

## FEEDING OF *Mustelus canis* (ELASMOBRANCHII, TRIAKIDAE) CAUGHT OFF SOUTH-SOUTHEAST COAST OF BRAZIL

[Alimentação de *Mustelus canis* (Elasmobranchii, Triakidae) capturado frente à costa sudeste-sul do Brasil]

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### ABSTRACT

Feeding habits of *Mustelus canis* (Mitchill, 1815), caught by the research vessel Orion, using bottom longline, off the south-southeast coast of Brazil (19-27° S) were studied. The frequency of occurrence of the items found in the stomach was analyzed, considering the variations on sex, stage of maturity, and length of the specimens and date of collection. The item Crustacea was the most frequent, occurring in 87.5% of the 56 stomachs with contents, followed by Teleostei, with a percentage of 60.7%. Among the crustaceans, Stomatopoda (46.4%) and Brachyura (50.5%) were the most observed items. The species presented feeding habits based on benthic crustacean, with little variation of diet, that can be caused by the increase on the capacity of catching with size, or to the use of different bathymetric zones for feeding.

**Key words:** *Mustelus canis*, feeding, elasmobranch, south-southeast coast, Brazil

### RESUMO

Estudou-se a alimentação de *Mustelus canis* (Mitchill, 1815) capturado pelo navio de pesquisas Orion, com a utilização de espinhel-de-fundo, frente à costa sudeste-sul do Brasil (19-27° S). Analisou-se a frequência de ocorrência dos itens encontrados em cada estômago, considerando as variações de sexo, estágio de maturidade, comprimento dos exemplares e época de captura. O item Crustacea foi o mais frequente, ocorrendo em 87,5% dos 56 estômagos com conteúdo, seguido do item Teleostei, cuja frequência de ocorrência foi 60,7%. Dentre os crustáceos, Stomatopoda (46,4%) e Brachyura (50,5%) foram os itens mais destacados. A espécie apresentou hábito alimentar principalmente carcino-bentófago, com pequenas variações na dieta, que podem ser atribuídas ao aumento da capacidade de captura do alimento, relacionado com o crescimento dos exemplares ou ao uso de diferentes zonas batimétricas para alimentação.

**Palavras-chave:** *Mustelus canis*, alimentação, elasmobrânquios, sudeste-sul, Brasil

### Introduction

Studies on fish feeding in natural environment are indispensable to the comprehension of its biology and ecology. The analysis of the diet of a species permits the explanation of variations in growth, reproductive and migratory aspects, and behavior of hunting for food (ROSECCHI and NOVAZE, 1987). This kind of knowledge can be used in order to obtain a better utilization of the fisheries targeting on certain species, using the adequate bait and set off at the time and position of water mass where the fish usually feeds. This information is also necessary for the evaluation

of the species as a fishing resource, and for conservation purposes.

Studies on biology of the dusky smooth-hound shark, *Mustelus canis* (Mitchill, 1815) (Elasmobranchii, Triakidae), are relatively rare, and very few of them refers to the fish feeding in Brazilian waters.

In this paper, the feeding of *M. canis* caught in the south-southeast of Brazil is studied with the purpose to identify the stomach contents and the probable existence of temporal and sexual variation, and also differences on the feeding habits between males and females, stages of maturity and size of the fish.

## Material and Methods

The samples of *M. canis* studied were caught by the research vessel Orion, using bottom longline during 20 trips of 10 days each, from April 1994 to May 1995, through an agreement signed by Instituto de Pesca and the fishing company Kawai Suisan. The area where the samples were collected is located off the south-southeast coast of Brazil, from the mouth of Doce River, Espírito Santo State (19°30' S) and Santa Catarina Island, Santa Catarina State (27°26' S). The collected samples were kept on ice. After the identification of sex and maturity stage, and the measure of total length (*senso* BASS, 1973), the stomach contents were fixed in formalin 10%. Afterwards, contents were washed and kept in alcohol 70° GL, until they were analyzed.

The items found in each stomach were identified to the lowest taxonomic level possible, with the help of appropriate literature (e. g. BOWMAN and ABELE, 1982) and confirmed by experts. Each stomach contents were analyzed by the frequency method of occurrence of the material found (HYNES, 1950), and, whenever possible, the total length of preys was measured.

The differences on the digestibility of the items of the contents, according to WALSH and FITZGERALD (1984), prevented from the application of the quantitative method, because in most of the time it

was not possible to separate the items, specially the non chitinous as the teleostei that remained just bones.

The item Cephalopoda was only considered when more than one corneous bill was found in the contents, in order to avoid that the squid used for baiting was considered as natural prey.

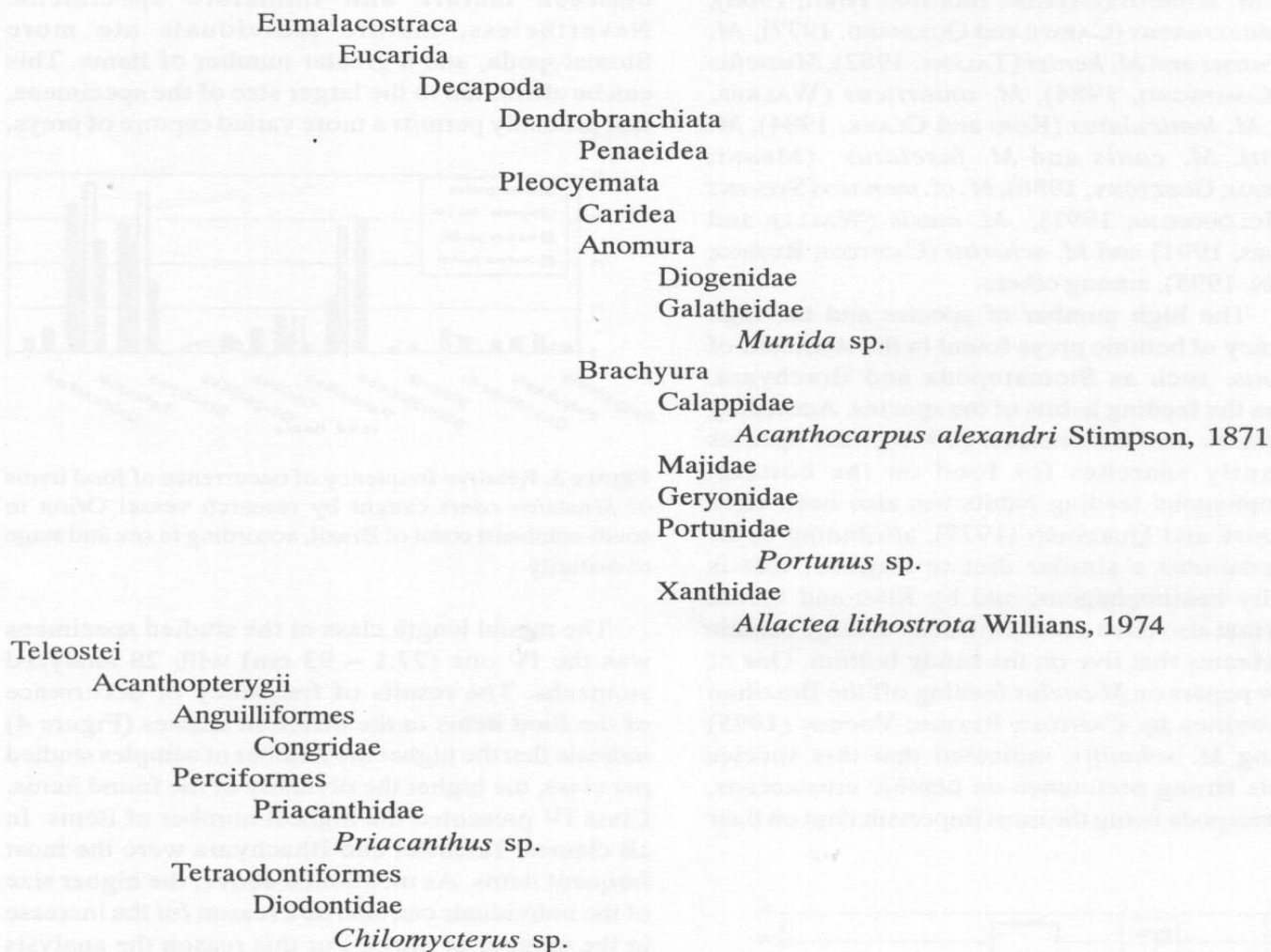
The results were analyzed taking into account the sample as a whole and distinguishing males from females, immature from mature, and different classes of total length. The samples examined were clustered in five classes with a range of 15 cm: I = 31.1-46 cm, II = 46.1-61 cm, III = 61.1-76 cm, IV = 76.1-91 cm and V = 91.1-106 cm. For the temporal analysis, the collection of the samples were gathered in three periods: (1) January-April; (2) May-August; (3) September-December.

## Results and Discussion

*Mustelus canis* was considered one of the most important elasmobranch, being the second most caught species from the 20 trips made by the research vessel Orion (AMORIM *et al.*, 1995). Stomachs of 115 *M. canis* were examined. The sharks were caught on depths ranging from 70 to 280 m and comprised by 39 females, 73 males and three without sex identification. Fifty-nine stomachs were empty or presented just the bait used. The total length of the specimens sampled ranged from 33.2 to 105.4 cm.

In the 56 stomachs with food contents, the items identified were as follows:

- Cnidaria
  - Antipatharia
- Annelida
  - Polychaeta
- Mollusca
  - Cephalopoda
    - Loliginidae
    - Octopodidae
  - Bivalvia
- Arthropoda
  - Crustacea
    - Malacostraca
      - Hoplocarida
        - Stomatopoda
          - Gonodactylidae
          - Pseudosquillidae
            - Parasquilla boschii* Manning, 1970
          - Squillidae



The analysis of the stomach contents showed that *M. canis* is a crustacean feeder species, with the item Crustacea appearing in 87.5% of the 56 stomachs with contents. Teleostei was the second most abundant item, with a frequency of occurrence of 60.7% (Figure 1). These results are similar to those obtained by MENNI; COUSSEAU; GOSZTONY (1986) for some specimens of *M. canis* caught off Argentina coast.

Among the crustaceans, Stomatopoda (46.4%) and Brachyura (50.5%) were the most observed items. It is important to note that Pseudosquillidae was present in 84.6% of the 26 stomachs with Stomatopoda (Figure 2), while the item Brachyura presented a higher heterogeneity among organisms. The high abundance of Pseudosquillidae in the diet is confirmed by the number of individuals in the stomachs, reaching five specimens (up to 12 cm of length) identified in just one stomach.

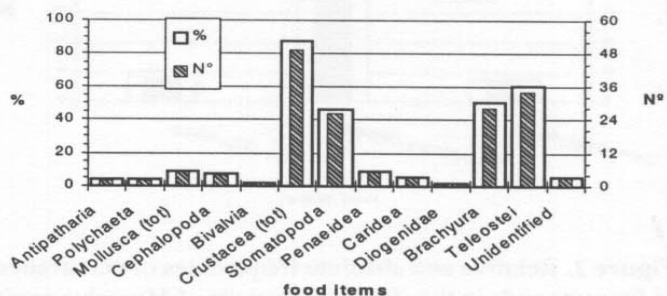


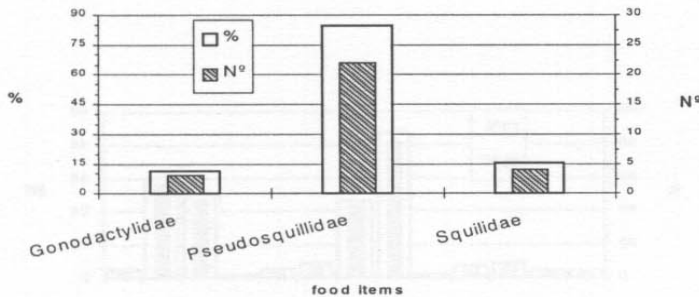
Figure 1. Relative and absolute frequencies of occurrence of the food items of *Mustelus canis* caught by research vessel Orion in south-southeast coast of Brazil

The predominance of crustaceans in the feeding of the species from the genus *Mustelus* seems to follow a pattern, and has been cited for different species and places by many authors, as: *M. canis* (BIGELOW and SCHROEDER, 1948), *M. higmani* (SPRINGER and LOWE, 1963), *M. mustelus* (LAZARETTO,



1964), *M. schmitti* (OLIVIER; BASTIDA; TORTI, 1968), *M. mediterraneus* (CAPAPÉ and QUIGNARD, 1977), *M. californicus* and *M. henlei* (TALENT, 1982), *Mustelus* spp. (COMPAGNO, 1984), *M. antarcticus* (WALKER, 1984), *M. lenticulatus* (KING and CLARK, 1984), *M. schmitti*, *M. canis* and *M. fasciatus* (MENNI; COUSSEAU; GOSZTONY, 1986), *M. cf. manazo* (STEVENS and MCLOUGHLIN, 1991), *M. masis* (WALLER and BARANES, 1991) and *M. schmitti* (CAPITOLI; RUFINO; VOOREN, 1995), among others.

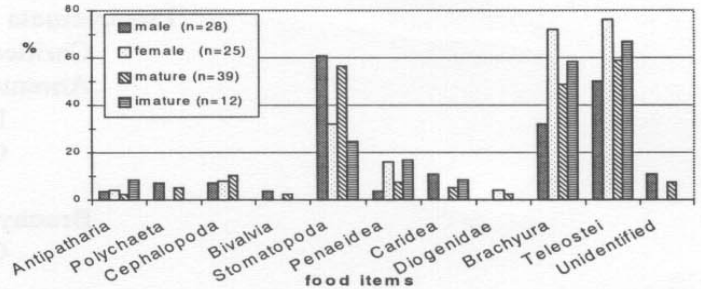
The high number of species and the high frequency of benthic preys found in the stomachs of *M. canis*, such as Stomatopoda and Brachyura, confirm the feeding habits of the species. According to BIGELOW and SCHROEDER (1948), this species constantly searches for food on the bottom. Benthophagous feeding habits has also been cited by CAPAPÉ and QUIGNARD (1977), attributing to *M. mediterraneus* a similar diet to Rajidae, that is basically benthophagous, and by KING and CLARK (1984) that also cited a predominance of large benthic invertebrates that live on the sandy bottom. One of the few papers on *Mustelus* feeding off the Brazilian coast, written by CAPITOLI; RUFINO; VOOREN (1995) studying *M. schmitti*, indicated that this species presents strong preference on benthic crustaceans, with Decapoda being the most important item on their diet.



**Figure 2.** Relative and absolute frequencies of occurrence of Stomatopoda in the stomach contents of *Mustelus canis* caught by research vessel Orion in south-southeast coast of Brazil

When comparing results, by sex, and stages of maturity (Figure 3), it is observed that Teleostei (76.0%) and Brachyura (72.0%) were the most frequent items. For the males, the most frequent items were Stomatopoda (60.7%), followed by Teleostei (50.0%) and Brachyura (32.1%). Based on the maturity stage, there were not great differences

between mature and immature specimens. Nevertheless, mature individuals ate more Stomatopoda, and a greater number of items. This can be attributed to the larger size of the specimens, that probably permits a more varied capture of preys.

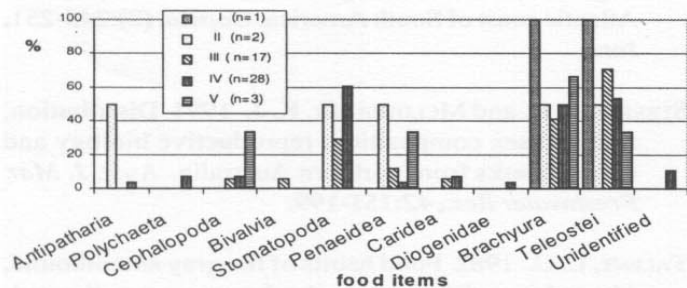


**Figure 3.** Relative frequency of occurrence of food items of *Mustelus canis* caught by research vessel Orion in south-southeast coast of Brazil, according to sex and stage of maturity

The modal length class of the studied specimens was the IV one (77.1 – 93 cm) with 28 analyzed stomachs. The results of frequency of occurrence of the food items in the different classes (Figure 4) indicate that the higher the number of samples studied per class, the higher the diversity of the found items. Class IV presented the highest number of items. In all classes, Teleostei and Brachyura were the most frequent items. As mentioned above, the higher size of the individuals can also be a reason for the increase in the number of preys. For this reason the analysis was affected by the small number of stomachs of specimens of classes I and II.

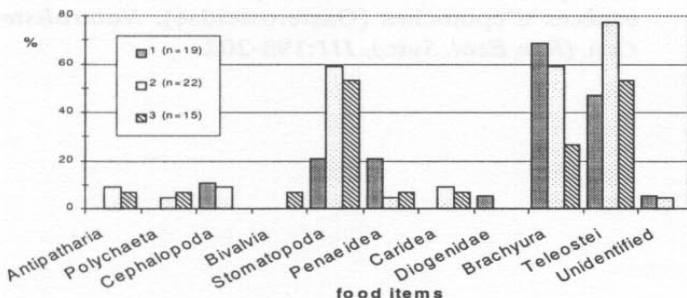
The average total length of the studied females was 76.8 cm, corresponding to class III (Figure 4). The average length for the males was 79.8 cm (class IV). Considering that males are, in general, larger than females and the mature larger than immature, it is possible to consider that the differences between males and females and maturity stages are due to the size of the individuals: the largest fish caught mostly Stomatopoda, while the smallest ones caught mostly Brachyura, and, on the other hand, Teleostei was important for all the groups. Another hypothesis to be considered is the bathimetric variation of the feeding zone, with individuals of different sizes at different depths, which reflected in the composition of the diet, as it was observed for *M. schmitti* in Rio Grande do Sul State by CAPITOLI; RUFINO; VOOREN (1995). Variation between the diet of young and adult was also observed by CAPAPÉ and QUIGNARD (1977)

for *M. mediterraneus*. These authors found young male and female feeding mainly on crustaceans, while the adults ate more teleosts. This was not observed in this study, but can also be explained by the differences in the feeding zones. This fact was also reported by KING and CLARK (1984) that have found differences for *M. lenticulatus* in distinct zones, but attribute the variation to the studied depth, which can change the composition of the benthic preys.



**Figure 4.** Relative frequency of occurrence of the food items of *Mustelus canis* caught by the research vessel Orion in south-southeast coast of Brazil, by total length class (cm): I (31.1-46), II (46.1-61), III (61.1-76), IV (76.1-91) and V (91.1-106)

Figure 5 shows that the diet of the caught individuals presented almost the same pattern in different periods of the year. The item Teleostei usually presented higher frequency, followed by Brachyura and Stomatopoda. Variations on the diet during the year are mentioned (e.g. CAPAPÉ and QUIGNARD, 1977) as influence of the reproductive cycle in the diet, due to the viviparity of the group. In this study, the small number of females preclude us to confirm this observation.



**Figure 5.** Relative frequency of temporal occurrence of the food items found in the stomach contents of *Mustelus canis* caught by research vessel Orion in south-southeast coast of Brazil: (1) January-April; (2) May-August; (3) September-December

It is difficult to determine the importance of a prey in the feeding of one species because many items cannot be compared in several aspects, such as: size, weight, abundance and digestibility (ROSECCHI and NOVAZE, 1987). It is also difficult to quantify the error originated by mastication of some items and by their varied energetic values. Thus, the use of different feeding indexes presents different results, making them very subjective (WALSH and FITZGERALD, 1984). Based on this issues, we tried in this paper to produce basic information, and we recommend further studies with more details.

### Conclusion

In the Brazilian coast, *Mustelus canis* is a shark that feeds basically on crustaceans and teleosts caught on the bottom. These feeding habits are similar for males and females, in different maturity stages. The increase in size apparently permits the fish to catch more Stomatopoda and a larger variety of preys, perhaps due to the larger size of the mouth. Also, the increase in the swimming speed makes them more efficient for catching preys, or maybe, allow them to move to different areas where preys are more abundant.

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