

STOMACH CONTENT IN RELATION TO SHELL LENGTH, WIDTH, AND WEIGHT OF THE GASTROPOD *TROCHUS NILOTICUS* L.

Eddy Soekendarsi, Alex Palinggi & Slamet Santosa

Biology Department, Hasanuddin University, Ujung Pandang 90245, Indonesia

ABSTRACT

The stomach content of 66 individuals of *Trochus niloticus* contained 42 potential food taxa. The composition reflected that the snails had grazed on the surface of dead corals. Chrysophyta, Chlorophyta, Rhodophyta, Foraminifera, Cyanophyta, and settled pelagic organisms were mixed with a large quantity of detritus and sand. The snails measured 2.3-11.9 cm in shell length, 2.6-12.3 cm in shell width, 0.93-84.82 g in soft body wet weight, and the weight of stomach contents was 0.03-10.09 g.

The relationship between shell length and weight of stomach content was $y=0.0373 \exp(0.5003x)$, $r=0.91$; between shell width and weight of stomach content: $y=0.0325 \exp(0.4974x)$, $r=0.92$, and between soft body wet weight and weight of stomach content: $y=0.1793 + 0.0785x$, $r=0.97$.

INTRODUCTION

Trochus niloticus L., 1758 is a grazer, feeding on films of diatoms and other microalgae on flat surfaces (Shokita *et al.* 1991). But, more detailed information regarding natural food sources is lacking, so it is difficult to estimate the degree of resource overlap (competition for food) in the diverse communities of grazers living in coral reef areas. A first estimate can be obtained from studies of stomach content, although the snails obviously also ingest items without food value.

In addition, knowledge on food sources may be useful for the future cultivation of *Trochus* in Indonesia. Appropriate microalgae can be grown in culture and good locations for sea ranching of *Trochus niloticus* may be easier to identify in nature.

In this investigation we also estimate the relationship between the quantity of ingested food and the length, width, and weight of the soft body of *Trochus niloticus*.

MATERIALS AND METHODS

The investigation was carried out in the southern part of Sulawesi from March to May 1996. A total of 66 *Trochus niloticus* were sampled in habitats of sea grass, sand among coral, and on stony coral. Of this material, one collection of 24 individuals was

obtained by snorkelling and diving (2-14 m depth) on a coral reef location between Bira and Liukang Island (southern part of Bulukumba regions, ca. 150 km from Ujung Pandang, South Sulawesi).

Length and width of shells were measured in the field. The snails were preserved in 5 % formalin in saline water. The weight of soft bodies was measured, the stomachs dissected, and the content identified in the laboratory at Hasanuddin University.

Literature used for identification was Shiota (1966), Cushman (1970), Postuma (1971), Taylor (1972), Oemarjati & Wisnu (1990), and Yudianto (1992). Some material was sent to Aarhus University, Denmark, for verification by Dr Lisbeth Mathiesen. Data were analysed by covarians analysis (Sokal & Rohlf 1981).

RESULTS

Stomach content

The stomachs of *Trochus niloticus* contained a variety of benthic and pelagic material as shown in Tab. 1. Sand, detritus and *Sagitta* sp. were present in all stomachs while 41 living taxa were represented to a rather variable degree. Yet, Rhodophyta were found in most stomachs.

Table 1. Identified taxa and percentage of *Trochus niloticus* stomachs containing the identified food taxa.

Stomach contents	Frequency (%)
CHRYSOPHYTA	
<i>Navicula</i>	52.6
<i>Pleurozigma</i>	31.5
<i>Amphora</i>	36.8
<i>Synedra</i>	68.4
<i>Thalassiotrix</i>	73.6
<i>Tabellaria</i>	57.8
<i>Diatoma</i>	47.3
<i>Nitzschia</i>	89.4
<i>Biddulphia</i>	31.5
<i>Triceratium</i>	21.0
<i>Chaetoceros</i>	15.7
<i>Asteromphalus</i>	15.7
CHLOROPHYTA	
<i>Pediastrum</i>	78.9
<i>Echinospherella</i>	52.6
<i>Treubaria</i>	26.3
<i>Tetradron</i>	26.3
<i>Staurastrum</i>	42.1
<i>Cosmarium</i>	31.5
<i>Closterium</i>	31.5
CHYANOPHYTA	
<i>Oscillatoria</i>	47.3
<i>Lyngbya</i>	78.9
RHODOPHYTA	
<i>Gelidium</i>	94.7
<i>Gracilaria</i>	89.4
<i>Corallina</i>	89.4
PROTOZOA	
<i>Tretomphalus</i>	63.1
<i>Amphistegina</i>	21.0
<i>Elphidium</i>	10.5
<i>Nonionella</i>	15.7
<i>Baculogypsinoidea</i>	10.5
<i>Calcarina</i>	52.6
<i>Bolivina</i>	31.5
<i>Trifarina</i>	15.7
<i>Quinqueloculina</i>	5.2
<i>Miliolina</i>	36.8
<i>Bigenerina</i>	15.7
<i>Arcella</i>	31.5
<i>Tintinnopsis</i>	52.6
<i>Lacrymaria</i>	52.6
<i>Peridinium</i>	15.7
<i>Ceratium</i>	26.3
PORIFERA	
<i>Leucosolenia</i>	84.2
CHAETOGNATHA	
<i>Sagitta</i>	100.0
DETRITUS	100.0
SAND	100.0

Measurements

A total of 66 individuals of *T. niloticus* were sampled during the investigation. Measurements of these snails ranged from 2.3-11.9 cm in length, 2.6-12.3 cm in width, 0.93-84.82 g wet weight of soft body, and 0.03-10.09 g wet weight of stomach content.

Calculated relationships

Relationship between stomach content and length of shell. A positive relationship (exponential regression) between stomach content and shell length was calculated: $y=0.0375 \exp(0.05003x)$, $r=0.91$ ($p<0.01$) (Fig. 1).

Relationship between stomach content and shell width. A positive relationship (exponential regression) between stomach content and shell width was calculated: $y=0.0325 \exp(0.4974x)$, $r=0.92$ ($p<0.01$) (Fig. 2).

Relationship between stomach content and wet weight of flesh. Statistic analysis of the relationship between stomach content and wet weight of flesh showed a positive linear regression: $y=-0.1793+0.0785x$, $r=0.97$ ($p<0.01$) (Fig. 3).

DISCUSSION

The stomach content of *Trochus niloticus* showed that a variety of benthic detritus, benthic microalgae, and benthic macroalgae could be found. Most of this material could serve as food, but some material, such as Foraminifera, Porifera, Chaetognatha, and sand would have no, or very little, food value.

According to Asano (1940), *T. niloticus* is a herbivorous gastropod that grazes on algae and seagrass. He found that stomachs contained 20 species of Cyanophyceae, Bacillariophyceae, Chlorophyceae, Phaeophyceae, Rhodophyceae, and a small portion of Foraminifera, spicula of Porifera, eggs of *Liolophura*, larvae of Gastropoda, larvae of Pelecypoda, and sand.

Kubo (1991) investigated the faeces of *Trochus niloticus*. He found that 80 % of the faeces contained microalgae and diatoms.

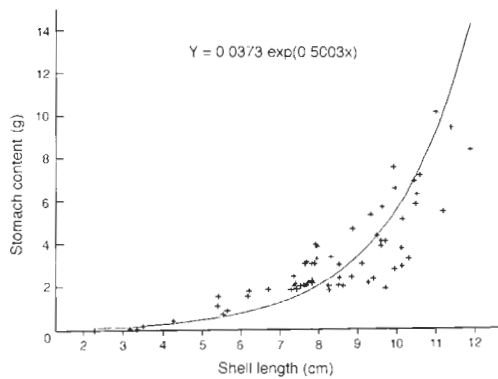


Figure 1. Relationship between stomach content and shell length of *Trochus niloticus*.

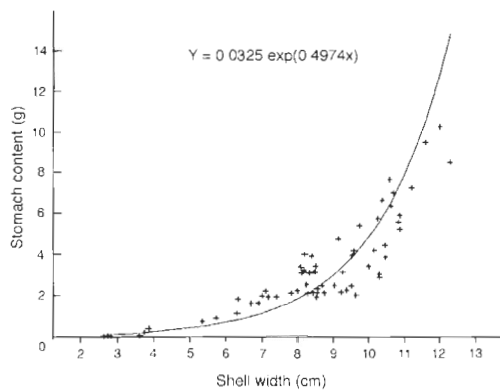


Figure 2. Relationship between stomach content and shell width of *Trochus niloticus*.

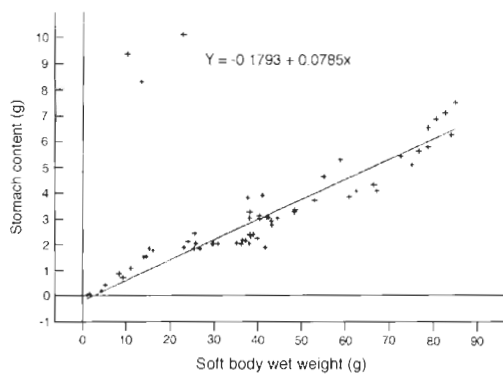


Figure 3. Relationship between stomach content and wet weight of soft body of *Trochus niloticus*.

The relationships between stomach content and length and width of shells displayed the same pattern. These findings were expected, because the growth of the shell and soft body should be matched by the growth of stomachs (Hatta 1992).

ACKNOWLEDGMENTS

We are grateful to Prof Jorgen Hylleberg for reading the manuscript; to DANIDA for making the 8th TMMP Workshop possible, and to Prof Dr Sumali Wiryowidagdo, Post Graduate Director, Hasanuddin University for general support.

REFERENCES

- Asano, N. 1940. On The Growth of Top Shell. Tokyo. - Journal of Fisheries **35**(4): 6 pp.
- Cushman, J.A. 1970. An Illustrated Key To The Genera Of The Foraminifera. Sharon, Massachusetts, United State Of America, 459 pp.
- Hatta, M. 1992. Studi Kemungkinan Budidaya Kerang Lola (*Trochus niloticus*) Ditinjau Dari Makanan Dan Habitat Serta Beberapa Aspek Biologis Dan Ekologi Lainnya Di Perairan Pantai Desa Bojo Kabupaten Barru. Karya Ilmiah Bidang Aquakultur. Fakultas Peternakan UNHAS, Ujungpandang, 58 pp. (in Indonesian).
- Kubo, H. 1991. Top Shell (*Trochus niloticus*) and Turban Snail (*Turbo argyrostomus*). Aquaculture in Tropical Areas. Midori Shobo, Tokyo, 14 pp.
- Oemarjati, B.S. & W. Wisnu. 1990. Taksonomi Avertebrata. Pengantar Praktikum Laboratorium, Penerbit Universitas Indonesia, Jakarta, 87 pp. (in Indonesian).
- Postuma, J.A. 1971. Manual of Planktonic Foraminifera. Elsevier Publishing Company, Amsterdam, London, New York, 556 pp.
- Shirota, A. 1966. The Plankton of South Vietnam. Midori Shobo, Tokyo, 287 pp.
- Shokita, S., K. Kakazu, A. Tomori & T. Toma. 1991. Aquaculture in Tropical Areas (English edition by M. Yamaguchi). Top Shell (*Trochus niloticus*) Green Snail (*Turbo marmoratus*) and Turban Snail (*Turbo argyrostomus*). Midori Shobo, Tokyo, 276 - 287.

- Sokal, R.R. & F.J. Rohlf. 1981. *Biometry*. W.H. Freeman and Company, New York, 859 pp.
- Taylor, W.R. 1972. *Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas*. Ann Arbor: The University of Michigan Press, 856 pp.
- Yudianto, S.A. 1992. *Pengantar Cryptogamae (Sistematik Tumbuhan Rendah)*. Penerbit Tarsito, Bandung, 247 pp. (in Indonesian).

ISSN 0858-3633