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## The fauna of the Tanki flip site-Aruba...

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## Résumé

L'étude archéozoologique des restes osseux de Tanki Flip, un vaste village Dabajuroïd situé au nord-est d'Aruba, a fourni des informations à propos des modes de subsistance de ce groupe. Cela a permis de mettre en évidence les lieux de pêche et de chasse ainsi que la présence d'échanges avec le continent. L'analyse des restes de chaque structure a été réalisée afin de percevoir les divergences et les similitudes entre les structures ovales et ronde.

## Abstract

*The zooarchaeological study of the faunal remains of Tanki Flip, a large Dabajuroïd village located on the northern part of Aruba, underline the subsistence patterns of this group. The fishing and hunting location and the presence of trade and exchanges with the mainland appear. An analysis of the remains in each structure of the site has been performed in order to see the differences and similarities between the oval and round structures.*

## Resumen

*El estudio arqueozoológico de los restos animales de Tanki Flip, una grande ciudade Dabajuroïd, situada en el nordeste de Aruba, deu informaciones a proposito de los metodos de subsistencia de este grupo, los lugares de pesca y de caça, tanto que la presencia de cambios con el continente. La analysis de los restos de cada estructura fuera realizada afin de perceber las diferencias y la similaridades entre las estructuras ovales y arredondas.*

## INTRODUCTION

This paper presents the results of the faunal analysis of Tanki Flip. This site is located in a semi-desert environment characterized by an arid vegetation (xerophitic, 425 mm of precipitation by year) at the present time, but was characterized by evergreen forests in pre-Columbian times (Versteeg & Ruiz, 1995). Three «guts» that are dry during most of the year drain water from the area around the site during the rainy season (see other Tanki Flip papers in the XVIth I.C.C.A.). The vegetation is denser along the «guts» and consequently the majority of small mammals, birds and lizards live here. The shore and the leeward/windward coastal waters with their rich marine fauna are at 3.000 and 5.000 meters, respectively, from the site.

The analysis of the faunal remains allows us to gain insight into the prehistoric economy and subsistence patterns. We can see the selection the Amerindians made while exploiting the available indigenous fauna. Amerindian activities are reflected in the distribution of the faunal remains over this large site. There is some evidence of fishing and hunting patterns and locations. It also shows the presence of contact by the import of (parts of) species from the continent.

The sample of the faunal remains consisted of 14,210 bones or bone fragments of which 4,922 were identified (Table 1). They represent 102 taxa (Table 2). The hypothetical absolute Minimum Number of Individuals of the excavated area is 318.

The preservation of the bone in Tanki Flip is generally poor due to the soil and subsoil conditions of the site (sand covering diorite, and infiltration and circulation of water during and after (the

sometimes heavy and intensive) rainfall). Therefore, the bones were fragmented and, sometimes, the identification could not go beyond the Family level.

## MATERIALS AND METHODS

Two collecting methods were employed. The first consisted of the features being cross-sectioned and being sifted in the field through a 2.8 mm screen. The bones were sorted from the screen in the field. The second one consisted (for the hearths, some burials and some selected other features) of sampling, weighing and water screening through 2.0 mm and 1.0 mm (over 1 mm screen was sifted to compare the results to 2 mm sifting procedures. It was abandoned when it turned out that no more results were obtained than by 2 mm sifters). mm sifters. The samples were dried, weighed and sorted with the aid of a (20x) microscope in the Archaeological Museum Aruba. The samples from the 1.0 mm screen showed the same results when they were compared to the 2.0 mm screen samples. Each structure yielded two different sets of samples: the 2.8 mm from all features inside and around the structure and the 2.0 mm ones from 20 features within 13 of the 15 Tanki Flip structures (no samples from features belonging the structures 9 and 11 were sifted over 2.0 mm screen).

The quantification measurements were obtained with standard zooarchaeological methods. The Number of Remains (NR), Number of Identified Specimens (NISP) and the Minimum Number of Individuals (MNI) (as calculated by the method taught to me by F. Poplin), were used for each feature and each sample. Twenty features were screened over 2.0 mm sifters and analyzed for the Number of Remains, Number of Identified Specimens, and Minimum Number of Individuals.

Both counting methods NISP and MNI were used, because the Number of Identified Specimens showed a low representation of the Mammals, Birds and Reptiles, and a high representation of the Fishes (because of the larger quantity of bones within fish). It turned out to be a good method, however, to see the importance of fragmentation and preservation of the bones. The calculations of Minimum Number of Individuals showed the importance of each Taxon without this over-representation of skeleton parts, but it can not show the bias of bone fragmentation.

The Number of Remains (NR), Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) of every structure (Table 3) and for the complete site were calculated, to have an idea of the importance of each species in the absolute and the highest theoretic Minimum Number of Individuals (these large tables are on file in the Archaeological Museum Aruba. They can be obtained from this Museum or from the author).

The features which did not belong to structures were counted and calculated separately, by areas between structures. These «Empty Areas» samples were added to have the «No-Str» sample. The Number of Remains, Number of Identified Specimen and Minimum Number of Individuals of each «Empty Area» were calculated.

The different formation and post-depositional processes of postholes are explained by Schinkel (1992: 167-168). If «It is evident that there is no 1:1 relationship between the material that was present on the house-floor around the post during habitation and material excavated from the fill», nevertheless, it is clear that there is some relationship. The counting methods, discussed above, were applied to features of the 15 TF structures.

The relationships between Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) or between Number of Species (NS) and Minimum Number of Individuals

(MNI) for each feature can be seen in Tables 4 and 5. Tables 4 and 5 were calculated using the formulas of Chaplin (1971: 16), Casteel (1976-1977), and Wing and Brown (1979: 119).

The faunal remains were identified to the lowest possible taxon. Identified bones were sorted by skeletal elements. Identifications were made using the comparative collection at the Florida Museum of Natural History in Gainesville with the help of Dr. E.S. Wing and her colleagues.

The number of identified vertebrae of Fishes (Osteichthyes) was counted in the Number of Identified Specimens, because they were identified to the lowest possible taxon. The spines of Osteichthyes were excluded because their identification was too time-consuming.

Fragments of Birds (Passer), Squirrel fishes (Holocentridae) or Crab were counted up to the level of Family, but not up to the level of Species, for the same reason. The lowest taxon of identification for Birds was «Passer-Colombidae», «Passer-Colombidae-*Zeinadura macroura*», «Passer-Small Bird» and «Passer-Large Bird». The «Small Bird» corresponds to the Family of «Passeriformes» and to all Birds which have a smaller size than the «Colombidae». «Passer-Large Birds» are larger than «Colombidae» and most of them correspond to the Family of «Pelecaniformes» and «Charadriiformes»; they were designated «Sea-Birds» in Tables 2 and 9.

Sometimes, inside a structure, a bone was identified up to the taxon of Species (for example: *Epinephelus morio*), but another bone was identified up to the taxon of Family (here: Serranidae) with the certainty that it was not an *Epinephelus morio*. Then, this second bone was counted as a new species, a new specimen, with his own Minimum Number of Individuals. All the taxa from Family to Species are exclusive categories. Yet, when a bone from one Class (for example: Perciformes) could be from one of the identified Family in the same feature (for example: Serranidae, Carangidae, Lutjanidae, Haemulidae, ...), it was not counted as a new species, neither as a specimen. The bones counted in the «Osteichthyes» taxa were not counted as new species, nor as new specimens.

The Number of Remains, Number of Identified Specimens and Minimum Number of Individuals (with the percentages) of each Order (Vertebrates, Mammals, Birds, Reptiles, Batrachians, Fishes and Invertebrates) were counted to compare the oval and the round structures as two groups. The same procedure was used for each Family, within each Order.

A  $\chi^2$  test was used to compare the Tanki Flip round and oval structures. This is a non-parametric method, which shows the differences between two qualitative variables. The statistical approach of M. Fletcher and G. R. Lock (1994) was used in this study.

The structures were sectioned, first in 4 quadrants of 900 (N, E, S, and W). Subsequently, 4 additional 900 quadrants were added, partially intersecting the latter (NE, SE, SW, and NW). The Number of Remains of each of the 8 quadrants was counted to discover the highest concentrations of bone remains inside each structure. The number of features with bone remains, the Number of Remains in each feature and the species present in them were listed. Comparisons of the percentages of the round and oval structures could be made. The statistical method of  $\chi^2$  was used to check the results.

A study was conducted on the habitat of Tanki Flip species and Families which were hunted or fished. This study allows an estimation of the utilization of the environment. It allows also an understanding of the different biotopes, ecosystems and ecological areas, exploited by the Tanki Flip inhabitants. The selection of the habitats made by these people or preferences can be seen.

ted. Another study was conducted on the different hunting and fishing techniques.

## RESULTS

Bones of 102 taxa were identified among the faunal remains excavated from the Tanki Flip site (Table 1). Fourteen thousand two hundred and ten bones or bone fragments were collected and 4,922 were identified (Table 1). The hypothetical absolute Minimum Number of Individuals of the excavated area is 318. The sea provided the greatest variety of animal species. The Fish bones are the most frequent in the site, in term of Number of Remains, Number of Identified Specimens, Minimal Number of Individuals and Number of Taxa (Table 2). Sea-turtles are also very well represented. Some terrestrial species from the interior of the island and from the mainland are also present.

The people of the Caribbean area (even of the islands) have access to a relatively high diversity of species. This study has also shown that some relatively rare species were not present in the samples in recognizable form: there is a large number of unidentifiable bones (65 %). The size of the samples is not large enough to off-set this effect. The percentage of unidentifiable remains found by Wing and Brown (1979: 120) for Caribbean sites is 23, ranging from 3 to 51 %. This can be explained by the size of the sieves used (mostly 6 mm) in the Caribbean. The Tanki Flip 2.8 mm samples (45 %) remain within this range.

The 2.0 mm ones, however, with 76.5 % of unidentifiable remains, yielded an extremely high percentage of unidentified bones. The explanation is that the major part of the unidentifiable bones is heavily fragmented. These are more numerous in the 2.0 mm screen samples than in the 2.8 mm ones. Except the finer sifter, the finer laboratory procedures by wet sifting and sorting by microscope (20 x magnification) are the background of the differences.

Few complete long bones of large species were found in the Tanki Flip site. In the case of sea-turtles, few bones were recovered more or less complete. One was located in Str 5, in a small pottery cache, that probably should be interpreted as a pottery / sea-turtle cache.

### *The Adequacy of the Samples*

They show that the samples are representative for the site, in spite of the fact that we would need more samples for a more complete representation of the rare animal species (Table 4 and 5). Samples screened with 2.0 mm have higher Number of Remains (NR) percentages, but smaller Minimum Number of Individuals (MNI) and Number of Identified Specimens (NISP) percentages. The size of the 2.8 mm screened bones influences the results because the importance of some rare species is inflated. The 2.0 mm screen samples are important because the smallest species and some juvenile specimens only could be identified in them. The TF bone fragmentation is high as discussed before (see «Osteichthyes» taxon in Table 2) and the Number of Identified Specimens (NISP) and the Minimum Number of Individuals (MNI) yield slightly biased results.

The relationships between the Minimum Number of Individuals (MNI) and the Number of Identified Specimens (NISP) (Tables 4 and 5) do show a straight line on the index of the NISP.

The Order of Fish (Osteichthyes) is predominant (Tables 2 and 6): 69.2 % of the NISP total. Reptiles are represented by 11.4 %; Vertebrates are represented by 7.6 %; Birds are represented by 4.9 %; Mammals are represented by 3.7 %; Invertebrates are represented by 2.8 %; and Batrachians are represented by 0.3 %.

Table 7 shows the Number of Identified Specimens (NISP) frequency of each Fish Family. The most common families are the Jacks (Carangidae) (16.7 %), Bonefishes (Albulidae) (13.7 %), Leather jacket (Balistidae) (11.2 %), Grunts (Haemulidae) (10.3 %), Seabass (Serranidae) (9.1 %), Needlefish (Belonidae) (8.2 %), and Tarpon (Elopidae) (5.1 %), which live in the coastal-to deeper shallow-waters all around the island, particularly in lagoons and near coral reefs (FAO Sheets, 1978). The Fish Order shows small variations between the different parts of the site, it is still predominant. The representation of Fishes is similar in the round and the oval structures.

The Mammals are not very abundant. Small species of Rodents, like Rice Rat (*Oryzomyini*) were found everywhere in the site. They represent 31.2 % of the Mammal remains. Moreover, 29.6 % of the remains are Microfauna (unidentified small species) and 25.4 % are unidentified Mammals.

A foot bone (astragalus) of Deer (*Odocoileus* sp.) was found in a special open area in the NE part of the site. This empty area is located between the oval structures 1 and 3 (see other Tanki Flip papers in the Proceedings of the XVIth I.C.C.A.). Bones of Cat (*Felis pardalis*) were recovered near Str. 11 and between Structures 8 and 7a. Remains of sheep or goat (Caprini) and pig (Suidae) were found in the N part of the site, near a Colonial period water reservoir and other Colonial period finds (see other Tanki Flip papers in the Proceedings of the XVIth I.C.C.A.). The oval structures yielded somewhat less Mammal remains (3.4 %) than the round structures (3.6 %).

Within the Order of Birds, 61 % of the remains are large Sea Birds, 25 % are small birds (Passeriformes) and 12.4 % are Pigeons (Colombidae) (Table 9). The round structures yielded more remains of Birds than the oval structures: 5.8 % and 4.4 % respectively.

Within the Order of Reptiles, Sea Turtles (Cheloniidae), Lizards (Polychridae) and Iguanas (Iguaniidae) are predominant (63.4 %, 18 % and 8.7 %) (Table 10). Bones of Freshwater Turtle (Testudiniidae) were recovered in the west part of the structure 3. The oval structures gave more remains of Reptiles than the round structures: 12.1 % against 7.1 %.

Within the Order of Invertebrates, the unidentified crab remains are the most important (49.3 %). One crab species, *Coenobita clypeatus*, is more represented (30 %) than an other, *Calinectes* sp. (15 %), or than the land crab (2.1 %) (Table 11). The urchin (Echinoid Family) is poorly represented (3.6 %). The remains of Invertebrates are more frequent in the round structures (11.3 %) than the oval ones (7.2 %).

The Order of Vertebrates, including all the unidentified Mammals and Reptiles, have a high Number of Remains (NR) and Number of Identified Specimens (NISP), but no MNI-calculation was done because of the problem of «double-MNI».

The frequency of each Order is different in the round and the oval structures (Table 8). The spectrum of species within each Family is different. The number of remains (percentages) of each species is different too. Moreover, the oval structures have higher Number of Remains and Number of Identified Specimens than the round structures (8,148 Number of Remains and 2,452 Number of Identified Specimens for the oval against 2,945 Number of Remains and 1,026 Number of Identified Specimens for the round). The structures located outside the identified structures (counted like «No-Str») represent 21.9 % of the absolute Number of Remains (that implies that ca 78.1 % of the bones came from within the 15 structures. For the 2.8 mm samples it is 57.6 %); 29.3 % of the absolute Number of Identified Specimens and 40.3 % of the hypothetical absolute Minimum Number of Individuals of the excavated area (Table 1).

gory of the bone remains. The Total Field sample was compared to the oval and round samples, because of the importance of the «No-Str» samples.

Even if the Orders' percentages for each samples (Round, Oval and Total Field) seem different, the  $\chi^2$  tests indicate that the samples are not significantly different by their representation of Orders. In spite of the fact that we see differences between oval and round structures, the  $\chi^2$  tests show that they are basically similar. This implies that there are no significant differences in the bone collections of oval, round structures and the total site. (The number resulting from the Chi-square test of the Round, Oval and Total Field samples is high (107.25), «which indicates a large difference between the observed and the expected frequencies, and so there would be significant evidence of association». The result of the Chi-square test between Round and Oval structures samples is 107.25. Between Round and Total Field samples the result is 61.12, and between Oval and Total Field samples, the result is 30.23. The table of percentages points of the Chi-square distribution gives 22.5 with 0.01% value for 6 degrees of freedom. The conclusion is that the table of percentage points of the Chi-square distribution shows that the three samples, Round, Oval, and Total Field are not significantly different, with a 0,01 % value for 6 degrees of freedom. Only the Oval and Total Field samples have a small association, but they are not significantly different. The distribution number should be higher than the results of the Chi-square tests in order to prove that the samples are significantly different.)

The number of taxa, Minimum Number of Individuals, Number of Remains and Number of Identified Specimens for the 2.0 mm samples are higher in Tanki Flip than for the 2.8 mm samples. This shows clearly the importance of the 2.0 mm screen procedure in order not to lose essential information.

There is a clear over-representation of the large bones in the 2.8 mm screen samples. The different procedures in sifting and sorting between 2.8 mm and 2.0 mm samples explains this phenomenon. Large bones are easier to sort with the eyes in the 2.8 mm screen than small bones. Small fragments of small bones are seen and collected by the 2.0 mm screen sifting and by the binocular sorting procedures, thus increasing the percentages of unidentifiable bones. Bones of Reptiles, Mammals and Vertebrates are over-represented, and bones of Fishes, Batrachians and Invertebrates are under-represented in the 2.8 mm in comparison with the 2.0 mm samples. Passer and Colombidae (the largest Birds' bones) have a higher percentage in the 2.8 than in the 2.0 mm samples, and Small Birds have a lower percentage in the 2.8 than the 2.0 mm.

In the round structures, samples Str11 and Str7 have the highest Number of Remains, Number of Identified Specimens, number of taxa, and Minimum Number of Individuals (Table 3). In the 2.0 mm samples, the Str7-2mm and Str13-2mm have the highest Number of Remains, Number of Identified Specimens, number of taxa and Minimum Number of Individuals. In the oval structures, Str14 and Str5 have the highest Number of Remains, Number of Identified Specimens, number of taxa and Minimum Number of Individuals. In the 2.0 mm samples, only the Str14-2mm ones have high Number of Remains, Number of Identified Specimens, number of taxa and Minimum Number of Individuals. In any case, the number of features here is not high.

In the round structures, Str2 and Str12 have the lowest Number of Remains, Number of Identified Specimens, number of taxa and Minimum Number of Individuals. In the 2.0 mm samples, the Str12-2mm and the Str6-2mm are the poorest. In the oval structures, the Str7a and Str4 have the poorest Number of Remains, Number of Identified Specimens, number of taxa and Minimum Number of Individuals. In the 2.0 mm samples, the Str3-2mm and the Str4-2mm are the poorest. In every case, the number of features is small.

Minimum Number of Individuals of 2.0 mm are higher than 2.8 mm samples. The biases linked to the differences in the procedures of sampling and screening (over-fragmentation and over-representation of small taxa in 2.0 mm, or under-representation of rare species in 2.8 mm) are less important. Even if the Minimum Number of Individuals preserve the differences between 2.0 and 2.8 mm samples when the Number of Remains is too small, Minimum Number of Individuals is a good tool for understanding whether the content of each sample is more or less the same as the others, or not.

In fact, the oval structures yielded the highest number of animal bones (Str14, Str1, Str10, Str5, Str7A and Str3). Only Str4 is relatively poor. Yet, two round structures yielded a relatively high Number of Remains: Str 11 and 7. The round structures Str 2, 6, 8, and 12 are the poorest.

On the overall distribution of bones in the structures, we can remark that the oval structures have more bones than the round ones (Table 3). Burned bones are predominantly in 13 features (that means, contain more than 10 burnt bones. Especially the features 94 and 3068 with an ashy content and many burned bones probably were hearths. See other Tanki Flip papers in the XVIth I.C.C.A. for more information): 6 are hearths and 7 are other features (possibly hearths that were not recognized as such during the field work).

The structures were sectioned in eight 90<sup>0</sup> quadrants: NW, NE, SE, SW, N, E, S and W. The Number of Remains (NR) were counted for each quadrant. The highest percentages of the richest and poorest quadrants of each structure are shown in Table 12 (See map of the structures in other Tanki Flip papers in the XVIth I.C.C.A.).

Some structures appear to have opposite richest quadrants; they are «facing» each other: Str5, Str6 and Str7A; Another group is Str8, Str9, and 12. Str3 and 14 have this to a lesser degree.

For example, the richer sector of Str8 is the South, the richer sector of Str12 is the North-West, and the richer sector of the Str9 is the North-East. These three rich sectors are located in front of each other. Could activity areas be common between two or three houses? Could these linked houses be round and oval at the same period?

#### *Habitat Assignment*

The different species found in the site belong to four ecological areas: shallow waters, coral reefs (or, the marine / shore environment), the interior of Aruba, and that of the mainland (the mainland opposite Aruba has different climatic zones and vegetation types).

A xerophytic vegetation was present over most of Aruba and all around the village of Tanki Flip (Cf.: Versteeg & Ruiz, 1995). The majority of Rodents, Batrachians and small Reptiles (*Gekko gekko*, *Ameiva* sp., *Iguana iguana*, Lizard undetermined) are endemic and live in cactus shrubs, arid vegetation at the present time, but were also living in the xerophytic forest of the interior of Aruba. They are attracted by water, habitats, and trees near open areas (Conant & Collins, 1991: 84, 95). The Tanki Flip village and its neighborhood offered all these conditions (see Chapter 2). They may have been hunted by the inhabitants of the village or by children training for hunting (Versteeg, Pers. Comm.).

The majority of the pigeons and doves belonging to the Family Columbidae of this island (*Zeinadura macroura* and *Zenaida auriculata*): «Inhabits acacia and cactus scrub and other arid vegetation (...)» According to Voous (1983: 142-143) *Particularly during long dry periods (they) approach human habitations and then feed on farm yards and in gardens (...)*. They are endemic to the island. They could be hunted near the village, where the vegetation is very similar to this habitat assignment. The taxon «Small Birds» includes endemic and migrant species.

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We can not give a specific habitat assignment for such a large taxon. The taxon «Large Birds» includes a majority of Sea Birds, which are present all around the island.

In the Shallow water category, different ecosystems which are located near the island exist. Included in this category are: continental coastal sea, beaches, passes between islands, shallow bays, estuaries, mangroves and lagoons. Twenty-two families of fish were identified in the samples that inhabit these shallow waters. They can be caught near the island, for example Jacks (Carangidae), Snappers (Lutjanidae) or Trigger fishes (Balistidae). Most of these families can be caught in the surface waters, in surf line or in the intertidal region.

Some sharks, like Bull sharks (*Carcharhinus leucas*), Tiger shark (*Galeocerdo cuvieri*), Scalloped Hammerhead (*Sphyrna lewini*), and Southern Stingray (*Dasayatis americana*) often approach close inshore and enter in closed bays and estuaries. Bones of sharks and rays are relatively frequent in Tanki Flip. In fact, these animals provide a high quantity of fat. Their skin is also very strong and could be used for utilitarian purposes, or as a grater. A bead made of a shark vertebra (*Sphyrna lewini*) was found in Tanki Flip.

Some sharks, like Tiger shark (*Galeocerdo cuvieri*) and fishes (like Snappers) (*Lutjanus* sp) are active at night, which may indicate that the inhabitants were (also) fishing at night using traps or lines.

Sea-turtles come back to their birth beach in order to lay their eggs. At this period of the year, it is easy to catch them near or on the beach. Because of their heavy weight, they were probably butchered on the beach and brought in parts to the village.

Invertebrates (like Sea-Crabs and Urchins) can be caught on the beaches or in the shallow waters. Land crabs can be found far inland.

Coral reefs, which are present along the south coast of the island, provided an important number of Fish, like Squirrel fishes (Holocentridae), Tile fishes (Malacanthidae), Grunts (Haemulidae) or Parrot fishes (Scaridae). Some Coral Reef fishes are active at night (some Drums) (*Equetus* sp.), which is another indication for possible fishing at night.

Colonial imported species: Sheep or goat and Pig (Caprini and Suidae) were identified in features where colonial glass and ceramics were found. These species were introduced by Europeans.

Tropical forest and rivers are absent on the island.

Deer (Cervidae), Cat (Felidae) and Freshwater Turtle (Testudiniidae) were probably imported from tropical forest areas of mainland. D. A. Hooijer remarks that remains of deer (*Odocoileus gymnotus* subsp.) were found in prehistoric archaeological contexts in the Santa Cruz and Savaneta sites on Aruba. *They do not belong to the extant fauna of Aruba* (Hooijer, 1960:154). So, the present finds of bones of this mainland species in a Dabajuroid context is not the only one. Even the small-scale excavations of the Sixties resulted in the find of these bones.

Deer, Cat and Freshwater Turtle were caught or imported by the Amerindians of Tanki Flip. A hunting group may have traveled to the mainland to hunt, but they could also have imported them by the mainland population. Our data are not conclusive on the organizational aspects of trade, but we can express 3 hypotheses:

- The mainland groups brought these animals to Aruba and traded with the Tanki Flip groups.
- Inhabitants of Tanki Flip came to the mainland and traded with local groups. In order to verify these two hypotheses, investigations at mainland Dabajuroid sites have to be done.
- Tanki Flip groups went to the mainland forest to hunt and brought the game back to Aruba.

At Tanki Flip, only pieces of the bodies of Cat, Deer and Freshwater Turtle were found. The opened area of the excavation is very large, but just few features yielded these taxa.

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The supposition that this game was butchered on the mainland and that only parts of the animals (or only the bones) were brought to the site is probable.

At least, we can notify the presence of the Deer, Cat and Freshwater Turtle (Cervidae, Felidae and Testudiniidae) in particular areas of the site. None of the bones of these «exotic» species were found inside structures, but either in the eastern outer circle or in open areas.

Bones of Freshwater Turtle (Testudiniidae) were recovered in the western part of the structure 3 close to a special open area located in the north-eastern part of the site, where a foot bone (Astragalus) of Deer (*Odocoileus* sp.) was found. This «empty area» is located between the oval structures 1 and 3, did not contain any other bone remains. Bones of Cat (*Felis pardalis*) were recovered near Str11, and between structures 8 and 7a. The first and last areas are not the richest of the excavated area, but Str11 yielded the highest number of shells and bones. The Special Open Area located between the two structures of this area could be a «ceremonial area» (see other Tanki Flip papers in the XVIth I.C.C.A.).

Tables 17, 18 and 19 show that 65% of the remains of the oval structures belong to species that live in shallow waters, estuaries and lagoons, against 42% in round structures. Twenty two % of the remains from the oval structures belong to coral reefs and rocky bottoms, against 38.1% in round structures. Twelve percent of the remains from oval structures belong to cactus shrubs and arid vegetation against 19;7% in round structures. These apparent differences were analyzed with

<sup>2</sup> tests (The Chi-square tests of the Round, Oval and Total Field samples result in a high number, «which indicates a large difference between the observed and the expected frequencies, and so there would be significant evidence of association». The result of the Chi-square test between Round and Oval structures samples is 87.54. Between Round and Total Field samples the result is 34.68, and between Oval and Total Field samples, the result is 24.70. The table of percentages points of the Chi-square distribution gives 18.5 with 0.01% value for 4 degrees of freedom. The table of percentage points of the Chi-square distribution shows that the three samples, Round, Oval, and Total Field are not significantly different, with a 0,01 % value for 6 degrees of freedom. Only the Oval and Total Field samples have a small association, but they are not significantly different. The distribution number should be higher than the results of the Chi-square tests in order to prove that the samples are significantly different. Even if the Habitat assignment percentages for each samples (Round, Oval and Total Field) seems different, the Chi-square tests indicate that the samples are not significantly different by their representation of Habitat assignment).

The results are that there is not a significant difference between those three sets of samples. The hunting and fishing locations are similar in round, oval structures and in the total site, but mark the specific find-locations of the exotic bones!

#### *Fishing and hunting techniques*

Different fishing strategies can be used to catch the fish species present in the Tanki Flip site: Nets, Lines, Traps and Spears.

Nets: this category includes the bottom nets, gillnets, seines and trammel nets, beachnets and castnets.

Lines: this category includes longlines, hook and lines, handlines and casting.

Traps: we did not make any sub-category in this category.

Spears: this category includes underwater catching and spears.

Most of the species present in the Tanki Flip site can be caught by nets, lines and traps. Net and line fishing techniques can be used from boats as well as by wading. All species of fish present in the site can be caught near the coast. All categories discussed above under «Line» and «Net» can have been used.

Different hunting strategies were used to catch the Mammals, Birds and Reptiles: Hunting, Trapping and Trade.

Most of the Reptiles, Birds and small Mammals can be caught by Hunting and Trapping. Turtles (Cheloniidae and Testudiniidae) and large Mammals (Cervidae and Felidae) can be hunted, or trapped. An ambushing technique to catch sea-turtles on the beach could yield eggs and female adult specimens in a relatively easy way to catch these large animals. The Colonial species, most Rodents and Lizards are classified as Intrusive; they are considered «village visitors» that died or were killed in the settlement.

These studies about habitat assignment and fishing techniques prove the importance of the coastal sea in the subsistence economy of the Tanki Flip population. This population exploited the environment near the site to a maximum extent: they did not need the off-shore area, and the limited number of juvenile specimens (we do not have measurements or counts for the Tanki Flip collection on juvenile versus adult individuals. However, during the taxonomic identification it became evident that the percentage of juvenile specimens is limited) in the site do not suggest any over-exploitation of any ecosystem used.

#### *Modified bone*

Four bones were modified by man: three polished points made with the inflated spines of Jacks (Carangidae), and one bead made in a perforated vertebra of shark (*Shyrna lewini*). The polishing of these points that can be seen by eyes (parallel grooves oriented in different directions) reduced the thickness of the spine. Two of these points were broken in their central part, but one was fossilized with this brake, because the patina in everywhere the same. The other one was freshly broken. The length of the complete spine is about 55.3 mm and their diameters are around 6 mm with an average of 4.3 to 8.5 mm. One of the broken ones has traces of resin. These tools could be hafted and used as points on longer tools. They can be used on soft materials, as meat, skin or plants. They could also have been used as ornaments.

The central part of the vertebra was perforated with a pointed tool, which gave a regular shape of the hole in both frontal and caudal view. Slight traces of this rotation can be seen with a microscope. A patina covers all the faces of the vertebra and the hole. The diameter of the vertebra is small (5.0 mm) and this could be a juvenile shark. This vertebra could be used as ornament or pendant.

As the «exotic» bones, the vertebra was found in a open area, between the Str- 14, -13, -11 and -3.

## CONCLUSIONS

The Tanki Flip 14.210 bones taught us that the fish remains were the most frequent within this site. The Sea-Turtles were also well represented and caches were found. In spite of these two frequent taxa, the faunal remains show a high diversity in the selection of the species (102 taxa). The shallow waters and the coral reefs provided the most abundant species. Some mainland species were also brought to this site.

The Tanki Flip faunal studies suggest that Dabajuroid farmers developed appropriate strategies to exploit the animal resources of this island. The role of marine resources in diet patterns has been shown by the importance of Fish remains compared to the Reptiles, Birds and Mammals.

The study of the samples of Tanki Flip showed that in order to obtain more insight into the diet of the inhabitants of the site more information is needed. One of the most important dietary remains which could provide additional information is the shell assemblage.

The study of differences between faunal samples from round versus oval structures yiel-

ded as result that there are no significant differences between these two groups. The study of the richest/poorest quadrants of each structure (Number of Remains) gave significant results: they are never the same, but, some structures have their richer quadrant opposite other. The round and oval structures can not be opposed to each other in this study. The kitchen, eating and dumping activities (= food preparation, consumption and deposition of the remains) could be common for two or three houses, which would mean that some round and some oval structures were occupied at the same period. This result can not prove the second hypothesis, because the evolution of the constructions cannot be seen.

It appears that two or more periods of habitations have been at this site, because of overlapping house structures, but on the basis of the analysis of the bones remains, we can not reconstruct these periods.

Interesting patterns were found to exist in the 64 features that contained sea-turtle bones. This has to be studied more in detail, by statistical methods.

Some imported Mammal and Reptile remains were found in the site. Deer, Cat and Freshwater turtles were caught on the mainland or imported to Aruba. They too, were found in site locations that suggest cache-activities by the inhabitants, as opposed to dumping activities

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Table 1. An overview of the Tanki Flip bone remains (NR = Number of Remains; NISP = Number of Identified Specimens; MNI = Minimum Number of Individuals).

Table 2. NISP and percentages of the 102 taxa in the Tanki Flip site.

Table 3. The Number of Remains (NR), Number of Identified Specimens (NISP), Minimum Number of Individuals (MNI) and Number of Taxa distributions of the bones over the 15 Tanki Flip structures.

Table 4. Relationship between the Minimum Number of Individuals (MNI) and the Number of Identified Specimens (NISP) in 2.8 mm and 2.0 mm samples of the Tanki Flip site. Each black diamond is one sample.

Table 5. Relationship between the Minimum Number of Individuals (MNI) and the Number of Specimens in 2.8 mm and 2.0 mm samples of the Tanki Flip site. Each black diamond is one sample.

Table 6. Percentages of frequency of each Order in the Tanki Flip site (%NISP).

Table 7. Frequencies of the Fish Families of the Tanki Flip site (%NISP) (Total NISP of Fish Family Taxon = 1836).

Table 8. Frequency of each Order in the Tanki Flip structures (NISP).

Table 9. Frequencies of the Bird Families in the Tanki Flip site (%NISP).

Table 10. Frequencies of the Reptile Families in the Tanki Flip site (%NISP).

Table 11. Frequencies of the Invertebrate Families in the Tanki Flip site (%NISP).

Table 12. Number of Remains and percentages of each quadrant of the Tanki Flip structures.

Table 13. Frequencies of the different habitats of the Tanki Flip archaeological species (%NISP).

Table 1. An overview of the Tanki Flip bone remains (NR = Number of Remains; NISP = Number of Identified Specimens; MNI = Minimum Number of Individuals).

	2.0 mm SAMPLES FROM STRUCTURES	2.8 mm SAMPLES FROM STRUCTURES	2.0 mm NO-Str	2.8 mm NO-Str	TOTAL
NR	8025	3068	859	2258	14210
NISP	1944	1534	291	1153	4922
HYPOTHETIC MNI	127	129	35	106	318
NUMBER OF TAXA	56	84	25	78	102

FAMILY	SPECIES	NISP	NISP%	TAXA	SPECIES	NISP	NISP%
<b>VERTEBRATES</b>							
VERTEBRATES	indet.	367	7,5%	MALACANTHIDAE	Malacanthus plumieri	42	0,9%
<b>MAMMALS</b>							
MAMMALS	indet.	48	1,0%	CARANGIDAE		216	4,4%
SUIDI	Sus scrofa domesticus	1	0,0%	CARANGIDAE	Caranx s sp.	55	1,1%
CAPRINI		17	0,3%	CARANGIDAE	Caranx hippos	3	0,1%
CERVIDI	Odocoileus sp.	1	0,0%	LUTJANIDAE	Lutjanus sp.	53	1,1%
FELIDAE	Felis pardalis	6	0,1%	HAEMULIDAE	Haemulon sp.	120	2,4%
SMALL MAMMAL		1	0,0%	HAEMULIDAE	Conodon nobilis	1	0,0%
MICROFAUNA		56	1,1%	HAEMULIDAE	Haemulon album	13	0,3%
RODENT		59	1,2%	HAEMULIDAE	Haemulon bonariense	8	0,2%
<b>BIRDS</b>							
PASSER	Sea Bird	148	3,0%	HAEMULIDAE	Haemulon flavolineatum	3	0,1%
PASSER	Small bird	65	1,3%	HAEMULIDAE	Haemulon sciurus	7	0,1%
COLOMBIDAE		5	0,1%	HAEMULIDAE	Haemulon steindachneri	16	0,3%
COLOMBIDAE	ccf Zeinadura macroura	25	0,5%	SCIAENIDAE		9	0,2%
<b>REPTILES</b>							
GHELONIIDAE		361	7,3%	SCIAENIDAE	Equetus sp.	5	0,1%
CHELONIIDAE	Small turtle	1	0,0%	SCIAENIDAE	Sciaenops ocellatus	1	0,0%
TESTUDINIDAE	Freshwater Turtle	4	0,1%	SPARIDAE		2	0,0%
POLYCHRIDAE	Indet.	101	2,1%	SPARIDAE	Archosargus rhomboidalis	1	0,0%
GEKKIDAE	Gekko gekko	9	0,2%	SPARIDAE	Calamus sp.	11	0,2%
TEIIDAE	Ameiva sp.	37	0,8%	SPARIDAE	Calamus bajonado	2	0,0%
IGUANIDAE	Iguana iguana	49	1,0%	SPARIDAE	Calamus pennatula	1	0,0%
<b>BATRACHIANS</b>							
Batrachians		17	0,3%	SPARIDAE	Pagrus sedecim	2	0,0%
<b>FISHES</b>							
OSTEICHTHYES		1546		kyphosidae		1	0,0%
31,4%				KYPHOSIDAE	Kyphosus sp.	1	0,0%
NIFORME		7	0,1%	EPHYPPIDAE	Chaetodipterus faber	1	0,0%
CARCHARHINIDAE		21	0,4%	LABRIDAE		3	0,1%
CARCHARHINIDAE	Carcharhinus sp.	10	0,2	LABRIDAE	Lacholaimus maximus	4	0,1%
%				SCARIDAE	Scarus sp.	19	0,4%
NIDAE	Carcharhinus acronotus	2	0,0%	SCARIDAE	Scarus coelestinus	1	0,0%
CARCHARHINIDAE	Carcharhinus leucas	6	0,1%	SCARIDAE	Scarus coellurus	1	0,0%
CARCHARHINIDAE	Galeocerdo cuvieri	2	0,0%	SCARIDAE	Sparisoma sp.	23	0,5%
SPHYRNIDAE	Sphyrna sp.	7	0,1%	SCARIDAE	Sparisoma rubipinne	1	0,0%
SPHYRNIDAE	Sphyrna lewini	2	0,0%	SCARIDAE	Sparisoma viride	5	0,1%
DASYATIDAE	Dasyatis amaricana	10	0,2%	MUGILIDAE	Mugil curema	2	0,0%
MYLIOBATIDAE	Aetobatis narinari	10	0,2%	SPHYRAENIDAE	Sphyrna sp.	6	0,1%
ELOPIDAE	Elops saurus	83	1,7%	SPHYRAENIDAE	Sphyrna barracuda	73	1,5%
Megalopidae	Megalops atlanticus	2	0,0%	ACANTHURIDAE	Acanthurus sp.	3	0,1%
AIBULIDAE	Albula vulpes	224	4,6%	ACANTHURIDAE	Acanthurus chirurgus	3	0,1%
CLUPEIDAE		15	0,3%	SCOMBRIDAE	Euthynnus alletteratus	19	0,4%
BELONIDAE		3	0,1%	SCOMBRIDAE	Scomberomorus sp.	1	0,0%
BELONIDAE	Strongylura sp.	33	0,7%	SCOMBRIDAE	Scomberomorus cavalla	1	0,0%
BELONIDAE	Strongylura notata	3	0,1%	BALISTIDAE		36	0,7%
BELONIDAE	Tylosurus sp.	8	0,2%	BALISTIDAE	Balistes sp.	9	0,2%
BELONIDAE	Tylosurus crocodilus	87	1,8%	BALISTIDAE	Balistes capricus	3	0,1%
Holocentridae	Holocentrus sp.	24	0,5%	BALISTIDAE	Balistes vetula	119	2,4%
Holocentridae	Holocentrus ascensionis	3	0,1%	BALISTIDAE	Melichtys niger	15	0,3%
Holocentridae	Holocentrus rufus	1	0,0%	BALISTIDAE	Xanthichthys ringens	1	0,0%
PERCIFORME		220	4,5%	<b>INVERTEBRATES</b>			
SERRANIDAE		45	0,9%	CRAB		69	1,4%
SERRANIDAE	Epinephelus sp.	73	1,5%	CRAB	Coenobita clypeatus	42	0,9%
				CRAB	Calinectes sp.	21	0,4%
				CRAB	Laznd crab	3	0,1%
				ECHINOID		5	0,1%
						102	4922

Table 2. NISP and percentages of the 102 taxa in the Tanki Flip site.

Table 3. The Number of Remains (NR), Number of Identified Specimens (NISP), Minimum Number of Individuals (MNI) and Number of Taxa distributions of the bones over the 15 Tanki Flip structures.

	Str. 1	Str. 2	Str. 3	Str. 4	Str. 5	Str. 6	Str. 7	Str. 8	Str. 9
NR	2724	315	510	25	426	293	626	543	173
NISP	351	125	143	163	305	19	225	149	70
HYPOTHETIC MNI	51	18	23	5	35	10	61	31	25
NUMBER OF TAXA	31	38	29	10	31	7	36	28	17

	Str. 10	Str. 11	Str. 12	Str. 13	Str. 14	Str. 15	TOTAL	NR	NISP
NR	88	712	497	124	380	4200	5896	1117	4713
NISP	37	202	167	15	184	981	1787	1498	3181
HYPOTHETIC MNI	11	31	44	17	38	41	275	128	218
NUMBER OF TAXA	13	25	21	15	24	51	86	51	102

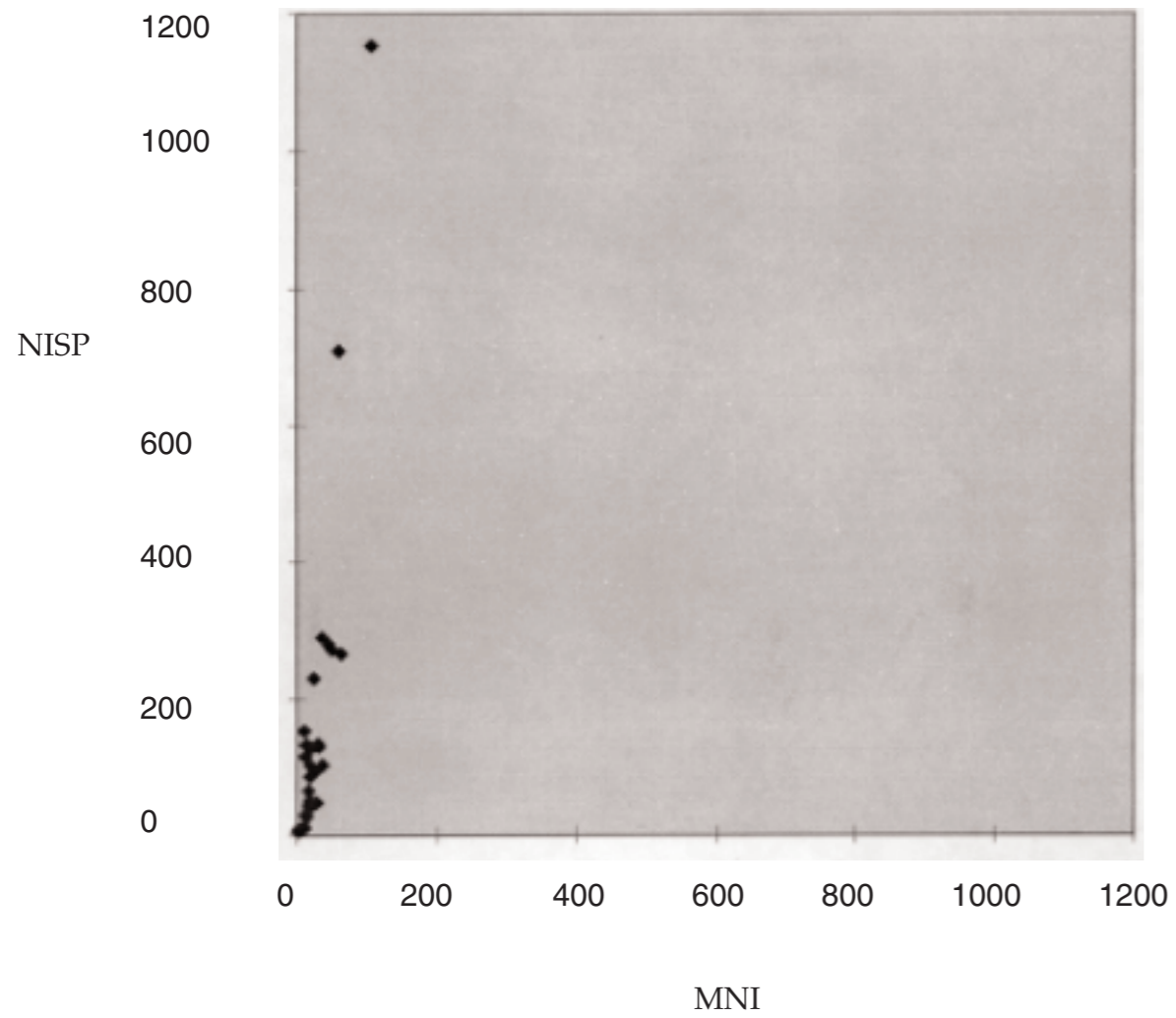


Table 4. Relationship between the Minimum Number of Individuals (MNI) and the Number of Identified Specimens (NISP) in 2.8 mm and 2.0 mm samples of the Tanki Flip site. Each black diamond is one sample.

Number of specimen

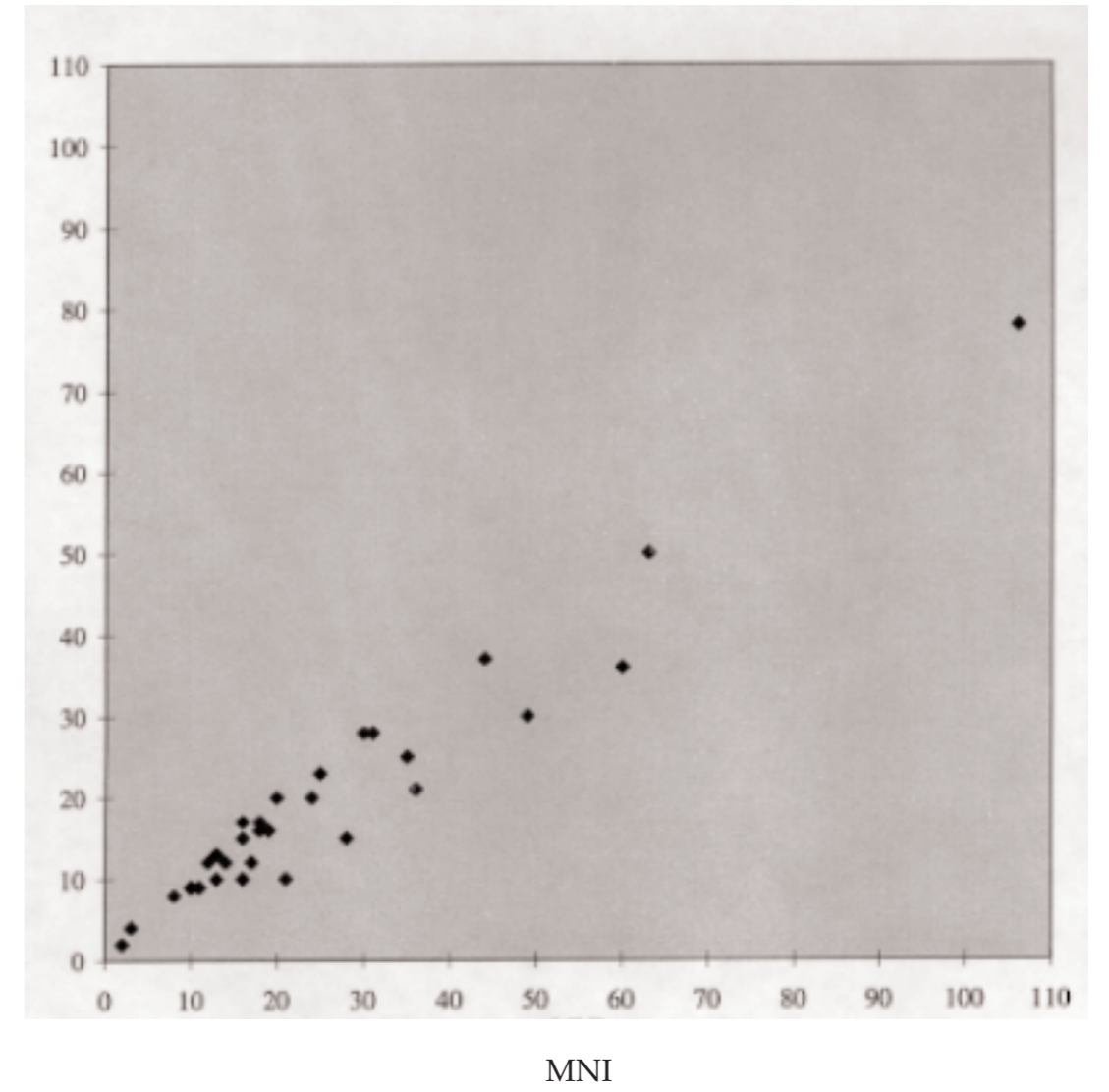


Table 5. Relationship between the Minimum Number of Individuals (MNI) and the Number of Specimens in 2.8 mm and 2.0 mm samples of the Tanki Flip site. Each black diamond is one sample.

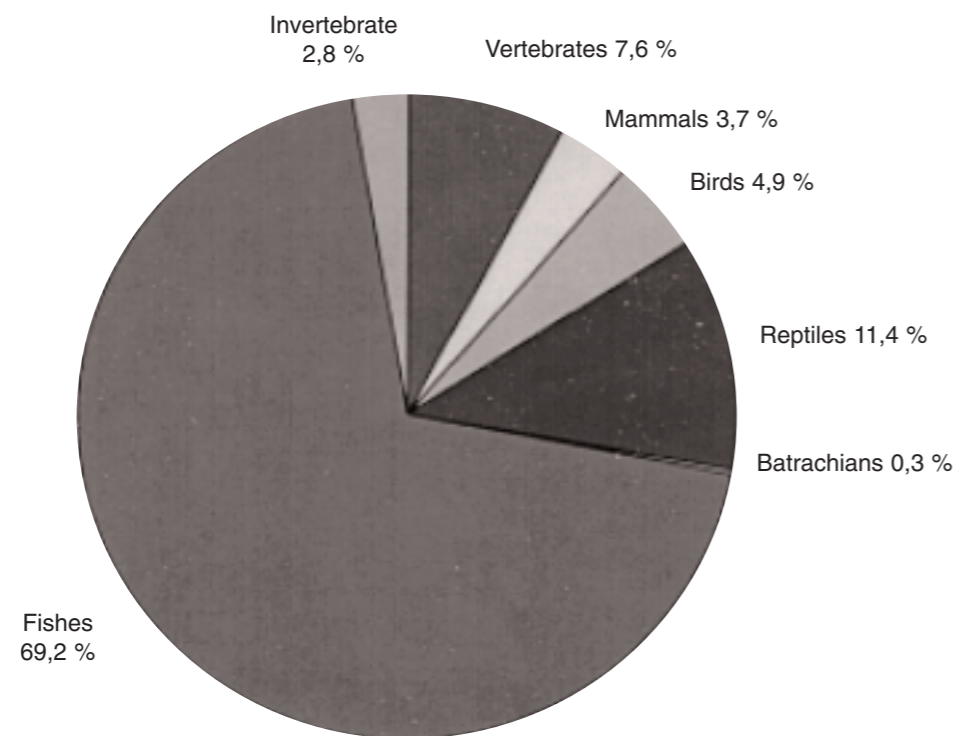


Table 6. Percentages of frequency of each Order in the Tanki Flip site (%NISP).

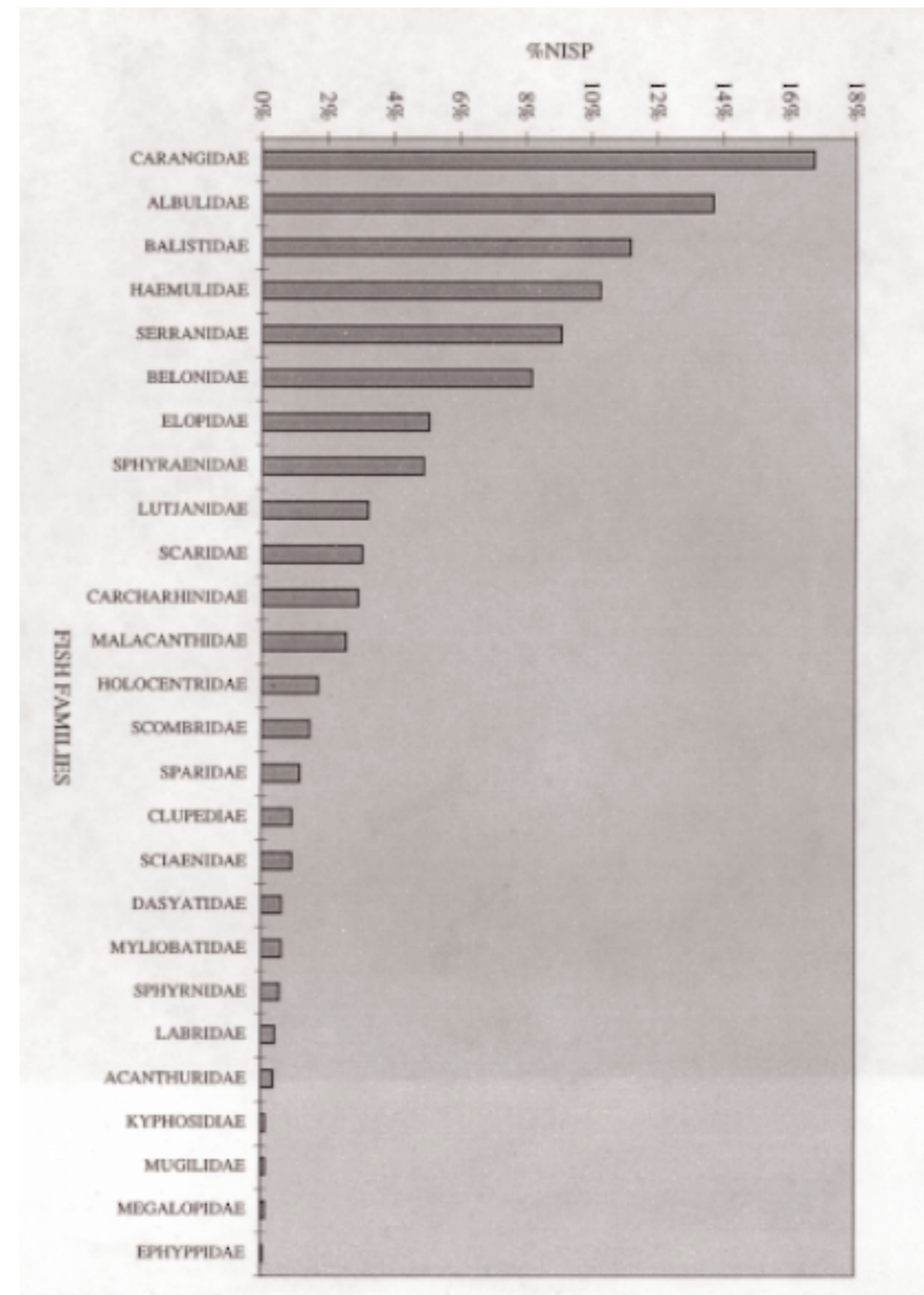


Table 7. Frequencies of the Fish Families of the Tanki Flip site (%NISP) (Total NISP of Fish Family Taxon = 1836).

Table 8. Frequency of each Order in the Tanki Flip structures (NISP).

ORDERS	Site	1992	1993	1994	1995	1996	1997	1998	1999
Ardeidae	10	10	1	1	12	12	22	4	10
Columbidae	7	0	1	0	11	1	20	0	1
Diapitidae	35	12	15	7	30	0	30	10	2
Reptiles	10	0	10	10	11	5	20	15	1
Cheloniidae	4	0	0	0	0	0	0	2	0
Fishes	27	41	56	123	107	60	130	140	24
Amphibians	30	11	1	0	0	0	10	0	0
TOTAL	100	128	164	164	364	81	295	185	55

ORDERS	Site	1992	1993	1994	1995	1996	1997	1998	1999
Ardeidae	1	0	13	0	0	0	20	0	11
Columbidae	0	10	1	0	0	0	20	0	1
Fishes	1	0	10	0	1	0	10	0	1
Reptiles	1	21	10	0	0	0	20	0	1
Amphibians	0	0	1	0	0	0	0	0	0
Fishes	20	100	200	10	100	100	100	100	100
Ardeidae	0	0	0	0	0	0	0	0	0
TOTAL	21	131	224	10	100	100	120	100	124

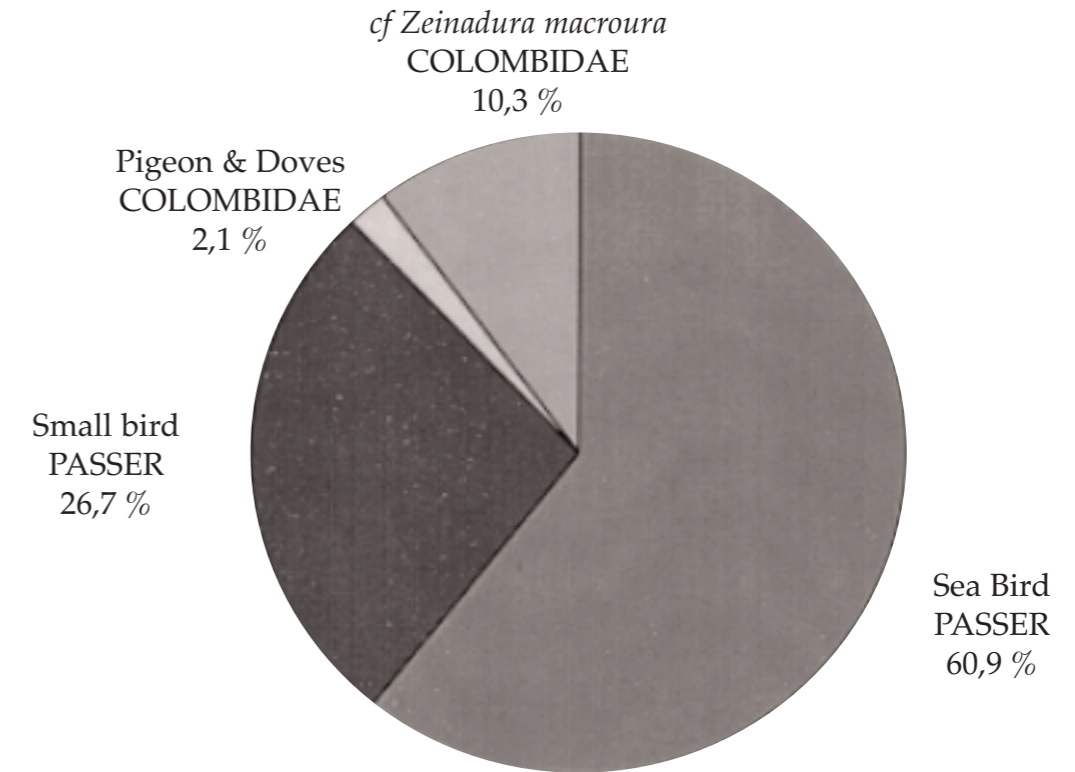


Table 9. Frequencies of the Bird Families in the Tanki Flip site (%NISP).

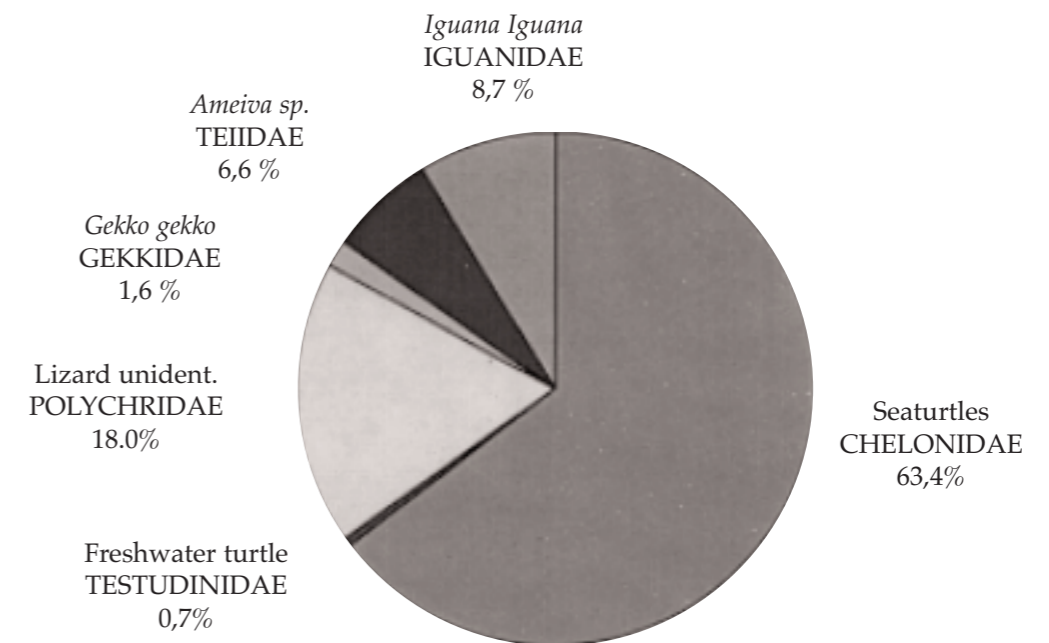


Table 10. Frequencies of the Reptile Families in the Tanki Flip site (%NISP).

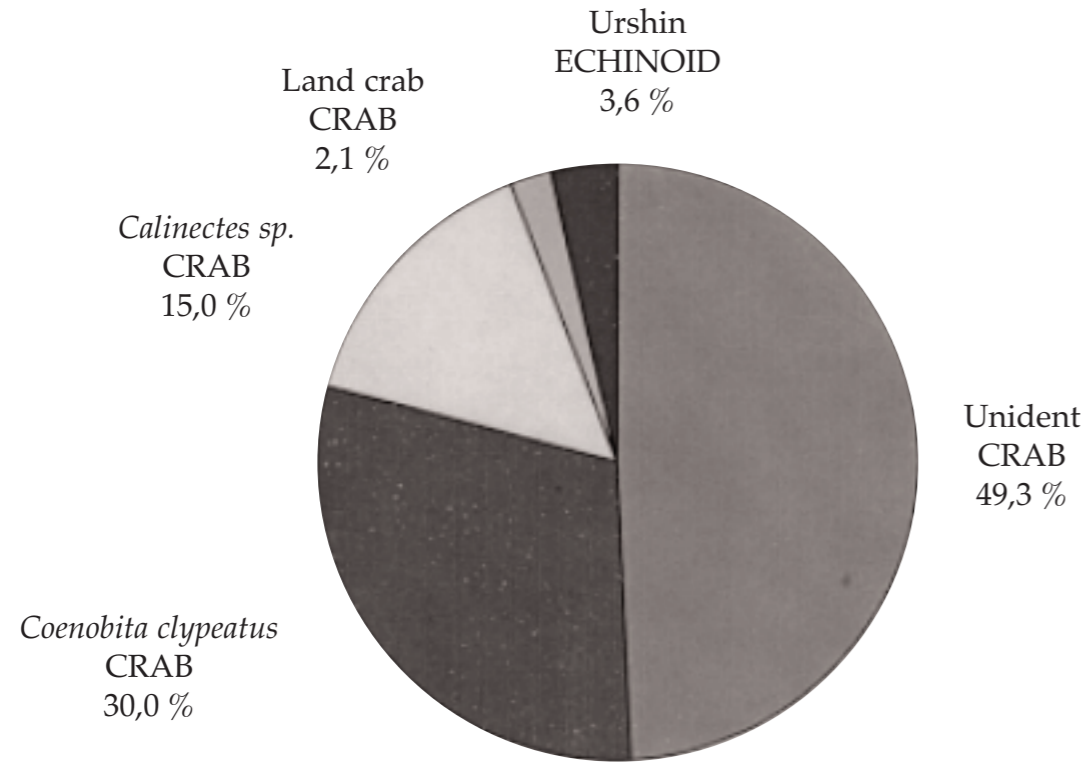


Table 11. Frequencies of the Invertebrate Families in the Tanki Flip site (%NISP).

Table 12. Number of Remains and percentages of each quadrant of the Tanki Flip structures.

STRUCTURE	SE-1		SE-2		SE-3		SE-4		SE-5		SE-6		SE-7		SE-8			
	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%		
NORTH	0	0%	1	16,6%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
EAST	37	42,5%	9	26,3%	75	41,7%	75	41,7%	187	46,9%	55	15,6%	141	35,6%	141	35,6%	141	35,6%
SOUTH	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
WEST	12	6,2%	0	0%	13	6,2%	0	0%	37	9,3%	29	8,3%	13	3,3%	42	10,5%	29	7,3%
	185	100%	10	100%	10	100%	10	100%	10	100%	10	100%	10	100%	10	100%	10	100%

STRUCTURE	SE-1		SE-2		SE-3		SE-4		SE-5		SE-6		SE-7		SE-8			
	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%	NR	%		
NORTH	1	4,7%	4	11,7%	2	11,2%	3	15,0%	3	14,3%	13	42,7%	15	26,7%	10	18,2%	10	18,2%
EAST	3	12,3%	8	29,6%	35	27,9%	72	18,1%	4	2,7%	13	17,0%	14	14,5%	13	14,5%	13	14,5%
SOUTH	11	43%	7	50%	37	50,2%	117	14,5%	0	0%	79	67,0%	7	6,2%	3	2,7%	3	2,7%
WEST	10	40%	32	50,8%	48	44,7%	179	24,4%	0	0%	5	3,6%	187	24,8%	140	18,6%	140	18,6%
	25	100%	35	100%	47	100%	140	100%	16	100%	84	100%	40	100%	140	100%	140	100%

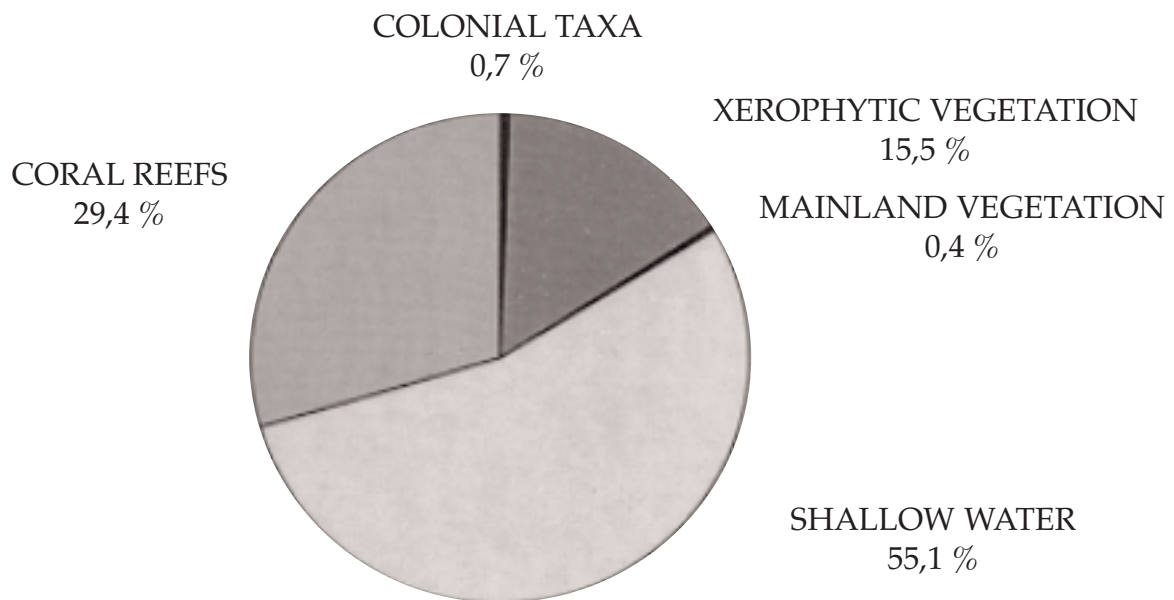


Table 13. Frequencies of the different habitats of the Tanki Flip archaeological species (%NISP).



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DEL CARIBE**

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**Conseil Régional de la Guadeloupe et Auditorium de la Ville de Basse  
Terre**

**24 au 28 juillet 1995**

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Terre

24 au 28 juillet 1995

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BASSE TERRE, 1995

## EDITORIAL

L'édition des actes du XVI<sup>e</sup> Congrès d'Archéologie de la Caraïbe était un événement très attendu par l'ensemble de la communauté des historiens et des archéologues .

Cette publication, en deux volumes, témoigne de la richesse du congrès qui s'est déroulé à Basse Terre en juillet 1995.

La qualité, la variété et le nombre des communications des chercheurs caractérisent cette publication ou chacun découvrira les toutes dernières découvertes archéologiques réalisées dans la Caraïbe.

Mais au delà de son aspect purement scientifique, cet ouvrage est un signe de reconnaissance des peuples aujourd'hui disparus qui ont été les premiers occupants de l'arc antillais.

Après avoir inauguré, il y a près de 15 ans, le musée Edgar Clerc , il m'est particulièrement agréable de publier ces actes du XVI<sup>e</sup> Congrès International d'Archéologie de la Caraïbe.

Lucette Michaux Chevry  
Sénateur- Maire de la Ville de Basse Terre  
Président du Conseil Régional de la Guadeloupe

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Maire de la Ville de BASSE TERRE.*

*Melle Alissandra CUMMINS, Président de l'Association Internationale d'Archéologie de la Caraïbe.*

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**DEDICACE**

Le XVI° Congrès International d'Archéologie à été tout spécialement dédié au Docteur Irving

ROUSE et à Jacques PETITJEAN ROGET, fondateurs de l'Association Internationale

d'Archéologie de la Caraïbe, en reconnaissance de leur contribution au développement de la

recherche archéologique dans la Caraïbe.



Melle Alissandra CUMMINS Présidente de l'AIAC, Jacques PETITJEAN ROGET, et le Docteur

Irving ROUSE, hôtes d'honneur du XVI° Congrès International d'Archéologie

(Photo G.RICHARD)