

INTRODUCTION

Palaemonid shrimp are found throughout the Everglades ecosystem, and species range in habitat types from fresh to marine. While considerable research has been done on *Palaemonetes paludosus* (riverine grass shrimp), which primarily inhabits freshwater marshes, little is known about the ecology of other palaemonid species present in the Everglades, except for early descriptive studies by McPherson et al. (1970) and Odum and Heald (1972).

In the southwest section of Everglades National Park (ENP), freshwater marshes transition to an expansive array of mangrove forests, islands, tidal bays, and creeks where salinity varies both seasonally and spatially. How organisms respond to this variation in salinity is poorly understood. Palaemonid shrimp may respond in both short (daily) and longer (seasonal) timescales by drifting with tides (Anderson, 1985). This may allow organisms to change distributions in response to seasonal variation in hydrological conditions, and thus occupy parts of the estuary with suitable salinity conditions.

RESEARCH QUESTIONS

This study asks the following questions: (1) How do palaemonid shrimp species segregate spatially along the Shark River Estuary?, (2) How does species distribution relate to the spatial and seasonal variation in hydrological conditions, particularly salinity?, (3) If species replacement occurs along the estuary, do these shrimp species play identical functional roles in the community, and (4) Do they potentially compete with one other, such that competition may be a major determinant of their distributional patterns?

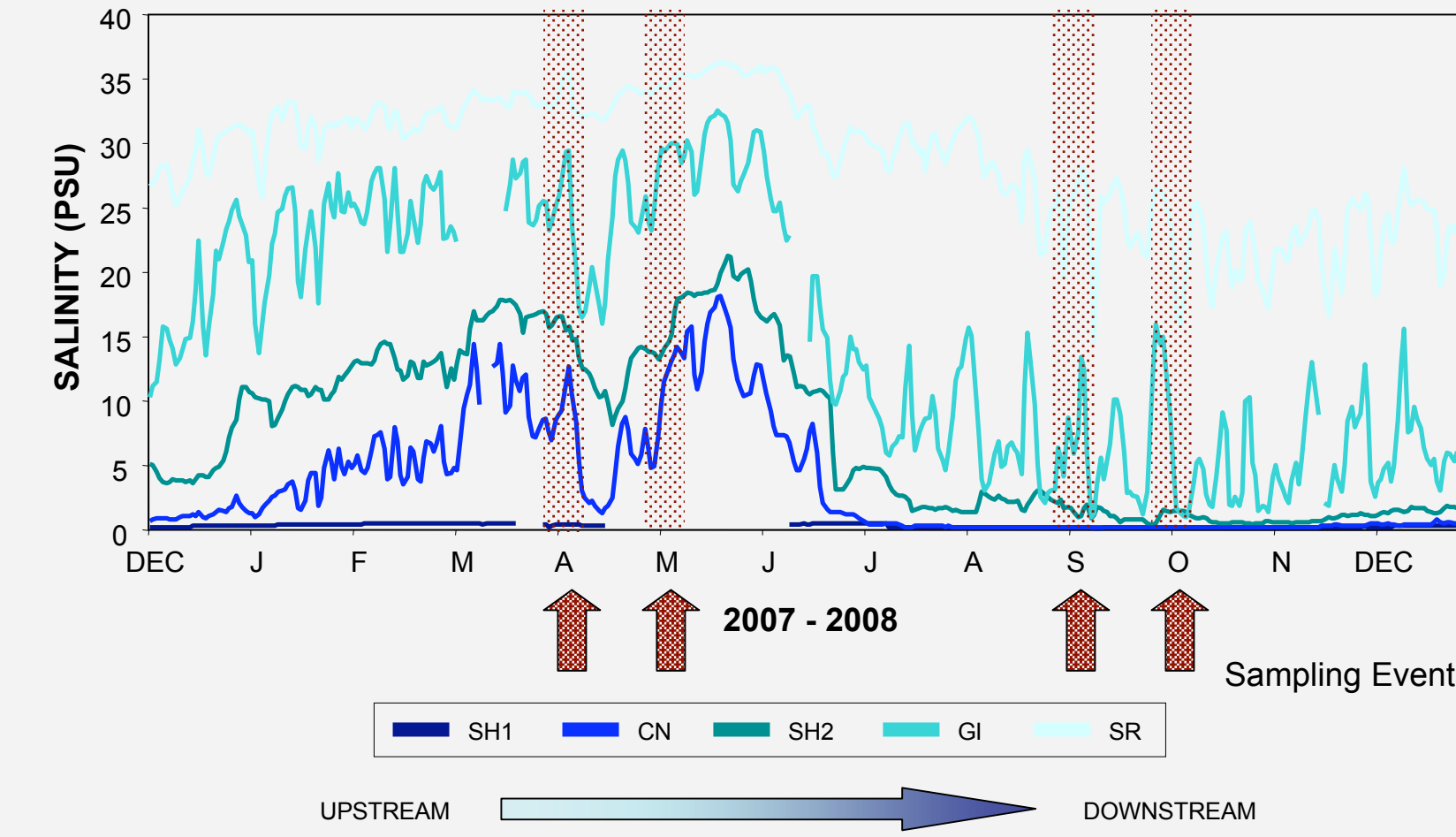
SAMPLING METHODS



Fig. 1. Location of 8 study sites evenly distributed along the 32.1 km estuary. *RB 13 was used for isotope samples in the dry season only.

- We sampled shrimp species from the marsh-mangrove ecotone at the downstream end of Shark River Slough to the marine environment in Ponce de Leon Bay.
- Eight sites were sampled with 10 unbaited Gee® minnow traps in 4 sampling events during April-May (dry season), and September-October (wet season) of 2008 (8 sites x 10 traps x 4 samples = 320 traps).
- Traps were set overnight, attached to mangrove prop roots and set low in the water column (Average depth = 1.05 m).
- Abiotic variables were measured with a YSI-85 unit at trap deployment.
- Isotope collections for the dry season occurred during a separate sampling event in March, while wet season isotope collections occurred during September and October 2008 (not analyzed yet).
- Isotope samples were placed on ice in the field and brought back to the lab for mass spectrometer analysis at the SERC Stable Isotope Laboratory at FIU. Prior to analysis, shrimp muscle was removed and dried at 60°C for 48 hours.
- Preliminary SI sample sizes for the dry season are n=25 (4 shrimp x 6 sites, with SRS 5 only having 1 shrimp). An additional 16 shrimp per site have been submitted for further isotope analysis from both the wet and dry seasons (total n=258).

HYDROLOGICAL CONDITIONS



• Yearly variation in salinity across the estuary from 2 USGS* and 3 ENP hydrological stations.

• Salinity is minimal at the marsh-mangrove ecotone, but varies significantly in the mid-estuary between the dry and wet seasons.

• Salinity variation is highest at Gunboat Island (GI), but decreases closer to the Gulf.

*Margin Land Ecosystem Study, U.S. Geological Survey. Contact Gordon Anderson or Thomas J Smith III for further information. Data is provisional and may require additional validation before final release.

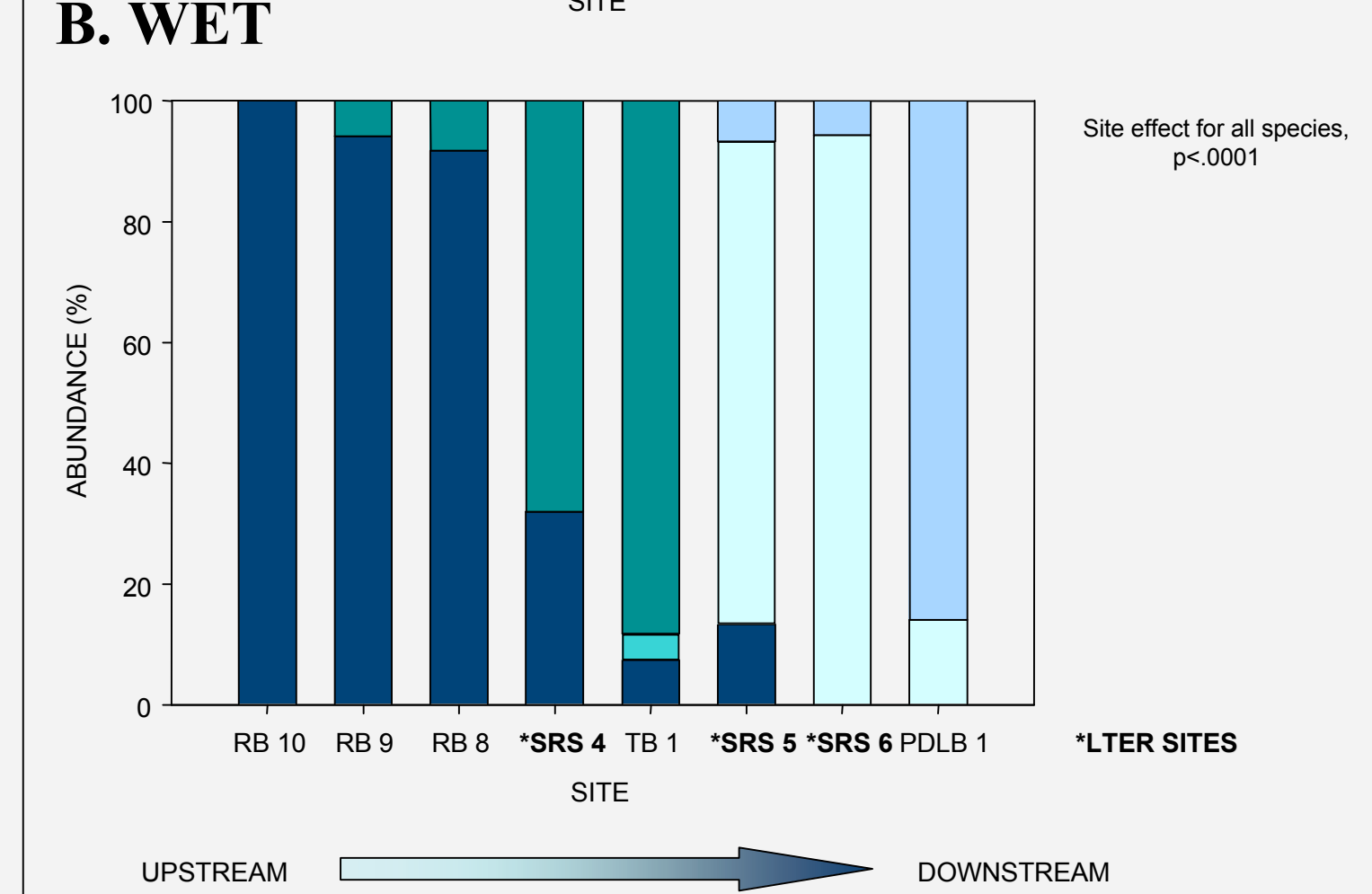
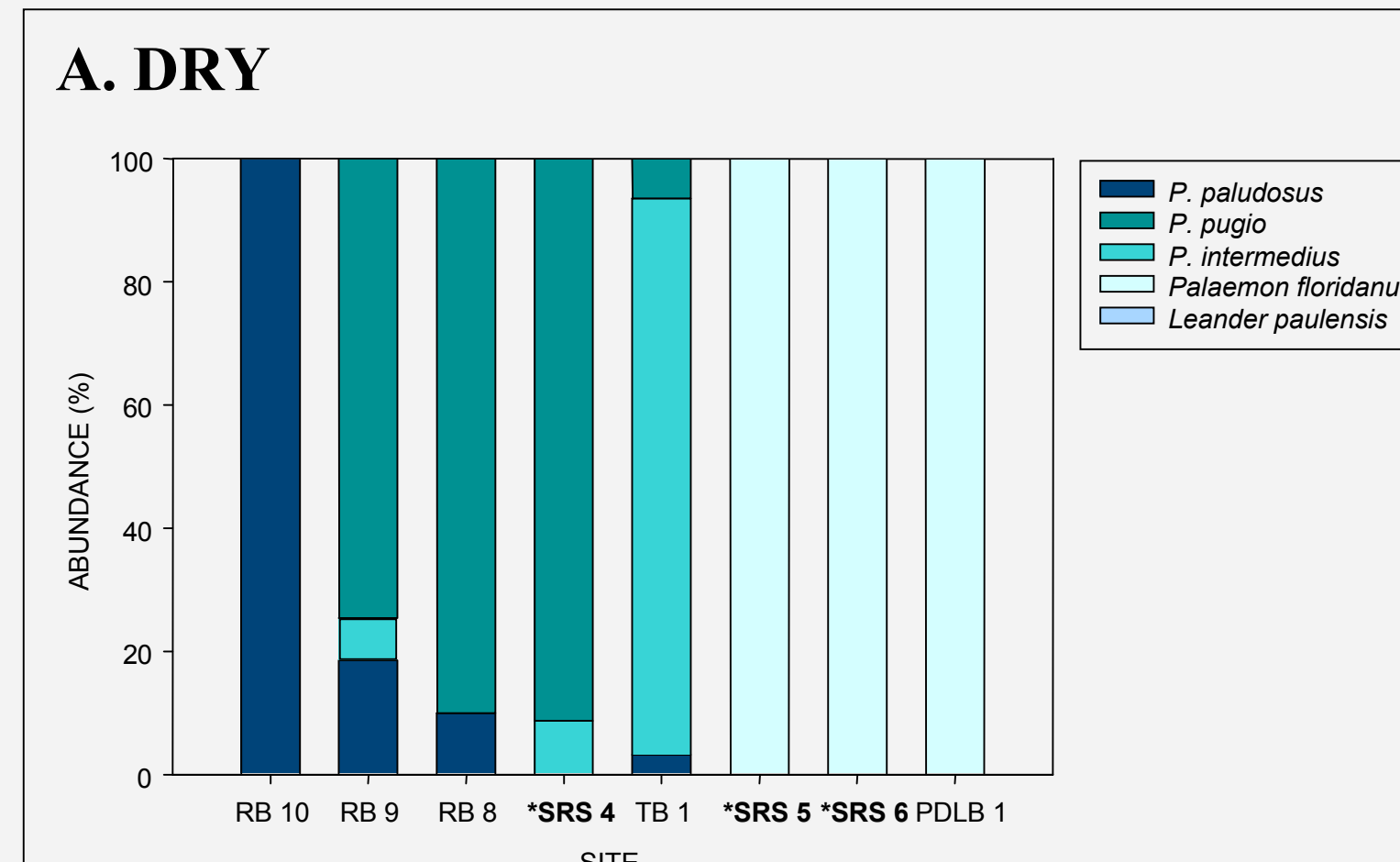
RESULTS

TABLE 1. Catch Per Unit Effort (CPUE) for all species during dry and wet seasons.

SPECIES	TOTAL CPUE	
	DRY (April and May)	WET (Sept. and Oct.)
<i>Palaemonetes paludosus</i>	843	242
<i>Palaemonetes pugio</i>	120	85
<i>Palaemonetes intermedius</i>	38	3
<i>Palaemon floridanus</i>	111	150
<i>Leander paulensis</i>	0	58
TOTAL	1,112	538

TABLE 2. ANOVA results examining variation in CPUE as a function of sites, season, sampling event, and covariates.

SOURCE	df	F	P VALUE
SITE	7, 601	11.55	<.0001
SEASON	1, 601	0.25	0.6147
SITE*SEASON	7, 601	7	<.0001
MONTH*SEASON	2, 601	7.87	0.0004
MONTH*SITE*SEASON	14, 601	9.74	<.0001
TRAP DEPTH	1, 601	0.4	0.5265
TEMPERATURE	1, 601	0.05	0.8212
DISSOLVED OXYGEN	1, 601	0.04	0.8471
SALINITY	1, 601	0.04	0.8387



Figs. 2A & B. Relative composition of palaemonid shrimp samples across sites during the (A) dry and (B) wet seasons. Composition varies seasonally: *P. paludosus* and *P. pugio* become more dispersed downstream during the wet season, whereas *P. intermedius* decreases and *L. paulensis* was only collected in the wet season.

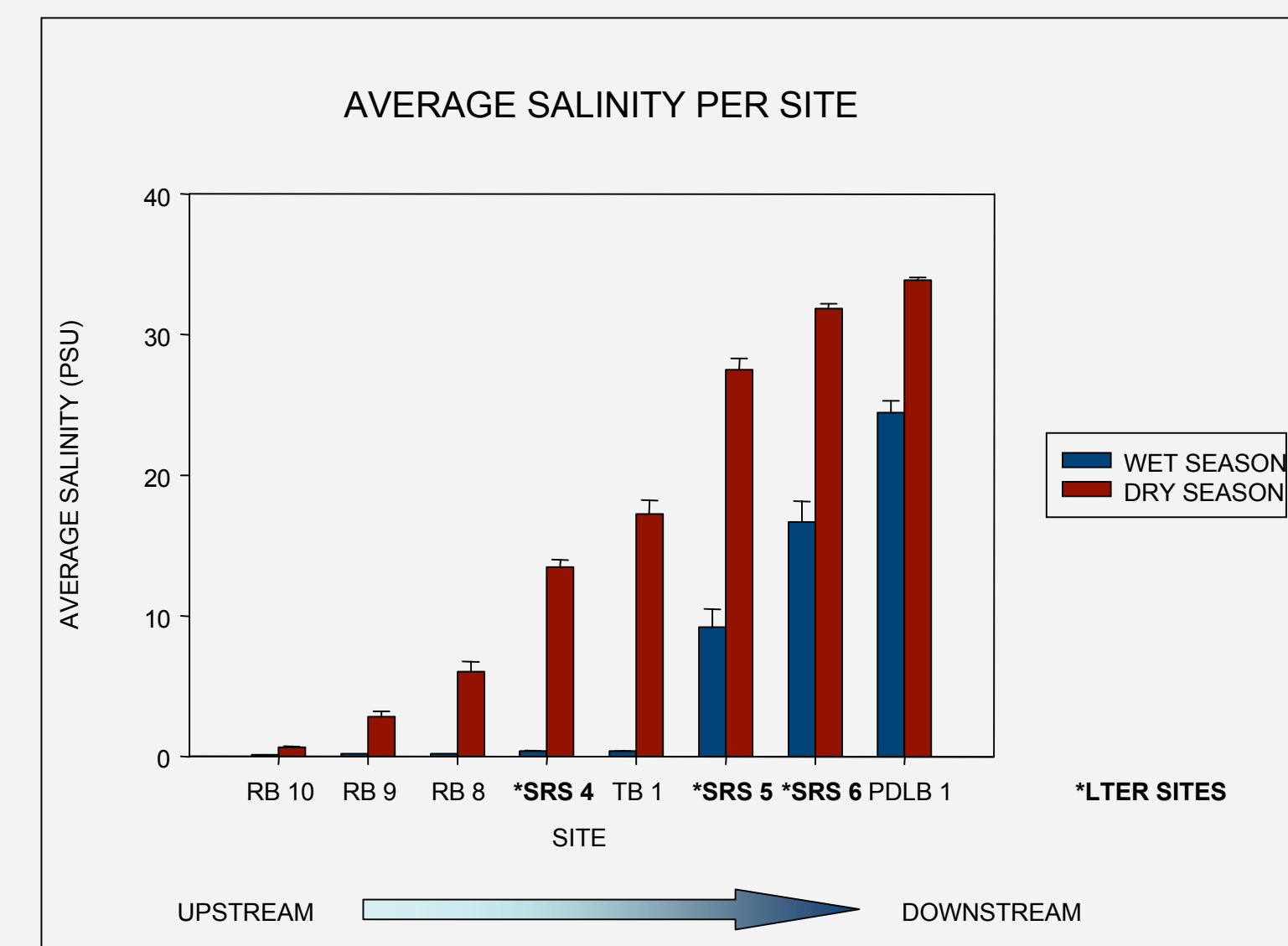


Fig. 3. Average salinity across sites and seasons. Salinity is higher in the dry season sample, and minimal at upstream sites in the wet season.

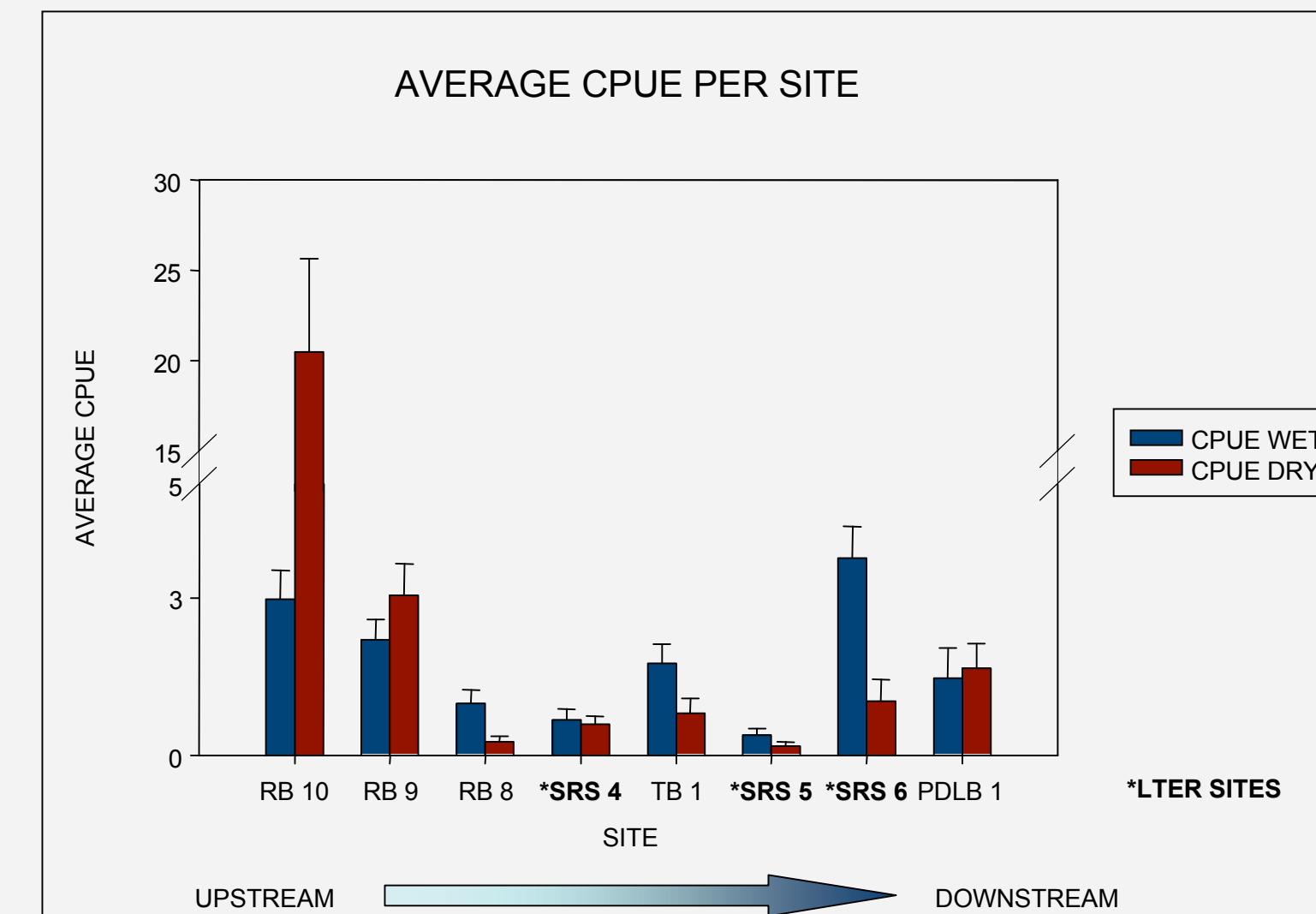
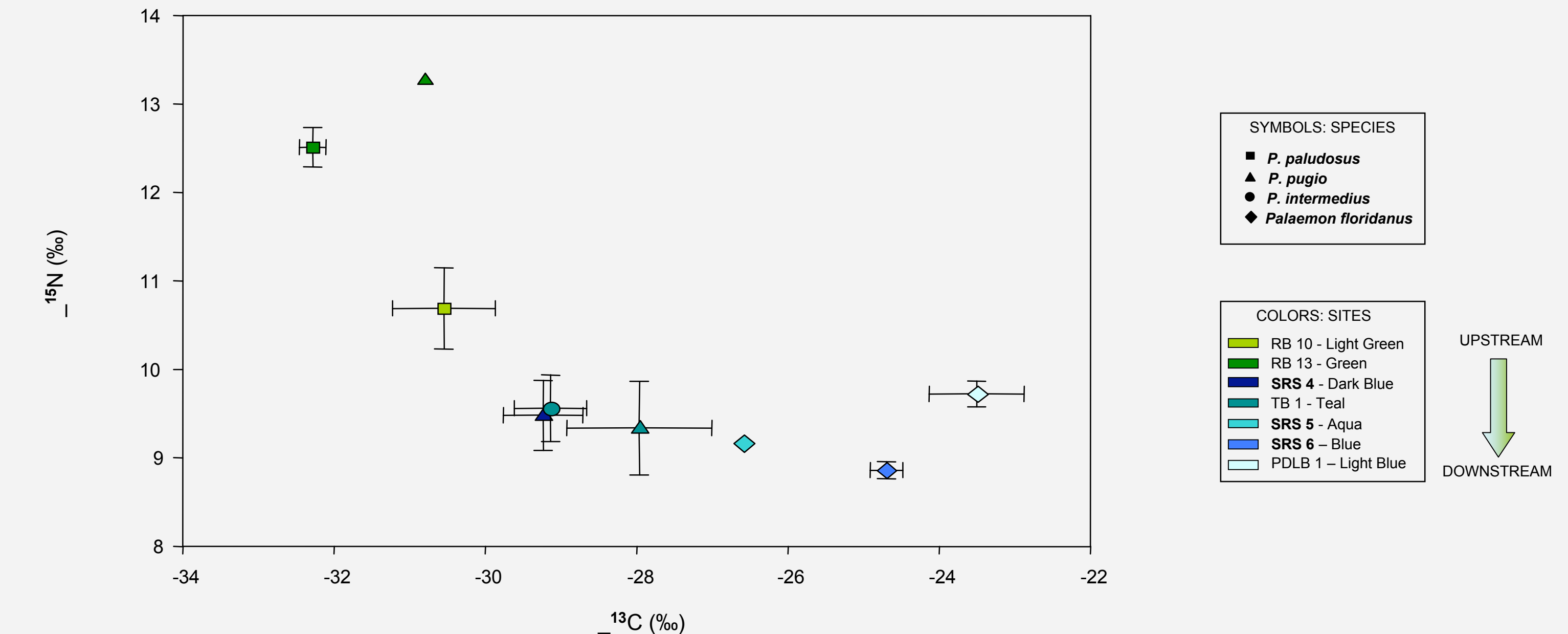


Fig. 4. Seasonal and site variation in trap CPUE. Variation was detected at half the sites. In the wet season CPUE is more evenly distributed across sites. In the dry season CPUE increases at the most upstream site but decreases elsewhere.

PRELIMINARY DRY SEASON STABLE-ISOTOPE RESULTS



• There is limited co-occurrence of species at each site, with most sites dominated by one species, making direct trophic placement comparisons between species difficult.

• ¹⁵N signatures from marine and estuarine sites show less than a 3‰ difference indicating that the species that occur in this region likely play similar roles in the community.

• ¹⁵N signatures from the ecotone are more enriched. These enriched ¹⁵N values may result from higher total Nitrogen in the freshwater portion of the Shark River estuary and connectivity to upstream freshwater inputs (Fry and Smith, 2002).

• ¹³C signatures show site variation, with upstream sites being more depleted relative to downstream sites which was also found by Cornett (2006) and Fry and Smith (2002).

• Competition for resources among these species is possible since many palaemonid shrimp ¹³C signatures exhibit less than 1‰ difference.

DISCUSSION

- Five palaemonid shrimp species occur throughout the Shark River estuary, and their distribution and abundance varies seasonally.
- CPUE is dominated by *P. paludosus*, particularly at upstream sites; the distribution of this common marsh species expands significantly downstream at low salinities in the wet season.
- At the downstream end of the estuary, composition is dominated largely by *Palaemon floridanus*. Multiple species co-occurred in the mid-estuary (i.e., Tarpon Bay).
- Salinity measurements had little explanatory power when examining variation in CPUE, and the same was true for the other physicochemical variables examined: dissolved oxygen, temperature, and trap depth. We suspect this is due to the fact that most of the species have broad salinity tolerances (*P. paludosus* 0-10, *P. pugio* 2-36, *P. intermedius* 1-20.4, and *Palaemon floridanus* 22-31 Williams (1984) Anderson (1985)).
- Preliminary stable isotope analyses suggest that shrimp species appear to play similar functional roles, especially at downstream sites. Patterns of N and C enrichment match those detected by previous studies, which are thought to result from variation in freshwater input and primary production across the estuary.

LITERATURE CITED

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