

# TIME BUDGETS FOR NASSAU GROUPEL (*EPINEPHELUS STRIATUS*) ON LITTLE CAYMAN ISLAND

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*Abstract:* All animals must budget their time to maximize fitness. I studied Nassau Grouper behavior and time budgets in Jackson Bay, Little Cayman. I found that Nassau Grouper use their time differently throughout the day. Near dusk they spend most of their time searching for crustaceans, compared to morning and afternoon when they mostly hunt using a “sit-and-wait” strategy.

*Keywords:* territoriality, fish and crustacean predation

## INTRODUCTION

Effective time allocation is important to all animals and involves balancing energy use with energy intake. Those individuals that are more effective at budgeting their time will likely have higher fitness, passing these traits on to future generations. Often efficiency varies by time of day. Unlike many reef fish which may modify activities to avoid predation, adult Nassau Grouper (*Epinephelus striatus*) are one of the top predators and can generally move freely with little risk other than intraspecific aggression related to territoriality. Nassau Groupers are generalist predators with a diet of ca. 54% fish, with the remainder mostly crustaceans (Randall 1967). They feed throughout the day but mostly in the early morning and at dusk (Sadovy et al. 1999). Little Cayman has one of the last viable populations

of Nassau Grouper in the Caribbean, thus making Little Cayman an ideal area for research on the species.

I predicted that Nassau Grouper would allocate their time differently throughout the day, spending morning and dusk mostly searching and midday sitting and waiting (see definitions of behaviors in Methods, below).

## METHODS

I measured Nassau Grouper time budgets on 6-8 March 2008 at 8:00, 11:00, 16:30 in Jackson Bay, Little Cayman. At each sampling period, I located a single adult Nassau Grouper and recorded its behaviors for one hour. For each sample I followed a separate individual, identified by the patterning on its body, especially the spotting within the stripes. I grouped behaviors into five categories:

swimming, drifting, searching, sitting, and cleaning. Only sustained, directed swimming events used to change location were recorded as "swimming" (short swims were disregarded). I defined drifting as slow movement among sea fans or other objects with little or no tail movement, staying in one location only briefly. Searching was defined as actively looking underneath various rocks, caves, or crevices. I defined sitting as remaining stationary for more than several minutes, apparently in the classic 'sit-and-wait' behavior of many predatory fish. Cleaning was defined as waiting or being actively cleaned at a cleaning station. Behaviors were recorded only if they occurred in periods of one minute or longer. I also collected detailed observational data documenting predation events, territorial displays, approximate fish size, repeated sightings, and total distance moved. The frequency of each behavior was tested with chi-squared tests, comparing to a null model assuming no temporal partitioning.

## RESULTS

Grouper behaviors varied by time of day ( $X^2 = 50.9$ ,  $df = 8$ ,  $P < 0.001$ ). The differences were driven primarily by the dusk measurements; there was no significant difference between morning and midday in time spent

sitting ( $X^2 = 0.996$ ,  $df = 1$ ,  $P = 0.32$ ) or searching ( $X^2 = 1.88$ ,  $df = 1$ ,  $P = 0.17$ ). Searching was significantly more frequent at dusk ( $X^2 = 24.3$ ,  $df = 2$ ,  $P < 0.001$ ). While there were no significant differences between fish behavior at midday and morning, groupers spent 53% of their time sitting at midday and only 41% sitting during the morning. In contrast to the morning, 63% of dusk samples were spent searching (Table 1). Little time was spent swimming, being cleaned, or drifting in any time period.

Table 1. Proportion of time spent on various activities for Nassau Grouper in Jackson Bay, Little Cayman. Data from seven one-hour sampling periods and one 30 min. sample.

Activity	Morning	Midday	Dusk
Cleaning	24%	17%	12%
Drifting	3%	10%	13%
Searching	24%	13%	63%
Sitting	41%	53%	7%
Swimming	8%	7%	5%
<b>Totals</b>	100%	100%	100%

I noted six predation events during the 7.5 hours of observation; four were successful. During searching behavior at dusk, groupers consumed one crab and part of one spiny lobster. There was one successful attack on a fish, while sitting at midday. Additionally one cleaner fish was consumed after being cleaned at a cleaning station during a midday sample. While drifting, two unsuccessful attacks occurred; the first on a large parrotfish in the morning and the

other on a small barracuda at midday.

Most groupers moved < 100m during a the observation period, but the largest fish sampled moved hundreds of meters along the reef parallel to the shore during the hour of monitoring. There were also many territorial displays with the larger fish always winning the dispute.

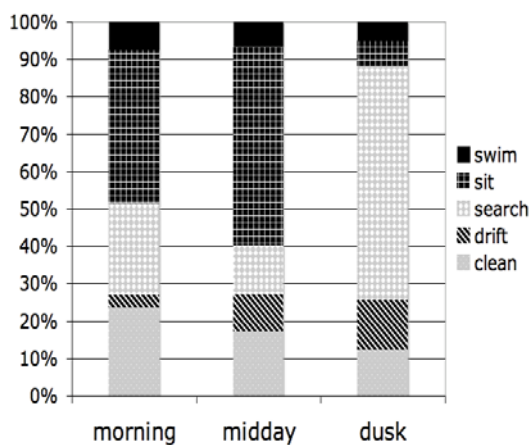


Figure 1. Time budgets for Nassau Groupers at Jackson Bay, Little Cayman Data from seven one-hour bouts and one 30 min. bout.

## DISCUSSION

Nassau groupers allocate their time differently throughout the day, possibly to maximize foraging efficiency. It appears they take advantage of dusk to hunt nocturnal crustaceans such as spiny lobsters as they emerge from hiding.

I was unable to assess behavior in the early morning hours; possibly dawn and dusk behaviors may be similar, though based on my

data morning behaviors do not differ from those at midday. Nassau groupers may be acquiring nearly half of their food in the hour or two before sunset, leaving the rest of the day to hunt for fish, etc.

It is likely that the energy expended searching for crustaceans has the greatest payoff at dusk. Since searching is likely more energetically costly than sitting and drifting, the net energy gain of crustacean and fish predation may be similar.

While searching and sitting make up the majority of their time swimming, drifting and cleaning are also major uses of time. Swimming may be costly and thus only used when it is necessary to move to another area. Drifting appeared to be used opportunistically as a passive hunting strategy while the individuals were moving around the reef, essentially resting. Cleaning seemed to be relatively similar at all times of day.

## REFERENCES

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