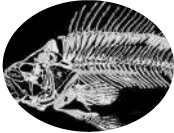


CHAPTER 2

History of Ichthyology



Ichthyology is simply the science of studying fishes. **Ichthyology**- word *ichthy*, deriving from the Greek word *ixthu*, combining form of *ixthus*, meaning "fish". This includes bony fish, cartilaginous fish and jawless fish. Historically, ichthyologists were naturalists who described fishes they collected.

Fish are the most diverse group of vertebrates, with more than one-half of the total vertebrate species. Approximately 33000 living species of fishes were described so far. Now, Ichthyology is considered to be the study of fish populations, their habitat requirements, and fisheries resources.

Ichthyology originated near the beginning of the Upper Paleolithic period, about forty thousand years ago, and continues to the present day. Fishes would be just as diverse and successful without ichthyologists studying them, but what we know about their diversity is the product of the efforts of workers worldwide over several centuries



EARLY ICHTHYOLOGY(300 B.C.E.–1499 C.E.)The Greek philosopher and natural historian, Aristotle incorporated ichthyology into formal scientific study between 335 B.C.E. and 322 B.C.E., he provided the earliest taxonomic classification of fish, in which 117 species of Mediterranean fish were accurately described. Furthermore, Aristotle observed the anatomical and behavioural differences between fish and marine mammals. However, this system naturally contained a great number of errors of fact and of interpretation. In the first century B.C.E., Romans were practiced aquaculture according to Pliny the Elder. The Romans focused on trout and mullet and were quite adept at breeding fish in ponds.



Aristotle

THE DEVELOPMENT OF MODERN ICHTHYOLOGY (1500 C.E.–1799 C.E.)

From 16th century onwards, so many works has been done by different authors. Belon, Salviani and Rondelet studied and wrote on the fishes of the Mediterranean and Europe.



Belon, Salviani and Rondelet

P. Belon travelled in the countries bordering on the eastern part of the Mediterranean, in the years 1547-50; he collected rich stores of positive knowledge, which he deposited in several works. The one most important for the progress of Ichthyology is that entitled *De aquatilibus libri duo*. Belon knows about 110 fishes, of which he gives rude, but generally recognizable, figures. In his descriptions he pays regard to the classical as well as vernacular nomenclature, and states the outward characteristics, sometimes even the number of fin-rays, frequently also the most conspicuous anatomical peculiarities.

Guillaume Rondelet (1507-1557) work comprises not less than 197 marine and 47 fresh-water fishes in his work *De Piscibus Marinum*. His descriptions are more complete and his figures much more accurate than those of Belon. Hippolyte Salviani (1514-1572) a Roman ichthyologist studied fishes of Italy. He prepared the figures of 92 species on 76 plates. No attempt is made at natural classification, in this respect Salviani is not compared with Rondete and Belon. W. Piso and G. Margrav studied the fauna of Brazil. Margav's observations were published by his colleague, and embodied in a work *Historia naturalis Braziliae* (1648), in which the fourth book treats of the fishes. He describes about 100 species. He made a coloured drawings of the objects observed and described them.

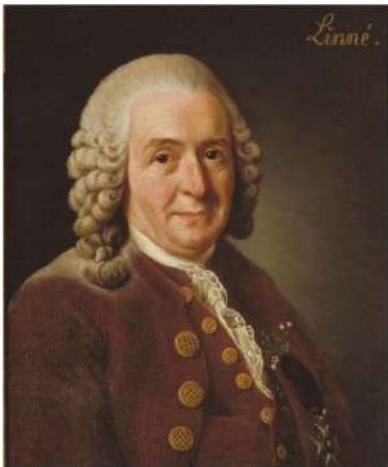
Some anatomical researches were done by different authors, Borreli (1608-79), who wrote a work *Do mote animalium* (1680), in which he explained the mechanism of swimming, and function of the air-bladder; M. MALPIGHI (1628-94), who examined the optic nerve of the sword-fish; SWAMMERDAM (1637-80), who described the intestines of numerous fishes; and J. DUVERNEY (1648-1730), who entered into detailed researches of the organs of respiration.

A new era in the history of Ichthyology commences with Ray, Willughby, and Artedi, who were the first to recognise the true principles by which the natural affinities of animals should be determined.

John Ray (1627-1705) and Francis Willughby (1635-1672) from England published *De Historia Piscium* (1686) in which a rational system of classification was proposed, the fishes proper are then arranged in the first place according to the cartilaginous or osseous nature of the skeleton; further subdivisions being formed with regard to the general form of the body, the

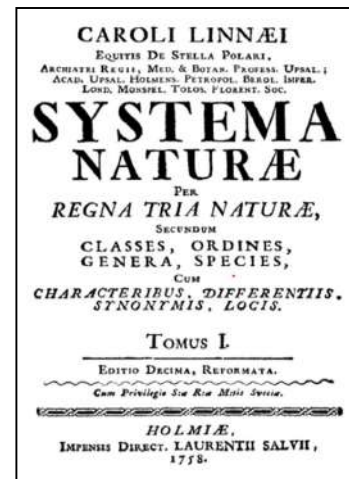
presence or absence of ventral fins, the soft or spinous structure of the dorsal rays, the number of dorsal fins. Around 420 species are thus arranged and described by them.

Peter Artedi (1705-1735) one of Linnaeus's colleagues, who known as the "father of ichthyology" contributed to Linnaeus's refinement of the principles of taxonomy. He was very much interested in fishes rather than other animals. He collected and organised all of the available literature from the time of Aristotle to his own day. Artedi's work included representatives of most of the major fish groups and he developed standard methods for making counts and measurements of anatomical features that are modernly exploited. He recognized five additional orders of fish: Malacopterygii, Acanthopterygii, Branchiostegi, Chondropterygii, and Plagiuri. He studied some major collections from Hans Sloane in London and Albertus Seba in Amsterdam. In 1735 Artedi drowned at the age of 30. Linnaeus posthumously published Artedi's manuscripts as *Ichthyologia* (1738). The work is divided into two parts *Bibliotheca Ichthyologica* and *Philosophia Ichthyologica*.



Carolus Linnaeus (1707–1778) The classification used within the *Historia Piscium* was improved upon by Carolus Linnaeus (1707–1778), the "father of modern taxonomy." In 1735, Linnaeus published his work on taxonomy, the *Systema Naturae* from Netherlands. The 10th edition of *Systema Naturae* was published in two volumes in 1758 and 1759, which marks the starting point of zoological nomenclature. He introduced the naming of living organisms using binomial nomenclature for animals, something he had already done for plants in his 1753 publication of *Species Plantarum*. Linnaeus work represented a great

simplification and rationalisation of the data that had been published on the variety of living organisms. The immediate results were to provide a structure to the knowledge that was accumulating and to provoke more scientific and popular interest in botany and zoology. The *Systema Naturae* was the main framework which naturalists of the English and French explorations of the late 18th century used for classifying the organisms they discovered. Linnaeus's taxonomic approach became the systematic approach to the study of organisms, including fish. Several of Linnaeus students (Daniel Solander; Peter Forsskål; Carl Thunberg and Pehr Osbeck) made significant contributions to ichthyology and several worked in the Indo-pacific region.



Carl Peter Thunberg (1743—1828), a Swedish doctor and student of Linnaeus, undertook several expeditions in South Africa, Japan, Java and Ceylon. His work included the original descriptions of several species. Pehr Osbeck (1723—1805) described fishes from China and Japan. Forsskål (1732—1763) was worked on fishes of Red Sea. His work included collections of, and observations on, fishes of the Red Sea. Forsskål described nearly 200 species as new. Majority of the fishes he had described have a wide distribution in the Indo-pacific region.

MODERN ERA

(1800 C.E.–Present)

In the late 18th and early 19th centuries the influx to Europe of new species, particularly from the Indo-Pacific region, provided a great stimulus for the study of these unfamiliar. Marcus Elieser Bloch (1723-1799), studied fishes from the rivers of Germany and from foreign places. His associate and student, philologist and naturalist Johann Gottlob Theaenus Schneider (1750—1822), who completed the task, publishing *Systema Ichthyologiae Iconibus* (1801). The number of species enumerated in it amounts to 1519. The system of Bloch and Schneider was succeeded by that of Bernard Germain Etienne de Lacépède (1756—1826). Lacépède completed a great work of compilation and original description that was of major importance to ichthyology. His *Histoire Naturelle des Poissons* was published in five volumes from 1798 to 1803. The author was only relayed on his notes and manuscript and his work was infinitely less than that of his fellow-labourer.

Georges Cuvier (1769-1832) was born in Montbéliard, France. In 1816 he published *Règne Animal* in which he described the structural relationships of animal groups for the classification of fishes, defining orders, families and genera. He used a wide variety of morphological and anatomical characters to describe animals. His great work *Histoire Naturelle des Poissons* were published in different volumes from 1828 to 1849. After Cuvier's death in 1832 his work continued by his assistant Achille Valenciennes (1794-1865). The *Histoire Naturelle des Poissons* provided a good foundation for classifying new species. It was the principal text used by zoologists who dealt with fishes.



Jean Jacques Dussumier (1792—1883), a ship-owner and merchant from Bordeaux, was referred to by Cuvier (1828) as 'a young man who has already made several voyages in his own ships to China and India' and credited him with sending collections of fishes from Malabar and the Seychelles to the Muséum National d'Histoire Naturelle in Paris.

Pierre Antoine Delalande (1787—1823) had been an assistant naturalist to Etienne Geoffroy Saint-Hilaire and so was a most informed collector. He travelled to Brazil, Cape Verde and the Cape of Good Hope and brought back extensive natural history collections, including large numbers of fishes. Valenciennes described the Yellowtail Kingfish, *Seriola lalandi*, from Delalande's specimens from Brazil.

Eduard Rüppell (1794—1884), a German naturalist and explorer. He collected fish from the Gulf of Suez from 1826, reported his work in *Fische des Rothen Meeres* (Rüppell 1828), and provided Cuvier with specimens.

Heinrich Kuhl (1797—1821), another German naturalist. In 1820 Kuhl, in Company with his friend and colleague Jan Coenraad Van Hasselt (1797—1823) of Holland, travelled to the Dutch East Indies. They travelled widely in western Java, collecting plants and animals, and made descriptions and drawings of many species.

Philipp von Siebold (1796—1866) was born in Germany. He joined a trading expedition to Japan as a naturalist-physician. During this time he studied fishes from Japan. Conrad Jacob Temminck (1778-1858) and his colleague Hermann Schlegel (1804-1848) studied von

Siebold's collection of specimens and drawings of fishes to produce the *Pisces* volume of *Fauna Japonica* (1842—1850). This included the description of approximately 40 species.

John Richardson (1787—1865), a British naturalist. He was born in Scotland. He was appointed Assistant Surgeon in the Royal Navy. He wrote accounts dealing with the natural history, and especially the ichthyology, of several other Arctic voyages, and was the author of *Icones Piscium* (1843), *Catalogue of Apodal Fish in the British Museum* (1856), the second edition of *Yarrell's History of British Fishes* (1860), *The Polar Regions* (1861) and *Arctic Ordeal: The Journal of John Richardson* Edited by C. Stuart Houston (1984).

Patrick Russell (1726—1805) was born in Edinburgh and studied medicine. He worked for 20 years in Aleppo, where he combined his work as a doctor with the study of natural history. He moved to the coastal city of Visakhapatnam, India where he was employed by the East India Company to study natural history. Russell (1803) published *Descriptions and figures of two hundred fishes collected from Visakhapatnam on the coast of Coromandel*.

Francis Buchanan (1762—1829) was also a medical officer in the East India Company. He was born in Scotland. He began his service with the East India Company in 1794 as a surgeon in Bengal. Buchanan's contributions to natural history were mostly in botany and ichthyology. He studied the fishes of the region, in particular the fishes of the Ganges.

John Whitchurch Bennett was a British army officer who worked as a Civil Servant in Ceylon (now Sri Lanka) from 1816 to 1827. He studied fishes from Ceylon and published his work as *Fishes found on the coast of Ceylon*.

Cantor Theodore Cantor (1809—1860) of the Bengal Medical Service (East India Company) was a Danish born physician and naturalist who wrote notes on Indian fishes and was later based in Penang. Here he obtained specimens from the local fishermen and published a *Catalogue of Malayan Fishes* (1850).

Johannes Peter Müller (1801—1858) was born in Nuremberg, Germany and studied medicine and natural science. His work on fishes included reviews of the most primitive of vertebrates (lampreys), primitive fishes (ganoid fishes and lungfish), cartilaginous fishes (sharks and rays) and a revision of Cuvier's fish classification. Friedrich Gustav Jacob Henle (1809-1885) was the student and co-worker of Müller. He studied medicine and became an assistant to Müller at Berlin. Henle worked in the fields of comparative anatomy, histology, physiology and pathology. Müller and Henle cooperated to produce major systematic works on sharks and rays, culminating in their *Systematische Beschreibung der Plagiostomen* (1838-1841). In this book, nearly 40 new genera were defined and most of these are retained today. In all, Müller and Henle described over 100 new species and about 60% of these are regarded as valid.

Peter Bleeker (1819-1878) published 500 separate contributions, chiefly on the fishes of the tropical Indo-Pacific. His book which was not only fully illustrated, it was one of the best 9 volumes from previous works of other authors. The book name is *Atlas Ichthyologique des Indes Orientales Néerlandaises*, 1862-1877. The literature from that work is the most accurate and comparable to many literature found today.





Albert C.L.G. Günther (1830-1914) published his *Catalogue of the Fishes of the British Museum* between 1859 and 1870, describing over 6,800 species and mentioning another 1,700. Generally considered one of the most influential ichthyologists.

Carl Benjamin Klunzinger (1834—1914), he studied fishes from Red Sea. He published his work named *Synopsis der Fische des Rothen Meeres* (1871). Klunzinger spent several more years collecting fishes from the Red Sea, and published another major work on them in 1884. His work on the Red Sea fishes constituted Klunzinger's major contribution to ichthyology.

Franz Steindachner (1834—1919) studied natural science in Vienna and specialised in ichthyology. He worked on the fish collections of the Kaiserlich-Königliches Hof-Cabinet, enlarging them through collecting in Europe, the Canary Islands and Africa during the 1860s. He directed deep sea expeditions in the Mediterranean between 1891 and 1893 and expeditions in the Red Sea between 1895 and 1898. Steindachner received fish collections by gift, exchange and purchase, from all over the world, describing over 1000 species of fish.

INDIAN ICTHYOLOGY

The foundation for fisheries research in India was laid by some of the early taxonomists notable among them were Cuvier, Valenciennes, Lacepede, Bloch, Schneider, Forsskal, Bleeker and Albert Gunther. There were also naturalists with different avocations in India, who collected and described fishes, other aquatic animals and plants and made observations on bionomics. Notable among those who had contributed to our knowledge are Patrick Russell, Hamilton-Buchanan, Edward Blyth, Stolizka, Sykes, J. McClelland and T.C. Jerdon. The most outstanding contribution was that of Dr. Sir Francis Day.



Francis Day (1829—1889)

A veterinary surgeon and naturalist who travelled extensively in India in the mid-nineteenth century. From 1859 to 1862, he collected and preserved fishes from Cochin and published *The Fishes of Malabar* (1865). He published his major work *The Fishes of India: being a Natural History of the Fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon* in two volumes (1875—1878) followed by FISHES in the 'Fauna of British India' series in two volumes (1889) describing 1,418 species are the two most indispensable works on Indian fish taxonomy to date.

In 1975 *A comprehensive volume on Fish and fisheries of India* was authored by Dr. V.G.Jhingaran. The publications on *Commercial Sea Fishes of India* by Talwar and Kacker (1984) and *Fishes of the Laccadive Archipelago* by Jones and Kumaran (1980) are some of the major work done in India. There were many taxonomist contributed to the fisheries research in India during the 20th century. Some of the major contributors are S L Hora, A G K Meneon, K C Jayaram and E G Silas.

Sunder Lal Hora (1896 - 1955), was born in Punjab. He was the second Indian director of the Zoological Survey of India, succeeding Bains Prasad. He was an Indian ichthyologist and was known for his biogeographical theory on the affinities of Western Ghats and Indo-Malayan forms. Hora was also among the Indian pioneers of fish and wildlife conservation. A genus of ricefish, *Horaichthys* ("Hora's Fish"), was created in his honor. The catfish genus *Horabagrus* is named after him. He has to his credit about 425 publications.

A. G. K. Menon, full name Ambat Gopalan Kutty Menon (1921-2002), was an Indian ichthyologist and university professor. He was guided by S L Hora, Menon dealt intensively during his studies and in the years afterwards with the Satpura hypothesis. Menon dealt with a number of higher taxa of fish. During his more than fifty years of research, He published more than 100 scientific publications, many of them monographs. In addition to revisions of a number of taxa, Menon wrote the first descriptions of 43 fish species.

K. C. Jayaram, was the former Deputy Director of Zoological Survey of India. He has a rich experience in freshwater fish taxonomy and zoogeography. He was trained by the late Dr. S. L. Hora in the specialisation of Siluroid fishes. He was considered an authority on the Indian catfishes. He was invited as a consultant by the FAO for the preparation of identification sheets for the Siluroid families Ariidae and Plotosidae of the Western Indian Ocean. His major work, *The Handbook of Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka* (1981) gives a full account of fish fauna of the region.

Eric Godwin Silas, born on 10 January 1928 at Demodhera, Ceylon (Sri Lanka). In 1963 he was appointed as Marine Biologist in Central Marine Fisheries Research Station, Mandapam Camp, where he started work on Tunas from the Indian Seas. The Mariculture projects and programmes in CMFRI were initiated by Dr. Silas as Head of the Marine Biology and Oceanography Division. He was appointed as the Director of CMFRI in June 1975. Many Inter-organizational collaborative programmes were initiated by him. The Marine Biological Association of India owes a lot to Dr. Silas for his untiring support for the Association and its Journal. He was its President, and also functioned as the Editor of Its Journal. His upgrading the Central Marine Fisheries Research Institute as a World Class Centre of Research, training and Extension by improving the physical infrastructure of land, buildings, laboratories and amenities, as well as developing trained manpower, both Scientific and Technical of high competence and calibre is well known. Two of the Units he developed at CMFRI, budded and grew to become National Research Centres, namely, The National Bureau of Fish Genetic Resources (NBFGR, ICAR) at Lucknow and the Centre for Marine Living Resources (CMLRE). He has published nearly 300 scientific papers and monographs during his research career of over sixty years.

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