SHORT-TERM UPTAKE OF ^{15}N TRACER BY AUTOTROPHS AND GRAZERS IN A SEAGRASS BED

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INTRODUCTION

A major problem of global importance for coastal ecosystems is anthropogenic nitrogen enrichment via river runoff and submarine groundwater transport. To study the uptake of anthropogenic nitrogen and its movement through seagrass food webs, fertilizers simulating eutrophication that are either depleted (Mutchler et al. 2004) or enriched (Sullivan, Fry & Symonds unpublished) in the heavy isotope of nitrogen (^{15}N) have been used. Such studies have shown that seagrass leaves and benthic microalgae (epiphytic algae attached to seagrass leaves and those resident within sediments) may be differentially labeled, and that the label can be detected in consumer species occupying lower trophic levels. However, the time course of ^{15}N labeling of primary producers and lower level consumers has not been studied. Accordingly, we undertook a study to determine the short-term uptake of label by autotrophs and consumers in a seagrass bed.

METHODS AND MATERIALS

All field work was carried in an extensive, mixed seagrass bed at Turkey Point Shoal 3 km south of the FSU Coastal & Marine Laboratory containing approximately equal proportions of the seagrasses *Thalassia testudinum* Banks ex Koenig and *Syringodium filiforme* Kuetzing. Enrichment of the water column was achieved through placing 4 porous PVC tubes in a rectangular configuration about 2 cm above the sediment surface. Each tube contained 340 g of an NPK (15-5-10) fertilizer specially formulated [ammonium sulfate = nitrogen source] so that its stable nitrogen isotope ratio (☒^{15}N) was +1710 ‰. Fertilization tubes were placed in the seagrass bed on 22 August 2005 and samples were collected from 6 control sites (i.e. no fertilizer added) and 6 enriched sites 1, 2, 4, 10 and 17 days after enrichment commenced.

Fig. 1. *Thalassia testudinum* blades, rhizomes, roots, and Epiphytes

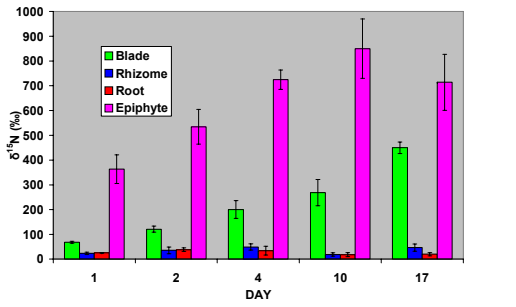


Fig. 2. *Syringodium filiforme* blades, rhizomes, roots, and Epiphytes

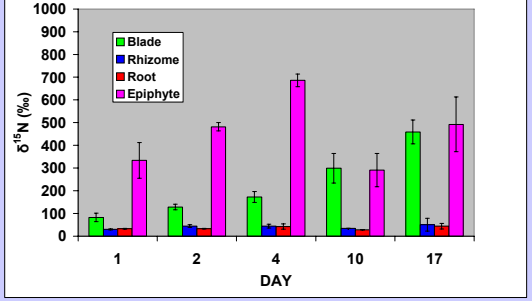


Fig. 3. SEDIMENT MICROALGAE (SMA)

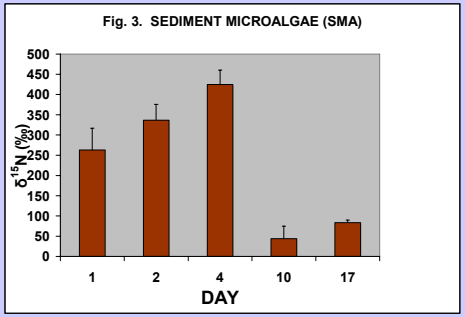
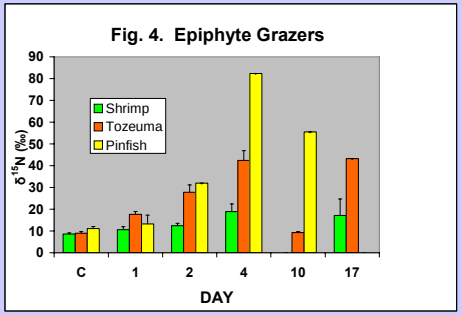


Fig. 4. Epiphyte Grazers



RESULTS

On day 1 mean ☒^{15}N values for epiphytes, seagrass leaves, and sediment microalgae (SMA) were 350 ‰, 75 ‰, and 260 ‰, respectively (see Figs 1-3). Natural or background ☒^{15}N values are 1 to 6 ‰. Epiphytes on *Thalassia* reached 850 ‰ on day 10 whereas *Syringodium* epiphytes had a maximum value of nearly 700 ‰ on day 4. Virtually all values for roots and rhizomes were between 20 and 50 ‰. *Tozeuma* (arrow shrimp) doubled its ☒^{15}N from a background (i.e. C values in Fig. 4) value of 9 ‰ to 18 ‰ on day 1 and reached a maximum of 43 ‰ on day 4, whereas pinfish collected on days 4 and 10 had values of 82 and 56 ‰, respectively.

CONCLUSIONS

The rapidity with which the label was taken up by the primary producers was unexpected but has been seen in other studies. In just 24 hours epiphytes many cm above the horizontally placed fertilizer tubes had ☒^{15}N values of 350 ‰ and reached 700 ‰ only 3 days later. This is consistent with results from flume experiments with *Thalassia testudinum* where the major removal of ^{15}N-labeled ammonium were the epiphytic algae rather than seagrass leaves or SMA (Cornelisen & Thomas 2006). In a perched dune lake ☒^{15}N values of attached benthic algae increased by an order of magnitude over background values after only 5 hours of water column enrichment (Hadwen & Bunn 2005). This suggests that any pulse of nutrients added to seagrass beds will be rapidly taken up by epiphytic algae and to a lesser degree seagrass leaves and SMA.

The significantly enriched values for arrow shrimp, pinfish, and to some degree brown shrimp were unexpected over such a short time frame and indicate rapid ingestion of benthic microalgae. More importantly, they suggest that at least the first two consumer species may have very small home ranges within a seagrass bed. Thus, a spin off of using ^{15}N labeling techniques may be to test for residency of seagrass faunal species.

REFERENCES

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Hadwen, W.L. & Bunn, S.E. 2005. Food web responses to low-level nutrient and ^{15}N-tracer additions in the littoral zone of an oligotrophic dune lake. *Limnology & Oceanography* 50:1096-1105.

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