

To whatever purpose the analysis of fish remains is applied, a basic knowledge of fish osteology is essential. As archaeologists are often forced to rely on their own efforts in the identification of fish or other remains which they recover, it is essential that they themselves develop the requisite level of knowledge and skill. It is for this reason that the drawing of each element of the species represented in this manual was undertaken.

Scope of Coverage

Four of the most common families of marine fish in the Northern Hemisphere are represented in this handbook; the Salmonidae, Gadidae, Scorpaenidae, and Pleuronectidae. They were chosen because they comprise species which are indigenous to both the North Atlantic and North Pacific Oceans, and were, according to a range of archaeological and ethnographic evidence, economically exploited in both regions in the past.

One species from each of the above families is illustrated.

Oncorhynchus keta (Pacific)

The first osteology constitutes a Pacific salmon (*O. keta*). Its Atlantic cousin, *Salmo salar*, belongs to a different genus, but both are of the sub-family Salmoninae, and the family Salmonidae. The external appearance of these species is distinct, but their skeletons, like those of all salmonids, are very characteristic. (see Tchernavin 1938 plates II, III, and V, for an illustrated comparison of the articulated skulls of *O. keta* and *S. salar*). In fact, it is difficult to identify bones of the Salmonidae to species, even with the aid of a comparative collection. There is also considerable variation introduced through breeding changes. As Tchernavin concludes in his study of the breeding changes in salmon:

The skulls of adult migratory *Salmo* and *Oncorhynchus* are subject to striking changes throughout the whole life of the fish. These changes are so marked that the study of the salmon skull becomes in fact, a study of its changes. Many characteristics regarded as 'fortuitous variations' or 'taxonomic distinctions' are found to be features of particular phases of these regular changes. [Tchernavin 1938:165]

In this respect, the osteology of *Oncorhynchus keta* is typical of the salmon.

Of the four species of fish depicted in this manual, only the salmon (both Pacific and Atlantic) are anadromous; the remainder (cod, rockfish, and halibut) are exclusively marine. Anadromous fish breed in freshwater and migrate to marine feeding grounds where they spend the majority of their life cycle.

References: Parker 1873; Gregory 1933; Tchernavin 1938; Norden 1961; Vladykov 1962; Kazakov et al. 1982; Pichugin 1983; Jollie 1984.

Gadus morhua (Atlantic)

The Atlantic cod (*G. morhua*) is illustrated as a typical example of the family Gadidae. The same genus of cod exists in the Pacific (*G. macrocephalus*), and in terms of osteology, these two species show no discernible differences. In fact, in all respects the species are very similar. As early as 1887, investigators such as Bean (1887:198-199) questioned the validity of classifying Atlantic and Pacific cods as separate species. Schultz and Welander (1935:131-133) noted only visceral differences and differences in length of barbel and dorsal fin. Migdalski and Fichter (1977) noted no difference between the species, apart from the fact that the fins of the Pacific species are more pointed.

References: Bean 1887; De Beer 1928; Gregory 1933; Schultz and Welander 1935; Mujib 1967; Migdalski and Fichter 1977.

Sebastes marinus (Atlantic)

Rockfish are present in both the Atlantic and the Pacific, but are represented by a much greater number of Pacific species. The species illustrated here, the red rockfish, commonly called red snapper, is today highly valued commercially. Its common name is applied to different rockfish species from both the Pacific and the Atlantic, but each is a member of the genus *Sebastes*. The scientific name for the Atlantic species is *Sebastes marinus*, and it is this species that is used here to represent the family Scorpaenidae. Osteologically, all members of this family are very similar in appearance, and as a basic guide to fish elements, this family is a useful illustration of the osteology of the 'higher' bony fishes.

References: Starks 1898; Allis 1909; Gregory 1933; Echeverra 1986.

Hippoglossus stenolepis (Pacific)

The final osteology is of the Pacific halibut (*H. stenolepis*), of the family Pleuronectidae. When compared to the skeleton of the Atlantic species (*H.*

hippoglossus), there is little apparent difference in form. Personal examination of both species and consultation with experts left little doubt that the vertebrae and caudal bones of the two species are quite indistinguishable. Any variation in form was not easily detected in the individual elements of the head, and is therefore considered negligible for archaeological purposes.

References: Traquair 1865; Boulenger 1902; Regan 1910; Gregory 1933.

Comparative analysis of fish skeletons was conducted at the Museum of Zoology, University of Cambridge in England, where Atlantic specimens were available for examination. Pacific specimens were obtained from Vancouver, B.C., Canada.

Interoceanic comparative studies of fish osteologies are very rare. However, from an archaeological point of view, specimens from either ocean can be considered as representative of their respective families. This conclusion is based on an examination of the general form and particular distinguishing features and attributes of the individual bony elements. The aim of this comparative study was not to develop new criteria for species classification, but rather to confirm that the above specimens are representative of species from both oceans. Archaeologists working on the North Atlantic Coast can identify their material on the basis of illustrations of Pacific species, and the converse holds for North Pacific archaeologists.

Organization

The manual is divided into five sections. The first section is an introduction to the general fish skeleton; the cranium and lateral facial bones, the appendicular skeleton, and the axial skeleton. The subsequent sections are individually illustrated osteologies, presented in taxonomic order, of the salmon, cod, rockfish, and halibut. The bone elements are disarticulated and organized by anatomical region. The drawings are organized by species rather than element because the range and morphology of skeletal elements varies considerably between species. As an aid to preparing reference collections it is more useful to have the elements of each species kept together.

Because the goals of archaeologists differ from those of biologists, the bones are not necessarily represented at the angle in which they naturally occur in the articulated skeleton. Most of the elements show at least two viewpoints from