Overgrazing by Green Turtles?

Exceeded carrying capacity of an Indo-Pacific seagrass meadow

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Introduction

Numbers of the green turtle (*Chelonia mydas*) rapidly declined over the last 30 years. One of the few remaining sites where high densities of green turtles are found is the island of Derawan (East-Kalimantan, Indonesia), where they feed on a ***Halodule uninervis*** dominated seagrass meadows. The turtles feeding on this location show **two unique grazing styles.** Because turtle conservation efforts in the area are high, there is an **urgent need for data on the number of sea turtles that the seagrass meadows can support.**

Turtle census

Turtle density within 10 m on either side of a canoe was surveyed using line transects (±367m). There was **no significant relation between the number of turtles and weather, water depth, tide, and time of day.**

average density = 15.4 turtles ha^{-1} (SE = 2.2)

Methods 'Digging'

'Digging' = grazing on leaf, rhizome & root

Consumption through 'digging'

During 34 days, all new grazing patches in three transects (10*50 m) were measured and marked.

grazed biomass = area grazing patches · standing stock

Regrowth after 'digging'

The biomass grown in 5 caged (naturally grazed) patches after 29 days was harvested.

digging regrowth rate = biomass / #days

Methods 'Snacking'

'Snacking' = grazing on leafs

Consumption through 'snacking'

Leaf biomass after 21 days was compared between five caged and five uncaged plots.

snacking = leaf biomass caged plots – leaf biomass uncaged plots

Regrowth after 'snacking'

Leaf biomass in five caged plots (2.25 m^2) was monitored over a period of 63 days, while snacking was mimicked every two weeks.

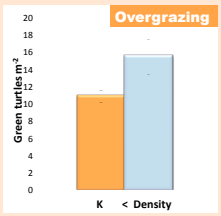
snacking regrowth rate = biomass$_t$ - (0.25·biomass$_{t-1}$) / #days

(0.25 = rest fraction leaf biomass after snacking)

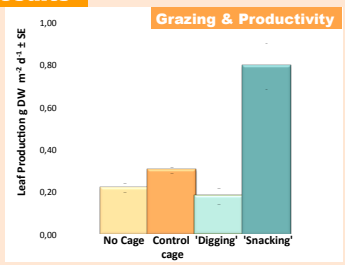
Results

	'Digging'	'Snacking'
Consumption per turtle	90.07 g DW d^{-1}	335.24 g DW leaf d^{-1}
Regrowth	0.17 g DW d^{-1} m^{-2}	0.79 g DW leaf d^{-1} m^{-2}
Foraging area per turtle	526 m^2	405 m^2

Total carrying capacity (K) = 930 m^2 turtle^{-1} = 11 turtles ha^{-1}



Results



Maximum standing leaf biomass	
No Cage	11 g DW leaf m^{-2}
Control Cage	19 g DW leaf m^{-2}
'Digging'	15 g DW leaf m^{-2}
'Snacking'	15 g DW leaf m^{-2}

Conclusions

- ★ The carrying capacity of the Derawan seagrass meadow for the green turtle is 11 turtles ha^{-1}. At present, turtle density at Derawan is 15 turtles ha^{-1}. The **carrying capacity is exceeded by 40%** (4 turtles ha^{-1}). This could indicate that the **foraging grounds of Derawan are overgrazed**.
- ★ Green turtles at Derawan show a unique grazing type „**Digging**", where selective feeding of whole seagrass plants, including roots and rhizomes is displayed. The **search for these alternative nutrient resources** could be explained by low standing biomass of seagrass leafs.
- ★ The local carrying capacity is increased by "Snacking" of turtles. "**Snacking" increases seagrass (leaf-) productivity** by factor 2.5 and therefore provides a **positive feedback.**

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