

The Diet of *Monodactylus Sebae* (Cuvier, 1829) in Two Adjacent Lagoon Habitats Within the Aby-Tendo-Ehy Lagoon Complex (Côte d'Ivoire)

KOFFI Kouakou Barthélemy^{1*}, MOTCHIE Fato Edouard¹, KOUADIO Akissi Nathalie¹, N'Godjigui DIABY², KOUAKOU Kouamé Augustin², KONE Tidiani³

¹École Normale Supérieure (ENS), Department of Science and Technology, Life and Earth Sciences Section, 08 BP 10 Abidjan 08, Côte d'Ivoire

²Research and Teaching Unit in Hydrobiology and Aquatic Eco-technology, Laboratory of Natural Environments and Biodiversity Conservation, UFR Biosciences, Félix Houphouët-Boigny University, 22 BP 582 Abidjan 22, Côte d'Ivoire

³Laboratory of Biodiversity and Tropical Ecology, UFR Environment, Jean Lorougnon Guédé University (UJLoG), BP 150 Daloa, Côte d'Ivoire

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*Corresponding author: KOFFI Kouakou Barthélemy

École Normale Supérieure (ENS), Department of Science and Technology, Life and Earth Sciences Section, 08 BP 10 Abidjan 08, Côte d'Ivoire

Abstract

Original Research Article

This study investigated the diet of the fish species *Monodactylus sebae* in two lagoons forming part of the Aby-Tendo-Ehy lagoon complex in south-eastern Côte d'Ivoire. The diet of *Monodactylus sebae* (Cuvier, 1829) was studied in the Aby-Tendo lagoon complex (Côte d'Ivoire). The fish were caught between October and December 2012. The mean intestinal coefficient (MIC = 1.08) allowed *Monodactylus sebae* to be classified as an omnivorous species. Analysis of stomach contents revealed a total of 19 items, including fish, insects, crustaceans, annelids, arachnids and plant debris. The relative importance index (% IRI) was used to categorise the prey: the overall diet consists primarily of Clupeidae (63.4 per cent); secondary prey is represented by Chironomidae larvae (14.4 per cent), whilst the other items (Cichlidae (2.6 per cent), Coenagriidae (4.2%), Elmidae larvae (2.6%), shrimps (2.5%) and annelids (0.1%)) are considered incidental prey. Significant variations in the diet were observed depending on sampling sites and size classes.

Keywords: *Monodactylus sebae*, trophic ecology, lagoon, West Africa.

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INTRODUCTION

Fish are very important in the context of human nutrition. They provide around 40 per cent of the protein requirements for two-thirds of the world's population, particularly in developing countries (Who, 1971). Furthermore, through the fishing and aquaculture activities they generate, fish represent a significant source of employment and thus an excellent means of combating unemployment and poverty. This socio-economic importance of fishing is particularly evident in lagoon environments, such as the Aby Lagoon. According to Charles-Dominique *et al.*, (1980), small-scale fishing in the Aby Lagoon is highly profitable for the entire population engaged in it.

Furthermore, fish can serve as bioindicators (Hay *et al.*, 1996; Hugué *et al.*, 1996). In this context, the presence or absence of a species can provide information on the level of pollution in aquatic environments. From a medical perspective, fish can be

used to combat certain water-borne diseases. This is the case with schistosomiasis (Lévêque, 1999), where fish preferentially mollusc-eating species, eliminate the vectors of this disease (molluscs) by feeding on them.

Fish are particularly important in aquatic ecosystems because of the roles they play within food webs. They make a significant contribution to maintaining biodiversity within these environments. They are often used to enrich the fauna of certain natural water bodies deemed to be insufficiently productive, by occupying the ecological niches left vacant (Moreau *et al.*, 1998; Lévêque, 1999).

However, for such interventions to be effective, they require a sound understanding of the biology of the taxa involved, in particular their diet (Diomandé *et al.*, 2001). Understanding the feeding habits of fish in their natural environment is, in fact, an essential step towards understanding their biology and ecology. It can help

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explain variations in growth, certain aspect of reproduction, migrations, and foraging and feeding behaviour (Rosecchi and Nouaze, 1987). Furthermore, studying fish diets provides insights into the presence, abundance and availability of prey, as well as the trophic potential of the environment (Paugy and Lévêque, 1999). *Monodactylus sebae* (Cuvier, 1829), known as the African sunfish, is native to the tropical Atlantic Ocean. It is found in the eastern Atlantic, from the West African coast and the Canary Islands as far south as Angola (Bauchot, 1992). Its diet has been the subject of a number of studies (Fagade and Olaniyan, 1973; Ndombour, 2008), notably in Senegal in the Sine-Saloum estuary and in Nigeria in the Lagos Lagoon.

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In Côte d'Ivoire, apart from the studies by Daget and Iltis (1965) and Koné *et al.*, (2003), which provided information on the geographical distribution of this species, no studies have been carried out on its feeding ecology. However, it is well known that the diet of fish can vary from one habitat to another, depending on the resources available in that habitat (Lauzanne, 1975). This study focuses on the diet of *Monodactylus*

sebae in two contiguous compartments of the Aby-Tendo-Ehy lagoon complex.

MATERIALS AND METHODS

Study area

The Aby Lagoon (Figure 1) is one of the three lagoons in the Ivorian lagoon system (the Ebrié Lagoon, the Grand-Lahou Lagoon and the Aby Lagoon). These lagoons cover nearly 300 km of coastline. Each of these lagoons is connected to the sea via channels (Durand and Chantraine, 1982). The Aby-Tendo-Ehy lagoon complex is situated in the far south-east of Côte d'Ivoire, stretching along a 30 km stretch of coastal barrier (Chantraine, 1980). It covers an average area of 424 km² and comprises three zones: Aby, Tendo and Ehy (Chantraine, 1980). Two monitoring stations have been established on this lagoon. The Tendo lagoon, situated in the central part of the complex, is smaller in size. It stretches for 22 km in length, with a width varying between 1.5 and 3.5 km. The Aby lagoon is situated between longitudes 2°84' and 3°36' west on the one hand, and latitudes 5°08' and 5°38' north on the other (Seu-Anoï, 2012). The main channel of the Aby Lagoon the name by which other authors have referred to the entire complex is the largest, with an area of 305 km², a length of 24.5 km and a width of 15.5 km.

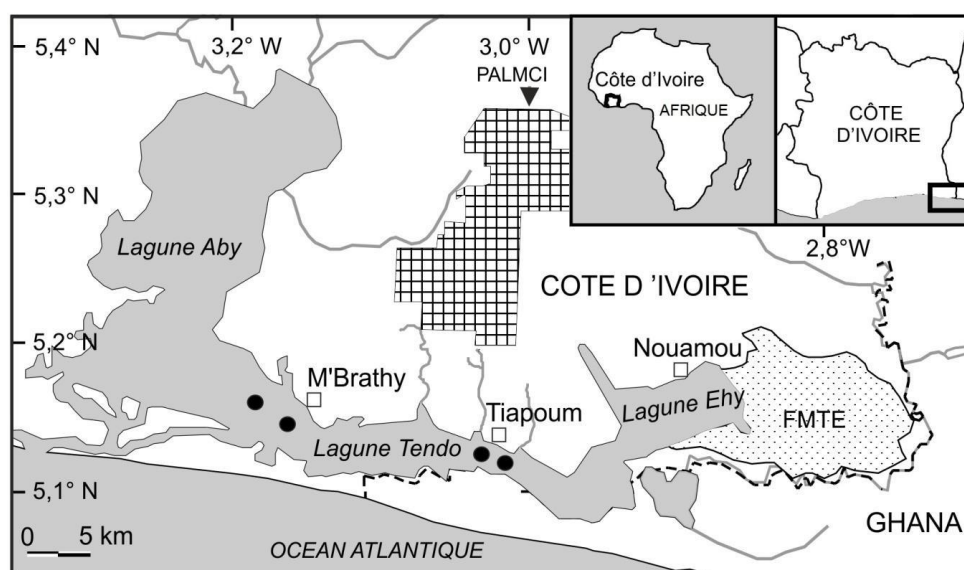


Figure 1: Geographical location of the Aby and Tendo lagoons and the various sampling sites (Location of sites (•))

- Sampling and analysis of stomach contents

The fish were caught using two sets of monofilament gillnets with mesh sizes of 6, 8, 10, 12, 15, 20, 25, 30, 35, 40, 45 and 50 mm. At each station, the two sets of gillnets were set at 5.00 pm and hauled in the following day at 7.00 am. The fish caught were identified using the identification keys provided by Paugy *et al.*, (2003 a and b) and weighed. Standard lengths were measured; following dissection, the intestines were

measured, the stomachs were removed and preserved in 5 per cent formalin. The lengths obtained were used to establish size classes in order to study the diet of *Monodactylus sebae* in relation to the size of the individuals. In the laboratory, sieves with diameters of 100 and 500 micrometres were used to filter the stomach contents; to determine the volumes of the prey, a graduated cylinder marked in millilitres was used, and to count the zooplankton contained in the stomachs, a

Bogorov counting chamber was employed. Finally, a binocular magnifying glass was used to examine the food items. The prey were sorted, counted and weighed after being dried on blotting paper. The various prey items were identified with reference to the works of Needham (1962), Durand and Lévêque (1980), Déjoux *et al.*, (1981), Scholtz and Holm (1985), Dierl and Ring (1992) and Paugy *et al.*, (2003).

Data processing :

The data collected were used to determine methods that take into account the relative proportions of prey in terms of number (numerical method), mass (gravimetric methods), volume (volumetric methods) or frequency of occurrence (occurrence method). These various methods, along with their advantages and disadvantages, are discussed by Berg (1979) and Hyslop (1980).

The frequency of occurrence is calculated using the following formula :

$$\% Fo = Ni/Nt \times 100$$

Where Ni = number of stomachs containing prey item i and Nt = total number of full stomachs examined.

The numerical percentage :

$$\% N = Ni/Nt \times 100$$

Where N = total number of individuals of a given prey item and Nt = total number of prey items ingested.

The weight percentage :

$$\% P = Pi/Pt \times 100$$

Where Pi = total mass of individuals of prey item i and Pt = total mass of prey items ingested.

The volumetric percentage :

$$\% V = Vi/Vt \times 100$$

Where Vi = total volume of individuals of a given prey species and Vt = total volume of prey consumed.

To highlight the prey species that contribute most to a predator's diet and to provide as much information as possible, various combinations of the methods described above have been proposed. Hureau's (1970) dietary coefficient Q combines information on abundance and biomass, whilst indices such as the IRI (relative importance index) by Pinkas *et al.*, (1971) and the MFI (main food item) by Zander (1982) combine occurrences, abundance and mass or volume. There are no standard methods for studying the diet of fish. According to Cortès (1997), the choice of which descriptor(s) to analyse depends on the author, the focus and objectives of their study, as well as the availability of research resources and equipment.

In order to minimise the biases arising from the use of a single measure, we decided to use an index that incorporates all these methods. Consequently, the relative importance index developed by Pinkas *et al.*, (1971) seemed appropriate for this study. Indeed, by

combining frequency of occurrence, numerical percentage and weight percentage, this index allows for a much more accurate interpretation of the diet, whilst minimising the margins of error caused by each of these percentages.

$$\% IRI = \% Fi \times (\% N + \% P)$$

Where %Fi = frequency of occurrence of prey item i, %N = numerical percentage of the prey item and %P = weight percentage of the prey item.

To calculate the numerical percentage of certain food items, such as plant debris, animal debris, unidentified debris, small organisms present in very large numbers in a given stomach, and grains of sand, we adopted the approach proposed by Rosecchi and Nouaze (1987). These authors suggest that such prey items should be counted as a single unit so as not to distort the numerical percentage. We have therefore assigned the number 1 to these prey items whenever they are present.

We chose to identify the different categories of prey {preferred, secondary and incidental prey} by referring to the method proposed by Rosecchi and Nouaze (1987). To this end, the value of each prey's index is expressed as a percentage of the sum of all indices { $\sum \% IRI$ }. The prey items are then ranked in descending order according to the percentage value of the IRI obtained. Starting with the prey item ranked 1st, the indices of each prey item, from the first to the nth, are added together until 50 per cent or more of the total index is reached. These prey items are termed 'preferred'. Continuing in the same order, the IRI percentages of the prey items are added together until 75 per cent or more is reached; these additional prey items are the secondary prey, whilst the remaining food items constitute incidental prey (Rosecchi and Nouaze, 1987).

Calculation of the mean intestinal coefficient : the intestinal coefficient (CI) is defined as the ratio of the length of the intestine (LI) to the standard length (LS) of the fish. The mean intestinal coefficient represents the ratio of the sum of the intestinal coefficients to the total number of intestines examined.

$$IC = IL/SL \quad \quad \quad AMIC = \sum IC / N$$

where AMIC = average intestinal coefficient and N = total number of intestines examined.

Statistical analyses

The data obtained from the analyses are subjected to various types of statistical processing:

- Spearman's correlation coefficient was used to highlight similarities or differences in diet according to fish size or sampling sites.
- A linear regression line was used to assess the relationship between standard length and intestinal length in the fish.

Linear regression line:

The linear regression line was used to establish the relationship between intestinal length and the standard length of the individual. This line passes through the highest point of a scatter plot. The linear correlation coefficient (r) allows the strength of the relationship between the variables to be assessed. The coefficient ranges from -1 to 1. Any value close to these two limits indicates a strong correlation between the two variables. If $0.87 \leq r \leq 1$, the correlation is said to be strong, whilst if $r = 0$, there is said to be no correlation between the variables under study. The various analyses were carried out using STATISTICA 7.1 software (Statsoft Inc.)

RESULTS

Relationship between intestinal length and standard length in fish

The relationship between intestinal length and standard length was established on the basis of a total sample of 50 fish. Figure 2 shows a linear relationship with the equation $y = 1.02x + 4.65$. The value of the correlation coefficient ($r = 0.72$) indicates that these two variables are positively correlated. The graph therefore reveals that intestinal length increases with the size of the individual. The relative intestinal coefficients for all the

individuals analysed range from 0.63 to 2.40. The mean intestinal coefficient (MIC) is 1.08.

Diet of *Monodactylus sebae*

Sample composition

The study of the diet of *Monodactylus sebae* (Cuvier, 1829) in the Aby-Tendo lagoon complex was carried out on 50 individuals ranging in size from 40 to 110 mm. Of all the individuals studied, 11 stomachs were empty and 39 contained food, corresponding to a stomach emptiness rate of 22 per cent. The distribution of the individuals analysed by size class is shown in Figure 3. The majority of the fish analysed were between 40 and 110 mm in length, ranging from 65 to 80 mm at the M'Brathy (Aby Lagoon) and Tiapoum (Tendo Lagoon) sites respectively.

Qualitative aspects of the diet

From a qualitative perspective, the diet of *Monodactylus sebae* is highly varied within the Aby-Tendo lagoon complex (Table I). It comprises 19 prey items. These taxa include both vertebrates and invertebrates. Plants and inorganic compounds are also found in the stomach contents. The vertebrates consist of small fish belonging to the families Cichlidae and Clupeidae. The invertebrates consist of insects, crustaceans, annelids and arachnids.

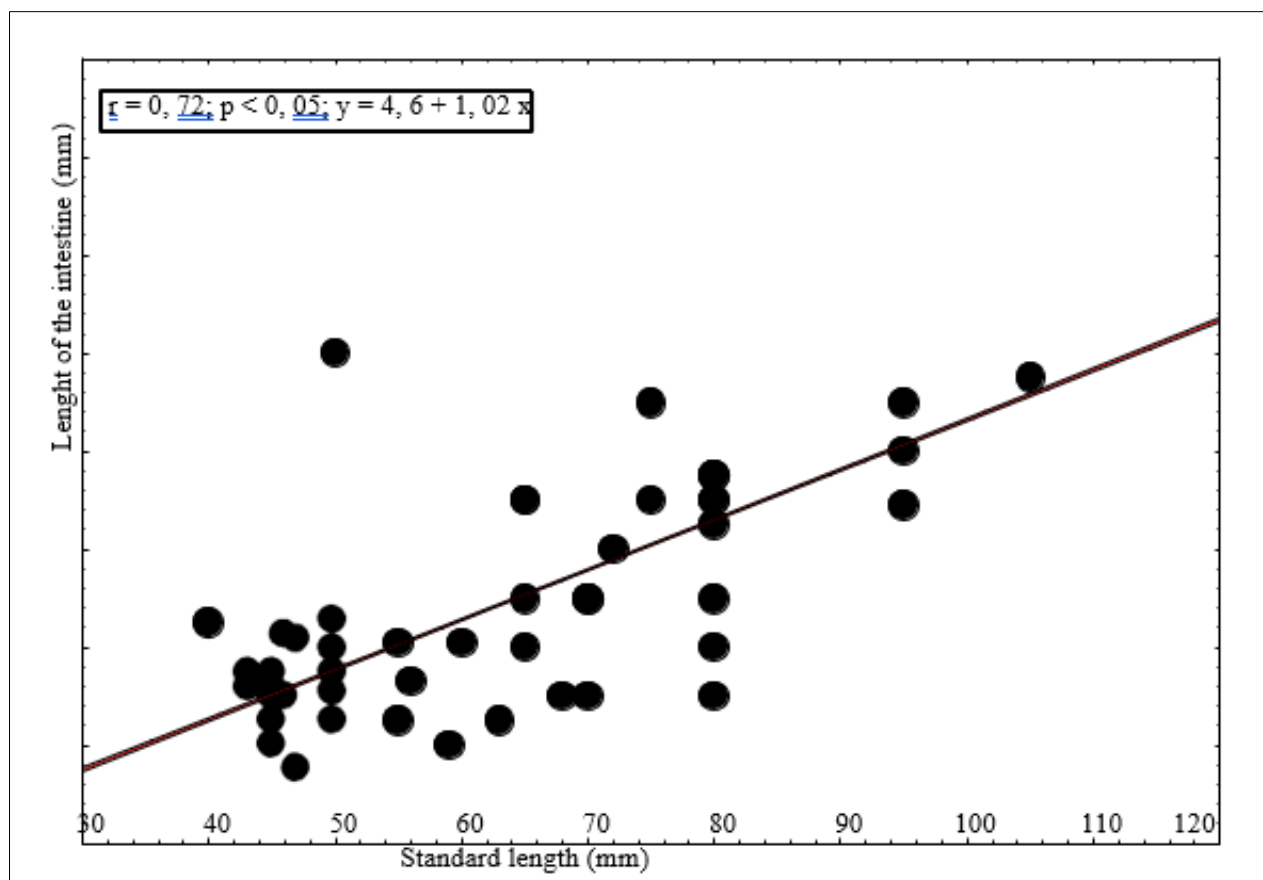


Figure 2: Relationship between standard length and intestinal length in individuals of *Monodactylus sebae* (Cuvier, 1829) (40 mm < SL < 110 mm) caught in the Aby-Tendo lagoon complex (Côte d'Ivoire)

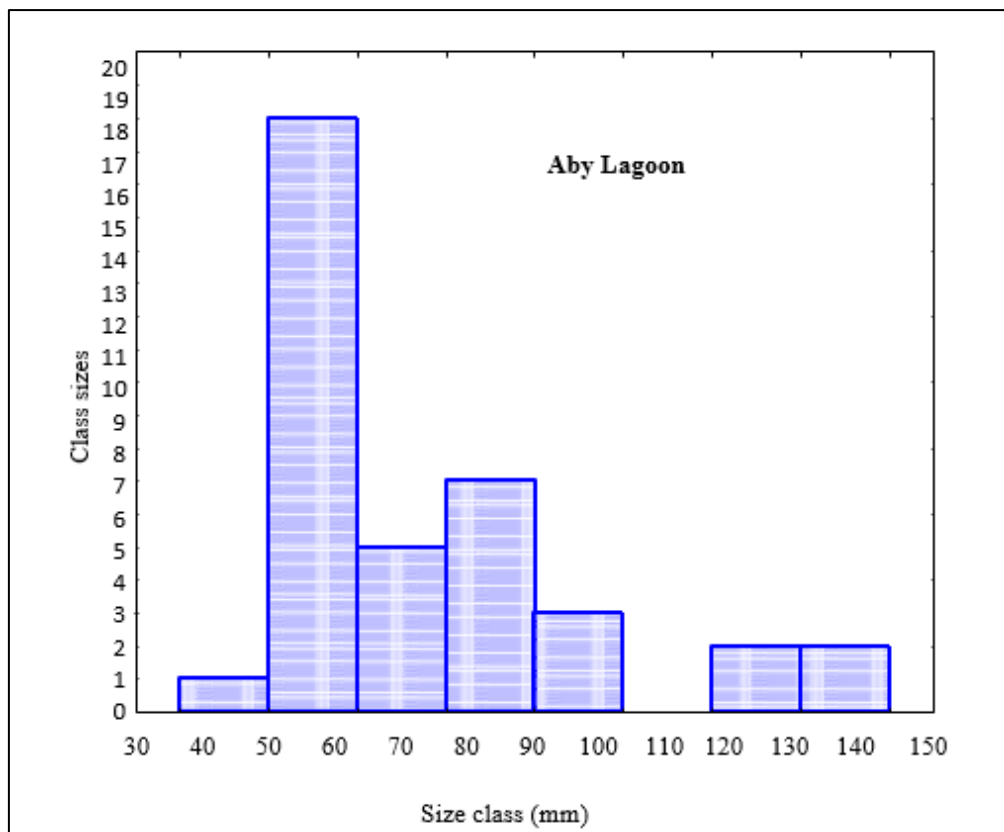


Figure 3: Size structure of *Monodactylus sebae* samples collected from the Aby (M'Brathy) lagoon (Côte d'Ivoire) between October and December 2012

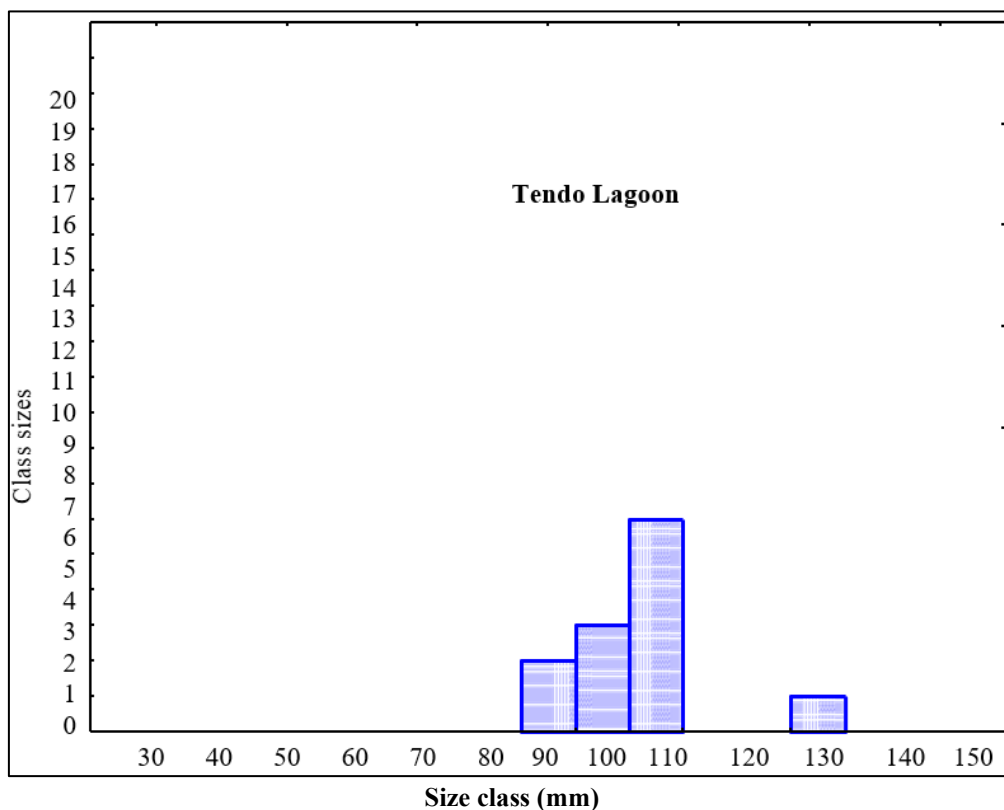


Figure 4: Size structure of *Monodactylus sebae* samples collected from the Tendo (Tiapoum) lagoon (Côte d'Ivoire) between October and December 2012

Table I: Numerical percentage (%N), frequency of occurrence (%Fo), weight percentage (%W), and relative importance index (%RII) of prey items found in the stomachs of *Monodactylus sebae* (Cuvier, 1829) caught in the Aby-Tendo lagoon complex (Ivory Coast) between October and December 2012

Prey	%N	%Fo	%P	%IRI
FISH				
Clupeidae	22,9	18,21	57,66	63,42
Cichlidae	8,4	5,46	2,63	2,61
Fish vertebrae	3,6	1,80	4,37	0,62
Fish remains	1,2	1,80	0,07	0,10
Fish scales	7,2	10,90	5,76	6,12
INSECTS				
Diptera				
Chironomidae (larves)	19,3	14,50	3,68	14,40
Chironomidae (adultes)	1,2	1,80	0,14	0,10
Beetles				
Elmidae larvae	3,6	5,50	7,43	2,
Ephemeroptera				
Potamanthidae	1,2	1,80	0,02	0,10
Odonata				
Coenagriidae	7,2	9,10	3,48	4,20
Insects remains	6,0	9,10	0,21	2,45
ANNELIDS				
Polychaetes	1,2	1,80	0,02	0,10
ARACHNIDS				
Tétragnathidae	1,2	1,80	0,62	0,14
CRUSTACEANS				
Isopodes	3,6	3,60	2,79	0,99
Shrimp remains	2,4	3,60	0,21	0,41
Atyidae	2,4	1,80	10,49	1,00
Cyclopidae	1,2	1,80	0,21	0,11
PLANTS				
Plant debris	2,4	3,60	0,18	0,40

The class Insecta comprises four orders, including Diptera (Chironomidae), Coleoptera (Elmidae), Ephemeroptera (Potamanthidae) and Odonata (Coenagriidae). Crustaceans are represented by isopods, shrimps (Atyidae) and Cyclopidae. The only representative of the Annelida is the polychaetes. As for the Arachnida, only the family Tétragnathidae was identified in the stomach contents. The plant fraction consists of plant debris, whilst the mineral fraction is represented by grains of sand.

Quantitative study of the diet

Overall analysis of the diet

The Relative Importance Index (IRI) was used to classify prey into different dietary categories. Thus, the Clupeidae, accounting for more than half of the total IRI (63.4 per cent), represent the preferred prey. Chironomidae larvae, with a percentage of 14.4 per cent, are classified as secondary prey. Other food items, with low percentages, consist of Coenagriidae (4.2 per cent), Cichlidae (2.6 per cent), Elmidae larvae (2.6 per cent), crustaceans (2.5 per cent), plant debris (0.4 per cent), polychaete annelids (0.1 per cent), arachnids (Tétragnathidae) (0.1 per cent) and grains of sand (0.1 per cent) constitute the category of incidental items.

In terms of abundance, the diet of *Monodactylus sebae* is dominated primarily by the Clupeidae, accounting for 22.9 per cent. Next come Chironomidae larvae, at 19.3 per cent. Cichlidae, at 8.4 per cent, rank third in this classification, followed by Coenagriidae (7.2 per cent). Shrimps of the family Atyidae, isopods, as well as Elmidae larvae and plant debris follow, with percentages ranging from 2.4 to 3.6 per cent. Other prey items account for low percentages, below 2 per cent. Based on weight percentage, the diet of *Monodactylus sebae* is dominated by Clupeidae. The mass percentage of these prey items is estimated at 57.7 per cent, compared with 10.7 per cent for shrimps (Atyidae), 7.4 per cent for Elmidae larvae, 3.7 per cent for Coenagriidae and 3.5 per cent for Chironomidae larvae. Other food items are less well represented, with values not exceeding 3 per cent.

Variation in diet according to sampling sites

Monodactylus sebae individuals were captured at two sites: the M'Brathy station in the Aby lagoon and the Tiapoum station in the Tendo lagoon. In the Aby lagoon, 38 *Monodactylus sebae* individuals were captured, compared with 12 in the Tendo lagoon. The diet comprised 14 prey items at M'Brathy (Aby Lagoon), compared with 9 at Tiapoum (Tendo Lagoon). Figures 4

and 5 present the results obtained from the calculation of the relative importance index. In Aby Lagoon, Clupeidae constitute the primary prey, with a relative importance index (RII) estimated at 78.9 per cent. Next come Chironomidae larvae (5.3 per cent) and Cichlidae (4.2 per cent), which are classified as secondary prey. Other prey items with RII values ranging from 0.2 to 3.8 per cent fall into the category of incidental food. These include shrimps (Athyidae), isopods, Cyclopidae, polychaete annelids, arachnids (Tetragnathidae) and insects (Potamanthidae). Larvae of beetles from the family Elmidae were not observed in the stomach contents at this site.

In the Tendo Lagoon, based on the IRI percentages of prey, it can be seen that the preferred food

items are Chironomidae larvae (47.8 per cent) and Elmidae larvae (28.43 per cent). Coenagriidae (14.2 per cent) are classified as secondary prey. The other species are incidental prey. At this site, no crustaceans were found in the stomach contents. Cichlidae and annelids were also not observed in any stomachs at this site, in contrast to the results from Aby Lagoon. Spearman's correlation coefficient, calculated on the basis of the food index percentage (%IRI), is not significant ($R_s = 0.29$; $p > 0.05$). We therefore conclude that there is a difference in dietary patterns between the two study sites. In Aby Lagoon, the preferred prey consists of fish, particularly Clupeidae, whilst in Tendo Lagoon, these are considered incidental food items, with insects—particularly the larvae of Chironomidae and Elmidae—being the preferred prey.

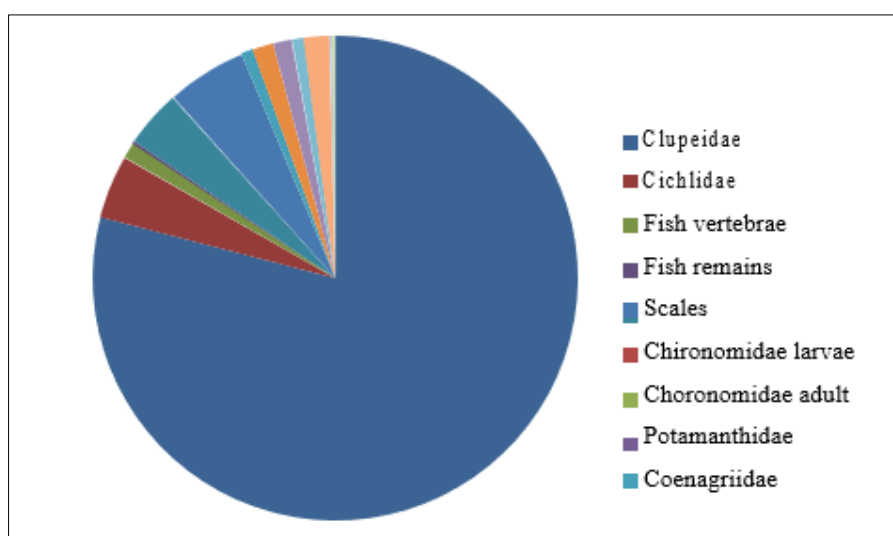


Figure 5: Relative abundance of prey items found in the stomachs of *Monodactylus sebae* (Cuvier, 1829) caught in the Aby Lagoon (Ivory Coast) between October and December 2012

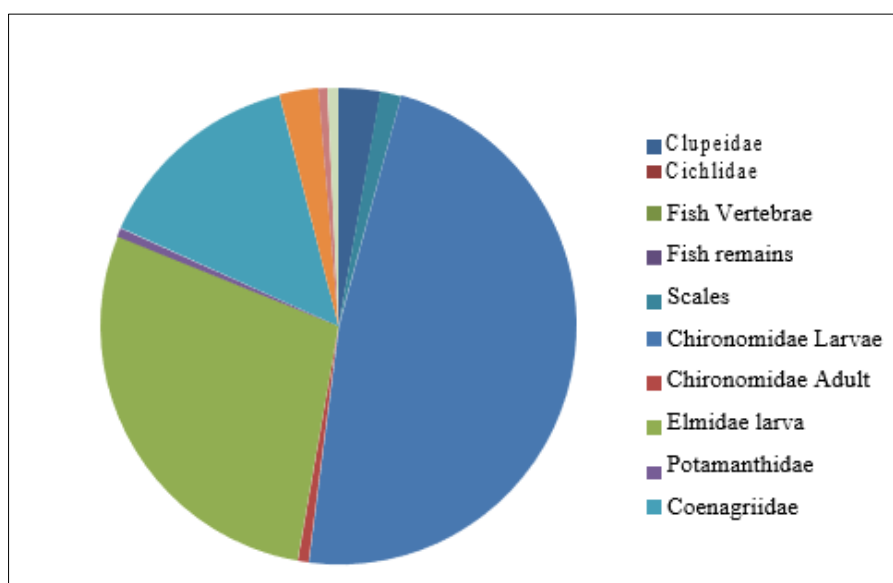


Figure 6: Relative importance of prey items found in the stomachs of *Monodactylus sebae* (Cuvier, 1829) caught in the Tendo lagoon (Ivory Coast) between October and December 2012

Variation in diet according to fish size

The sizes of the *Monodactylus sebae* individuals analysed ranged from 40 mm to 110 mm. To study the composition of the diet according to size, the specimens were divided into two classes. The individuals in these groups all originated from the Aby lagoon. The first group (Group A) consists of individuals ranging in size from 40 to 50 mm. Nineteen individuals were sampled from this group. The second group (Group B), comprising individuals larger than 50 mm, also consists of 19 individuals.

The relative importance index (Table II) reveals that the preferred food of the smaller individuals encountered (i.e. those ranging in size between 40 and 50 mm) are fish belonging to the Cichlidae family (32.79

per cent) and Chironomidae larvae (22.25 per cent). Clupeidae (12.73 per cent), insect debris (7.32 per cent), Coenagriidae (7.01 per cent) and isopods constitute secondary prey. Other food items are considered incidental. For individuals in Class B, the most important prey consists of fish from the Clupeidae family (86.85%). Secondary prey consists solely of fish vertebrae (4.86%). Other food items, in particular shrimps of the families Atyidae (2.1 per cent), Coenagriidae (0.35 per cent) and Chironomidae larvae (0.8 per cent), are considered to be incidental prey. Spearman's correlation coefficient, calculated from the percentages of the relative importance indices of the prey items, is not significant ($R_s = 0.21$; $p > 0.05$). We therefore conclude that the diets of these two size classes in the Aby lagoon differ.

Table II: Relative Importance Index (%IRI) of prey items found in the stomachs of two size classes of *Monodactylus sebae* (Cuvier, 1829) caught in the Aby Lagoon (Ivory Coast) between October and December 2012

Prey	Classe A	Classe B
	40 ≤ LS ≤ 5	LS > 50
FISH		
Clupeidae	12,73	86,85
Fish vertebrae	0,00	4,86
Cichlidae	32,79	0,69
Fish scales	0,00	1,36
Fish remains	1,06	0,34
INSECTS		
Insect remains	7,32	0,00
DIPTERA		
Chironomidae (Larves)	22,25	0,80
ODONATA		
Coenagriidae	7,01	0,35
CRUSTACEANS		
Atyidae	0,00	2,10
Shrimp remains	4,61	0,00
Cyclopidae	1,44	0,00
Isopodes	7,34	0,34
ARACHNIDS		
Tétragnathidae	0,00	0,42
PLANTS		
Plant debris	0,00	1,89

DISCUSSION

In fish, numerous studies have shown that there is a positive correlation between the type of food consumed and gut length (Geistdoer, 1981; Paugy, 1994). The gut appears to be longer in herbivores, shorter in carnivores and of intermediate length in omnivores. Several authors have attempted to classify fish on the basis of their mean intestinal coefficient (MIC) values: according to Fryer and Iles (1972), $0.6 < MIC < 2.4$ corresponds to omnivorous fish, $1.6 < MIC < 7.9$ to herbivorous fish and $MIC > 1.2$ to fish that feed on other fish. According to Paugy (1994), $MIC < 0.85$; $0.32 < MIC < 2.18$ and $0.8 < MIC < 3.01$ indicate that the fish are ichthyophagous, invertivorous and omnivorous, respectively. Based on previous studies, it appears that

Monodactylus sebae has a CIM (1.08) which can be classified either as invertivorous or omnivorous, depending on the reference studies considered. However, when considering the categories of prey actually found in the stomachs of *Monodactylus sebae*, it becomes clear that this species is predominantly omnivorous. Indeed, the highly diverse prey items include invertebrates, plant debris and vertebrates.

The diet of *Monodactylus sebae* in the Aby-Tendo lagoon complex is very diverse. Analysis of stomach contents reveals that this species feeds on a very wide variety of prey items, the main groups being fish, crustaceans, polychaete annelids, insects, arachnids and plants. Research carried out on this species by Ndombour

(2008) and Sène (1994) in the Sine-Saloum estuary in Senegal confirms this finding.

In quantitative terms, fish, particularly Clupeidae, are the preferred prey of this species in the Aby-Tendo lagoon complex during the rainy season. They alone account for the majority of the prey found in the stomachs. These results contradict the observations made by the authors cited above. Indeed, according to the latter, the diet of *Monodactylus sebae* is predominantly composed of polychaete annelids. The numerical percentage of fish is very low (0.1 per cent) according to Ndombour (2008). Fagade and Olaniyan (1973), on the other hand, make no mention of the presence of polychaetes in the diet of this species in the Lagos Lagoon in Nigeria. According to them, the most important prey items in the diet of *Monodactylus sebae* are amphipods, euphausiids and filamentous algae. Nor do these authors mention the presence of fish prey in the stomach contents of this species. These results, which are at the very least contradictory with regard to the quantitative aspects of this species' trophic ecology, could be explained by the fact that fish utilise the resources most readily available to them in their environment. Indeed, according to Blaber (1980), the relative abundance of a prey species in stomach contents may reflect its abundance and availability in the environment. Lauzanne (1975) takes a similar view. In his view, dietary diversity depends on the variety and abundance of potential prey. The high numbers of aquatic insects in this case, Chironomidae larvae highlight their notable presence in the lagoons during this time of year. The consumption of Chironomidae larvae underscores the benthivorous nature of *Monodactylus sebae*. Indeed, Chironomidae larvae are primarily detritivores feeding on the sedimentary layer covered with benthic algae (Whitfield *et al.*, 2006). By feeding on zooplanktonic prey such as Cyclopidae, *Monodactylus sebae* also demonstrates an ability to forage for food in the water column (pelagic behaviour).

The results also highlighted quantitative variations in the diet of *Monodactylus sebae* depending on the habitats sampled. Whilst the preferred prey in Aby Lagoon consists of fish (Clupeidae), in Tendo Lagoon it is insects specifically the larvae of Chironomidae and Elmidae that are considered the preferred prey. These results could be explained by the fact that, at each site, the most frequently consumed prey are those that are most readily available. Furthermore, the ecological, environmental and physico-chemical characteristics that influence prey distribution could account for the variations observed across these habitats. Salinity, which is virtually zero at Tendo, is likely a factor influencing the geographical distribution of certain prey. Strictly terrestrial prey, such as spiders of the family Tetragnathidae, appear to be incidental. During the rainy season, runoff carries terrestrial organisms into the aquatic environment. Rising water levels during floods

are also cited as a factor explaining these events (Diomandé *et al.*, 2001).

The presence of grains of sand suggests that *Monodactylus sebae* forages in the bottom silt. According to some authors, such as Kouamélan (1999), the ingested sand may be used to break down the exoskeletons of certain food items, in this case those belonging to the family Crustaceae.

The variation in diet according to size class is essentially qualitative in nature. Fish are consumed by virtually all size classes. Cichlidae, consumed mainly by the smallest individuals, are virtually absent from the diet of individuals in larger size classes. This situation could be explained by selective feeding on the part of the larger individuals. Indeed, the Cichlidae that are consumed are juveniles (their average size is 10 mm). Their small size would therefore be better suited to the morphology of the smaller individuals of *Monodactylus sebae*. The disappearance of these prey items in favour of much larger fish prey, represented by the Clupeidae, can be explained by the morphological adaptations possessed by larger individuals.

Indeed, these individuals, in the case of *Monodactylus sebae*, have wider mouths, capable of consuming larger prey. These observations are consistent with other studies carried out on different species. Diomandé *et al.*, (2001) highlighted this behaviour

CONCLUSION

The diet of *Monodactylus sebae* in the Aby-Tendo lagoon complex is predominantly made up of fish prey, specifically Clupeidae, with the species *Pellonula leonensis* being the most common. Insects, particularly Chironomidae larvae, constitute secondary prey. Other prey taxa are considered to represent incidental prey. Environmental characteristics appear to influence the geographical distribution of prey. The diet of *Monodactylus sebae* in the Aby lagoon consists mainly of Clupeidae, whilst in the Tendo lagoon, insects (larvae of Chironomidae and Elmidae) represent the primary prey. The study of size classes indicated that *Monodactylus sebae* selects prey based on its size. The size of prey increases as the fish grow. All these strategies used by fish to secure their food supply are essential to their survival, as they enable them to adapt to fluctuations in their environments.

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