APPENDIX A

ANALYSIS OF FAUNAL MATERIAL FROM AN ARCHAEOLOGICAL SITE COMPLEX AT MANGILAO, GUAM

By

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and

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Analysis of Faunal Material from an Archaeological Site Complex at Mangilao, Guam

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ABSTRACT

A collection of approximately 8,000 fish bones from an archaeological site complex at Mangilao on the island of Guam was analysed. Identifiable bones were found in 127 different assemblages. In total, these bones produced a Minimum Number of Individuals of 267 fishes (NISP=394). There were also a few bones of rats, birds and flying fox in the collections, but details of these are reported elsewhere.

The collections were examined for possible changes through time and from one area to another, without showing signs of significant variation.

Although 20 different families of fish are represented in these collections, all assemblages are dominated by fish belonging to the Scaridae family (parrotfish). This is similar to most other archaeological collections throughout the Pacific. Second in importance are fish belonging to the Coryphaenidae family (dolphinfish), and fifth in abundance are significant quantities of fish in the Istiophoridae/Xiphiidae families (swordfish and marlins). It is exceptional to find these species in archaeological sites in the Pacific; the bones from Mangilao are matched only in other sites in the Marianas chain of islands.

A few bones were found from at least 5 species which are not present in the comparative collection at the Archaeozoology Laboratory at the Museum of New Zealand.

Keywords: ARCHAEOLOGY, ARCHAEOZOOLOGY, FISH, GUAM, MARIANAS, DOLPHINFISH, SWORDFISH, MARLIN

INTRODUCTION

The results of the analysis of archaeological fish bone from numerous small excavations at Mangilao on the island of Guam are reported here.

The sites were excavated as part of mitigation during preparations for a golf course. The fish remains from these excavations were sent to the author by *Micronesian Archaeological Research Services* for identification using the comparative collection and other facilities at the Archaeozoology Laboratory, Museum of New Zealand. This report presents the results of this work.

Figure 1 shows the location of Guam at the bottom end of the Marianas chain of islands. Figure 2 is a map of Guam, and Figure 3 shows the area on Guam where the investigations were carried out. The three excavated sites from which fish bones were recovered are highlighted.

CURATORIAL DETAILS

On arrival at the Archaeozoology Laboratory all faunal material was re-bagged. Figure 4 shows a typical original bag containing the bones. This bag has numerous items of information written on

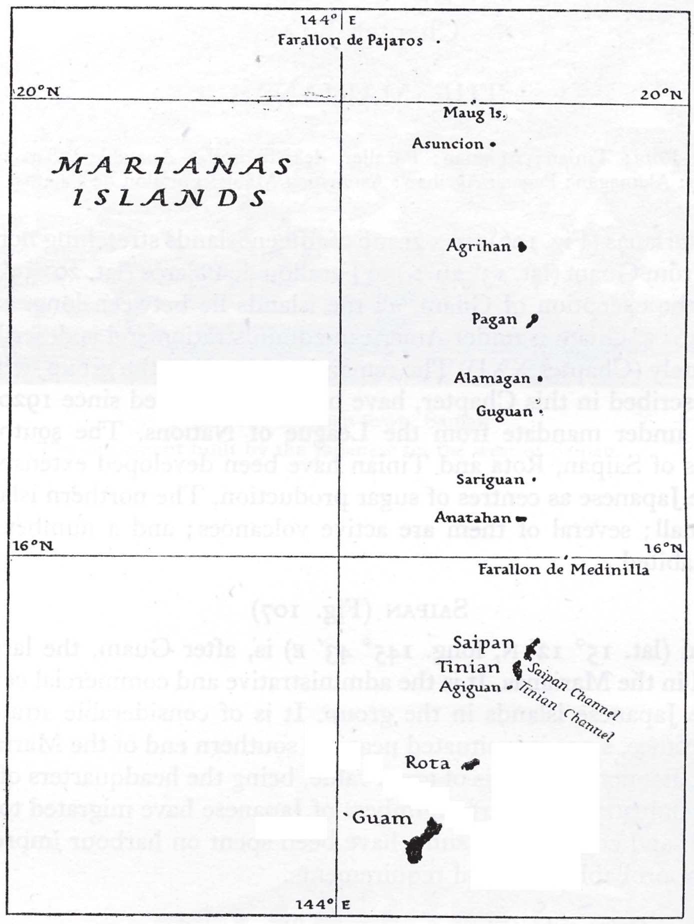

Figure 1: Map of the Mariana Islands with Guam at the extreme south

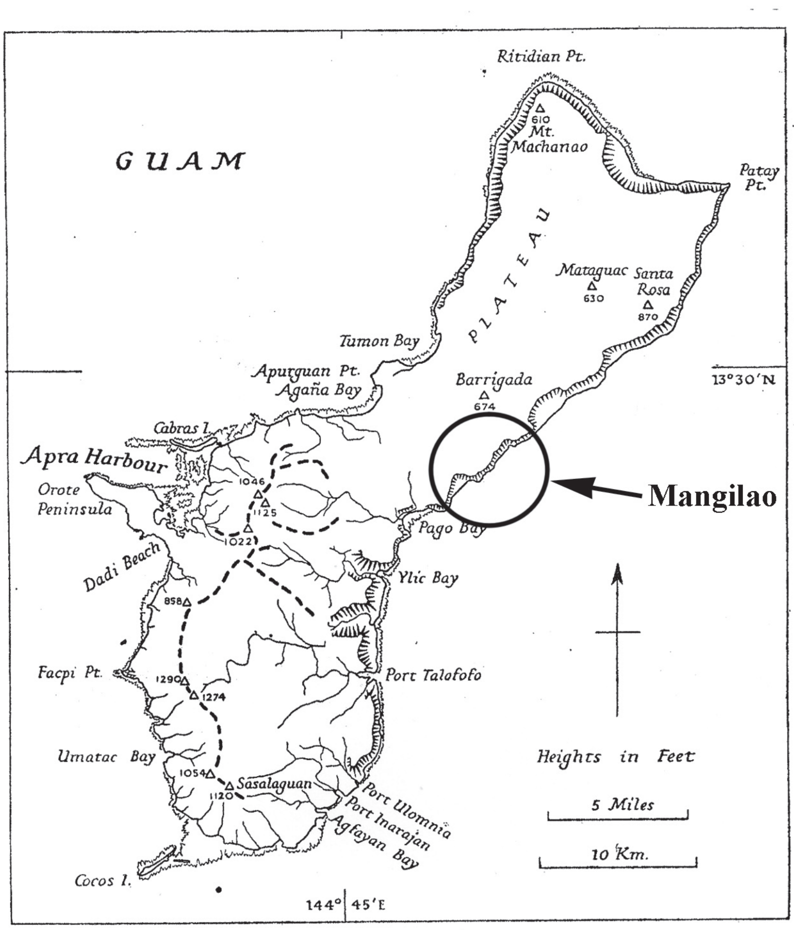

Figure 2: Plan of Guam. The Mangilao area is on the east coast

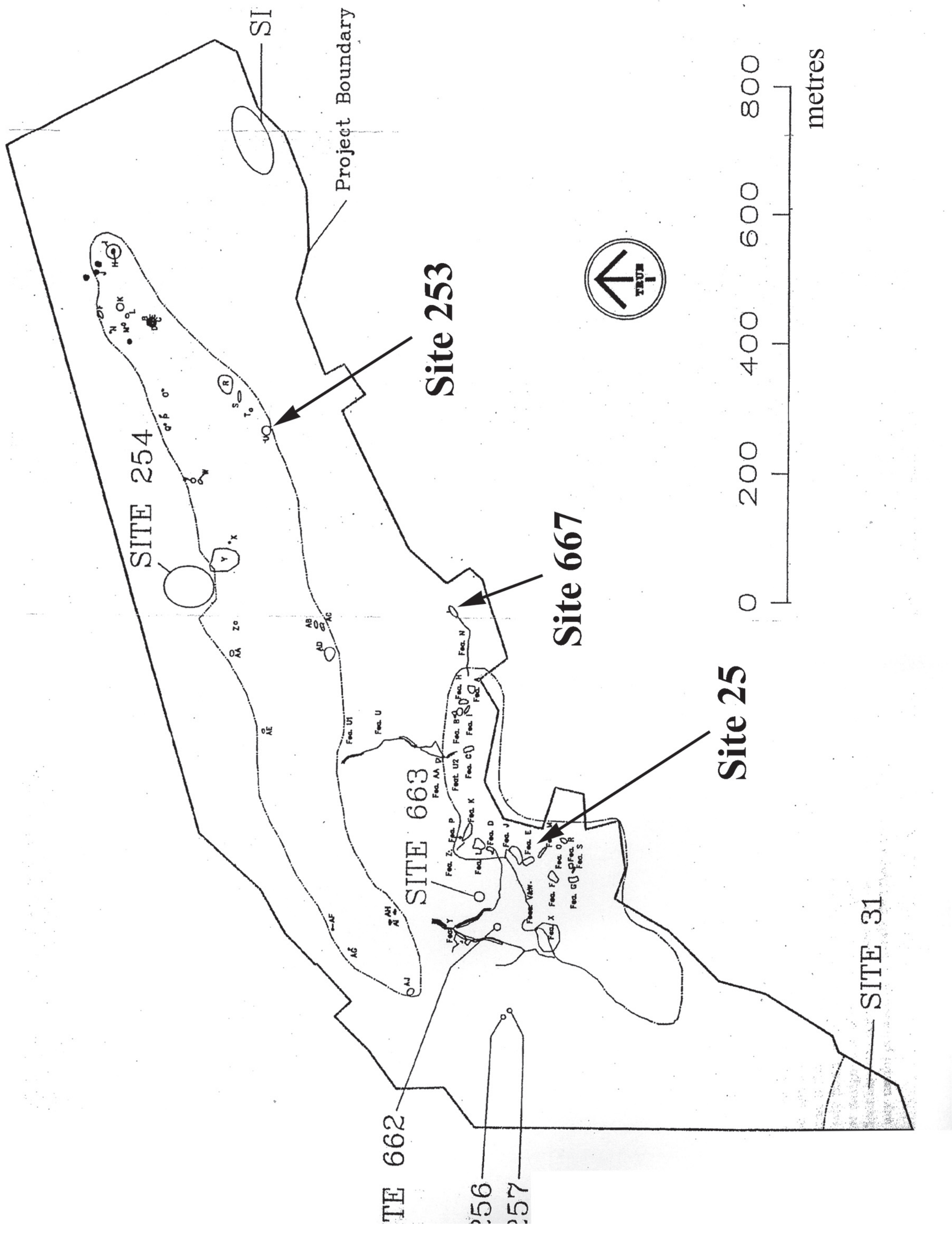

Figure 3: Map of the Mangilao Project area. Numbered locations are specific archaeological sites. Note the location of sites 25, 253 and 667.

it, which would be impossible to replicate many times as individual bones are removed, re-bagged, and identified. It is a fundamental curatorial procedure in archaeology never to destroy locational information relating to any item recovered. Fortunately, this information is available in a database (Excel files) held by *Micronesian Archaeological Research Services*, cross-referenced by a unique accession number which appears on each bag. In Figure 4 the bag is labelled #2559. The database listing for #2559 shows the following:

Catalogue Number	#2559
Site	25
Unit (Square)	420
Strat. (Layer)	IIIb

These details constitute the minimum information required for curation. In particular the Site, Square and Layer information constitutes a unique location in time and space known as an *Assemblage*. This assemblage is the unit used for calculation of MNI (minimum number of individuals during faunal analysis). For example, if one right dentary of *Monotaxis grandoculis* is found in one such assemblage, and a left dentary of *Monotaxis grandoculis* is found in another discrete assemblage, then this would count as MNI=2 for this species. Conversely, if one right dentary of *Monotaxis grandoculis* is found in one such assemblage, and a left dentary of *Monotaxis grandoculis* is found in the same discrete assemblage, then this would count as MNI=1 for this species, regardless of how big or small the two bones are. Clearly, the identification of what constitutes an assemblage is a very important matter during faunal analysis. Our usual procedure is to define one square metre of one individual layer as an assemblage and use that to define assemblages. In the case of the Mangilao collection, many of the Excavation Units (EUs or Squares) were one metre square, although others were larger than this.

Since the catalogue number was uniquely cross-referenced to Site, Square and Layer, using the database, this number is ideal to use during re-bagging, to ensure that locational information is not lost. It was therefore written on all bags during the re-bagging process to preserve original provenance information (See Figure 5). One bag, on which the accession number had been incorrectly transcribed, was excluded from the analysis.

Almost all of the fish remains derives from Site 25. In the body of this report, results are reported only for Site 25. In the Appendices, identifications are also given for bones from Site 253 and Site 667.

The bones in each original bag were tipped out in a sorting tray and sorted into basic categories: fish, bird, rat, flying fox, turtle, crustacea, and separately re-bagged in self-sealing plastic bags. The non-fish remains consist mainly of fragmented bones of rat and flying fox. There was also a considerable number of crustacean parts. In the case of fish remains, these were sorted into anatomical parts which are useful for identification to species, genera, or family, and separately re-bagged, and the original unique catalogue number written on each bag. Unidentifiable fish remains were returned to their original bags. More than 90% of archaeological fish bones are fragments of vertebrae and spines, and not normally used for quantitative analysis. However, they certainly have other scientific value, such as growth rate studies of ancient fishes, and for this reason are kept for posterity after excavation.

Identification of the fish remains was made using comparative material held at the Archaeozoology Laboratory, Museum of New Zealand Te Papa Tongarewa. As each identification was made, the anatomy (for example 2 LD = 2 Left Dentaries) and the taxon identified were written on a

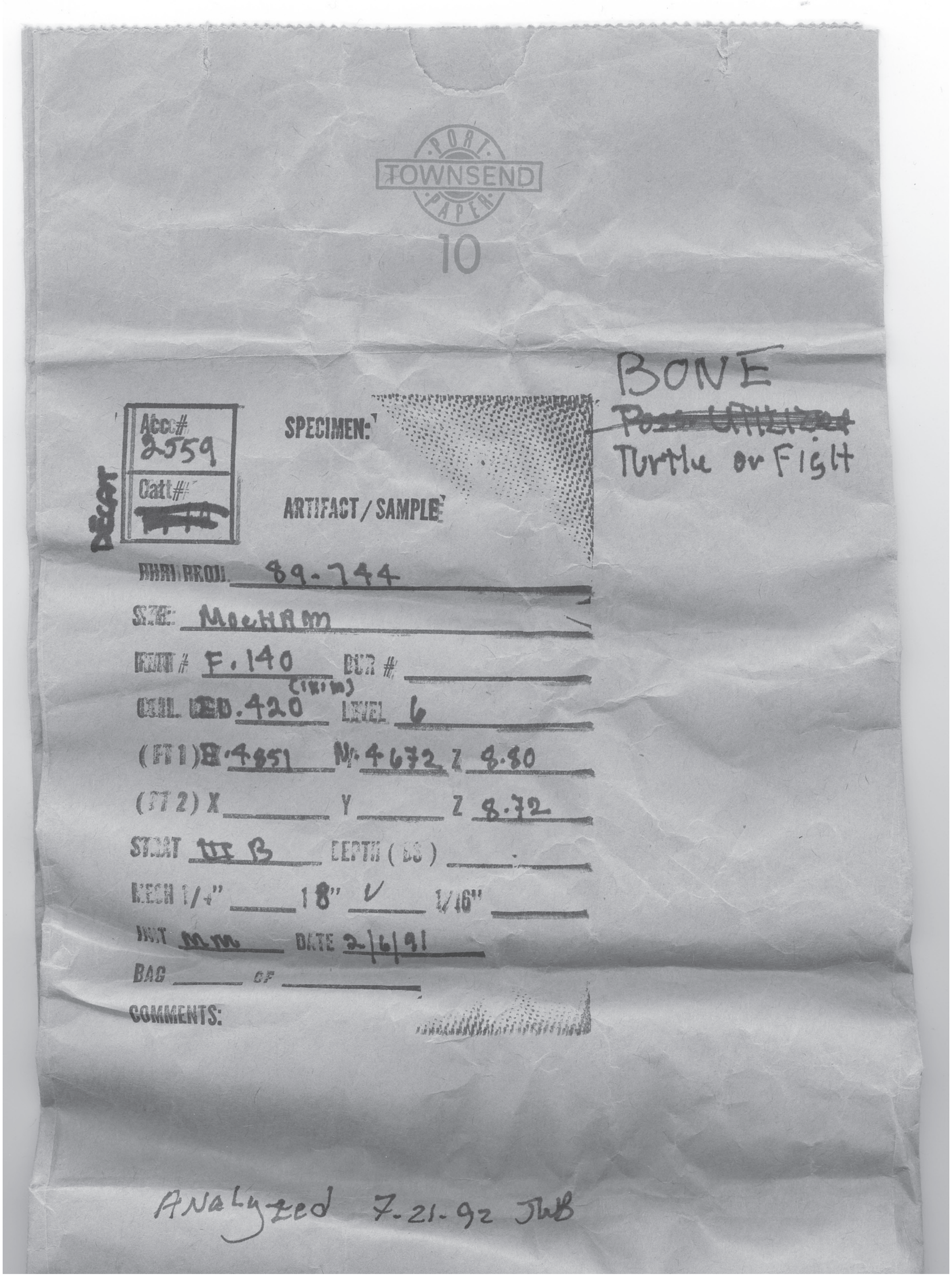

Figure 4: Copy of a typical original bag before re-bagging, including catalogue number #2559

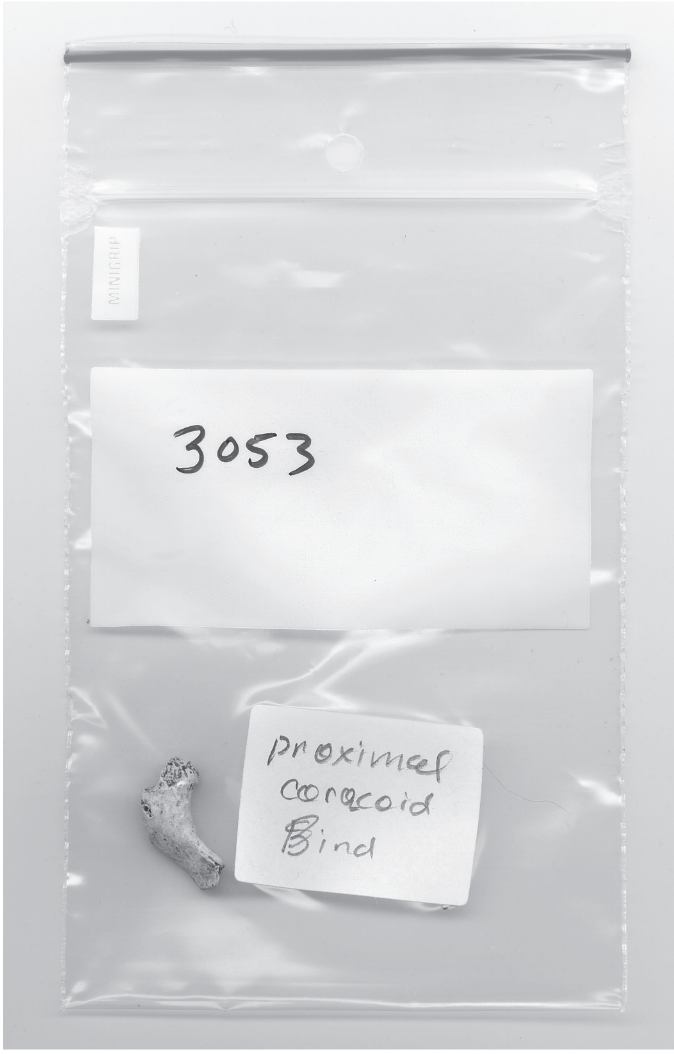

Figure 5: A typical self-sealing plastic bag after re-bagging. The original catalogue number #3053 preserves the unique location details. The identification is written on a removable label on the outside of the bag.

removable label which was stuck on the bag. At a later stage, when information was entered into a computer database (known as Kupenga), a reference number was allocated from the database, and this is written on the bag, and circled. This process ensures that there is a direct link between the two databases and every single bag. Should a more precise identification be made at some later stage, or an error identified in anatomy or species, one can return to the precise point in the database, make any corrections necessary and then update all tables using suitable software held by the authors.

In a few cases bones belonged to species not present in the Archaeozoology Laboratory. When this happens 'Unidentified Species A' is entered. In the case of Mangilao, six different unidentified species were found, and labelled A to F respectively. These occur in the category Teleostomi in Tables in this report. Only a few of the standard fish bones from Mangilao could not be identified.

METHODS OF FISH BONE ANALYSIS

The methods of analysis closely follow the technique developed in New Zealand for the treatment of archaeological fish bone assemblages from the Pacific Islands generally. This has been described elsewhere (Leach and Davidson, 1977; Leach 1986, 1997) so only a few details need to be given here. The assemblages covered in this report are quite small and make it difficult to observe significant temporal variation.

The identifiable fish bones were sorted anatomically and re-bagged. Taking each part of the anatomy in turn, bones were then sorted into taxonomic categories, and identified with reference to the comparative collection, which contains mounted bones of over 300 Pacific species. The nomenclature and taxonomy largely follow Munro (1967).

It is important to note that all identifications are made to the lowest taxonomic level possible. The level at which tropical Pacific fish bone can be identified varies greatly. For example, amongst the Holocentridae family, the cranial anatomy, particularly the dentary, of *Ostichthys murdjan* is very distinctive. *Holocentrus ruber* is also fairly distinctive, but a bone apparently belonging to this species would not be entered as such on a bag. Instead the identification would be entered as *Holocentrus* cf. *ruber*, indicating that this species is the most similar in the comparative collection, but although the genus is certain the species is not. Other bone specimens belonging to this family can only be identified to the level of *Holocentrus* sp. At the other end of the scale, with one exception, cranial bones of the Scaridae family are not identified to a level lower than family. The exception is *Bolbometopon muraticum*, which is of exceptional size. Fleming has shown that close familiarity with the cranial anatomy of the Scaridae permits identification to sub-family without great difficulty, and that the bucktooth characteristics of *Calotomus* spp. are also distinctive (Fleming, 1986: 167 ff.). However, the different Scaridae species have similar habitats and are caught by similar methods. From the point of view of studying human behaviour, identifying to species is therefore of little value.

The calculation of minimum numbers follows the general technique of Chaplin (1971), and is further discussed by Leach (1986, 1997). No attempt is made to increase MNI by taking into account observed size mis-matches. For comparative purposes, NISP values were also calculated and given in this report.

BASIC RESULTS OF FISH BONE ANALYSIS

Some 394 bones were able to be identified from 127 different assemblages from Site 25 at Mangilao. The Minimum Number of Individuals (MNI) for each type of fish was calculated and these details are provided in the Appendix, and summarised by family in Tables 1, 2 and 3 (see also Figures 5, 6 and 7). The bones were generally in good condition. However, a few premaxilla of Diodontidae (pufferfish) were very weathered and may not represent food remains. They have, however, been included in the analysis.

TABLE 1
Mangilao Site 25 Total MNI by Family
All Assemblages Combined

Family Name	**MNI**	**%**		
Scaridae	97	36.33	±	6.0
Coryphaenidae	41	15.36	±	4.5
Coridae/Labridae	21	7.87	±	3.4
Lethrinidae	20	7.49	±	3.3
Istiophoridae/Xiphii	14	5.24	±	2.9
Epinephelidae	11	4.12	±	2.6
Elasmobranchii	10	3.75	±	2.5
Diodontidae	9	3.37	±	2.4
Balistidae	8	3.00	±	2.2
Acanthuridae	7	2.62	±	2.1
Nemipteridae	6	2.25	±	2.0
Lutjanidae	5	1.87	±	1.8
Acanthocybiidae	4	1.50	±	1.6
Teleostomi	4	1.50	±	1.6
Carangidae	2	0.75	±	1.2
Coridae	2	0.75	±	1.2
Scombridae	2	0.75	±	1.2
Echeneidae	2	0.75	±	1.2
Holocentridae	1	0.37	±	0.9
Kyphosidae	1	0.37	±	0.9
Total	**267**	**100**		

Confidence limits are provided for each percentage in this and other Tables in this report. A percentage statistic (or proportions, whose sum=1.0) is a measure of relative abundance in the sense that when one percentage changes, so do all the others, so that the sum remains 100.0. The significance of any difference in relative abundance between two sets is easily tested by calculating the error range of each percentage (or proportion) to see if the two sets overlap or not. The calculation of the confidence limit of a proportion is as follows (Snedecor and Cochran 1967: 210–211; Leach and de Souza 1979: 32):

$$C = K * (P * (1.0 - P) / N)^{0.5} + 1 / 2N$$

C is the confidence limit, P is the proportion, N the sample size, and K is a constant related to the chosen probability level (= 1.96 for 95% confidence, following the distribution of Student's t). The factor 1/2N is added as a correction for continuity, which is important for small samples. For example, If N=128 and there are 7 items with some characteristic, then P=0.054688, and C=0.0433. So the 95% confidence range can be expressed as 5.47% ± 4.33%. For small samples, the distribution of Student's t must be consulted to adjust the value of C accordingly. For example if N=35, C will be 2.02, not 1.96.

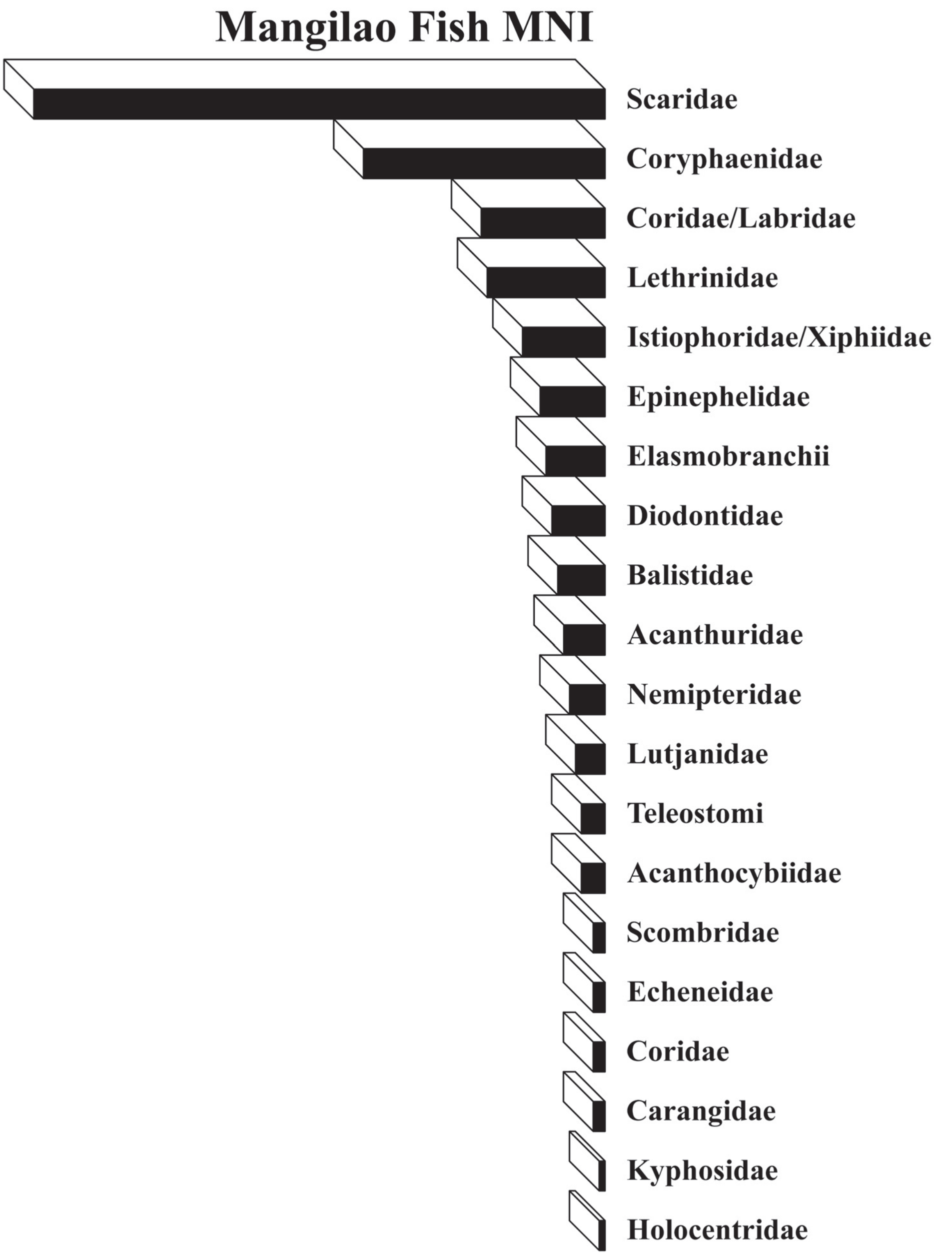

Figure 6: The abundance of different families of fish at Site 25, Mangilao.

TABLE 2
Mangilao MNI and Percent by Family
Assemblages Combined into Four Periods
1=Early, 2=Middle, 3=Late, 4=Historic

Family	**1**	**2**	**3**	**4**	**Total**	**%**
Scaridae	6	33	43	2	84	35.44
Coryphaenidae	-	21	18	-	39	16.46
Lethrinidae	-	14	4	1	19	8.02
Coridae/Labridae	-	11	5	-	16	6.75
Istiophoridae/Xiphiidae	-	3	9	1	13	5.49
Epinephelidae	1	8	2	-	11	4.64
Elasmobranchii	1	6	2	1	10	4.22
Balistidae	1	4	2	-	7	2.95
Diodontidae	-	-	6	1	7	2.95
Acanthuridae	-	2	2	1	5	2.11
Lutjanidae	-	3	2	-	5	2.11
Acanthocybiidae	-	3	1	-	4	1.69
Nemipteridae	-	3	1	-	4	1.69
Teleostomi	-	4	-	-	4	1.69
Coridae	1	1	-	-	2	0.84
Scombridae	-	2	-	-	2	0.84
Echeneidae	-	2	-	-	2	0.84
Carangidae	-	-	1	-	1	0.42
Holocentridae	-	1	-	-	1	0.42
Kyphosidae	-	-	1	-	1	0.42
Totals	**10**	**121**	**99**	**7**	**237**	**100**

Family	**1**	**2**	**3**	**4**
Scaridae	60.0±39.1	27.3±8.3	43.4±10.4	28.6±46.5
Coryphaenidae	-	17.4±7.2	18.2±8.2	-
Lethrinidae	-	11.6±6.1	4.0±4.4	14.3±37.6
Coridae/Labridae	-	9.1±5.5	5.1±4.9	-
Istiophoridae/Xiphiidae	-	2.5±3.2	9.1±6.2	14.3±37.6
Epinephelidae	10.0±25.9	6.6±4.8	2.0±3.3	-
Elasmobranchii	10.0±25.9	5.0±4.3	2.0±3.3	14.3±37.6
Balistidae	10.0±25.9	3.3±3.6	2.0±3.3	-
Diodontidae	-	-	6.1±5.3	14.3±37.6
Acanthuridae	-	1.7±2.7	2.0±3.3	14.3±37.6
Lutjanidae	-	2.5±3.2	2.0±3.3	-
Acanthocybiidae	-	2.5±3.2	1.0±2.5	-
Nemipteridae	-	2.5±3.2	1.0±2.5	-
Teleostomi	-	3.3±3.6	-	-
Coridae	10.0±25.9	0.8±2.0	-	-
Scombridae	-	1.7±2.7	-	-
Echeneidae	-	1.7±2.7	-	-
Carangidae	-	-	1.0±2.5	-
Holocentridae	-	0.8±2.0	-	-
Kyphosidae	-	-	1.0±2.5	-
Totals	**100.0**	**100.0**	**100.0**	**100.0**

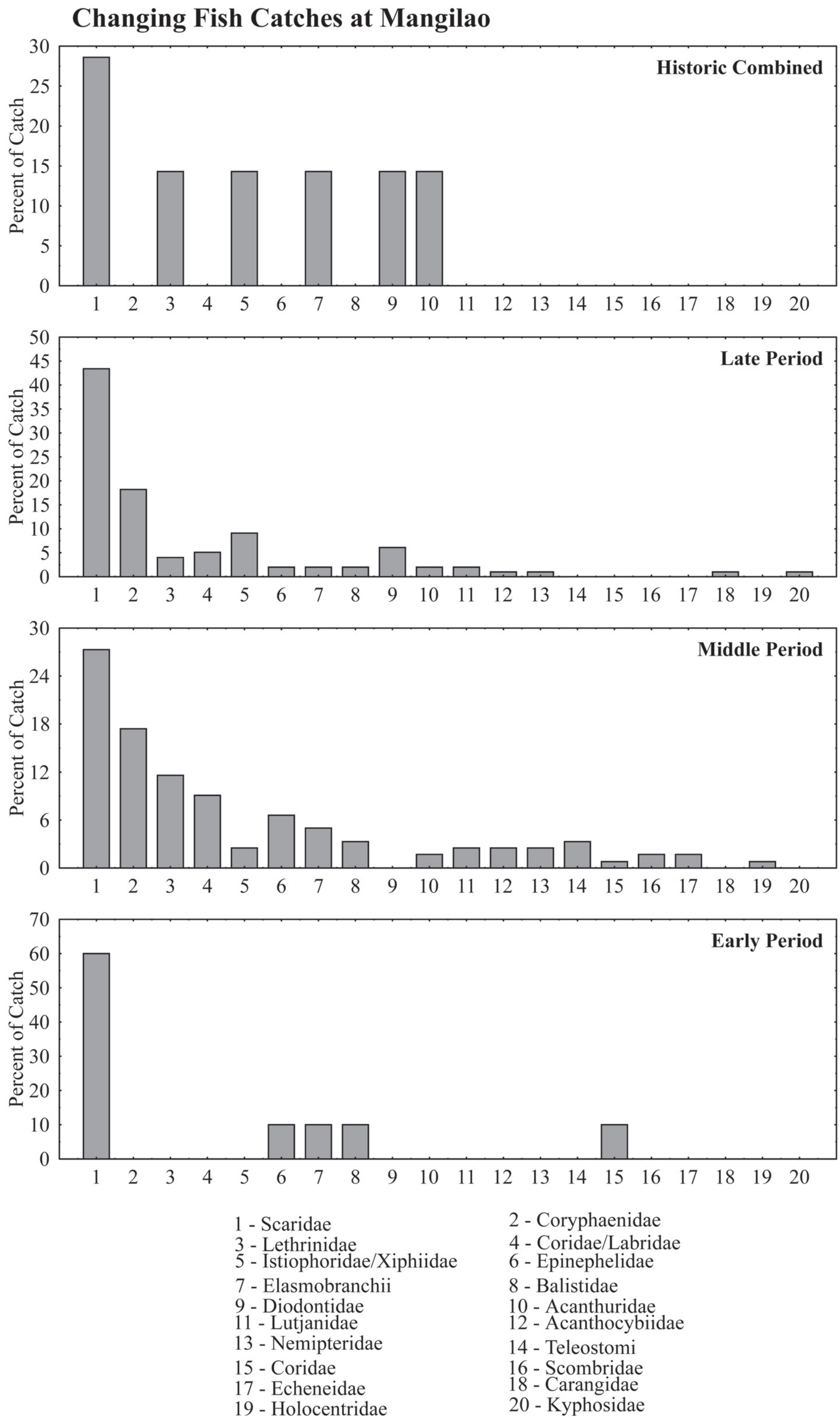

Figure 7: Relative abundance of fish at different Time Periods at Mangilao.

TABLE 3
Mangilao MNI and Percent by Family
Assemblages Combined into Three Areas
1=Western, 2=Central, 3=Eastern

Family Name	**1**	**2**	**3**	**Total**	**%**
Scaridae	23	5	69	97	36.33
Coryphaenidae	6	3	32	41	15.36
Coridae/Labridae	1	4	16	21	7.87
Lethrinidae	2	2	16	20	7.49
Istiophoridae/Xiphiidae	7	-	7	14	5.24
Epinephelidae	2	1	8	11	4.12
Elasmobranchii	5	-	5	10	3.75
Diodontidae	-	1	8	9	3.37
Balistidae	1	1	6	8	3.00
Acanthuridae	1	1	5	7	2.62
Nemipteridae	1	-	5	6	2.25
Lutjanidae	-	1	4	5	1.87
Acanthocybiidae	-	1	3	4	1.50
Teleostomi	-	-	4	4	1.50
Carangidae	-	-	2	2	0.75
Coridae	1	-	1	2	0.75
Scombridae	-	-	2	2	0.75
Echeneidae	-	-	2	2	0.75
Holocentridae	-	-	1	1	0.37
Kyphosidae	-	1	-	1	0.37
Total	**50**	**21**	**196**	**267**	**100**

Family	**1**	**2**	**3**
Scaridae	46.0±15.1	23.8±21.7	35.2±6.9
Coryphaenidae	12.0±10.2	14.3±18.2	16.3±5.4
Coridae/Labridae	2.0±5.0	19.0±20.2	8.2±4.1
Lethrinidae	4.0±6.6	9.5±15.7	8.2±4.1
Istiophoridae/Xiphiidae	14.0±10.8	-	3.6±2.9
Epinephelidae	4.0±6.6	4.8±12.0	4.1±3.0
Elasmobranchii	10.0±9.5	-	2.6±2.5
Diodontidae	-	4.8±12.0	4.1±3.0
Balistidae	2.0±5.0	4.8±12.0	3.1±2.7
Acanthuridae	2.0±5.0	4.8±12.0	2.6±2.5
Nemipteridae	2.0±5.0	-	2.6±2.5
Lutjanidae	-	4.8±12.0	2.0±2.2
Acanthocybiidae	-	4.8±12.0	1.5±2.0
Teleostomi	-	-	2.0±2.2
Carangidae	-	-	1.0±1.7
Coridae	2.0±5.0	-	0.5±1.3
Scombridae	-	-	1.0±1.7
Echeneidae	-	-	1.0±1.7
Holocentridae	-	-	0.5±1.3
Kyphosidae	-	4.8±12.0	-
Totals	**100.0**	**100.0**	**100.0**

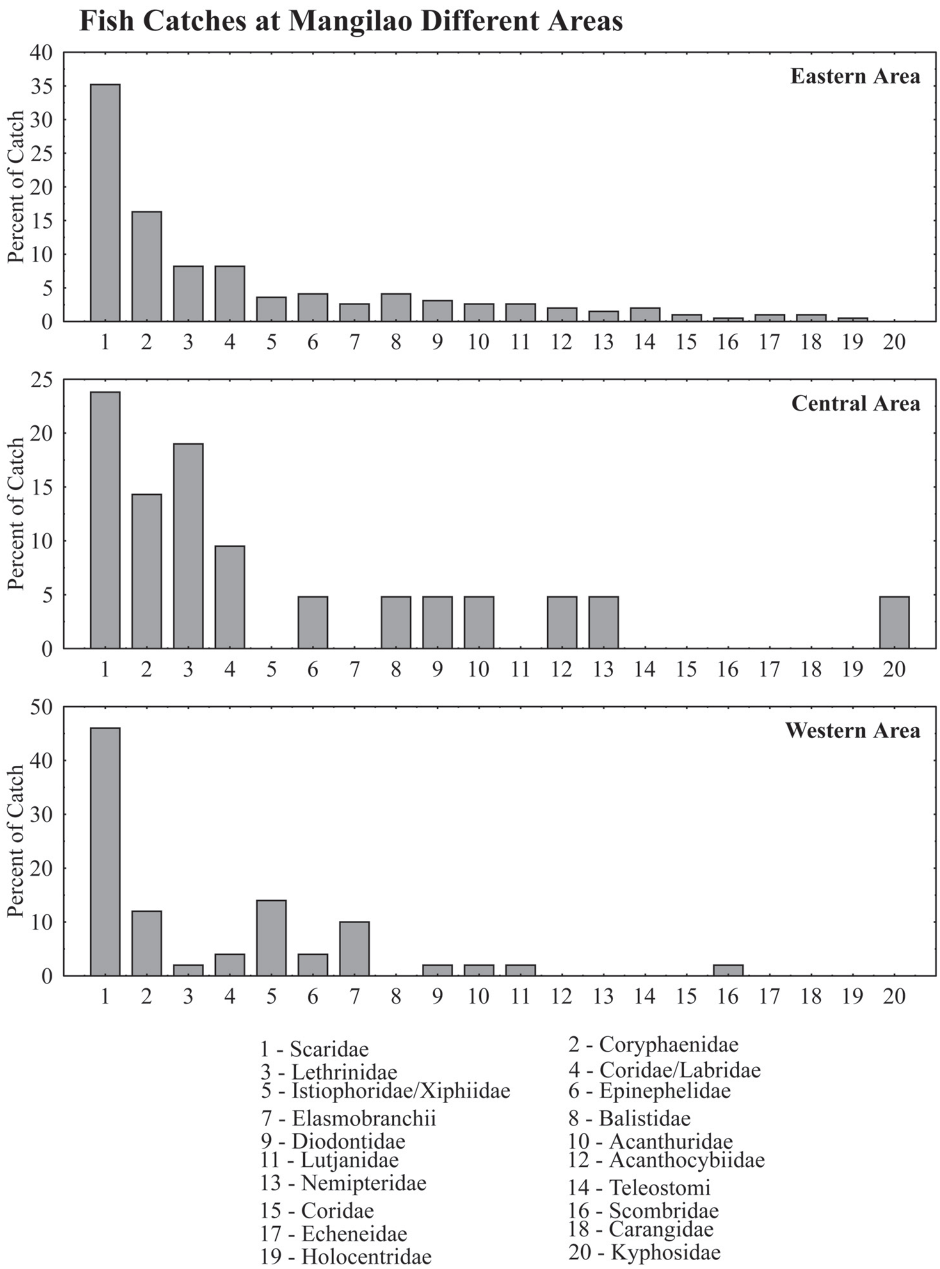

Figure 8: Relative abundance of fish at different areas at Mangilao.

The time periods represented in Table 2 and Figure 7 were arrived at with advice from *Micronesian Archaeological Research Services*. The groupings suggested were:

Historic	Layers I and II
Late Period	Layer IIIa
Middle Period	Layers IIIb to IIIf
Early Period	Layer IIIg (only present in the western area)

Some identified bones were from mixed or uncertain contexts. These are excluded from Table 2 and Figure 7.

The split into three areas in Table 3 and Figure 8 follows clear divisions of excavated squares. These are listed in Table 6 in the Appendix. Statistical errors for each percentage are given in Tables 2 and 3 (for details of this see below Table 1). These assist evaluation of the significance of any observed difference between time periods or areas. For example, it will be noticed that in the case of swordfish and marlin there is an apparent rise in abundance through time.

Historic Period	14.3%
Late Period	9.1%
Middle Period	2.5%
Early	0.0%

Such an inference, however, must be tempered by the statistical error margins around these estimates, which are: 2.5±3.2, 9.1±6.2, and 14.3±37.6 respectively. Clearly, these margins overlap, and the inference fails to be confirmed. With much larger samples it is possible that this apparent trend through time could be confirmed; on the other hand, it may be quashed.

Careful examination of both Tables 2 and 3 will show that no changes in time or from one area to another can be confirmed.

THE GENERAL CHARACTER OF FISHING AT MANGILAO SITE 25

The fish remains at Mangilao belong to at least 20 different families (Figure 1). This is fairly typical for Pacific Island prehistoric people. The catch is also dominated by only a few species, four or five at most. Again, there is nothing unusual about this. The most common type of fish in almost all archaeological sites in the Pacific belong to the Scaridae, and once again Mangilao is no exception.

One interesting find at Mangilao is the presence of two right maxillae of some species of tuna, unfortunately not able to be identified other than to family. Tuna are rare in Pacific island archaeological sites.

It is also notable that there are examples of both the humphead wrasse (*Cheilinus undulatus*) and the humphead parrotfish (*Bolbometopon muricatum*). This is unusual in our experience of Pacific archaeological fish bone collections. These fish grow to considerable size (humphead parrotfish to about 1.2 metres, and humphead wrasse to about 1.8 metres) and are very strong animals. If they are speared and not killed outright they will instantly dive taking both the spear and the fishermen to depths. They would also make a mess of any net they become entangled in. It is uncertain how these fish would have been caught in prehistoric times.

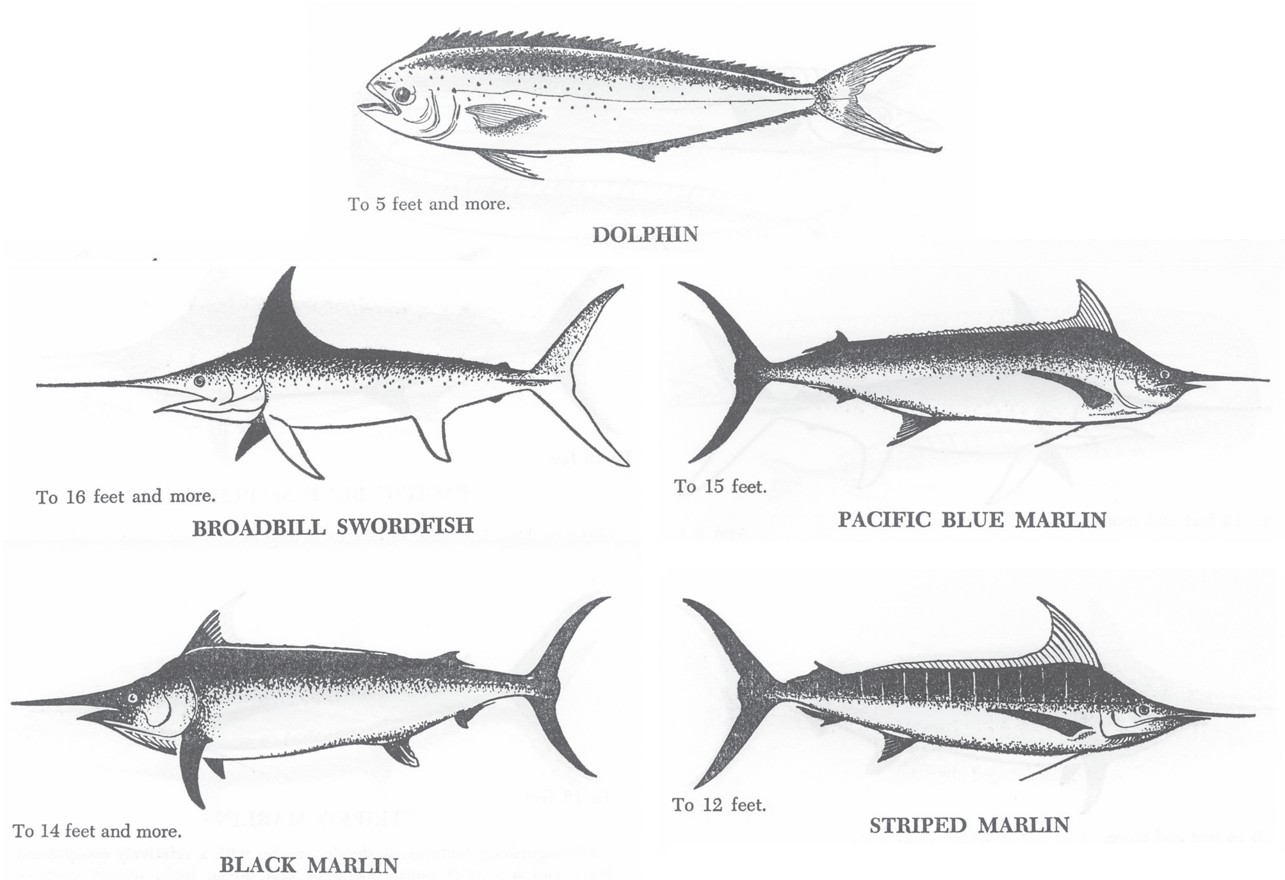

Figure 9: The dolphinfish and several species of swordfish and marlin

However, the most unusual aspect of the fish remains at Mangilao is the presence of significant numbers of dolphinfish and one or more species belonging to the Istiophoridae or Xiphiidae families or both (Figure 9).

Dolphinfish were mainly identified from their distinctive vertebrae, although a few cranial bones were also present. These fish are quite numerous at Mangilao, and catching them shows great enterprise on the part of the prehistoric people on Guam. Dolphinfish are very strong and can reach great speed in the water. One of their favourite foods is flyingfish, which they are able to follow underwater as they fly overhead, capturing them as they re-enter the water.

Mention must be made of the systematic hunting of dolphinfish in recent times by the Yami people of Botel Tobago, off the south-east coast of Taiwan (Hsu 1982: 116 ff.; Kano and Segawa 1956: 186). However, several archaeological sites at O-Luan-Pi on the southernmost tip of Taiwan suggest a more convincing link with the Marianas (Leach *et al*. 1988a: 37, 53; Li 1997). These sites in Taiwan date from about 2,000 to 5,000 BP and possess notable similarities with sites in Guam and elsewhere in the Marianas. People in both these areas possessed highly specialised fishing skills, not seen in any other part of Oceania.

Dolphinfish are migratory, and are most abundant in the Guam waters from February to April (Amesbury and Myers 1982: 49); there is an even shorter period when they can be taken in the waters about Botel Tobago — during May and June (Kano and Segawa 1956: 186). These authors also note (ibid.) that the fish when caught has a special hook placed in its mouth and this is then tied tight to the tail. The fish is literally bent to death in this manner (see also Hsu 1982: 296). This seems a very odd way of killing a fish, since a cut through the arteries at the base of the operculum kills even large fishes very quickly. It is noteworthy that this same method of constraining the fish was used in Tahiti (see Nordhoff 1930: 170), although the hook which actually caught the fish was used. Nordhoff also makes an important remark in passing that "in the old days, before Micronesians and Cook Islanders taught the Society Island people how to catch flying fish by torchlight… " (ibid.: 169), they were caught during the day. This remark confirms a suspicion, now difficult to document, that during the historic period in the Pacific, there was a great deal of exchange of knowledge on different fishing methods. This makes it very difficult now to evaluate from historic records what are genuinely 'traditional' methods. Nevertheless, there could be some significance in the parallel between Botel Tobago and the Marianas and Guam when it comes to dolphinfish.

Unfortunately, comparative material is not available which would assist with identification of marlin or swordfish from Site 25 even to the correct genus. Although our database is coordinated with the family organisation of Munro (1967), the most cited authority on the higher level taxonomy of fishes is Nelson (1994) who divides the family Xiphiidae into two subfamilies: Xiphinae (swordfish) and Istiophorinae; the latter having three genera: Istiophoris (sailfishes), Tetrapturus (spearfishes) and Makaira (marlins) (Nelson 1994: 428–429). The distribution of these fishes is complex, varying both seasonally and geographically. It is always tempting to assist identification of archaeological fauna using modern distributional data; however, there is a problem associated with this approach — over archaeological time there can be significant changes in climate and oceanic current circulation patterns, which have a dramatic affect on the distribution of many animals, fishes included. This temptation should therefore be resisted and bones identified from their unique anatomical details alone.

There are a number of parts of the anatomy which are highly distinctive of marlin and swordfish. Their mouthparts are obviously unusual, but so are their vertebrae, which are considerably elongated,

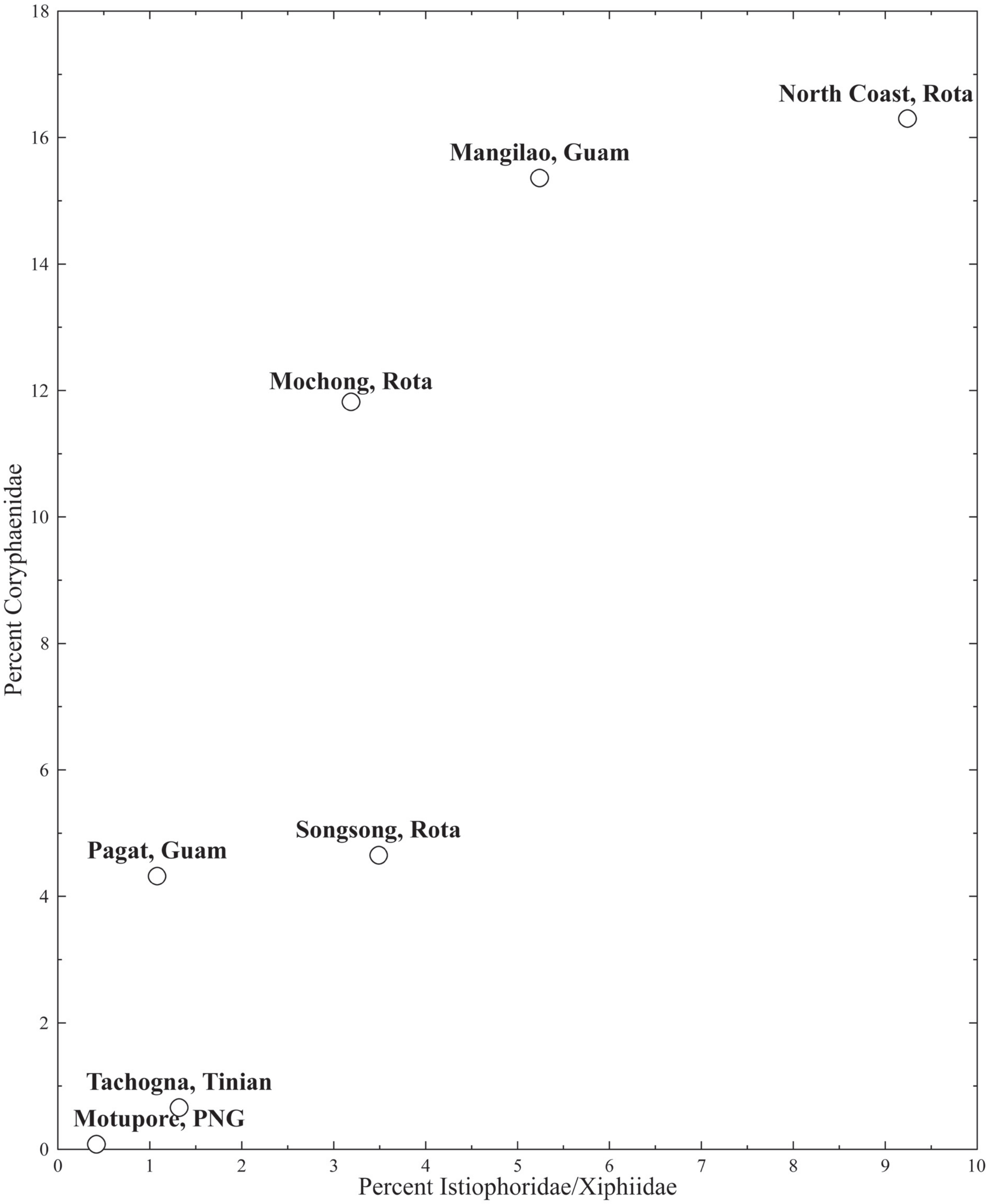

Figure 10: The relative abundance of swordfish/marlin and dolphinfish. Only 7 sites of more than 70 in the database have significant archaeological remains of fishes of these families.

with an hourglass shaped interior. They also possess a partly ossified secondary shell inside the vertebral cavity. Finally, the zygapophyses are greatly elongated, acting as anchoring plates for their strong back muscles, which assist high speed in the water when hunting. Therefore, fragments of both vertebrae and zygapophyses may be identified to this group of fishes. Finally, the caudal peduncle of this group of fishes is again highly distinctive, and since there is only one per fish is ideal for calculating MNI.

Although it is not possible at the moment to identify which kind of swordfish or marlin was being caught at Mangilao, at least two species were certainly present. The database of fish remains from Pacific archaeological sites in the Archaeozoology Laboratory contains information from 74 sites scattered across the Pacific. Only seven sites have evidence of swordfish/marlin fishing, and these are shown on Figure 10. Other than Motupore near Port Moresby in Papua New Guinea, these sites are all located in the Marianas chain. The presence of prehistoric big-game fishing for swordfish/marlin, dolphinfish and tuna has been noted before at archaeological sites on the island of Rota: at Mochong (Leach *et al*. 1988a), at Songsong (Leach *et al*. 1988b), and on the road to the airport on the north coast between these two (Davidson and Leach 1988), on Tinian at Tachogna (Leach *et al*. 1988a), and at the Pagat site on Guam (Craib 1986: Table C-3).

There are far too many bones of these fish in increasing numbers of archaeological sites for them to have been simply isolated examples washed ashore; rather it seems fairly certain that they were being systematically hunted in prehistoric times. One possibility is that these people learned how to catch them after specimens were hooked on dolphinfish lines. Pollard (1969: 70 ff.) has some useful comments to make on marlin habits. He notes that small black marlin will take lure hooks, but that it is almost impossible to get a large marlin to accept a lure. Instead, bait trolling is required, and the bait should be sizeable — bait fish as large as 3.5 to 4.5 kg are very effective. If flying fish were used for bait trolling for dolphinfish, then it is quite feasible that some smaller marlin were hooked in this way. Once people learned how to catch small specimens, then it is possible that experimentation with different kinds of bait trolling might result in the capture of large specimens. In this respect, Zamora had some useful comments to make in AD 1602 on the Marianas fishermen in the historic period. It appears that flying fish was a very important target of their fishing:

> the first flying fish is eaten raw; the second is baited on a large hook attached to a line that is cast over the stern of the boat. Many dorados [mahimahi; dolphin fish; *Coryphaena hippurus*], agujas paladares [possibly blue marlin, or *Makaira higricans* [sic, *nigricans*]], and other large fish are caught in this manner (Driver 1983: 208).

The social importance of these large fish is also recorded by Zamora, and he describes various aspects of associated ceremonial behaviour and salting of the meat for preservation. One interesting story, reminiscent of Ernest Hemingway's tale of the 'Old Man and the Sea', is recounted as follows:

> …a very large blue marlin [aguja paladar] took the hook. His line was very thin and, as he did not want to break it, he hesitated to pull it in. Yet he was very anxious to land the fish; therefore, he very cautiously began playing and tiring it. This took a long time. Meanwhile, a large shark appeared and attacked the blue marlin in the midsection of its back. In order not to let go of his line, the indio allowed his boat to capsize. Then he tied the end of his line to the capsized funei, followed the line through the water to the shark, and diverted him from his catch. Then he brought the blue marlin back to his boat, righted the craft, and sailed home, flying a woven mat as a banner from the masthead. Once ashore, he began to

> tell us what had happened and, like a person who believes he has accomplished a great feat, very proudly strutted pompously along the beach (Driver 1983: 209).

To catch and land a swordfish or marlin, weighing at least several hundred and possibly as much as a thousand kilograms, from a dugout canoe, is a considerable achievement, and must have been a spectacular sight. However the Mangilao fishermen were catching these fish it would have been a very dangerous pastime for people in a canoe, as these fish will readily attack their persecutor. There is a record of a swordfish penetrating boat decking to a depth of 27 inches; the specimen is on display in the British Museum of Natural History (Pollard 1969: 68). Another possibility is that these fish were caught with harpoons, while they basked on the surface. This would also be a dangerous method, possibly resulting in immediate retaliation on the part of the fish, unless it was killed outright. In this respect it is worth noting that the modern fishermen of Ulithi usually cut a line once they know they have hooked a marlin, with the simple comment “too dangerous”. The prehistoric fishermen of Mangilao deserve our admiration.

FISH REMAINS FROM SITES 253 AND 667

Only a few fish bones were identified from these two sites, and do not merit separate comment. The identifications are provided in the Appendix in Tables 8, 9, 11 and 12.

CONCLUSIONS

This collection of fish remains from numerous small excavations at Mangilao on the island of Guam has revealed some interesting aspects of prehistoric fishing behaviour. In particular, the presence of big-game fishes well back into the prehistoric period extends our knowledge of this activity further south in the Marianas chain.

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APPENDIX: Detailed Results of Fish Analysis from Mangilao

The Tables in this Appendix are printouts from the *Kupenga Fishbone Database* in the Archaeozoology Laboratory at the Museum of New Zealand Te Papa Tongarewa and should be read as follows:

Tables 4 to 7 and 10 provide details of the identifications of fish remains from Site 25.

Table 4 provides totals for the whole site.

At the head of each Table appears a list of the assemblages (space/time units) which have been combined together to form each column in the table. Referring to Table 4, an example is:

(498, 3) = GOLF004 Square 208, Layer IIId

'GOLF' is the code in the *Kupenga Fishbone Database* for Mangilao site 25. '498, 3' is the code in the database which identifies the unique space/time assemblage in Mangilao Site 25 which is Square 208, Layer IIId. The code '004' attached to GOLF shows that Square 208 is the fourth spatial unit listed for Site 25. Any codes appearing as either '999' or with a ? symbol refer to an unknown provenance in the site.

Once each column has been defined in this manner, this is followed by the listing of the Minimum Number of Individuals (MNI) according to taxon and the percent MNI of each taxon for each of the columns identified at the head of the Table.

Database codes for Taxon and Family also appear in the Tables below. For example, In Table 4, Taxon #1 = *Acanthocybium solandri*. Further down in the Family tabulation Family #140 refers to Scaridae.

The figures are then presented according to family in decreasing order of abundance (as in Table 1 and Figure 6). The last part of this Table shows the systematic error associated with each percentage.

Tables 5 and 6 present the same information, now broken down into four time periods and three spatial divisions, as described in the text. In Table 5, 1 = Early Prehistoric, 2 = Middle Prehistoric, 3 = Late Prehistoric, and 4 = Historic and Recent. In Table 6, 1 = Western, 2 = Central and 3 = Eastern.

Table 7 presents NISP (number of identified specimens) from Site 25 according to taxon and family, and shows the breakdown by anatomy of identified specimens of the most common family (Scaridae).

Table 10 lists all individual identifications from Site 25 according to excavations unit (square), layer, anatomy and taxon.

Tables 8 and 11 provide details of identifications from Site 253.

Table 8 presents NISP by taxon and family, and by anatomy for the most common family, Scaridae.

Table 11 lists all individual identifications from Site 253 according to excavation unit (square), layer, anatomy and taxon.

Tables 9 and 12 provide the same information for Site 667.

Table 4: Mangilao Site 25 MNI All Assemblages Combined

```
Column Numbers and Equivalent Assemblage Reference Numbers
Column  1        = (  495,    1) = GOLF001 Square 999,  Layer ?
                 = (  495,    2) = GOLF001 Square 999,  Layer IIIa
                 = (  498,    3) = GOLF004 Square 208,  Layer IIId
                 = (  498,    4) = GOLF004 Square 208,  Layer IIIe
                 = (  499,    1) = GOLF005 Square 210,  Layer IIIa/b
                 = (  506,    2) = GOLF012 Square 233,  Layer IIIe
                 = (  510,    1) = GOLF016 Square 240,  Layer IIIc
                 = (  511,    1) = GOLF017 Square 241,  Layer IIIe
                 = (  511,    3) = GOLF017 Square 241,  Layer IIIg2
                 = (  512,    1) = GOLF018 Square 242,  Layer IIIe
                 = (  514,    1) = GOLF020 Square 244,  Layer IIIe
                 = (  514,    3) = GOLF020 Square 244,  Layer IIIg2
                 = (  515,    2) = GOLF021 Square 245,  Layer IIIg2
                 = (  516,    1) = GOLF022 Square 246,  Layer IIIe
                 = (  516,    2) = GOLF022 Square 246,  Layer IIIg1
                 = (  517,    2) = GOLF023 Square 247,  Layer IIIg2
                 = (  519,    4) = GOLF025 Square 249,  Layer IIIg2
                 = (  526,    2) = GOLF032 Square 260,  Layer IIIa
                 = (  533,    1) = GOLF039 Square 271,  Layer Ib
                 = (  534,    1) = GOLF040 Square 272,  Layer IIIa
                 = (  535,    2) = GOLF041 Square 273,  Layer IIIb
                 = (  536,    2) = GOLF042 Square 276,  Layer III
                 = (  537,    2) = GOLF043 Square 278,  Layer Ic
                 = (  538,    1) = GOLF044 Square 282,  Layer IIIa
                 = (  539,    1) = GOLF045 Square 283,  Layer IIIa
                 = (  539,    2) = GOLF045 Square 283,  Layer IIIb
                 = (  540,    1) = GOLF046 Square 284,  Layer IIIa
                 = (  541,    2) = GOLF047 Square 285,  Layer IIIb
                 = (  541,    3) = GOLF047 Square 285,  Layer IIIe
                 = (  542,    1) = GOLF048 Square 286,  Layer IIIa
                 = (  543,    1) = GOLF049 Square 287,  Layer IIIa
                 = (  544,    1) = GOLF050 Square 288,  Layer IIIa
                 = (  545,    2) = GOLF051 Square 289,  Layer IIIb
                 = (  546,    1) = GOLF052 Square 291,  Layer IIIa
                 = (  547,    1) = GOLF053 Square 292,  Layer IIIa
                 = (  549,    2) = GOLF055 Square 294,  Layer IIIb
                 = (  550,    1) = GOLF056 Square 297,  Layer IIIa
                 = (  551,    1) = GOLF057 Square 298,  Layer IIIa
                 = (  552,    2) = GOLF058 Square 299,  Layer IIIb
                 = (  553,    2) = GOLF059 Square 300,  Layer IIb
                 = (  554,    1) = GOLF060 Square 301,  Layer IIa
                 = (  560,    1) = GOLF066 Square 400,  Layer IIIb
                 = (  562,    1) = GOLF068 Square 402,  Layer IIIa
                 = (  562,    2) = GOLF068 Square 402,  Layer IIIb
                 = (  563,    1) = GOLF069 Square 403,  Layer IIIa
                 = (  564,    1) = GOLF070 Square 409,  Layer IIIa
                 = (  566,    1) = GOLF072 Square 411,  Layer IIIa
                 = (  569,    1) = GOLF075 Square 414,  Layer IIIa
                 = (  570,    2) = GOLF076 Square 416,  Layer IIIb
                 = (  570,    3) = GOLF076 Square 416,  Layer IIIc
                 = (  571,    1) = GOLF077 Square 417,  Layer IIIa
                 = (  571,    2) = GOLF077 Square 417,  Layer IIIa/b/c
                 = (  571,    3) = GOLF077 Square 417,  Layer IIIb
                 = (  571,    4) = GOLF077 Square 417,  Layer IIIc
                 = (  572,    1) = GOLF078 Square 418,  Layer IIIa
                 = (  572,    2) = GOLF078 Square 418,  Layer IIIb
                 = (  573,    2) = GOLF079 Square 419,  Layer IIIa2
                 = (  573,    3) = GOLF079 Square 419,  Layer IIIa3
                 = (  573,    4) = GOLF079 Square 419,  Layer IIIb
                 = (  574,    1) = GOLF080 Square 420,  Layer IIIa
                 = (  574,    2) = GOLF080 Square 420,  Layer IIIb
                 = (  574,    3) = GOLF080 Square 420,  Layer IIIc
                 = (  574,    4) = GOLF080 Square 420,  Layer IIIc1
                 = (  575,    1) = GOLF081 Square 421,  Layer IIIa
                 = (  575,    2) = GOLF081 Square 421,  Layer IIIa/b
                 = (  575,    3) = GOLF081 Square 421,  Layer IIIb
                 = (  575,    5) = GOLF081 Square 421,  Layer IIId
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= (  576,    2) = GOLF082 Square 422,  Layer IIIa2
= (  577,    1) = GOLF083 Square 423,  Layer IIIa1
= (  577,    3) = GOLF083 Square 423,  Layer IIIb
= (  578,    1) = GOLF084 Square 424,  Layer IIIa
= (  578,    2) = GOLF084 Square 424,  Layer IIIa2
= (  578,    3) = GOLF084 Square 424,  Layer IIIb
= (  578,    4) = GOLF084 Square 424,  Layer IIIc
= (  579,    1) = GOLF085 Square 425,  Layer IIIa
= (  579,    3) = GOLF085 Square 425,  Layer IIIc
= (  580,    1) = GOLF086 Square 426,  Layer IIIa
= (  581,    1) = GOLF087 Square 427,  Layer IIIa
= (  581,    2) = GOLF087 Square 427,  Layer IIIb
= (  582,    3) = GOLF088 Square 428,  Layer IIIc
= (  582,    4) = GOLF088 Square 428,  Layer IIId
= (  584,    1) = GOLF090 Square 430,  Layer IIIa
= (  584,    2) = GOLF090 Square 430,  Layer IIIa/a1
= (  584,    5) = GOLF090 Square 430,  Layer IIIc
= (  585,    1) = GOLF091 Square 431,  Layer IIIa
= (  585,    2) = GOLF091 Square 431,  Layer IIIb
= (  586,    1) = GOLF092 Square 432,  Layer IIIa
= (  587,    2) = GOLF093 Square 433,  Layer IIIb
= (  588,    2) = GOLF094 Square 434,  Layer IIIa
= (  593,    2) = GOLF099 Square 439,  Layer Id
= (  594,    1) = GOLF100 Square 440,  Layer Id
= (  599,    1) = GOLF105 Square 445,  Layer IIIa
= (  600,    1) = GOLF106 Square 449,  Layer IIIb
= (  601,    1) = GOLF107 Square 450,  Layer 999
= (  601,    3) = GOLF107 Square 450,  Layer IIIb
= (  601,    4) = GOLF107 Square 450,  Layer IIIc
= (  602,    2) = GOLF108 Square 451,  Layer IIIa
= (  602,    3) = GOLF108 Square 451,  Layer IIIb
= (  602,    4) = GOLF108 Square 451,  Layer IIIc
= (  603,    1) = GOLF109 Square 452,  Layer IIIa
= (  604,    1) = GOLF110 Square 453,  Layer IIIa
= (  605,    1) = GOLF111 Square 454,  Layer IIIa
= (  606,    1) = GOLF112 Square 456,  Layer Id
= (  607,    2) = GOLF113 Square 457,  Layer IIIb
= (  608,    1) = GOLF114 Square 458,  Layer IIIa
= (  609,    1) = GOLF115 Square 459,  Layer IIIa
= (  610,    1) = GOLF116 Square 460,  Layer IIIa
= (  611,    2) = GOLF117 Square 461,  Layer IIIb
= (  612,    1) = GOLF118 Square 462,  Layer IIIa
= (  614,    1) = GOLF120 Square 464,  Layer IIIa
= (  617,    1) = GOLF123 Square 468,  Layer 999
= (  617,    2) = GOLF123 Square 468,  Layer IIIa
= (  617,    3) = GOLF123 Square 468,  Layer IIIb
= (  619,    2) = GOLF125 Square 470,  Layer IIIb
= (  620,    1) = GOLF126 Square 471,  Layer IIIa
= (  621,    1) = GOLF127 Square 472,  Layer 999
= (  621,    2) = GOLF127 Square 472,  Layer IIIa
= (  623,    2) = GOLF129 Square 474,  Layer IIIb
= (  624,    1) = GOLF130 Square 475,  Layer IIIa
= (  624,    2) = GOLF130 Square 475,  Layer IIIb
= (  625,    1) = GOLF131 Square 476,  Layer 999
= (  625,    3) = GOLF131 Square 476,  Layer IIIb\c
= (  625,    4) = GOLF131 Square 476,  Layer IIIc
= (  626,    1) = GOLF132 Square 477,  Layer IIIa
= (  627,    1) = GOLF133 Square 478,  Layer IIIa
= (  627,    2) = GOLF133 Square 478,  Layer IIIb
= (  628,    1) = GOLF134 Square 479,  Layer IIIa
```

Overall Totals for these Assemblages by Taxa

Taxon #	**Taxon Name**	**MNI**	**%**
1	Acanthocybium soland	4	1.50
2	Acanthuridae	6	2.25
4	Acanthurus sp.	1	0.37
14	Balistidae	8	3.00
20	Carangoides laticaud	1	0.37

25	Caranx sp.	1	0.37
30	Cheilinus undulatus	2	0.75
32	Coridae/Labridae	21	7.87
33	Coryphaena hippurus	41	15.36
35	Diodon sp.	9	3.37
36	Elasmobranchii	10	3.75
38	Epinephelus/Ceph sp.	11	4.12
44	Holocentrus sp.	1	0.37
45	Istiophoridae/Xiphii	14	5.24
48	Kyphosus sp.	1	0.37
50	Lethrinidae	20	7.49
52	Lutjanus sp.	5	1.87
58	Monotaxis granoculis	6	2.25
78	Scaridae	90	33.71
85	Teleostomi Species A	1	0.37
86	Teleostomi Species B	1	0.37
87	Teleostomi Species C	1	0.37
88	Teleostomi Species D	1	0.37
92	Thunnidae/Katsuwonid	2	0.75
96	Remora sp.	2	0.75
113	Bolbometopon sp.	7	2.62
Totals		**267**	**100**

Taxon	**1**	**Totals**
1	4	4
2	6	6
4	1	1
14	8	8
20	1	1
25	1	1
30	2	2
32	21	21
33	41	41
35	9	9
36	10	10
38	11	11
44	1	1
45	14	14
48	1	1
50	20	20
52	5	5
58	6	6
78	90	90
85	1	1
86	1	1
87	1	1
88	1	1
92	2	2
96	2	2
113	7	7
Totals	**267**	**267**

Overall Totals for these Assemblages by Family

Family #	**Family Name**	**MNI**	**%**
140	Scaridae	97	36.33
85	Coryphaenidae	41	15.36
222	Coridae/Labridae	21	7.87
114	Lethrinidae	20	7.49
221	Istiophoridae/Xiphii	14	5.24
97	Epinephelidae	11	4.12
192	Elasmobranchii	10	3.75
175	Diodontidae	9	3.37
180	Balistidae	8	3.00
159	Acanthuridae	7	2.62

110	Nemipteridae	6	2.25
106	Lutjanidae	5	1.87
73	Acanthocybiidae	4	1.50
197	Teleostomi	4	1.50
88	Carangidae	2	0.75
138	Coridae	2	0.75
72	Scombridae	2	0.75
174	Echeneidae	2	0.75
57	Holocentridae	1	0.37
124	Kyphosidae	1	0.37
Total		**267**	**100**

Family	1	Totals
140	97	97
85	41	41
222	21	21
114	20	20
221	14	14
97	11	11
192	10	10
175	9	9
180	8	8
159	7	7
110	6	6
106	5	5
73	4	4
197	4	4
88	2	2
138	2	2
72	2	2
174	2	2
57	1	1
124	1	1
Totals	**267**	**267**

Family %	1
140	36.3+- 6.0
85	15.4+- 4.5
222	7.9+- 3.4
114	7.5+- 3.3
221	5.2+- 2.9
97	4.1+- 2.6
192	3.7+- 2.5
175	3.4+- 2.4
180	3.0+- 2.2
159	2.6+- 2.1
110	2.2+- 2.0
106	1.9+- 1.8
73	1.5+- 1.6
197	1.5+- 1.6
88	0.7+- 1.2
138	0.7+- 1.2
72	0.7+- 1.2
174	0.7+- 1.2
57	0.4+- 0.9
124	0.4+- 0.9
Total	**100.0**

Table 5: Mangilao Site 25 MNI For Four Time Periods

```
Column Numbers and Equivalent Assemblage Reference Numbers
Column  1         = (  516,    2) = GOLF022 Square 246,  Layer IIIg1
                  = (  511,    3) = GOLF017 Square 241,  Layer IIIg2
                  = (  514,    3) = GOLF020 Square 244,  Layer IIIg2
                  = (  515,    2) = GOLF021 Square 245,  Layer IIIg2
                  = (  517,    2) = GOLF023 Square 247,  Layer IIIg2
                  = (  519,    4) = GOLF025 Square 249,  Layer IIIg2
Column  2         = (  535,    2) = GOLF041 Square 273,  Layer IIIb
                  = (  539,    2) = GOLF045 Square 283,  Layer IIIb
                  = (  541,    2) = GOLF047 Square 285,  Layer IIIb
                  = (  545,    2) = GOLF051 Square 289,  Layer IIIb
                  = (  549,    2) = GOLF055 Square 294,  Layer IIIb
                  = (  552,    2) = GOLF058 Square 299,  Layer IIIb
                  = (  560,    1) = GOLF066 Square 400,  Layer IIIb
                  = (  562,    2) = GOLF068 Square 402,  Layer IIIb
                  = (  570,    2) = GOLF076 Square 416,  Layer IIIb
                  = (  571,    3) = GOLF077 Square 417,  Layer IIIb
                  = (  572,    2) = GOLF078 Square 418,  Layer IIIb
                  = (  573,    4) = GOLF079 Square 419,  Layer IIIb
                  = (  574,    2) = GOLF080 Square 420,  Layer IIIb
                  = (  575,    3) = GOLF081 Square 421,  Layer IIIb
                  = (  577,    3) = GOLF083 Square 423,  Layer IIIb
                  = (  578,    3) = GOLF084 Square 424,  Layer IIIb
                  = (  581,    2) = GOLF087 Square 427,  Layer IIIb
                  = (  585,    2) = GOLF091 Square 431,  Layer IIIb
                  = (  587,    2) = GOLF093 Square 433,  Layer IIIb
                  = (  600,    1) = GOLF106 Square 449,  Layer IIIb
                  = (  601,    3) = GOLF107 Square 450,  Layer IIIb
                  = (  602,    3) = GOLF108 Square 451,  Layer IIIb
                  = (  607,    2) = GOLF113 Square 457,  Layer IIIb
                  = (  611,    2) = GOLF117 Square 461,  Layer IIIb
                  = (  617,    3) = GOLF123 Square 468,  Layer IIIb
                  = (  619,    2) = GOLF125 Square 470,  Layer IIIb
                  = (  623,    2) = GOLF129 Square 474,  Layer IIIb
                  = (  624,    2) = GOLF130 Square 475,  Layer IIIb
                  = (  627,    2) = GOLF133 Square 478,  Layer IIIb
                  = (  625,    3) = GOLF131 Square 476,  Layer IIIb\c
                  = (  510,    1) = GOLF016 Square 240,  Layer IIIc
                  = (  570,    3) = GOLF076 Square 416,  Layer IIIc
                  = (  571,    4) = GOLF077 Square 417,  Layer IIIc
                  = (  574,    3) = GOLF080 Square 420,  Layer IIIc
                  = (  578,    4) = GOLF084 Square 424,  Layer IIIc
                  = (  579,    3) = GOLF085 Square 425,  Layer IIIc
                  = (  582,    3) = GOLF088 Square 428,  Layer IIIc
                  = (  584,    5) = GOLF090 Square 430,  Layer IIIc
                  = (  601,    4) = GOLF107 Square 450,  Layer IIIc
                  = (  602,    4) = GOLF108 Square 451,  Layer IIIc
                  = (  625,    4) = GOLF131 Square 476,  Layer IIIc
                  = (  574,    4) = GOLF080 Square 420,  Layer IIIc1
                  = (  498,    3) = GOLF004 Square 208,  Layer IIId
                  = (  575,    5) = GOLF081 Square 421,  Layer IIId
                  = (  582,    4) = GOLF088 Square 428,  Layer IIId
                  = (  498,    4) = GOLF004 Square 208,  Layer IIIe
                  = (  506,    2) = GOLF012 Square 233,  Layer IIIe
                  = (  511,    1) = GOLF017 Square 241,  Layer IIIe
                  = (  512,    1) = GOLF018 Square 242,  Layer IIIe
                  = (  514,    1) = GOLF020 Square 244,  Layer IIIe
                  = (  516,    1) = GOLF022 Square 246,  Layer IIIe
                  = (  541,    3) = GOLF047 Square 285,  Layer IIIe
Column  3         = (  495,    2) = GOLF001 Square 999,  Layer IIIa
                  = (  526,    2) = GOLF032 Square 260,  Layer IIIa
                  = (  534,    1) = GOLF040 Square 272,  Layer IIIa
                  = (  538,    1) = GOLF044 Square 282,  Layer IIIa
                  = (  539,    1) = GOLF045 Square 283,  Layer IIIa
                  = (  540,    1) = GOLF046 Square 284,  Layer IIIa
                  = (  542,    1) = GOLF048 Square 286,  Layer IIIa
                  = (  543,    1) = GOLF049 Square 287,  Layer IIIa
                  = (  544,    1) = GOLF050 Square 288,  Layer IIIa
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              = (  546,    1) = GOLF052 Square 291,  Layer IIIa
              = (  547,    1) = GOLF053 Square 292,  Layer IIIa
              = (  550,    1) = GOLF056 Square 297,  Layer IIIa
              = (  551,    1) = GOLF057 Square 298,  Layer IIIa
              = (  562,    1) = GOLF068 Square 402,  Layer IIIa
              = (  563,    1) = GOLF069 Square 403,  Layer IIIa
              = (  564,    1) = GOLF070 Square 409,  Layer IIIa
              = (  566,    1) = GOLF072 Square 411,  Layer IIIa
              = (  569,    1) = GOLF075 Square 414,  Layer IIIa
              = (  571,    1) = GOLF077 Square 417,  Layer IIIa
              = (  572,    1) = GOLF078 Square 418,  Layer IIIa
              = (  574,    1) = GOLF080 Square 420,  Layer IIIa
              = (  575,    1) = GOLF081 Square 421,  Layer IIIa
              = (  578,    1) = GOLF084 Square 424,  Layer IIIa
              = (  579,    1) = GOLF085 Square 425,  Layer IIIa
              = (  580,    1) = GOLF086 Square 426,  Layer IIIa
              = (  581,    1) = GOLF087 Square 427,  Layer IIIa
              = (  584,    1) = GOLF090 Square 430,  Layer IIIa
              = (  585,    1) = GOLF091 Square 431,  Layer IIIa
              = (  586,    1) = GOLF092 Square 432,  Layer IIIa
              = (  588,    2) = GOLF094 Square 434,  Layer IIIa
              = (  599,    1) = GOLF105 Square 445,  Layer IIIa
              = (  602,    2) = GOLF108 Square 451,  Layer IIIa
              = (  603,    1) = GOLF109 Square 452,  Layer IIIa
              = (  604,    1) = GOLF110 Square 453,  Layer IIIa
              = (  605,    1) = GOLF111 Square 454,  Layer IIIa
              = (  608,    1) = GOLF114 Square 458,  Layer IIIa
              = (  609,    1) = GOLF115 Square 459,  Layer IIIa
              = (  610,    1) = GOLF116 Square 460,  Layer IIIa
              = (  612,    1) = GOLF118 Square 462,  Layer IIIa
              = (  614,    1) = GOLF120 Square 464,  Layer IIIa
              = (  617,    2) = GOLF123 Square 468,  Layer IIIa
              = (  620,    1) = GOLF126 Square 471,  Layer IIIa
              = (  621,    2) = GOLF127 Square 472,  Layer IIIa
              = (  624,    1) = GOLF130 Square 475,  Layer IIIa
              = (  626,    1) = GOLF132 Square 477,  Layer IIIa
              = (  627,    1) = GOLF133 Square 478,  Layer IIIa
              = (  628,    1) = GOLF134 Square 479,  Layer IIIa
              = (  584,    2) = GOLF090 Square 430,  Layer IIIa/a1
              = (  577,    1) = GOLF083 Square 423,  Layer IIIa1
              = (  573,    2) = GOLF079 Square 419,  Layer IIIa2
              = (  576,    2) = GOLF082 Square 422,  Layer IIIa2
              = (  578,    2) = GOLF084 Square 424,  Layer IIIa2
              = (  573,    3) = GOLF079 Square 419,  Layer IIIa3
Column  4     = (  533,    1) = GOLF039 Square 271,  Layer Ib
              = (  537,    2) = GOLF043 Square 278,  Layer Ic
              = (  593,    2) = GOLF099 Square 439,  Layer Id
              = (  594,    1) = GOLF100 Square 440,  Layer Id
              = (  606,    1) = GOLF112 Square 456,  Layer Id
              = (  554,    1) = GOLF060 Square 301,  Layer IIa
              = (  553,    2) = GOLF059 Square 300,  Layer IIb
```

Overall Totals for these Assemblages by Taxa

Taxon #	**Taxon Name**	**MNI**	**%**
1	Acanthocybium soland	4	1.69
2	Acanthuridae	4	1.69
4	Acanthurus sp.	1	0.42
14	Balistidae	7	2.95
25	Caranx sp.	1	0.42
30	Cheilinus undulatus	2	0.84
32	Coridae/Labridae	16	6.75
33	Coryphaena hippurus	39	16.46
35	Diodon sp.	7	2.95
36	Elasmobranchii	10	4.22
38	Epinephelus/Ceph sp.	11	4.64
44	Holocentrus sp.	1	0.42
45	Istiophoridae/Xiphii	13	5.49
48	Kyphosus sp.	1	0.42

50	Lethrinidae	19	8.02
52	Lutjanus sp.	5	2.11
58	Monotaxis granoculis	4	1.69
78	Scaridae	78	32.91
85	Teleostomi Species A	1	0.42
86	Teleostomi Species B	1	0.42
87	Teleostomi Species C	1	0.42
88	Teleostomi Species D	1	0.42
92	Thunnidae/Katsuwonid	2	0.84
96	Remora sp.	2	0.84
113	Bolbometopon sp.	6	2.53
Totals		**237**	**100**

Taxon	**1**	**2**	**3**	**4**	**Totals**
1	-	3	1	-	4
2	-	1	2	1	4
4	-	1	-	-	1
14	1	4	2	-	7
25	-	-	1	-	1
30	1	1	-	-	2
32	-	11	5	-	16
33	-	21	18	-	39
35	-	-	6	1	7
36	1	6	2	1	10
38	1	8	2	-	11
44	-	1	-	-	1
45	-	3	9	1	13
48	-	-	1	-	1
50	-	14	4	1	19
52	-	3	2	-	5
58	-	3	1	-	4
78	4	31	41	2	78
85	-	1	-	-	1
86	-	1	-	-	1
87	-	1	-	-	1
88	-	1	-	-	1
92	-	2	-	-	2
96	-	2	-	-	2
113	2	2	2	-	6
Totals	**10**	**121**	**99**	**7**	**237**

Overall Totals for these Assemblages by Family

Family #	**Family Name**	**MNI**	**%**
140	Scaridae	84	35.44
85	Coryphaenidae	39	16.46
114	Lethrinidae	19	8.02
222	Coridae/Labridae	16	6.75
221	Istiophoridae/Xiphii	13	5.49
97	Epinephelidae	11	4.64
192	Elasmobranchii	10	4.22
180	Balistidae	7	2.95
175	Diodontidae	7	2.95
159	Acanthuridae	5	2.11
106	Lutjanidae	5	2.11
73	Acanthocybiidae	4	1.69
110	Nemipteridae	4	1.69
197	Teleostomi	4	1.69
138	Coridae	2	0.84
72	Scombridae	2	0.84
174	Echeneidae	2	0.84
88	Carangidae	1	0.42
57	Holocentridae	1	0.42
124	Kyphosidae	1	0.42
Total		**237**	**100**

Family	**1**	**2**	**3**	**4**	**Totals**
140	6	33	43	2	84
85	-	21	18	-	39
114	-	14	4	1	19
222	-	11	5	-	16
221	-	3	9	1	13
97	1	8	2	-	11
192	1	6	2	1	10
180	1	4	2	-	7
175	-	-	6	1	7
159	-	2	2	1	5
106	-	3	2	-	5
73	-	3	1	-	4
110	-	3	1	-	4
197	-	4	-	-	4
138	1	1	-	-	2
72	-	2	-	-	2
174	-	2	-	-	2
88	-	-	1	-	1
57	-	1	-	-	1
124	-	-	1	-	1
Totals	**10**	**121**	**99**	**7**	**237**

Family %	**1**		**2**		**3**		**4**	
140	60.0+-	39.1	27.3+-	8.3	43.4+-	10.4	28.6+-	46.5
85	-	-	17.4+-	7.2	18.2+-	8.2	-	-
114	-	-	11.6+-	6.1	4.0+-	4.4	14.3+-	37.6
222	-	-	9.1+-	5.5	5.1+-	4.9	-	-
221	-	-	2.5+-	3.2	9.1+-	6.2	14.3+-	37.6
97	10.0+-	25.9	6.6+-	4.8	2.0+-	3.3	-	-
192	10.0+-	25.9	5.0+-	4.3	2.0+-	3.3	14.3+-	37.6
180	10.0+-	25.9	3.3+-	3.6	2.0+-	3.3	-	-
175	-	-	-	-	6.1+-	5.3	14.3+-	37.6
159	-	-	1.7+-	2.7	2.0+-	3.3	14.3+-	37.6
106	-	-	2.5+-	3.2	2.0+-	3.3	-	-
73	-	-	2.5+-	3.2	1.0+-	2.5	-	-
110	-	-	2.5+-	3.2	1.0+-	2.5	-	-
197	-	-	3.3+-	3.6	-	-	-	-
138	10.0+-	25.9	0.8+-	2.0	-	-	-	-
72	-	-	1.7+-	2.7	-	-	-	-
174	-	-	1.7+-	2.7	-	-	-	-
88	-	-	-	-	1.0+-	2.5	-	-
57	-	-	0.8+-	2.0	-	-	-	-
124	-	-	-	-	1.0+-	2.5	-	-
Totals	**100.0**		**100.0**		**100.0**		**100.0**	

Table 6: Mangilao Site 25 MNI For Western, Central and Eastern Areas

```
Column Numbers and Equivalent Assemblage Reference Numbers
Column  1        = (  498,    3) = GOLF004 Square 208,  Layer IIId
                 = (  498,    4) = GOLF004 Square 208,  Layer IIIe
                 = (  499,    1) = GOLF005 Square 210,  Layer IIIa/b
                 = (  506,    2) = GOLF012 Square 233,  Layer IIIe
                 = (  510,    1) = GOLF016 Square 240,  Layer IIIc
                 = (  511,    1) = GOLF017 Square 241,  Layer IIIe
                 = (  511,    3) = GOLF017 Square 241,  Layer IIIg2
                 = (  512,    1) = GOLF018 Square 242,  Layer IIIe
                 = (  514,    1) = GOLF020 Square 244,  Layer IIIe
                 = (  514,    3) = GOLF020 Square 244,  Layer IIIg2
                 = (  515,    2) = GOLF021 Square 245,  Layer IIIg2
                 = (  516,    1) = GOLF022 Square 246,  Layer IIIe
                 = (  516,    2) = GOLF022 Square 246,  Layer IIIg1
                 = (  517,    2) = GOLF023 Square 247,  Layer IIIg2
                 = (  519,    4) = GOLF025 Square 249,  Layer IIIg2
                 = (  526,    2) = GOLF032 Square 260,  Layer IIIa
                 = (  533,    1) = GOLF039 Square 271,  Layer Ib
                 = (  534,    1) = GOLF040 Square 272,  Layer IIIa
                 = (  535,    2) = GOLF041 Square 273,  Layer IIIb
                 = (  536,    2) = GOLF042 Square 276,  Layer III
                 = (  537,    2) = GOLF043 Square 278,  Layer Ic
                 = (  538,    1) = GOLF044 Square 282,  Layer IIIa
                 = (  539,    1) = GOLF045 Square 283,  Layer IIIa
                 = (  539,    2) = GOLF045 Square 283,  Layer IIIb
                 = (  540,    1) = GOLF046 Square 284,  Layer IIIa
                 = (  541,    2) = GOLF047 Square 285,  Layer IIIb
                 = (  541,    3) = GOLF047 Square 285,  Layer IIIe
                 = (  542,    1) = GOLF048 Square 286,  Layer IIIa
                 = (  543,    1) = GOLF049 Square 287,  Layer IIIa
                 = (  544,    1) = GOLF050 Square 288,  Layer IIIa
                 = (  545,    2) = GOLF051 Square 289,  Layer IIIb
                 = (  546,    1) = GOLF052 Square 291,  Layer IIIa
                 = (  547,    1) = GOLF053 Square 292,  Layer IIIa
                 = (  549,    2) = GOLF055 Square 294,  Layer IIIb
                 = (  550,    1) = GOLF056 Square 297,  Layer IIIa
                 = (  551,    1) = GOLF057 Square 298,  Layer IIIa
                 = (  552,    2) = GOLF058 Square 299,  Layer IIIb
                 = (  553,    2) = GOLF059 Square 300,  Layer IIb
                 = (  554,    1) = GOLF060 Square 301,  Layer IIa
Column  2        = (  587,    2) = GOLF093 Square 433,  Layer IIIb
                 = (  588,    2) = GOLF094 Square 434,  Layer IIIa
                 = (  593,    2) = GOLF099 Square 439,  Layer Id
                 = (  594,    1) = GOLF100 Square 440,  Layer Id
                 = (  599,    1) = GOLF105 Square 445,  Layer IIIa
                 = (  603,    1) = GOLF109 Square 452,  Layer IIIa
                 = (  604,    1) = GOLF110 Square 453,  Layer IIIa
                 = (  605,    1) = GOLF111 Square 454,  Layer IIIa
                 = (  608,    1) = GOLF114 Square 458,  Layer IIIa
                 = (  609,    1) = GOLF115 Square 459,  Layer IIIa
                 = (  610,    1) = GOLF116 Square 460,  Layer IIIa
                 = (  614,    1) = GOLF120 Square 464,  Layer IIIa
Column  3        = (  560,    1) = GOLF066 Square 400,  Layer IIIb
                 = (  562,    1) = GOLF068 Square 402,  Layer IIIa
                 = (  562,    2) = GOLF068 Square 402,  Layer IIIb
                 = (  563,    1) = GOLF069 Square 403,  Layer IIIa
                 = (  564,    1) = GOLF070 Square 409,  Layer IIIa
                 = (  566,    1) = GOLF072 Square 411,  Layer IIIa
                 = (  569,    1) = GOLF075 Square 414,  Layer IIIa
                 = (  570,    2) = GOLF076 Square 416,  Layer IIIb
                 = (  570,    3) = GOLF076 Square 416,  Layer IIIc
                 = (  571,    1) = GOLF077 Square 417,  Layer IIIa
                 = (  571,    2) = GOLF077 Square 417,  Layer IIIa/b/c
                 = (  571,    3) = GOLF077 Square 417,  Layer IIIb
                 = (  571,    4) = GOLF077 Square 417,  Layer IIIc
                 = (  572,    1) = GOLF078 Square 418,  Layer IIIa
                 = (  572,    2) = GOLF078 Square 418,  Layer IIIb
                 = (  573,    2) = GOLF079 Square 419,  Layer IIIa2
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= (  573,    3) = GOLF079 Square 419,  Layer IIIa3
= (  573,    4) = GOLF079 Square 419,  Layer IIIb
= (  574,    1) = GOLF080 Square 420,  Layer IIIa
= (  574,    2) = GOLF080 Square 420,  Layer IIIb
= (  574,    3) = GOLF080 Square 420,  Layer IIIc
= (  574,    4) = GOLF080 Square 420,  Layer IIIc1
= (  575,    1) = GOLF081 Square 421,  Layer IIIa
= (  575,    2) = GOLF081 Square 421,  Layer IIIa/b
= (  575,    3) = GOLF081 Square 421,  Layer IIIb
= (  575,    5) = GOLF081 Square 421,  Layer IIId
= (  576,    2) = GOLF082 Square 422,  Layer IIIa2
= (  577,    1) = GOLF083 Square 423,  Layer IIIa1
= (  577,    3) = GOLF083 Square 423,  Layer IIIb
= (  578,    1) = GOLF084 Square 424,  Layer IIIa
= (  578,    2) = GOLF084 Square 424,  Layer IIIa2
= (  578,    3) = GOLF084 Square 424,  Layer IIIb
= (  578,    4) = GOLF084 Square 424,  Layer IIIc
= (  579,    1) = GOLF085 Square 425,  Layer IIIa
= (  579,    3) = GOLF085 Square 425,  Layer IIIc
= (  580,    1) = GOLF086 Square 426,  Layer IIIa
= (  581,    1) = GOLF087 Square 427,  Layer IIIa
= (  581,    2) = GOLF087 Square 427,  Layer IIIb
= (  582,    3) = GOLF088 Square 428,  Layer IIIc
= (  582,    4) = GOLF088 Square 428,  Layer IIId
= (  584,    1) = GOLF090 Square 430,  Layer IIIa
= (  584,    2) = GOLF090 Square 430,  Layer IIIa/a1
= (  584,    5) = GOLF090 Square 430,  Layer IIIc
= (  585,    1) = GOLF091 Square 431,  Layer IIIa
= (  585,    2) = GOLF091 Square 431,  Layer IIIb
= (  586,    1) = GOLF092 Square 432,  Layer IIIa
= (  600,    1) = GOLF106 Square 449,  Layer IIIb
= (  601,    1) = GOLF107 Square 450,  Layer 999
= (  601,    3) = GOLF107 Square 450,  Layer IIIb
= (  601,    4) = GOLF107 Square 450,  Layer IIIc
= (  602,    2) = GOLF108 Square 451,  Layer IIIa
= (  602,    3) = GOLF108 Square 451,  Layer IIIb
= (  602,    4) = GOLF108 Square 451,  Layer IIIc
= (  606,    1) = GOLF112 Square 456,  Layer Id
= (  607,    2) = GOLF113 Square 457,  Layer IIIb
= (  611,    2) = GOLF117 Square 461,  Layer IIIb
= (  612,    1) = GOLF118 Square 462,  Layer IIIa
= (  617,    1) = GOLF123 Square 468,  Layer 999
= (  617,    2) = GOLF123 Square 468,  Layer IIIa
= (  617,    3) = GOLF123 Square 468,  Layer IIIb
= (  619,    2) = GOLF125 Square 470,  Layer IIIb
= (  620,    1) = GOLF126 Square 471,  Layer IIIa
= (  621,    1) = GOLF127 Square 472,  Layer 999
= (  621,    2) = GOLF127 Square 472,  Layer IIIa
= (  623,    2) = GOLF129 Square 474,  Layer IIIb
= (  624,    1) = GOLF130 Square 475,  Layer IIIa
= (  624,    2) = GOLF130 Square 475,  Layer IIIb
= (  625,    1) = GOLF131 Square 476,  Layer 999
= (  625,    3) = GOLF131 Square 476,  Layer IIIb\c
= (  625,    4) = GOLF131 Square 476,  Layer IIIc
= (  626,    1) = GOLF132 Square 477,  Layer IIIa
= (  627,    1) = GOLF133 Square 478,  Layer IIIa
= (  627,    2) = GOLF133 Square 478,  Layer IIIb
= (  628,    1) = GOLF134 Square 479,  Layer IIIa
= (  495,    1) = GOLF001 Square 999,  Layer ?
= (  495,    2) = GOLF001 Square 999,  Layer IIIa
```

Overall Totals for these Assemblages by Taxa

Taxon #	**Taxon Name**	**MNI**	**%**
1	Acanthocybium soland	4	1.50
2	Acanthuridae	6	2.25
4	Acanthurus sp.	1	0.37
14	Balistidae	8	3.00
20	Carangoides laticaud	1	0.37

25	Caranx sp.	1	0.37
30	Cheilinus undulatus	2	0.75
32	Coridae/Labridae	21	7.87
33	Coryphaena hippurus	41	15.36
35	Diodon sp.	9	3.37
36	Elasmobranchii	10	3.75
38	Epinephelus/Ceph sp.	11	4.12
44	Holocentrus sp.	1	0.37
45	Istiophoridae/Xiphii	14	5.24
48	Kyphosus sp.	1	0.37
50	Lethrinidae	20	7.49
52	Lutjanus sp.	5	1.87
58	Monotaxis granoculis	6	2.25
78	Scaridae	90	33.71
85	Teleostomi Species A	1	0.37
86	Teleostomi Species B	1	0.37
87	Teleostomi Species C	1	0.37
88	Teleostomi Species D	1	0.37
92	Thunnidae/Katsuwonid	2	0.75
96	Remora sp.	2	0.75
113	Bolbometopon sp.	7	2.62
Totals		**267**	**100**

Taxon	1	2	3	Totals
1	-	1	3	4
2	1	1	4	6
4	-	-	1	1
14	1	1	6	8
20	-	-	1	1
25	-	-	1	1
30	1	-	1	2
32	1	4	16	21
33	6	3	32	41
35	-	1	8	9
36	5	-	5	10
38	2	1	8	11
44	-	-	1	1
45	7	-	7	14
48	-	1	-	1
50	2	2	16	20
52	-	1	4	5
58	1	-	5	6
78	20	5	65	90
85	-	-	1	1
86	-	-	1	1
87	-	-	1	1
88	-	-	1	1
92	-	-	2	2
96	-	-	2	2
113	3	-	4	7
Totals	**50**	**21**	**196**	**267**

Overall Totals for these Assemblages by Family

Family #	Family Name	MNI	%
140	Scaridae	97	36.33
85	Coryphaenidae	41	15.36
222	Coridae/Labridae	21	7.87
114	Lethrinidae	20	7.49
221	Istiophoridae/Xiphii	14	5.24
97	Epinephelidae	11	4.12
192	Elasmobranchii	10	3.75
175	Diodontidae	9	3.37
180	Balistidae	8	3.00
159	Acanthuridae	7	2.62

110	Nemipteridae	6	2.25
106	Lutjanidae	5	1.87
73	Acanthocybiidae	4	1.50
197	Teleostomi	4	1.50
88	Carangidae	2	0.75
138	Coridae	2	0.75
72	Scombridae	2	0.75
174	Echeneidae	2	0.75
57	Holocentridae	1	0.37
124	Kyphosidae	1	0.37
Total		**267**	**100**

Family	1	2	3	Totals
140	23	5	69	97
85	6	3	32	41
222	1	4	16	21
114	2	2	16	20
221	7	-	7	14
97	2	1	8	11
192	5	-	5	10
175	-	1	8	9
180	1	1	6	8
159	1	1	5	7
110	1	-	5	6
106	-	1	4	5
73	-	1	3	4
197	-	-	4	4
88	-	-	2	2
138	1	-	1	2
72	-	-	2	2
174	-	-	2	2
57	-	-	1	1
124	-	1	-	1
Totals	**50**	**21**	**196**	**267**

Family %	1	2	3
140	46.0+- 15.1	23.8+- 21.7	35.2+- 6.9
85	12.0+- 10.2	14.3+- 18.2	16.3+- 5.4
222	2.0+- 5.0	19.0+- 20.2	8.2+- 4.1
114	4.0+- 6.6	9.5+- 15.7	8.2+- 4.1
221	14.0+- 10.8	- -	3.6+- 2.9
97	4.0+- 6.6	4.8+- 12.0	4.1+- 3.0
192	10.0+- 9.5	- -	2.6+- 2.5
175	- -	4.8+- 12.0	4.1+- 3.0
180	2.0+- 5.0	4.8+- 12.0	3.1+- 2.7
159	2.0+- 5.0	4.8+- 12.0	2.6+- 2.5
110	2.0+- 5.0	- -	2.6+- 2.5
106	- -	4.8+- 12.0	2.0+- 2.2
73	- -	4.8+- 12.0	1.5+- 2.0
197	- -	- -	2.0+- 2.2
88	- -	- -	1.0+- 1.7
138	2.0+- 5.0	- -	0.5+- 1.3
72	- -	- -	1.0+- 1.7
174	- -	- -	1.0+- 1.7
57	- -	- -	0.5+- 1.3
124	- -	4.8+- 12.0	- -
Totals	**100.0**	**100.0**	**100.0**

Table 7: Mangilao Site 25 NISP by Taxon

1	Acanthocybium soland	4
2	Acanthuridae	6
4	Acanthurus sp.	1
14	Balistidae	8
20	Carangoides laticaud	1
25	Caranx sp.	1
30	Cheilinus undulatus	2
32	Coridae/Labridae	26
33	Coryphaena hippurus	92
35	Diodon sp.	18
36	Elasmobranchii	11
38	Epinephelus/Ceph sp.	11
44	Holocentrus sp.	1
45	Istiophoridae/Xiphii	36
48	Kyphosus sp.	1
50	Lethrinidae	23
52	Lutjanus sp.	5
58	Monotaxis granoculis	7
78	Scaridae	125
85	Teleostomi Species A	1
86	Teleostomi Species B	1
87	Teleostomi Species C	1
88	Teleostomi Species D	1
92	Thunnidae/Katsuwonid	2
96	Remora sp.	2
113	Bolbometopon sp.	7
Total		**394**

NISP by Family

57	Holocentridae	1
72	Scombridae	2
73	Acanthocybiidae	4
85	Coryphaenidae	92
88	Carangidae	2
97	Epinephelidae	11
106	Lutjanidae	5
110	Nemipteridae	7
114	Lethrinidae	23
124	Kyphosidae	1
138	Coridae	2
140	Scaridae	132
159	Acanthuridae	7
174	Echeneidae	2
175	Diodontidae	18
180	Balistidae	8
192	Elasmobranchii	11
197	Teleostomi	4
221	Istiophoridae/Xiphii	36
222	Coridae/Labridae	26
Total		**394**

NISP by Anatomy for Family of Interest = 140 Scaridae

1	Left Dentary	11
2	Right Dentary	10
4	Right Articular	1
7	Left Premaxilla	15
8	Right Premaxilla	12
10	Right Maxilla	1
11	Inferior Pharyngeal Cluster	35
12	Right Superior Pharyngeal Cluster	30
13	Left Superior Pharyngeal Cluster	17

Table 8: Mangilao Site 253 NISP by Taxon

32	Coridae/Labridae	1
33	Coryphaena hippurus	6
35	Diodon sp.	2
38	Epinephelus/Ceph sp.	1
58	Monotaxis granoculis	2
78	Scaridae	5
Total		**17**

NISP by Family

85	Coryphaenidae	6
97	Epinephelidae	1
110	Nemipteridae	2
140	Scaridae	5
175	Diodontidae	2
222	Coridae/Labridae	1
Total		**17**

NISP by Anatomy for Family of Interest = 140 Scaridae

8	Right Premaxilla	2
11	Inferior Pharyngeal Cluster	1
12	Right Superior Pharyngeal Cluster	2

Table 9: Mangilao Site 667 NISP by Taxon

25	Caranx sp.	1
28	Cheilinus sp.	1
32	Coridae/Labridae	8
33	Coryphaena hippurus	6
36	Elasmobranchii	1
38	Epinephelus/Ceph sp.	1
45	Istiophoridae/Xiphii	1
50	Lethrinidae	1
52	Lutjanus sp.	4
78	Scaridae	18
Total		**42**

NISP by Family

85	Coryphaenidae	6
88	Carangidae	1
97	Epinephelidae	1
106	Lutjanidae	4
114	Lethrinidae	1
138	Coridae	1
140	Scaridae	18
192	Elasmobranchii	1
221	Istiophoridae/Xiphii	1
222	Coridae/Labridae	8
Total		**42**

NISP by Anatomy for Family of Interest = 140 Scaridae

2	Right Dentary	1
3	Left Articular	1
6	Right Quadrate	3
8	Right Premaxilla	2
11	Inferior Pharyngeal Cluster	6
12	Right Superior Pharyngeal Cluster	4
13	Left Superior Pharyngeal Cluster	1

Table 10: List of Identifications of Fish Remains from Mangilao Site 25

Mangilao Square 457	Layer IIIb	1 Buckler	Acanthuridae	1
Mangilao Square 289	Layer IIIb	1 Vertebra	Coryphaena hippurus	2
Mangilao Square 402	Layer IIIb	1 Vertebra	Coryphaena hippurus	3
Mangilao Square 450	Layer IIIb	1 Vertebra	Coryphaena hippurus	4
Mangilao Square 461	Layer IIIb	1 Vertebra	Coryphaena hippurus	5
Mangilao Square 421	Layer IIIb	1 Vertebra	Coryphaena hippurus	6
Mangilao Square 420	Layer IIIb	2 Vertebra	Coryphaena hippurus	7
Mangilao Square 428	Layer IIId	1 Vertebra	Coryphaena hippurus	8
Mangilao Square 417	Layer IIIb	2 Vertebra	Coryphaena hippurus	9
Mangilao Square 468	Layer IIIb	1 Vertebra	Coryphaena hippurus	10
Mangilao Square 424	Layer IIIb	1 Vertebra	Coryphaena hippurus	11
Mangilao Square 418	Layer IIIb	1 Vertebra	Coryphaena hippurus	12
Mangilao Square 450	Layer IIIb	3 Vertebra	Coryphaena hippurus	13
Mangilao Square 421	Layer IIIb	1 Vertebra	Coryphaena hippurus	14
Mangilao Square 433	Layer IIIb	2 Vertebra	Coryphaena hippurus	15
Mangilao Square 241	Layer IIIe	1 Vertebra	Elasmobranchii	16
Mangilao Square 294	Layer IIIb	1 Vertebra	Coryphaena hippurus	17
Mangilao Square 402	Layer IIIb	1 Vertebra	Coryphaena hippurus	18
Mangilao Square 420	Layer IIIc	1 Vertebra	Coryphaena hippurus	19
Mangilao Square 457	Layer IIIb	1 Vertebra	Coryphaena hippurus	20
Mangilao Square 424	Layer IIIc	2 Vertebra	Coryphaena hippurus	21
Mangilao Square 451	Layer IIIb	1 Vertebra	Coryphaena hippurus	22
Mangilao Square 417	Layer IIIc	1 Vertebra	Coryphaena hippurus	23
Mangilao Square 427	Layer IIIb	1 Vertebra	Coryphaena hippurus	24
Mangilao Square 419	Layer IIIb	1 Vertebra	Coryphaena hippurus	25
Mangilao Square 242	Layer IIIe	1 Vertebra	Coryphaena hippurus	26
Mangilao Square 244	Layer IIIe	1 Vertebra	Elasmobranchii	27
Mangilao Square 400	Layer IIIb	1 Vertebra	Istiophoridae/Xiphii	28
Mangilao Square 451	Layer IIIc	1 Vertebra	Istiophoridae/Xiphii	29
Mangilao Square 450	Layer IIIb	2 Zygapophysis	Istiophoridae/Xiphii	30
Mangilao Square 451	Layer IIIb	1 Left Articular	Lethrinidae	31
Mangilao Square 468	Layer IIIb	1 Left Articular	Teleostomi Species B	32
Mangilao Square 428	Layer IIId	1 Left Quadrate	Epinephelus/Ceph sp.	33
Mangilao Square 420	Layer IIIc	1 Left Quadrate	Lutjanus sp.	34
Mangilao Square 424	Layer IIIb	1 Left Quadrate	Lutjanus sp.	35
Mangilao Square 420	Layer IIIb	1 Left Quadrate	Epinephelus/Ceph sp.	36
Mangilao Square 417	Layer IIIc	1 Left Quadrate	Epinephelus/Ceph sp.	37
Mangilao Square 476	Layer IIIb\c	1 Right Quadrate	Lethrinidae	38
Mangilao Square 470	Layer IIIb	1 Right Quadrate	Lethrinidae	39
Mangilao Square 294	Layer IIIb	1 Right Quadrate	Lethrinidae	40
Mangilao Square 417	Layer IIIb	1 Left Maxilla	Epinephelus/Ceph sp.	41
Mangilao Square 430	Layer IIIc	1 Right Maxilla	Epinephelus/Ceph sp.	42
Mangilao Square 424	Layer IIIc	1 Right Maxilla	Lethrinidae	43
Mangilao Square 424	Layer IIIb	1 Right Maxilla	Teleostomi Species D	44
Mangilao Square 450	Layer IIIc	1 Right Maxilla	Thunnidae/Katsuwonid	45
Mangilao Square 402	Layer IIIb	1 Right Maxilla	Thunnidae/Katsuwonid	46
Mangilao Square 475	Layer IIIb	1 Left Superior Pharyn	Scaridae	47
Mangilao Square 427	Layer IIIb	1 Left Superior Pharyn	Scaridae	48
Mangilao Square 424	Layer IIIc	1 Left Superior Pharyn	Scaridae	49

Mangilao Square 425	Layer IIIc	1	Right Superior Phary	Scaridae	50
Mangilao Square 283	Layer IIIb	1	Right Superior Phary	Scaridae	51
Mangilao Square 418	Layer IIIb	1	Right Superior Phary	Scaridae	52
Mangilao Square 475	Layer IIIb	1	Right Superior Phary	Scaridae	53
Mangilao Square 423	Layer IIIb	1	Right Superior Phary	Scaridae	54
Mangilao Square 470	Layer IIIb	1	Right Superior Phary	Scaridae	55
Mangilao Square 285	Layer IIIb	1	Right Superior Phary	Scaridae	56
Mangilao Square 208	Layer IIIe	1	Right Superior Phary	Scaridae	57
Mangilao Square 427	Layer IIIb	1	Right Superior Phary	Scaridae	58
Mangilao Square 240	Layer IIIc	1	Right Superior Phary	Scaridae	59
Mangilao Square 424	Layer IIIb	1	Left Dentary	Acanthocybium soland	60
Mangilao Square 476	Layer IIIc	1	Left Dentary	Acanthocybium soland	61
Mangilao Square 449	Layer IIIb	1	Buckler	Acanthurus sp.	62
Mangilao Square 450	Layer IIIb	1	Right Premaxilla	Coridae/Labridae	63
Mangilao Square 240	Layer IIIc	1	Right Premaxilla	Coridae/Labridae	64
Mangilao Square 420	Layer IIIc	1	Left Premaxilla	Teleostomi Species A	65
Mangilao Square 420	Layer IIIb	1	Dorsal/Erectile Spin	Balistidae	66
Mangilao Square 433	Layer IIIb	1	Dorsal/Erectile Spin	Balistidae	67
Mangilao Square 420	Layer IIIc	1	Dorsal/Erectile Spin	Balistidae	68
Mangilao Square 449	Layer IIIb	1	Dorsal/Erectile Spin	Balistidae	69
Mangilao Square 430	Layer IIIc	1	Inferior Pharyngeal	Scaridae	70
Mangilao Square 476	Layer IIIb\c	2	Inferior Pharyngeal	Scaridae	71
Mangilao Square 474	Layer IIIb	1	Inferior Pharyngeal	Scaridae	72
Mangilao Square 430	Layer IIIc	1	Inferior Pharyngeal	Scaridae	73
Mangilao Square 416	Layer IIIc	1	Inferior Pharyngeal	Scaridae	74
Mangilao Square 450	Layer IIIc	1	Inferior Pharyngeal	Scaridae	75
Mangilao Square 420	Layer IIIc	1	Inferior Pharyngeal	Scaridae	76
Mangilao Square 478	Layer IIIb	1	Inferior Pharyngeal	Scaridae	77
Mangilao Square 427	Layer IIIb	1	Inferior Pharyngeal	Scaridae	78
Mangilao Square 420	Layer IIIc	1	Inferior Pharyngeal	Cheilinus undulatus	79
Mangilao Square 425	Layer IIIc	1	Tooth/Dental Plates	Monotaxis granoculis	80
Mangilao Square 420	Layer IIIc	1	Tooth/Dental Plates	Coridae/Labridae	81
Mangilao Square 420	Layer IIIc1	1	Tooth/Dental Plates	Coridae/Labridae	82
Mangilao Square 449	Layer IIIb	1	Tooth/Dental Plates	Elasmobranchii	83
Mangilao Square 428	Layer IIIc	1	Tooth/Dental Plates	Elasmobranchii	84
Mangilao Square 417	Layer IIIc	1	Tooth/Dental Plates	Elasmobranchii	85
Mangilao Square 418	Layer IIIb	1	Tooth/Dental Plates	Elasmobranchii	86
Mangilao Square 241	Layer IIIe	1	Tooth/Dental Plates	Elasmobranchii	87
Mangilao Square 416	Layer IIIc	1	Right Articular	Lutjanus sp.	88
Mangilao Square 425	Layer IIIc	1	Left Premaxilla	Lethrinidae	89
Mangilao Square 450	Layer IIIb	1	Left Superior Pharyn	Scaridae	90
Mangilao Square 416	Layer IIIb	1	Left Premaxilla	Scaridae	91
Mangilao Square 450	Layer IIIb	2	Left Premaxilla	Scaridae	92
Mangilao Square 299	Layer IIIb	1	Left Premaxilla	Scaridae	93
Mangilao Square 421	Layer IIId	1	Left Premaxilla	Scaridae	94
Mangilao Square 431	Layer IIIb	1	Left Premaxilla	Scaridae	95
Mangilao Square 424	Layer IIIc	1	Left Premaxilla	Scaridae	96
Mangilao Square 418	Layer IIIb	1	Right Premaxilla	Scaridae	97
Mangilao Square 416	Layer IIIb	1	Right Premaxilla	Scaridae	98
Mangilao Square 433	Layer IIIb	1	Right Premaxilla	Scaridae	99
Mangilao Square 420	Layer IIIb	1	Right Premaxilla	Scaridae	100

Mangilao Square 470	Layer IIIb	1 Right Premaxilla	Scaridae	101
Mangilao Square 285	Layer IIIe	1 Right Premaxilla	Scaridae	102
Mangilao Square 273	Layer IIIb	1 Left Premaxilla	Scaridae	103
Mangilao Square 208	Layer IIId	1 Right Premaxilla	Epinephelus/Ceph sp.	104
Mangilao Square 420	Layer IIIc	1 Right Premaxilla	Teleostomi Species C	105
Mangilao Square 468	Layer IIIb	1 Left Premaxilla	Coridae/Labridae	106
Mangilao Square 468	Layer IIIb	1 Right Premaxilla	Coridae/Labridae	107
Mangilao Square 416	Layer IIIc	1 Right Premaxilla	Coridae/Labridae	108
Mangilao Square 457	Layer IIIb	1 Right Premaxilla	Coridae/Labridae	109
Mangilao Square 424	Layer IIIc	1 Left Premaxilla	Coridae/Labridae	110
Mangilao Square 425	Layer IIIc	1 Left Premaxilla	Coridae/Labridae	111
Mangilao Square 476	Layer IIIb\c	1 Right Premaxilla	Coridae/Labridae	112
Mangilao Square 417	Layer IIIc	2 Left Premaxilla	Lethrinidae	113
Mangilao Square 424	Layer IIIb	1 Left Premaxilla	Lethrinidae	114
Mangilao Square 246	Layer IIIe	1 Left Premaxilla	Lethrinidae	115
Mangilao Square 416	Layer IIIb	1 Right Premaxilla	Lethrinidae	116
Mangilao Square 417	Layer IIIc	1 Right Premaxilla	Lethrinidae	117
Mangilao Square 418	Layer IIIb	1 Right Premaxilla	Lethrinidae	118
Mangilao Square 430	Layer IIIc	1 Left Dentary	Scaridae	119
Mangilao Square 450	Layer IIIb	1 Left Dentary	Scaridae	120
Mangilao Square 433	Layer IIIb	1 Left Dentary	Scaridae	121
Mangilao Square 475	Layer IIIb	1 Right Dentary	Scaridae	122
Mangilao Square 416	Layer IIIb	1 Right Dentary	Scaridae	123
Mangilao Square 417	Layer IIIb	1 Right Dentary	Scaridae	124
Mangilao Square 431	Layer IIIb	1 Right Dentary	Bolbometopon sp.	125
Mangilao Square 416	Layer IIIb	1 Right Dentary	Bolbometopon sp.	126
Mangilao Square 424	Layer IIIb	1 Left Dentary	Remora sp.	127
Mangilao Square 450	Layer IIIb	1 Right Dentary	Remora sp.	128
Mangilao Square 416	Layer IIIb	1 Left Dentary	Holocentrus sp.	129
Mangilao Square 416	Layer IIIb	1 Left Dentary	Monotaxis granoculis	130
Mangilao Square 233	Layer IIIe	1 Left Dentary	Monotaxis granoculis	131
Mangilao Square 424	Layer IIIc	1 Right Dentary	Acanthocybium soland	132
Mangilao Square 476	Layer IIIc	1 Right Dentary	Coridae/Labridae	133
Mangilao Square 421	Layer IIId	1 Left Dentary	Epinephelus/Ceph sp.	134
Mangilao Square 457	Layer IIIb	1 Left Dentary	Epinephelus/Ceph sp.	135
Mangilao Square 417	Layer IIIc	1 Right Dentary	Lethrinidae	136
Mangilao Square 450	Layer IIIb	1 Right Dentary	Lethrinidae	137
Mangilao Square 420	Layer IIIc	1 Right Dentary	Lethrinidae	138
Mangilao Square 292	Layer IIIa	1 Vertebra	Coryphaena hippurus	139
Mangilao Square 411	Layer IIIa	3 Vertebra	Coryphaena hippurus	140
Mangilao Square 424	Layer IIIa	5 Vertebra	Coryphaena hippurus	141
Mangilao Square 414	Layer IIIa	1 Vertebra	Coryphaena hippurus	142
Mangilao Square 292	Layer IIIa	1 Vertebra	Coryphaena hippurus	143
Mangilao Square 422	Layer IIIa2	2 Vertebra	Coryphaena hippurus	144
Mangilao Square 425	Layer IIIa	1 Vertebra	Coryphaena hippurus	145
Mangilao Square 402	Layer IIIa	1 Vertebra	Coryphaena hippurus	146
Mangilao Square 422	Layer IIIa2	2 Vertebra	Coryphaena hippurus	147
Mangilao Square 417	Layer IIIa	1 Vertebra	Coryphaena hippurus	148
Mangilao Square 431	Layer IIIa	1 Vertebra	Coryphaena hippurus	149
Mangilao Square 427	Layer IIIa	1 Vertebra	Coryphaena hippurus	150
Mangilao Square 288	Layer IIIa	1 Vertebra	Coryphaena hippurus	151

Mangilao Square 409	Layer IIIa	1	Vertebra	Coryphaena hippurus	152
Mangilao Square 402	Layer IIIa	1	Vertebra	Coryphaena hippurus	153
Mangilao Square 462	Layer IIIa	1	Vertebra	Coryphaena hippurus	154
Mangilao Square 419	Layer IIIa3	1	Vertebra	Coryphaena hippurus	155
Mangilao Square 424	Layer IIIa	1	Vertebra	Coryphaena hippurus	156
Mangilao Square 424	Layer IIIa	2	Vertebra	Coryphaena hippurus	157
Mangilao Square 417	Layer IIIa	3	Vertebra	Coryphaena hippurus	158
Mangilao Square 417	Layer IIIa	1	Vertebra	Coryphaena hippurus	159
Mangilao Square 453	Layer IIIa	1	Vertebra	Coryphaena hippurus	160
Mangilao Square 424	Layer IIIa2	1	Vertebra	Coryphaena hippurus	161
Mangilao Square 292	Layer IIIa	1	Vertebra	Coryphaena hippurus	162
Mangilao Square 459	Layer IIIa	1	Vertebra	Coryphaena hippurus	163
Mangilao Square 292	Layer IIIa	1	Vertebra	Coryphaena hippurus	164
Mangilao Square 427	Layer IIIa	1	Vertebra	Coryphaena hippurus	165
Mangilao Square 298	Layer IIIa	1	Vertebra	Coryphaena hippurus	166
Mangilao Square 284	Layer IIIa	1	Vertebra	Istiophoridae/Xiphii	167
Mangilao Square 403	Layer IIIa	1	Vertebra	Istiophoridae/Xiphii	168
Mangilao Square 417	Layer IIIa	1	Vertebra	Istiophoridae/Xiphii	169
Mangilao Square 451	Layer IIIa	1	Vertebra	Istiophoridae/Xiphii	170
Mangilao Square 451	Layer IIIa	6	Zygapophysis	Istiophoridae/Xiphii	171
Mangilao Square 288	Layer IIIa	1	Zygapophysis	Istiophoridae/Xiphii	172
Mangilao Square 283	Layer IIIa	1	Zygapophysis	Istiophoridae/Xiphii	173
Mangilao Square 283	Layer IIIa	1	Zygapophysis	Istiophoridae/Xiphii	174
Mangilao Square 422	Layer IIIa2	2	Dorsal/Erectile Spin	Balistidae	175
Mangilao Square 298	Layer IIIa	1	Buckler	Acanthuridae	176
Mangilao Square 468	Layer IIIa	1	Buckler	Acanthuridae	177
Mangilao Square 462	Layer IIIa	1	Tooth/Dental Plates	Monotaxis granoculis	178
Mangilao Square 287	Layer IIIa	1	Tooth/Dental Plates	Elasmobranchii	179
Mangilao Square 462	Layer IIIa	1	Tooth/Dental Plates	Elasmobranchii	180
Mangilao Square 272	Layer IIIa	1	Inferior Pharyngeal	Scaridae	181
Mangilao Square 297	Layer IIIa	1	Inferior Pharyngeal	Scaridae	182
Mangilao Square 418	Layer IIIa	1	Inferior Pharyngeal	Scaridae	183
Mangilao Square 423	Layer IIIa1	2	Inferior Pharyngeal	Scaridae	184
Mangilao Square 417	Layer IIIa	1	Inferior Pharyngeal	Scaridae	185
Mangilao Square 419	Layer IIIa3	1	Inferior Pharyngeal	Scaridae	186
Mangilao Square 291	Layer IIIa	1	Inferior Pharyngeal	Scaridae	187
Mangilao Square 475	Layer IIIa	1	Inferior Pharyngeal	Scaridae	188
Mangilao Square 418	Layer IIIa	1	Inferior Pharyngeal	Scaridae	189
Mangilao Square 472	Layer IIIa	1	Inferior Pharyngeal	Scaridae	190
Mangilao Square 420	Layer IIIa	2	Inferior Pharyngeal	Scaridae	191
Mangilao Square 421	Layer IIIa	1	Inferior Pharyngeal	Scaridae	192
Mangilao Square 260	Layer IIIa	1	Inferior Pharyngeal	Bolbometopon sp.	193
Mangilao Square 471	Layer IIIa	1	Left Superior Pharyn	Bolbometopon sp.	194
Mangilao Square 432	Layer IIIa	1	Left Superior Pharyn	Scaridae	195
Mangilao Square 417	Layer IIIa	1	Left Superior Pharyn	Scaridae	196
Mangilao Square 417	Layer IIIa	1	Left Superior Pharyn	Scaridae	197
Mangilao Square 445	Layer IIIa	1	Left Superior Pharyn	Scaridae	198
Mangilao Square 427	Layer IIIa	1	Left Superior Pharyn	Scaridae	199
Mangilao Square 417	Layer IIIa	1	Left Superior Pharyn	Scaridae	200
Mangilao Square 460	Layer IIIa	1	Left Superior Pharyn	Scaridae	201
Mangilao Square 453	Layer IIIa	1	Left Superior Pharyn	Scaridae	202

Mangilao Square 423	Layer IIIa1	1	Right Superior Phary	Scaridae	203
Mangilao Square 472	Layer IIIa	1	Right Superior Phary	Scaridae	204
Mangilao Square 417	Layer IIIa	1	Right Superior Phary	Scaridae	205
Mangilao Square 472	Layer IIIa	1	Right Superior Phary	Scaridae	206
Mangilao Square 418	Layer IIIa	1	Right Superior Phary	Scaridae	207
Mangilao Square 479	Layer IIIa	1	Right Superior Phary	Scaridae	208
Mangilao Square 422	Layer IIIa2	1	Right Superior Phary	Scaridae	209
Mangilao Square 999	Layer IIIa	2	Right Superior Phary	Scaridae	210
Mangilao Square 431	Layer IIIa	1	Right Superior Phary	Scaridae	211
Mangilao Square 421	Layer IIIa	1	Inferior Pharyngeal	Scaridae	212
Mangilao Square 453	Layer IIIa	1	Right Premaxilla	Kyphosus sp.	213
Mangilao Square 454	Layer IIIa	1	Right Premaxilla	Epinephelus/Ceph sp.	214
Mangilao Square 431	Layer IIIa	1	Right Premaxilla	Lethrinidae	215
Mangilao Square 454	Layer IIIa	1	Right Premaxilla	Lethrinidae	216
Mangilao Square 458	Layer IIIa	1	Right Premaxilla	Coridae/Labridae	217
Mangilao Square 459	Layer IIIa	1	Right Premaxilla	Coridae/Labridae	218
Mangilao Square 460	Layer IIIa	1	Right Premaxilla	Coridae/Labridae	219
Mangilao Square 426	Layer IIIa	1	Left Premaxilla	Coridae/Labridae	220
Mangilao Square 426	Layer IIIa	1	Left Premaxilla	Scaridae	221
Mangilao Square 427	Layer IIIa	1	Left Premaxilla	Scaridae	222
Mangilao Square 432	Layer IIIa	1	Left Premaxilla	Scaridae	223
Mangilao Square 414	Layer IIIa	1	Right Premaxilla	Scaridae	224
Mangilao Square 430	Layer IIIa	1	Right Premaxilla	Scaridae	225
Mangilao Square 417	Layer IIIa	1	Right Premaxilla	Scaridae	226
Mangilao Square 409	Layer IIIa	1	Left Premaxilla	Scaridae	227
Mangilao Square 999	Layer IIIa	1	Left Premaxilla	Scaridae	228
Mangilao Square 422	Layer IIIa2	1	Left Premaxilla	Scaridae	229
Mangilao Square 286	Layer IIIa	1	Left Premaxilla	Scaridae	230
Mangilao Square 283	Layer IIIa	1	Left Premaxilla	Istiophoridae/Xiphii	231
Mangilao Square 283	Layer IIIa	1	Left Premaxilla	Istiophoridae/Xiphii	232
Mangilao Square 283	Layer IIIa	1	Right Premaxilla	Istiophoridae/Xiphii	233
Mangilao Square 283	Layer IIIa	1	Left Premaxilla	Istiophoridae/Xiphii	234
Mangilao Square 283	Layer IIIa	1	Right Premaxilla	Istiophoridae/Xiphii	235
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Mangilao Square 478	Layer IIIa	1	Left Premaxilla	Diodon sp.	238
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Mangilao Square 423	Layer IIIa1	1	Left Premaxilla	Diodon sp.	241
Mangilao Square 427	Layer IIIa	1	Left Premaxilla	Diodon sp.	242
Mangilao Square 427	Layer IIIa	1	Right Premaxilla	Diodon sp.	243
Mangilao Square 424	Layer IIIa	1	Right Premaxilla	Diodon sp.	244
Mangilao Square 424	Layer IIIa	1	Left Premaxilla	Diodon sp.	245
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Mangilao Square 430	Layer IIIa	1	Right Premaxilla	Diodon sp.	247
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Mangilao Square 403	Layer IIIa	1 Left Dentary	Caranx sp.	254
Mangilao Square 432	Layer IIIa	1 Left Dentary	Scaridae	255
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Mangilao Square 417	Layer IIIa	1 Left Dentary	Scaridae	259
Mangilao Square 471	Layer IIIa	1 Left Dentary	Scaridae	260
Mangilao Square 282	Layer IIIa	1 Left Dentary	Scaridae	261
Mangilao Square 420	Layer IIIa	1 Right Dentary	Scaridae	262
Mangilao Square 477	Layer IIIa	1 Right Dentary	Scaridae	263
Mangilao Square 420	Layer IIIa	1 Right Dentary	Scaridae	264
Mangilao Square 454	Layer IIIa	1 Right Dentary	Scaridae	265
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Mangilao Square 249	Layer IIIg2	1 Left Premaxilla	Epinephelus/Ceph sp.	282
Mangilao Square 241	Layer IIIg2	1 Right Premaxilla	Scaridae	283
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Mangilao Square 241	Layer IIIg2	1 Right Superior Phary	Bolbometopon sp.	285
Mangilao Square 241	Layer IIIg2	1 Right Superior Phary	Scaridae	286
Mangilao Square 244	Layer IIIg2	1 Right Premaxilla	Scaridae	287
Mangilao Square 244	Layer IIIg2	1 Left Superior Pharyn	Bolbometopon sp.	288
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Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	290
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Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	292
Mangilao Square 999	Layer ?	2 Vertebra	Coryphaena hippurus	293
Mangilao Square 999	Layer ?	6 Vertebra	Coryphaena hippurus	294
Mangilao Square 999	Layer ?	2 Vertebra	Coryphaena hippurus	295
Mangilao Square 999	Layer ?	2 Vertebra	Coryphaena hippurus	296
Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	297
Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	298
Mangilao Square 999	Layer ?	2 Vertebra	Coryphaena hippurus	299
Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	300
Mangilao Square 999	Layer ?	1 Vertebra	Coryphaena hippurus	301
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Mangilao Square 999	Layer ?	1	Buckler	Acanthuridae	305
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Mangilao Square 999	Layer ?	1	Dorsal/Erectile Spin	Balistidae	307
Mangilao Square 999	Layer ?	1	Right Articular	Scaridae	308
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Mangilao Square 417	Layer IIIa/b/c	1	Left Superior Pharyn	Scaridae	310
Mangilao Square 999	Layer ?	1	Right Superior Phary	Scaridae	311
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Mangilao Square 999	Layer ?	1	Left Premaxilla	Monotaxis granoculis	330
Mangilao Square 450	Layer 999	1	Left Premaxilla	Coridae/Labridae	331
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Mangilao Square 450	Layer 999	1	Right Premaxilla	Coridae/Labridae	333
Mangilao Square 468	Layer 999	1	Right Premaxilla	Coridae/Labridae	334
Mangilao Square 999	Layer ?	1	Right Premaxilla	Diodon sp.	335
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Mangilao Square 999	Layer ?	1	Left Premaxilla	Diodon sp.	337
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Mangilao Square 185	Layer IIIa5	1 Vertebra	Coryphaena hippurus	1
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Mangilao Square 3	Layer IIIa	2 Vertebra	Coryphaena hippurus	3
Mangilao Square 3	Layer IIIa	1 Vertebra	Coryphaena hippurus	4
Mangilao Square 92	Layer IIIa	1 Right Dentary	Monotaxis granoculis	5
Mangilao Square 92	Layer IIIa	1 Right Superior Phary	Scaridae	6
Mangilao Square 1	Layer IIIa	1 Right Superior Phary	Scaridae	7
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APPENDIX B

ANALYSIS OF FAUNAL MATERIAL FROM AN ARCHAEOLOGICAL SITE AT YLIG, GUAM

By

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and

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Analysis of Faunal Material from an Archaeological Site at Ylig, Guam

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CONTENTS

ANALYSIS OF FAUNAL MATERIAL FROM AN ARCHAEOLOGICAL SITE AT YLIG, GUAM

Leach, B.F., and Davidson, J.M.
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ABSTRACT

A collection of approximately 2,000 fish bones from an archaeological site at Ylig on the island of Guam was analysed. Identifiable bones were found in 59 different assemblages. In total, these bones produced a Minimum Number of Individuals of 95 fishes (NISP=170).

Although 15 different families of fish are represented in this collection, all assemblages are dominated by fish belonging to the Coryphaenidae family (dolphinfish). This is highly unusual compared to all other archaeological fish collections so far examined from the Pacific region. These collections are usually dominated by Scaridae. At Ylig, fishes of the Scaridae family are second in abundance. Also notable at Ylig is the presence of fish in the Istiophoridae/Xiphiidae families (swordfish and marlins). It is exceptional to find these species in archaeological sites in the Pacific; the bones from Ylig are matched only in other sites in the Marianas chain of islands. The recovery method was not systematic for all parts of the excavation, so there could be some bias in the relative abundance of different species.

The collection was examined for possible changes through time, but did not show signs of significant variation.

Keywords: ARCHAEOLOGY, ARCHAEOZOOLOGY, FISH, GUAM, MARIANAS, DOLPHINFISH, SWORDFISH, MARLIN

INTRODUCTION

This report presents the results of the analysis of archaeological fish bone from an excavation at a site near the mouth of the Ylig river on the east coast of the island of Guam. The fish remains from this excavation were sent to the authors by *Micronesian Archaeological Research Services* for identification using the comparative collection and other facilities at the Archaeozoology Laboratory, Museum of New Zealand.

The site was excavated as part of mitigation during reconstruction and widening of the road from Yona to Ylig bridge. The initial focus of the excavation was the recovery of burials; collection of faunal material was not part of the brief. As the work progressed, however, more midden was encountered. Systematic recovery was carried out only for the lower (earlier) deposits.

Figure 1 shows the location of Guam at the bottom end of the Marianas chain of islands. Figure 2 is a map of Guam showing the location of the excavation at Ylig, and Figure 3 shows the precise area on the roadway where the investigation was carried out.

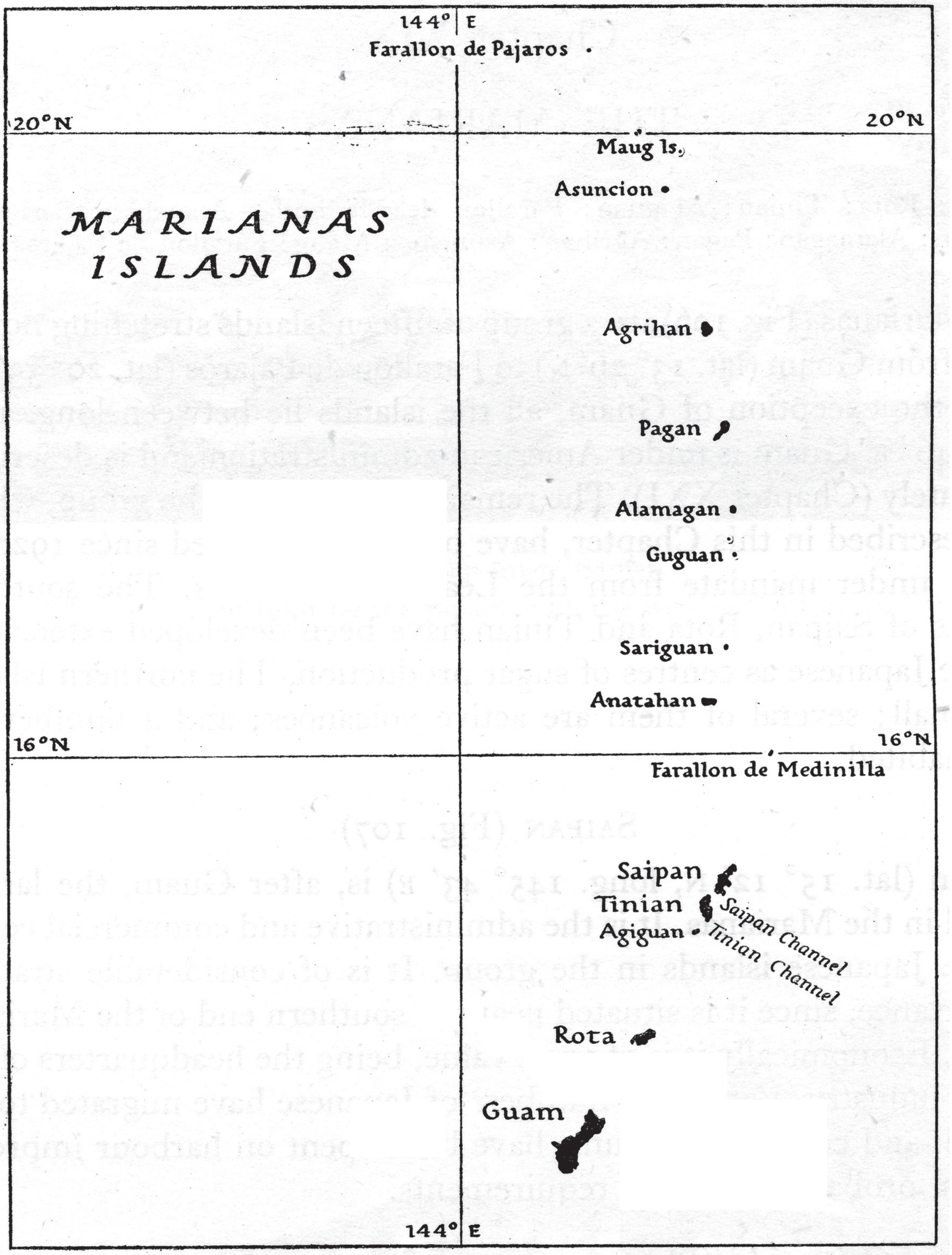

Figure 1: Map of the Mariana Islands with Guam at the extreme south

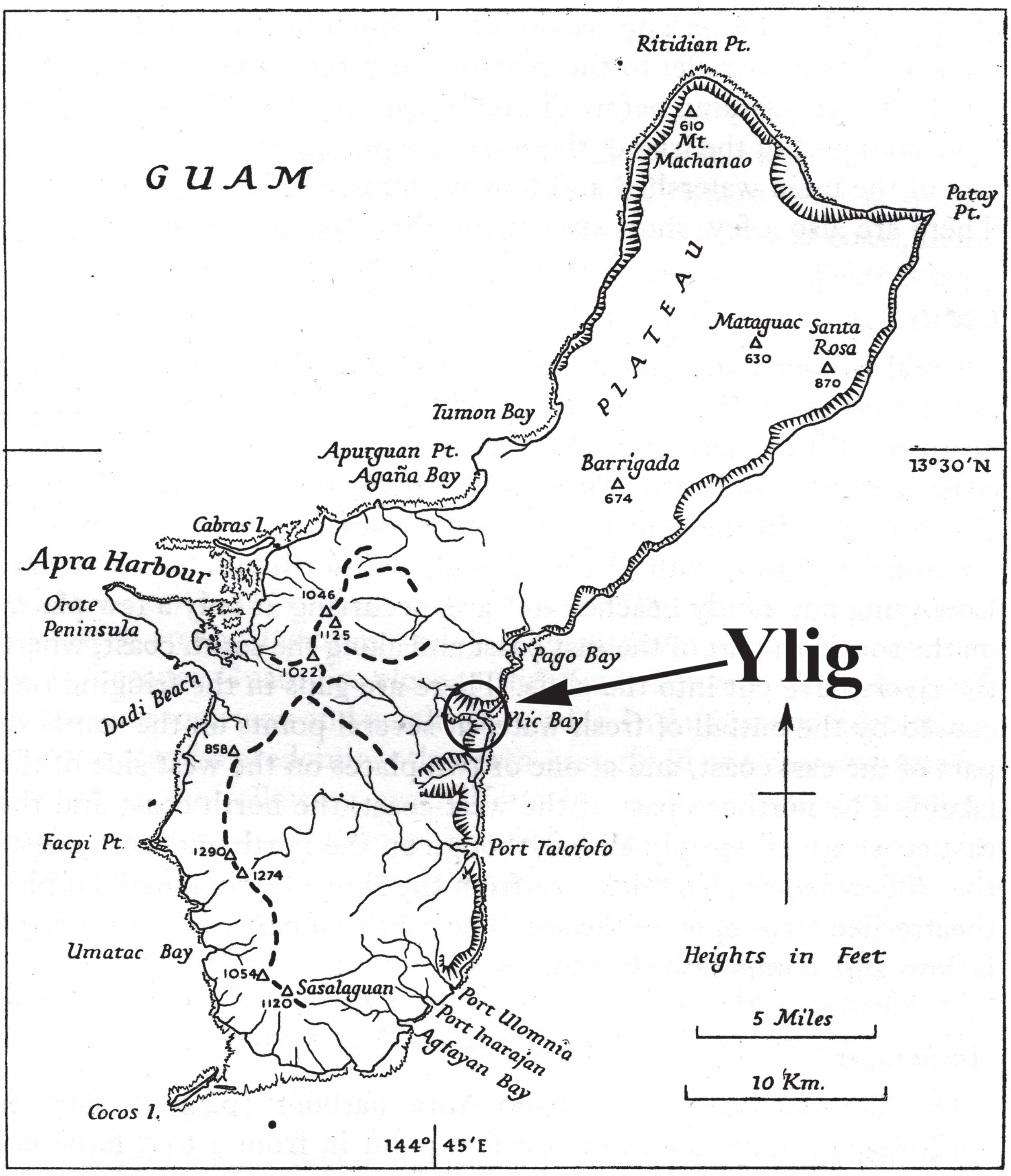

Figure 2: Plan of Guam. The Ylig area is on the east coast

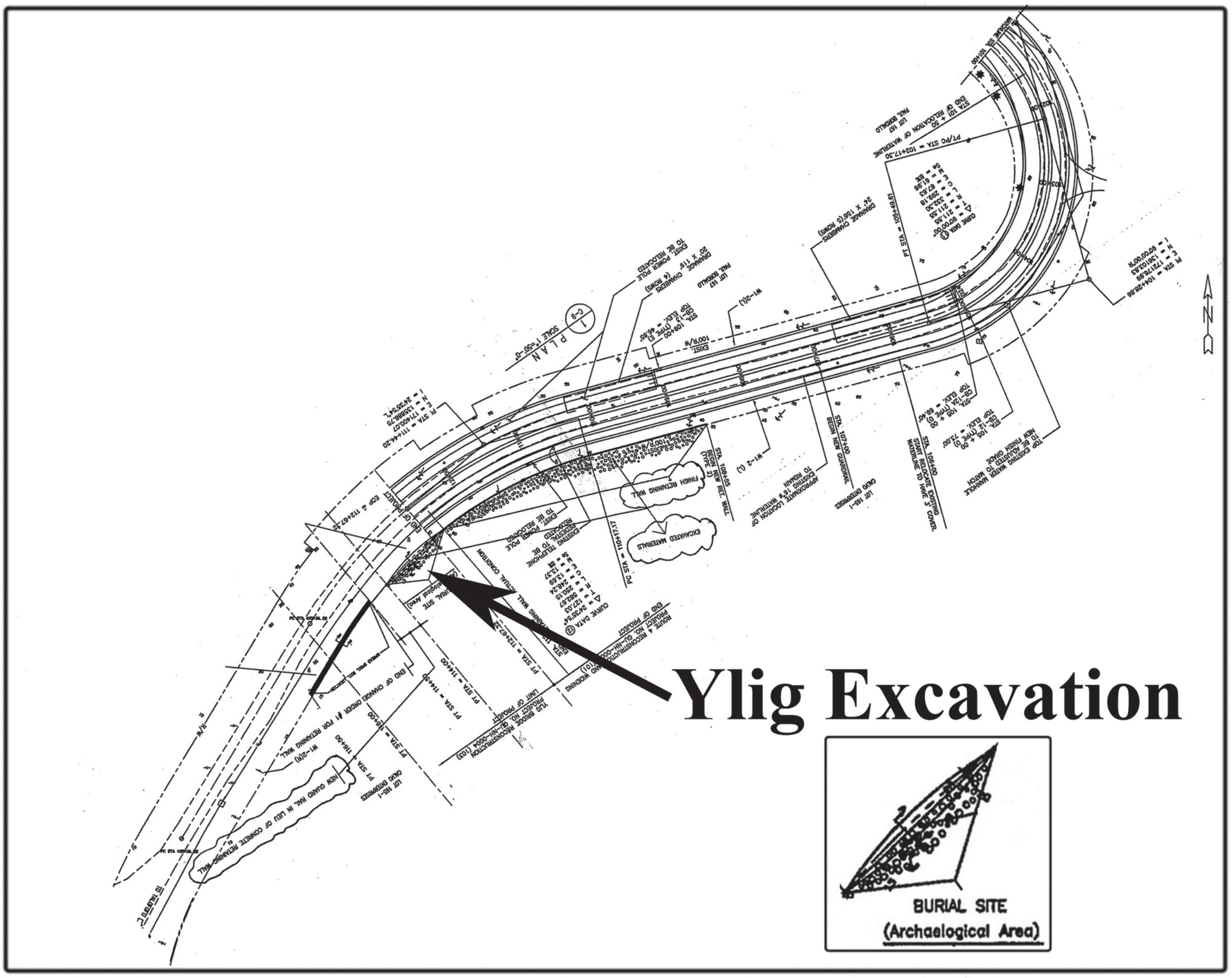

Figure 3: Map of the Ylig Road Widening Project area. The archaeological excavation is marked 'Burial Site' on the south-east side of the road.

CURATORIAL DETAILS

On arrival at the Archaeozoology Laboratory all faunal material was re-bagged. Figure 4 shows a typical original bag containing the bones. This bag has the original locational information written on it, which would be difficult to replicate many times as individual bones are removed, re-bagged, and identified. It is a fundamental curatorial procedure in archaeology never to destroy locational information relating to any item recovered. Fortunately, this information is available in a database (Excel files) held by *Micronesian Archaeological Research Services*, cross-referenced by a unique accession number which appears on each bag. In Figure 4 the bag is labelled #686. The database listing for #686 shows the following:

Catalogue Number	#686
Site	Ylig
Test Type [Square]	Between B-39 and B-40
Time Period [Layer]	Pre-Latte

These details constitute the minimum information required for curation. In particular the Site, Square and Layer information constitutes a unique location in time and space known as an *Assemblage*. This assemblage is the unit used for calculation of MNI (minimum number of individuals during faunal analysis). For example, if one right dentary of *Monotaxis grandoculis* is found in one such assemblage, and a left dentary of *Monotaxis grandoculis* is found in another discrete assemblage, then this would count as MNI=2 for this species. Conversely, if one right dentary of *Monotaxis grandoculis* is found in one such assemblage, and a left dentary of *Monotaxis grandoculis* is found in the same discrete assemblage, then this would count as MNI=1 for this species, regardless of how big or small the two bones are. Clearly, the identification of what constitutes an assemblage is a very important matter during faunal analysis. Our usual procedure is to define one square metre of one individual layer as an assemblage and use that to define assemblages. In the case of the Ylig collection, we used the spatial designation in the Excel spreadsheet provided by *Micronesian Archaeological Research Services*.

Since the catalogue number was uniquely cross-referenced to Site, Square and Layer, using the database, this number is ideal to use during re-bagging, to ensure that locational information is not lost. It was therefore written on all bags during the re-bagging process to preserve original provenance information (See Figure 5).

The bones in each original bag were tipped out in a sorting tray and sorted into basic categories, such as fish, bird, turtle, crustacea, and separately re-bagged in self-sealing plastic bags. The non-fish remains consist mainly of fragmented parts of crustacea, of which there was a considerable amount. In the case of fish remains, these were sorted into anatomical parts which are useful for identification to species, genera, or family, and separately re-bagged, and the original unique catalogue number written on each bag. Unidentifiable fish remains were returned to their original bags. More than 90% of archaeological fish bones are fragments of vertebrae and spines, and are not normally used for quantitative analysis. However, they certainly have other scientific value, such as growth rate studies of ancient fishes, and for this reason should be kept for posterity after excavation.

Identification of the fish remains was made using comparative material held at the Archaeozoology Laboratory, Museum of New Zealand Te Papa Tongarewa. As each identification was made, the anatomy (for example 2 LD = 2 Left Dentaries) and the taxon identified were written on a removable label which was stuck on the bag. At a later stage, when information was entered into

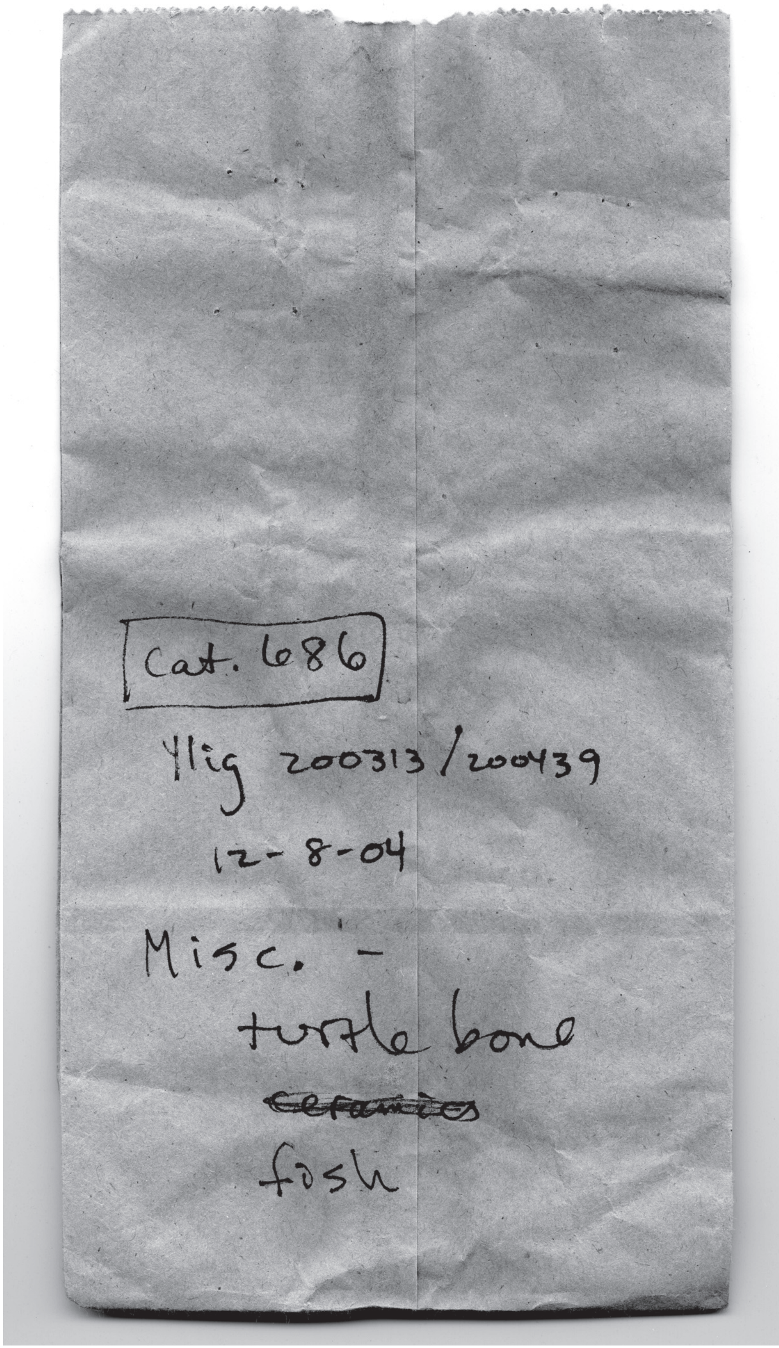

Figure 4: Copy of a typical original bag before re-bagging, including catalogue number #686

Figure 5: A typical self-sealing plastic bag after re-bagging. The original catalogue number #104 preserves the unique location details. The identification is written on a removable label on the outside of the bag (Right premaxilla *Caranx* sp.). The circled number 94 is the bag number in the Kupenga fish bone database.

a computer database (known as Kupenga), a reference number was allocated from the database, and this is written on the bag, and circled (See Figure 5). This process ensures that there is a direct link between the two databases on every single bag. Should a more precise identification be made at some later stage, or an error identified in anatomy or species, one can return to the precise point in the database, make any corrections necessary and then update all tables using suitable software held by the authors.

In a few cases, bones belonged to species not present in the Archaeozoology Laboratory. When this happens 'Unidentified Species A' is entered. In the case of Ylig, two different unidentified species were found, and labelled A and F respectively. These occur in the category Teleostomi in Tables in this report. Only a few of the standard fish bones from Ylig could not be identified.

METHODS OF FISH BONE ANALYSIS

The methods of analysis closely follow the technique developed in New Zealand for the treatment of archaeological fish bone assemblages from the Pacific Islands generally. This has been described elsewhere (Leach and Davidson, 1977; Leach 1986, 1997) so only a few details need to be given here. The assemblages covered in this report are quite small, which makes it difficult to observe significant temporal variation.

The identifiable fish bones were sorted anatomically and re-bagged. Taking each part of the anatomy in turn, bones were then sorted into taxonomic categories, and identified with reference to the comparative collection, which contains mounted bones of over 300 Pacific species. The nomenclature and taxonomy largely follow Munro (1967).

It is important to note that all identifications are made to the lowest taxonomic level possible. The level at which tropical Pacific fish bone can be identified varies greatly. For example, amongst the Holocentridae family, the cranial anatomy, particularly the dentary, of *Ostichthys murdjan* is very distinctive. *Holocentrus ruber* is also fairly distinctive, but a bone apparently belonging to this species would not be entered as such on a bag. Instead the identification would be entered as *Holocentrus* cf. *ruber*, indicating that this species is the most similar in the comparative collection, but although the genus is certain the species is not. Other bone specimens belonging to this family can only be identified to the level of *Holocentrus* sp. At the other end of the scale, with one exception, cranial bones of the Scaridae family are not identified to a level lower than family. The exception is *Bolbometopon muraticus*, which is of exceptional size. Fleming has shown that close familiarity with the cranial anatomy of the Scaridae permits identification to sub-family without great difficulty, and that the bucktooth characteristics of *Calotomus* spp. are also distinctive (Fleming, 1986: 167 ff.). However, the different Scaridae species have similar habitats and are caught by similar methods. From the point of view of studying human behaviour, identifying to species is therefore of little value.

The calculation of minimum numbers follows the general technique of Chaplin (1971), and is further discussed by Leach (1986, 1997). No attempt is made to increase MNI by taking into account observed size mis-matches. For comparative purposes, NISP values were also calculated and given in this report.

BASIC RESULTS OF FISH BONE ANALYSIS

One hundred and seventy bones were able to be identified in 59 different assemblages from the Ylig site. The Minimum Number of Individuals (MNI) for each type of fish was calculated and these details are provided in the Appendix, and summarised by family in Tables 1 and 2 (see also Figures 6 and 7). The bones were generally in good condition.

Table 1: Total MNI by Family for the Ylig Site, All Assemblages Combined

Family Name	MNI	%		
Coryphaenidae	37	38.9	±	10.4
Scaridae	18	18.9	±	8.5
Acanthuridae	8	8.4	±	6.2
Epinephelidae	6	6.3	±	5.5
Lethrinidae	5	5.3	±	5.1
Istiophoridae/Xiphiidae	4	4.2	±	4.6
Lutjanidae	4	4.2	±	4.6
Carangidae	3	3.2	±	4.1
Coridae/Labridae	2	2.1	±	3.4
Elasmobranchii	2	2.1	±	3.4
Teleostomi	2	2.1	±	3.4
Sphyraenidae	1	1.1	±	2.6
Balistidae	1	1.1	±	2.6
Diodontidae	1	1.1	±	2.6
Holocentridae	1	1.1	±	2.6
Total	**95**	**100**		

Confidence limits are provided for each percentage in this and other Tables in this report. A percentage statistic (or proportions, whose sum=1.0) is a measure of relative abundance in the sense that when one percentage changes, so do all the others, so that the sum remains 100.0. The significance of any difference in relative abundance between two sets is easily tested by calculating the error range of each percentage (or proportion) to see if the two sets overlap or not. The calculation of the confidence limit of a proportion is as follows (Snedecor and Cochran 1967: 210–211; Leach and de Souza 1979: 32):

$$C = K * (P * (1.0 - P) / N)^{0.5} + 1 / 2N$$

C is the confidence limit, P is the proportion, N the sample size, and K is a constant related to the chosen probability level (= 1.96 for 95% confidence, following the distribution of Student's t). The factor 1/2N is added as a correction for continuity, which is important for small samples. For example, If N=128 and there are 7 items with some characteristic, then P=0.054688, and C=0.0433. So the 95% confidence range can be expressed as 5.47% ± 4.33%. For small samples, the distribution of Student's t must be consulted to adjust the value of C accordingly. For example if N=35, C will be 2.02, not 1.96.

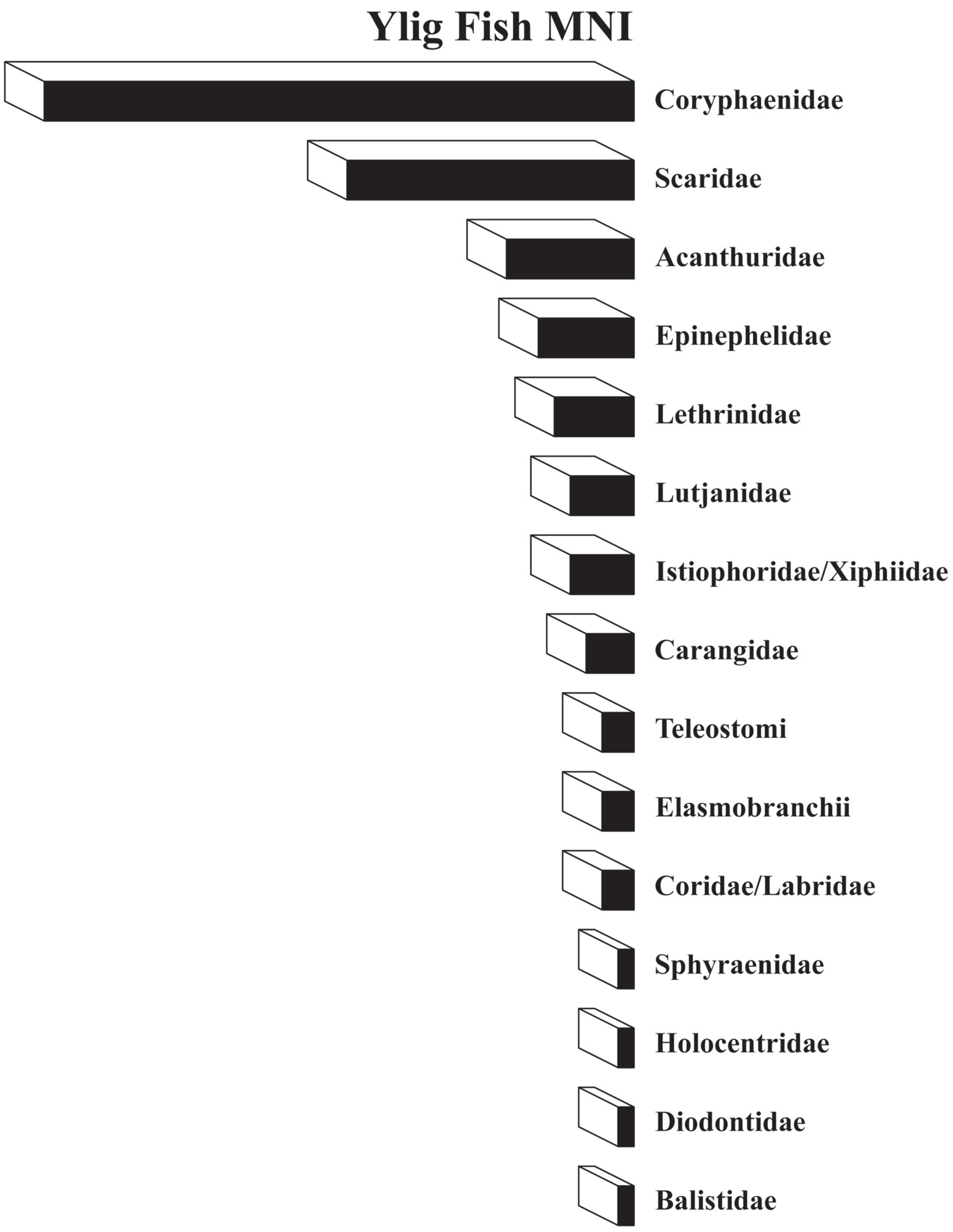

Figure 6: The abundance of different families of fish at the Ylig site.

Table 2: MNI and Percent by Family for the Ylig Site Assemblages Combined into Two Periods, and Mixed Provenance.

1=Pre-Latte, 2=Latte, 3=Mixed

Family	1	2	3	Total	%
Coryphaenidae	5	14	18	37	38.95
Scaridae	3	9	6	18	18.95
Acanthuridae	-	5	3	8	8.42
Epinephelidae	2	4	-	6	6.32
Lethrinidae	-	2	3	5	5.26
Istiophoridae/Xiphiidae	-	1	3	4	4.21
Lutjanidae	1	2	1	4	4.21
Carangidae	-	1	2	3	3.16
Coridae/Labridae	-	-	2	2	2.11
Elasmobranchii	1	-	1	2	2.11
Teleostomi	1	-	1	2	2.11
Sphyraenidae	-	1	-	1	1.05
Balistidae	1	-	-	1	1.05
Diodontidae	-	-	1	1	1.05
Holocentridae	-	1	-	1	1.05
Total	**14**	**40**	**41**	**95**	**100**

Family	1	2	3
Coryphaenidae	35.7±30.9	35.0±16.4	43.9±16.8
Scaridae	21.4±26.9	22.5±14.5	14.6±12.3
Acanthuridae	-	12.5±11.8	7.3±9.4
Epinephelidae	14.3±23.5	10.0±10.8	-
Lethrinidae	-	5.0±8.2	7.3±9.4
Istiophoridae/Xiphiidae	-	2.5±6.2	7.3±9.4
Lutjanidae	7.1±18.2	5.0±8.2	2.4±6.1
Carangidae	-	2.5±6.2	4.9±8.0
Coridae/Labridae	-	-	4.9±8.0
Elasmobranchii	7.1±18.2	-	2.4±6.1
Teleostomi	7.1±18.2	-	2.4±6.1
Sphyraenidae	-	2.5±6.2	-
Balistidae	7.1±18.2	-	-
Diodontidae	-	-	2.4±6.1
Holocentridae	-	2.5±6.2	-
Totals	**100.0**	**100.0**	**100.0**

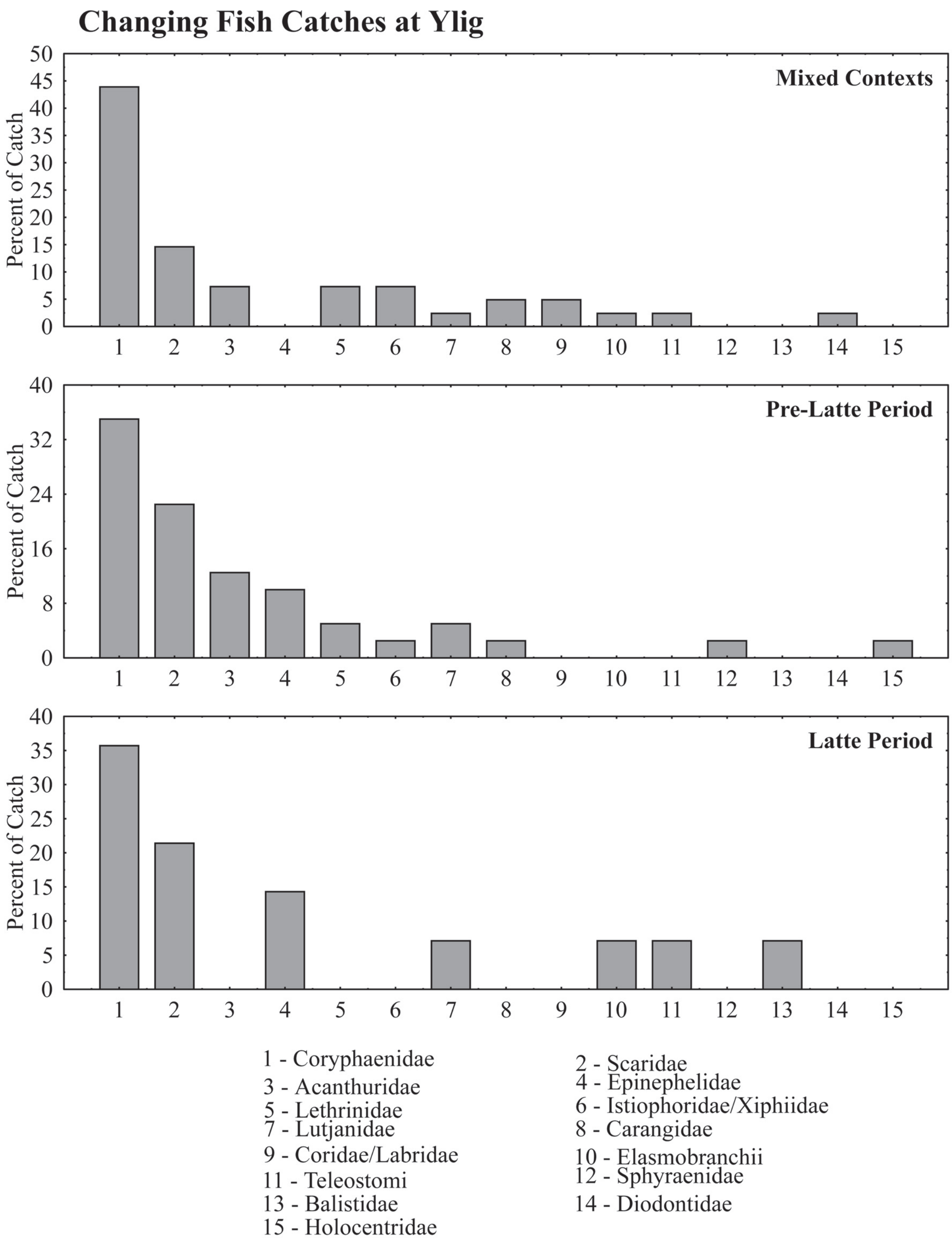

Figure 7: The relative abundance of fish at different time periods at Ylig.

Statistical errors for each percentage are given in Tables 1 and 2 (for details of this see Table 1). These assist evaluation of the significance of any observed difference between time periods. Careful examination of Table 2 reveals that no change in abundance from Pre-Latte to Latte period is significant.

THE GENERAL CHARACTER OF FISHING AT THE YLIG SITE

The fish remains at Ylig belong to at least 15 different families (Table 1, Figure 6). This is fairly typical for a relatively small Pacific assemblage. However, the composition of the collection is most unusual. It is completely dominated by dolphinfish (Coryphaenidae), with only one other family, parrotfish (Scaridae), contributing more than ten percent of MNI. Scarids are usually the most common type of fish in archaeological sites in the Pacific. The six most common fish families at Ylig are shown in Figure 8.

Is the high relative abundance of dolphinfish real? There are two possible reasons why the number might be inflated: preferential collection of large vertebrae, and the use of vertebrae to calculate MNI. The dolphinfish at Ylig were mainly identified from their distinctive vertebrae, although some cranial bones were also present (listed in Table 7 in the Appendix).

Although faunal material was not systematically collected throughout the excavations, recovery from the earlier, deeper deposits was consistent. The policy was to keep all material retained by a quarter-inch-mesh sieve (Yee 2006: pers. comm.). The relative abundance of dolphinfish in the earlier 'Pre-Latte' time period is not biased by preferential collection. Figure 7 shows a consistently high representation of dolphinfish in the three sub-collections (Latte, Pre-Latte, and Mixed), providing confidence that the high relative abundance throughout the site is not a result of preferential collection.

In calculating MNI, it is preferable to use only cranial bones or other special bones such as caudal peduncles, where one bone equals one fish. Items such as vertebrae, teeth, and some spines can cause MNI to be inflated. However, such bones are sometimes the only evidence of the presence of certain species. In the case of dolphinfish, which are so rare in Pacific archaeological sites, we identify the distinctive vertebrae, bearing in mind the possibility of inflated MNI. We apply the same methodology to all assemblages, so that if there is bias, it is consistent from layer to layer and site to site. In any one site, such as Ylig, the method should reveal any changes in relative abundance through time, even if the overall relative number is inflated. The same applies to inter-site comparisons. One could also argue that the heads of some of these large dangerous fish might be cut off before bringing the fish home, thereby greatly reducing the number of cranial bones deposited in the midden.

Therefore, although it is possible that the MNI of dolphin fish is inflated at Ylig, there is no doubt that these fish were being systematically taken in some numbers by the inhabitants throughout the period of use of the area excavated. Dolphinfish are migratory, and are most abundant in the Guam waters from February to April, although a few may be taken all year round (Amesbury and Myers 1982: 49). The most effective way of catching them is by trolling a bait or lure over deep offshore waters.

It is notable that the Ylig collection also contains at least one species from the Istiophoridae/Xiphiidae families (marlin and swordfish). These fishes were also identified mainly from their distinctive vertebrae and zygapophyses, but again, one cranial bone was present.

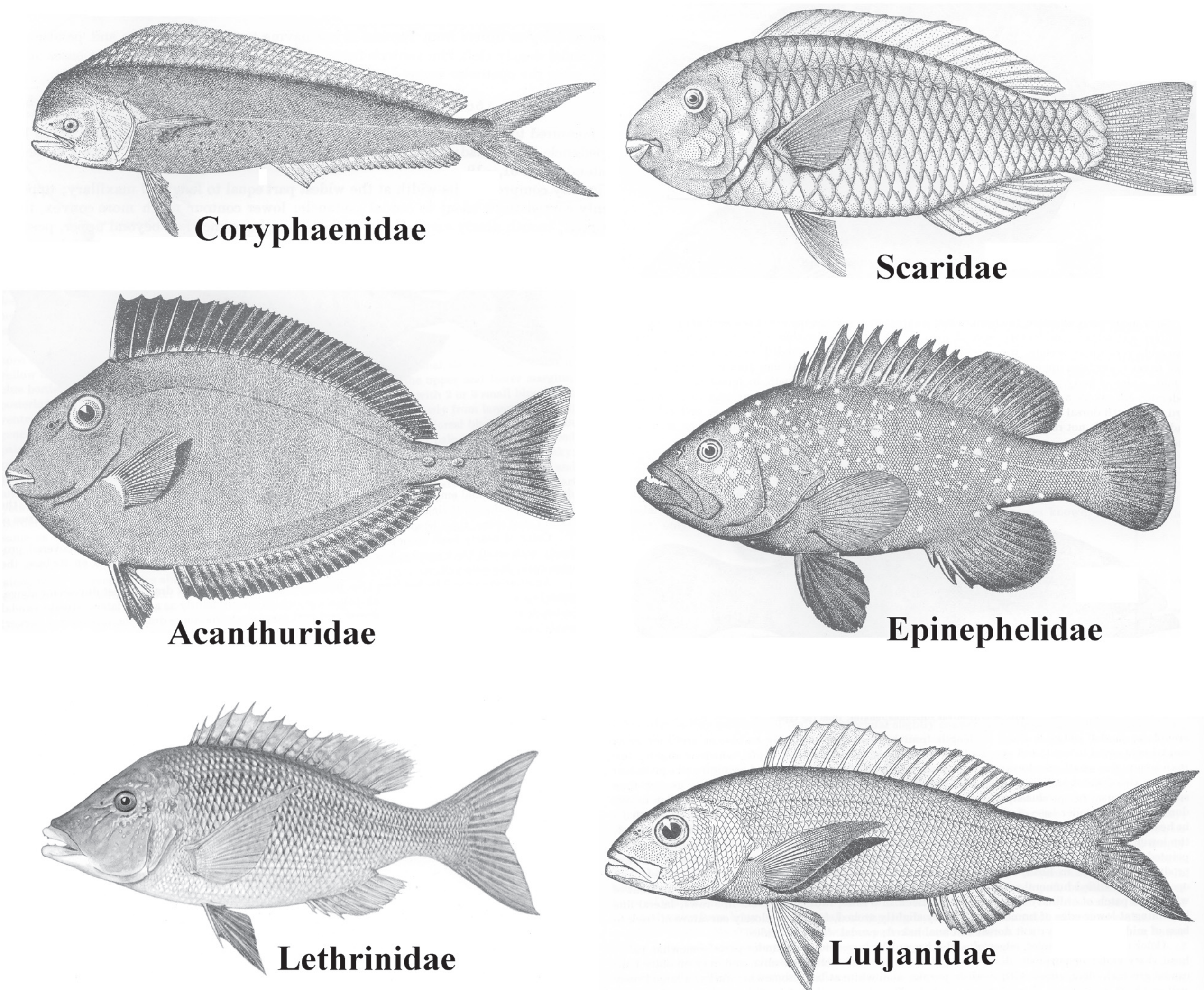

Figure 8: The most abundant types of fish at Ylig come from six families, examples of which are shown here.

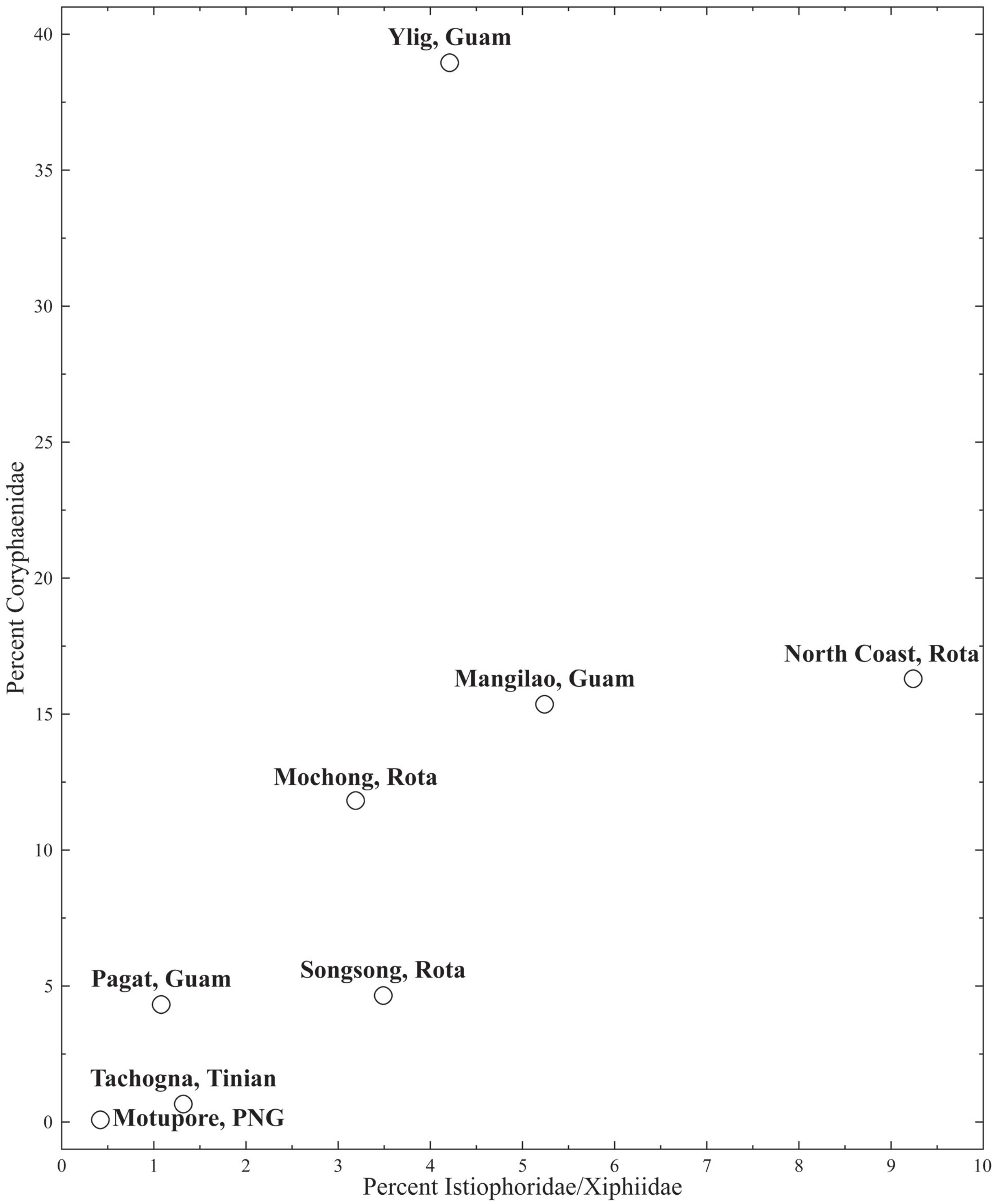

Figure 9: The relative abundance of swordfish/marlin and dolphinfish. Only 8 sites of more than 70 in the database (Table 8) have significant archaeological remains of fishes of these families. The Ylig site has by far the greatest abundance of dolphinfish so far seen in Pacific island archaeological sites.

We have previously discussed in some detail the prehistoric capture of marlin and dolphinfish in the Marianas (Davidson and Leach 1988; Leach *et al*. 1988a, 1988b; Leach and Davidson 2006). Ylig provides further supporting evidence that this big game fishing was the rule, rather than the exception in these islands (Figure 9).

Despite the importance of large game fish at Ylig, there are no tuna remains among the identified bones. This is in keeping with other assemblages from the Marianas, in which tuna are uncommon.

Another large fish represented at Ylig is the humphead parrotfish (*Bolbometopon muraticus*). This is also unusual in our experience of Pacific archaeological fish bone collections. It is not clear how these fish, which grow up to about 1.2 m and are very strong, were caught in pre-European times.

Acanthuridae (unicornfish) are the third most numerous family at Ylig. These fish are present in many Pacific assemblages, but not usually in such high relative abundance. The only effective way of catching them is by netting in inshore waters around coral thickets. It is likely that most of the scarids and Balistidae (triggerfish) were also taken in this way.

Epinephelidae (groupers and rock cod), Lethrinidae (emperorfish), and Lutjanidae (Pacific snapper and sea perch) are usually taken on a baited hook. Although this method was obviously used by the people of Ylig, it was apparently not as important as netting and pelagic trolling. Coridae/Labridae (wrasses and tuskfish) were probably also caught by baited hook, although netting would also capture them.

Of the other fish at Ylig, Carangidae (trevallies) and the single barracuda (Sphyraenidae) would be taken by trolling and the Diodontidae (porcupinefish) and Holocentridae (squirrelfish/soldierfish) by general foraging.

Figure 7 shows the relative abundance of fish from the Latte and Pre-Latte periods and from 'Mixed contexts'. The last include assemblages from contexts described as Latte?, Latte/Disturbed, Latte/Pre-Latte, Pre-Latte/Disturbed, Disturbed, and ?.

There are no discernible differences between the three subgroups. The Latte subgroup is smaller than the other two, because midden was not collected from upper layers during the first phases of the project. The relatively large subgroup from Mixed (or disturbed) contexts is due to the nature of the project. However, the similarity between the three groups suggests that fishing practices at Ylig were probably consistent throughout the use of the site.

CONCLUSIONS

This collection of fish remains from a mitigation project at Ylig on the island of Guam has added further support to our understanding of prehistoric fishing behaviour in the Mariana Islands. In particular, the Ylig assemblage reflects a strong emphasis on the hunting of dolphin fish and some hunting of marlin/swordfish throughout the occupation of the site. Netting, fishing with baited hook and trolling for smaller pelagic fish were also practised at Ylig.

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APPENDIX: Detailed Results of Fish Analysis from Ylig

The Tables in this Appendix are printouts from the *Kupenga Fishbone Database* in the Archaeozoology Laboratory at the Museum of New Zealand Te Papa Tongarewa and should be read as follows:

Tables 3 to 7 provide details of the identifications of fish remains from Ylig.

Table 3 provides totals for the whole site.

At the head of each Table appears a list of the assemblages (space/time units) which have been combined together to form each column in the table. Referring to Table 3, an example is:

(694, 1) = YLIG002 above B-52 fill, Latte/Pre-Latte

'YLIG' is the code in the *Kupenga Fishbone Database* for the Ylig site. '694, 1' is the code in the database which identifies the unique space/time assemblage in the Ylig Site: 'Above B-52 fill, Latte/-Pre Latte'. The code '002' attached to YLIG shows that this spatial provenance is the second spatial unit listed for Ylig in the database. Any codes appearing with '?' symbol refer to an unknown stratigraphic provenance in the site.

Once each column has been defined in this manner, this is followed by the listing of the Minimum Number of Individuals (MNI) according to taxon and the percent MNI of each taxon for each of the columns identified at the head of the Table.

Database codes for Taxon and Family also appear in the Tables below. For example, In Table 3, Taxon #6 = *Agrioposphyraena barracuda*. Further down in the Family tabulation Family #65 refers to Sphyraenidae.

The figures are then presented according to family in decreasing order of abundance (as in Table 1 and Figure 6). The last part of this Table shows the systematic error associated with each percentage.

Table 4 presents the same information, now broken down into two time periods and mixed provenance, as described in the text. In Table 4, 1 = Pre-Latte, 2 = Latte, 3 = Mixed Provenance.

Table 5 presents NISP (number of identified specimens) from the Ylig site according to taxon.

Table 6 presents NISP according to family and shows the breakdown by anatomy of identified specimens of Scaridae.

Table 7 lists all individual identifications from the Ylig site according to excavation unit, layer, anatomy and taxon.

Table 3: Ylig MNI All Assemblages Combined

Column Numbers and Equivalent Assemblage Reference Numbers

Column		Assemblage	Sub	Reference
Column 1	= (	694,	1)	= YLIG002 above B-52 fill, Latte/Pre-Latte
	= (	698,	1)	= YLIG006 B-40 pit, Pre-Latte
	= (	700,	1)	= YLIG008 B-52 fill, Pre-Latte
	= (	701,	1)	= YLIG009 B-54 fill, Pre-Latte
	= (	702,	1)	= YLIG010 B-55 fill, Pre-Latte
	= (	703,	1)	= YLIG011 below B-52 in ashy soil, Pre-Latte
	= (	704,	1)	= YLIG012 Between B-39 and B-40, Pre-Latte
	= (	705,	1)	= YLIG013 Clear above B-38 pit, ?
	= (	706,	1)	= YLIG014 East Test Trench, ?
	= (	709,	1)	= YLIG017 ETP Test Trench 3 meters W of ETP 20, Pre-Latte
	= (	710,	1)	= YLIG018 ETP Test Trench S of GPA pole, Pre-Latte
	= (	711,	2)	= YLIG019 ETP-1, Latte
	= (	712,	1)	= YLIG020 ETP-10, ?
	= (	712,	2)	= YLIG020 ETP-10, Disturbed
	= (	714,	1)	= YLIG022 ETP-11, Disturbed
	= (	715,	1)	= YLIG023 ETP-15, Latte/Pre-Latte
	= (	717,	1)	= YLIG025 ETP-17, Latte
	= (	721,	2)	= YLIG029 ETP-27-29, Latte?
	= (	722,	1)	= YLIG030 ETP-29, Disturbed
	= (	723,	1)	= YLIG031 ETP-30, ?
	= (	725,	1)	= YLIG033 ETP/WTP-21 B-34, Landslide above
	= (	727,	1)	= YLIG035 Near B-38, Pre-Latte
	= (	728,	1)	= YLIG036 ST-20, Disturbed
	= (	730,	1)	= YLIG038 TU-1, Latte
	= (	730,	2)	= YLIG038 TU-1, Latte/Pre-Latte
	= (	730,	3)	= YLIG038 TU-1, Pre-Latte/Disturbed
	= (	731,	1)	= YLIG039 TU-2, Disturbed
	= (	731,	2)	= YLIG039 TU-2, Latte
	= (	731,	3)	= YLIG039 TU-2, Latte/Pre-Latte
	= (	732,	1)	= YLIG040 TU-3, Disturbed
	= (	732,	2)	= YLIG040 TU-3, Latte
	= (	732,	3)	= YLIG040 TU-3, Latte/Disturbed
	= (	732,	4)	= YLIG040 TU-3, Latte/Pre-Latte
	= (	734,	1)	= YLIG042 TU-6, Latte
	= (	739,	1)	= YLIG047 WTP 8-10, ?
	= (	740,	1)	= YLIG048 WTP-11, Pre-Latte
	= (	741,	1)	= YLIG049 WTP-11-15, ?
	= (	742,	2)	= YLIG050 WTP-12, Latte
	= (	743,	1)	= YLIG051 WTP-13, ?
	= (	744,	1)	= YLIG052 WTP-13-15, Pre-Latte
	= (	745,	2)	= YLIG053 WTP-14, Pre-Latte
	= (	746,	2)	= YLIG054 WTP-15, Pre-Latte
	= (	749,	1)	= YLIG057 WTP-17, ?
	= (	751,	1)	= YLIG059 WTP-19, ?
	= (	753,	1)	= YLIG061 WTP-2, ?
	= (	753,	3)	= YLIG061 WTP-2, Latte/Pre-Latte
	= (	753,	4)	= YLIG061 WTP-2, Pre-Latte
	= (	754,	1)	= YLIG062 WTP-20, ?
	= (	757,	1)	= YLIG065 WTP-22, ?
	= (	760,	1)	= YLIG068 WTP-25, ?
	= (	761,	1)	= YLIG069 WTP-26, ?
	= (	762,	1)	= YLIG070 WTP-27, ?
	= (	764,	1)	= YLIG072 WTP-28-30, Disturbed
	= (	765,	1)	= YLIG073 WTP-30, Pre-Latte
	= (	766,	1)	= YLIG074 WTP-39, Disturbed
	= (	767,	2)	= YLIG075 WTP-8, Pre-Latte
	= (	769,	1)	= YLIG077 WTP-8-9, Pre-Latte
	= (	770,	2)	= YLIG078 WTP-9, Pre-Latte
	= (	771,	1)	= YLIG079 WTP-9-10, Pre-Latte

Overall Totals for these Assemblages by Taxa

Taxon #	**Taxon Name**	**MNI**	**%**
2	Acanthuridae	8	8.42
6	Agrioposphyra barrac	1	1.05
14	Balistidae	1	1.05
25	Caranx sp.	3	3.16
32	Coridae/Labridae	2	2.11
33	Coryphaena hippurus	37	38.95
34	Diodon hystrix	1	1.05
36	Elasmobranchii	2	2.11
38	Epinephelus/Ceph sp.	6	6.32
44	Holocentrus sp.	1	1.05
45	Istiophoridae/Xiphii	4	4.21

50	Lethrinidae	5	5.26
52	Lutjanus sp.	4	4.21
78	Scaridae	17	17.89
85	Teleostomi Species A	1	1.05
90	Teleostomi Species F	1	1.05
113	Bolbometopon sp.	1	1.05
Totals		**95**	**100**

Taxon	**1**	**Totals**
2	8	8
6	1	1
14	1	1
25	3	3
32	2	2
33	37	37
34	1	1
36	2	2
38	6	6
44	1	1
45	4	4
50	5	5
52	4	4
78	17	17
85	1	1
90	1	1
113	1	1
Totals	**95**	**95**

Overall Totals for these Assemblages by Family

Family #	**Family Name**	**MNI**	**%**
85	Coryphaenidae	37	38.95
140	Scaridae	18	18.95
159	Acanthuridae	8	8.42
97	Epinephelidae	6	6.32
114	Lethrinidae	5	5.26
221	Istiophoridae/Xiphii	4	4.21
106	Lutjanidae	4	4.21
88	Carangidae	3	3.16
222	Coridae/Labridae	2	2.11
192	Elasmobranchii	2	2.11
197	Teleostomi	2	2.11
65	Sphyraenidae	1	1.05
180	Balistidae	1	1.05
175	Diodontidae	1	1.05
57	Holocentridae	1	1.05
Total		**95**	**100**

Family	**1**	**Totals**
85	37	37
140	18	18
159	8	8
97	6	6
114	5	5
221	4	4
106	4	4
88	3	3
222	2	2
192	2	2
197	2	2
65	1	1
180	1	1
175	1	1
57	1	1
Totals	**95**	**95**

```
Family %     1
---------------------
      85  38.9+- 10.4
     140  18.9+-  8.5
     159   8.4+-  6.2
      97   6.3+-  5.5
     114   5.3+-  5.1
     221   4.2+-  4.6
     106   4.2+-  4.6
      88   3.2+-  4.1
     222   2.1+-  3.4
     192   2.1+-  3.4
     197   2.1+-  3.4
      65   1.1+-  2.6
     180   1.1+-  2.6
     175   1.1+-  2.6
      57   1.1+-  2.6
---------------------
Totals   100.0
```

Table 4: Ylig MNI in Three Groups: Latte, Pre-Latte, Mixed

```
Column Numbers and Equivalent Assemblage Reference Numbers
Column  1        = (  711,    2) = YLIG019 ETP-1,  Latte
                 = (  717,    1) = YLIG025 ETP-17,  Latte
                 = (  730,    1) = YLIG038 TU-1,  Latte
                 = (  731,    2) = YLIG039 TU-2,  Latte
                 = (  732,    2) = YLIG040 TU-3,  Latte
                 = (  734,    1) = YLIG042 TU-6,  Latte
                 = (  742,    2) = YLIG050 WTP-12,  Latte
Column  2        = (  698,    1) = YLIG006 B-40 pit,  Pre-Latte
                 = (  700,    1) = YLIG008 B-52 fill,  Pre-Latte
                 = (  701,    1) = YLIG009 B-54 fill,  Pre-Latte
                 = (  702,    1) = YLIG010 B-55 fill,  Pre-Latte
                 = (  703,    1) = YLIG011 below B-52 in ashy soil,  Pre-Latte
                 = (  704,    1) = YLIG012 Between B-39 and B-40,  Pre-Latte
                 = (  709,    1) = YLIG017 ETP Test Trench 3 meters W of ETP 20,  Pre-Latte
                 = (  710,    1) = YLIG018 ETP Test Trench S of GPA pole,  Pre-Latte
                 = (  727,    1) = YLIG035 Near B-38,  Pre-Latte
                 = (  740,    1) = YLIG048 WTP-11,  Pre-Latte
                 = (  744,    1) = YLIG052 WTP-13-15,  Pre-Latte
                 = (  745,    2) = YLIG053 WTP-14,  Pre-Latte
                 = (  746,    2) = YLIG054 WTP-15,  Pre-Latte
                 = (  753,    4) = YLIG061 WTP-2,  Pre-Latte
                 = (  765,    1) = YLIG073 WTP-30,  Pre-Latte
                 = (  767,    2) = YLIG075 WTP-8,  Pre-Latte
                 = (  769,    1) = YLIG077 WTP-8-9,  Pre-Latte
                 = (  770,    2) = YLIG078 WTP-9,  Pre-Latte
                 = (  771,    1) = YLIG079 WTP-9-10,  Pre-Latte
Column  3        = (  721,    2) = YLIG029 ETP-27-29,  Latte?
                 = (  732,    3) = YLIG040 TU-3,  Latte/Disturbed
                 = (  694,    1) = YLIG002 above B-52 fill,  Latte/Pre-Latte
                 = (  715,    1) = YLIG023 ETP-15,  Latte/Pre-Latte
                 = (  730,    2) = YLIG038 TU-1,  Latte/Pre-Latte
                 = (  731,    3) = YLIG039 TU-2,  Latte/Pre-Latte
                 = (  732,    4) = YLIG040 TU-3,  Latte/Pre-Latte
                 = (  753,    3) = YLIG061 WTP-2,  Latte/Pre-Latte
                 = (  730,    3) = YLIG038 TU-1,  Pre-Latte/Disturbed
                 = (  705,    1) = YLIG013 Clear above B-38 pit,  ?
                 = (  706,    1) = YLIG014 East Test Trench,  ?
                 = (  712,    1) = YLIG020 ETP-10,  ?
                 = (  723,    1) = YLIG031 ETP-30,  ?
                 = (  739,    1) = YLIG047 WTP 8-10,  ?
                 = (  741,    1) = YLIG049 WTP-11-15,  ?
                 = (  743,    1) = YLIG051 WTP-13,  ?
                 = (  749,    1) = YLIG057 WTP-17,  ?
                 = (  751,    1) = YLIG059 WTP-19,  ?
                 = (  753,    1) = YLIG061 WTP-2,  ?
                 = (  754,    1) = YLIG062 WTP-20,  ?
                 = (  757,    1) = YLIG065 WTP-22,  ?
                 = (  760,    1) = YLIG068 WTP-25,  ?
                 = (  761,    1) = YLIG069 WTP-26,  ?
                 = (  762,    1) = YLIG070 WTP-27,  ?
                 = (  712,    2) = YLIG020 ETP-10,  Disturbed
                 = (  714,    1) = YLIG022 ETP-11,  Disturbed
                 = (  722,    1) = YLIG030 ETP-29,  Disturbed
```

= (728, 1) = YLIG036 ST-20, Disturbed
= (731, 1) = YLIG039 TU-2, Disturbed
= (732, 1) = YLIG040 TU-3, Disturbed
= (764, 1) = YLIG072 WTP-28-30, Disturbed
= (766, 1) = YLIG074 WTP-39, Disturbed
= (725, 1) = YLIG033 ETP/WTP-21 B-34, Landslide above

Overall Totals for these Assemblages by Taxa

Taxon #	**Taxon Name**	**MNI**	**%**
2	Acanthuridae	8	8.42
6	Agrioposphyra barrac	1	1.05
14	Balistidae	1	1.05
25	Caranx sp.	3	3.16
32	Coridae/Labridae	2	2.11
33	Coryphaena hippurus	37	38.95
34	Diodon hystrix	1	1.05
36	Elasmobranchii	2	2.11
38	Epinephelus/Ceph sp.	6	6.32
44	Holocentrus sp.	1	1.05
45	Istiophoridae/Xiphii	4	4.21
50	Lethrinidae	5	5.26
52	Lutjanus sp.	4	4.21
78	Scaridae	17	17.89
85	Teleostomi Species A	1	1.05
90	Teleostomi Species F	1	1.05
113	Bolbometopon sp.	1	1.05
Totals		**95**	**100**

Taxon	**1**	**2**	**3**	**Totals**
2	-	5	3	8
6	-	1	-	1
14	1	-	-	1
25	-	1	2	3
32	-	-	2	2
33	5	14	18	37
34	-	-	1	1
36	1	-	1	2
38	2	4	-	6
44	-	1	-	1
45	-	1	3	4
50	-	2	3	5
52	1	2	1	4
78	2	9	6	17
85	1	-	-	1
90	-	-	1	1
113	1	-	-	1
Totals	**14**	**40**	**41**	**95**

Overall Totals for these Assemblages by Family

Family #	**Family Name**	**MNI**	**%**
85	Coryphaenidae	37	38.95
140	Scaridae	18	18.95
159	Acanthuridae	8	8.42
97	Epinephelidae	6	6.32
114	Lethrinidae	5	5.26
221	Istiophoridae/Xiphii	4	4.21
106	Lutjanidae	4	4.21
88	Carangidae	3	3.16
222	Coridae/Labridae	2	2.11
192	Elasmobranchii	2	2.11
197	Teleostomi	2	2.11
65	Sphyraenidae	1	1.05
180	Balistidae	1	1.05
175	Diodontidae	1	1.05
57	Holocentridae	1	1.05
Total		**95**	**100**

Family	1	2	3	Totals
85	5	14	18	37
140	3	9	6	18
159	-	5	3	8
97	2	4	-	6
114	-	2	3	5
221	-	1	3	4
106	1	2	1	4
88	-	1	2	3
222	-	-	2	2
192	1	-	1	2
197	1	-	1	2
65	-	1	-	1
180	1	-	-	1
175	-	-	1	1
57	-	1	-	1
Totals	**14**	**40**	**41**	**95**

Family %	1	2	3
85	35.7+- 30.9	35.0+- 16.4	43.9+- 16.8
140	21.4+- 26.9	22.5+- 14.5	14.6+- 12.3
159	- -	12.5+- 11.8	7.3+- 9.4
97	14.3+- 23.5	10.0+- 10.8	- -
114	- -	5.0+- 8.2	7.3+- 9.4
221	- -	2.5+- 6.2	7.3+- 9.4
106	7.1+- 18.2	5.0+- 8.2	2.4+- 6.1
88	- -	2.5+- 6.2	4.9+- 8.0
222	- -	- -	4.9+- 8.0
192	7.1+- 18.2	- -	2.4+- 6.1
197	7.1+- 18.2	- -	2.4+- 6.1
65	- -	2.5+- 6.2	- -
180	7.1+- 18.2	- -	- -
175	- -	- -	2.4+- 6.1
57	- -	2.5+- 6.2	- -
Totals	**100.0**	**100.0**	**100.0**

Table 5: NISP by Taxon

2	Acanthuridae	11
6	Agrioposphyra barrac	1
14	Balistidae	1
25	Caranx sp.	3
32	Coridae/Labridae	2
33	Coryphaena hippurus	99
34	Diodon hystrix	2
36	Elasmobranchii	2
38	Epinephelus/Ceph sp.	7
44	Holocentrus sp.	1
45	Istiophoridae/Xiphii	5
50	Lethrinidae	5
52	Lutjanus sp.	4
78	Scaridae	24
85	Teleostomi Species A	1
90	Teleostomi Species F	1
113	Bolbometopon sp.	1
Total		**170**

Table 6: NISP by Family

57	Holocentridae	1
65	Sphyraenidae	1
85	Coryphaenidae	99
88	Carangidae	3
97	Epinephelidae	7
106	Lutjanidae	4
114	Lethrinidae	5
140	Scaridae	25
159	Acanthuridae	11
175	Diodontidae	2
180	Balistidae	1
192	Elasmobranchii	2
197	Teleostomi	2
221	Istiophoridae/Xiphii	5
222	Coridae/Labridae	2
Total		**170**

NISP by Anatomy for Family of Interest = 140 Scaridae

1	Left Dentary	2
2	Right Dentary	3
4	Right Articular	1
8	Right Premaxilla	4
11	Inferior Pharyngeal Cluster	3
12	Right Superior Pharyngeal Cluster	5
13	Left Superior Pharyngeal Cluster	7

Table 7: List of Identifications of Fish Remains from Ylig

Ylig,Gua	WTP-14	Pre-Latte	1 Vertebra	Coryphaena hippurus	1
Ylig,Gua	Near B-38	Pre-Latte	5 Vertebra	Coryphaena hippurus	2
Ylig,Gua	ETP Test Trench 3 me	Pre-Latte	1 Vertebra	Coryphaena hippurus	3
Ylig,Gua	below B-52 in ashy s	Pre-Latte	3 Vertebra	Coryphaena hippurus	4
Ylig,Gua	WTP-14	Pre-Latte	3 Vertebra	Coryphaena hippurus	5
Ylig,Gua	WTP-15	Pre-Latte	13 Vertebra	Coryphaena hippurus	6
Ylig,Gua	WTP-9	Pre-Latte	1 Vertebra	Coryphaena hippurus	7
Ylig,Gua	WTP-13-15	Pre-Latte	2 Vertebra	Coryphaena hippurus	8
Ylig,Gua	ETP Test Trench S of	Pre-Latte	2 Vertebra	Coryphaena hippurus	9
Ylig,Gua	WTP-15	Pre-Latte	3 Vertebra	Coryphaena hippurus	10
Ylig,Gua	WTP-11	Pre-Latte	1 Vertebra	Coryphaena hippurus	11
Ylig,Gua	ETP Test Trench S of	Pre-Latte	1 Vertebra	Istiophoridae/Xiphii	12
Ylig,Gua	B-52 fill	Pre-Latte	1 Vertebra	Coryphaena hippurus	13
Ylig,Gua	WTP-8-9	Pre-Latte	1 Vertebra	Coryphaena hippurus	14
Ylig,Gua	WTP-8	Pre-Latte	1 Vertebra	Coryphaena hippurus	15
Ylig,Gua	WTP-14	Pre-Latte	1 Left Superior Pharyn	Scaridae	16
Ylig,Gua	B-55 fill	Pre-Latte	1 Left Superior Pharyn	Scaridae	17
Ylig,Gua	WTP-8	Pre-Latte	1 Left Superior Pharyn	Scaridae	18
Ylig,Gua	B-40 pit	Pre-Latte	1 Left Superior Pharyn	Scaridae	19
Ylig,Gua	ETP Test Trench 3 me	Pre-Latte	1 Right Superior Phary	Scaridae	20
Ylig,Gua	below B-52 in ashy s	Pre-Latte	1 Right Superior Phary	Scaridae	21
Ylig,Gua	Near B-38	Pre-Latte	1 Caudal Peduncle	Acanthuridae	22
Ylig,Gua	ETP Test Trench S of	Pre-Latte	1 Buckler	Acanthuridae	23
Ylig,Gua	WTP-15	Pre-Latte	3 Buckler	Acanthuridae	24
Ylig,Gua	B-54 fill	Pre-Latte	1 Buckler	Acanthuridae	25
Ylig,Gua	WTP-14	Pre-Latte	1 Buckler	Acanthuridae	26
Ylig,Gua	ETP Test Trench S of	Pre-Latte	1 Left Dentary	Scaridae	27
Ylig,Gua	WTP-9-10	Pre-Latte	1 Right Dentary	Scaridae	28
Ylig,Gua	WTP-8-9	Pre-Latte	1 Right Dentary	Scaridae	29
Ylig,Gua	WTP-8-9	Pre-Latte	1 Right Dentary	Lethrinidae	30
Ylig,Gua	WTP-11	Pre-Latte	1 Right Dentary	Epinephelus/Ceph sp.	31
Ylig,Gua	WTP-11	Pre-Latte	1 Left Dentary	Epinephelus/Ceph sp.	32
Ylig,Gua	WTP-30	Pre-Latte	1 Left Dentary	Agrioposphyra barrac	33
Ylig,Gua	Near B-38	Pre-Latte	1 Left Dentary	Lutjanus sp.	34
Ylig,Gua	Between B-39 and B-4	Pre-Latte	1 Left Dentary	Coryphaena hippurus	35
Ylig,Gua	ETP Test Trench S of	Pre-Latte	1 Left Premaxilla	Epinephelus/Ceph sp.	36
Ylig,Gua	WTP-14	Pre-Latte	1 Right Premaxilla	Epinephelus/Ceph sp.	37
Ylig,Gua	WTP-14	Pre-Latte	1 Right Premaxilla	Scaridae	38
Ylig,Gua	Between B-39 and B-4	Pre-Latte	1 Right Premaxilla	Lethrinidae	39
Ylig,Gua	WTP-15	Pre-Latte	1 Right Premaxilla	Acanthuridae	40
Ylig,Gua	WTP-8	Pre-Latte	1 Left Premaxilla	Caranx sp.	41
Ylig,Gua	ETP Test Trench S of	Pre-Latte	1 Left Premaxilla	Coryphaena hippurus	42
Ylig,Gua	WTP-2	Pre-Latte	1 Right Premaxilla	Coryphaena hippurus	43

Ylig,Gua	Near B-38	Pre-Latte	1	Left Articular	Epinephelus/Ceph sp.	44
Ylig,Gua	WTP-14	Pre-Latte	1	Left Articular	Coryphaena hippurus	45
Ylig,Gua	B-55 fill	Pre-Latte	1	Right Articular	Scaridae	46
Ylig,Gua	WTP-11	Pre-Latte	1	Left Maxilla	Holocentrus sp.	47
Ylig,Gua	WTP-8-9	Pre-Latte	1	Left Maxilla	Lutjanus sp.	48
Ylig,Gua	Clear above B-38 pit	?	2	Vertebra	Coryphaena hippurus	49
Ylig,Gua	TU-2	Latte/Pre-Latte	6	Vertebra	Coryphaena hippurus	50
Ylig,Gua	ETP-11	Disturbed	8	Vertebra	Coryphaena hippurus	51
Ylig,Gua	WTP 8-10	?	3	Vertebra	Coryphaena hippurus	52
Ylig,Gua	ST-20	Disturbed	3	Vertebra	Coryphaena hippurus	53
Ylig,Gua	ETP-11	Disturbed	2	Vertebra	Coryphaena hippurus	54
Ylig,Gua	WTP-2	?	2	Vertebra	Coryphaena hippurus	55
Ylig,Gua	WTP-28-30	Disturbed	2	Vertebra	Coryphaena hippurus	56
Ylig,Gua	TU-3	Latte/Pre-Latte	2	Vertebra	Coryphaena hippurus	57
Ylig,Gua	WTP-13	?	2	Vertebra	Coryphaena hippurus	58
Ylig,Gua	TU-1	Pre-Latte/Disturbed	2	Vertebra	Coryphaena hippurus	59
Ylig,Gua	ETP-10	Disturbed	2	Vertebra	Coryphaena hippurus	60
Ylig,Gua	WTP-2	Latte/Pre-Latte	1	Vertebra	Coryphaena hippurus	61
Ylig,Gua	ETP-10	Disturbed	1	Vertebra	Coryphaena hippurus	62
Ylig,Gua	TU-3	Latte/Pre-Latte	1	Vertebra	Coryphaena hippurus	63
Ylig,Gua	WTP-26	?	1	Vertebra	Coryphaena hippurus	64
Ylig,Gua	ETP-10	?	1	Vertebra	Coryphaena hippurus	65
Ylig,Gua	WTP-19	?	1	Vertebra	Coryphaena hippurus	66
Ylig,Gua	ETP-29	Disturbed	1	Vertebra	Coryphaena hippurus	67
Ylig,Gua	ETP-27-29	Latte?	1	Vertebra	Coryphaena hippurus	68
Ylig,Gua	WTP-25	?	1	Vertebra	Istiophoridae/Xiphii	69
Ylig,Gua	WTP-39	Disturbed	2	Zygapophysis	Istiophoridae/Xiphii	70
Ylig,Gua	WTP-20	?	1	Buckler	Acanthuridae	71
Ylig,Gua	WTP-11-15	?	1	Buckler	Acanthuridae	72
Ylig,Gua	ST-20	Disturbed	1	Caudal Peduncle	Acanthuridae	73
Ylig,Gua	TU-3	Latte/Pre-Latte	1	Vertebra	Caranx sp.	74
Ylig,Gua	ETP-15	Latte/Pre-Latte	1	Caudal Peduncle	Coridae/Labridae	75
Ylig,Gua	WTP-27	?	1	Right Dentary	Teleostomi Species F	76
Ylig,Gua	WTP-17	?	1	Left Premaxilla	Istiophoridae/Xiphii	77
Ylig,Gua	TU-2	Disturbed	1	Left Superior Pharyn	Scaridae	78
Ylig,Gua	TU-2	Disturbed	2	Right Superior Phary	Scaridae	79
Ylig,Gua	TU-3	Disturbed	1	Left Superior Pharyn	Scaridae	80
Ylig,Gua	TU-3	Disturbed	1	Right Superior Phary	Scaridae	81
Ylig,Gua	TU-2	Disturbed	2	Inferior Pharyngeal	Scaridae	82
Ylig,Gua	ETP-30	?	1	Inferior Pharyngeal	Scaridae	83
Ylig,Gua	ETP/WTP-21 B-34	Landslide above	1	Tooth/Dental Plates	Elasmobranchii	84
Ylig,Gua	above B-52 fill	Latte/Pre-Latte	1	Left Dentary	Scaridae	85
Ylig,Gua	East Test Trench	?	1	Right Dentary	Coridae/Labridae	86
Ylig,Gua	WTP-22	?	1	Right Dentary	Lethrinidae	87
Ylig,Gua	TU-2	Latte/Pre-Latte	1	Right Dentary	Lethrinidae	88
Ylig,Gua	TU-2	Latte/Pre-Latte	1	Left Premaxilla	Coryphaena hippurus	89

Ylig,Gua TU-3	Latte/Pre-Latte	1	Left Premaxilla	Diodon hystrix	90
Ylig,Gua TU-3	Latte/Pre-Latte	1	Right Premaxilla	Diodon hystrix	91
Ylig,Gua TU-3	Latte/Disturbed	1	Right Premaxilla	Lethrinidae	92
Ylig,Gua WTP-20	?	1	Right Premaxilla	Lutjanus sp.	93
Ylig,Gua ETP-10	Disturbed	1	Right Premaxilla	Caranx sp.	94
Ylig,Gua ETP-30	?	1	Right Premaxilla	Scaridae	95
Ylig,Gua TU-3	Latte	3	Vertebra	Coryphaena hippurus	96
Ylig,Gua TU-2	Latte	2	Vertebra	Coryphaena hippurus	97
Ylig,Gua TU-3	Latte	1	Vertebra	Coryphaena hippurus	98
Ylig,Gua TU-1	Latte/Pre-Latte	1	Vertebra	Coryphaena hippurus	99
Ylig,Gua TU-3	Latte	1	Vertebra	Coryphaena hippurus	100
Ylig,Gua ETP-1	Latte	1	Vertebra	Coryphaena hippurus	101
Ylig,Gua TU-3	Latte	1	Vertebra	Coryphaena hippurus	102
Ylig,Gua TU-6	Latte	1	Vertebra	Coryphaena hippurus	103
Ylig,Gua ETP-17	Latte	1	Vertebra	Coryphaena hippurus	104
Ylig,Gua TU-2	Latte	1	Left Superior Pharyn	Bolbometopon sp.	105
Ylig,Gua TU-2	Latte	1	Tooth/Dental Plates	Elasmobranchii	106
Ylig,Gua ETP-1	Latte	1	Dorsal/Erectile Spin	Balistidae	107
Ylig,Gua ETP-1	Latte	1	Right Dentary	Epinephelus/Ceph sp.	108
Ylig,Gua TU-1	Latte/Pre-Latte	1	Right Dentary	Scaridae	109
Ylig,Gua TU-6	Latte	1	Left Maxilla	Teleostomi Species A	110
Ylig,Gua ETP-1	Latte	1	Left Maxilla	Lutjanus sp.	111
Ylig,Gua WTP-12	Latte	1	Left Premaxilla	Epinephelus/Ceph sp.	112
Ylig,Gua ETP-1	Latte	1	Right Premaxilla	Scaridae	113
Ylig,Gua TU-1	Latte	1	Right Premaxilla	Scaridae	114

Table 8: Analysed Fish Remains from Sites in the Tropical Pacific and New Zealand

Fish remains from these archaeological sites have been analysed using strictly controlled methods, and the results are contained in the database at the Archaeozoology Laboratory, Te Papa Tongarewa Museum of New Zealand.

1: Tropical Pacific Islands

No.	Abbrev.	Site Name
1	ANAI	Anaio, Ma'uke, Cook Islands
2	KALO	Kaloko, Hawaii
3	DONG	Dongan, Papua New Guinea
4	MOT2	Motupore, Papua New Guinea (Groube)
5	NGAA	Ngaaitutaki, Mangaia, Cook Islands
6	TEPA	Tepaopao, Mangaia, Cook Islands
7	ERUA	Erua, Mangaia, Cook Islands
8	FAIS	Fais, Caroline Islands
9	TIWI	Tiwi Cave Site, New Caledonia
10	KIRI	Nikunau Island, Kiribati
11	HANE	Hane, Ua Huka, Marquesas
12	VATA	Vatcha Site Ch1 New Caledonia
13	VATB	Vatcha Site Ch2 New Caledonia
14	VATC	Vatcha Sondage A New Caledonia
15	VATD	Vatcha Sondage B New Caledonia
16	VATE	Vatcha Sondage C New Caledonia
17	LAPI	Lapita, New Caledonia, Sand
18	FAHA	Fa'ahia Sinoto Excavation
19	FAHB	Fa'ahia Navorro Excavation
20	PWEK	Pwekina, New Caledonia
21	LOYA	Mouli A, Loyalty Islands
22	LOYB	Mouli B, Loyalty Islands
23	LOYC	Hnenigec, Loyalty Islands
24	LOYD	Peete, Loyalty Islands
25	LOYE	Hnajoisisi, Loyalty Islands
26	LOYF	Keny, Loyalty Islands
27	LOYG	Nonime, Loyalty Islands
28	CIKO	Cikobia, Site 006, Fiji
29	GAAS	Mangaas, Efate, Vanuatu
30	IFOO	Ifo, Erromango, Vanuatu
31	PONA	Ponamla, Erromanga, Vanuatu
32	MAL1	Ndavru, Malekula, Vanuatu
33	MAL2	Malua Bay, Malekula, Vanuatu
34	MAL3	Woplamplam, Malekula, Vanuatu
35	MAL4	Wambraf, Malekula, Vanuatu
36	MAL5	Yalu, Malekula, Vanuatu
37	MAL6	Navaprah, Malekula, Vanuatu
38	CIK1	Cikobia, Site 001, Fiji
39	CIK2	Cikobia, Site 005, Fiji
40	NAVA	Navatu, Fiji
41	CIK3	Cikobia, Site 04, Fiji
42	CIK4	Cikobia, Site 090, Fiji
43	CIK5	Cikobia, Site 037, Fiji
44	CIK6	Cikobia, Site 047, Fiji
45	CIK7	Cikobia, Site 087, Fiji
46	KURI	Kurin, Loyalty Islands
47	LOYH	Hnajoisisi, Hna Cave, Loyalty Islands
48	ARAP	Arapus, Efate, Vanuatu
49	TIO1	Tiouande Site 5, New Caledonia
50	TIO2	Tiouande Site 14, New Caledonia
51	KULU	Kulu, Beqa, Fiji
52	BUAN	Buangmerabak, New Ireland
53	URUN	Urunao, Guam
54	MANG	Mangaia Mound, Tongatapu
55	GOLF	Mangilao Golf Course, Site 25, Guam
56	GOLG	Mangilao Golf Course, Site 253, Guam
57	GOLH	Mangilao Golf Course, Site 667, Guam
58	YLIG	Ylig,Guam
59	XXXX	Balof Cave, New Ireland, Papua New Guinea (White)
60	XXXX	Pagat, Guam (Craib)
61	XXXX	Kapingamarangi, Caroline Is (Leach)
62	XXXX	Leluh, Kosrae (Cordy)
63	XXXX	Motupore 1, Port Morseby, Papua New Guinea (Allen)
64	XXXX	Nan Madol, Ponape (Athens)
65	XXXX	Nukuoro, Caroline Is (Davidson)
66	XXXX	Palau (Masse)
67	XXXX	Ponape (*)
68	XXXX	Te Ana Pua, Ua Pou, Marquesas (Ottino)
69	XXXX	RF2 Reef Islands, Solomons (Green)
70	XXXX	Mochong, Rota, Mariana Is (Craib)
71	XXXX	RotaSIU, Mariana Is (Butler)
72	XXXX	Songsong, Rota, Mariana Is (McManamon)
73	XXXX	Taumako, Solomons (Leach)
74	XXXX	Tinian Mariana Is (*)
75	XXXX	Vaito'otea, Huahine, Society Is (Sinoto)
76	XXXX	Afenta, Saipan, Mariana Is (McGovern Wilson)

2: New Zealand

No.	Abbrev.	Site Name
1	BRE1	Breaksea Sound 1,Discovery Cove,(BSS/1)
2	BRE2	Breaksea Sound 2, Chatham Point 3, BSS/2
3	CASC	Cascade Cove, Dusky Sound (CC/1)
4	CHAL	Chalky Is, Chalky Inlet, Southport CH/1
5	COOP	Coopers Island, Dusky Sound, (CI/1)
6	DUND	Davidson Undefended Site, Motutapu Is
7	FOXR	Fox River, Te Onumata, Potikohua River
8	FOXT	Foxton
9	GARD	Garden Island, Chalky Inlet, Southport
10	GLEN	The Glen, Tasman Bay
11	HARW	Harataonga Bay W Midden, Gt Barrier Is
12	HOTW	Hot Water Beach, Coromandel Peninsula
13	HUDS	Hudson's Site, Goose Bay, Kaikoura
14	IKAE	Te Ika a Maru, Eastern Flat
15	IKAF	Te Ika a Maru, Flat at Base of Pa
16	KAHN	Kahiti North, Hansons Bay, Chatham Is
17	KAHS	Kahiti South, Hansons Bay, Chatham Is
18	KIRI	Te Kiri Kiri, Ruapuke Island, (KK/1)

19 LEEI Lee Island Site, on Ruapuke Island, LI/1
20 LOBE Long Beach, Dunedin
21 LONG Long Island, Dusky Sound, (LI/1)
22 LUND Leahy Undefended Site, Motutapu Island
23 MAKB Makara Beach Midden
24 MAKT Makara Terrace Midden
25 MILF Milford
26 NGAI Te Ngaio, Petre Bay, Chatham Island
27 OHIN Ohinemamao, Petre Bay, Chatham Island
28 OMIH Omihi, Kaikoura
29 PAPA Papatowai, Catlins
30 PARA Parangiaio, Ruapuke Island, (PP/1)
31 PARE Paremata
32 PCR1 Port Craig Cave, Foveaux Strait, (PC/1)
33 PCR2 Port Craig Dry Rock Shelter 1, Foveaux
34 PCR3 Port Craig Dry Rock Shelter 2, Foveaux
35 PCR4 Port Craig Midden, Foveaux Strait, PC/4
36 PEKP Peketa Pa, Kaikoura
37 PJAC Port Jackson, Coromandel
38 POKI Pokiakio, Petre Bay, Chatham Islands
39 ROSS Ross Rocks, Otago
40 SAN1 Sandhill Point 1, Foveaux Strait, SHP/1
41 SAN2 Sandhill Point 2, Foveaux Strait, SHP/2
42 SAN3 Sandhill Point 3, Foveaux Strait, SHP/3
43 SAN4 Sandhill Point 4, Foveaux Strait, SHP/4
44 SOU1 Southport 1, Fiordland, (SP/1)
45 SOU4 Southport 4, Cave Site, Fiordland, SP/4
46 SOU5 Southport 5, Cave Site, Fiordland, SP/5
47 SOU6 Southport 6, Fiordland, (SP/6)
48 SOU7 Southport 7, Fiordland, (SP/7)
49 SOU8 Southport 8, Fiordland, (SP/8)
50 SOU9 Southport 9, Cave Site, Fiordland, SP/9
51 STAT Station Bay Pa, Motutapu Island
52 SUND Sunde Site, Motutapu Island
53 TAIA Taiaroa Head, Otago Peninsula
54 TAKA Takahanga Post Office Site Kaikoura
55 TITC Titirangi Cattleyards, Marlborough
56 TITG Goose Bay Midden, Titirangi, Marlborough
57 TITP Titirangi Pa, Marlborough Sounds
58 TITS Titirangi Sandhills, Marlborough Sounds
59 TIWA Tiwai Point, Bluff Harbour
60 TUMB Tumbledown Bay, Banks Peninsula
61 WAKAWakapatu, Western Southland
62 MANAParewanui Midden, Bulls, Manawatu
63 SHAG Shag River Mouth
64 KOKO Kokohuia, Hokianga
65 MATA Midden 8, Matakana Island
66 WASH Washpool Site, Palliser Bay
67 MAK3 Makotukutuku M3 Fort Site, Palliser Bay
68 MAK1 Makotukutuku M1 Camp Site, Palliser Bay
69 BLR2 Black Rocks BR2 Pond Midden, Palliser
70 BLR3 Black Rocks BR3 Black Midden, Palliser
71 BLR4 Black Rocks BR4 Crescent Midden Palliser
72 BLR5 Black Rocks Fan
73 MAN1 Mana Island South Midden R26/141A
74 MAN2 Mana Island North Settlement R26/141
75 ANDR Andrewburn, Fiordland
76 HURI Huriawa Peninsula. Areas A,B,Salvage
77 KELL Kelly's Beach, Stewart Island
78 OLDP Old Pier Point Avoca, Kaikoura
79 OMIM Omimi, Otago
80 OTOK Otokia Mouth, Brighton Beach, Otago
81 POUN Pounawea, Otago
82 PURA Purakanui Inlet, Otago
83 RIVE Riverton, Southland
84 ROTO Rotokura, Tasman Bay
85 WAIA Waianakarua Mouth, North Otago
86 HARP Harataonga Bay Pa, Great Barrier Island
87 SLIP Slipper Island, Near Tairua Harbour
88 TAIR Tairua, Coromandel
89 WHANWhangamata Wharf, Coromandel
90 CROS Cross Creek Site
91 WAIH Waihora, Chatham Islands
92 CHAA CHA, Chatham Islands
93 CHBB CHB, Chatham Islands
94 CHCC CHC, Chatham Islands
95 PANA Panau, Canterbury Peninsular
96 TWIL Twilight Beach, Northland
97 AUPO Aupori Dune Middens 90 Mile Beach
98 HOUH Houhora
99 WAIP Waipoua
100 NHBWNorthland Harbour Board Site, Whangaraei
101 SUN2 Sunde Site Oyster lens
102 SUN3 Sunde Site soft shore midden
103 WES1 Westfield N42/941
104 HAML Hamlins Hill N42/137
105 HAHE Hahei N44/215
106 HARS N44/97
107 ORUR Oruarangi N49/28
108 RAUP Raupa N53/37, T13/13
109 AOTE Aotea N64/25
110 KOHI Kohika N68/104
111 AWARAwaroa N26/18
112 BARB N26/214
113 BARK Bark Bay
114 TAUP Taupo Point
115 APPL Appleby
116 HAUL Haulashore Island
117 BRUC Bruce Bay
118 TIRO Tiromoana N135/1
119 PAR2 Pararaki Wall, Pararaki North N168-9/41
120 PLE1 Pleasant River (Anthropology) S155/8
121 PLE2 Pleasant River (Smith)
122 TUMA Tumai, Pleasant River Mouth South
123 MAPO Mapoutahi S164/13
124 PUKE Pukekura Pa, Tairoa Head
125 PAP2 Papatowai S184/5
126 WES2 West Point WP/1, Ruapuke Island

APPENDIX C

PRE-WAR JAPANESE FISHERIES IN MICRONESIA FOCUSING ON BONITO AND TUNA FISHING IN THE NORTHERN MARIANA ISLANDS

By

Wakako Higuchi

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Pre-war Japanese Fisheries in Micronesia
—Focusing on Bonito and Tuna Fishing in the Northern Mariana Islands—

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Pre-war Japanese Fisheries in Micronesia
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in the Northern Mariana Islands—

Introduction

As a participant in World War I, Japan took control of the German colonies in Micronesia in 1914, and called them the South Sea Islands — comprising Saipan, Palau, Yap, Chuuk (formerly Truk), Pohnpei (formerly Ponape) and the Marshalls. The Japanese Navy administered the islands until 1922. Later, the civilian-run South Seas Bureau governed the islands as a League of Nations mandate. By the mid-1930s, the navy again became politically and militarily involved in the administration of the islands.

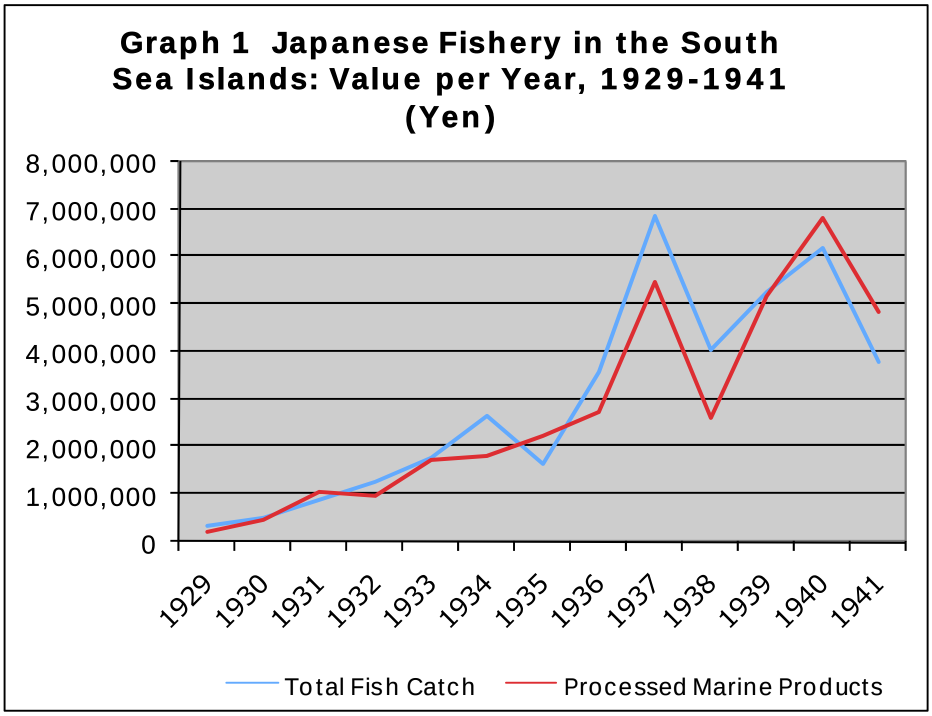
As seen in Graph 1 below**,** the fishing industry in Micronesia increased rapidly throughout the 1930s, becoming one of the major economic achievements in the islands during Japanese rule, along with the sugarcane, copra, and phosphate industries. The main marine product was bonito caught by pole-and-line.

This report will review records of the bonito and tuna fisheries in the South Sea Islands during the South Seas Bureau administration. The review is divided into three periods: 1922–1931, 1931-1941, 1941-1942. The period 1922-1931 can be termed the Experimentation Period. The next period, 1931-1941, saw the rise of fishery industries in the South Sea Islands. The last period covers fisheries during the early Pacific War, 1941-1942. There are no South Seas Bureau fishery statistics available between 1943 and 1944. Fishing efforts in the Saipan district will be examined separately, since the other areas within the South Sea Islands are not pertinent to the present project.

Japanese references compiled prior to 1951 do not specify each kind of bonito and tuna caught. They simply identify fish as either bonito (*katsuwo*) or tuna (*maguro*). According to Okamoto Hiroaki, National Research Institute of Far Seas Fisheries, Japan, when "bonito" pole-and-line fishery is discussed in Japanese references, the species taken included mainly *Katsuwonus pelamis* (skipjack, or *katsuwo*), also *Auxis thazard* (*hirasôda*) and *Auxis rochei* (frigate mackerel, or *marusôda*); and probably *Euthynuus affins* (*suma*) and *Sarda orientalis* (bonito, or *hagatsuwo*). Japanese fishing grounds until then were limited to the western and central Pacific north of the equator. [1]

In the same way, the term, "tuna" includes the following species: *Thunnus thynnus* (Pacific bluefin tuna), *T. alalunga* (albacore), *T. obesus* (bigeye tuna), and *T. albacares* (yellowfin tuna).

[1] Okamoto Hiroaki, "Taiheiyô sensô izen oyobi shûsen chokugo no Nihon no maguro gyogyô dêta no tansaku (Search for the Japanese Tuna Fishing Data Before and Just After World War II)," *Suisan Sôgô Kenkyûjo Sentâ Kenkyû Hôkoku 13* (Shizuoka: Suisan Sôgô Kenkyû Sentâ, 2004): 18.



Source: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Tokyo: Nan'yôchô, 1935), p. 124-126; and Nan'yôchô, *Nan'yô Guntô yôran,* 1929-1942.

Fisheries during the Experimentation Period (1922-1931)

With two fishery regulations — the Regulations for the Fishery Industry in the South Sea Islands (1916), and the Regulations for Encouragement of Fishery Industry in the South Sea Islands (1922), the South Seas Bureau's policy was always to promote and support fisheries in the islands. In 1925, the South Seas Bureau launched the research ship *Hakuômaru* (10 tons), and began ocean research on bonito pole-and-line fisheries. Catches were poor in spite of the observation of large schools of fish. Though attempts at encouraging fisheries were made, they failed for a variety of reasons. The most serious problems throughout the pre-war years were difficulties in handling and marketing the fish — preservation, lack of local markets in the islands, a small Japanese population in the islands, and inadequate transportation to Japan.

Bonito Fishing in the South Sea Islands: It appears that the bonito fishery in the South Sea Islands first began in the 1920s. An individual by the name of Uehara Kamezô hired five Okinawan fishermen and an Okinawan-style large canoe on Saipan. In late 1925, he took *akadoro* (the general term for *Apogonidae*, *Amia*, *Apogon*, and *Chilodipterus*), small baitfish on the reef at Palau. They caught bonito — 50 to 100 bonito per day — two to three miles distant from the eastern channel and off the lighthouse at Palau.[2]

[2] Marukawa Hisatoshi, "Nan'yô Guntô no suisan (2)" *Nan'yô Suisan 5, no. 3* (March 1939): 8.

Similarly, Taiyô Suisan Kabushiki Kaisha (Taiyô Marine Products Company) on Saipan hired Okinawan fishermen and caught bonito, also in the Palau area. However, because of lack of bait and the strong trade winds, the catch was poor. Taiyô Suisan also took bonito using the South Seas Bureau's *Hakuômaru* for two years, but the poor catches resulted in the dissolution of the company.

In Chuuk, Okinawan fisherman, Tamashiro Eishô, began a bonito fishery around 1918. Fishermen from Shizuoka also engaged in fishing. While other fishermen from Shizuoka failed, Tamashiro succeeded. The reason for Tamashiro's success was that his Okinawan employees were skillful at catching the bait needed for a good haul in the South Seas.

Two things were required for successful fishing: quantity and quality of bait, and skilled Okinawan fishermen.[3] Bonito fishing was totally dependent on the right kind of bait. In Palau, there was abundant baitfish — *kibinago* (*Stolephorus delicatulus* [Bennett]), and especially *nan'yo katakuchi iwashi* (*Engraulis heterolobus* [Rueppel]). Although the latter was the best bait for bonito pole-and-line fishing, these small fish could not be caught in waters around Saipan. Instead, *akamura* (*Caessio chrysozoma* [Kuhl & Hass], *maaji* (*Trachinrus japonicus* [Temm. & Schl.]), *meaji* (*Trachurops crumenophthalma* [Bloch.]), *shimaaji* (*Caranx malabalicus* [Cuv. & Val.]), and another kind of horse mackerel (*C. leptolepis* [Cuv. & Val].) were used on Saipan.[4] For catching bait, Okinawan divers were necessary. In the 1920s, bonito fisheries were gradually centered around the waters of Palau, and Saipan.[5] Okinawan fishermen, mainly from Itoman, Okinawa, were recruited to work in the South Sea Islands. Out of a total of 1,336 workers engaged in the fisheries industry in 1932, 405 worked out of the Saipan district (30%), 425 in the Palau district (32%), 234 in the Chuuk district (18%), 178 in the Pohnpei district (13%), 83 in the Yap district (6.2%), and 11 in the Juluit district (0.8%).[6]

Table 1 below shows the number of fishing permits issued by the South Seas Bureau. The permits for bonito fishing slowly increased in the Saipan district from the 1920s on, but the number of permits was still fewer than 8 by 1931.

Table 2 below shows that there were 23 permitted vessels in the Saipan district, with 167 fishermen as of 1930. According to Table 3, the total value of the Saipan fish catch increased from 19,627 yen in 1929 to 70,296 yen in 1930, owing to the employment of four vessels of 20 tons and more.

Also, as seen in Table 3**,** the bonito catch in Saipan district increased from 24,690 kg in 1929 to 258,004 kg in 1930, an increase of more than 10 times. Because of the

[3] Marukawa Hisatoshi, ibid., p. 12.
[4] Marukawa Hisatoshi, "Nan'yô Guntô no suisan (4)" *Nan'yô Suisan 5, no. 5* (May 1939): 4-9.
[5] The total Japanese population in the South Sea Islands in 1929 was 16,202 (male: 10,291, and female: 5,911). Of them, 8,289 were from Okinawa – 51%. 7,754 Okinawans (94%) lived on the Saipan District, while 347 Okinawan (4%) lived on the Palau District. Nan'yôchô, *Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, December 1934), pp. 34-39.
[6] Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), p. 54.

increase of motorized vessels on Saipan, bonito catches rapidly increased to 564,258 kg by 1931, 23 times more than in 1929. These increases were catches by vessels from Yaizu, Japan, which organized as Nan'yô Suisan Kigyô Kumiai (South Seas Fishery Companies' Association, later Nankô Suisan) in 1931. In 1925, bonito catches made up 14% of the total fish catch in the South Sea Islands (33% in the Saipan district). This increased to 55% in 1929, 78% in 1930 and 73% in 1931 (53%, 87%, and 90% in the Saipan district respectively). As a result, bonito fishing became a major industry on Saipan, as well as in other parts of the South Sea Islands. And owing to the increase of bonito fish catches, dried bonito production also increased accordingly, as seen in Table 4.

Tuna Fishing: The South Seas Bureau Marine Laboratory reported in 1938 that the density of tuna schools in the South Sea Islands was the same as for bonito.[7] However, processing of tuna after catch was more difficult than bonito because tuna needed icing to keep it fresh. Further development of the tuna fisheries had to wait for construction of necessary refrigeration, ice storage, and processing facilities. As mentioned above, island conditions — such as distance from Japan's markets, and limited local consumption in the South Sea Islands — were also a detriment to growth of the tuna fishery. There were only three longliners for tuna fisheries, and these were only at Palau as late as 1935. Table 3 shows increasing tuna catches starting in 1930. Nan'yô Suisan's pole-and-line vessels probably took these tuna.

During the Experimentation Period, Japanese bonito fisheries focused on the seas of Palau, Chuuk, and Saipan districts. Fishing grounds located near the outer islands and far seas had been untouched. The South Seas Bureau wrote in 1935 that there was plenty of scope for the fishing industry in the South Sea Islands, if fishing methods were improved and fishing grounds expanded. However, it also added, "excluding of areas of poor condition such as Saipan."[8] For increasing the catch of fish in the islands and because Saipan appeared more developed with many Okinawan immigrants, bonito fishery in the Saipan district water was necessary and important. However, in the long term Saipan was not expected to yield as much fish as other islands along the equator would likely do.

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[7] Nan'yôchô, *Nan'yôcho Suisan Shikenjô yôran* (Palau: Nan'yôchô, December 1938), p. 35.
[8] Nan'yôchô, "Takumu daijin seigi Nan'yôchô bunai rinji shokuin secchi sei chû kaisei no ken," April 18, 1935.

Table 1 Fishing Permits Issued by the South Seas Bureau (S: Saipan District = Saipan, Tinian, and Rota)

	Total	**Fixed Net**	**Raising**	**Hawks-bill**	***Tectus maximus*, Pearl Oyster**	**Bonito**	**Other Fish**	**Trepang**	**Coral**	**Whaling**
1922	38 **S: 9**	---	2	1	3	1 **S: 1**	21 **S: 7**	9 **S: ---**	1 **S: 1**	---
1923	43 **S: 10**	1	2	1	3	2 **S: 1**	23 **S: 7**	10 **S: 1**	1 **S: 1**	---
1924	55 **S: 15**	1	2	1	3	3 **S: 2**	31 **S: 10**	13 **S: 2**	1 **S: 1**	---
1925	90 **S: 31**	2	2	5	6	4 **S: 3**	50 **S: 24**	19 **S: 2**	1 **S: 1**	1 **S: 1**
1926	86 **S: 18**	---	2	10	8	11 **S: 6**	35 **S: 9**	18 **S: 1**	1 **S: 1**	1 **S: 1**
1927	94 **S: 21**	1	2	9	7	12 **S: 6**	44 **S: 11**	17 **S: 2**	1 **S: 1**	1 **S: 1**
1928	94 **S: 21**	2	2	8	7	12 **S: 5**	48 **S: 14**	13 **S: ---**	1 **S: 1**	1 **S: 1**
1929	94 **S: 23**	2	2	6	6	17 **S: 6**	46 **S: 15**	13 **S: ---**	1 **S: 1**	1 **S: 1**
1930	87 **S: 16**	2	2	5	4	24 **S: 8**	37 **S: 7**	13 **S: 1**	--- **S: ---**	--- **S: ---**
1931	74 **S: 9**	1	2	4	1	36 **S: 7**	21 **S: 1**	9 **S: 1**	--- **S: ---**	--- **S: ---**
1932	103 **S: 22**	1	2	3	4	37 **S: 10**	47 **S: 11**	9 **S: 1**	--- **S: ---**	--- **S: ---**
1933	124 **S: 47**	1 **S: ---**	1 **S: ---**	5 **S: ---**	2 **S: ---**	51 **S: 16**	56 **S: 30**	8 **S: 1**	--- **S: ---**	--- **S: ---**

Source: Statistics 1922-1932: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), pp. 348; and Statistics 1933: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), pp. 126

Table 2 Fishing Vessels and Fish Catch in the South Sea Islands (S: Saipan District = Saipan, Tinian, and Rota)

Total Fishing Vessels		**Fishing Vessels**									**Crew**	**Total Fish Catch (yen)***
		Non-Motorized Vessels				**Motorized Vessels**						
		Total	<5 tons	5-20 tons	>20 tons	Total	**Steam Engine**		**Motor**			
							<20 tons	>20 tons	<20 tons	>20 tons		
1928	1,044 **S: 35**	1,031 **S: 32**	1,031 **S: 32**	--- **S: ---**	--- **S: ---**	13 **S: 3**	--- **S: ---**	--- **S: ---**	13 **S: 3**	--- **S: ---**	1,781 **S: 102**	247,933 **S: 24,490**
1929	846 **S: 34**	825 **S: 32**	825 **S: 32**	--- **S: ---**	--- **S: ---**	21 **S: 2**	--- **S: ---**	--- **S: ---**	21 **S: 2**	--- **S: ---**	1,665 **S: 105**	305,849 **S: 19,627**
1930	1,007 **S: 23**	979 **S: 19**	975 **S: 15**	--- **S: ---**	4 **S: 4**	28 **S: 4**	--- **S: ---**	--- **S: ---**	23 **S: ---**	5 **S: 4**	1,861 **S: 167**	488,487 **S: 70,296**
1931	1,041 **S: 40**	980 **S: 22**	980 **S: 22**	--- **S: ---**	--- **S: ---**	61 **S: 18**	--- **S: ---**	--- **S: ---**	57 **S: 18**	4 **S: ---**	2,599 **S: 324**	850,490 **S: 141,013**
1932	1,116 **S: 92**	1,053 **S: 75**	1,053 **S: 75**	--- **S: ---**	--- **S: ---**	63 **S: 17**	--- **S: ---**	--- **S: ---**	62 **S: 17**	1 **S: ---**	2,933 **S: 498**	1,252,121 **S: 374,564**
1933	376 **S: 90**	314 **S: 73**	314 **S: 73**	--- **S: ---**	--- **S: ---**	62 **S: 17**	--- **S: ---**	--- **S: ---**	62 **S: 17**	--- **S: ---**	1,882 **S: 492**	1,790,322 **S: 406,964**

Source: 1928-1932 Statistics: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), p. 349; and 1933 Statistics: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), p. 126
* Some of these statistics are not consistent with the grand total in Table 3.

Table 3 Fish Catch in the South Sea Islands: Quantity and Value (S: Saipan District = Saipan, Tinian, and Rota)

	Grand Total	**Total Fish Catch**	**Bonito**	**Tuna**	**Mackerel**
1922	113,596 yen **S: 4,961 yen**	360,653 kg 90,062 yen **S: 8,741 kg** **S: 4,961 yen**	9,713 kg 6,770 yen **S: 2,363 kg** **S: 1,890 yen**	6,075 kg 3,730 yen **S: 1,312 kg** **S: 875 yen**	13,399 kg 3,573 yen **S:** --- **S:** ---
1923	175,609 yen **S: 10,202 yen**	304,740 kg 78,525 yen **S: 19,680 kg** **S: 9,677 yen**	7,305 kg 5,068 yen **S: 2,813 kg** **S: 2,250 yen**	6,652 kg 3,673 yen **S: 1,252 kg** **S: 888 yen**	7,110 kg 4,121 yen **S: 19 kg** **S: 14 yen**
1924	115,178 yen **S: 15,192 yen**	252,593 kg 82,173 yen **S: 19,261 kg** **S: 10,447 yen**	17,741 kg 11,580 yen **S: 9,097 kg** **S: 6,065 yen**	11,951 kg 5,971 yen **S: 1,534 kg** **S: 1,024 yen**	11.944 kg 9,545 yen **S: 45 kg** **S: 30 yen**
1925	204,452 yen **S: 18,740 yen**	251,445 kg 93,453 yen **S: 43,061 kg** **S: 16,181 yen**	36,319 kg 17,520 yen **S: 14,305 kg** **S: 6,348 yen**	12,229 kg 4,557 yen **S: 1,403 kg** **S: 749 yen**	7,725 kg 5,760 yen **S: 787 kg** **S: 210** yen
1926	254,372 yen **S: 27,817 yen**	399,349 kg 142,884 yen **S: 75,813 kg** **S: 27,022 yen**	92,284 kg 42,282 yen **S: 44,842 kg** **S: 17,937 yen**	55,534 kg 22,423 yen **S: 2,314 kg** **S: 1,235 yen**	31,043 kg 15,813 yen **S: 690 kg** **S: 369 yen**
1927	232,725 yen **S: 19,417 yen**	380,467 kg 136,378 yen **S: 51,416 kg** **S: 18,263 yen**	52,954 kg 23,781 yen **S: 28,110 kg** **S: 10,778 yen**	54,266 kg 24,327 yen **S: 2,906 kg** **S: 1,475 yen**	4,586 kg 1,834 yen **S:** --- **S:** ---
1928	277,933 yen **S: 24,490 yen**	583,995 kg 166,045 yen **S: 57,855 kg** **S: 21,028 yen**	163,714 kg 48,644 yen **S: 26,494 kg** **S: 10,219 yen**	164,182 kg 38,629 yen **S: 1,260 kg** **S: 618 yen**	4,380 kg 1,805 yen **S:** --- **S:** ---
1929	342,659 yen **S: 19,627 yen**	850,129 kg 215,432 yen **S: 46,416 kg** **S: 16,832 yen**	469,511 kg 126,937 yen **S: 24,690 kg** **S: 9,876 yen**	172,001 kg 31,825 yen **S: 562 kg** **S: 300 yen**	9,784 kg 3,910 yen **S:** --- **S:** ---
1930	510,767 yen **S: 70,296 yen**	1,719,870 kg 413,129 yen **S: 297,938 kg** **S: 68,430 yen**	1,335,720 kg 327,861 yen **S: 258,004 kg** **S: 56,142 yen**	111,997 kg 13,947 yen **S: 4,534 kg** **S: 2,493 yen**	2,993 kg 714 yen **S:** --- **S:** ---
1931	871,490 yen **S: 141,013 yen**	3,873,968 kg 787,888 yen **S: 628,255 kg** **S: 139,448 yen**	2,816,808 kg 622,983 yen **S: 564,258 kg** **S: 122,022 yen**	211,910 kg 29,898 yen **S: 16,734 kg** **S: 5,622 yen**	888 kg 189 yen **S:** --- **S:** ---
1932	1,266,866 yen **S: 374,564 yen**	5,797,617 kg 1,181,693 yen **S: 1,577,385 kg** **S: 372,021** yen	4,861,263 kg 944,261 yen **S: 1,309,725 kg** **S: 317,916 yen**	361,445 kg 50,801 yen **S: 48,244 kg** **S: 15,438 yen**	341 kg 137 yen **S:** --- **S:** ---
1933	1,790,322 yen **S: 406,964 yen**	7,725,086 kg 1,708,886 yen **S: 1,902,707 kg** **S: 405,715 yen**	6,889,401 kg 1,512,631 yen **S: 1,762,300 kg** **S: 370,184 yen**	374,796 kg 59,811 yen **S: 9,584 kg** **S: 2,908 yen**	4,154 kg 788 yen **S:** --- **S:** ---

Table 3 Fish Catch in the South Sea Islands: Quantity and Value (S: Saipan District = Saipan, Tinian, and Rota) (Continued)

	Horse Mackerel	Spanish Mackerel	Grey Mullet	Shark	Other Fish	Shellfish Others
1922	31,875 kg 11,018 yen **S: 1,275 kg** **S: 680 yen**	--- --- **S: ---** **S: ---**	10,500 kg 4,200 yen **S: ---** **S: ---**	--- --- **S: ---** **S: ---**	289,091 kg 60,771 yen **S: 3,791 kg** **S: 1,506 yen**	23,534 yen **S: ---**
1923	19,695 kg 8,364 yen **S: 1,856 kg** **S: 990 yen**	49 kg 34 yen **S: 49 kg** **S: 34 yen**	6,473 kg 2,627 yen **S: 285 kg** **S: 152 yen**	2,471 kg 566 yen **S: 97 kg** **S: 26 yen**	254,985 kg 54,072 yen **S: 13,309 kg** **S: 5,323 yen**	97,084 yen **S: 525 yen**
1924	22,087 kg 13,523 yen **S: 570 kg** **S: 304 yen**	668 kg 363 yen **S: 349 kg** **S: 233 yen**	4,613 kg 1,632 yen **S: 19 kg** **S: 15 yen**	6,356 kg 1,969 yen **S: 1,519 kg** **S: 324 yen**	177,233 kg 37,590 yen **S: 6,128 kg** **S: 2,452 yen**	33,005 yen **S: 4,745 yen**
1925	27,697 kg 17,462 yen **S: 2,610 kg** **S: 1,392 yen**	1,642 kg 563 yen **S: 386 kg** **S: 228 yen**	2,606 kg 1,187 yen **S: 127 kg** **S: 46 yen**	5,269 kg 1,949 yen **S: 1,024 kg** **S: 273 yen**	157,958 kg 44,455 yen **S: 21,919 kg** **S: 6,935 yen**	110,999 yen **S: 2,559 yen**
1926	24,637 kg 9,056 yen **S: 1,431 kg** **S: 665 yen**	1,425 kg 406 yen **S: 94 kg** **S: 51 yen**	9,225 kg 3,479 yen **S: 150 kg** **S: 80 yen**	3,941 kg 653 yen **S: 2,347 kg** **S: 313 yen**	181,260 kg 48,772 yen **S: 23,895 kg** **S: 6,372 yen**	111,488 yen **S: 795 yen**
1927	61,601 kg 25,224 yen **S: 1,560 kg** **S: 599 yen**	581 kg 155 yen **S: ---** **S: ---**	16,796 kg 6,410 yen **S: ---** **S: ---**	2,419 kg 447 yen **S: 1,800 kg** **S: 315 yen**	187,264 kg 54,200 yen **S: 17,040 kg** **S: 5,096 yen**	96,347 yen **S: 1,154 yen**
1928	40,192 kg 16,223 yen **S: 3,037 kg** **S: 1,201 yen**	2,449 kg 845 yen **S: 615 kg** **S: 245 yen**	13,264 kg 4,990 yen **S: ---** **S: ---**	12,900 kg 1,006 yen **S: 1,031 kg** **S: 124 yen**	182,914 kg 53,903 yen **S: 25,418 kg** **S: 8,621 yen**	111,888 yen **S: 3,462 yen**
1929	29,599 kg 11,396 yen **S: 2,100 kg** **S: 840 yen**	926 kg 241 yen **S: 105 kg** **S: 50 yen**	34,005 kg 5,409 yen **S: 337 kg** **S: 108 yen**	2,186 kg 337 yen **S: 1,612 kg** **S: 215 yen**	132,117 kg 35,377 yen **S: 17,010 kg** **S: 5,443 yen**	127,227 yen **S: 2,795 yen**
1930	32,554 kg 7,616 yen **S: 244 kg** **S: 82 yen**	1,796 kg 243 yen **S: 75 kg** **S: 36 yen**	48,176 kg 4,721 yen **S: ---** **S: ---**	5,445 kg 760 yen **S: 4,871 kg** **S: 638 yen**	181,189 kg 57,267 yen **S: 30,210 kg** **S: 9,039 yen**	97,638 yen **S: 1,866 yen**
1931	75,970 kg 16,983 yen **S: 187 kg** **S: 60 yen**	5,230 kg 652 yen **S: 907 kg** **S: 352 yen**	269,610 kg 16,052 yen **S: ---** **S: ---**	24,010 kg 1,357 yen **S: 3,854 kg** **S: 503 yen**	469,542 kg 99,774 yen **S: 42,315 kg** **S: 10,879 yen**	83,602 yen **S: 1,565 yen**
1932	180,849 kg 50,762 yen **S: 86,671 kg** **S: 14,795 yen**	1,583 kg 627 yen **S: 1,508 kg** **S: 603 yen**	55,272 kg 3,529 yen **S: ---** **S: ---**	6,055 kg 626 yen **S: 6,055 kg** **S: 626 yen**	330,809 kg 130,950 yen **S: 125,182 kg** **S: 22,643 yen**	85,173 yen **S: 2,543 yen**
1933	62,413 kg 20,771 yen **S: 6,683 kg** **S: 2,704 yen**	2,118 kg 380 yen **S: ---** **S: ---**	29,957 kg 6,713 yen **S: 250 kg** **S: 50 yen**	1,704 kg 253 yen **S: 1,704 kg** **S: 253 yen**	360,543 kg 107,539 yen **S: 122,186 kg** **S: 29,616 yen**	81,436 yen **S: 1,249 yen**

Source: 1922-1932 Statistics: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), pp. 350-353; and 1933 Statistics: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), pp. 124-125.

Table 4 Marine Products in the South Sea Islands: Quantity and Value (S: Saipan District = Saipan, Tinian, and Rota)

	Total	Dried Bonitos	Dried Tuna	Trepang	Shark Fin	Canned Tuna
1922	19,957 yen	120 kg 160yen **S: ---**	--- --- **S: ---**	21,011 kg 19,797 yen **S: ---**	--- --- **S: ---**	--- --- **S: ---**
1923	20,353 yen **S: 760 yen**	--- --- **S: ---**	--- --- **S: ---**	23,149 kg 20,353 yen **S: 1,200 kg** **S: 760 yen**	--- --- **S: ---** **S: ---**	--- --- **S: ---** **S: ---**
1924	38,480 yen **S: 19,290 yen**	1,095 kg 3,404 yen **S: 855 kg** **S: 2,508 yen**	1,030 kg 3,744 yen **S: ---** **S: ---**	57,859 kg 30,969 yen **S: 35,460 kg** **S: 16,419 yen**	364 kg 363 yen **S: 364 kg** **S: 363 yen**	--- --- **S: ---** **S: ---**
1925	18,997 yen **S: 4,240 yen**	1,560 kg 4,116 yen **S: 484 kg** **S: 1,292 yen**	1,061 kg 2,264 yen **S: ---** **S: ---**	25,196 kg 12,072 yen **S: 2,966 kg** **S: 2,798 yen**	75 kg 150 yen **S: 75 kg** **S: 150 yen**	30 kg 15 yen **S: ---** **S: ---**
1926	77,414 yen **S: 9,205 yen**	9,543 kg 28,540 yen **S: 3,293 kg** **S: 8,780 yen**	16,054 kg 38,541 yen **S: 19 kg** **S: 50 yen**	14,861 kg 9,958 yen **S: ---** **S: ---**	188 kg 375 yen **S: 188 kg** **S: 375 yen**	--- --- **S: ---** **S: ---**
1927	40,940 yen **S: 7,058 yen**	4,751 kg 12,445 yen **S: 1,976 kg** **S: 5,270 yen**	6,169 kg 13,160 yen **S: ---** **S: ---**	9,326 kg 11,437 yen **S: 1,965 kg** **S: 1,598 yen**	128 kg 190 yen **S: 128 kg** **S: 190 yen**	--- --- **S: ---** **S: ---**
1928	111,424 yen **S: 19,808 yen**	18,893 kg 37,805 yen **S: 2,235 kg** **S: 5,960 yen**	28,219 kg 45,160 yen **S: ---** **S: ---**	35,520 kg 27,453 yen **S: 18,210 kg** **S: 13,688 yen**	289 kg 415 yen **S: 75 kg** **S: 160 yen**	--- --- **S: ---** **S: ---**
1929	220,209 yen **S: 12,348 yen**	104,310 kg 138,122 yen **S: 2,580 kg** **S: 6,885 yen**	33,735 kg 48,629 yen **S: ---** **S: ---**	48,480 kg 27,399 yen **S: 9,885 kg** **S: 5,273 yen**	203 kg 190 yen **S: 203 kg** **S: 190 yen**	--- --- **S: ---** **S: ---**
1930	484,547 yen **S: 23,730 yen**	232,825 kg 434,743 yen **S: 13,654 kg** **S: 21,425 yen**	22,954 kg 28,815 yen **S: 113 kg** **S: 255 yen**	31,271 kg 16,928 yen **S: 1,140 kg** **S: 1,520 yen**	668 kg 530 yen **S: 668 kg** **S: 530 yen**	--- --- **S: ---** **S: ---**
1931	1,064,341 yen **S: 97,466 yen**	842,210 kg 997,840 yen **S: 68,044 kg** **S 94,236 yen**	42,665 kg 44,388 yen **S: 755 kg** **S: 855 yen**	14,213 kg 6,829 yen **S: 2,760 kg** **S: 2,106 yen**	794 kg 541 yen **S: 386 kg** **S: 269 yen**	--- --- **S: ---** **S: ---**
1932	981,634 yen **S: 214,213 yen**	972,875 kg 917,989 yen **S: 192,172 kg** **S: 210,072yen**	73,746 kg 55,985 yen **S: 3,152 kg** **S: 3,278yen**	3,412 kg 2,266 yen **S: 1,087 kg** **S: 725 yen**	206 kg 138 yen **S: 206 kg** **S: 138 yen**	--- --- **S: ---** **S: ---**
1933	1,747,595 yen **S: 383,173 yen**	1,305,290 kg 1,662,066 yen **S: 297,654 kg** **S: 379,650 yen**	68,626 kg 76,410 yen **S: 4,100 kg** **S: 3,493 yen**	5,216 kg 2,623 yen **S: ---** **S: ---**	60 kg 30 yen **S: 60 kg** **S: 30 yen**	? 6,466 yen **S: ---** **S: ---**

Source: 1922-1932 Statistics: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), pp. 354-355; and 1933 Statistics: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), p. 126.

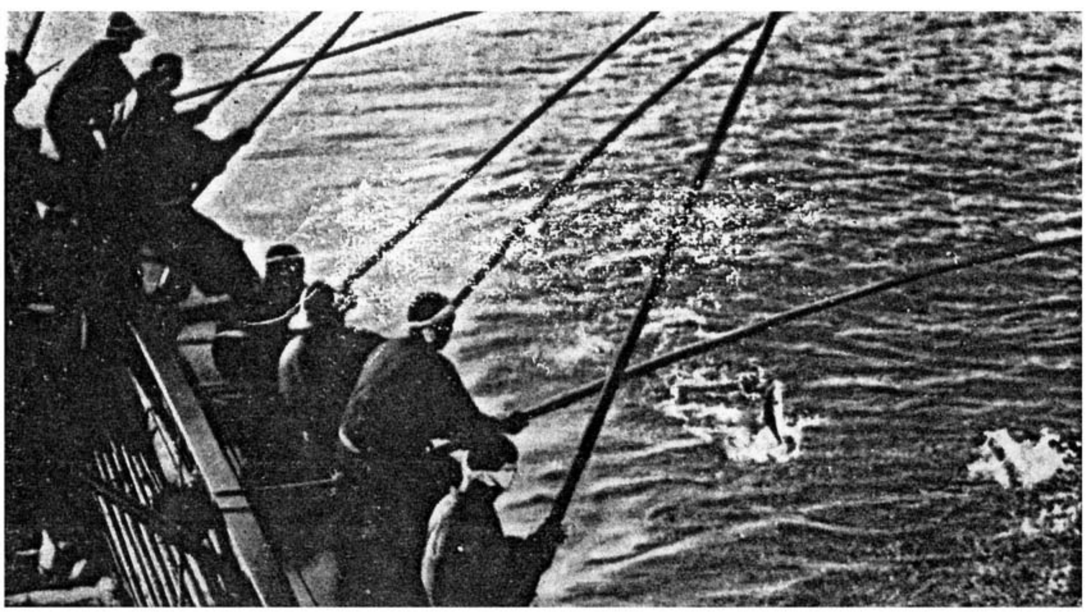
The Rise of Fishing Industries (1931-1941)

As seen in Table 4, the value of marine products in the South Sea Islands rapidly increased after 1930 — 2.2 times, 4.8 times, and 7.9 times in 1930, 1931, and 1933 respectively, compared with 1929. The industry that once concentrated on tortoise and other shells changed its focus and half the total catch was a single product — bonito.

Hara Kô's bonito fishing efforts had success after his experience in 1927 and 1929 in the South Sea Islands. Hara, from Makurazaki, Kagoshima, showed that bonito fishing in the South Sea Islands could be highly profitable, and his efforts attracted other bonito fishermen from Japan.

In 1931Anbara Ichizô organized Nan'yô Suisan Kigyô Kuniai, a business association for bonito and tuna industries in Yaizu, Shizuoka. Nan'yô Suisan established a fishing base at Malakal, Palau, opened a Saipan office, and began bonito fishing. The company also purchased bonito caught by Okinawan fishermen.

Seeking more investment, Anbara asked Nan'yô Kôhatsu President Matsue Haruji for financial support. Originally a sugar growing and processing company, Nan'yô Kôhatsu established a fishery department within the company to support Nan'yô Suisan's fishing activities. In January 1935, Anbara and Matsue established the Nankô Suisan Kabushiki Kaisha or Nankô Marine Production Company, capitalized with 1.2 million yen. The president was Matsue, and the vice President was Anhara, with headquarters at Palau. An office on Saipan was opened as well. Photo 1 shows Nankô Suisan's fishermen doing pole-and-line bonito fishing.



By 1938, there were two more bonito fishery and canning companies — Kimi Suisan at Palau and Hamaichi Shôji at Palau and Chuuk —in addition to Nankô Suisan. Nankô Suisan mainly employed fishermen from Okinawa and Yaizu, and it was the only bonito fishery and processing company on Saipan. By 1942, Nankô Suisan was responsible for 90% of bonito caught in the South Sea Islands.[9] As to the background of the monopoly, Nankô Suisan's business was strongly supported by the South Seas Bureau, the Overseas Affairs Ministry (an upper body of the South Seas Bureau), and the Japanese Navy, which was responsible for the South Sea Islands ocean area.

The South Sea Islands Ten-Year Development Plans (1935): With Japan's withdrawal from the League of Nations in 1935, the Overseas Affairs Ministry of the Japanese government prepared a comprehensive ten-year development plan for the islands. The plan designated the islands as part of Japan's outer defence system, and as an advanced base for future planned expansion to the south. The development plan called for construction of infrastructure, particularly at Saipan and Palau, which included harbour facilities, roads, communication facilities, water supply systems to vessels, and housing — all of which were also necessary for the improvement of fisheries. The plan also budgeted 4.4 million yen for marine research and for the fishing industries (water service for fishing vessels, ice manufacture, cold storage, oil storage, shipbuilding, ironworks, and repair facilities at fishing ports). The plan also promoted excursions into new fishing grounds at New Guinea, and in the Arafra, Banda, Celebes, Sulu, and Flores Seas. The advance base for all of this expansion was designated the South Sea Islands.

Fisheries as National Policy: Because of Japan's worsening international reputation, and isolation in the early 1930s, Japanese fishing vessels were shut out from the major southern fishing grounds near the Dutch East Indies.[10] In order to achieve some sort of breakthrough, the government designed the "Fundamentals of National Policy" in August 1936. The policy called for expansion into new fishing grounds south of the South Sea Islands. Accordingly, the South Seas Bureau established the Marine Laboratory at Palau in 1937, for research on fishing, fish processing, and fishing-techniques.

Marine resources research focused on the bonito fishery grounds in the Western and Central Caroline Islands. Also in 1937, Nan'yô Takushoku Kabushiki Kaisha (South Seas Colonization Company) was established to carry out government policy under the guidance of the Overseas Affairs Ministry, and Nankô Suisan was purchased and operated by this semi-governmental company. With the financial assistance of Nan'yô Takushoku, Nankô Suisan increased its capital from 2.5 million yen in 1937 to 5.0 million yen in 1939, for the purchase of equipment for the tuna industry, expansion of existing facilities, and construction of a tuna-canning factory at Palau. The company's capital was again increased to 10 million yen in 1941, to build a ship for longline fishing only, and a refrigerator ship as well as to install ice manufacture, freezing, and cold storage facilities. In addition to bonito fisheries, Nankô Suisan began tuna fisheries.

[9] Nan'kô Suinsan Kabushiki Kaisha, *Nan'kô Suisan Kabushiki Kaisha gaiyô*, October 1942, p. 6.
[10] Gotô Ken'ichi, "Gyôgyô, nanshin, Okinawa," in *Iwanami kôza: Kindai Nihon to shokuminchi 3, Shokuminchika to sangyôka* (Tokyo: Iwanami Shoten, 1993), pp. 166-167.

This entailed purchase of tuna and operation of transportation facilities and related businesses (shipbuilding, ironworks, and finance) — all with government assistance.

Bonito Fisheries: The bonito catch in the Saipan district was always ranked third behind Palau and Chuuk. Saipan had two characteristic disadvantages. One was the lack of bait. As mentioned above, Saipan lacked baitfish, *nan'yô katakushi iwashi* (*Engraulis heterolobus* [Rueppel]). Instead, young fish, *akamuro* (*Caecionidae*), were used at Saipan. Every September, schools of *akamuro* approached the west coast of Saipan. For one month while *akamuro* stayed at depths of 15 to 25 meters in rocky coral areas, vessels stopped fishing for bonito. Okinawan divers searched the bait area and used stretch nets called *chûsô shikiami* (25 meters height, and 12 meters width) amongst the rocks in 15 meters depths. The *akamuro* were chased by the divers into the nets. The live *akamuro*, 10-centimeters long, were kept alive in submerged fishnets (*katsusuami*) for 30 to 40 days. Only skilled Okinawan divers could catch *akamuro* using this method.

Another disadvantage was that the bonito-fishing season in waters around the Saipan district was shorter than at Palau and Chuuk, because of Saipan's higher latitude. In comparison to the open ocean fishing (*yûri gyojô*) in the waters around Palau, Saipan's fishing grounds were close to the reef that rose steeply from the ocean bottom and neighboring areas (*sone gyojô*) where bonito were always found though the number was not large. Therefore, the catches at Saipan were not big takes. During the off-season around Saipan, pole-and-line fishing was conducted north of Anatahan, especially in the area of Maug Island. However, the conditions in the waters around Maug Island — *sone gyojô* — were the same as at Saipan so that the catch was limited. Fishing vessels also found schools of migratory fish and fish congregating near drift timbers and caught them.[11]

As of 1935, Nankô Suisan's Saipan office (5,600 square meters) in Garapan owned four bonito vessels (17 tons each) and contracted with another four vessels for purchase of fish, for a total of eight vessels. All bonito caught were transported in lighters from the fishing vessels at the port and unloaded at the wooden pier that jutted out 40 meters from the beach. All fish were then taken to the factory by handcart. Processing capacity at the factory was 20 tons/day. Ice manufacturing was 5 tons/day. In 1936, a new factory was built alongside a quay at Chikkô (Tanapag), north of Garapan. It included an ice manufacturing facility (15 tons/day), refrigeration facility (5 tons/day), cold storage facility (5 tons/day), and ice warehouse (400 tons). The Saipan factories processed fresh bonito into toasted, dried, and shaved dried bonito. Ironwork for repairing fishing vessels was done at the Nan'yô Kôhatsu's factory.

For processing bonitos caught by three fishing vessels operating in the outer ocean north of Saipan, a branch factory was built at Pagan Island. The factory was able to cut and process bonito into rough dried bonito (*arabushi*) before sending it to the Saipan factory for completion of the process.

[11] Marukawa Hisatoshi, "Nan'yô Guntô no suisan (2)" *Nan'yô Suisan 5, no. 3* (March 1939): 12-13.

Table 5 shows the bonito fishery catches at Saipan. After Nan'yô Suisan began business on Saipan, the catches reached 3,697,298 kg in 1937, up from the 564,258 kg caught in 1931 — a 6.6 times increase in six years. The 1937 catch was the peak of that four-year fishing cycle. The catch at Saipan also more than doubled in between 1936 and 1937. After that, the catch decreased for two years, but reached 3,379,048 kg in 1940.

A Nankô Suisan publication, *Nan'kô Suisan no ashiato* (Nan'kô Suisan's Footmark), reported that 1941 was the peak of the next four-year bonito cycle. Again, according to the publication, the total value of the bonito catch in 1941 was worth 6,159,000 yen, and dried bonito was worth 6,816,000 yen.[12] However, corroborating data were not found in the South Seas Bureau's handbook. Therefore, in Table 5 note ***, the claim that 1941 was a bumper year cannot be verified.

Again, referring to Table 5, the total number of bonito vessels in 1937 and 1938 was 145. Of these, Saipan had 36 in 1937 (25% of the total), and 34 in 1938 (23% of the total). Weight of Saipan's bonito catch was 11% of the total in 1937, and 17% in 1938. Catch per vessel at Saipan was less than the average catch in the South Sea Islands because of poor fishing grounds around Saipan, as mentioned before.

More than 90% of the bonito caught was processed into dried bonito, called "*nankô bushi*" (Nankô's dried bonitos). Of that total, Nankô Suisan's factories produced nearly 80% of the total dried bonito. After processing, all dried bonito was shipped to Japan, amounting to about 60% of the total consumption of dried bonito in Japan in 1937.[13] In Photo 2, Nankô Suisan employees pack dried bonito in wooden boxes.

[12] Kawakami Zenkurô, *Nankô Suisan no ashiato* (Tokyo: Nankô Suisan, 1995), p. 284.
[13] Nan'kô Suisan Kabushiki Kaisha, *Nan'kô Suisan Kabushiki Kaisha gaiyô*, pp. 6-7.

In contrast, the Japanese residents in the islands consumed fresh fish such as horse mackerel, Spanish mackerel, striped mullet and other reef fish (*meyasu, sunakuchi, kamasu, and itoyori*).

The fishing industry's exemption from fuel taxation was abolished in 1937 because of the costly Japan-China War. The price of fuel suddenly rose in Japan and influenced fishery operations in the South Sea Islands. In October 1937, the South Seas Bureau promulgated "Regulations on Financial Assistance to Fishery Management" that subsidized 30% to 50% of the cost of the fisheries. One of the reasons for this large government assistance was the importance of dried bonito to support the food requirements of the Japanese military in China and at home.

Tuna Fisheries: Until the mid-1930s, Japan's tuna fisheries were secondary and seasonal operations. Tuna was occasionally caught during pole-and-line bonito fishing. After some home-based longliners began catching tuna near the Western Caroline Islands in 1938, tuna fishing became a year-round industry in the South Sea Islands.

Some records show that in 1938, *Daini Shinkômaru* (118 tons), belonging to Tôhoku Shinkôsha, was loaded to capacity with *Pacific* bluefin tuna (*Thunnus orientalis*) and yellowfin, 200 nautical miles east of the Mariana Islands and returned to Japan. In autumn of the same year, *Fukujumaru* (80 tons), from Wakayama, operated tuna fisheries off Saipan. *Hideyoshimaru* (99 tons) from Hiyori Fushimaru port, Wakayama, returned to its homeport in Japan with a full load of tuna after 60-70 days of operation in the "South Seas." Such good catches attracted tuna fishermen from all over Japan.

In 1938, the South Seas Bureau Marine Laboratory found a new yellowfin fishing ground near the north equatorial current. It was estimated that the value of catches in these waters would be close to 20 million yen. By 1939, the number of Japanese longliners fishing the grounds south of 20-degree north latitude was 76.[14] Although Japan had been exporting albacore to the U.S., it suddenly became more difficult after 1938, because the U.S. imposed custom duties of 30% to 45% and then 75%.[15] Partly as a result of these increases, the Japanese long-liners, which were used for taking albacore in Japan's eastern fishing ground, changed their grounds to the south, aiming at yellowfin. Through this effort, the Japanese fisheries expanded from Saipan, south to New Guinea, New Britain, and the Solomon Islands.

As mentioned above, one of the greatest problems these vessels faced was how to keep tuna fresh during the long return voyage to Japan. Wooden ships of less than 100 tons did not have an ice machine. As a result, Saipan became an important supply base because Nankô Suisan had ice making machines and cold storage there. In addition, fresh water and food were located at Saipan.

[14] Dômei Tsûshinsha, *Sekai no umi ni: Katsuo maguro gyogyô no subete* (Tokyo: Dômei Tsûshinsha, 1974), p. 35.
[15] Nan'yôchô, "Takumu daijin seigi Nan'yôchô bunai rinji shokuin secchi sei chû kaisei no ken" October 1, 1940.

Table 5 Bonito Catches and Dried Bonito Production in the South Sea Islands (S: Saipan District = Saipan, Tinian, and Rota)

	Permits of Bonito Fishery	Bonito Catches (kg)	Bonito Catches (yen)	Dried Bonito (kg)	Dried Bonito (yen)
1922	1 (Bonito & Tuna) **S: 1**	9,713 kg **S: 2,363 kg**	6,770 yen **S: 1,890 yen**	120 kg **S: ---**	160 yen **S: ---**
1923	2 (Bonito & Tuna) **S: 1**	7,305 kg **S: 2,813 kg**	5,068 yen **S: 2,250 yen**	--- **S: ---**	--- **S: ---**
1924	3 (Bonito & Tuna) **S: 2**	17,741kg **S: 9,097 kg**	11,580 yen **S: 6,065 yen**	1,095 kg **S: 855 kg**	3,404 yen **S: 2,508 yen**
1925	4 (Bonito & Tuna) **S: 3**	36,319 kg **S: 14,805 kg**	17,520 yen **S: 6,348 yen**	1,560 kg **S: 484 kg**	4,116 yen **S: 1,292 yen**
1926	11 (Bonito & Tuna) **S: 6**	92,284 kg **S: 44,842 kg**	42,282 yen **S: 17,937 yen**	9,548 kg **S: 3,293 kg**	28,540 yen **S: 8,780 yen**
1927	12 (Bonito & Tuna) **S: 6**	52,954 kg **S: 28,110 kg**	23,781 yen **S: 10,778 yen**	4,751 kg **S: 1,976 kg**	12,445 yen **S: 5,270 yen**
1928	12 (Bonito & Tuna) **S: 5**	163,714 kg **26,494 kg**	48,644 yen **S: 10,219 yen**	18,893 kg **S: 2,235 kg**	37,805 yen **S: 5,960 yen**
1929	17 (Bonito & Tuna) **S: 6**	469,511 kg **S: 24,690 kg**	126,937 yen **S: 9,876 yen**	104,310 kg **S: 2,580 kg**	138,122 yen **S: 6,885 yen**
1930	24 (Bonito & Tuna) **S: 8**	1,335,720 kg **S: 258,004 kg**	327,861 yen **S: 56,142 yen**	282,825 kg **S: 13,654 kg**	434,743 yen **S: 21,425 yen**
1931	36 (Bonito & Tuna) **S: 7**	2,816,808 kg **S: 564,258 kg**	622,983 yen **S: 122,022 yen**	842,210 kg **S: 68,044 kg**	997, 840 yen **S: 94,236 yen**
1932	37 (Bonito & Tuna) **S: 10**	4,861,263 kg **S: 1,309,725 kg**	944,261 yen **S: 317,916 yen**	972,875 kg **S: 192,172 kg**	917,989 yen **S: 210,072 yen**
1933	51 (Bonito & Tuna) **S: 16**	6,889,401 kg **S: 1,762,300 kg**	1,512,631 yen **S: 370,184 yen**	1,305,290 kg **S: 297,654 kg**	1,662,066 yen **S: 379,650 yen**
1934	76 **S: 23**	8,956,411 kg **S: 2,516,000 kg**	2,205,050 yen **S: 503,200 yen**	1,594,170 kg **S: 419,512 kg**	1,714,590 yen **S: 470,469 yen**
1935	67 **S: 17**	11,722,284 kg **S: 1,785,977 kg**	1,317,919 yen **S: 420,983 yen**	2,097,388 kg **S: 264,133 kg**	2,127,424 yen **S: 360,593 yen**
1936	87 **S: 19**	14,265,772 kg **S: 1,696,006 kg**	1,468,996 yen **S: 220,481 yen**	2,422,856 kg **S: 425,072 kg**	2,671,357 yen **S: 581,628 yen**
1937	145 **S: 36**	34,060,809 kg **S: 3,697,298 kg**	2,833,905 yen **S: 382,210 yen**	5,812,745 kg **S: 626,176 kg**	5,081,774 yen **S: 601,738 yen**
1938	145 **S: 34**	14,958,592 kg **S: 2,592,029 kg**	1,356,969 yen **S: 315,411 yen**	2,501,222 kg **S: 451,883 kg**	2,429,521 yen **S: 426,657 yen**
1939	135	19,019,188 kg **S: 1,297,354 kg**	2,462,707 yen **S: 358,996 yen**	3,229,686 kg **S: ---**	4,963,052 yen **S: ---**
1940	133 **S: 25**	18,233,967 kg **S: 3,379,048 kg**	4,430,385 yen*** **S: 721,560 yen**	2,973,270 kg **S: 561,122 kg**	5,193,000 yen **S: 1,190,146**
1941*	129 **S: 26**	11,545,053 kg **S: 1,297,354 kg**	2,918,934 yen*** **S: 358,996 yen**	1,333,840 kg **S: 182,152 kg**	4,250,434 yen*** **S: 491,227 yen**
1942	113 **S: 27**	14,872,781 kg** **S: ---**	--- **S: ---**	1,905,130 kg** **S: ---**	5,307,063 yen** **S: ---**

Sources: 1922-1932 statistics: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), pp. 348-355;
1933 statistics: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), p. 125-126.
1934-1942 statistics for bonito fishery permits: Nan'yôchô, *Nan'yô Guntô yôran*, 1934-1942.
1934-1937 statistics for fisheries except for bonito fishery permits: Nan'yôchô, *Nan'yôchô Suisan Shinkenjô yôran* (Palau: Nan'yôchô Suisan Shikenjô, 1938), pp. 42-58.
1938, 1940, and 1941 statistics: Nanyôchô, *Nan'yô Guntô yôran*, 1939, 1941, and 1942.
1939 and 1942 statistics: Ôkurashô Kanrikyoku, *Nihonjin no kaigai katsudô ni kansuru rekishiteki chôsa: Tsûkan dai nijûissatsu Nanyô Guntô hen daini bunsatsu: Dainibu Nan'yô Guntô keizai sangyô*, 1949, p. 86-87, and pp. 147-148.
* All statistics for bonito fishery for 1941 and 1942, printed in 1942 and 1943 editions of *Nan'yô Guntô yôran*, respectively, are identical. The statistics for 1941 are used in this table.
** This statistics were cited from the text of Ôkurashô Kanrikyoku publication.
*** According to Kawakami *Zenkurô's Nankô Suisan no ashiato*, the bonito catch in 1940 was 5,255,000 yen in value; 6,159,000 yen in 1941; and the value of dried bonito in 1941 was 6,816,000 yen.

Table 6 shows tuna catches in the South Sea Islands. In 1939, 40 longliners (120 tons) from Japan, mainly from Misaki, Kanagawa, and 10 from the South Sea Islands, caught 41,400,000 kg. However, because of their small size and low numbers, ships from the South Sea Islands caught only 1.3% (551,250 kg) of total tuna catch for 1939.[16]

Nankô Suisan became involved in tuna fisheries after contracting with longliners in Fukushima in November 1939, and in Miyagi in 1940. It purchased bait — *nakaba iwashi* (one of the sardines) — in Misaki, and caught yellowfin tuna and bigeye tuna in the seas near Palau. The company began a full-scale tuna fishery in 1941, once it was determined that the catch would remain fresh after long-distance transportation.

Yellowfin tuna and bigeye tuna were the two major tuna fisheries in the South Sea Islands, but total catch of the former was considerably larger than the latter. The longliners also caught striped marlin, bonito and shark. Flying fish (*tobiowo*), and brown-striped mackerel scad (*muroaji*) were the main baitfish on Saipan, while brown-striped mackerel scad (*muroaji*) and sardine (*iwashi*) were used in the waters around Palau.

According to Table 6**,** tuna caught by longliners in the South Sea Islands increased from 858,793 kg in 1940, to 1,023,093 kg in 1941, after Nankô Suinsa began its tuna fishery. However, the catch in waters around the Saipan district decreased rapidly from 84,506 kg to 33,699 kg for unknown reasons.

In September 1941, a tuna-canning factory was opened on Malakal Island, Palau, after the catch of yellowfin started looking up. In December 1940, cans of tuna in oil were exported to New York from Palau, via Java in order to get around the high tariff imposed on Japanese marine products. Mitsubishi Shoji, a major trading firm in Japan, also exported 10,000 cases of canned tuna to Germany during this same period. Frozen fillet of yellowfin and bigeye tuna were also exported to the Chinese cities of Tientsin and Beijing. There are no details on tuna caught in waters around Saipan during this time period.

Graph 2 presents data on bonito and tuna catches in the Saipan district during 1922-1941. Note that the marked increase in bonito in the early 1930s is not matched by a similar increase in tuna. In all years, the bonito catch greatly exceeded the tuna catch. Furthermore, bonito was cyclical in that every three or four years the catches were huge, viz, in 1932, 1935, and 1939.

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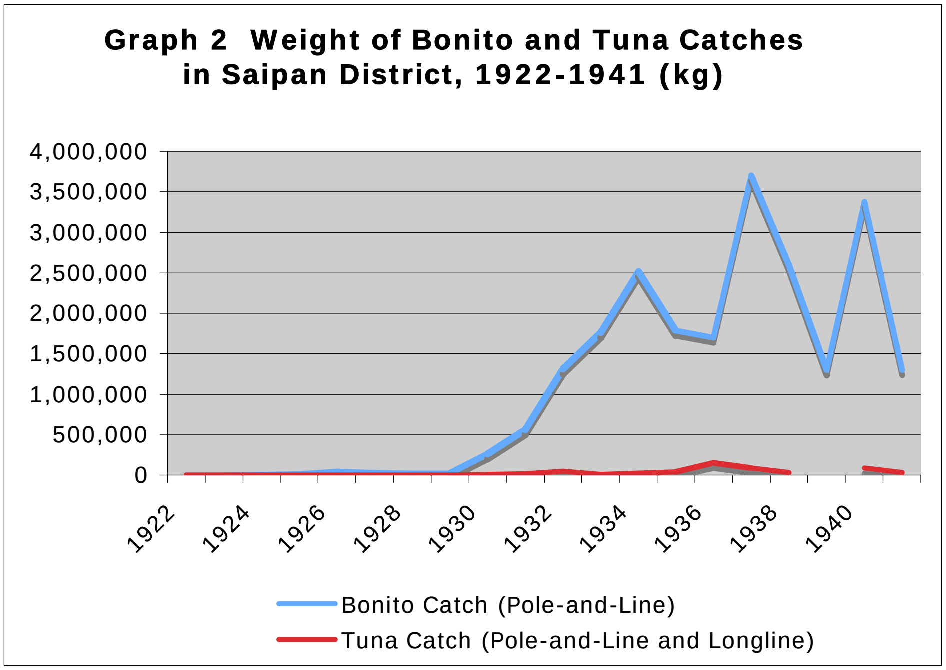
[16] Ibid.

Table 6 Tuna Catches and Dried Tuna Production in the South Sea Islands (S: Saipan District = Saipan, Tinian, and Rota)

	Permits of Tuna Fishery	Tuna Catches (kg)	Tuna Catches (yen)	Dried Tuna (kg)	Dried Tuna (yen)
1922	1 (Bonito & Tuna) **S: 1**	6,075 kg **S: 1,312 kg**	3,730 yen **S: 875 yen**	--- **S: ---**	--- **S: ---**
1923	2 (Bonito & Tuna) **S: 1**	6,652 kg **S: 1,252 kg**	3,673 yen **S: 888 yen**	--- **S: ---**	--- **S: ---**
1924	3 (Bonito & Tuna) **S: 2**	11,951 kg **S: 1,534 kg**	5,971 yen **S: 1,024 yen**	1,030 kg **S: ---**	3,744 yen **S: ---**
1925	4 (Bonito & Tuna) **S: 3**	12,229 kg **S: 1,403 kg**	4,557 yen **S: 749 yen**	1,061 kg **S: ---**	2,264 yen **S: ---**
1926	11 (Bonito & Tuna) **S: 6**	55,534 kg **S: 2,314 kg**	22,423 yen **S: 1,235 yen**	16,054 kg **S: 19 kg**	38,541 yen **S: 50 yen**
1927	12 (Bonito & Tuna) **S: 6**	54,266 kg **S: 2,906 kg**	24,327 yen **S: 1,475 yen**	6,169 kg **S: ---**	13,160 yen **S: ---**
1928	12 (Bonito & Tuna) **S: 5**	164,182 kg **S: 1,260 kg**	38,629 yen **S: 618 yen**	28,219 kg **S: ---**	45,160 yen **S: ---**
1929	17 (Bonito & Tuna) **S: 6**	172,001 kg **S: 562 kg**	31,825 yen **S: 300 yen**	33,735 kg **S: ---**	48,629 yen **S: ---**
1930	24 (Bonito & Tuna) **S: 8**	111,997 kg **S: 4,534 kg**	13,947 yen **S: 2,493 yen**	22,954 kg **S: 113 kg**	28,815 yen **S: 255 yen**
1931	36 (Bonito & Tuna) **S: 7**	211,910 kg **S: 16,734 kg**	29,898 yen **S: 5,622 yen**	42,665 kg **S: 755 kg**	44,388 yen **S: 855 yen**
1932	37 (Bonito & Tuna) **S: 10**	361,445 kg **S: 48,244 kg**	50,801 yen **S: 15,438 yen**	73,746 kg **S: 3,152 kg**	55,985 yen **S: 3,278 yen**
1933	51 (Bonito & Tuna) S: 16	374,796 kg **S: 9,584 kg**	59,811 yen **S: 2,908 yen**	68,626 kg **S: 4,100 yen**	76,410 yen **S: 3,493 yen**
1934		427,041 kg **S: 27,289 kg**	116,449 yen **S: 9,366 yen**	93,329 kg **S: 3,160 kg**	85,237 yen **S: 2,293 yen**
1935	13 **S: 10**	480,014 kg **S: 42,915 kg**	105,501 yen **S: 15,530 yen**	102,404 kg **S: 6,264 kg**	99,485 yen **S: 5,172 yen**
1936		587,116 kg **S: 151,019 kg**	110,160 yen **S: 52,857 yen**	71,972 kg **S: ---**	75,172 yen **S: ---**
1937	7 **S: 3**	681,176 kg **S: 88,876 kg**	90,828 yen **S: 27,121 yen**	384,011 kg **S: ---**	381,377 yen **S: ---**
1938	8 **S: 2**	270,899 kg **S: 33,920 kg**	42,934 yen **S: 11,786 yen**	49,127 kg **S: 675 kg**	41,634 yen **S: 608 yen**
1939	Japan: 40 Ships (120 tons), South Sea Islands: 10 Ships (20 tons)*	Japan & SSI 41,400,000 kg* SSI: 551,250 kg* SSI: 361.530 kg**	Japan & SSI 16,560,000 yen* SSI: 98,500 yen* SSI: 93,043 yen**	SSI: 54,831 kg**	SSI: 66.777 yen**
1940	23 **S: 2**	Japan & SSI: 64,875,000 kg* SSI: 858,793 kg **S: 84,506**	Japan & SSI: 25,950,000 yen* SSI: 306,126 yen **S: 34,787 yen**	85,496 kg **S: 101 kg**	119,140 yen **S: 284 yen**
1941***	21 **S: 2**	1,023,093 kg **S: 33,669 kg**	315,705 yen **S: 19,913 yen**	66,719 kg **S: ---**	129,882 yen **S: ---**

SSI: South Sea Islands
Sources: 1922-1932 statistics: Nan'yôchô, *Dainikai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1934), pp. 348-355; 1933 statistics: Nan'yôchô, *Daisankai, Nan'yôchô tôkei nenkan* (Palau: Nan'yôchô, 1935), p. 125-126.
1934-1942 statistics for tuna fishery permits: Nan'yôchô, *Nan'yô Guntô yôran*, 1934-1942.
1934-1937 statistics for fisheries except for tuna fishery permits: Nan'yôchô, *Nan'yôchô Suisan Shinkenjô yôran* (Palau: Nan'yôchô Suisan Shikenjô, 1938), pp. 42-58.
1938, 1940, and 1941 statistics: Nanyôchô, *Nan'yô Guntô yôran*, 1938, 1940, and 1941.
*1939 statistics: "Takumu daijin seigi Nanyôchô Suisan Shikenjô kansei chû kaisei ni kansuru ken" October 1, 1940.
**1939 statistics: Ôkurashô Kanrikyoku, *Nihonjin no kaigai katsudô ni kansuru rekishiteki chôsa: Tsûkan dai nijûissatsu Nanyô Guntô hen daini bunsatsu: Dainibu Nan'yô Guntô keizai sangyô*, 1949, p. 86-87, and pp. 147-148.
* 1940 statistics: "Takumu daijin seigi Nanyôchô Suisan Shikenjô kansei chû kaisei ni kansuru ken" October 1, 1940.
*** All statistics for tuna fishery for 1941 and 1942, printed in 1942 and 1943 editions of *Nan'yô Guntô yôran*, respectively, are identical. The statistics for 1941 are used in this table.



Source: See Table 5 and Table 6.

War and Fishery: 1941-1944

Because of the long-term Japan-China War that began in 1937, the Japanese government tightened material controls starting in late 1939. This caused a shortage of fuel and supplies for some fisheries. In particular, the shortage of fiber nets and line was serious. After the Pacific War broke out in December 1941, fishing vessels, along with their crews, were gradually requisitioned for military service. As of 1942, Nankô Suisan had offices in Tokyo, Saipan, Chuuk, Pohnpei, Kosrae, Jaluit, Dalian (China), Yaizu, and Okinawa. There were also offices at Guam, Ambon, Rabaul, Kavieng (New Ireland), and Manila — areas that Japanese forces had taken. However, because of the war, Japan's commercial fishing activities in the South Sea Islands declined.

After the outbreak of war with the U.S., the Nankô Suisan Saipan ice plant and cold storage facility were taken over by the Japanese Navy. All fresh and semi-processed bonito were distributed for military use. Dried bonito was also supplied to the military. In June 1942, 8,000 dried bonitos — emergency food for 4,000 military personnel — were distributed to the Japanese troops on Saipan. Some 10,000 additional Japanese army troops were landed on Saipan and Tinian after March 1944, and the factories and attached buildings of Nankô Suisan in Garapan were taken over completely by the military. The company employees, except for those engaged in fishing, were mobilized for construction work on airfields and fortifications, and fishing activities in the Mariana Islands ended completely when U.S. forces approached the islands in mid-1944.

Guam, a U.S. territory in the Mariana Islands since 1898, was occupied by Japan on December 10, 1941. According to Japanese Navy orders, Nankô Suisan's Saipan office established its Ômiya (Guam) Branch Office in Agana. Two bonito pole-and-line vessels from Saipan started fishing off Guam and supported the military's self-sufficiency efforts on the island. These vessels were later used to patrol around the island in anticipation of a U.S. attack, and fishing activities were dramatically reduced. The following is a summary of the Japanese Navy's Civil Administration Department report on Nan'kô Suisan's fishing on Guam between 1942 and 1943:

> "The company began bonito fishing with two 21-ton ships southwest of Matsuyama (Merizo), in the southern part of the island, and between Guam and Rota. A dried bonito factory was built to process 60 *kan* (225 kg) of bonito per month, but the result was disappointing, with 'no hope of increasing production' because of an unfavorable period of migratory fish, and few schools of baitfish in the Guam and Saipan areas. Large catches were not expected because of the influence of seasonal winds and rough waters. The catch for 1942 was 82,170 kg of bonito and 7,230 kg of other types of fish, totalling 89,400 kg. There was no catch of other fish in July, October, and December. Since no bonito was caught between January and April, and between June and July 1943, the total fell to 7,340 kg for that year. Other fish catches also decreased to 45,465 kg. After the *Daini Tôkaimaru*, a cargo-passenger ship and a commercial cruiser, was sunk in Apra Harbor in January 1943, the fisheries rapidly declined."[17]

Conclusion

During the Experimentation Period, 1922-1931, fishing permits, total fish catches, including bonito catches, in the South Seas Islands increased markedly during the 1920s and early 1930s (Table 1-3). As well, the Saipan district went through an historic change in 1930 and 1931. The Saipan district caught a large percentage of bonito (20% in 1931, 27% in 1932 and 26% in 1933) in the South Sea Islands, even though the seas around Saipan were regarded as poor fishing grounds. This increase in bonito catches resulted from the introduction of motorized vessels and increased Japanese government support (Table 2-3).

From 1931-1941, the government's national fisheries policy was directed at increasing the amount of fish caught and processed for consumption in Japan and China. Catches of bonito rose markedly in the 1930s, but the Saipan district's contribution actually declined percentagewise (Table 5 and Graph 2). This shows that the fishing grounds expanded in both the South Sea Islands and further south to newly occupied areas.

In the period from 1941 to 1942, fisheries in the South Sea Islands collapsed due to the Pacific War. Fisheries in the Saipan district were no exception.

In conclusion, it should be pointed out that from the 1930s through to the 1940s, the fisheries in the South Sea Islands were influenced not only by the coming of war, but by Japanese government policy, both in terms of financial assistance and administrative policy.

[17] Sanbô Honbu, *Ômiyatô heiyô chishi shiryô*, 1944, p. 60.