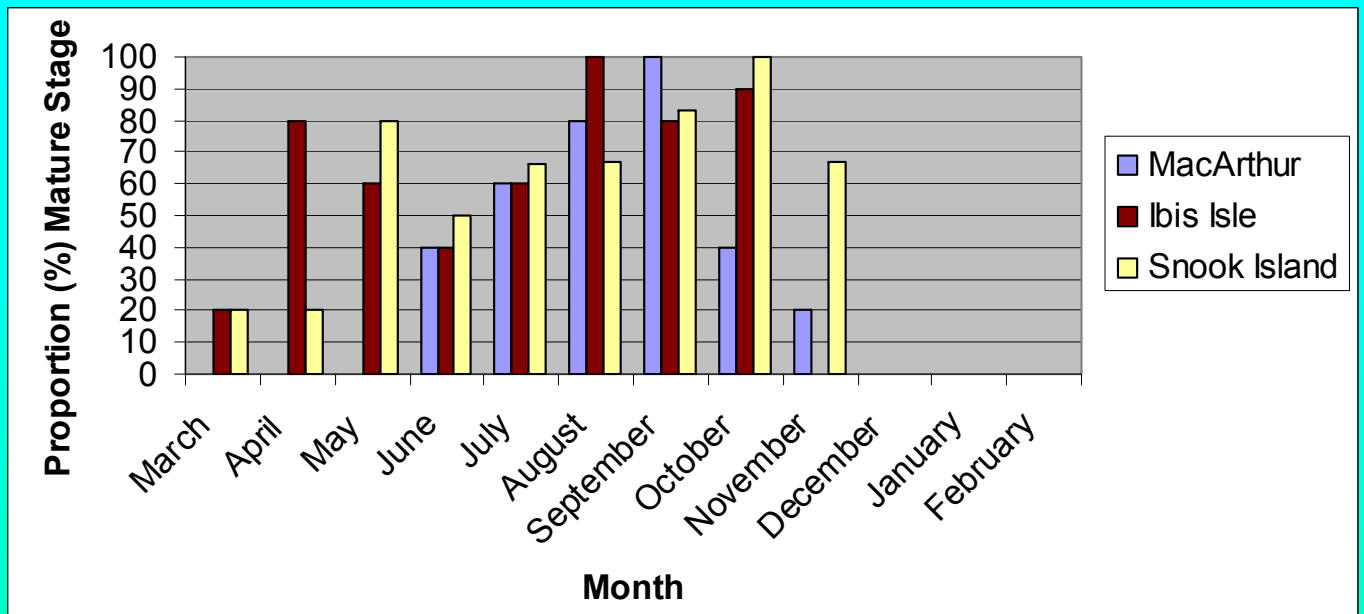
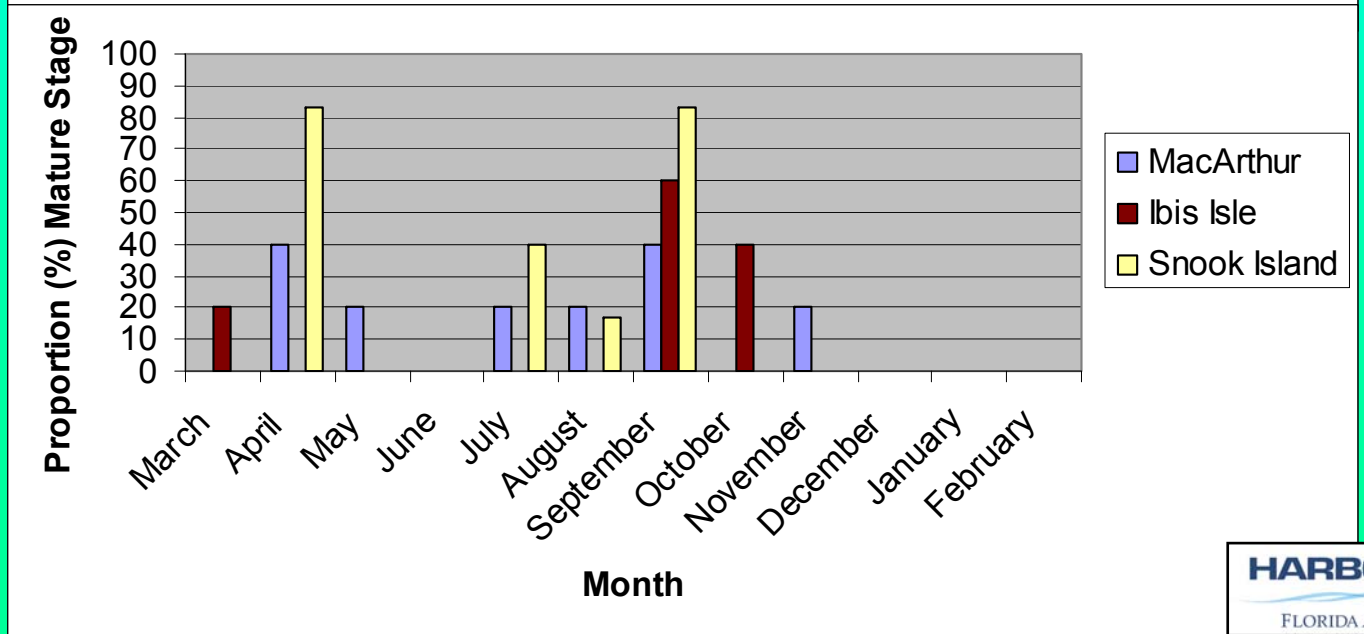
Proportion (%) of sampled oysters at mature reproductive stages (stage 5-7) from sites in Lake Worth Lagoon: A) March 2008-February 2009 and B) March 2009-November 2009. *n.b.* Snook Island is combined inner/outer.





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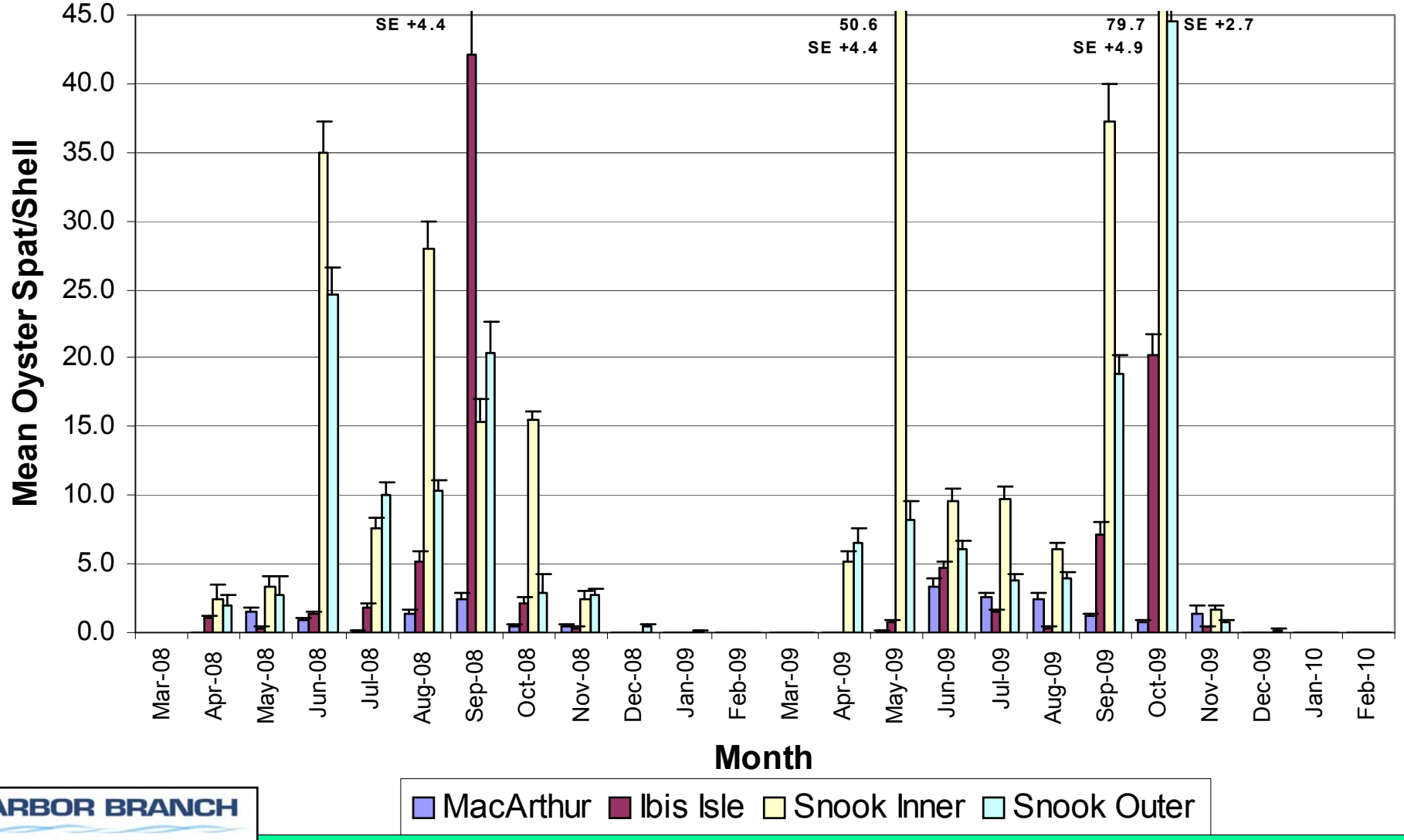
LARVAL RECRUITMENT



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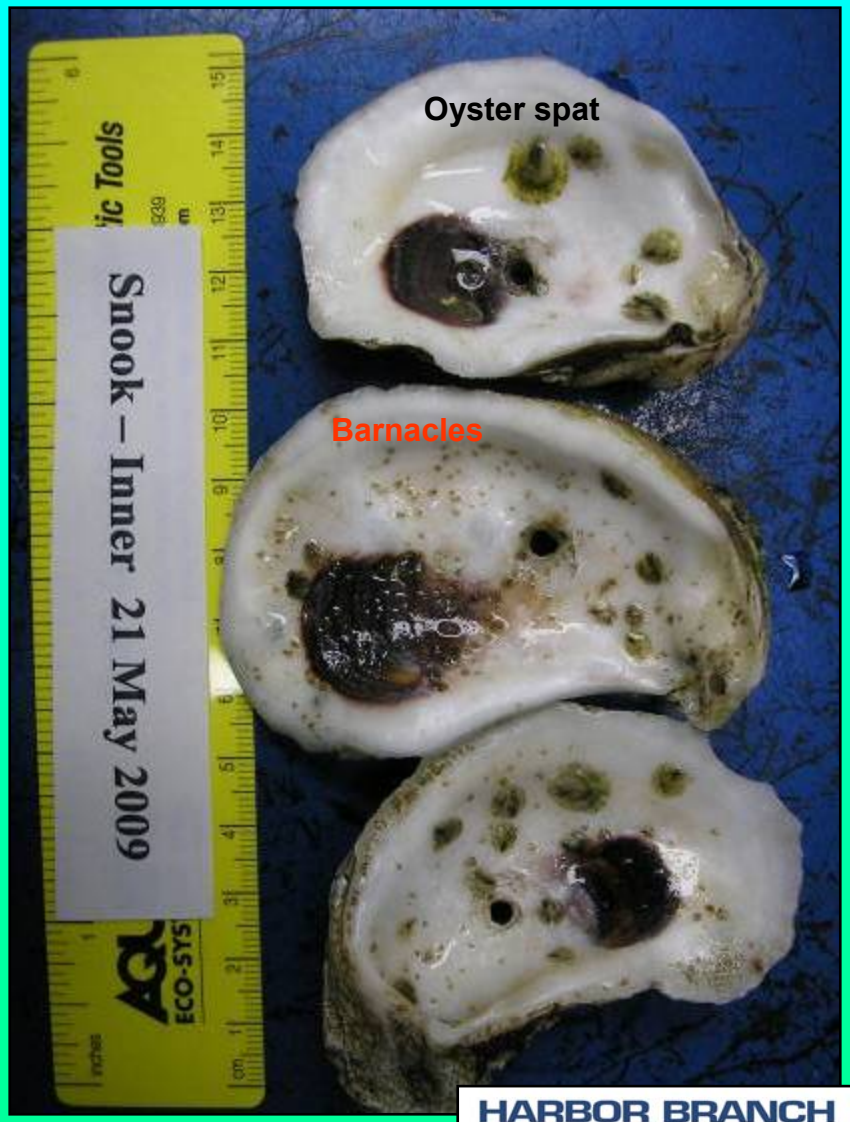
Mean Annual Recruitment

- **Year 1**
  - **MacArthur: 0.7 spat/shell**
  - **Ibis Isle: 4.9 spat/shell**
  - **Snook-Inner: 10.0 spat/shell**
  - **Snook-Outer: 7.0 spat/shell**
- **Year 2**
  - **MacArthur: 1.1 spat/shell**
  - **Ibis Isle: 3.2 spat/shell**
  - **Snook-Inner: 18.1 spat/shell**
  - **Snook-Outer: 8.5 spat/shell**



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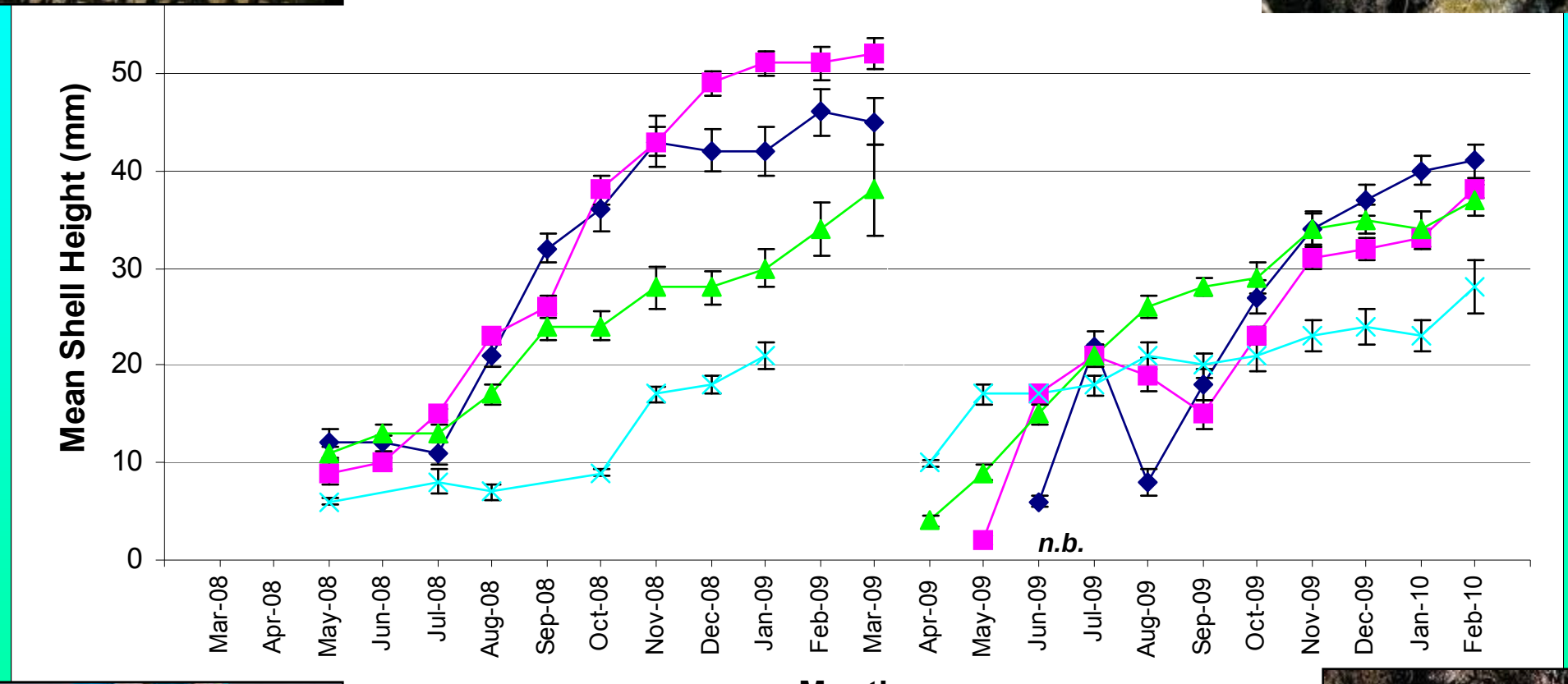
ARRAY OYSTERS – GROWTH



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SUMMARY - RESULTS

- **Water Quality Parameters**: Little differences between sites, except MP higher salinity and SI and II lower in summer; not below acceptable levels.
- **Oyster Density**: Average density in the fall of year one at SI (54/m^2) was similar to MP (42/m^2), but lower than II (291/m^2). In year two SI was similar (186/m^2) to both natural sites (MP=132/m^2, II=208/m^2). No vertical distribution at SI.
- **Condition Index**: CI of oysters varied (1.21-4.24), but mean (±s.d.) was similar between sites (SI=2.98±0.55, MP=2.91±0.71, II=2.54±0.47).
- **Reproduction**: Bi-modal reproduction (late-spring/early-summer and fall) was evident at SI in both years, but only in year one at MP and II.
- **Larval Recruitment**: Overall mean: SI highest (10.4±16.3 spat/shell), followed by II (3.9±9.0 spat/shell) and MP (0.8±1.0 spat/shell).
- **Juvenile Growth**: Final shell height of recruited juveniles was less at SI (34 mm) compared to the IbIs (51 mm) and MP (46 mm) in year one, but similar in year two (SI=37; II=38; MP=41 mm).
- **Health**: Dermo intensity ranged from 0-4.5 (Mackin scale), but mean intensity (±s.d.) was low (SI=0.9±0.7, II=1.0±1.0, MP=1.1±1.0) with a mean prevalence at SI of 59%, II of 67% and MP of 66%. No MSX (*Haplosporodium nelsoni*) was found at any of the sites. Other parasites found included gregarine protozoa *Nematopsis sp.*, turbellarians, trematode *Bucephalus*, cestode *Tylocephalum*, cnidarians *Eutima sp.* and pea crabs *Pinnotheres sp.*

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CONCLUSIONS

- Oyster beds/reefs in Lake Worth Lagoon are as productive or more productive than oyster reefs in other east Florida locales.
- Annual variation in oyster productivity may be the result of natural or man-made variations in environmental parameters (e.g., temperature, salinity, phytoplankton, fresh-water releases).
- Created oyster reefs, as exemplified by Snook Island, are as productive as natural reefs.
- Productivity may be enhanced by carefully considering placement of created reefs in relation to natural oyster beds.

RECOMMENDATIONS

- The construction of additional artificial reefs, similar to that created at Snook Island are recommended.
- Improving, maintaining and increasing successful natural reefs, similar to the Ibis Isle restoration project, are recommended.
- Due to year-to-year fluctuations seen, multi-year monitoring is recommended at sites.
- Additional monitoring of sites after restoration projects have been completed, such as Ibis Isle, are recommended to measure the impact of those restoration projects.
- Encourage student and community volunteers to participate in restoration and monitoring projects under the direction of a biologist.
- Implementation of smaller volunteer projects, such as Living Shorelines, and monitoring of those projects in conjunction with homeowners, student and community volunteers under the direction of a biologist.
- Using multiple sampling sites within an area, e.g., monitoring other islands in the Snook Islands Natural Area to better describe variation at a site (i.e., vertical distribution).

Take Home Message

LWL is a productive system with patches of healthy oyster populations that can be

expanded by providing substrate and relying on natural recruitment.

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ACKNOWLEDGEMENTS

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- Federico Prahl, Michelle Harangody and William Krebs (HBOI), and
- Palm Beach – Environmental Resources Management personnel and support (Project #2008-0404)

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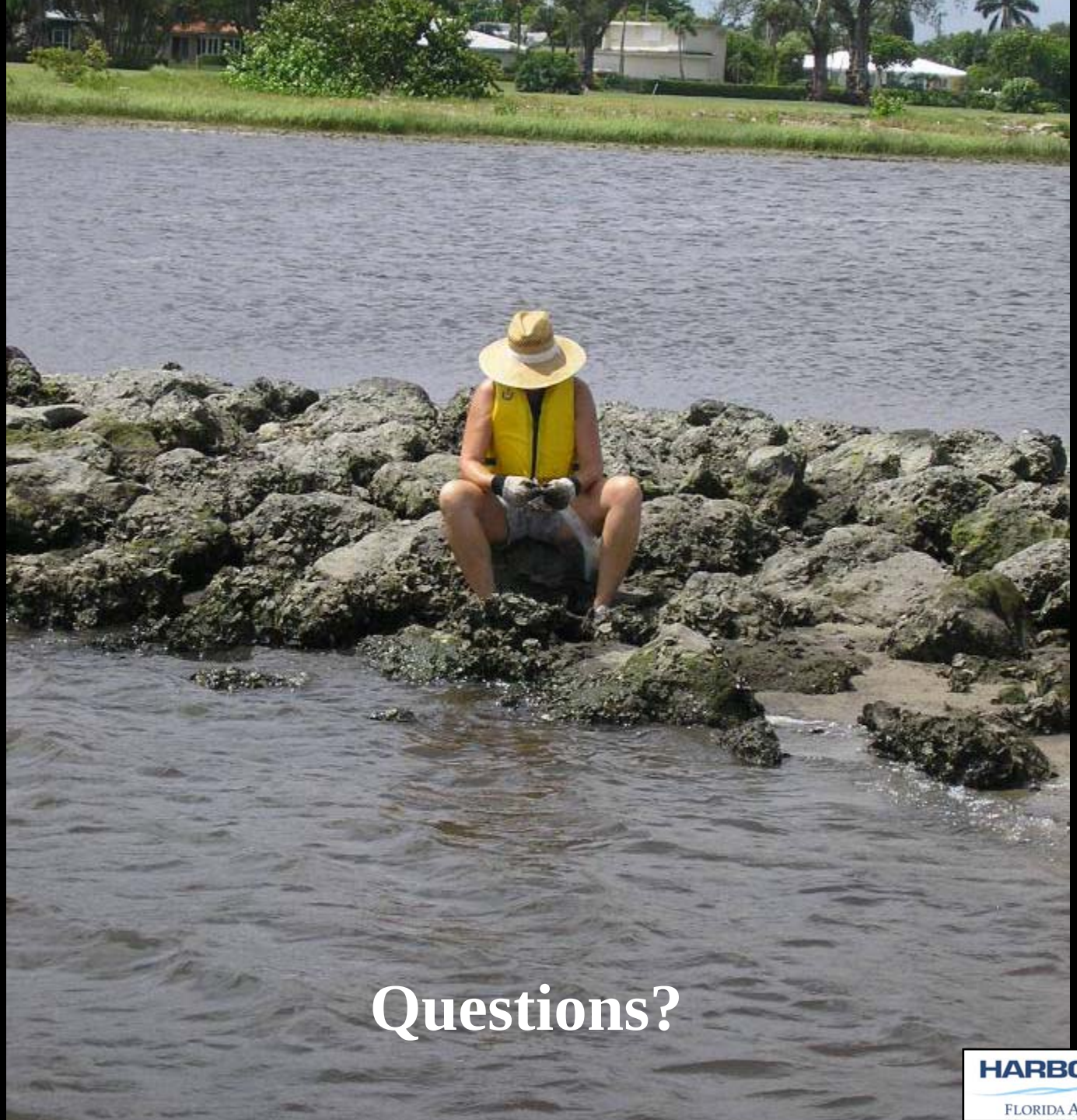

Questions?

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