Observations on the feeding activities of the West African Manatee, *Trichechus senegalensis* Link, 1795 in a semi-wild environment

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Abstract

The presence of the West African manatee, *Trichechus senegalensis* in a semi-wild holding facility in Little Stream Farm, Ibesikpo Asutan Local Government Area, presented an opportunity to study directly, aspects of their biology, which hitherto were little known. This study was conducted to identify their plant food preferences and feeding behaviour as a reflection of what may approximate their activities in the wild. The selected plants were weighed (wet weight in kg) with spring balance in batches of 3kg per plant species and offered in batches to the manatee for a specified period (initially for 24 hours, then 4 hours and 10 hours). Of the 15 plant species presented, *Emilia sonchifolia*, *Commelina diffusa*, *Nymphaea* sp., *Panicum laxum*, *Eleusine indica* and *Rhynchosia* sp. had high preference levels while the quantity of *Chromolaena* sp. consumption was minimal. *Bambusa* sp., *Heliotropium indicum*, *Ludwigia abyssinica* and *Hyptis lanceolata* were ignored by the animal on repeated presentations. Studies on day-time and night-time feeding showed little difference in quantities of food consumed. However, the maximum consumption of 7kg was observed at daytime feeding on day 4 of the 14 days trial. The result showed that in the event of West African manatee rescue and fostering in temporary holding facilities, these plants' checklists may come in handy as food materials. They may also come for important considerations as plants whose natural growth and propagation should be encouraged in areas designated for West African manatee conservation.

Keywords: Feeding activities, West African manatee, semi-wild environment, plant species

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Introduction

The West African manatee *Trichechus senegalensis* Link, 1795 is a member of the mammalian Order Sirenia, a poorly known order of aquatic mammals that are believed to have descended from a common ancestor as the elephants (Happold 1987). They are highly adaptable and can be found practically in any permanent water body they can gain entrance; ranging from large and small rivers, freshwater and saltwater lagoons, lakes and reservoirs to coastal estuaries (Powell 1996).

Despite this reputed widespread occurrence of the West African manatee, it is restricted to only a few suitable locations where some large numbers of individuals may be present. This sporadic occurrence, coupled with the dearth of information on their life history and habitat requirements had often led to unsustainable hunting and habitat destruction under the erroneous belief that after all, other healthy populations abound elsewhere and consequently, the low priority rating (Vulnerable) assigned to it in the IUCN Red List. According to Powell (1996) and Keith-Diagne (2015), the West African manatee has a diversified diet and is therefore not a strict herbivore. Apart from cases of fish and aquatic mollusc remains, which have been reported from the gut contents, it is known to feed predominantly on aquatic vegetations and over 60 different plant species such as mangrove plants, *Vossia sp*, *Echinochloa sp*, *Paspalum sp*, turtle grass among others have been identified (Happold 1987; Powell 1996; Keith-Diagne 2015). However, the feeding activities of the manatee have been of great consideration among researchers of the mammal. IUCN (2006) reported that the manatee feeds on a wide variety of submerged, emergent, floating and shoreline vegetation, where they use their fore-limbs to dig into the sediment to remove seagrass' rhizomes or roots (Lefebvre and Powell 1990).

As a necessary precursor for the effective conservation of the West African manatee in the wild or in *ex-situ* facilities, aspects of their ecology and feeding biology must be studied to provide useful guidelines. As noted by Marsh *et al* (2012), in comparison with the other sirenians (especially the West Indian manatee), the diet of the West African manatee is poorly known and the diversity of plants eaten is seriously underestimated.

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Most of the reports on their dietary preferences are at best anecdotal (Powell 1996; Anne *et al* 2017). This study on the feeding preferences of the West African manatee in a semi-wild environment was undertaken to fill some of the gaps in the knowledge of their feeding behaviour and food preferences.

Materials and methods

The study area lies between latitude 4°50′ and 5°00′ N; and longitudes 7°45′ and 8°00′ E (Figure 1). The area is characterized by a rainy season, which begins in April and lasts till early November and a brief dry season, which starts in late November and ends in March. The relative humidity is high in the rainy seasons and low in the dry seasons. The Little Stream Farm support subsistence crop farming such as *Abelmoschus esculentus* (Okra), *Zea mays* (Corn), *Manihot esculentus* (Cassava), *Telfauria occidentalis* (Pumpkin), *Talinum triangulare* (Waterleaf) and *Cucueropsis mannii* (Melon). The adjoining area had a big fish farm with about 100 earthen ponds fed with water from the stream and an orchard. The physico-chemical quality of the stream (Table 1), the terrain, vegetation and major economic activities of the people had been described by Esenowo *et al* (2014).

A sub-adult male manatee measuring 1.9m in length and weighing 255kg was rescued in 2008 from manatee hunters at the upper Qua Iboe River at Nyaraenyin, Ikot Ekpene, Akwa Ibom State by the Ministry of Environment. In the absence of any protected river/stream or holding facility in the state, it was handed over to a fish farm (Little Stream Farm Ltd) for temporary custody in a secured stream channel. The captured manatee (Plate 1) was initially kept in a fish tank for two weeks. Thereafter, the manatee was kept in a channel (later named as manatee canal) in the Ikot Akpa Oso stream, which is a first order tributary of the Qua Iboe River where the animal was originally caught. The canal had a length of 99.63m, mean width of 3.00m and a depth of 1.2m. It was cordoned off at the lower reaches from the mainstream channel with strong wire-netting. Observations on the feeding activities of the manatee were made through direct observation.

To determine aquatic and bank plant food acceptable to the manatee, 15 plant species from 12 families growing at the study site were used in sample trials. These plants were *Asystasia gangetica, Eleusine indica, Emilia sonchifolia, Pandiaka involucrata, Commelina diffusa, Chromolaena odorata, Neophrolepis undulata, Rhynchosia* sp. *Musa* spp., *Nymphaea odorata*, *Bambusa vulgaris, Panicum laxum, Heliotropium indicum, Ludwigia abyssinica* and *Hyptis lanceolata*.

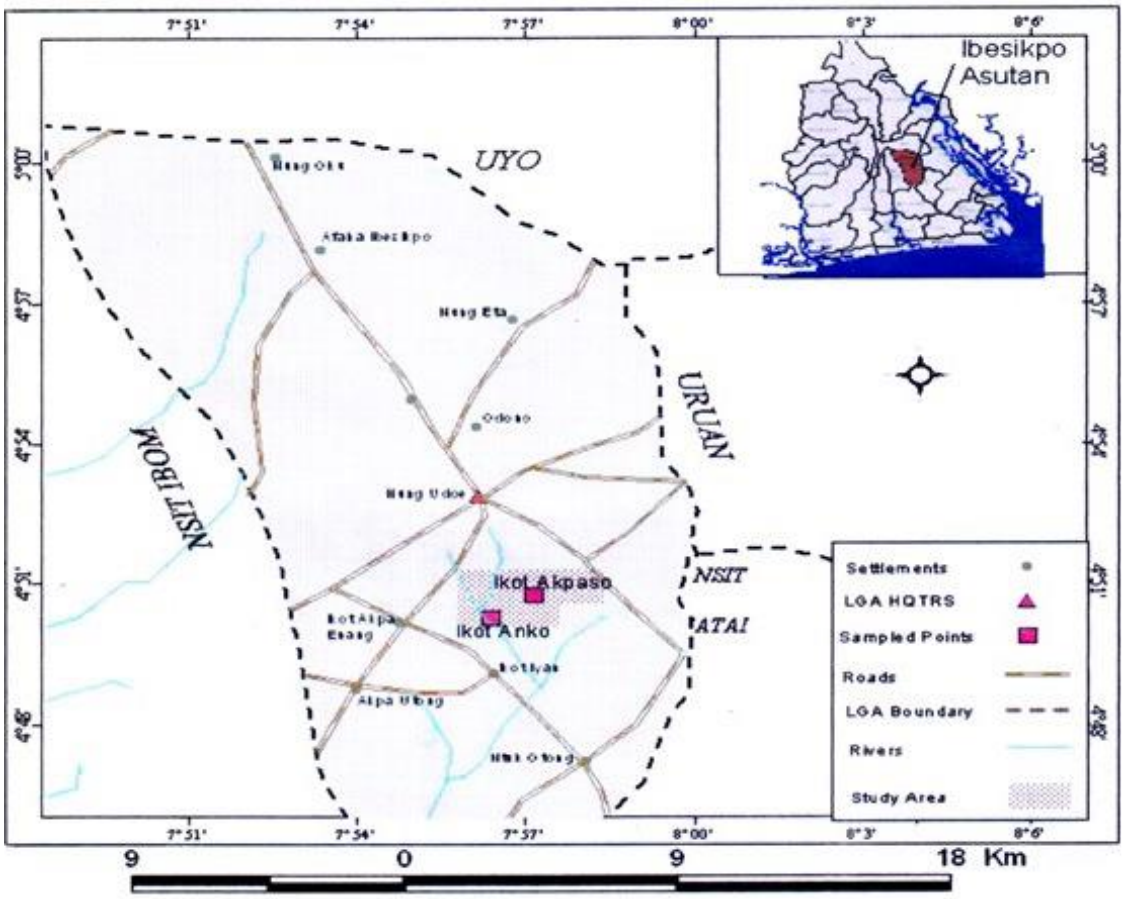

Figure 1. Map of the study area, with an insert of map of Akwa Ibom State

Plate 1. The male manatee being recovered from a fish tank.

Table 1: The mean and standard error of the Physico-chemical parameters of Little Stream Farm

Physico-chemical parameters	August Mean ± SE	October Mean ± SE	November Mean ± SE
pH	5.95±0.24	6.23±0.46	7.23±0.05
Water temperature (°C)	27±0.41	26.05±1.28	26.62±1.55
Free CO_2 (mg/l)	8.40±1.25	9.30±1.33	8.80±1.74
Total alkalinity (mg/l)	10.5±0.70	10.52±2.06	10.02±2.78
DO (mg/l)	6.52±0.22	7.77±2.41	7.77±1.62
Biochemical oxygen demand (mg/l)	1.92±0.41	2.9±0.08	2.49±0.93

Source: Esenowo *et al* (2014), SE= standard error

Five of these plants were tied separately to five wooden stakes in the stream (Plate 2) after taking their weights using a spring balance. After 24 hours they were examined for consumed parts, allowed to drain off water and weighed. This was repeated for three days for all the plants in batches of fives.

Plate 2: Manatee canal showing samples of plant food presented to the manatee

To determine the manatee's preference for the consumed species, 3 different plant species of equal weights (3kg) were tied with separate strings to the same stake and allowed to trail in the water for four (4) hours. The plant species when pulled out of the water, were allowed to drain off water and reweighed. This was repeated for the remaining 12 plant species that were consumed in batches of three in three trials. The mean weights of the plant species consumed were calculated.

Having identified the plants consumed by the manatee, the quantity of food consumed in the daytime and during the night was determined by weighing and tying bunches of the plants with strings secured to stakes. Daytime samples were started by 7.00am and removed for re-weighing by 5.00pm while night-time was from 7.30pm to 5.30am. The number of plant materials consumed on each occasion was determined by subtracting the final from the initial weight after draining-off excess water. This procedure was repeated for 14 days.

Results

The pH range showed that the stream tended towards alkalinity (Table 1). Fifteen (15) plant species grouped into 12 families were introduced to the manatee as food (Table 2). *Asystasia gangetica, Eleusine indica, Emilia sonchifolia, Commelina diffusa, Rhynchosia, Nymphaea odorata,* and *Panicum laxum* were the highly preferred plant species (Table 2). The results showed that Group 4 plant species comprising of *Panicum laxum, Rhynchosia sp* and *Eleusine indica* were the most consumed (6kg) followed by Group 3, while Group 1 was the least consumed (Table 3). The quantity of plant species consumed by the manatee during day and night time feeding is presented in Figure 2.

The consumption rate for the 1st day time trial was 6 kg. This rose to 10.5kg (day time + night) on the second day and 12kg and 10.5kg (day time + night) on the 3rd and

4th days, respectively. However, having received regular feeding, the rate of consumption dropped from day 5 to day 10 with oscillations of between 6kg to 8 kg (day time + night) in-between. There was a steady rise again from day 11 (9.3kg) to 14 (11.5kg) in the consumption rate (Figure 2).

Discussion

The physico-chemical parameters are within the stipulated range recommended as safe for aquatic fauna as reported by Esenowo *et al* (2014). According to Lefebvre *et al* (2000), manatees limited to a water temperature value of 27°C will eat properly, increase in weight, and become nourished and mature fast.

Eleven (11) out of the 15 plant species introduced to the manatee were accepted as food. Three species *Heliotropium indicum*, *Ludwigia abyssinica* and *Hyptis lanceolata* were not consumed. *Bambusia* sp. was rarely nibbled and the animal did not pay attention to it, thereafter when *Emilia sonchifolia* (mean weight consumed in 3 trials was 2.50kg) was offered separately to the manatee in equal quantities and conditions, the manatee showed greater preference for the plant species.

Table 2: Plant species consumed by the manatee and the preference level

Family	Plant species	Common Name	Preference level
Acanthaeceae	*Asystasia gangetica* (L.) T. Anderson	Hunter's weed	++++
Asteraceae	*Eleusine indica* (L.) Gaertn	Goose grass	++++
	Emilia sonchifolia (L.) DC. ex Wight	Shaving brush	++++
Amaranthaceae	*Pandiaka involucrata* (Moq.) Hook.f	-	++
Commelinaceae	*Commelina diffusa* Burmf	Spreading day flower	++++
	Chromolaena odorata (L.) R. M. Kingard H. Rob.	Siam weed	+
Dryopteridaceae	*Neophrolepis undulata*	Sword fern	+++
Fabaceae	*Rhynchosia sp* Lour.	Cover crop	++++
Musaceae	*Musa sp* L.	Plantain (leaves)	++
Nymphaeaceae	*Nymphaea odorata* Aiton	Waterlily	++++
Poacaea	*Bambusa sp* Schreb.	Indian Bamboo	-
	Panicum laxum Sw.	-	++++
Boraginaceae	*Heliotropium indicum* L.	Indian heliotrope	-
Onagraceae	*Ludwigia abyssinica* A. Rich	Water primrose	-
Labiatae	*Hyptis lanceolate* Poit	-	-

++++ - highly preferred, +++ - moderately preferred, ++ - lowly preferred , +- uncertain, - - not preferred

Table 3: Consumed weight of plants species by the manatee and relative percentage weight of the plants

Group	Plant species	Consumed weight (kg)	% weight of each plant species consumed	% weight of grouped plant species consumed (%)
1	*Bambusa vulgaris*	0.00	0.00	
	Asystasia gangetica	2.00	10.15	17.76
	Neophrolepis undulata	1.50	7.61	
		3.5		
2	*Commelina diffusa*	2.30	11.67	
	Chromolaena odorata	1.00	5.08	22.33
	Musa sp	1.10	5.58	
		4.40		
3	*Nymphaea odorata*	2.00	10.15	
	Pandiaka involucrata	1.30	6.60	29.44
	Emilia sonchifolia	2.50	12.69	
		5.80		
4	*Panicum laxum*	2.00	10.15	
	Rhynchosia sp	2.00	10.15	30.46
	Eleusine indica	2.00	10.15	
		6.00		
	Total	**19.70**		

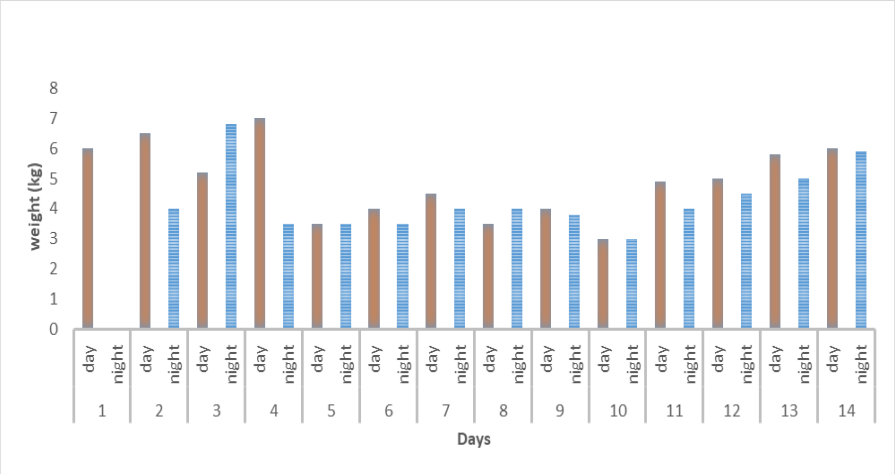

Figure 2. Quantity of feed consumed by the manatee during day and night time feeding.

It was also observed from the results that the manatee fed both during the day and night time. It was clear, however, that a slightly more quantity of food was consumed in the daytime than at the night. This might have been influenced by the fact that it was in a protected environment with no threat posed to it. The study was initiated at a period when the plant food in the canal had almost been depleted and whatever the manatee was obtaining there was marginal.

The placid and clear water of the canal (transparency >2.0m) made observations of the behaviour and activities of the manatee possible (Plate 3). When the 15 species of plants were initially offered to the manatee separately in groups of five different plant samples at a time, it was observed that the animal moved randomly from one sample to the other (e.g. from sample 2 to 1, then 5, 3 and 4). When it approached a bunch, it grappled with and nibbled a bit before moving to the next. It sampled (tasted) all five species of plants before returning to a specific bunch to graze. Considerable time was taken and substantial quantities consumed of the highly preferred species (e.g. *Commelina diffusa*, *Emilia sonchifolia Panicum laxum* among others) before moving to the next plant bunch. Less preferred plants such as *Chromolaena odorata* were simply brushed with the bristles on the snout and scarcely nibbled before the manatee moved away. In subsequent presentations, the manatee went to the more favoured plants first before coming to feed on the others in no particular order of preference.

Marsh *et al* (2012) reviewed the optimal foraging theory, which states that natural selection favours animals whose behavioural strategies maximize their net energy intake per unit of time spent foraging. Thus, out of a wide range of food available, animals restrict themselves to a few preferred types, taking note that nutrient content may vary with phenological stage and that plants may possess chemical defences and toxins. This may explain the non-utilisation of *Heliotropium indicum, Ludwigia abyssinica* and *Hyptis lanceolata.* Some of these plants are pungent, aromatic or hirsute (Etukudo 2003) and may possess toxic alkaloids such as Pyrrolizidine indicine found in *Heliotropium* spp. Pyrrolizidine is known to have toxic effects on the liver and lungs and is a mutagenic and carcinogenic agent (Carballo *et al* 1992; van Weeren *et al* 1999). Thus, the manatee might have been instinctively using its innate knowledge of plants to avoid potentially toxic specimens while showing a great preference for seven (7) out of the 15 species presented to it.

Plate 3: The manatee surfacing to inhale air in the clear, calm water of the canal

During the time of studying the feeding activities in the daytime, it was observed that after the introduction of food by 7.00am, the manatee was most active between the hours of 9.00am to 1.00pm (approx. 5 hours) and thereafter retreated to relatively shallow water (c.1m) near the bank and sheltered from direct sunlight to rest. From 4.00pm, it begins to roam the canal again.

When taken by surprise by human intrusion during feeding, it feigned death and 'froze' for about 30 seconds with plant materials sticking out of its mouth. After three months in the facility, it paid less attention to human presence and continued with its normal activities. Reynolds and Odell (1991), Powell (1996), and Keith-Diagne (2015) reported that the manatee takes up fish in its diet. Keith-Diagne (2015) observed that fish and aquatic molluscs make a significant contribution to the average lifetime diet composition of manatees in Gabon (10%) and Senegal (50%). However, in the course of this study, the manatee was observed to have carefully excluded a dead fish (*Coptodon* sp.) entangled in the

bunch of plant food from the meal ingested. The canal contained fish species such as *Coptodon* sp, *Hemichromis* sp, *Epiplatys* sp, *Alestes nurse* and *Clarias* among others. *Coptodon* sp. were regularly seen cleaning the body of the manatee by grazing on the micro-algae encrusted on its body while the manatee completely ignored their presence and rather forage on the plant materials.

Conclusion

In conclusion, the manatee, which is known to be a voracious herbivore, does, however, show preferences in the selection of food items consumed; preferring the soft, succulent roots, stems and leaves of the favoured plants. The findings also indicated the enormous task of restricting the manatee to limited space and attempting to meet its feeding demands. The migratory and roaming habits of the manatee may not be unconnected with its voracious nature as it quickly degrades the standing crop of plant biomass in a restricted area. The plants identified in this study that were acceptable to the manatee may prove useful in the sustenance of the species in the event of rescued animals in restricted holding facilities or captive-breeding programmes, but it is suggested that such captive periods should be brief except adequate measures have been taken to provide food materials and enabling water quality conditions.

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