THE ROLE OF HERBIVOROUS FISHES IN THE RECYCLING OF NITROGENOUS NUTRIENTS ON CORAL REEFS

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Herbivorous fishes, such as the parrotfishes (Scaridae, Sparidae) and surgeonfishes (Acanthuridae), are the largest and most mobile group of coral reef herbivores. As such they should be expected to have an important role in

the regeneration (and cycling) of nutrients from (and to) primary producers on coral reefs. These fishes are diurnally active, during which time they graze on macro and microalgae over much of the shallower fore-reef and back-reef zones. At night they sleep in shelters and in crevices predominantly in the deeper fore-reef zones. During their evening migration from the shallow high productivity grazing areas to their deeper sleeping areas they could potentially transport large amounts of inorganic and organic nitrogen, in the form of fecal material and excretory products, to the deep reef community.

To test this hypothesis, nocturnal defecation and excretion rates of seven species of herbivorous fishes were measured in situ during Hydrolab missions 83-10 and 84-6. Excretion of ammonia and of organic matter was measured by incubating fishes captured while sleeping on the deeper fore-reef (15m-25m), for periods of up to one hour duration in chambers made of PVC tubing. Nocturnal defecation rates were measured by placing similarly captured fishes overnight into covered buckets anchored onto the reef and filtering the contents of the buckets onto pre-combusted filters the next morning.

Ammonia excretion rates for the parrotfishes (five species) ranged from 276 to 1062 ng-at N per gm wet weight per hour during the first 15 minutes of incubation, but dropped to 126-1188 ng-at per gm wet weight per hour later during the incubations, probably as the fishes recovered from stress of capture. Ammonia excretion rates of the acanthurids were almost twice those of the parrotfishes, possibly reflecting a greater night-time level of activity.

Excretion of organic nitrogen, although variable, was up to four times greater than that of ammonia. Nocturnal defecation rates were about 1-2 gms dry weight per fish for the acanthurids, but the parrotfishes had negligible night-time defecation rates. These defecation rates were much lower than the gut content measurements made on fish speared just before dusk or early during the night.

Using nocturnal densities of herbivorous fishes measured during other missions, averaging 0.2 fish/m^2, we estimate that about 350 μg-at of ammonia N and 1000 μg-at of organic N will be excreted per m^2 per night. In addition, another 100-200 μg-at of N will be deposited as fecal material. Therefore, nocturnal excretion and deposition of nitrogen by herbivorous fish alone is enough to support a rate of primary production of 120-300 mg C per m^2 per day, depending on what C:N ratio is used. This amounts to 5%-10% of reported coral reef productivity rates. Since day-time excretion and defecation rates are bound to be many times greater, it is obvious that recycling of nutrients through herbivorous fishes is an important pathway in the nutrient dynamics of coral reefs.