

The Deep-Sea Tortugas Shipwreck, Florida: the Animal Bones

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The excavation of the Tortugas shipwreck between 1990-91 at a depth of 405m off the Tortugas islands in the Florida Keys incorporated the pioneering use of a sediment removal and filtration sieving system (SeRF), which was built into the rear of the Remotely-Operated Vehicle Merlin. Coupled with excavation by Remotely-Operated Vehicle, this tool enabled a collection of 165 animal bones to be recovered from this Tierra Firme fleet *navio* lost in 1622 and identified as the Portuguese-built and Spanish-operated 117-ton *Buen Jesús y Nuestra Señora del Rosario*.

The bones were re-examined by the author in 2011, which resulted in the identification of a typical assemblage characterized by the consumption onboard ship of pig, sheep, cattle and chickens. The presence of black rat bones is not unexpected in light of the historically attested 'plague' that ran riot on the 1622 fleet. More rare are the discovery of the ship's cat and the unparalleled identification of a small parrot (cf. blue-headed), possibly a type of high-status cargo formerly known only from historical sources.

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1. Introduction

A collection of 165 animal bones was recovered from the deep-sea Tortugas shipwreck in 1990-91 and was submitted for analysis in 2011. Analytical techniques followed standard zooarchaeological procedures. Wherever possible, identifications of taxa and anatomy were made using the author's modern comparative osteological collections and with reference to established works (Boessneck *et al.*, 1964; Gilbert *et al.*, 1981; Kozuch and Fitzgerald, 1989; Schmid, 1972). For specimens of species outside the range of the author's collections, identifications were made with the kind assistance of colleagues working at the Natural History Museum (Tring) and Royal Albert Memorial Museum, Exeter.

Measurements (in mm) were taken on selected specimens using Draper dial calipers (graduated 0.02mm), following the system of von den Driesch (1976) for the mammal and bird bones and Kozuch and Fitzgerald (1989) for the shark vertebrae. Determination of sex in the sheep innominate (TOR-90-00175-BN) was based on the criteria of Armitage (1977: 78-81) and the criteria of West (1982) for the domestic fowl tarsometatarsus (TOR-90-00216-BN). Wear stages recorded in the pig molar teeth followed the classification system of Grant (1982). A summary of the results of the analysis carried out on the recovered faunal assemblage is presented in Tables 1-2.

2. Preservation

Although a few of the Tortugas shipwreck's bones were remarkably well preserved, the majority were assessed as

poorly/moderately well preserved with many exhibiting evidence of post-depositional attritional damage from seabed sedimentary disturbance and, in some cases, also corrosion effects from prolonged exposure in sea water.

Whereas the overall condition of the bones and pattern of butchery recorded in the cattle vertebra, pig mandible and bird radius was consistent with that of other 17th-century archaeological food waste examined by the author, the two sawn pieces of pig vertebrae raised some concerns owing to their exceptionally good state of preservation, unstained appearance and evidence of fine-toothed sawing, all of which suggested the distinct possibility that these specimens were intrusive.

The use of saws in butchery practice dates from the latter half of the 18th century at the earliest; before this period, disjuncting/cutting up the carcass in preparation for cooking was performed using axes, cleavers and boning knives. It seemed highly improbable, therefore, that the sawn pig vertebrae were contemporary with the other food bones from the shipwreck. This observation is further supported by the fact that these specimens match exactly bones of modern pork chops/'baby back ribs' in the author's comparative osteological collections. In consequence, these specimens have been omitted from the final analysis and interpretation below.

Three other specimens displayed evidence of butchery marks contemporary with the final voyage. The thoracic vertebra of a cattle bone (TOR-90-00182-BN; Fig. 21) had been chopped, as had the mandible of a pig (TOR-90-00192-BN; Fig. 9). The radius of a bird, possibly a turkey (TOR-90-00301-BN; Fig. 15), exhibited knife cuts.

| Class | Taxon | Common Name | NISP |
|----------------------|---------------------------------|------------------------|--------------|
| Mammalia | <i>Bos</i> (domestic) | Cattle | 3 |
| | cf. <i>Bos</i> (domestic) | cf. cattle | 2 |
| | <i>Ovis</i> (domestic) | Sheep | 1 |
| | <i>Ovis/Capra</i> (domestic) | Sheep/Goat | 3 |
| | <i>Sus</i> (domestic) | Pig | 22 |
| | <i>Sus</i> (?) (domestic) | Pig (?) | 4 |
| | <i>Felis</i> (domestic) | Domestic cat | 2 (MNI = 1) |
| | <i>Rattus rattus</i> | Black Rat | 21 (MNI = 5) |
| | Family <i>Delphinidae</i> | Dolphin | 1 |
| | Indeterminate | | 18 |
| Aves | <i>Gallus gallus</i> (domestic) | Chicken | 4 |
| | cf. <i>Pionus menstruus</i> | cf. blue-headed parrot | 2 (MNI = 1) |
| | <i>Meleagris gallopavo</i> (?) | Turkey (?) | 1 |
| | Unidentified | | 3 |
| Elasmobranchiomorphi | Family <i>Carcharhinidae</i> | Requiem sharks | 6 |
| Osteichthyes | Family <i>Serranidae</i> | Grouper spp. | 3 |
| | Unidentified | Reef fishes | 37 |
| Reptilia | Family <i>Chelonidae</i> | Marine turtle | 1 |
| | Unidentified | Turtle/tortoise (?) | 5 |
| Indeterminate | Bone fragments | | 26 |

Table 1. Numbers of animal bones present (NISP) on the Tortugas shipwreck.

3. Interpretation & Discussion

Numerically (even after excluding the two sawn vertebrae), pig bones from the wreck predominated over those of cattle and sheep/goats (Table 1; Figs. 1-12), reflecting the significant contribution this animal made to the diet of Spanish mariners serving on board Indies ships, an observation in keeping with the official ration system for such vessels in the 17th century (Phillips, 1986: 241). Some of the bones on the Tortugas wreck could have derived from live pigs carried on board ship to provide fresh meat for the captain's table during the trans-Atlantic crossing, a common practice testified in historical accounts (cf. Newton, 1928: 374).

However, other historical sources suggest an alternative interpretation should also be considered for the pig extremity foot bones. Among the supplies of foodstuffs carried on board the *Nina* for the voyage to the New World in 1498 were "three pannier baskets of pigs' feet" (Lyon, 1989: 64). Pigs' feet are also mentioned in the official ration lists for sailors serving on Spanish Indies

ships in the 17th century (Phillips, 1986: 168). Based on such records, it is suggested that the seven metapodial bones from the Tortugas wreck may not necessarily have derived from live animals, but could instead represent the remains of preserved (dried/salted) pigs' trotters.

Similarly, it was not possible to establish with any confidence whether the chopped pig jawbone (TOR-90-00192-BN; Fig. 9) from the wreck originated from a live animal that had been slaughtered/butchered on board as a source of fresh meat or was from preserved salt pork that formed part of the ship's store of provisions. In the Tortugas specimen the bone had been chopped/cleaved transversely through the ascending ramus just below the condylar process, a butchery technique similarly noted on four pig jawbones from the wreck of the Spanish Armada wreck *La Trinidad Valencera* of 1588, which were believed to be cured (dry-salted) cheek pieces (including the tongue) – a convenient, easily packed/transported meat ration (Armitage, 1995a: 35-6).

| Inv. No. | Class/Taxon/ Common Name | Bone Element/ NISP/Side | Preservation; Corroded/Eroded; Abraded/Attrition; Staining | Notes |
|-------------------|--|----------------------------|--|---|
| CATTLE | | | | |
| TOR-90-00165-BN | Mammalia, <i>Bos</i> (domestic), cattle | Patella 1 | Moderate/good; corroded, pitted, abraded; grayish iron staining | |
| TOR-90-00176-BN | Mammalia, <i>Bos</i> (domestic), cattle | Radius 1 | Good; graying brown staining | Piece of shaft, spiral fractured/broken |
| TOR-90-00182-BN | Mammalia, <i>Bos</i> (domestic), cattle | Thoracic vertebra; 1 | Good; brownish staining | Chopped piece of centrum/fused epiphysial plate |
| TOR-90-00194-BN | Mammalia, cf. cattle | Vertebra 1 | Moderate/good; abraded; dark graying staining | Broken piece of unfused/detached epiphyseal plate |
| TOR-90-00195-BN | Mammalia, cf. cattle | Vertebra 1 | Moderate; pitted; some abrasion; creamy with iron staining | Broken piece of unfused/detached epiphyseal plate |
| SHEEP/GOAT | | | | |
| TOR-90-00175-BN | Mammalia, <i>Ovis</i> (domestic), sheep | Innominate; 1 Right | Good; some erosion & abrasion; graying brown staining | Female; depth rim of acetabulum 1.54mm, LA 28.1mm, LAR 26.7mm |
| TOR-90-00179-BN | Mammalia, <i>Ovis/Capra</i> (domestic), sheep/goat | Rib 1 | Poor; corroded; very abraded; brownish gray staining | 2 broken pieces of shaft |
| TOR-90-00180-BN | Mammalia, <i>Ovis/Capra</i> (domestic), sheep/goat | Rib 1 | Moderate/good; browning staining | Articular end & shaft |
| TOR-90-00309-BN | Mammalia, <i>Ovis/Capra</i> (domestic), sheep/goat | Rib 1 | Moderate/slightly abraded; grayish staining | Shaft |
| PIG | | | | |
| TOR-90-00166-BN | Mammalia, <i>Sus</i> (domestic), pig | Femur 1 | Moderate/good; corroded & abraded; grayish iron staining | Shaft only survives; from young animal |
| TOR-90-00167-BN | Mammalia, <i>Sus</i> (domestic), pig | Radius 1 | Moderate/good; corroded & abraded; grayish staining | Shaft - prox. & distal epiphyses unfused/detached; from young animal under 1 year |
| TOR-90-00169-BN | Mammalia, <i>Sus</i> (domestic), pig | Femur; 1 Right | Good; grayish with iron streaks | Shaft with prox. & distal epiphyses unfused/detached; subadult |
| TOR-90-00177-BN | Mammalia, <i>Sus</i> (domestic), pig | Humerus; 1 Right | Very poor; heavily corroded & abraded; creamy white | Shaft |
| TOR-90-00178-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Very poor; heavily corroded & abraded; creamy white | Distal end only; distal epiphysis unfused/detached |
| TOR-90-00181-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Good; very pale graying staining | Distal epiphysis unfused/detached |
| TOR-90-00183-BN | Mammalia, <i>Sus</i> (domestic), pig | Metacarpus IV 1 | Good; slightly; very slightly; grayish staining | Complete except for unfused/detached distal epiphysis |

Table 2A. Catalogue of diagnostic faunal remains from the Tortugas shipwreck.

| Inv. No. | Class/Taxon/ Common Name | Bone Element/ NISP/Side | Preservation; Corroded/Eroded; Abraded/Attrition; Staining | Notes |
|------------------|---|-------------------------------|--|---|
| (PIG) | | | | |
| TOR-90-00184-BN | Mammalia, <i>Sus</i> (domestic), pig | Fibula 1 | Poor; very corroded; very eroded; light grayish staining | Piece of shaft only |
| TOR-90-00185-BN | Mammalia, <i>Sus</i> (domestic), pig | Tibia; 1 Right | Good; graying/ tinged iron staining | Unfused/detached distal epiphysis; young animal |
| TOR-90-00190-BN | Mammalia, cf. pig | Vertebra 1 | Very good; creamy white | Unfused/detached epiphyseal plate |
| TOR-90-00191-BN | Mammalia, cf. pig | Vertebra 1 | Very good; creamy White/slight iron staining | Part of an unfused/ detached epiphyseal plate |
| TOR-90-00192-BN | Mammalia, <i>Sus</i> (domestic), pig | Mandible; 1 Left | Good; very slightly abraded; brownish gray staining | Condylar process/piece of ascending ramus; butchered/chopped |
| TOR-90-00290-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Moderate; slightly abraded; grayish staining | Distal epiphysis unfused/detached |
| TOR-90-00292-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Moderate; slightly abraded; grayish staining | Distal epiphysis unfused/detached |
| TOR-90-00294-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Moderate; abraded; grayish staining | Distal end broken off |
| TOR-90-00295-BN | Mammalia, <i>Sus</i> (domestic), pig | Metapodial 1 | Good; grayish staining | Distal epiphysis only/ unfused & detached |
| TOR-90-00302-BN | Mammalia, <i>Sus</i> (domestic), pig | Incisor 1 | Very good; not stained | |
| TOR-90-00303-BN | Mammalia, <i>Sus</i> (domestic), pig | Premolar tooth | Very good; not stained | Lower P2 |
| TOR-90-00304-BN | Mammalia, <i>Sus</i> (domestic), pig | dp4 1 | Very good; not stained | Deciduous fourth premolar tooth; wear stage d |
| TOR-90-00305-BN | Mammalia, <i>Sus</i> (domestic), pig | Molar tooth 1 | Good; some patches brown staining | Some damage (post depositional) to roots, otherwise complete; cf. second lower molar, left; wear stage b |
| TOR-90-00306-BN | Mammalia, <i>Sus</i> (domestic), pig | Molar tooth 1 | Good/fragment; not stained | Crown only survives, in pieces |
| TOR-90-00307-BN | Mammalia, <i>Sus</i> (domestic), pig | Molar tooth 1 | Good/fragment; not stained | Crown only survives, in pieces |
| TOR-90-00308-BN | Mammalia, <i>Sus</i> (domestic), pig | Molar tooth 1 | Good; not stained | Some damage (post depositional) to roots, otherwise complete; bag includes small frag. from another molar tooth (not acc. separately) |
| CAT | | | | |
| TOR-90-00193-BN | Mammalia, <i>Felis catus</i> , domestic cat | Mandible 2 Right & left | Very good; white | Right & left paired jawbones from adult cat. Measurements (mm): [1] 53.5; [5] 18.4; [7] 6.7; [8] 24.9; diastema 5.9 |
| BLACK RAT | | | | |
| TOR-90-00196-BN | Mammalia, <i>Rattus rattus</i> , black rat | Tibia 1 Right | Good; gray brown staining | Tibia & fibula intact except for unfused/detached prox. Epiphysis (dist. epiphysis is fused) |

Table 2B. Catalogue of diagnostic faunal remains from the Tortugas shipwreck.

| | | | | |
|----------------------|--|--------------------------|--|---|
| (BLACK RAT) | | | | |
| TOR-90-00197-BN | Mammalia, <i>Rattus rattus</i> , black rat | Tibia 1 Right | Good; gray brown staining | Lacks fibula, otherwise intact apart from unfused/detached prox. epiphysis |
| TOR-90-00198-BN | Mammalia, <i>Rattus rattus</i> , black rat | Tibia 1 Left | Moderate; gray brown staining | Lacks fibula plus part of proximal end/broken off |
| TOR-90-00199-BN | Mammalia, <i>Rattus rattus</i> , black rat | Tibia 1 Right | Moderate; slightly abraded; gray brown staining | Lacks fibula plus part of proximal end/broken off |
| TOR-90-00200-BN | Mammalia, <i>Rattus rattus</i> , black rat | Tibia 1 Left | Good; slightly abraded; gray brown staining | Lacks fibula plus part of proximal end/broken off |
| TOR-90-00201-BN | Mammalia, <i>Rattus rattus</i> , black rat | Innominate 1 Right | Moderate; slightly abraded; gray brown staining | Acetabulum is fused (adult); owing to broken/incomplete ischium unable to ascertain sex |
| TOR-90-00202-BN | Mammalia, <i>Rattus rattus</i> , black rat | Femur 1 Right | Moderate; gray brown staining | Shaft intact except for damaged distal end; prox. epiphysis unfused/detached, probably same with distal Epiphysis |
| TOR-90-00203-BN | Mammalia, <i>Rattus rattus</i> , black rat | Humerus 1 | Poor/moderate; slightly abraded; gray brown staining | Shaft, distal end broken off; prox. epiphysis unfused/detached |
| TOR-90-00204-BN | Mammalia, <i>Rattus rattus</i> , black rat | Humerus 1 Left (?) | Poor; abraded; gray brown staining | Shaft fragment |
| TOR-90-00205-BN | Mammalia, <i>Rattus rattus</i> , black rat | Metapodial 2 | Good; gray brown staining | Two complete metapodials (foot bones) |
| TOR-90-00206-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 1 | Good | Upper incisor |
| TOR-90-00207-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 1 | Good | Upper incisor |
| TOR-90-00208-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 1 | Good | Upper incisor |
| TOR-90-00209-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 2 | Good | 1 upper & 1 lower incisor |
| TOR-90-00210-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 1 | Good | 1 lower incisor |
| TOR-90-00211-BN | Mammalia, <i>Rattus rattus</i> , black rat | Incisor 1 | Good | 1 lower incisor |
| TOR-90-00287-BN | Mammalia, <i>Rattus rattus</i> , black rat | Metapodial 1 | Fragment; abraded; grayish staining | Dist. part of bone |
| TOR-90-00289-BN | Mammalia, <i>Rattus rattus</i> , black rat | Metapodial 2 | Good; gray brown staining | Complete; distal epiphysis fused |
| DOMESTIC FOWL | | | | |
| TOR-90-00212-BN | Aves, <i>Gallus gallus</i> , domestic fowl | Coracoid; 1 Left | Good; gray brown staining | Small scrawny chicken. Measurements (mm): GL 51.0 est.; Lm 48.5; BF - ; Bb - |
| TOR-90-00214-BN | Aves, <i>Gallus gallus</i> , domestic fowl | Humerus 1 | Moderate; gray staining | Shaft; prox. & distal ends damaged (post deposition); SC 6.2; rat gnawing (incisor grooves) marks mid shaft |

Table 2C. Catalogue of diagnostic faunal remains from the Tortugas shipwreck.

| | | | | |
|------------------------|--|------------------------------|--|---|
| (DOMESTIC FOWL) | | | | |
| TOR-90-00216-BN | Aves, <i>Gallus gallus</i> , domestic fowl | Tarsometatarsus 1 | Moderate/good; very slightly abraded; gray staining | Prox. end missing; unspurred = female; Measurements (mm): SC 5.4 |
| TOR-90-00224-BN | Aves, <i>Gallus gallus</i> , domestic fowl | Carpometacarpus 1 Left | Moderate; some abrasion; gray brown staining | Broken/incomplete specimen; small scrawny chicken |
| PARROT | | | | |
| TOR-90-00170-BN | Aves, cf. <i>Pionus menstruus</i> , blue- headed parrot | Tarsometatarsus 1 Left | Moderate; some damage, whitish | Measurements (mm): GL 17.3; Bp 7.0; Bd 8.8; SC 4.0 |
| TOR-90-00217-BN | Aves, cf. <i>Pionus menstruus</i> , blue- headed parrot | Femur 1 Left | Good; very slightly abraded; gray staining | Measurements (mm): GL 38.35; Bp 6.9; Bd 6.4; SC 2.9 |
| MISCELLANEOUS | | | | |
| TOR-90-00168-BN | Mammalia, unidentified | Fragments 2 -- | Poor/moderate; corroded & abraded; grayish staining | |
| TOR-90-00186-BN | Mammalia, not pig (?) | 1 | Moderate; abraded/ waterworn; grayish staining | |
| TOR-90-00213-BN | Aves, indeterminate | Tibiotarsus 1 | Moderate; slightly abraded; gray brown staining | Shaft fragment |
| TOR-90-00215-BN | Aves, indeterminate | Tibiotarsus 1 | Moderate; very slightly abraded; gray staining | Shaft only |
| TOR-90-00296-BN | Aves, indeterminate | Humerus 1 | Moderate/good; grayish brown staining | Shaft only; both ends broken |
| TOR-90-00301-BN | Aves, indeterminate | Radius 1 | Moderate; orange staining | Proximal part of radius of an immature bird, cf. size of a turkey; knife cut marks present |
| TURTLE | | | | |
| TOR-90-00174-BN | Reptilia, Family <i>Chelonidae</i> , turtle | Coracoid 1 | Poor; very corroded; very abraded; waterworn; whitish with iron staining | Large marine turtle (cf. size of green turtle) |
| cf. GROUPE | | | | |
| TOR-90-00235.1-BN | Osteichthyes, Family <i>Serranidae</i> , grouper | 1 Left | Very good; pale graying staining | |
| TOR-90-00235.2-BN | Osteichthyes, Family <i>Serranidae</i> , grouper | 1 | Very good; pale graying staining | |
| TOR-90-00237-BN | Osteichthyes, Family <i>Serranidae</i> , grouper | 1 Right | Moderate; slightly abraded; graying staining | |

Table 2D. Catalogue of diagnostic faunal remains from the Tortugas shipwreck.

| SHARK | | | | |
|-----------------|--|---------------|---|---|
| TOR-90-00225-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): MLB 22.5; CCL 12.4; DVH - ; intraforaminal width 4.5; interforaminal width 6.3 |
| TOR-90-00226-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): MLB [23.8]; CCL [14.1]; DVH [22.5]; intraforaminal width 3.4; interforaminal width 4.3 |
| TOR-90-00227-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): too heavily abraded/worn |
| TOR-90-00228-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): MLB 17.3; CCL 6.6 ; DVH 17.2; intraforaminal width 3.1; interforaminal width 2.9 |
| TOR-90-00229-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): MLB - ; CCL 4.5 ; DVH 13.7; intraforaminal width 2.1; interforaminal width 3.8 |
| TOR-90-00230-BN | Elasmobranchiomorphi, Family <i>Carcharhinidae</i> , Requiem shark | Vertebra 1 | Poor; corroded; heavily abraded; chalky white | Post-depositional damage; measurements (mm): MLB 14.8; CCL 7.9 ; DVH - ; intraforaminal width 3.6; interforaminal width 4.9 |

Table 2E. Catalogue of diagnostic faunal remains from the Tortugas shipwreck.

Four domestic fowl *Gallus gallus* bone elements were identified (one coracoid, one carpometacarpus, one humerus, one tarsometatarsus), which were not unexpected because it is well documented that live chickens were commonplace on Spanish ships sailing to and from the Americas in this period (Figs. 13-14). For instance, in the official records of the fleet sailing to New Spain in 1631, 210 hens were noted as having been consumed by sick sailors during the voyage (Hamilton, 1929: 441). An indication of the numbers of chickens carried onboard Spanish vessels is further revealed in records relating to the ill-fated galleon *Nuestra Señora de Los Tres Reyes*. When loading supplies at Portobello in preparation for the homeward voyage in 1634, 87 “live chickens in a cage” taken on board were intended for feeding sick sailors during the trans-Atlantic crossing (Phillips, 1990).

Measurements taken on selected *Gallus gallus* bones revealed that those on board the Tortugas vessel were scrawny, bantam-sized birds compared to modern boiling and laying chickens (Tables 4-5). The Tortugas chickens in this respect matched those from 16th-century Spanish

St. Augustine, Florida, whose very small size was “comparable to a Mediterranean class of Brown Leghorn Bantam” (Reitz and Scarry, 1985: 71).

In addition to hens, live sheep were frequently carried on Spanish ships to provide special food for sick sailors, as well as to supplement the diet of the ships’ higher-ranking officers/passengers (Phillips, 1986: 178). This practice probably accounts for the presence of the female sheep pelvis bone (TOR-90-00175-BN; Fig. 16) among the faunal assemblage recovered from the wreck.

Apart from a single specimen, little could be inferred from so few specimens of cattle bones other than that they are probably representative of the salt beef and/or fresh beef consumed on board (Figs. 16-21). Specimen TOR-90-00182-BN, a thoracic vertebra (Fig. 21), however, was particularly noteworthy because it exhibited evidence of multiple chopping, a tertiary butchery pattern observed previously by the author in five cattle vertebrae recovered from the wreck of the 1588 Spanish Armada vessel *La Trinidad Valencera* (Armitage, 1995a).

| Skeletal Remains | Cattle | Cf. Cattle | Sheep | Sheep/Goat | Pig | Cf. Pig |
|---------------------------|----------|------------|----------|------------|-----------|----------|
| Mandible | | | | | 1 | |
| Incisor | | | | | 1 | |
| Upper/Lower Cheek Teeth | | | | | 6 | |
| Indet. Vertebral Fragment | | 2 | | | | 4 |
| Thoracic Vertebra | 1 | | | | | |
| Lumbar Vertebra | | | | | 1 | |
| Rib | | | | 3 | | |
| Humerus | | | | | 1 | |
| Radius | 1 | | | | 1 | |
| Metacarpus IV | | | | | 1 | |
| Innominate | | | 1 | | | |
| Femur | | | | | 2 | |
| Tibia | | | | | 1 | |
| Fibula | | | | | 1 | |
| Patella | 1 | | | | | |
| Metapodial | | | | | 6 | |
| TOTALS | 3 | 2 | 1 | 3 | 22 | 4 |

Table 3. Skeletal elements of the main domesticates from the Tortugas shipwreck.

| Site | Date | | N | Mean | Min. | Max. | Reference |
|---|--------------------------|-----|---------|------|------|-----------|----------------------|
| St. Augustine, Florida | 16 th century | GL | 3 | 52.0 | 51.0 | 53.0 | Reitz & Scarry, 1985 |
| | | Lm | 5 | 48.0 | 46.0 | 50.0 | |
| Tortugas shipwreck, Florida, inv. TOR-90-00212-BN | 1622 | GL* | 1 | | | 51.0 est. | Armitage, 2012 |
| | | Lm | 1 | | | 48.5 | |
| <i>Earl of Abergavenny</i> shipwreck, Dorset | 1805 | GL | 2 | | 54.5 | 62.4 | Armitage, 2002 |
| | | Lm | 2 | | 51.7 | 59.2 | |
| Laying hen, Booth Museum collections (102093) | Modern | GL | 1 | | | 60.6 | Armitage |
| | | Lm | 1 | | | 57.6 | |
| Black Minorca bantam, English Heritage collections (AML 2787) | Modern | GL | 1 | | | 52.9 | Armitage |
| | | Lm | No data | | | | |

* The Tortugas shipwreck specimen's GL value is estimated and allows for the slight reduction by post-depositional damage.

Table 4. Size of the chicken coracoid from the Tortugas shipwreck in comparison with archaeological and modern specimens. Measurements (in mm): GL greatest (diagonal) length; Lm medial length.

Such chopped pieces of vertebrae reveal the extent to which cattle carcasses were cut up in preparation for cooking meals onboard ship and perhaps were the basis of the “dishes of broth” referenced by Italian Priest Gemelli during his Pacific voyage from the Philippines to Mexico in the late 17th century (Macintyre, 1979: 115). Significantly, both the Tortugas wreck and *La Trinidad Valencera* bones derived from very small cattle. Similar small-sized

cattle were represented by vertebrae examined from the 16th-century Emanuel Point shipwreck, Pensacola, Florida (Baker, 1995). Comparison may be made with the exceptionally large/robust cattle raised by the Spanish on Hispaniola during the same period – as evidenced by the zooarchaeological evidence from Puerto Real (Reitz and Ruff, 1994: 706) – and said to be much superior in size and appearance to those from Spain (Reitz, 1992: 87).

| Site | Date | SC | N | Mean | Min. | Max. | Reference |
|---|------------------------------|----|---|------|------|------|----------------------|
| St. Augustine, Florida | 16 th century | SC | 4 | 5.1 | 4.6 | 6.0 | Reitz & Scarry, 1985 |
| Tortugas shipwreck, Florida, inv. TOR-90-00216-BN | 1622 | SC | 1 | | | 5.4 | Armitage, 2012 |
| Stonewall Spanish shipwreck, Bermuda | Mid-17 th century | SC | 4 | 6.3 | 5.2 | 7.1 | Armitage, 1997 |
| Readers Point British wreck, Jamaica | 18 th century | SC | 1 | | | 6.1 | Armitage, 1995c |
| <i>Earl of Abergavenny</i> shipwreck, Dorset | 1805 | SC | 1 | | | 6.6 | Armitage, 2002 |
| Laying hen, Booth Museum collections (102093) | Modern | SC | 1 | | | 8.0 | Armitage |
| Boiling hen (author's collections) | Modern | SC | 1 | | | 7.6 | Armitage |

Table 5. Size of the chicken tarsometatarsus from the Tortugas shipwreck in comparison with archaeological and modern specimens. Measurement (in mm): SC minimum shaft width. All specimens female (unspurred).

Distinctive rodent tooth gnawing marks were identified on the mid shaft of a chicken humerus from the wreck (TOR-90-00214-BN; Fig. 13) and indicated that this bone had been scavenged by a hungry shipboard rat. Even more tangible evidence for the presence of these rodents on this vessel was provided by 21 bone elements indentified as the remains of at least five black rats, *Rattus rattus* (Figs. 22-27):

- Incisor: 7
- Humerus: 2
- Innominate: 1
- Femur: 1
- Tibia: 5
- Metapodial: 5

The Tortugas rat evidence sheds further light on the known problem of rat infestation on the 1622 fleet. Contemporary accounts reveal that the crews not only suffered hurricanes, but were also threatened by a plague of rats. On one ship, over one thousand were killed while the vessel was in Havana, with several thousand more subsequently discovered when the vessel was at sea (Phillips, 1986: 157). These rats reportedly caused widespread destruction, gnawing through stored food supplies and contaminating the fresh water in barrels, as well as invading the chicken coops to attack and eat the fowl (Stemm *et al.*, 2013: 55).

Despite the often reputed strong swimming abilities of rats, experiments carried out by Spennemann and Rapp (1987) revealed that even in the relatively calm and warm lagoonal waters of the South Pacific black rats experienced

difficulties remaining afloat for more than 20 minutes. On the basis of such evidence it is to be presumed that rats trying to swim away from the doomed vessels of the 1622 fleet would very quickly have become exhausted and drowned in the turbulent storm-tossed sea. Others trapped below decks also drowned; their bones found in the wreck serve as testimony to their fate.

Given the commonplace occurrence of rats on European vessels of the period (cf. Macintyre, 1979: 110; Phillips, 1986: 157; Armitage 1989; Armitage, 1995b), it is not surprising that cats were frequently taken on board in order to attempt to control the numbers of such unwelcome vermin. Contemporary eyewitness references were made to ships' cats (see, for example, Pedro Fernandez de Quiros: Markham, 1967: 393). Faunal remains from shipwrecks also bear witness to this practice, including from the Tortugas wreck, which yielded right and left lower jawbones (TOR-90-00193-BN; Figs. 28-29) from an adult cat. Metrical comparison with archaeological and modern data revealed that the Tortugas cat would have been of below average size for the 17th century and a very small individual when judged against the majority of present day domestic cats (Table 6).

Cat bones are also associated with a small number of Spanish and English shipwrecks of differing status. An ulna was recovered from the Spanish armada *Trinidad Valencera*, lost off the coast of Donegal, Ireland, in 1588 (Armitage, 1995a). The English merchant vessel *Sea Venture*, which foundered off Bermuda in 1609, contained a cat's fibula (Armitage, 1987; 1989), while a cat's mandible was present on HMS *Sapphire*, wrecked in Bay Bulls, Newfoundland, in 1696 (Cumbaa, 1979).

Although the majority of the bones of reef fishes in the Tortugas shipwreck faunal assemblage was probably intrusive material, deriving from fish that had lived and died in the vicinity of the wreck, and are thus omitted from this study, the three bones of grouper (dentary, maxilla and premaxilla) (TOR-90-00235.1-BN, TOR-90-00235.2-BN and TOR-90-00237-BN) may perhaps represent waste from food consumed on board. According to Randall (1968: 57), “groupers are [today considered] the most valuable food fishes of the tropical seas” and European mariners in the 17th century were also clearly acquainted with the food value of such fish, as illustrated by William Dampier’s declaration that the “grooper [sic] is good sweet meat” (Dampier, 1697; Gray, 1968: 70).

Archaeological evidence for the consumption of grouper on board a mid 17th-century Spanish ship lost off Bermuda was provided by a butchered (chopped) dentary of this species recovered from the Stonewall wreck (Armitage, 1997). Burnt and cut Cravalle Jack (*Caranx hippos*) bone elements from the wreck of the *Nuestra Señora de Atocha* further support the inclusion of fresh caught fish in the Spanish shipboard diet (Chapin, 1990: 40). It must be presumed that the Stonewall and *Atocha* specimens are not isolated instances of Spanish mariners exploiting locally abundant reef fishes as a food source. Historical sources reveal that crews of Spanish Indies treasure ships in this period were encouraged to augment their shipboard rations while at anchor and awaiting departure from New World ports, and for this purpose their ships were routinely equipped with “fish hooks and other fishing paraphernalia” (Hamilton, 1929: 437).

As with the reef fish bones, the Requiem shark vertebrae found on the Tortugas wreck could be intrusive material, but it is notable that while English seamen of the period considered sharks to be “malevolent fish” and “unwholesome as food” (see Unwin, 1961: 113), and would only catch and eat such creatures when faced with starvation (cf. Dampier, 1684; Masfield, 1906: 107), their Spanish counterparts in the New World apparently held no such qualms at eating shark meat. As noted by Reitz and Scarry (1985: 76) and Reitz (1992: 88-9), together with rays and marine bony fishes, sharks were a major vertebrate group exploited by 16th-century Spanish coastal settlements in Florida. However, all the shark vertebrae from the wreck site had every appearance of being intrusive owing to their poor preservation and absence of any evidence of butchery.

The single, positively identified marine turtle bone, a coracoid (TOR-90-00174-BN; Fig. 30) may be considered intrusive to the site in the absence of any butchery marks and the poor preservation (leached/abraded/water-worn condition). The identification of other presumed

| Site | Date | N | Min. | Max. | Mean |
|-----------------------------|-------------------------------------|---|------|------|------|
| Tortugas shipwreck, Florida | 1622 | 1 | | 18.4 | |
| Cheapside | c. 1600 | 1 | | 18.2 | |
| Aldgate | First half 17 th century | 2 | 18.8 | 19.9 | |
| London Wall | Mid-17 th century | 1 | | 17.5 | |
| Fulham Pottery | c. 1660-80 | 3 | 18.3 | 19.1 | 18.8 |
| Modern Cats | Modern | 7 | 18.5 | 23.6 | 20.6 |

Table 6. Size of the cat jawbone from the Tortugas shipwreck in comparison with archaeological examples from London and modern specimens. Measurement (in mm): [5] length of cheektooth row P3 - M1.



Fig. 1. Femur, Mammalia, Sus (domestic), pig (TOR-90-00166-BN).



Fig. 2. Radius, Mammalia, Sus (domestic), pig (TOR-90-00167-BN).



Fig. 3. Femur, Mammalia, Sus (domestic), pig (TOR-90-00169-BN).

| Specimen | Greatest Length | Proximal Width | Distal Width | Min. Shaft Width |
|---------------------------------------|-----------------|----------------|--------------|------------------|
| Tortugas shipwreck * | 38.55 | 6.9 | 6.4 | 2.9 |
| Comparative Femur | | | | |
| <i>Pionus menstruus</i> , 1896.6.9.2 | 37.5 | 7.1 | 7.4 | 2.9 |
| <i>Pionus menstruus</i> , 1925.1.27.1 | 38.2 | 7.1 | 7.1 | 3.0 |
| <i>Pionus menstruus</i> , 1996.57.1 | 36.5 | 7.1 | 7.4 | 2.9 |

* Note that the Tortugas shipwreck specimens' GL, PW, DW are surviving dimensions, which are slightly reduced by damage.

Table 7. Measurements (in mm) taken from the Tortugas shipwreck parrot femur (TOR-90-00217-BN) in comparison with modern specimens of the blue-headed parrot *Pionus menstruus* held by the Bird Group, Department of Zoology, Natural History Museum. Data source: Dr. Joanne Cooper, Natural History Museum, Tring, UK.

reptile bones (turtle/tortoise) among the faunal assemblage proved elusive, despite consultation with several zooarchaeological colleagues. It is suggested, however, that these other specimens probably also represent intrusive remains of marine turtles. A periodic (inner ear bone) of a dolphin (TOR-90-00335-BN) was recovered from the wreck site and is also intrusive. These specimens are not listed in the diagnostic faunal site catalogue.

By far the most remarkable specimens in the Tortugas shipwreck faunal assemblage were two parrot bones: a tarsometatarsus (TOR-90-00170-BN; Fig. 30) and a femur (TOR-90-00217-BN; Fig. 31) believed to derive from a single individual. This unfortunate bird had probably been abandoned below decks and drowned when the vessel sank.

An initial identification of the tarsometatarsus as the remains of a parrot (Family *Psittacidae*) by Armitage was subsequently confirmed by Dr. Joanne Cooper, Curator of Avian Anatomical Collections, Bird Group, Natural History Museum, UK, who also found the morphology of the femur was consistent with parrots. Due to the preservation of the specimens, and the great diversity of smaller parrots in the Caribbean and Central South American region, it was difficult to assign the parrot bones without doubt to a specific taxon. However, the femur was compared to a wide range of small to medium Caribbean, South American and Africa taxa and was found to most closely resemble the genus *Pionus*, a genus of medium-sized, chunky, short-tailed parrots. In terms of size, the bones appear to be most similar to the Blue-headed *Pionus menstruus* (Table 7). According to Dr. Cooper, both bones are highly likely to be from the same bird and their identification as possibly *Pionus* is significant for several reasons (Cooper and Armitage, forthcoming).

Firstly, the seven species of *Pionus* are essentially birds indigenous to Central and northern South America



Fig. 4. Humerus, Mammalia, *Sus* (domestic), pig (TOR-90-00177-BN).



Fig. 5. Metapodial, Mammalia, *Sus* (domestic), pig (TOR-90-00181-BN).



Fig. 6. Metacarpus IV, Mammalia, *Sus* (domestic), pig (TOR-90-00183-BN).



Fig. 7. Tibia, Mammalia, *Sus (domestic)*, pig (TOR-90-00185-BN).



Fig. 8. Incisor, Mammalia, *Sus (domestic)*, pig (TOR-90-00302-BN).



Fig. 9. Mandible, Mammalia, *Sus (domestic)*, pig (TOR-90-00192-BN).



Fig. 10. Premolar tooth, Mammalia, *Sus (domestic)*, pig (TOR-90-00303-BN).



Fig. 11. Dp4, Mammalia, *Sus (domestic)*, pig (TOR-90-00304-BN).



Fig. 12. Molar tooth, Mammalia, *Sus (domestic)*, pig (TOR-90-00306-BN).



Fig. 13. Humerus, Aves, Gallus gallus, domestic fowl (TOR-90-00214-BN).



Fig. 14. Tarsometatarsus, Aves, Gallus gallus, domestic fowl (TOR-90-00216-BN).



Fig. 15. Radius, Aves, indeterminate (TOR-90-00301-BN).

(including the Amazon region), and are not birds of the Caribbean Islands, suggesting trade with the mainland rather than the archipelagos. Opportunities for such trade would have been possible when the Spanish Tierra Firme fleet of galleons called at the important ports/way stations of Portobello (Panama) and Cartagena (Columbia) to load gold and silver from the mines of Peru, Ecuador, Venezuela and Columbia before sailing to join the convoy at Havana and the trans-Atlantic crossing to Seville, Spain (Mathewson, 1986: 18-19).

Secondly, evidence of trade in smaller parrot species is scarce, and indeed physical evidence of any parrots almost non-existent. The trade in parrots from the New World became established in the late 15th century, led by Spanish and Portuguese explorers and merchants. As early as 1494, 60 “long-tailed parrots (macaws)” were shipped to Cadiz from Hispaniola (George, 1980: 80). By 1526, New World parrots were so familiar that Gonzalo Fernandez de Oviedo was able to remark in his *General and Natural History of the Indies* that “so many species have been carried to Spain, it is hardly worth while to take time to describe them here” (Boehrer, 2004).

This sentiment was echoed in 1684 when buccaneer John Esquemeling observed that it was well known that parrots in Europe had been transported from the New World (Stallybrass, 1992: 42-3), indicating that mariners had discovered the profitability of bringing back live parrots (as well as other animals, notably monkeys: Armitage, 1983) in order to satisfy the demand for ownership of exotic creatures, especially those destined for royal menageries, such as at Versailles. Some idea of the profit in this trade is indicated by the cost of parrots sold in late 17th-century Amsterdam for “roughly sixty guilders” (Margócsy, 2010: 67).

Exotic and expensive, parrots commonly featured in paintings of the 1500s and 1600s, perhaps as inhabitants of paradise or accompanying images of their owners in portraits as status symbols. A review of the collections of the Museo del Prado, Madrid, reveals that macaws and amazons were most frequently depicted during this time, with smaller parrots rarely shown (Gomez Cano *et al.*, 2010). However, despite their abundance in art and other documentation, physical evidence of parrots in 16th and 17th-century Europe is extremely rare, limited to one other archaeological find amongst 17th-century rubbish excavated in Norwich, England (Albarella *et al.*, 1997: 51-2).

4. Conclusions

Alongside the Tortugas shipwreck, two other shipwreck faunal assemblages associated with the ill-fated 1622 homeward bound Tierra Firme fleet have been studied and



Fig. 16. Innominate, Mammalia, Ovis (domestic), sheep (TOR-90-00175-BN).



Fig. 17. Rib, Mammalia, Ovis/Capra (domestic), sheep/goat (TOR-90-00179-BN).



Fig. 18. Rib, Mammalia, Ovis/Capra (domestic), sheep/goat (TOR-90-00309-BN).



Fig. 19. Patella, Mammalia, Bos (domestic), cattle (TOR-90-00165-BN).



Fig. 20. Radius, Mammalia, Bos (domestic), cattle (TOR-90-00176-BN).



Fig. 21. Thoracic vertebra, Mammalia, Bos (domestic), cattle (TOR-90-00182-BN).



Fig. 22. Tibia, Mammalia, Rattus rattus, black rat (TOR-90-00197-BN).



Fig. 23. Tibia, Mammalia, Rattus rattus, black rat (TOR-90-00199-BN).



Fig. 24. Tibia, Mammalia, Rattus rattus, black rat (TOR-90-00200-BN).



Fig. 25. Femur, Mammalia, Rattus rattus, black rat (TOR-90-00202-BN).

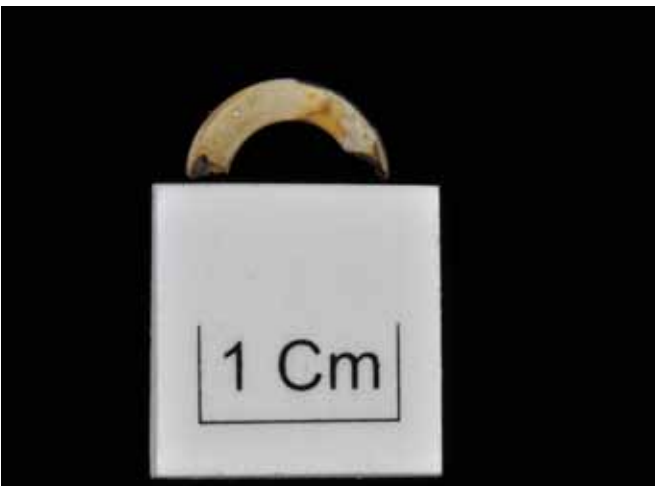


Fig. 26. Incisor, Mammalia, Rattus rattus, black rat (TOR-90-00206-BN).



Fig. 27. Incisor, Mammalia, Rattus rattus, black rat (TOR-90-00210-BN).



Figs. 28-29. Mandible, *Mammalia*, *Felis catus domestic cat* (TOR-90-00193-BN).



Fig. 30. Tarsometatarsus, Aves, cf. *Pionus menstruus*, blue-headed parrot (TOR-90-00170-BN).



Fig. 31. Femur, Aves, cf. *Pionus menstruus*, blue-headed parrot (TOR-90-00217-BN).



Fig. 32. Coracoid, Reptilia, Family Chelonidae, turtle (TOR-90-00174-BN).

documented and derive from the *Atocha* and the *Santa Margarita* (Chapin, 1990). The present analysis of the Tortugas material provides further insights into the preserved and fresh meat provisions of mariners serving on board vessels engaged in transatlantic voyages in the 17th century.

For all three vessels examined there is a concordance that demonstrates a heavy reliance on the customary Old World domesticates (pigs, cattle, sheep/goats and chickens) as principal sources of meat consumption, which was supplemented by lesser contributions from New World exotic animals (notably turtle and marine fish). Unlike the *Atocha* and *Margarita*, however, there is no evidence among the Tortugas wreck faunal remains that the vessel was carrying live horses and donkeys. At 550 tons each, these galleons were significantly larger than the 117-ton *Buen Jesús y Nuestra Señora del Rosario* and, therefore, probably were better suited through capacity to accommodate these animals.

However, the *Buen Jesús* differs from these other companion vessels in carrying at least one live parrot, which was perhaps originally part of a larger caged consignment. This discovery provides an unparalleled archaeological glimpse into the commercial trade of European merchants in exotic New World parrots in the 17th century. The importance of the Tortugas discovery lies in the fact that there are few other archaeological finds indicative of the transportation and trade in exotic New World fauna. Other identified examples include the remains of a South American yellow-footed land tortoise, *Geochelone denticulate*, in the wreck of a Dutch vessel of c. 1620-40 off Bermuda (Armitage, 1989) and a jawbone of a South American capuchin monkey, *Cebus nigrivittatus*, dated c.1640-80 from the River Thames foreshore (Armitage, 1983).

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