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The food and feeding habits of the catfishes, *Chrysichthys walkeri* (Gunther), *Chrysichthys filamentosus* (Boulenger) and *Chrysichthys nigrodigitatus* (Lacépède) in the Lekki Lagoon, Nigeria

KOLA IKUSEMIJU AND C. I. O. OLANIYAN
*Department of Biological Sciences, University of Lagos,
Lagos, Nigeria*

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A total of 1436 specimens were examined in the study of the food habits of the three *Chrysichthys* species in Lekki Lagoon. Certain differences were found in their food habits. *Chrysichthys walkeri* fed mostly on insects, *Chrysichthys filamentosus* on crustaceans and *Chrysichthys nigrodigitatus* on molluscs. It is suggested the observed diversity in feeding habits might be due to an active response to interspecific competition.

I. INTRODUCTION

No previous work has been carried out on the resident fish population in Lekki Lagoon. Little information has been published on the catfishes belonging to the genus *Chrysichthys* which occur commonly in West Africa and support a major fishery in the lagoon. This paper gives the results obtained from the examination of 1436 specimens of *Chrysichthys walkeri* (Gunther), *Chrysichthys filamentosus* (Boulenger) and *Chrysichthys nigrodigitatus* (Lacépède) caught during the period 1969–1971, deals with the food and feeding habits, and the relationship of the catfishes to other fishes in the lagoon.

II. MATERIALS AND METHODS

Lekki Lagoon (Fig. 1) is located in Lagos State of Nigeria. It has a surface area of 247 km² with a maximum depth of 6.4 m, a greater part is shallow and less than 3.0 m deep. A 5.2 m beam trawl was used for sampling at the various stations marked I–VI in Fig. 1. The conical cod-end of the beam trawl was made of 0.64 m nylon netting. Next to the cod-end was 1.27 cm mesh bait liner. The main body of the net was of nylon netting, 2.54–3.18 cm.

Each haul lasted 10 min at a pre-determined fishing depth. Fish samples were immediately preserved in 10% formalin for further analysis in the laboratory. During the entire study, thirty regular trips were undertaken representing 144 daylight and 37 night-time hauls.

The contents of the stomachs were analysed to establish the food habits of the fishes. Since the fishes caught from the trawl net were immediately preserved in formalin, their stomach contents were representative of their last meals. The numerical, frequency of occurrence, and volumetric methods used have been examined by Hynes (1950), Hunt & Carbine (1950) and Lagler (1956).

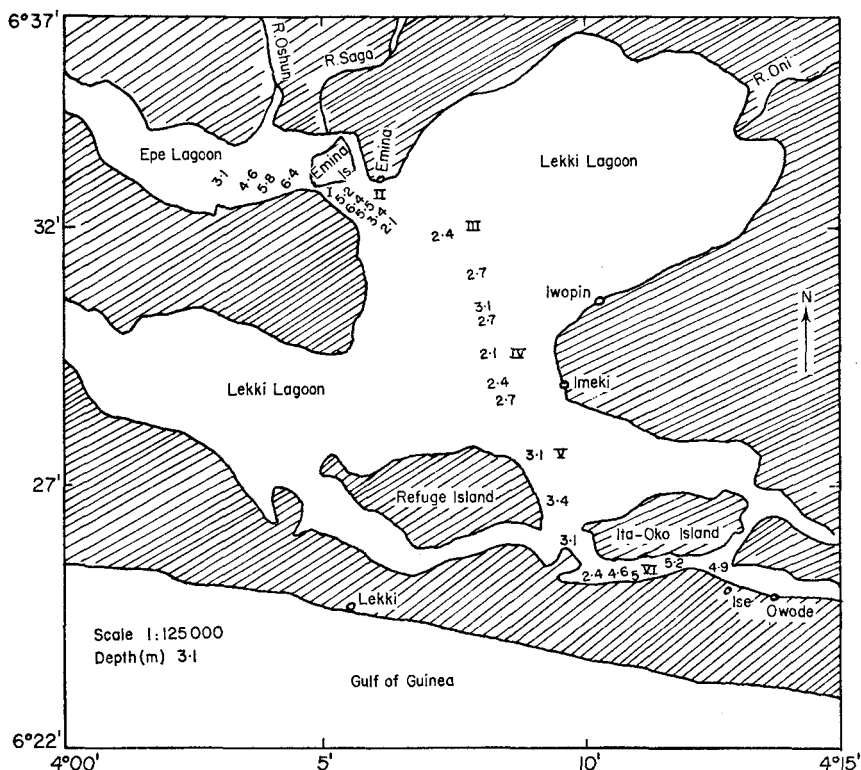


FIG. 1. Map of Lekki Lagoon showing the fishing stations.

III. RESULTS AND DISCUSSION

FOOD AND FEEDING HABITS OF *C. WALKERI*

A total of 577 specimens of *C. walkeri* (total length 5.0–25.7 cm) were examined, of which 132 (22%) had empty stomachs. A summary of the food items is presented in Table I.

By the numerical method, chironomid larvae accounted for 25% of all food items and occurred in 51% of all fish examined; these larvae were also the most important by the volumetric method representing 63% of food eaten. Ostracods contributed 36 and 30% as food items by numerical and occurrence methods respectively, but accounted for only 5% of the volume of food eaten. Cladocera contributed 18% by number, occurred in 15% of the stomachs but accounted for only 2% of the volume of food eaten. Copepods (*Diaptomus* sp. and *Acartia* sp.) accounted for 13 and 25% as food items by numerical and occurrence methods respectively, and contributed 2% by the volumetric method. The hemipteran, *Notonecta* sp. accounted for 2% by number, 22% by occurrence and 7% by volume respectively. Mysids, chaoborid larvae, trichopteran larvae, molluscs and fishes were the least abundant and represented only 0.8% by numerical and 2–8% by occurrence methods.

FOOD HABITS IN RELATION TO SIZE

The specimens of *C. walkeri* were divided into two groups to facilitate the comparison of their food habits. The first comprised of small fish 5–14 cm total length, the second consisted of the larger fish, 15–24 cm total length. A summary of the

percentage composition of food for the two size categories is presented in Table II. There were distinct differences in the food habits as related to size. Crustacea were the main food item for the small fish whereas fish, molluscs and insects were relatively more important for the larger fish. Although this change in the diet associated with increase in size has been previously reported, Thomas (1966), Fagade & Olaniyan (1972), it is reported for *C. walkeri* for the first time.

TABLE I. Summary of the food items of 577 *C. walkeri* from Lekki Lagoon

| | Numerical Method | | Frequency Method | | Volumetric Method | |
|--------------------------------|------------------|---------|------------------|---------|-------------------|---------|
| | Number | Percent | Number | Percent | Volume (cc) | Percent |
| Crustacea | | | | | | |
| Cladocera | | | | | | |
| <i>Daphnia</i> sp. | 7296 | 18.48 | 36 | 15.9 | 0.72 | 2.13 |
| Copepoda | | | | | | |
| <i>Diaptomus</i> sp. | 3372 | 8.54 | 40 | 17.6 | 0.66 | 1.95 |
| <i>Acartia</i> sp. | 1941 | 4.92 | 17 | 7.5 | 0.29 | 0.86 |
| Ostracoda | 14 333 | 36.31 | 68 | 30.0 | 1.81 | 5.34 |
| Mysidacea | | | | | | |
| <i>Mysis</i> sp. | 43 | 0.11 | 10 | 4.4 | 0.54 | 1.60 |
| Insecta | | | | | | |
| Diptera | | | | | | |
| Chironomid larvae | 10 236 | 25.93 | 117 | 51.1 | 21.34 | 63.10 |
| Chaoborid larvae | 242 | 0.61 | 11 | 4.8 | 0.57 | 1.69 |
| Trichoptera | | | | | | |
| Trichopteran larvae | 310 | 0.79 | 20 | 8.8 | 0.15 | 0.44 |
| Hemiptera | | | | | | |
| <i>Notonecta</i> sp. | 996 | 2.52 | 52 | 22.9 | 2.55 | 7.54 |
| Mollusca | | | | | | |
| <i>Iphigenia truncata</i> | 341 | 0.86 | 21 | 9.2 | 0.84 | 2.48 |
| <i>Limnaea truncatula</i> | 60 | 0.15 | 5 | 2.2 | 0.27 | 0.80 |
| <i>Pachymelania bryonensis</i> | 300 | 0.76 | 13 | 5.7 | 0.81 | 2.40 |
| Pisces | | | | | | |
| Pisces | 8 | 0.02 | 6 | 2.6 | 0.71 | 2.10 |
| Unidentified items | — | — | 20 | 8.8 | 2.56 | 7.57 |

DIURNAL VARIATION IN FOOD HABIT OF *C. WALKERI*

A total of 112 specimens of *C. walkeri* were caught during the day of which 27 (24%) had empty stomachs as opposed to 43 of 149 specimens (28%) caught at night.

The day and night variation in food and feeding habits of *C. walkeri* is presented in Table III. Ostracods were an important food item at night accounting for 50.26% by number and 37.3% by occurrence of food eaten, but during daylight hours they contributed only 11.98% by number and 21.2% by occurrence methods. Chironomid larvae were taken during day and night with a greater number during the day (77.08%)

TABLE II. Summary of the food items of *Ch. walkeri* from Lekki Lagoon in percentages by size groups

| Total Lengths No. examined | 5-14 cm 83 | | | 15-24 cm 144 | | |
|--------------------------------|----------------|----------------|----------------|-----------------|----------------|----------------|
| | N ¹ | O ² | V ³ | N ¹ | O ² | V ³ |
| Crustacea | | | | | | |
| Cladocera | | | | | | |
| <i>Daphnia</i> sp. | 10.10 | 13.2 | 5.6 | 24.1 | 17.2 | 1.6 |
| Copepoda | | | | | | |
| <i>Diaptomus</i> sp. | 7.50 | 15.6 | 5.3 | 8.14 | 18.0 | 1.4 |
| <i>Acartia</i> sp. | 1.00 | 3.6 | 0.5 | 6.71 | 9.7 | 0.9 |
| Ostracoda | 72.80 | 48.2 | 25.9 | 15.13 | 19.4 | 2.3 |
| Mysidacea | | | | | | |
| <i>Mysis</i> sp. | 0.05 | 3.6 | 5.0 | 0.10 | 4.8 | 1.1 |
| Insecta | | | | | | |
| Diptera | | | | | | |
| Chironomid larvae | 4.80 | 43.3 | 28.1 | 39.10 | 56.2 | 66.9 |
| Chaoborid larvae | 0.00 | 0.0 | 0.0 | 1.00 | 7.6 | 1.9 |
| Trichoptera | | | | | | |
| Trichopteran larvae | 0.30 | 8.4 | 3.3 | 1.10 | 8.2 | 1.8 |
| Hemiptera | | | | | | |
| <i>Notonecta</i> sp. | 2.10 | 27.7 | 16.2 | 2.18 | 20.1 | 6.1 |
| Mollusca | | | | | | |
| <i>Iphigenia truncata</i> | 1.20 | 3.6 | 5.1 | 1.09 | 12.5 | 2.1 |
| <i>Limnaea truncatula</i> | 0.00 | 0.0 | 0.0 | 0.20 | 3.4 | 0.9 |
| <i>Pachymelania bryonensis</i> | 0.15 | 2.4 | 2.0 | 1.13 | 7.6 | 2.6 |
| Pisces | | | | | | |
| Pisces | 0.00 | 0.00 | 0.00 | 0.03 | 4.1 | 2.3 |
| Unidentified items | — | 4.8 | 3.0 | — | 11.1 | 8.1 |

N¹, number; O², occurrence; V³, volume.

but equal proportions of 64.7% and 63.6% for day and night by the occurrence method. Cladocera and copepods occurred in the diet only at night. The mollusc, *Limnaea truncatula* was also eaten only at night. The other food items as indicated in Table III were taken equally during the day or night.

FOOD AND FEEDING HABITS OF *C. FILAMENTOSUS*

A total of 756 specimens of *C. filamentosus* were examined, of which 101 (13.3%) had empty stomachs. Although the specimens ranged between 6.0 cm and 22.2 cm in total length, 96% of them fell within the 10-18 cm range and these were likely to be of approximately the same age. A summary of the food items is presented in Table IV.

By the numerical method, ostracods accounted for 55% of all food items and were the most common by the frequency of occurrence method, representing 55%; they contributed 21% by volume of total food eaten. Ostracods have not been observed as a major food for *Chrysichthys* sp. Sandon & Tayid (1953) reported the food of *C. auratus* in River Nile as consisting of young fish and vegetable matter, while Imevbore & Bakare (1970) noted the food of the same species in River Niger consisted of bivalve molluscs and trichopteran larvae.

The cladoceran, *Daphnia* sp. contributed 21% as food items by numerical and occurrence methods respectively but only 6% by volume. The copepods, *Diaptomus* sp. and *Acartia* sp. both accounted for 11% by number, 33% by occurrence but only 3% by volume of all food eaten. In general, *C. filamentosus* fed on crustaceans. Chironomid larvae contributed only 6% of food eaten by the numerical method but occurred in 38% of the stomachs and accounted for 42% by volume of all food eaten. The hemipteran, *Notonecta* sp. accounted for 3% by number, 21% by occurrence and 11% by volume. The molluscs were the least eaten, occurring in only 3% of all the fish examined. *C. filamentosus* in Lekki Lagoon did not feed on fish or fish eggs.

DIURNAL VARIATION IN FOOD ITEMS OF *C. FILAMENTOSUS*

One hundred and thirty-four specimens were examined during the day of which 26 (19%) had empty stomachs; 29 of 133 fish (21%) caught during the night had empty stomachs.

The day and night variations in food and feeding habits of *C. filamentosus* are presented in Table V. Ostracods were an important food item during both day and night, accounting for 54 and 51% respectively by number and for 60 and 46% respectively by occurrence methods. Chironomid larvae, an important food item for the fish during the dry months were consumed more at night than during the day, contributing 31 and 41% by number and 42.3 and 67.3% by occurrence method during day and

TABLE III. Diurnal variation in food items of *C. walkeri* from Lekki Lagoon, November 1970–March 1971

| | Numerical Method | | | | Occurrence Method | | | |
|--------------------------------|------------------|-------|---------|-------|-------------------|-------|---------|-------|
| | Number | | Percent | | Number | | Percent | |
| | Day | Night | Day | Night | Day | Night | Day | Night |
| | Day | Night | Day | Night | Day | Night | Day | Night |
| Crustacea | | | | | | | | |
| Cladocera | | | | | | | | |
| <i>Daphnia</i> sp. | 900 | 0 | 5.50 | 0 | 9 | 0 | 10.6 | 0 |
| Copepoda | | | | | | | | |
| <i>Diaptomus</i> sp. | 236 | 0 | 1.44 | 0 | 8 | 0 | 9.4 | 0 |
| Ostracoda | 1959 | 9962 | 11.98 | 50.26 | 18 | 41 | 21.2 | 37.3 |
| Mysidacea | | | | | | | | |
| <i>Mysis</i> sp. | 4 | 4 | 0.02 | 0.02 | 1 | 2 | 1.2 | 1.8 |
| Insecta | | | | | | | | |
| Diptera | | | | | | | | |
| Chironomid larvae | 12 606 | 8248 | 77.08 | 41.61 | 55 | 70 | 64.7 | 63.6 |
| Chaoborid larvae | 41 | 326 | 0.25 | 1.64 | 9 | 18 | 10.6 | 16.4 |
| Hemiptera | | | | | | | | |
| <i>Notonecta</i> sp. | 526 | 521 | 3.22 | 2.63 | 21 | 35 | 24.7 | 31.9 |
| Mollusca | | | | | | | | |
| <i>Iphigenaia truncata</i> | 63 | 261 | 0.39 | 1.32 | 6 | 15 | 7.1 | 13.6 |
| <i>Limnaea truncatula</i> | 0 | 438 | 0 | 2.21 | 0 | 6 | 0 | 5.5 |
| <i>Pachymelania bryonensis</i> | 19 | 62 | 0.12 | 0.31 | 1 | 5 | 1.2 | 4.5 |
| Unidentified items | — | — | — | — | 9 | 13 | 10.6 | 11.8 |
| Number of fish examined: | Day | | 85 | | | | | |
| | Night | | 106 | | | | | |

night respectively. The fish fed on cladocerans mostly during the day. *Notonecta* sp. was equally important during both day and night. Apart from the chironomids, therefore, *C. filamentosus* fed on the same major food items by day and night.

FOOD AND FEEDING HABITS OF *C. NIGRODIGITATUS*

A total of 103 specimens of *C. nigrodigitatus* of total length 9–27 cm were examined out of which 47 (45%) had empty stomachs. A summary of the food items is presented in Table VI.

TABLE IV. Summary of the food items of 756 *C. filamentosus* from Lekki Lagoon

| | Numerical Method | | Frequency Method | | Volumetric Method | |
|--------------------------------|------------------|---------|------------------|---------|-------------------|---------|
| | Number | Percent | Number | Percent | Volume | Percent |
| Crustacea | | | | | | |
| Cladocera | | | | | | |
| <i>Daphnia</i> sp. | 22 841 | 21.97 | 144 | 29.2 | 1.39 | 6.56 |
| Copepoda | | | | | | |
| <i>Diaptomus</i> sp. | 6794 | 6.53 | 86 | 17.4 | 0.39 | 1.84 |
| <i>Acartia</i> sp. | 5249 | 5.05 | 78 | 15.8 | 0.25 | 1.18 |
| Ostracoda | 57 501 | 55.30 | 273 | 55.8 | 4.59 | 21.65 |
| Mysidacea | | | | | | |
| <i>Mysis</i> sp. | 43 | 0.04 | 20 | 4.1 | 0.44 | 2.08 |
| Insecta | | | | | | |
| Diptera | | | | | | |
| Chironomid larvae | 6883 | 6.62 | 190 | 38.5 | 8.94 | 42.17 |
| Chaoborid larvae | 127 | 0.12 | 23 | 4.7 | 0.50 | 2.36 |
| Trichoptera | | | | | | |
| Trichopteran larvae | 172 | 0.17 | 26 | 5.3 | 0.59 | 2.78 |
| Hemiptera | | | | | | |
| <i>Notonecta</i> sp. | 3903 | 3.75 | 105 | 21.2 | 2.39 | 11.27 |
| Mollusca | | | | | | |
| <i>Iphigenia truncata</i> | 13 | 0.01 | 3 | 0.07 | 0.01 | 0.05 |
| <i>Limnaea truncatula</i> | 94 | 0.09 | 12 | 2.1 | 0.15 | 0.70 |
| <i>Pachymelania bryonensis</i> | 366 | 0.35 | 17 | 3.4 | 0.93 | 4.39 |
| Unidentified items | — | — | 42 | 8.5 | 0.63 | 2.97 |

By the numerical and occurrence methods, the gastropod, *Pachymelania bryonensis* was the most important food accounting for 20% by number and occurred in 30% of all fish examined. Ostracods contributed 25% by number but occurred in only 12% of the stomachs. Cladocerans and copepods were also eaten accounting for 23 and 15% by number and 10 and 16% by occurrence methods respectively. Chironomid larvae contributed 5% by number but occurred in 26% of the stomachs examined. *C. nigrodigitatus* had greater preference for molluscs than the two other catfish species in the lagoon.

Fagade & Olaniyan (1973) reported the food of *C. nigrodigitatus* in Lagos Lagoon, consisted of bivalves (84%) mainly *Aloidis* sp. and gastropods, mainly *Neritina* sp. (14%). There is thus a noticeable difference in the diet of *C. nigrodigitatus* in Lagos Lagoon in which there is brackish water throughout the year, and the Lekki lagoon where there is fresh water.

RELATION OF THE FOOD OF THE CATFISH TO OTHER FISHES

The results of samplings made between 1969–1971 show the three species of catfish were the most abundant fish in Lekki lagoon, accounting for 42% of the total 5969 fishes caught. Three other species of fish, *Pellonula afzeliusi*, *Elops lacerta* and *Tilapia melanopleura* were also present. *Pellonula afzeliusi* fed mostly on *Acartia* sp. and *Daphnia* sp. but became pelagic at night during moonlight periods and fed on surfacing insects. *Elops lacerta* showed no diurnal vertical migration but fed mostly on juvenile fish (mostly the young of *Pellonula afzeliusi*) and *Notonecta* sp. *Tilapia melanopleura* fed mainly on *Notonecta* sp. and algal filaments. There seemed therefore to be no serious competition for food between the catfishes and the other major fish species in the lagoon.

TABLE V. Diurnal variation in food items of *C. filamentosus* from Lekki Lagoon, November 1970–March 1971

| | Numerical Method | | | | Frequency Method | | | |
|--------------------------------|------------------|-------|---------|-------|------------------|-------|---------|-------|
| | Number | | Percent | | Number | | Percent | |
| | Day | Night | Day | Night | Day | Night | Day | Night |
| | | | | | | | | |
| Crustacea | | | | | | | | |
| Cladocera | | | | | | | | |
| <i>Daphnia</i> sp. | 499 | 26 | 4.89 | 0.27 | 7 | 2 | 6.0 | 2.1 |
| Copepoda | | | | | | | | |
| <i>Diaptomus</i> sp. | 143 | 17 | 1.40 | 0.18 | 7 | 2 | 6.0 | 2.1 |
| <i>Acartia</i> sp. | 37 | 94 | 0.36 | 0.99 | 3 | 4 | 2.6 | 4.3 |
| Ostracoda | 5581 | 4907 | 54.66 | 51.40 | 70 | 44 | 60.3 | 46.3 |
| Insecta | | | | | | | | |
| Diptera | | | | | | | | |
| Chironomid larvae | 3174 | 3970 | 31.09 | 41.58 | 49 | 64 | 42.3 | 67.3 |
| Chaoborid larvae | 58 | 29 | 0.57 | 0.30 | 7 | 8 | 6.0 | 8.4 |
| Hemiptera | | | | | | | | |
| <i>Notonecta</i> sp. | 622 | 448 | 6.09 | 4.69 | 49 | 40 | 42.3 | 42.1 |
| Mollusca | | | | | | | | |
| <i>Iphigenia truncata</i> | 0 | 33 | 0 | 0.35 | 0 | 4 | 0 | 4.2 |
| <i>Pachymelania bryonensis</i> | 96 | 23 | 0.94 | 0.24 | 3 | 1 | 2.6 | 1.0 |
| Unidentified items | — | — | — | — | 3 | 6 | 2.6 | 6.3 |

COMPETITION FOR FOOD AMONGST THE CATFISH SPECIES

Although the occurrence of similar food items in the stomach contents of the catfishes suggests competition, it was also necessary to consider if the demand of the *Chrysichthys* species for these food items in Lekki Lagoon was in excess of supply. The analysis of the stomachs of *C. walkeri* and *C. filamentosus* showed 75% of the stomachs examined were more than half full of food organisms. This indicated an abundant supply of food organisms which might have reduced the overall competition for food amongst the three catfish species. However, from the results, *C. walkeri* fed mostly on insects, *C. filamentosus* on crustaceans and *C. nigrodigitatus* on molluscs. This diversity in feeding habit might be interpreted as an active response to inter-specific competition.

TABLE VI. Summary of the food items of 103 *C. nigrodigitatus* from Lekki Lagoon

| | Numerical Method | | Frequency Method | |
|--------------------------------|------------------|---------|------------------|---------|
| | Number | Percent | Number | Percent |
| Crustacea | | | | |
| Cladocera | | | | |
| <i>Daphnia</i> sp. | 1190 | 23.03 | 6 | 10.8 |
| Copepoda | | | | |
| <i>Diaptomus</i> sp. | 359 | 6.95 | 6 | 10.8 |
| <i>Acartia</i> sp. | 441 | 8.94 | 3 | 5.4 |
| Ostracoda | 1297 | 25.10 | 7 | 12.5 |
| Mysidacea | | | | |
| <i>Mysis</i> sp. | 6 | 0.12 | 2 | 3.6 |
| Insecta | | | | |
| Diptera | | | | |
| Chironomid larvae | 285 | 5.52 | 15 | 26.8 |
| Chaoborid larvae | 49 | 0.95 | 3 | 5.4 |
| Trichoptera | | | | |
| Trichopteran larvae | 66 | 1.28 | 5 | 8.9 |
| Hemiptera | | | | |
| <i>Notonecta</i> sp. | 362 | 7.00 | 7 | 12.5 |
| Mollusca | | | | |
| <i>Iphigenia truncata</i> | 38 | 0.74 | 7 | 12.5 |
| <i>Limnaea truncatula</i> | 19 | 0.37 | 3 | 5.4 |
| <i>Pachymelania bryonensis</i> | 1054 | 20.40 | 17 | 30.4 |
| Unidentified items | — | — | 7 | 12.5 |

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