Examining Tuna Trophic Dynamics Using Stable Isotope Analysis: "The Hawaiian Template"

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Trophic Dynamics and Migration Behavior of Tuna in the Equatorial and Sub-Tropical Pacific.

$\delta^{13}C$ Values: Source Information

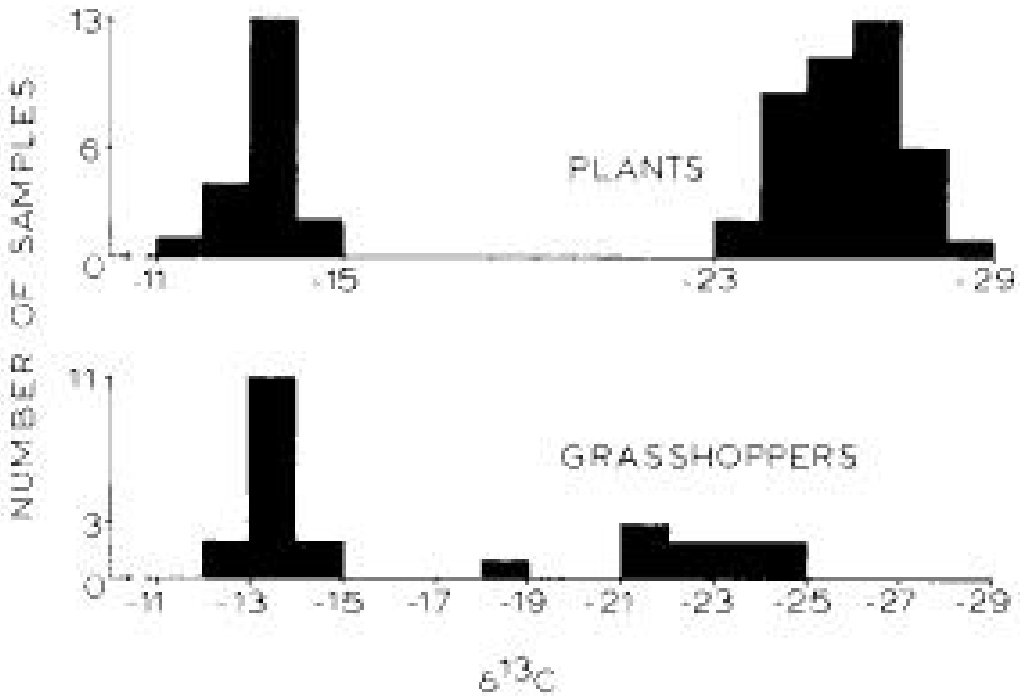
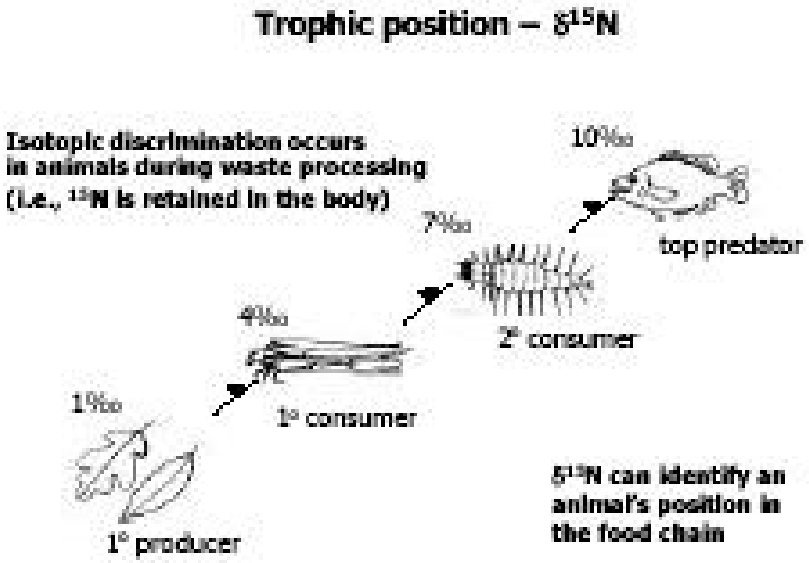


FIG. 1. $\delta^{13}C$ values of plants and grasshoppers at a West Texas study site. Values are expressed as ‰ (see text for explanation).

Fry et al. 1978

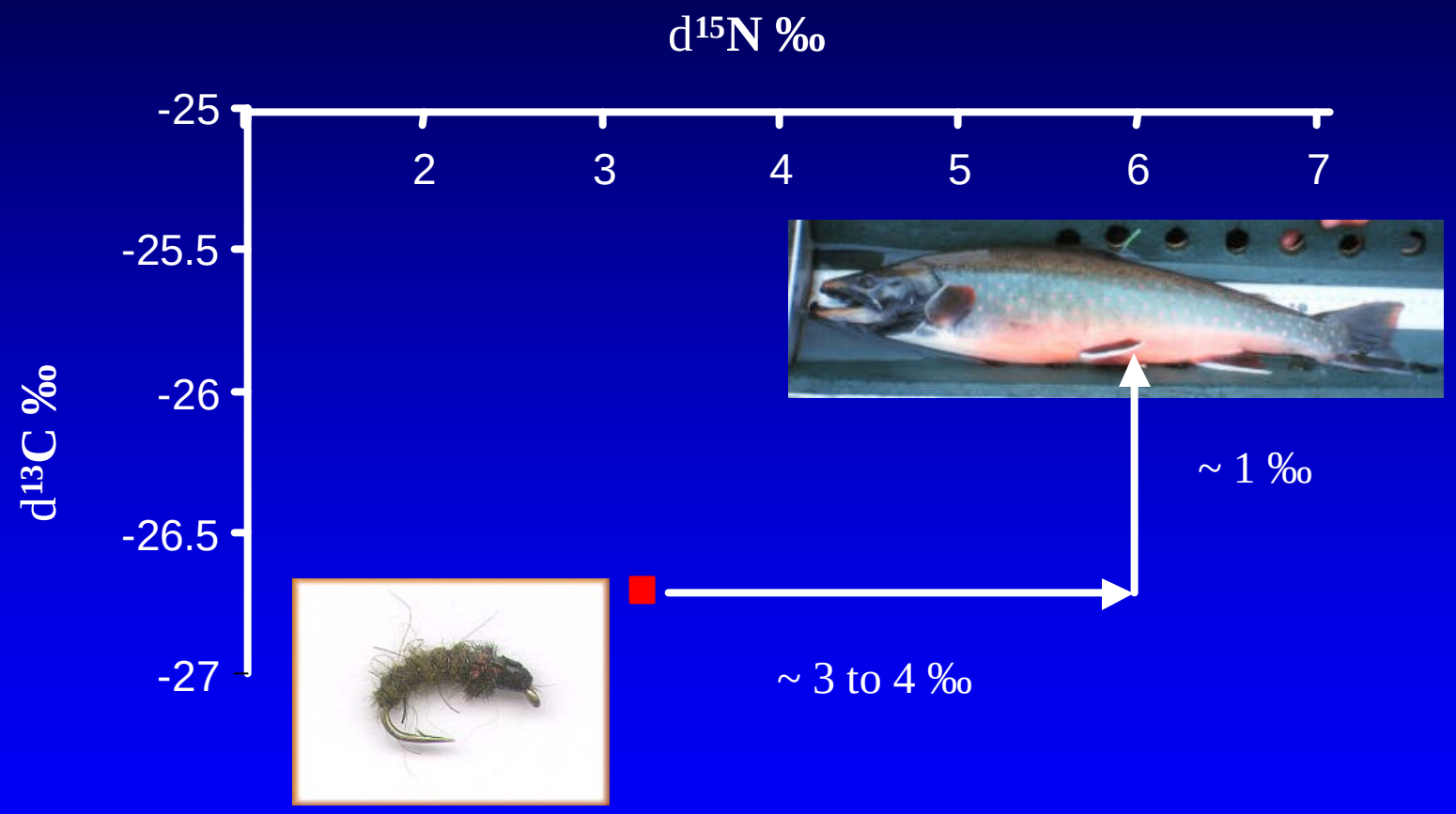
$\delta^{15}N$ Values: Trophic Information



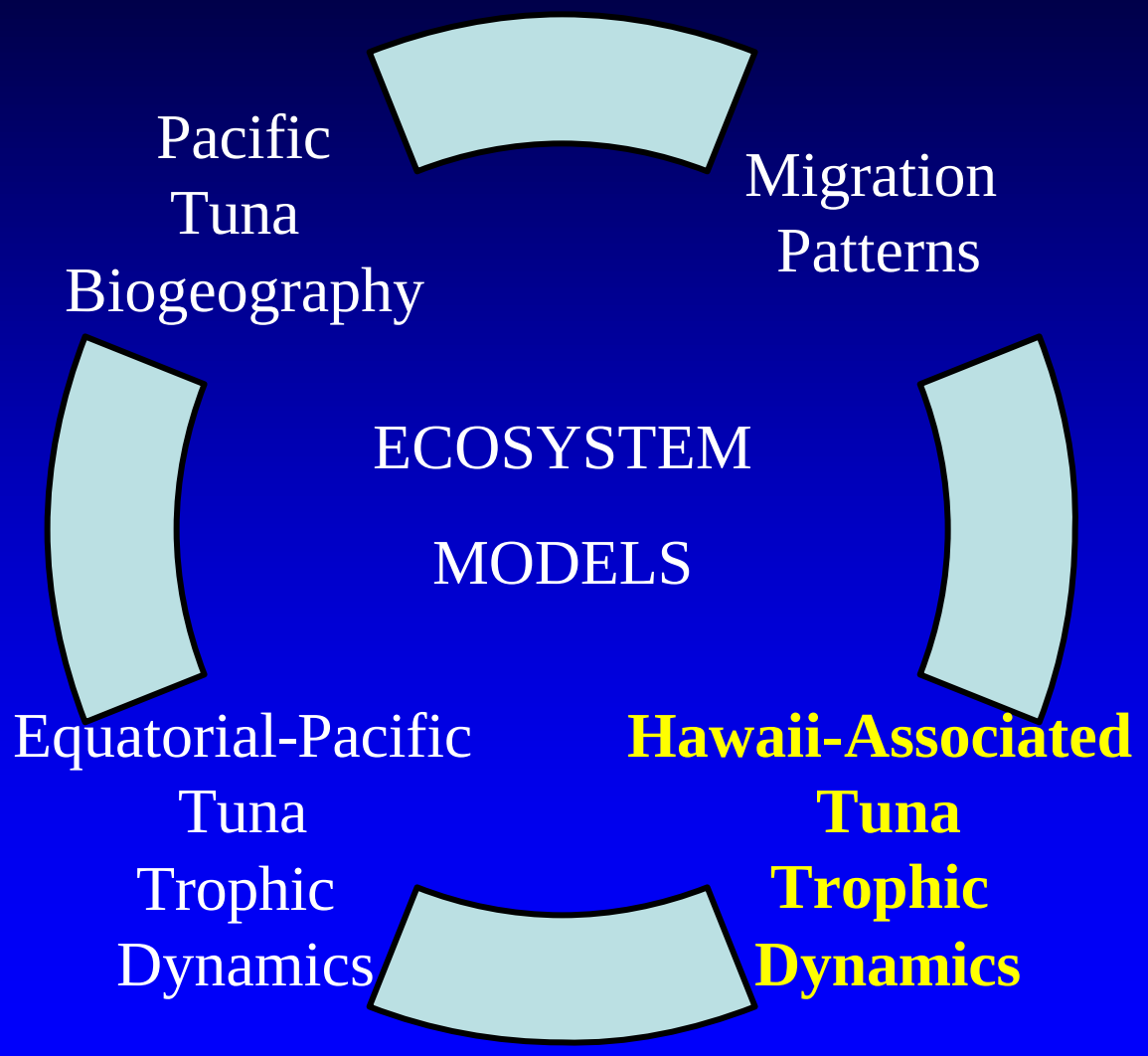
Courtesy of Dr. R. Doucett

"you are what you eat + 3 ‰"

An example: Southeast Alaska



Two PFRP Projects: The objectives



Hawaii-Associated Tuna Trophic Dynamics

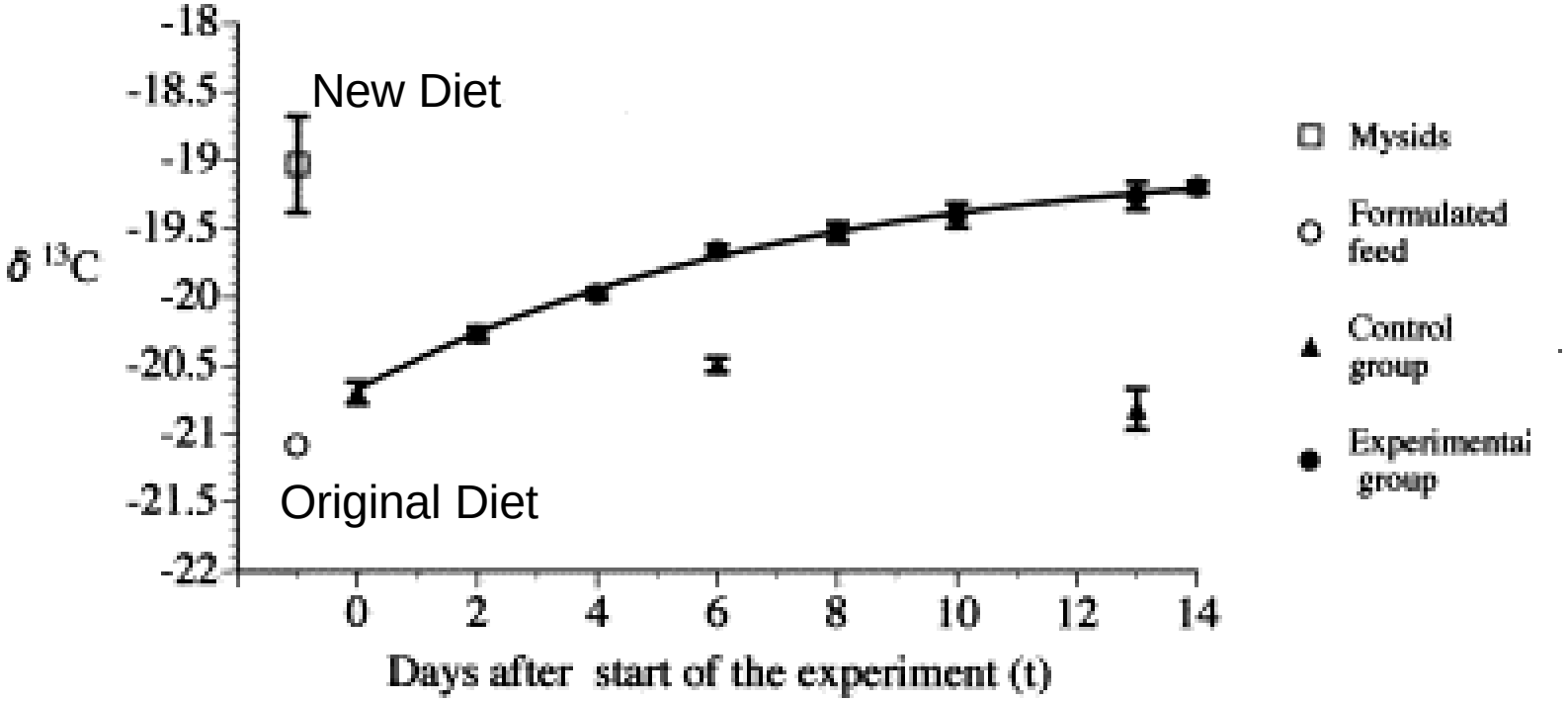
Measure *in situ* $\delta^{13}C$ and $\delta^{15}N$ to address:

- Individual Isotopic Variability
- Size or Ontogenic Variability
- Species differences
- FAD vs. Seamount Differences

Mesocosm Experiments/Feeding Trials:

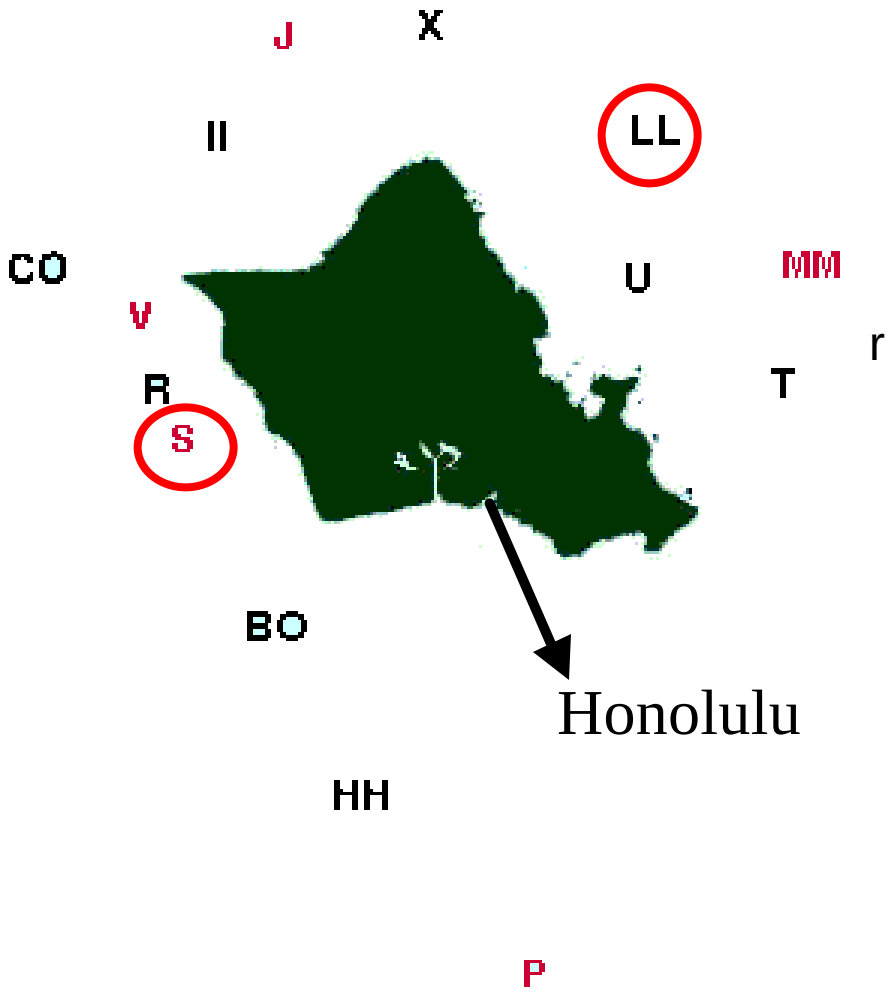
- Isotopic Pulse-Chase Experiments
  - Elucidate information on tissue turnover rates, metabolism, and tuna energetics.

Diet experiments: Revealing important isotopic information for trophic ecology studies.



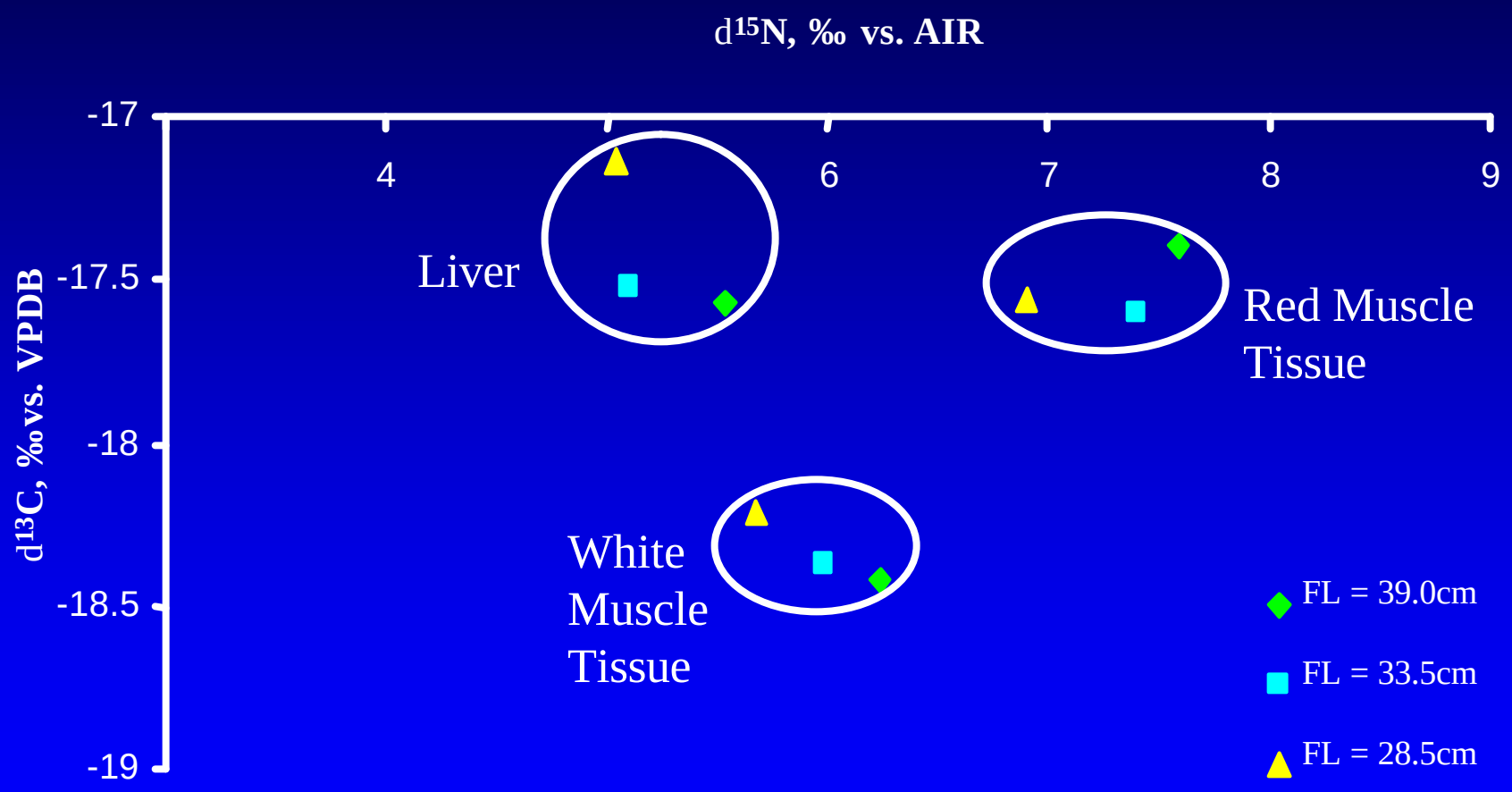
Tominaga et al. *In Press.*

Hawaii FAD Program

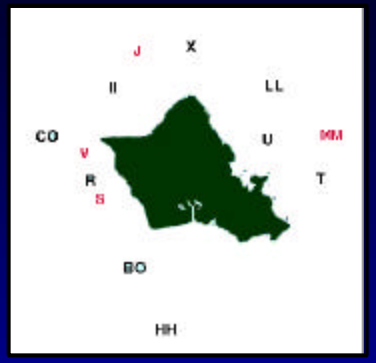


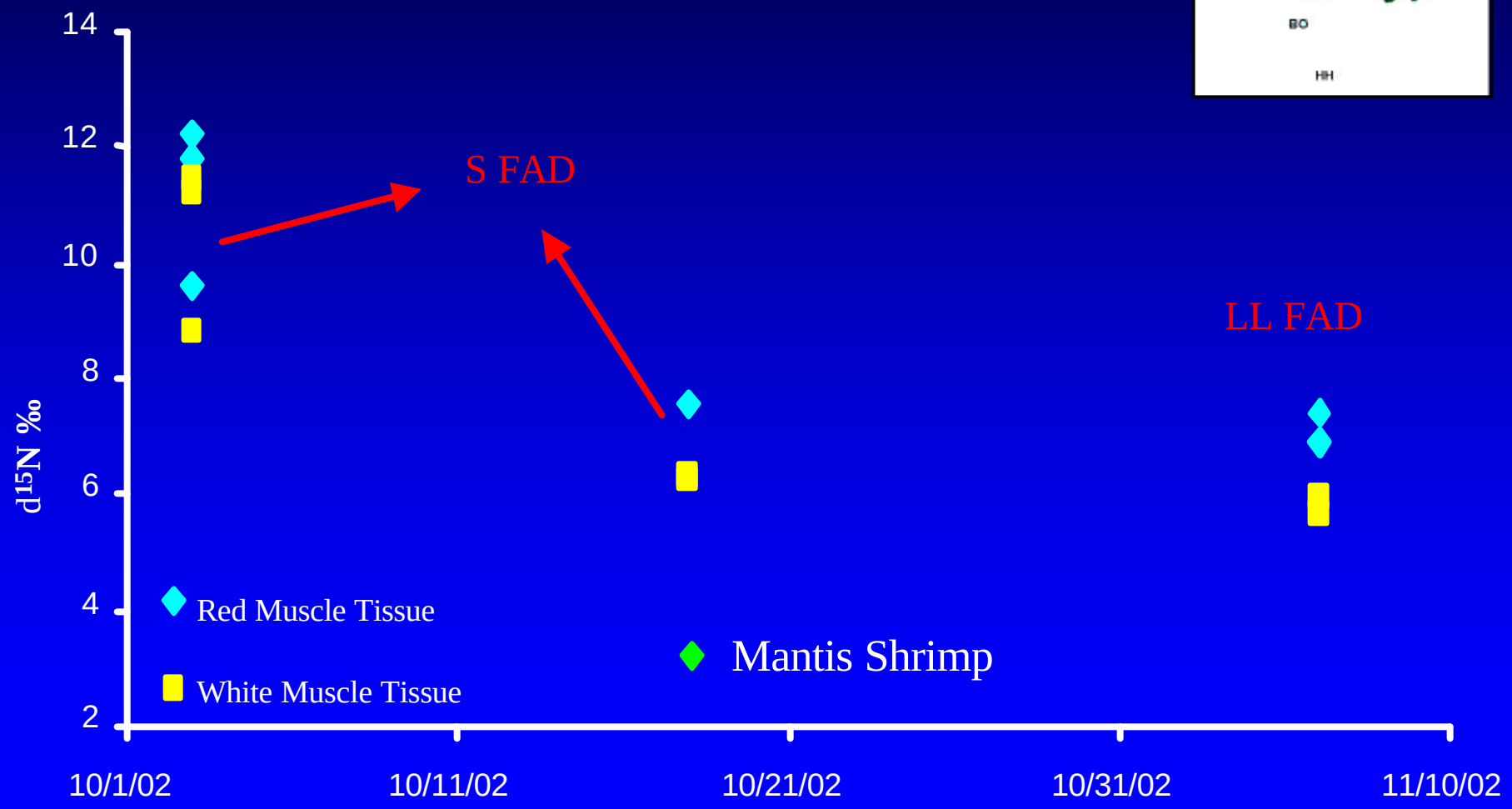
E. Hochberg

$d^{15}N$ vs. $d^{13}C$ of different tissue types in Hawaiian Yellowfin Tuna

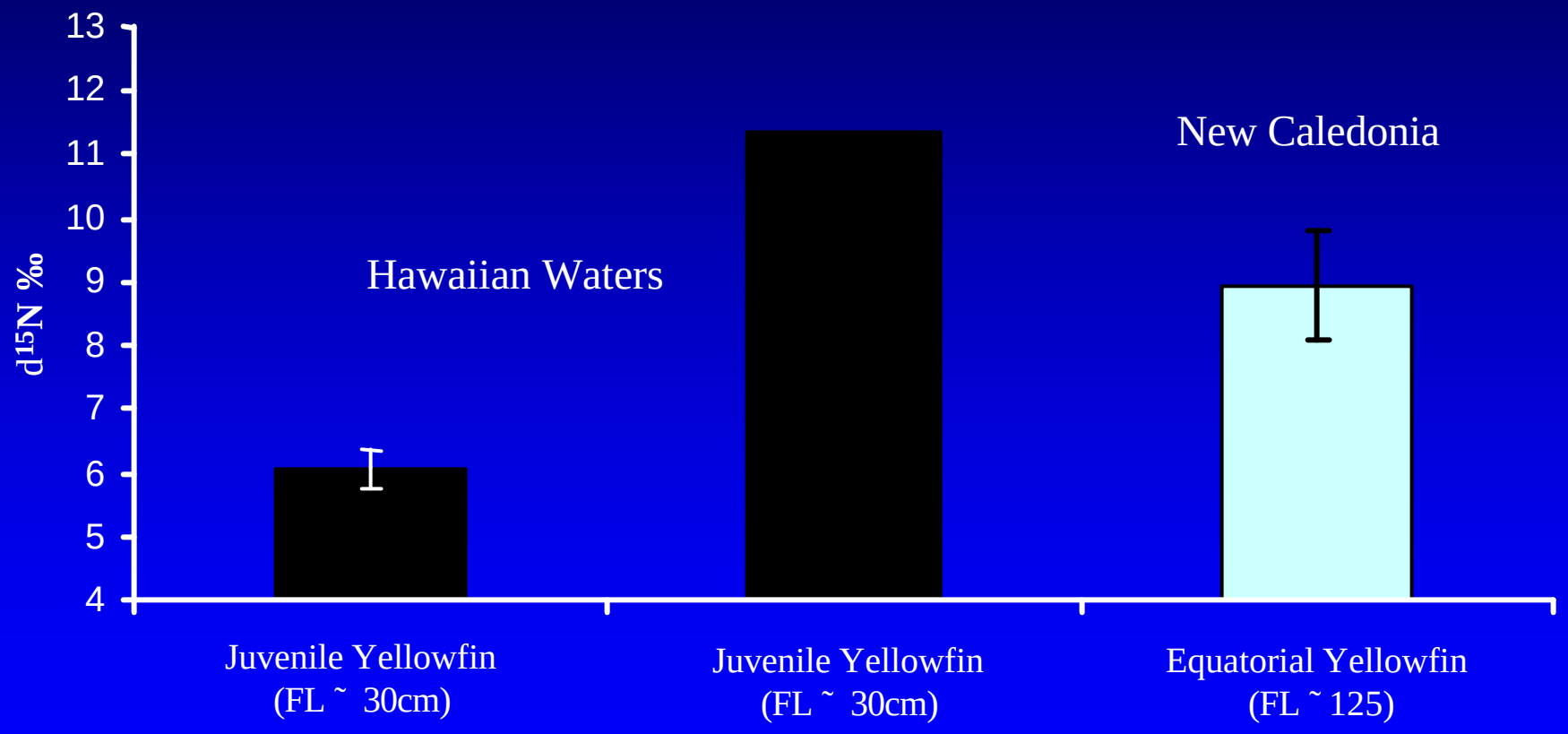


$\delta^{15}N$ of Yellowfin Tuna from Hawaiian FADs





$\delta^{15}N$ Variability Among Yellowfin Tuna



Future Research

Hawaiian Tuna PFRP Project

- Laboratory studies/Feeding experiments
- Systematic sampling of FADs and Cross-seamount
  - Sample one cohort over time?
- Analyze stomach contents of individuals

Future Research

Equatorial Pacific Tuna PFRP Project

Contrast tuna between non-upwelling and upwelling areas by:

- Characterizing the base of the food web (i.e. primary producers) and prey base in the two areas.
  - $\delta^{13}C$ and $\delta^{15}N$ of tissues
  - $\delta^{13}C$ of lipid classes (i.e. compound specific isotope analysis).
- Determine trophic relationships
- Characterize tuna movements based on isotopic signatures.