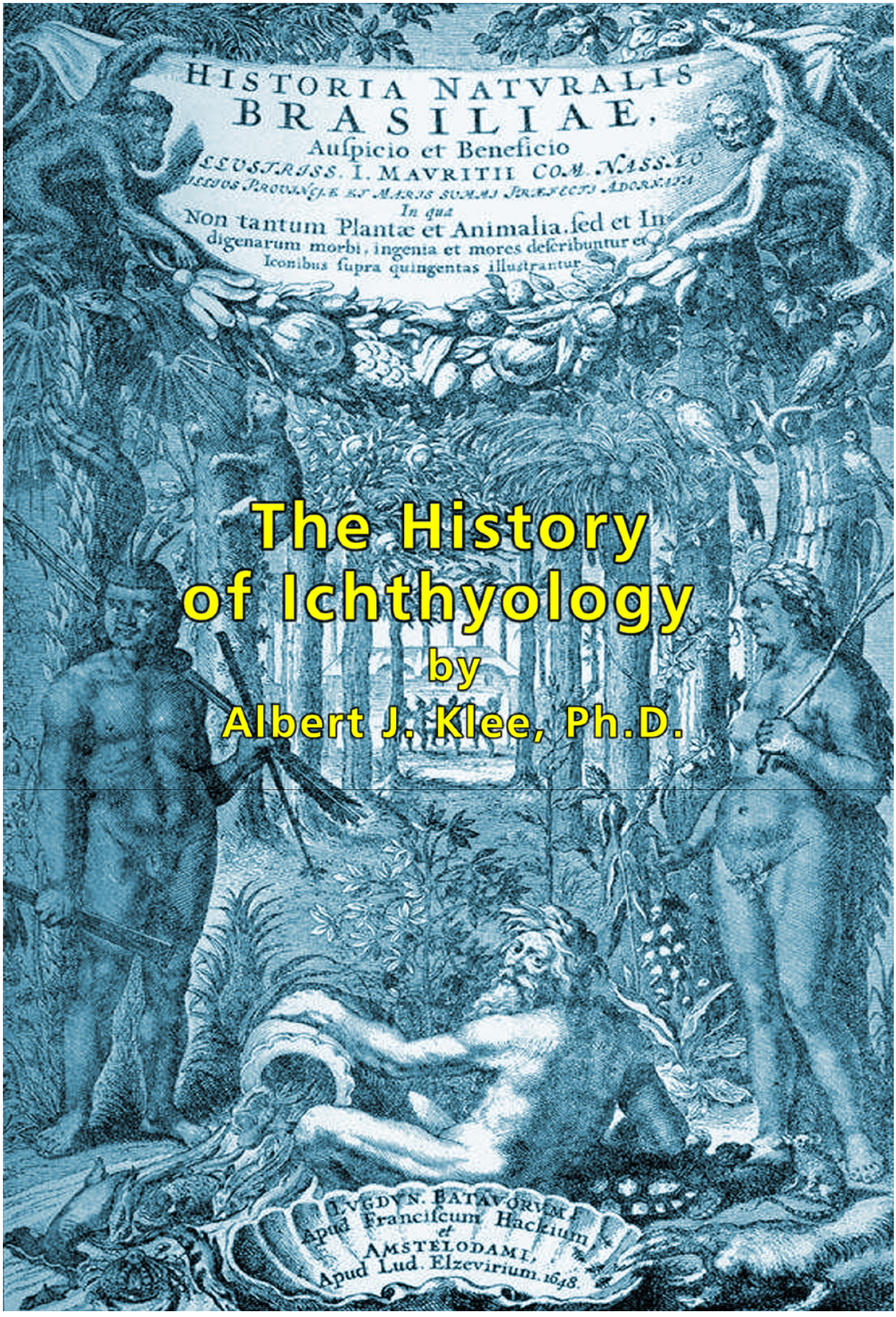

The History of Ichthyology

by

Albert J. Klee, Ph.D.

THE HISTORY OF ICHTHYOLOGY

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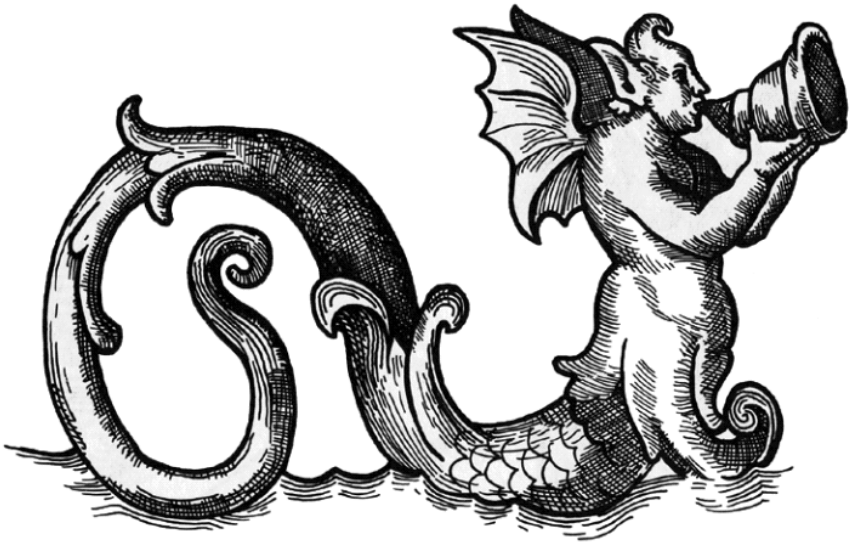


Layout and cover designs by Albert J. Klee

AJK Publications
Milford, Ohio

Qui lacerat, violatve, rapit, presens epitoma
Hunc laceretque voret, *Cerberus* absque mora.

JOHN SKELTON 1460-1529

That man who tears or harms this book, or carries it away,
Him let the hellhound *Cerberus* devour without delay.

INTRODUCTION

What ichthyologists have in common with aquarists is a fascination and enduring curiosity about fishes. Accordingly, this history of ichthyology was prepared with the serious aquarist in mind, its goal being to provide a historical background of the science that underlies the hobby. The term "history" used here, however, is presumptuous since there are many aspects to ichthyology, such as classification, life history, anatomy, behavior, ecology or physiology, and even aquarium maintenance, fish breeding, and conservation, whereas this history deals only with those men important in naming fishes and in the decision of how these names were defined and assigned. Although of little consequence to the average aquarist, advanced aquarists are often familiar with the author of a species and are directly involved when ichthyologists reclassify and rename aquarium species of interest to them.

It is a tendency on the part of more curious humans to want to know more about the people involved in any activity and this holds true for the aquarium hobby as well. The question of who the people were whose names appear after the names of our fishes is another of the questions I have tried to answer during the preparation of this monograph.

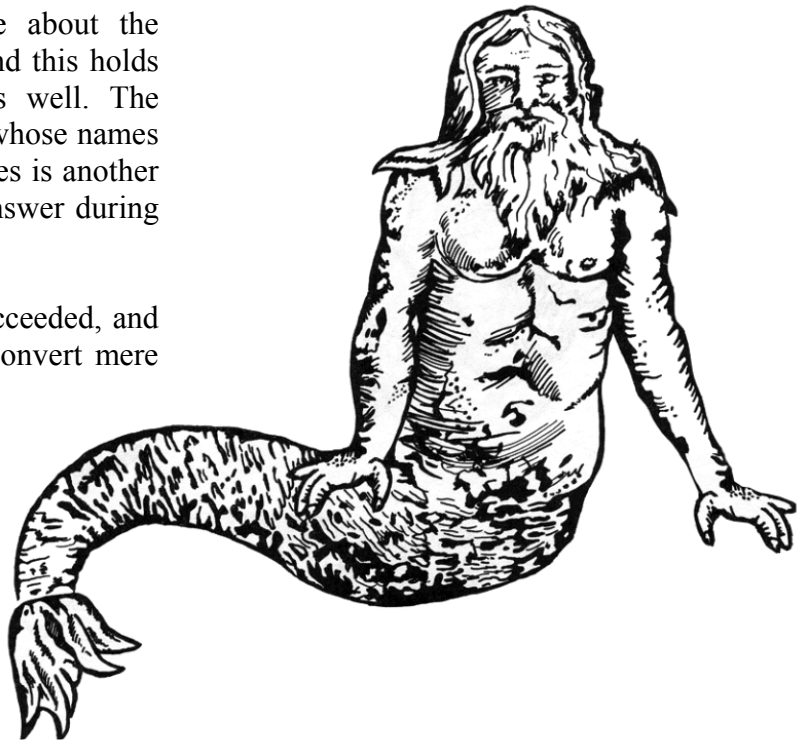
In this endeavor I hope I have succeeded, and if all I have accomplished is to convert mere names into live persons, then in my own mind I will have attained my goal.

I would like to express my appreciation for the assistance given me by Dr. Stanley H. Weitzman and Lisa Palmer, Division of Fishes, National Museum of Natural History, Smithsonian Institution in matters regarding Barton W. Evermann, Samuel Hildebrand, and Seth E. Meek.

Finally, it should be noted that I owe my wife, Harriet Joy, a debt of gratitude for her proofreading of this monograph and for her helpful suggestions for improving clarity and enhancement of the presentation.

Albert J. Klee

January 5, 2005



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The History of Ichthyology: Part I - The Beginnings

By Albert J. Klee, Ph.D.

Most accounts of the early history of ichthyology deal with the questions of "who" and "when," but leave a lot to be desired on the "what" and the "why." Some authors start off with Archelaus of Miletus (sixth century B.C.), crediting him with fundamental concepts such as species and the need for using one name for each type. None of his works survive, however, and since, according to ancient biographers such as Diogenes Laertius (third century A.D.), he maintained that animals are generated out of hot earth that sends up a thick mud as a sort of milk for their food, we'll skip Archelaus and start with someone who more appropriately deserves credit for the stirrings of this fascinating science.

The history of ichthyology begins with **Aristotle (384-322 B.C.)** and coincides with that of zoology generally. Aristotle had an excellent knowledge of the general structure of fishes and clearly discriminated them both from the aquatic animals with lungs and mammae (i.e. Cetaceans), and from the various groups of aquatic invertebrates. According to Aristotle:

1. The special characteristics of the true fishes consist in the gills and fins, the majority having four fins, but those of an elongate form, as the eels, having two only. The rays swim with their whole body, which is spread out. The gills are sometimes furnished with an operculum; sometimes they are without one, as in the cartilaginous fishes.

2. No fish has hairs or feathers; most are covered with scales, but some have only a rough or a smooth skin. The tongue is hard, often toothed, and sometimes so much adherent that it seems to be wanting. The eyes have no lids, nor are any ears or nostrils visible, for what takes the place of nostrils is a blind cavity; nevertheless they have the senses of tasting, smelling and hearing. All have blood.

3. All scaly fishes are oviparous, but the cartilaginous fishes (with the exception of the manta ray, which Aristotle places along with them) are viviparous. All have a heart, liver, and gall bladder, but the kidneys and urinary bladder are absent. They vary much in the structure of their intestines. The mullet, for example, has a fleshy stomach like a bird, while others do not have stomachs that can be stretched beyond their normal dimensions.

Aristotle's information on the habits of fishes, their migrations, mode and time of propagation, and economic uses is surprisingly correct. Unfortunately, it is often difficult to recognize the species when he gives a description. His ideas of distinction among species were as

Rembrandt's, "Aristotle Contemplating the Bust of Homer."

Pierre Belon (1517-1564).

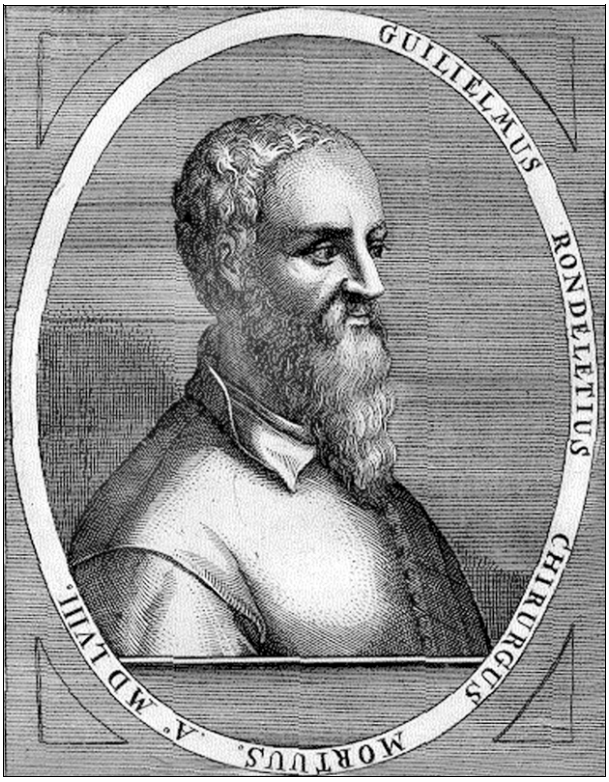
vague as those of the fishermen whose nomenclature he adopted. It never occurred to him, for example, that common names are subject to change or even entirely lost over the course of time. The difficulty of identifying his species is further compounded by his application of more than one popular name to the same fish, and to different stages of its growth. He accurately described, however, some 118 species of fishes, all of which are inhabitants of the Aegean Sea.

A few others who came later in the ancient world provided additional descriptions and observations of fishes. **Gaius Plinis Secundus**, known under the name Pliny the Elder (23-79 A.D.), was one such scientist and writer who had a passion for directly observing phenomena and taking notes. He wrote an important work on natural history based on his observations of the world around him (*Historia Naturalis of Gaius Plinius Secundus*). **Claudius Aelianus (175-235 A.D.)** wrote curious and interesting stories of animal life, frequently used to convey moral lessons (*De Natura Animalium).* These were merely observations, however, and did not approach the breadth of Aristotle's understanding of fishes. That one man should have laid so sure a basis for future progress in zoology is less surprising than the fact that, for about eighteen centuries afterwards, a science that attracted men gifted with the power of observation was no further advanced. Yet, such is the case. Aristotle's successors remained satisfied to be merely his copiers or commentators, and to collect fabulous stories or vague notions. It was not until the middle of the 16th century that ichthyology made new advancements with the appearance of Belon, Rondelet, and Salviani, who almost simultaneously published their great works by which the idea of species was established.

Pierre Belon (1517-1564) was a French naturalist who studied medicine at Paris and botany at Wittenberg before traveling extensively in Greece and the Middle East. His interest in comparative anatomy led to a volume on fishes, *De aquatilibus libri duo* (Paris, 1553), in which he recognized about one hundred and ten fishes, of which he gave crude but generally recognizable figures.

Although Belon rarely defined the terms he used, it is not difficult to work out the limits that he intended to assign to each division of aquatic animals. He very properly divided them into those provided with blood and those without, corresponding to our modern ideas of vertebrate and invertebrate aquatic animals. He classified the former according to size, the further subdivisions being based on the structure of the skeleton, mode of propagation, number of limbs, form of the body and physical character of the habitat.

Belon was one of the first naturalist-explorers and, despite being warned of the danger to



Guillaume Rondelet (1507-1566).

Christians, he wandered all over the hostile shores of the eastern Mediterranean, studying plant and animal life. Miraculously, he returned to Paris without a scratch. It was ironic, therefore, that shortly thereafter he was waylaid by robbers and killed while visiting the city's Boulogne Woods to gather herbs.

Guillaume Rondelet (1507-1566) had the great advantage over Belon of having gone through a complete course of instruction in anatomy as a pupil of the famous physician, Guentherus of Andernach (1505-1574), while studying medicine at the University of Montpellier. This is reflected throughout his publications, *Libri de piscibul puarinis* (Lyons, 1554), and *Universac aquatilium historia* (Lyons, 1555). His works are almost entirely limited to European and chiefly to Mediterranean forms, and comprises no fewer than one hundred and ninety-seven marine and forty-seven freshwater fishes.

His descriptions are more complete and his figures much more accurate than those of Belon; and the specific accounts are preceded by introductory chapters in which he treats in a general manner, the distinctions, external and internal parts, and economics of fishes. Nevertheless, they cannot be regarded as more than considerably enlarged editions of Belon's work. Although he worked independently of the latter, the system adopted by him is characterized by the same absence of the true principles of classification. Like Belon, he had no conception of the various categories of classification, confusing throughout his work the terms genus and species, but he had an intuitive notion of what his successors called a species and his principal object was to give as much information as possible regarding such species.

Ippolito Salviani (1514-1572) was personal physician to Julius III, Paul IV, and Cardinal

Ippolito Salviani (1514-1572).

Konrad Gesner (1515-1565).

Cervini. His major work (supported financially by Cardinal Cervini who was Pope Marcellus II for a month before he died) is the *Aquatilium animalium historia* (Rome, 1554-1557), which dealt exclusively with the fishes of Italy. It describes 92 species of Mediterranean fishes, obtained in the Roman fish markets. This was the first description of fishes to appear with copper engraved plates, the accuracy and beauty of which surpass any figures in the field of natural history published in the next 100 years, although those specific characteristics which nowadays constitute the value of a zoological drawing were overlooked at the time by the author.

Salviani made no attempt at a natural classification, but he generally placed allied forms in close proximity. The descriptions are equal to those given by Belon, entering much into the details of the uses and economic value of the several species, and were evidently composed with the view of collecting in a readable form all that might prove of interest to the class of society in which the author moved. Although Salviani's work is of a high order and could not fail to render ichthyology popular in the country of the fauna to which it was devoted, it did not advance ichthyology as a science. In this respect, Salviani is not to be compared with Rondelet or Belon.

Konrad Gesner (1515-1565) represents the epitome of the Renaissance man. He was a physician and professor of philosophy at the University of Zurich. In contrast to the tradition that based descriptions on a combination of real and fabled animals, Gesner managed to reestablish the natural sciences on a recognizably scientific footing of observation, experimentation, and deduction. His encyclopedic work, the 4,500 page four-volume zoological encyclopedia, *Historiae Animalium*, compiled from folklore, ancient and medieval texts, and correspondence with a wide network of scholars, travelers, and natural philosophers, was tempered by his skepticism and an emphasis on direct observations.

Volume IV of Gesner's 4,500 page four-volume zoological encyclopedia, *Historiae Animalium,* recorded fishes and other aquatic animals. Incorporating the work of Belon and Rondelet, it was by far the most extensive treatise on animals published up to then and so is considered the beginning of modern zoology (Gesner himself is sometimes termed, "the Father of Zoology"). Included in the work were the synonymy of each species, geographical variation, life history, fables, folklore, adages, proverbs, and emblems. The emblems, the purpose of which was to convey a clever truth, were very popular in their day, and consisted of an image, preferably an obscure motto, and an explanatory epigrammatic poem.

There are many aspects of ichthyology: behavior, collection, description, reproduction, anatomy, ecology, genetics, classification, and

evolution, to name some. However, a science must have a framework and one important part of the ichthyological framework is a naming convention. During the 1500's and 1600's, species naming practices varied. Many biologists gave the species they described long, unwieldy Latin names that could be altered at will. A scientist comparing two descriptions of species, therefore, might not be able to tell which one they had in mind. For example, the common wild briar rose was referred to by different botanists as *Rosa sylvestris inodora seu canina* and as *Rosa sylvestris alba cum rubore, folio glabro*. One solution was to designate one Latin name to indicate the genus and another as a "shorthand" name for the species. These two names make up what is known as the binomial (i.e., "two names") species name. In the briar rose case, for example, ultimately it became simply *Rosa canina*.

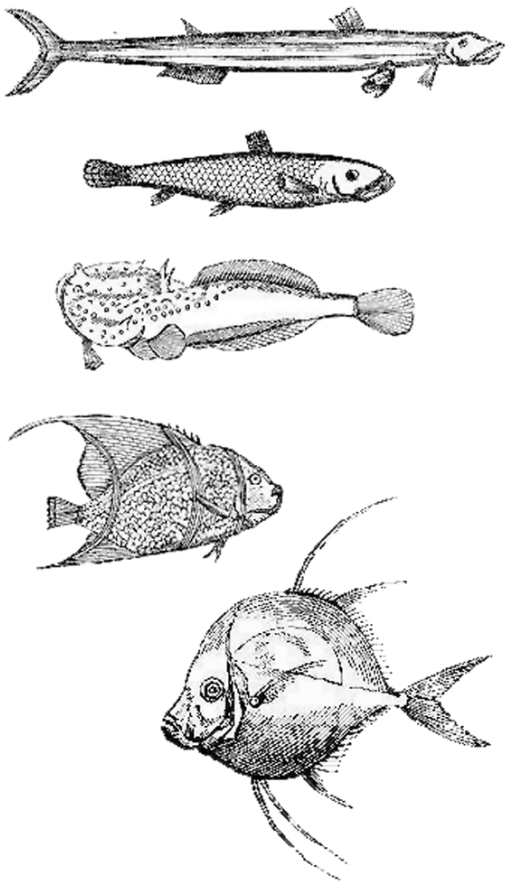
It is a common misconception that **Linnaeus (1707-1778)** was the one who invented binomial nomenclature. In actuality it was Gaspard Bauhin (1560-1624). Bauhin was a Swiss-French botanist, the son of a French physician who had to leave his native country on becoming a convert to Protestantism. Bauhin was born at Basel and studied medicine at Padua, Montpellier, and in Germany. His work, *Pinax theatri botanici* (1596), was the first to use this new convention for naming species. Besides being a pioneer in binomial nomenclature, Bauhin separated botany from medical material, nomenclaturally distinguished genera from species, and discarded alphabetical enumeration of plants as a method for grouping according to plant affinities.

However, although Linnaeus was not the first to use binomials, he was the first to use them consistently and, for this reason, Latin names that naturalists used before Linnaeus are not usually considered valid under the rules of nomenclature.

For nearly a century, the works of Belon and Rondelet continued to be the standard works on ichthyology, but the science did not remain stationary during that period. The attention of naturalists was now directed to the fauna of foreign countries, especially of the Spanish and Dutch possessions in the New World. In Europe, the establishment of anatomical schools and academies led to careful investigation of the internal anatomy of the more remarkable European forms. Limited as these efforts were as to their scope, they were sufficiently numerous to expand the views of naturalists and to destroy that fatal dependence on the preceding authorities who had kept even Rondelet and Belon in intellectual bondage.

The most noteworthy of those engaged in these inquiries in tropical countries were **Guilielmus Piso (1611-1678)** and **George Marcgrav (1610-1644)**. Piso was the personal physician to the governor of Dutch Brazil (Prince Maurice of Nassau-Siegen) and also the head of a scientific mission to Brazil ap-

Gaspard Bauhin (1560-1624).



Fish illustrations from George Marcgrav's *Historia naturalis Brasilise*, 1554-57.

pointed by the Prince. Marcgrav, a young German botanist/astronomer, was also part of the mission and, in 1648, the publication of his *Historia naturalis Brasilise* added another 100 species to the known number of fishes. Marcgrav was the first naturalist to publish descriptions and figures of fishes sufficiently exact to be identified specifically. Many are inaccurate and some comically grotesque, but he usually put sufficient character into his fish sketches to make them recognizable, and a number of the Brazilian fishes he figured were later introduced into Linnean nomenclature on the basis of his work.

John Ray (1627-1705) and **Francis Willughby (1635-1672)** were the first to recognize the true principles by which the natural affinities of animals should be determined. Their labors stand in so intimate a connection with each other that they represent but a single great step in the progress of ichthyology.

Ray studied at Cambridge where he became a fellow of Trinity College in 1649, but he lost his post for religious reasons. Ray had always intended becoming an ordained clergyman, but unfortunately he lived in an era when there was considerable interference by the State in the affairs of the church. When the Royalists returned to power, they insisted on re-establishing extreme ritual in the church. However, Ray distrusted a religion that depended so much on external practices and gave far more weight to inner spiritual institutions and the refinements of conscience. Ray would not compromise his beliefs and he was forced to leave the university in 1662.

Ray was now unable to support himself and his widowed mother. However, Francis Willughby, a wealthy former student of Ray's,

John Ray (1627-1705).

Francis Willughby (1635-1672).

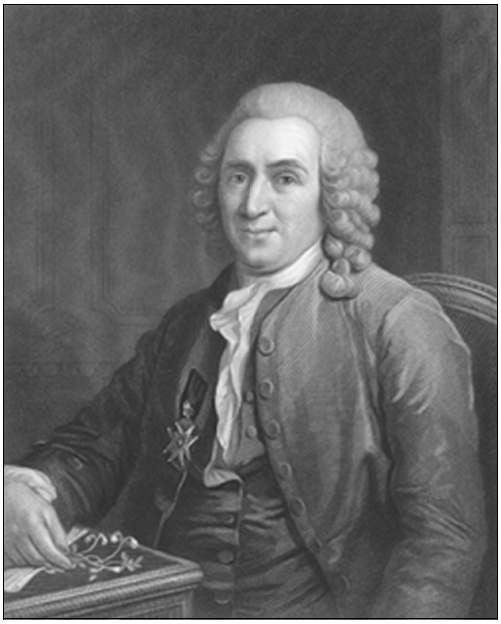
suggested that they should undertake scientific research together at Willughby's expense. Ray's dismissal actually became a turning point in his life that enabled his great work in biology to be carried out. With Willughby, he traveled widely in Europe studying botany and zoology. Ray's major work was the three volume, *Historia Plantarum* (1686-1704), and this generalized catalogue of plants laid the groundwork for the systematic classification that was to be brought into modern form by Linnaeus. It was Ray who specifically defined what was meant by a species, and Linnaeus subsequently used this as a building block for his classification system in which related species were grouped into genera, related genera were grouped into higher categories, and so on.

With Ray, Willughby undertook to do a complete natural history, he doing the animals, birds, fish, and insects, and Ray doing the plants. He is known especially for his early systematic work on birds and fishes, in which he made some of the most important contributions before those of Linnaeus. He toured the Continent with Ray, collecting material for his *Ornithologia* (1676). After Willughby's death, Ray published Willughby's *De Historia piscium* (1686).

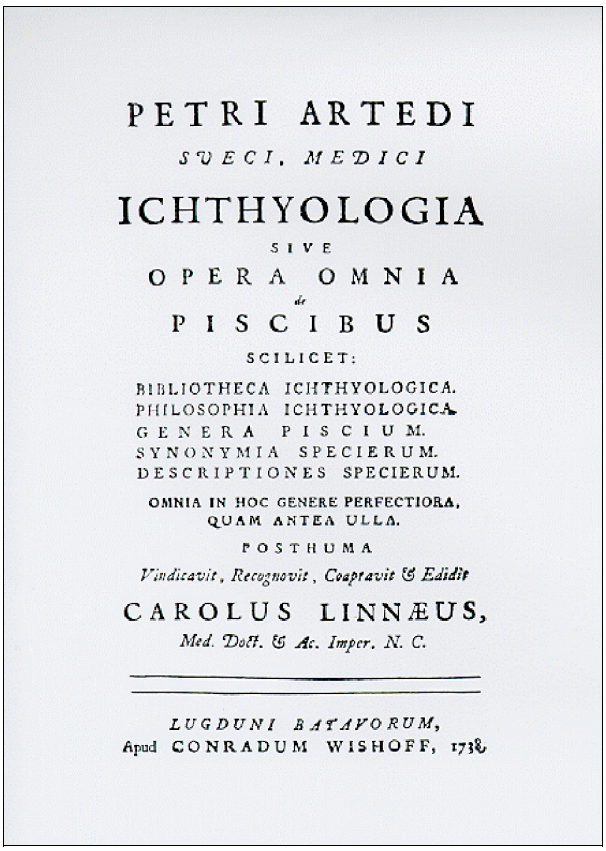
We now come to the one who has been hailed as "the Father of Ichthyology," Petrus Arctaedius, who later changed his name to **Peter Artedi**. Artedi was born in Anundsjö, Sweden in 1705, and was descended on his father's side through two generations of clergymen.

Not unnaturally the intention had been that he should follow in the paternal tradition in reading theology, but his own inclinations to the study of natural science eventually led him to reject his father's advice and take up the study of chemistry. He is said to have been the only student of this subject at the University of Uppsala at the time. As a student in the Faculty of Medicine he was granted a Royal scholarship but, owing to a scarcity of instruction in natural science at the University at that time, he was largely dependent on his own private studies to acquire knowledge of the subject.

Four years after Artedi had commenced his University career, Linnaeus arrived at Uppsala with the intention of studying natural science.



Carl Linnaeus (1707-1778).



PETRI ARTEDI

SUECI, MEDICI

ICHTHYOLOGIA

SIVE

OPERA OMNIA

de

PISCIBUS

SCILICET:

BIBLIOTHECA ICHTHYOLOGICA.
PHILOSOPHIA ICHTHYOLOGICA.
GENERA PISCIUM.
SYNONYMIA SPECIERUM.
DESCRIPTIONES SPECIERUM.

OMNIA IN HOC GENERE PERFECTIORA, QUAM ANTEA ULLA.

POSTHUMA

Vindicavit, Recognovit, Coaptavit & Edidit

CAROLUS LINNÆUS,

Med. Doct. & Ac. Imper. N. C.

LUGDUNI BATAVORUM,
Apud CONRADUM WISHOFF, 1738

The cover page of Artedi's *Ichthyologia.*

On his arrival he inquired after the names of other students engaged in similar studies, and since the name of Artedi was foremost in everyone's mind in this connection, Linnaeus was anxious to meet his fellow student.

Linnaeus, writing after Artedi's death, left an account of his impressions of Artedi at their first meeting, **"I saw him before me, lofty of stature and spare of figure; his hair was long and his face reminded me of John Ray's; he struck me as humble-minded, not hasty in forming an opinion, but yet prompt, firm and withal mature, a man of old-world honor and faith. It rejoiced me to remark that our talk turned at once upon stones, plants, and animals, and I was much moved at having so many of his scientific observations confided to me without the least hesitation or reserve upon that very first occasion on which we met. I sought his friendship, and so far was he from withholding it, that he promised me his services too, if such I needed, a promise he afterwards most loyally kept. This sacred friendship, thus spontaneously sealed, we fostered uninterruptedly for seven years in Uppsala, at all times with the same fidelity, but with ever-increasing warmth and attachment. He was my closest and most intimate friend and I was his."**

The two young men, whose characters and attainments complemented one another so well and who saw one another daily to discuss their theories and discoveries in natural science, found in their association the spur to further work and study. A spirit of friendly rivalry drove them on in competition, but eventually the natural interests of each made one or the other pre-eminent in a particular field. Thus, Artedi excelled in chemistry, ichthyology, and herpetology, while he yielded the fields of botany, birds, and insects to Linnaeus. Parenthetically, one might comment here that in thus dividing the world of natural science between them, they were following, if unconsciously, the precedent of John Ray and Francis Willughby, the English naturalists of the previous century. Each helped the other not only in personal money needs, but even making an agreement that the survivor would publish the works of the one deceased. Artedi drowned in 1735 in Holland and, true to his word, in 1738 Linnaeus published five manuscripts of Artedi under the general title of the *Ichthyologia*, adding a brief introduction and biography of the author.

Artedi was concerned primarily with the fishes he had examined himself, and in his *Descriptiones specierum* (the fifth part of the *Ichthyologia*), his descriptions of the species show his intimate knowledge derived from close examination and dissection of actual specimens. Albert Guenther, the leading ichthyologist of his time (1830-1914), spoke of them as **"descriptions which even now are models of exactitude and method,"** a summary which holds true even today. The species Artedi described in this section were nearly all those

that could be found on the shores of the Baltic or in the freshwaters of Sweden, and in some cases he actually cites the locality of origin of the specimen. In thus describing so meticulously the fishes of his native land, Artedi laid a sure foundation, based on actual observation, for later work on the Old World northern temperate zone fish fauna. In all, Artedi recognized 47 genera and 230 species.

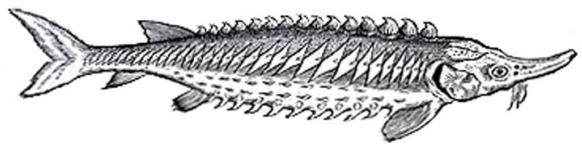
Nor was this his only contribution to ichthyology's immediate progress. His critical review of the literature preceding his time, *Bibliotheca ichthyologica* (the first part of the *Ichthyologia*), was remarkably complete and displayed an acute perception of the value of the works he reviewed. This, with the complementary *Synonymia nominum piscium* (the fourth part of the *Ichthyologia*) in which Artedi listed each species with a complete synonymy, clarified the existing literature and literary references to fish species, and together represent a considerable achievement as a bibliographic study.

It was, however, in the *Philosophia Ichthyologia* (the second part of the *Ichthyologia*) that Artedi's genius as an ichthyologist and a zoologist is most apparent. Here he defined the terms he proposed to use in connection with his studies, firstly his definition of a fish and of ichthyology, then the external characters of the fish: fins, body and head shape, scalation, with all naturally occurring variations. In fact, Artedi's characters for the study of fishes, with only minor alterations or additions, are those used by modern workers. For instance, the utilization of gill rakers, vertebrae, and lateral line scales, were all given prominence by Artedi as characters for the discrimination of genera and species. He then dealt with the division of fishes into classes, families, or orders, and remarked on the impracticability of any division not relying on natural features present in the fish. Thus he rejected any arrangement based on habitat of the animal, such as Rondelet's divisions between river fish, marsh fish, sea fish, etc. Artedi recommended that the genera should first be clearly defined and grouped together according to their natural features. The groups then would automatically fall into a natural sequence.

Artedi believed that a genus represented a group of species that agreed with each other in general but that differed in minor characters. Having established this generic concept, Artedi proceeded to group the genera into "maniples," the same family concept used today. The maniples were arranged into natural orders, and these into a class, representing the whole group of fishes. The only weakness in this ordering was below the genus, although he retained the binomial scheme of nomenclature. Artedi's short life had been sufficient for him to produce work that influenced ichthyology as a science more than that of any other man, but his influence also extended far beyond this single aspect of zoology. There is no doubt, for example, that Artedi greatly influenced Linnaeus. One can only imagine how much more Artedi could have accomplished had he not died from drowning at age thirty. In this, he reminds us of Wolfgang Amadeus Mozart.

The stimulating friendship between Linnaeus and Artedi had far reaching results. Both pos-

A wood cut of Linnaeus and Artedi arguing over who could best group the animal kingdom.



A plate from Gesner's *Historiae Animalium*, 1551-58.

sessed a native genius for the study of natural science, and their two minds both approaching the same problem with a differing outlook, formed a complementary union. Their work reflected their temperaments. Artedi's was remarkable for monographic depth and thoroughness, Linnaeus' for encyclopedic breadth and variety. Of Artedi's contribution to the final synthesis of the Linnaean method, there can be no doubt that it was considerable. Probably without Artedi's stimulation in his formative years, the Linnaean method would not have taken shape so early in Linnaeus' career; it might possibly never have crystallized at all.

In 1735, Artedi was staying in a lodging house in the dock area on the riverfront of Amsterdam. He lived a lonely life, going to a tavern from three until nine, working from nine at night to three in the morning, and sleeping from three to noon. On the evening of September 27, Artedi spent the evening in congenial company and, having stayed late engaged in conversation, he started for his lodgings at one o'clock. Somewhere on his path along the unlighted canals of Amsterdam he missed his way, fell into a canal and drowned. The accident was discovered the next day, and his body was taken to the City Hospital. His death certificate noted him as a pauper, his estate being unable to pay for his grave.

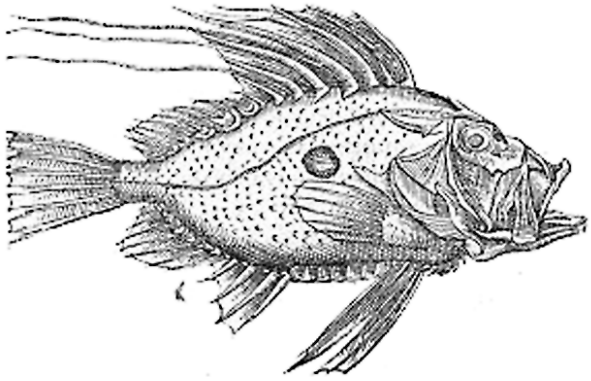
Transcribed from the back flyleaf of Linnaeus' copy of the *Ichthyologia* is the following couplet by George Shaw:

In humulum Artedi:
Here lies poor Artedi, in foreign land pyx'd
Not a man nor a fish, but something betwixt,
Not a man, for his life among fishes he past,
Not a fish, for he perished by water at last.
George Shaw (1751-1813)

Shaw was a medical practitioner and a lecturer in botany at Oxford University, a founder of the Linnean Society of London and Keeper of the Natural History Section of the British Museum. He published one of the first English descriptions with scientific names of several of the common Australian animals. He was among the first scientists to examine a platypus and published the first scientific description of it in *The Naturalist's Miscellany*.

During this excursion into the beginnings of the science of ichthyology I acquired some distinct impressions along the way. For one, I was reminded that the time gap between the first important stage (Aristotle) and the next one (Belon, Rondelet, and Salviani) was a long one, indeed. Aristotle's impact on the modern world has been profound and it has only been in more recent times that an evolutionary approach to the understanding of our world has progressively displaced the stationary Aristotelian view.

In reviewing the works of such pioneers as Belon, Rondelet, Salviani, Bauhin, Marcgrav, Gesner, Ray, Willughby, Linnaeus, and Artedi,



An illustration from Rondelet's *Libri de piscibus marinis*, 1554-55.

I was also reminded that these men wrote in Latin (although Willughby's *Ornithologia*, published in 1676, was translated into English by John Ray in 1678 as *The Ornithology of Francis Willughby*), and it was only after Artedi that important ichthyological works were written in the language of the country of the author.

A peculiarity I noticed involved the Latinization of proper names, e.g., Casparvs Bavhinus for Gaspard Bauhin, Joannes Rajus for John Ray, Conradus Oesnerus for Konrad Gesner, and Guilielmus Rondeletius for Guillaume Rondelet. To some extent this also manifested itself in Grecization as well, e.g., Salviani's first name from Ippolito to Hippolyte. This was a result of the need for intellectuals to set themselves off from the *profanum vulgus* (a term used by Horace meaning "the uninitiated masses"). This disdain of the uneducated was not based on moral grounds, but on the fact that the common people were using the vernacular, an idiom considered to be incapable of expressing the nuances of ancient wisdom. It signified an initiation into an exclusive community of scholars, just as a novice often adopted a different name upon entering a monastery to mark the importance of his or her decision.

A second motive for these name changes is that the adoption of a new name could mask a modest social background. Assuming a Latin name concealed humble origins and leveled the playing field. In this sense, these name changes can be interpreted as a step towards a more democratic society, because not birth and ancestral privileges but education and merit became the decisive factors in securing important positions hitherto closed to them in territorial and municipal administrations, in schools and universities, at the courts and in the church.

A noted example of this practice involved Linnaeus. The name he was given at his baptism was Carl Linnaeus, the Latin ending of his surname indicating academic status even at this early age, without which he would have been called Carl Nilsson, after his father. Later, even his first name was often Latinized to Carolus. (Swedes, however, know him as Carl von Linné, the name he took when he was raised to the nobility in 1757.) The Artedi family name had long been Latinized (his father was Olaus Arctaedius) but after having been at the University of Uppsala for ten years Artedi was no longer in receipt of a Royal scholarship so it was not necessary for him to maintain the name. He experimented with the name change a bit, first going from Arctaedius to Arctædi, and then a simplification to Artedi.

Another thing that struck me was that most of these men were trained as medical doctors, although a medical background as a stepping stone for the study of fishes was a logical one for the times. In those days the choices of study at the universities were few: law, medicine, and religion (another alternative for a young man was the military). Ray and Linnaeus, however, were devout Christians. Ray, for example, sought to turn the thoughts of his students from materialism to God, suggesting that, "instead of devoting themselves to games and dissipations, they would gain more satisfaction from the contemplation of the wisdom and goodness of God, as demonstrated in the exquisite works of nature."
Linnaeus on the other hand sought the divine

One of the plates in John Ray's *Synopsis Methodica Avium et Piscium*, 1713.

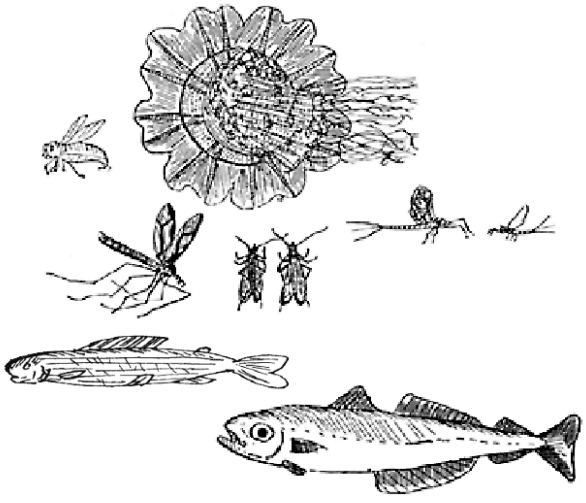
order of creation through reason. He was a pious man and natural theologian who wrote a theological essay, "The Oeconomy of Nature" (1749) to show the hand of God in nature. Linnaeus accordingly regularly attended church, and certainly never embraced the atheistic views of some his more sophisticated contemporaries. Linnaeus' one complaint with organized religion was that sermons could go on for too long. He trained his dog to slip out of the church during particularly long ones, and then would have to depart on the pretext of hunting up the missing animal!

Although an ichthyologist is not necessarily an aquarist, aquarium matters did arise during my examination of Rondelet's life. Rondelet had a villa outside the city of Montpellier with great tanks, fed with water brought through earthen pipes from the Fountain of Albe in Montpellier, in which he kept the fish whose habits he observed. His tanks were fed with water brought through earthen pipes from the Fountain of Albe, wherein he kept the fish whose habits he observed. Jules Emile Planchon, the author of an article that appeared in the *Montpellier Medical* for 1866 ("Rondelet et vies Disciples"), thinks that he had saltwater tanks also, and thus he may have been, as Planchon puts it, "the father of all Aquariums." As I pointed out, however, in my "The Toy Fish, A History of the Aquarium Hobby in America - The First One Hundred Years," the tanks were ponds or pools, so the honor, therefore, of being the first to keep fish in a glass container must go to Jeanne Rondelet, his wife, whom Rondelet claimed had kept a fish alive in a glass of water for three years.

In 1530, while still a scholar himself, Rondelet was appointed Procurator of Scholars - a post which brought him a small fee on each matriculation - and that year he took a fee from one of the most remarkable men of that or of any age, François Rabelais himself. (Rabelais was a renaissance writer, at first an ordained priest but he left his monastery to study medicine. As a doctor, he used his spare time to write and publish humorous pamphlets critical of established authority and that stressed his own perception of individual liberty.)

Rabelais seems to have liked Rondelet, and no wonder: Rondelet was a cheery little fellow, very fond of jokes, a good musician and violinist, and who, when he grew rich, liked nothing so well as to bring into his house any buffoon or strolling player to provide amusement for him. In a good-natured way, Rabelais poked fun at Rondelet, calling him "Rondibilis" for, indeed, Rondelet was a very round, plump, little man. It never ceases to amaze me what odd facts are uncovered in a study such as this one!

Lastly, I was struck by the fact that this early history of ichthyology involves two pairs of close friends, Ray and Willughby, and Linnaeus and Artedi. One of the most striking parallels is that in each pair, the surviving member was responsible for publishing the works of the other. In this respect we can return once again to Aristotle who wrote, **"Friendship is a single soul dwelling in two bodies."**

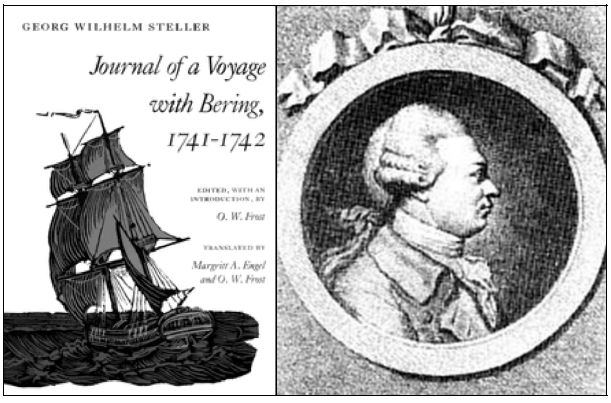


Fish and insects from Linnaeus' *Iter Lapponicum*, 1732.

The History of Ichthyology: Part II - 18th and 19th Century European Progress

One of the first to follow Artedi was **Georg Wilhelm Steller (1709-1746)**. Born in Windsheim, Franconia (Bavaria, Germany), Steller studied theology, medicine, and botany, and graduated with high honors. Despite his academic success, however, he could not find work in Germany and so traveled as an army surgeon to Russia. The Academy of Sciences sent him to Kamchatka (located on a peninsula situated opposite Alaska) to join Bering's famous voyage as a naturalist. The stated purpose of the expedition was to determine if Asia and America were joined by land, but Russia was also interested in extending Russian territory to include part of North America.

Although Bering and his men didn't much like him, Steller was able to do extensive work cataloging the flora and fauna of Alaska. When the crew was stranded on an island in the Bering Straight, it was Steller who saved many of the crewmembers by searching out the plants and meat that saved them from scurvy. Unfortunately, on the way back to Kamchatka, Stellar began drinking and upon his return was hounded by the Russian government. In November of 1746, despite ill health, he set off in a snowstorm for the Russian city of Tyumen, and froze to death at the age of thirty-seven.



Left: The cover of the Georg Wilhelm Steller (1709-1749) Bering voyage book. Right: Peter Simon Pallas (1741-1811), friend of Steller.

Steller's extensive work as a naturalist on Bering's second voyage was almost lost but a friend of his, naturalist Petrus Pallus, edited his journals after Steller's death and published them. As a result, we have first hand accounts of species that were extinct before other naturalists could describe. Steller described at least eight new genera of fishes, although the names were later changed in accordance with Linnaean nomenclature.

His friend, **Peter Simon (Pyotr Simonovich) Pallas (1741-1811)** was a Berlin biologist, who got his education in Göttingen and Leiden, and was active in the British Isles and in the Netherlands. He became Professor of Natural History at the St Petersburg Academy of Sciences in 1767, but between 1768 and 1774 he came under contract to the Russian government to head an Academy of Sciences expedition that studied a number of regions of Russia. As a result, he described many new species of mammals, birds, fish, and insects. In 1793 he was sent on an expedition to the Crimea, where he stayed during several years in an estate given to him by the Empress Katharina II. He eventually, however, returned home to Berlin.

Pehr Forskål (1732–1763) was a Finnish naturalist, explorer, and professor who studied briefly under Linnaeus in Sweden and mastered such diverse subjects as economics, theology, and Oriental languages. His broad knowledge made him a good choice for a

Left: Pehr Forskål (1732–1763).
Right: Carsten Niebuhr (1733-1815).

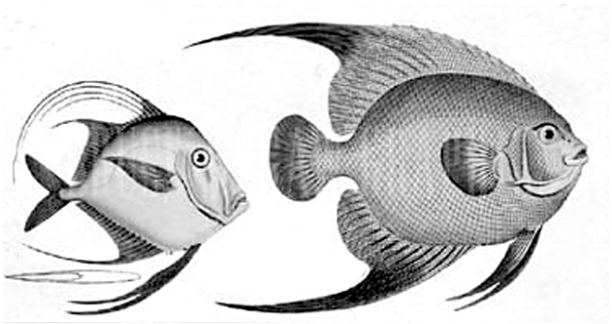
royal-sponsored expedition to explore Arabia, Palestine, Syria, Persia, and Asia Minor in 1761. Though Forskål died of malaria in Arabia in 1763, the expedition's sole survivor, German-born Carsten Niebuhr, published his descriptions of fishes and other animals. He was highly esteemed by Linnaeus and was considered an energetic, eager beaver with a fine sense of detail as well as completeness. However, some of his contemporaries thought him to be "stubborn, quarrelsome and rude."

Outstanding was **Otto Fabricius (1744-1822)**, a Danish missionary, naturalist, and linguist who conducted explorations on West Greenland. He lived in a primitive Eskimo camp during the five and a half years from 1768 on, making his observations helped only by a kayak, a cup and some bivalve shells used as bowls, a few hand-held lenses, and Linnaeus's *Systema Naturae*. Later he was appointed professor of theology and titular bishop but is most well known for his *Fauna Groenlandica*, published in 1780.

Thomas Pennant (1726-98) of Downing, Flintshire in Wales, was a landowner of independent means, a leading naturalist, traveler (Dr. Johnson describes him as "the best traveller I have ever read"), and antiquarian. His publications were valued for their highly readable treatment of the existing knowledge of natural history, and his *British Zoology* and *Arctic Zoology* brought him academic acclaim and stimulated zoological research.

The life work of **Marcus Elieser Bloch (1723-1799)** is an early base of modern ichthyological nomenclature and systematics. Compared with other authors, Bloch's work does not contain many compilations and is based mainly on his own scientific fish collection. This once comprised about 1400 specimens and about 800 of them are still available representing worldwide the largest still existing ichthyological collection of the 18-century. He published the monumental, *Allgemeine Naturgeschichte der Fische*, 1782-95 and in 1801, after Bloch died, his associate, Johann Schneider, published the *M. E. Blochii Systemae Ichthyologiae*, describing 1,519 species.

Left: Otto Fabricius (1744-1822).
Right: Thomas Pennant (1726-98).



Drawings of Marcus Elieser Bloch (1723-1799) from his *Ichthyologie, ou histoire naturelle des poissons.*

Bloch's work, *Ichthyologie, ou histoire naturelle des poissons*, 1795–97, is one of the high points in the history of ichthyology, both graphically and taxonomically. It is still in use as a standard reference for identification. Bloch described fishes from all over the world, relying on numerous contacts around the globe. In all, he listed more than 169 new species. Published in twelve volumes, each of the 432 hand-colored illustrations is identified in several languages. The silver and gold touches Bloch employed to mimic the reflective qualities of fish scales lend a dramatic sparkle to many of these impressive and richly colored images. Bloch made every effort to be comprehensive in this study, searching out species from "the four corners of the globe."

Before we discuss the French ichthyologists, it should be mentioned that although it is the post-Linnaeans that laid the cornerstones of today's systems, the French never really liked the Linnaean system. (A French Linnaean Society was almost an oxymoron.) The French workers, as well as their successors, rarely discussed their philosophical bases, but Cuvier for one stated, "classes, orders and genera are abstractions by man and do not exist in nature." The French workers saw nature as a continuum, like a great land mass on which they were drawing lines to separate and group man-made taxa. The characters of taxa were in the nature of latitude and longitude by which you could locate them on the map.

Bernard Germain Etienne de La Ville sur Illon Comte de Lacepède, who most likely had the longest name in the history of ichthyology, was a pupil of Buffon and a close friend of Voltaire. He was a naturalist, particularly interested in fishes and reptiles, and also a musician who composed symphonies and operas. Lacepède's work on *Quadrupèdes Ovipares* (Reptiles and Amphibians) and snakes was originally published in 1788-1789 as part of Buffon's *Histoire Naturelle*. These sections by Lacepède, as well as his sections of cetaceans and fishes, were subsequently reprinted numerous times over the next 100 years.

In 1788 he became a lecturer in the Royal Ministry of Natural History, and in the following year joined the French Revolution with enthusiasm. He was elected to a Chair in the Botanical Garden (Jardin du Roi) and became an administrator of the department thereafter. As a member of the Legislature, he also was active in the Committee of State Education. However, the excesses of the evolution in events frightened him, and he withdrew from public life until the coup of Thermidor (Thermidor refers to the coup of July 27, 1794 in which Maximilien Robespierre was guillotined and the Reign of Terror ended. Thermidor was the eleventh month in the French Revolutionary Calendar, which was used only in France and only for thirteen years. It was the middle month of summer, being named for heat). In 1803 he published his *Histoire naturelle des Poissons*. This publication, along with the work of Cuvier that followed, marked the birth of comparative anatomy and paleontology. Because he became one of Napoleon's

Comte de Lacepède (1756-1825)

Joseph Antoine Risso (1777-1845).

favorites, Lacepède had great political influence and used it to develop the Muséum d'Histoire Naturelle and Jardin des Plantes.

Joseph Antoine Risso (1777-1845) was a druggist, botanist, medical chemist, and zoologist in Nice, but is best known for his systematic works concerning Mediterranean fishes, *Ichthyologie de Nice* or *The Ichthyology of Nice or the Natural History of Fish of the Department of the Alps Maritimes*, published in 1810 in Paris. In its review, the Moniteur Universel (Universal Gazette) commented, **"This is the first topographic treaty on fish published by a Frenchman and is indisputably the most complete of all of its kind." In the Moniteur de Noter it was observed that Risso had had "paid considerable detail to attach the common names in the patois of Nice."**

Wilhelm Gottlieb von Tilesius von Tilenau (1769-1857), physician and natural historian, accompanied Hoffmansegg on his voyage through Portugal (Count Von Hoffmansegg was a German botanist and co-author of a flora of Portugal), and Krusenstern on his circumnavigation of the globe (Adam Johann von Krusenstern was a Russian navigator whose voyage was undertaken to stimulate the fur trade of the Pacific coast and to revive trade with China and Japan, but its real contribution was the knowledge of the hydrography of the North Pacific coast of America). As a result of his observations on these voyages, Tilesius published a work of scholarly opinion on the procreation of rays and sharks from Aristotle onward, and then went on to describe the anatomy and physiology of rays and sharks and their eggs. An expedition artist, Tilesius also traveled with the Georg H. von Langsdorff Voyage as its illustrator (von Langsdorff was a Doctor of medicine and natural history at the University of Göttingen; he explored the region of Minas Gerais, Brazil with Antoine Saint-Hilaire, and also explored the Mato Grosso from 1821-1829).

Baron Georges Léopold Chrétien Frédéric Dagobert (or simply Georges) Cuvier (1769-1832), who had the second longest name in the history of ichthyology, was born to a French Huguenot family in a small town close to Basel, at that time a part of the duchy of Würtemburg. Cuvier studied at the Carolinian Academy in Stuttgart from 1784 to 1788, a school founded by the Duke. After completing

Wilhelm Gottlieb von Tilesius von Tilenau (1769-1857).

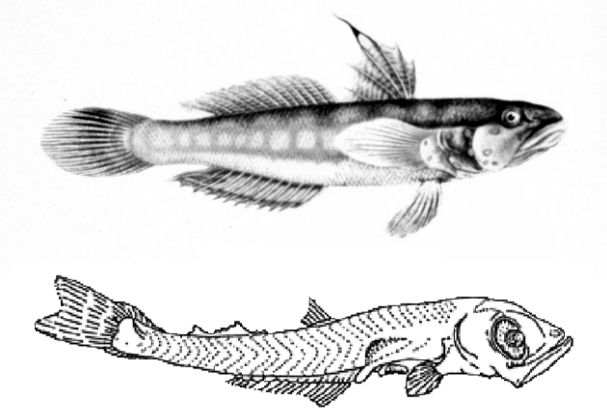
Georges Cuvier (1769-1832).

his studies he took a position as tutor to a noble family in Normandy, which kept him out of the way of the worst of the violence of the French Revolution. It was there that he became interested in marine life, which he skillfully depicted and studied, helped by the key literature of that time, i.e., the works of Aristotle. After a few years, rumors about his activity had reached Paris where he was summoned in 1794 and soon afterwards, with recommendations from both Jean Baptiste Lamarck (1744-1829) and Geoffroy Saint-Hilaire (1772-1844), was appointed Professor of Comparative Anatomy at the newly reformed Musée National d'Histoire Naturelle (National Museum of Natural History).

Cuvier stayed at his post when Napoleon came to power and was appointed by Napoleon to several government positions, including Inspector-General of Public Education and State Councilor. He continued as a State Councilor under three successive Kings of France, thus accomplishing the almost unbelievable feat of serving under three different, opposing French governments (Revolution, Napoleonic, and monarchy) without getting his head chopped off. (Cuvier actually died in the first large cholera epidemic in Europe, leaving just his widow, as their children all died young.) All the while, Cuvier lectured and did research at the Musée National, amazing his colleagues with his energy and devotion to science. By the time of his death he had been knighted, and made a Baron and a Peer of France.

Cuvier devoted himself to the study of fishes with particular predilection. His investigation of their anatomy, and especially of their skeletons, was continued until he had succeeded in completing so perfect a framework of the system of the whole class that his immediate successors only needed to fill out those details for which their master had no leisure. He ascertained the natural affinities of the infinite variety of forms, and accurately defined the divisions, orders, families and genera of the class, as they appear in the various editions of his *Regne Animal*.

His industry equaled his genius. He formed connections with almost every accessible part of the globe and for many years the Museum of the Jardin des Plantes was the center where all his ichthyological treasures were deposited. Since this collection contains all the materials on which his labors were based, it must still be considered as one of the most important. Soon after the year 1820, Cuvier, assisted by one of his pupils, Achille Valenciennes (1794-1865), commenced his great work on fishes, *Historie naturelle des Poissons*, of which the first volume appeared in 1828. After Cuvier's death in 1832, the work was left entirely in the hands of Valenciennes (a disciple of de Lamarck and who occupied the Chair of Nonarticulate Invertebrates at the Paris Museum for 33 years, and although an all round zoologist, he is most well-known as an ichthyologist), whose energy and interest gradually slackened. He left the work unfinished with the twenty-second volume (1848), which treats of the Salmonoids. Yet, incomplete as it is (it contained new species and summaries of descriptions by other



Two Genera named after Achille Valenciennes (1794-1865), Top: Valenciennea violifera (one of the Sifter or Sleeper Gobies), Bottom: Valenciennellus tripunctulatus (Constellation fish, one of the dragon fishes).

authors for a total of over 4500 fishes), it is indispensable to the student of ichthyology.

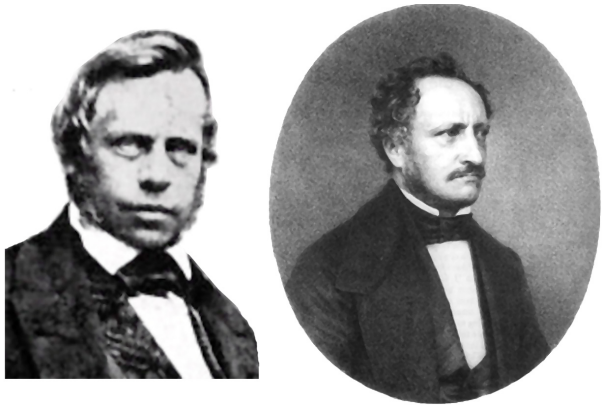
Without a doubt, Georges Cuvier possessed one of the finest minds in history. Almost single-handedly, he founded vertebrate paleontology as a scientific discipline and created the comparative method of organismal biology, an incredibly powerful tool. It was Cuvier who firmly established the fact of the extinction of past life forms. He contributed an immense amount of research in vertebrate and invertebrate zoology and paleontology, and also wrote and lectured on the history of science.

Johann Baptist von Spix (1781-1826), the son of a surgeon in Bavaria, Germany, received a doctorate in theology at the University of Bamburg (Berlin) before changing his career to medicine. During his practice of medicine, he pursued his interest in anatomy and physiology and traveled in France and Italy where he met with the most eminent scientists of the period, including Cuvier and Geoffroy St. Hilaire. He found his life's work in the field of natural history, specifically zoology, when in 1811 he was appointed the first Curator of Zoology at the Bayerische Akademie der Wissenschaften (the Bavarian Academy of Science) in Munich.

In 1815, Spix, botanist Carl Friedrich Philipp von Martius, and several other naturalists were selected to take part in an official Austrian expedition to Brazil. The opportunity was occasioned by the marriage of the Austrian emperor's daughter to the crown prince of Portugal, then living in Brazil thanks to the Napoleonic invasion of his country. From 1817 to 1820, traveling separately or together at different stages, Spix and Martius's explorations in the interior of the country turned out to be one of the most important scientific expeditions of the 19th century. Despite illnesses and harrowing obstacles Spix went up the Amazon River and through its jungles as far as the frontier with Peru. They were the first Europeans to explore these areas since the 1740's and their collections - including 85 species of mammals, 350 species of birds, nearly 2,700 species of insects, and fifty-seven living animals - provided material for a vast number of works.

Upon their return, Spix worked tirelessly, analyzing his zoological collections and publish-

Johann Baptist von Spix (1781-1826).



Left: Friedrich Gustav Jacob Henle (1809-1885) ,
Right: Johannes Peter Müller (1801-1858).

ing descriptions of many species new to European science in his works on the mammals, amphibians & reptiles, and birds of Brazil. Tragically, he died only 6 years later from the ills contracted during the trip ("nervous typhus" according to Martius's memorial in *Selecta Genera et Species Piscium*), and his remaining scientific studies (on fishes, mollusks, and insects) were completed by others (e.g., *Selecta Genera et Species Piscium*, 1829-1831, by Louis Agassiz).

Friedrich Gustav Jacob Henle (1809-1885) was a German anatomist and pathologist, and a student and the closest co-worker of Johannes Peter Müller. Henle became the greatest histologist and finest anatomist of his day. He maintained that disease is a deviation from normal physiological processes and that it was a physician's duty to prevent and cure disease. A man of wide interests, he was equally at home with the arts as with science (he was a poet and a fine musician, playing the violin, viola and violin cello, and had a wide circle of friends, including the composer Felix Mendelssohn and Alexander von Humboldt). Along with Müller he produced the first authoritative work on sharks (*Systematische Beschriebungen der Plagiostomen*, 1841).

Johannes Peter Müller (1801-1858) was the son of a shoemaker, but his mother succeeded in obtaining a good education for him. During his college courses in Germany he devoted himself to the classics and made his own translations of Aristotle. His first intention was to be a priest, but at eighteen his love for natural science turned him to medicine. He became professor of anatomy and physiology at the Berlin University in 1833, and was a Foreign Member of the Royal Society. A comparative anatomist, physiologist and zoologist, Müller is regarded as the founder of modern physiology.

Fauna Japonica (*Japanese fauna*), 1842-1850, was the first material written in a Western language about Japanese fauna. It introduced Japanese fauna to the West on a wide scale (it described, for example, the medaka, *Oryzias latipes*, although the authors placed it in the genus *Poecilia*). This work of **Philipp Franz Balthazar von Siebold (1796-1866)** was compiled by three scholars of the Leiden Museum on the basis of the enormous number of zoological specimens collected by Siebold during his stay in Nagasaki during 1823 and 1829, and of rough sketches by the Japanese artist Keiga Kawahara and others. It was published serially in five volumes over a long period, 1833 to 1850.

The section on fish was written by **Hermann Schlegel (1804-1884)** and **Coenraad Jacob Temminck (1778-1858)**. Both were employed by the Rijks Museum van Natuurlijke Historie in Leiden, Schlegel as Curator of Vertebrata and Temminck as its Director. Temminck, an Amsterdam aristocrat and zoologist, was its first director, from 1820-58. His father, the treasurer of the Dutch East India Company, had gathered a large bird collection and his son became an ornithologist of repute and extended the collection to include other animals. The condition for his directorship was that this collection should belong to the museum.

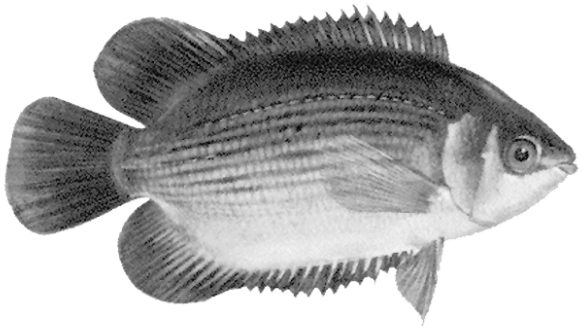
Left: Philipp Franz Balthazar von Siebold (1796-1866) ,
Right: Hermann Schlegel (1804-1884).

The second and last attempt to write a complete catalog of the fishes of the world was by **Albert Charles Lewis Guenther (1830-1914)**. Guenther was born in Esslingen am Neckar and studied theology and medicine in Tübingen, Berlin, and Bonn, obtaining a doctorate degree in both of these areas. As a sort of incidental sideline, he spent some time studying fishes. His first scientific work was published in 1853 and concerned the fishes of the Neckar, a river in Baden-Württemberg.

He immigrated to England in 1856 and worked in the St. Bartholomew Hospital in London. A year later he took a job with the British Museum as head of the Department of Zoology (which position he held from 1857 to 1895. Initially, it was the snakes that held his attention but later he concentrated on ichthyology, ultimately writing 226 articles and/or books about fishes.

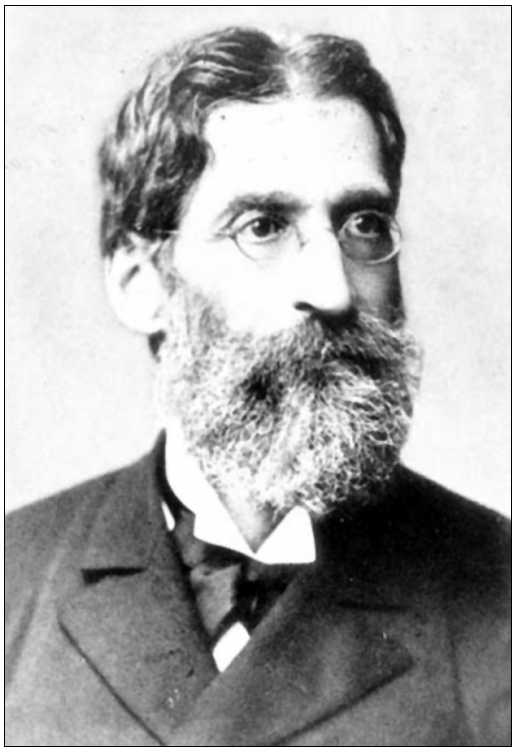
Guenther holds an honored position in the history of ichthyology, his greatest work being his *Catalogue of the Fishes of the British Museum*, published in eight volumes from 1859-1870. In this catalogue of over 4,000 pages, Guenther described over 6,800 species and mentioned another 1,700. It was the last work of its type, however, since too many species were being discovered and the task became more and more complicated, far more work than one person could accomplish.

Franz Steindachner (1834-1919) first studied law, but after completion of his studies turned to the natural sciences, becoming a regular visitor at the Imperial and Royal Court Natural History Museum of Vienna. After working in the fish collection on a temporary basis for a year, he was given a vacated office clerk position in 1861. He subsequently took over as curator of the fish, amphibian, and reptile collections. His first collecting trips led him to Spain, Portugal, the Canary Islands, and Sene-



Helostoma temmincki, named after Coenraad Jacob Temminck (1778-1858).

Albert Charles Lewis Guenther (1830-1914).



Franz Steindachner (1834-1919).

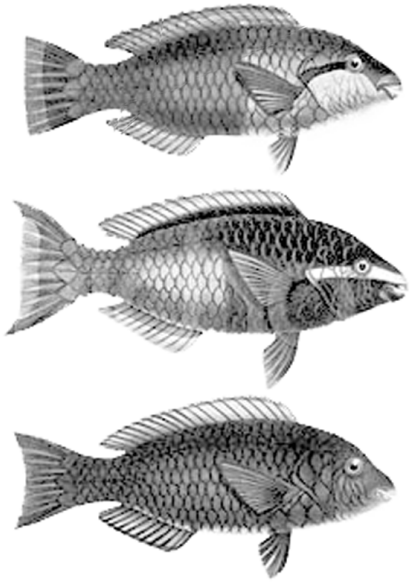
gal. Between 1859 and 1868 he published no fewer than 55 ichthyological articles, amounting to almost 900 pages and thus, within a very short time, established himself as an outstanding ichthyologist.

In recognition of his merits, Louis Agassiz, at that time the best-known naturalist of America, invited Steindachner in 1868 to accept a post at Cambridge University in Boston and he took a two years' leave to consider the offer on the spot. In Cambridge he worked up the collection from the Thayer expedition, particularly the South American freshwater fishes. Following Agassiz's invitation, Steindachner then took part in the Hassler expedition in 1871/72, which circumnavigated South America from Boston to San Francisco. From the enormous yield of this journey - more than 100,000 fish specimens - Steindachner was allowed to take material almost at will for his Viennese collection. Although he duly credited Aggasiz for this, nevertheless he felt a bit used, even exploited, by his famous colleague. Steindachner feared that Agassiz, slightly prone to vanity, might impede his own scientific activities and if he stayed in Cambridge he would remain forever in Agassiz's shadow. Consequently, he finally refused the professorship in Cambridge and returned to Vienna in 1874 for good.

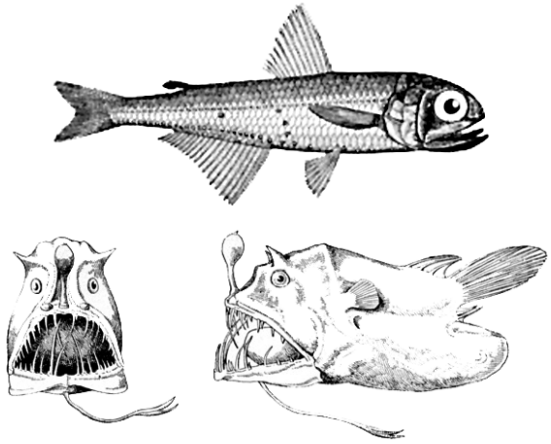
In 1898 Steindachner was promoted to Director of the Imperial Museum. His last big journey, in 1903, led him to Brazil, where he undertook extensive collecting trips, notwithstanding his advanced age of 69 and heavy bouts with malaria. The 85-year old Steindachner retired in 1919 after 60 years of service at the Museum, and was even allowed to use, as "Fischhofrat" or "Fish Councilor to the Court," his previous official apartment in the Museum. He died of pneumonia only 10 weeks later, probably aggravated by poor heating in the building.

Pieter Bleeker (1819-78) was a Dutch ichthyologist and surgeon who studied medicine in Haarlem and later in Paris, where he also took courses in zoology. In 1841 he was appointed Military Surgeon of the Netherlands East Indian Army and left for Batavia (Jakarta). During 1842-1847, he was stationed in Batavia where he started promoting natural history research and specializing in the study of fishes, of which he assembled a large collection. After having been banned from Batavia for some years because of being politically uncomfortable to the Dutch high officials in Batavia, he was allowed to return in 1849 to the medical school there and placed in charge of the training of native students for the medical profession.

At his return, he renewed his ichthyological studies and also took an interest in general natural history. He was mainly responsible for the founding in 1850 of the Rijksmuseum van Natuurlijke Historie (Royal Natural History Society) and made it a flourishing institution with its own journal. Bleeker made numerous



Some of the drawings of Pieter Bleeker (1819-78) from his *Atlas Ichthyologique des Indes Neerlandaises.*



Two fish described by Robert Collett (1842-1913).
Top: Muller's Scopelus, *Scopelus Mulleri*.
Bottom: Linophryne lucifer.

collecting trips all over Java (and also a trip to the Moluccan Islands and to Celebes in 1855), and published several notes and papers, mostly on ichthyology. He returned to the Netherlands in 1860, bringing home huge collections. He had an abiding passion for the study of fish, especially those of the Indonesian archipelago. He published 520 separate contributions, chiefly on the fishes of the tropical Indo-Pacific. During his life Bleeker sent more than 12,000 species from the East Indian Archipelago to Holland. His *Atlas Ichthyologique des Indes Orientales Néerlandaises,* 1862-1877, with its beautiful and accurate figures, may be considered one of the two most impressive books on fish ever published, the other being Bloch's *Ichthyologie ou histoire naturelle des poissons*.

Robert Collett (1842-1913) was the son of famed Norwegian author Camilla Collett, writer and women's rights advocate. Collett was a zoologist, working with vertebrates, particularly fishes. From 1864 he was curator at the Zoological Museum in Oslo, then in 1882 became (together with G.O. Sars) Director of the Museum and, in 1884, a professor there.

Francis Day (1829-1889), Inspector-General of Fisheries in India and Burma, was the leading nineteenth century ichthyologist of the Indian subcontinent, attaining this position after his initial career as a medical officer with the Madras establishment of the East India Company when fishes were but a hobby with him. He conducted a thorough survey of the fishes around the Bay of Bengal and in 1874 returned to England to work on his definitive guide to Indian fishes (*The Fishes of India,* 1875-1878) in the British Museum where he had sent many of his specimens. Its 1888 supplement and his two-volume *Fishes* in the 1889 *Fauna of British India* series contain useful data and descriptions of over 1400 species.

A lithograph by Francis Day (1829-1889) in his *Fishes of India*. The proportions of the shark are true to life and the pattern is faithfully rendered. The shading clearly shows the depth of the body and the angle and attachment of the fins.

Felipe Poey Aloy (1799-1891).

Felipe Poey Aloy (1799-1891), the son of French parents, was born in Havana. He studied law in Paris and graduated in 1820. He became a Professor in the National Academy of Law in Madrid but had to flee Spain because of his liberal ideas, and so he returned to Cuba in 1823. At this time he dedicated himself to his studies in natural sciences. In 1825 he traveled to France where he supplied Cuvier and Valenciennes with fish specimens from Cuba. During his stay in Paris he perfected his knowledge of Latin and acquired the necessary scientific training to begin his later work on the study of fish. He returned to Havana in 1833 and afterwards founded the Museo de Historia Natural and became the first professor of zoology and comparative anatomy at the Universidad de La Habana. He maintained relations with the most important naturalists of his time and worked with fishes for over 50 years. Among other works he was author of *Poissons de l'le de Cuba* (1874) and 20-volume work on the fishes of Cuba, *Ictiologia Cubana* (1955 and 1962).

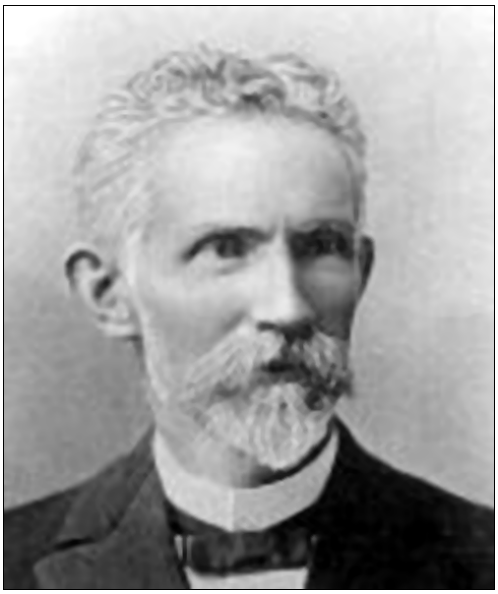
Poey described 85 species of Cuban fish that Cuvier included in his work. When Poey made systematic studies of fish species in the waters around Cuba in the 1800's, he deposited many of his specimens in U.S. institutions, such as the Smithsonian and Harvard University. His work, which laid the foundations of natural history research in Cuba, also helped initiate a tradition of close collaboration between scientists in the United States and Cuba.

Leon Louis Vaillant (1834-1915) was a French naturalist and malacologist, who took part in the expeditions with "Travailleur" (1880, 1881 & 1882) and "Talisman" (1883). Sabah made up about one-tenth of Borneo's total land area, but more than one third of the freshwater fishes known from Borneo were also known to occur in Sabah. The initial faunal survey carried out by Vaillant**,** *Contribution à l'étude de la faune ichthyologique de Bornéo*, 1883 (and also by Weber and de Beaufort during 1913-1922), resulted in the documentation of the majority of fish species found in Sabah.

Marie-Firmin Bocourt (1819-1904) was a French zoologist and artist at the Natural History Museum in Paris. With Vaillant, Bocourt wrote *Etudes sur les Poissons* (*Studies of Fish,* in: *Mission scientifique au Mexique et dans l'Amerique centrale, Recherches zoologiques*, 1883). In 1861 Bocourt, then an assistant of André Duméril (a protégé and close friend of Cuvier), was sent to Siam to receive an important gift of live animals that the king gave to France. He remained for a year in the region of Bangkok and there put together an important zoological collection that was deposited in the Paris Museum.

Friedrich Wilhelm Karl Berg (1843-1902) was a Russian-German zoologist. Conservator

A river loach from Borneo, Vaillantella euepipterus, named after **Leon Louis Vaillant (1834-1915)**



Friedrich Wilhelm Karl Berg (1843-1902).

of the Museum of Riga, he occupied various educational posts in that city until, recommended by the Director of the Museo Público de Buenos Aires, took over the post of Superintendent there in 1873. He also taught at the University of Buenos Aires until 1890, when he was offered the position of Director of the Museo Nacional de Montevideo. He occupied this post until 1892 when he was appointed Director of the Museo de Historia Natural de Buenos Aires. Berg is the author of nearly 200 scientific works, many of them involving Uruguayan and Argentinean fishes.

After reviewing this history of the European Ichthyologists of the 18th and 19th Century, I am struck with three things. The first is the risks they took and the prices they paid. Steller froze to death at the age of thirty-seven, Spix died from the malaria he contracted during his Brazilian trip, Forskål died of malaria in Arabia, and Steindachner was severely afflicted with the disease as well.

Lacepède came close to experiencing the guillotine during the Reign of Terror and, by risking his own life, Geoffroy Saint-Hilaire succeeded in rescuing several clergyman colleagues from that fate. Even after the decades following the Napoleonic wars, being politically active was a pursuit definitely not without its dangers. Henle, for example, led a life filled with politics and intrigue. He joined the Burschenschaft (student's association), and took part in its political activities and for this he was suspended from the university and was transferred to the Berlin "Hausvogtei," a place of detention where many students were sent at that time. Suspected of being an "enemy of the state," he was detained there to await trial, but through the intervention of Alexander Humboldt and others he was released from confinement after four weeks.

Others had different sorts of problems when traveling. At the end of his stay in Japan, for example, it became known that Siebold was copying a map of the northern regions of Japan with the connivance of the Imperial librarian and astronomer. The possession of maps was strictly forbidden and, upon being discovered by the Japanese authorities, Siebold was accused of high treason and being a spy for Russia. The Government imprisoned all of Siebold's known Japanese students and friends,

The Japanese mistress, Kusumoto Taki, Siebold was forced to leave behind, along with his 2-year old daughter.

searched his house repeatedly, confiscated objects, and informed him that he would not be allowed to leave the country. The astronomer was beheaded. After a prolonged investigation into the matter, Siebold was informed that he was to be permitted to leave Japan but was to be banished forever. His young Japanese mistress (Kusumoto Taki) and his two-year-old daughter were forbidden to accompany him and he was forced to leave them behind.

The second matter that caught my attention was one of the most famous debates in the history of biology. Cuvier's ideas led him to oppose the theories of his contemporaries, such as Buffon, Lamarck, and Geoffroy St. Hilaire, who suggested that animal morphology might be much more changeable and be affected by environmental conditions. They pointed to vestigial, functionless structures and to embryonic development to show that dissimilar organisms with different functions might nonetheless share a common structural plan. Cuvier, however, maintained that similarities between organisms could only result from similar functions. Writing in 1828, he stated: **"If there are resemblances between the organs of fishes and those of the other vertebrate classes, it is only insofar as there are resemblances between their functions."**

Matters came to a head in 1830 when two young naturalists, Meyranx and Laurencet, presented a comparison of the anatomy of vertebrates and cephalopods (squids, cuttlefish, and octopi), claiming that they were based on the same basic structural plan. Geoffroy enthusiastically adopted this claim as proof of the unity of plan shared by all animals. Cuvier, of course, could not reconcile it with the results of his careful anatomical research. This lead to the famous public debates between Cuvier and Geoffroy, a total of eight taking place from February to April 1830.

In these debates, Cuvier showed convincingly that many of Geoffroy's supposed examples of unity of structure were not accurate and that the supposed similarities between vertebrates and cephalopods were contrived and superficial. Geoffroy had some major disadvantages in these exchanges: while Cuvier was an adroit public speaker, Geoffroy Saint-Hilaire mumbled; where Cuvier was a master of the understandable metaphor, Geoffroy Saint-Hilaire was pedantic and long-winded; and while Cuvier had excellent dress sense and flaming red hair, Geoffroy Saint-Hilaire was bald and seems mostly to have worn whatever came to hand! While Cuvier is generally said to have won the debate, the views of Geoffroy continued to be perpetuated in scientific circles, and the repercussions of this debate on form versus function can still be felt in modern biology.

Despite their differences, however. the two men did not become enemies. They respected each other's research, and in 1832 Geoffroy gave one of the orations at Cuvier's funeral (an irony is that Cuvier's eulogy at Lamarck's funeral was not at all flattering to the old dead man compared to the kind words spoken by Geoffroy.

On occasion I am saddened by the weaknesses shown by some of these great names in ichthyology. Besides being a drunk, Steller was not easy to get along with and Forskål was obsti-

Geoffroy Saint-Hilaire (1772-1844).

A poster advertising an exhibit of Saartje (Sara) Baartman (1789-1816).

nate and ill mannered However, I was most disappointed with Cuvier, which brings us to Saartje (Sara) Baartman (1789-1816). Born in the Eastern Cape of present-day South Africa, Baartman was a member of the Khoisan group, the original inhabitants of southern Africa.

Her family moved to a shack near Cape Town and, while working as a 20-year-old servant to a local farmer, she attracted the attention of a visiting English ship's surgeon, William Dunlop. What made her a curiosity in the doctor's eyes were her extraordinary steatopygia - enlarged buttocks - and her unusually elongated labia, a genital peculiarity of some Khoisan women of the time. She agreed to go with Dunlop to England where, he promised her, she would become rich and famous as a subject of medical and anthropological research. She was 21 when she left Cape Town for London and at first she was indeed put under anatomical scrutiny by scientists, but before long her only role was as an exhibit before the general public.

Contemporary descriptions of her shows in London indicated that Baartman was made to parade naked along a "stage two feet high, along which she was led by her keeper and exhibited like a wild beast, being obliged to walk, stand or sit as he ordered." People paid one shilling to gawk at her and, for several years, working-class Londoners crowded in to shout vulgarities at the protruding buttocks and large vulva of the unfortunate woman.

Baartman's predicament drew the attention of a young Jamaican, Robert Wedderburn, who agitated against slavery and racism. Subsequently, his group pressured the Attorney General to stop this circus. Losing the case on a technicality, Baartman spent four years in London and then went on to Paris where she was exhibited in a traveling circus, controlled by an animal trainer in the show.

It was here that she crossed paths with Cuvier, Napoleon's surgeon-general at the time and who was considered to be the dean of comparative anatomy. In his capacity of social anthropologist he arrogantly and erroneously concluded that she was the missing link. She turned to prostitution and after dying penniless in 1816, Cuvier had her body cast in wax, dissected and the skeleton articulated. Her organs, including her genitals and brains, were preserved in bottles of formaldehyde. Her remains were displayed at the Musée de L'Homme in Paris until 1974, when they were removed from public view.

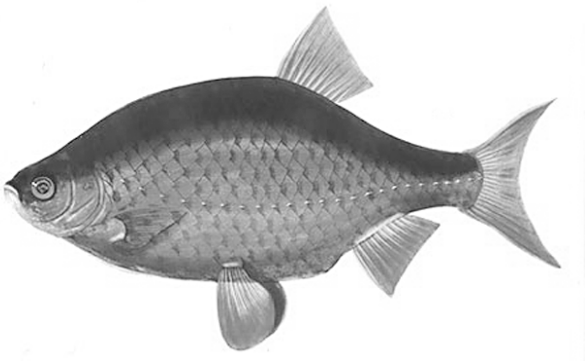
In post-apartheid South Africa, efforts were made to retrieve Baartman's remains. In 1994, then-President Nelson Mandela appealed to his French counterpart, but it took years of negotiations and wrangling before a law was passed in March 2002 allowing for her return (the text was carefully worded to prevent it from being used in other cases). French Research Minister Roger-Gerard Schwartzenberg stated: **"France wants to restore the dignity of Saartje Baartman, who was humiliated as a woman and ex-**

ploited as an African." In May 2002, her remains were brought home to South Africa and in August 2002, she was finally laid to rest in the Eastern Cape. Lastly, it is important to note

Finally, it is important to note **Sarah Bowdich (1791-1856)**, one of the more remarkable women in natural history in the 19th century. One of the earliest European women to visit tropical West Africa, she was the first woman to discover and systematically describe new species of plants and fish. Known to many only as the wife of Thomas E. Bowdich, the famous African explorer, she lived on the Gold Coast for more than eighteen months, visited the Gabon, and then studied Arabic Literature and natural history in Paris. She and her husband studied in Paris, where Cuvier and Humboldt acted as their scientific mentors. She published 20 books, among them the rare and beautiful *Fresh Water Fishes of Great Britain*, 1828. It was published in 12 installments each with four plates hand-colored in watercolor and gold and silver foil over a 10-year period. The technique was especially effective for recreating the metallic shimmer of fish scales. It took this long, according to her daughter, because **"My mother... having three children to support by her pen and pencil, could not afford to devote all her time to this one work, which accounts for the length of time it was in completion."** Each fish was painted from life and the accompanying text displays a thorough knowledge of ichthyology. Fewer than 100 copies of the book survive.

Married to Thomas E. Bowdich, African traveler and explorer, she edited and illustrated his works as well as her own. Bowdich was Born in 1791 and in 1813 was a partner in the firm of Bowdich, Son, & Luce, hatters. In that same year he married Sarah, daughter of Mr. John Eglington Wallis, of Colchester. He became a writer for the African Company at Cape Coast Castle in 1814 and joined the Company mission to Ashantee (in present day Ghana) in 1815. Bowdich and his wife studied in Paris, 1818-1821, where they met Cuvier. He undertook, with his wife, a second African expedition in 1822 and died of fever at Bathurst, Gambia in 1824 at the age of 33. This ended her career as a naturalist. Widowed and penniless, Sarah remarried and, under the name, "Mrs. R. Lee," became a popular writer and illustrator of scientific works for young people. More than twenty books and numerous stories were published, many of which drew upon her great knowledge of natural history and her African experiences.

Some of her books include: *Taxidermy: or, The art of collecting, preparing, and mounting objects of natural history - For the use of museums and travellers,* 1820; *Memoirs of Baron Cuvier*, 1833; *Stories of strange lands; and fragments from the notes of a traveller*, 1835; *Anecdotes of the habits and instincts of birds, reptiles, and fishes*, 1861; *British Animals and Birds*, 1865; *Foreign Animals and Birds*, 1865; and *Adventures in Australia: or, the Wanderings of Captain Spencer in the bush and the wilds*, 1879.



"Rud or Finscale," Known today as the Rudd (*Scardinius erythrophthalmus*). Drawn by Sarah Bowdich (from *Fresh Water Fishes of Great Britain*, 1828).

The History of Ichthyology: Part III - Ichthyology in America Up to the Civil War

We can date the start of American Ichthyology with the work of **Constantine Samuel Rafinesque-Schmaltz** (his last name was later written simply as "Rafinesque"). Born in 1784 of French parentage in a suburb of Constantinople, Turkey, he later traveled through Pennsylvania and Delaware, and from there he went to Sicily where he spent ten years as a merchant and in the study of botany. Before he left the United States in late December of 1804, Rafinesque had approached Thomas Jefferson asking to be appointed naturalist to one of the President's proposed western expeditions. After some delay, Jefferson sort of agreed to send him on the Red River expedition to be led by William Dunbar and George Hunter. Alas for young Rafinesque, he received word that he would be appointed only after he was in Sicily. Considering that the natural history collections of the Dunbar-Hunter expedition were essentially nil, science lost out on both accounts.

While in Sicily, Rafinesque had been publishing widely, especially articles in scientific journals, most notably the New York-based journal *Medical Repository* (of that publication, more will be said a bit later). He also published a number of books, e.g., his journal, *Specchio delle scienze*, (two volumes), published in 1814, and his 1815 book, *Analyse de la nature*, both printed in Palermo. The latter work was particularly significant for in it Rafinesque outlined a system of classification for all living organisms that was remarkably novel. For botany in particular it could have been highly significant had he fully described all of the groups he recognized. Instead, he treated only a few in detail as examples, leaving the vast majority of new names without descriptions. As a result, later authors published many of his new families of plants without giving him credit, for which he complained bitterly.

In 1815 he sailed for New York, but was shipwrecked on the Long Island coast, losing his valuable books, collections, manuscripts, and drawings. In 1818 he became Professor of Botany in Transylvania University in Lexington, Kentucky and subsequently traveled and lectured in various places, finally settling in Philadelphia where he resided until his death in 1842.

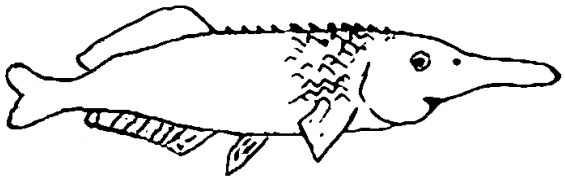
The intellectual breadth of the man was enormous. By the time he was 52, among other accomplishments he had been a botanist, geologist, historian, poet, philosopher, philologist,

Constantine Samuel Rafinesque (1784-1842).

economist, merchant, manufacturer, professor, surveyor, architect, author and editor. In the early and middle 1800s he roamed the eastern part of the North American continent, collecting and cataloguing plants and animals of which he is credited with having first described more than 100 species.

Though his erudition was impressive, Rafinesque's readiness to advertise the fact it made him a difficult man to like. One 19th-century educator observed that, **"No more remarkable figure has ever appeared in the annals of science, but Rafinesque loved no man or woman."** During his various stints as a teacher he was often a figure of fun. Whenever he did or thought something he almost always wrote a book or monograph on the topic. One book, a 5,400-line epic poem, discussed a theory of evolution that predates Darwin's by more than 20 years (he assumed thirty to one hundred years as the average time required for the production of a new species, and five hundred to a thousand years for a new genus).

So great was his zeal for naming new things that he claimed to have discovered and given names to 12 species of lightning and thunder on the headwaters of the Ohio River! Rafinesque had a predilection for inventing many nonsensical generic names of peculiar sound and spelling, e.g., in fishes, *Onus*, *Stizostedion*, *Ilictis* and *Atractosteus*. Nevertheless, as a consequence of being one of the first ichthyologists to study two of the world's richest fish faunas, those of Sicily and the Ohio River, he was an important ichthyologist. David Starr Jordan had this to say of him: **"His various papers show his peculiar traits, intense activity, keen philosophical insight, and hopeless slovenliness in method."**



The mythical Devil-Jack Diamond fish, described by Audubon as a joke, ended up as a real creature in Rafinesque's notes (drawing by Rafinesque).

Although the story has been told before, it is worth telling again. Rafinesque was an acquaintance of the great ornithologist and painter of birds, Audubon, and in 1818 he found himself a guest at Audubon's home at Hendersonville, Kentucky. Now Audubon's own personal formula for relaxing was to play the violin and he owned quite an expensive instrument. Unfortunately for the great ornithologist, the violin happened to be kept in the room occupied by Rafinesque. The story is best told by Audubon himself (*Ornithological Biography*, 1831-9):

"Of a sudden I heard a great uproar in the naturalist's room. I got up, reached the place in a few moments, and opened the door, when, to my astonishment, I saw my guest running about the room naked, holding the handle of my favourite violin, the body of which he had battered to pieces against the walls in attempting to kill the bats which had entered by the open window, probably attracted by the insects flying around his candle. I stood amazed, but he continued jumping and running round and round, until he was fairly exhausted, when he begged me to procure one of the animals for him, as he felt convinced that they belonged to 'a new species'. Although I was convinced of the contrary, I took up the bow of my demolished Cremona, and administering a smart tap to each of the bats as it came up, soon got specimens enough. The war ended, I again bade him good night, but could not help observing the state of the room. It was strewed with plants, which it would seem he had arranged into groups, but which were now scattered about in confusion. 'Never mind, Mr. Audubon,' quoth the eccentric naturalist,' never mind, I'll soon arrange them again. I have the bats, and that's enough.'"

Samuel Latham Mitchill (1764-1831).

To say that Audubon was annoyed when he learned what happened to his violin is an understatement and he vowed revenge. Thereupon he sat down and painted several mythical fishes, showing them to Rafinesque with the comment that they were seen by him, "down by the river." Rafinesque, of course, was delighted and promptly wrote a paper entitled, "Further Discoveries in Natural History." In this paper he described three new genera, viz., *Pogostoma*, *Dinectus* and *Litholepis*. The last-named genus literally means "stone-scaled" and was given by Rafinesque after Audubon told him that the fish in question was known locally as the "Devil-jack Diamond Fish," the scales of which would "turn a rifle ball!"

Rafinesque was the object of several of Audubon's additional ichthyological jokes, all of which were dutifully written up in the scientific literature, a process that took several years. Unfortunately, European ichthyologists afterwards tended to regard all American new species with considerable misgivings and created a reputation for undependability that was to frustrate all American ichthyologists in their dealings with their European counterparts for the next forty years or so. As late as 1860, Philip Henry Gosse, a name well known to aquarists interested in the history of the hobby, wrote in *The Romance of Natural History,* **"We do naturally look with a lurking suspicion on American statements, when they describe unusual or disputed phenomena."**

Next on the American ichthyological scene was **Samuel Latham Mitchill (1764-1831)**, one of the great polymaths of the early Republic. Mitchill was born in North Hempstead, Long Island to Quaker parents and after receiving basic medical training from an uncle, he attended the University of Edinburgh, from which he received his medical degree in 1786. A man with extraordinarily wide ranging interests, a "chaos of knowledge," Mitchill was seldom tied long to any single discipline, and after returning to New York and obtaining a license to practice medicine, he launched into the study of law. Very shortly, too, he entered into the public affairs of the young country. In 1788, he was appointed a commissioner to negotiate with the Six Nations for the purchase of lands in western New York state, and he served three terms in the New York state legislature beginning in 1791. Mitchill was again in the legislature in 1798, when he supported Fulton's monopoly of steam navigation in New York waters. His last term in state office came in 1810.

Mitchill's scientific career began in earnest in 1792, when he was appointed to the chair of natural history at Columbia University where he later also taught chemistry and botany. His early analysis of the spring waters at Saratoga, N.Y., brought him widespread public attention. As an avid dabbler in many areas of science, from chemistry and mineralogy to biology and a host of applied sciences, Mitchill's scientific productivity was impressive, even by the prolific standards of the day, and while his theories often proved erroneous, equally often his research formed the foundation for later, more fruitful work. His research in chemistry, for example, led to better products in gunpow-

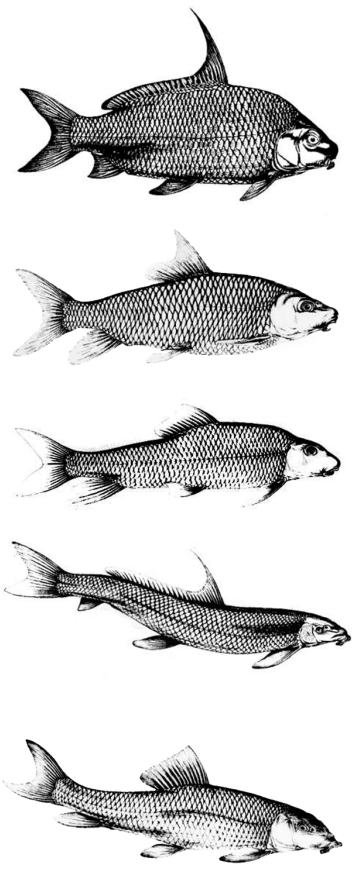
der, detergents, and disinfectants.

Mitchill's contributions to the development of the natural sciences in the United States, however, lie mainly in the structural, rather than theoretical realm. In 1797, he, Edward Miller and Elihu H. Smith, founded the *Medical Repository*, a leading scientific journal of the day, and Mitchill served as its chief editor for over twenty-three years. Most crucial of all, though, may have been his role as one of the most ardent promoters of the sciences in the United States Congress. Mitchill resigned his chair at Columbia in 1801 to take a seat in the House of Representatives (1801-4), followed by a term in the Senate (1804-9), and again in the House (1810-13). He became an advocate of quarantine laws and the exploration of the Louisiana Purchase, and a strong supporter of the Library of Congress. Proving that his back, and not just his brain, was useful to his country, Mitchill helped dig trenches for the defense of New York City during the War of 1812.

Charles Alexander LeSueur (1778-1846).

While in Congress, Mitchill continued to pursue his own scientific research. He received an appointment as Professor of Chemistry at the College of Physicians and Surgeons in New York, 1807, and from 1808 to 1820, held the chair of natural history, and afterwards that of botany. In 1826 he helped found Rutgers Medical College and served as Vice-President of that school during the four years of its existence. His furious rate of publication never abated. Mitchill's ichthyological work mainly concerned the fishes of New York (he commonly bought his new specimens from fishermen and fishmongers). As a noted student of the natural sciences he was generous to his fellow naturalists and tradition suggests that Mitchill took Rafinesque into his home. While Rafinesque lived in Sicily, he published several papers in Mitchell's journal, *Medical Repository*, so in a sense the two men were at least scientifically acquainted. In addition to providing lodging for the near-destitute Rafinesque, Mitchill also sought employment for him. In 1817 Mitchill founded and was the first president of the Lyceum of Natural History of New York City and Rafinesque became a member soon afterwards and presented its first scientific lecture.

Charles Alexander LeSueur (1778-1846) was born in Havre-de-Grace, France. His family was not particularly well off, but LeSueur was able to attend the School of Hydrography where he learned drafting and applied graphic techniques. In 1800, Captain Nicholas Baudin was commissioned by the French government to undertake a scientific voyage of discovery to the Australian continent known then as New Holland, and LeSueur was one of the artists selected to accompany the famous journey. Although he in fact enlisted as an assistant gunner, his drafting work was so impressive that Commander Baudin assured him that he would not have to do any of the normal jobs on board ship. He was to be on board to draw and nothing else.



Examples of LeSueur's outstanding drawings of fishes (from his *A new genus of Fishes, of the order Abdominales, proposed, under the name of Catostomus, and the characters of this genus, with those of its species,* 1817).

As a result of his friendship with the zoologist Péron, LeSueur became more of a specialist in drawing animals as the journey progressed. Under Péron's guidance, LeSueur learnt the art of taxidermy, and the skills needed for trapping and hunting animals. At times, Péron would dance about and play the fool to distract the indigenous Australians while LeSueur sketched them. LeSueur also learnt from Péron the importance of color and paying particular attention to detail. Apart from completing drawings of many animals, he produced a variety of landscapes often including aspects of indigenous Australian culture. While pursuing a troop of monkeys on a stop over in Timor, he was bitten in the heel by a venomous reptile. He was alone, at some distance from town, and his leg started to become numb. He hastened toward the fort as fast as his condition would permit, as his leg had by that time become rigid. The ship's surgeon-major, fortunately being at home, immediately deeply cauterized the wound, and after a large piece of his flesh was removed and the wound dressed, he was miraculously nursed back to health.

Upon completion of the expedition, LeSueur returned to France in 1804 where he and Péron set about the task of publishing the results of the expedition. In 1806 the Emperor Napoleon himself gave permission for LeSueur and Péron to publish their findings in a Journal to be called, *Voyage de découvertes aux Terres Australes*, written by Péron and illustrated with forty plates by LeSueur. They were issued a pension or salary to support them as they worked on it and the first volume appeared in 1807. It is justly one of the most famous depictions of Australia ever produced, with virtually the entire southern coast labeled "Terre Napoléon," indicating French colonial ambitions. The map is controversial even today.

After the fall of Napoleon and the collapse of his Empire in 1815, however, LeSueur was worried that he would lose his pension. Having published a few articles in scientific magazines between 1813 and 1815, he joined the geologist William Maclure on a study tour of the United States of America. He ended up staying there for twenty-two years, his journeys taking him from the islands of the West Indies to the Great Lakes of North America.

During his stay in the United States LeSueur's reputation grew. He studied mainly fish and

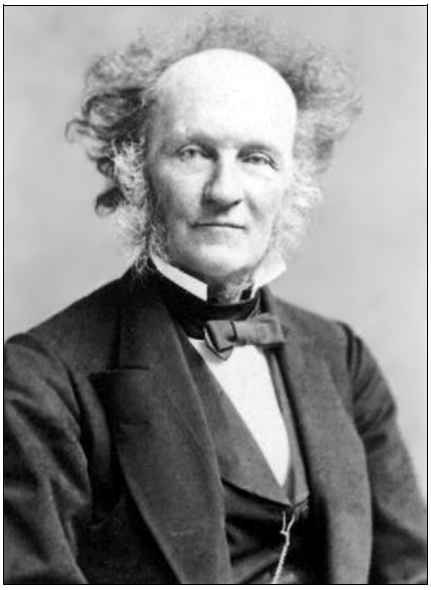
Sir John Richardson (1787-1865).

tortoises, and published many articles in the *Journal of the Academy of Natural Sciences of Philadelphia*. He even had a go at living on a commune on the banks of the Ohio River. When Robert Owen at New Harmony, Indiana, established the famous socialistic colony LeSueur was one of its members. He came down from Pittsburgh in 1825 in the famous "boat-load of knowledge," the boat bringing William Maclure, Robert Owen, the Owen sons, Thomas Say, LeSueur and other famous scientists and educators to New Harmony. LeSueur was one of the pioneers of lithography (the art of writing or drawing on stone, and of printing the impression on paper) in the United States and was the first to illustrate many of the fishes and other animals of this country.

His scientific work was done chiefly in America, and it ranked with the best of its kind at the time. LeSueur's most important memoir was a monograph of the suckers, a group of American fishes constituting his genus *Catostomus,* each species being represented by a clever and accurate figure, the drawing and engraving both by the hand of LeSueur. Other valuable papers were on blennies, rays, and flying fishes, accounts of new species from the West Indies, and descriptions of tortoises and other reptiles. With less range of learning than Rafinesque and some other contemporaries, LeSueur had, what Rafinesque had not, i.e., sound sense and faithfulness in the study of details. He was perhaps the first of that school of systematic zoology in America that regards no fact as so unimportant that it need not be correctly ascertained and stated, a method of work that has been often associated with the name of Spencer F. Baird. This attention to accuracy in detail marks the so-called "Bairdian epoch" in vertebrate zoology.

The history of the exploration of Canada is studded with the names of the Scots, none more important than **Sir John Richardson (1787-1865)**, of Dumfries, a naval surgeon and naturalist who made accurate surveys of more of the Canadian Arctic coast than any other explorer. Richardson's long career in the Royal Navy, where he rose from assistant surgeon to inspector of hospitals and fleets, put him into the center of the battle at Copenhagen, the blockade of the Tagus, and in many other naval operations. However, his service to Canada's future began when he was surgeon and naturalist to Sir John Franklin's first overland expedition to the Canadian Arctic in 1819-22.

Richardson wrote important works in many fields in natural history, specializing in Arctic biology and general ichthyology. He gained much of his knowledge in the second Franklin expedition serving as second in command and surveying some 900 miles of Canadian Arctic coast. With John Rae in 1848 he then made an overland journey to search for the third Franklin expedition, lost somewhere in the frozen Arctic wilds. Though he found no trace of Franklin, Richardson discovered that Franklin's ships had been crushed by the ice and his team had tried to return by foot but, ill-prepared, all were lost. The rescue mission was able to glean further information about the



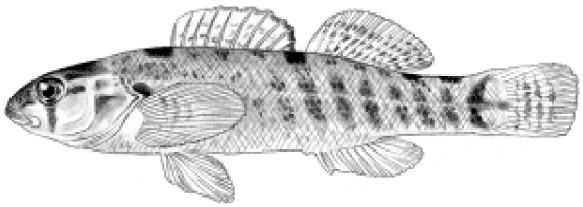
David Humphreys Storer (1804-1891)

area, which was published by Richardson in *An Arctic Searching Expedition* (1851). Richardson was an expert in ichthyology and his natural history works include *Fauna Boreali-Americana* (1829-37), *Icones Piscium* (1843), the second edition of *Yarrell's History of British Fishes* (1860) and *The Polar Regions* (1861).

An interesting note on Richardson involves John Reeves, an English tea inspector by trade, who was a keen amateur naturalist and documented the animals and plants in and around Canton, China. He also collected specimens and commissioned talented Chinese artists to paint them in the Western scientific tradition under his supervision. He generously shared his collections with other naturalists, and in particular they attracted the interest of Richardson. As a result, Reeves engaged the Chinese artists to make copies of all of his fish drawings so that a complete set could be given to Richardson. Richardson subsequently wrote an important scientific paper on the fishes of Japan and China, describing around 80 new fish species that were based entirely on these drawings. One of these was *Cyprinus hybiscoides*. When Richardson first described it in 1846, it was thought to be distinct from the common carp *(Cyprinus carpio)*; however it is now considered to just be a variety, and its current scientific name is *Cyprinus carpio var. rubrofuscus*.

Born in Portland, Massachusetts, **David Humphreys Storer (1804-1891)** focused his work on the fishes from that state. After graduating from Bowdoin College, he received his medical degree from Harvard and, in 1838, became Attending Physician at the Boston Lying-in Hospital. In 1837, Storer, along with Dr. Oliver Wendell Holmes and others, founded the Tremont Medical Society to improve the study of obstetrics. The success of this undertaking enabled Storer to become dean of the Harvard Medical School in 1855.

In 1837, Storer had begun an ambitious translation from the French of Louis Charles Kiener's *General Species and Iconography of Recent Shells*, which though aborted because of lack of interest or financial support, resulted in a grateful Kiener naming two species of marine mollusks after him. Storer could often be found at the wharves and in the fish markets, searching for unusual fish while attired in a long swallow- tailed coat and a tall silk hat. When he undertook to write his report on the fishes and reptiles of Massachusetts, he admitted that he **"could scarcely tell the difference between a flounder and any other flatfish."** He worked daily on his specimens in the Boston Society of Natural History's museum from 5 a.m. until breakfast time writing *A report on the fishes of*



The Rainbow Darter, *Etheostoma caeruleum*, Storer (1845).

Jared Potter Kirtland (1793-1877).

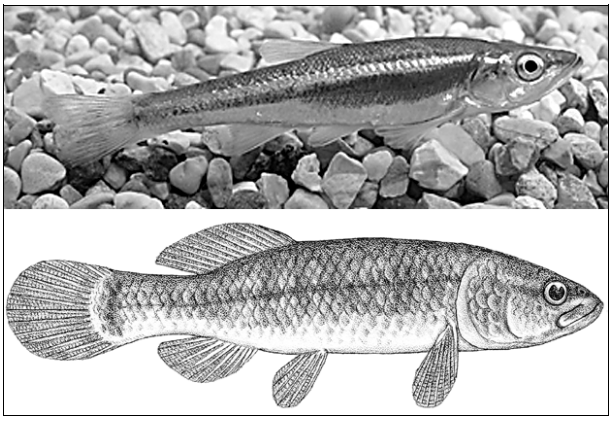
Massachusetts, which was published in 1839. (The Society, founded in 1830, replaced the Linnaean Society, which had been active from 1813 to 1823. The founding members of both groups were mostly physicians who were interested in natural history.) When Louis Agassiz arrived in the United States in 1846, Storer's *A Synopsis of the Fishes of North America* had just appeared in print. Storer was one of the first people that Agassiz visited, and they became fast friends.

In 1849 Storer and his son, Frank, sailed to Labrador to study fish species and his monograph, *Observations on the fishes of Nova Scotia and Labrador with descriptions of new species*, was published by Boston Society of Natural History in 1851. When he died in 1891, David Humphreys Storer was the oldest physician in Boston.

Jared Potter Kirtland (1793-1877), born in Wallingford, Connecticut, was a naturalist, horticulturalist, and politician as well as a physician and co-founder of Western Reserve University's Medical School. His father came to Poland, Ohio in 1803, leaving young Jared with his maternal grandfather, Jared Potter. Potter was a physician and naturalist and, under his supervision, Kirtland became an expert in cultivating trees and flowers, and assisted in caring for a large plantation of white mulberry trees used to cultivate silk worms.

At age twelve, Kirtland began to study the Linnaean system of botany, a subject that would hold his attention throughout his life. In 1813 he entered the newly formed department of Medicine at Yale College, and it is said he was the first student to matriculate in that department. In addition to medicine Kirtland had private instruction in the areas of botany, geology, mineralogy and zoology. He also studied at the medical department of the University of Pennsylvania in Philadelphia, but returned to Yale and received his degree in 1815.

Kirtland practiced medicine, held an elected position of probate judge, and continued his work cultivating flowers, trees, and honeybees. His wife, Caroline Atwater, and their two children became ill with what was then called "sinking typhus fever" and Caroline and one of the children died of the disease. Kirtland, shocked and distraught over his loss decided to move to Ohio where his father was still living.



Top: Redside Dace, *Clinostomus elongatus,* Kirtland (1840). Bottom: Umbra limi, Kirkland (1840).

In 1828 Kirtland was elected to the state legislature, where he served three terms, and quickly became a leader. He worked for prison reform and helped to get a charter for the Ohio Pennsylvania Canal. During his stay in Ohio Kirtland wrote 19 papers on the fishes of Ohio and described many species. Examples include: *Report on the zoology of Ohio. First Annual Report of the Geological Survey of the State of Ohio* (1838), *Descriptions of the fishes of the Ohio River and its tributaries* (1840), and *Descriptions of the fishes of Lake Erie, the Ohio River and their tributaries* (1844). Kirtland's background in medicine, natural history, and politics reminds one of Samuel Latham Mitchill's background, the former noted for his description of Ohio fishes, however, and the latter for those of New York.

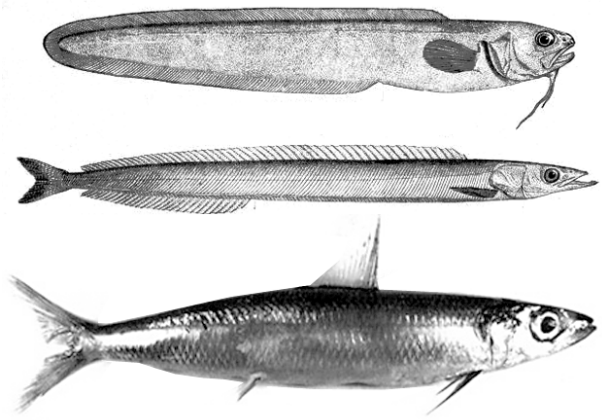
The ichthyology of New York was to be given a further boost by the appearance of **James Ellsworth DeKay (1792-1851)**. His father was a sea captain sent from the American colonies to Europe in 1775 and DeKay (he himself spelled it sometimes as Dekay or De Kay) was born in Lisbon, Portugal. DeKay was brought back to Scarsdale, New York, when he was two years old but tragically, his mother died when he was six and his father when he was ten. Fortunately, however, his father left him with a pension of $3,000 a year, a sum on which he would live comfortably for the rest of his life.

He studied medicine at Edinburgh where he took his degree as a physician. However, repelled by practice (this was a time when anesthesia did not exist and medical treatments were usually more harmful than beneficial), he turned to natural history. On his arrival in the United States, he married a daughter of Henry Eckford, the naval architect, whom he subsequently accompanied to Turkey where the latter was appointed superintendent of the naval yards at Constantinople. There he was entrusted by Eckford with negotiations with Brazil and other South American powers relative to the ships of war that had been ordered by these countries. In 1833 he published (anonymously) *Travels in Turkey* (1833), in which he gave a favorable view of the country and its institutions. The Hellenists of the day, however, were incensed that an American should appear as a defender of the oppressors of Greece!

Shortly after his return from Europe he settled permanently in Oyster Bay, Long Island, devoting himself to cultivate friends in literary circles, studying natural history, and contributing to the New York press. Among the literary men he befriended were Washington Irving, Joseph Rodman Drake (an early American poet), James Fennimore Cooper, Fitz-Greene Halleck (another early American poet and friend of Drake), William Cullen Bryant, and other men of mark in literature and science. He was described as a man of **"uprightness, amiability, and cheerful temperament."**

While in Turkey, DeKay had made a special study of the Asiatic cholera, about which little was known in America. He had the opportunity to put in practice what he had learned on

James Ellsworth DeKay (1792-1851).



Top: The Sand Cusk, *Ophidium marginatum*, DeKay (1842). Middle: The Sand Lance, *Ammodytes americanus*, DeKay (1842). Bottom: The Round Herring, *Etrumeus teres*, DeKay (1842).

this disease during the outbreak of cholera in New York City where Dr. DeKay hastened to give his services to the afflicted. During this time he became famous because he promoted the use of port wine as a cholera remedy. Despite its uncertain health benefits, the advice was so highly regarded that in the New York City bars he had a drink named after him, the "Dr. DeKay," and he was also nicknamed "Dr. Port."

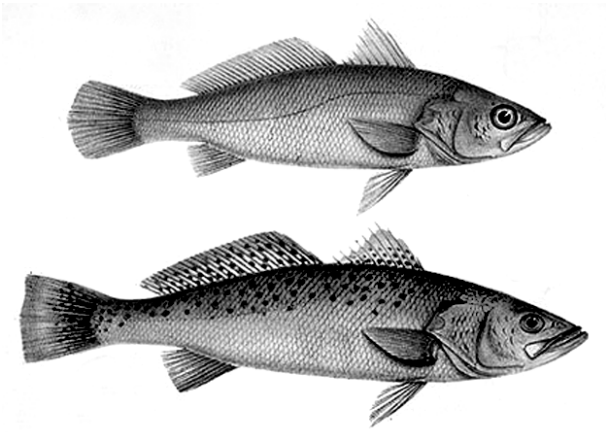
DeKay's first scientific paper was published in 1821, just two years after his return from Europe and he soon joined the major scientific associations of New York. From the dedications in his medical thesis, it can be inferred that DeKay may have studied with Samuel Latham Mitchill. Mitchill, as DeKay, had graduated from the University of Edinburgh, and it is possible that Mitchill played a role in getting him into that University. Also, Mitchill switched from medicine to the natural sciences and was the founder of the New York Lyceum of Natural History, an association in which DeKay participated actively; therefore, it is reasonable to think that Mitchell acted as both mentor and role model to the young DeKay.

However, it was a new government-sponsored initiative that placed him in the position of generating his main scientific opus. In 1836 the state of New York ordered a geological survey, making it comprehensive enough to cover botany and zoology, and entrusted those departments to DeKay, hiring him with an annual salary of $1,500. The results of his researches are contained in five volumes of the *Survey* (1842-49).

DeKay also helped to establish what would become the major elaboration of the story of the Adirondacks as a romantic landscape and setting the pattern for increasingly popular camping trips seeking to recapture the vigor of body and soul weakened by the stresses of modern life. This work took him eight years, and the results were published between 1842-1844 in the form of five quarto volumes titled*, Zoology of New York, or the New-York fauna; comprising detailed descriptions of all the animals hitherto observed within the state of New York, with brief notices of those occasionally found near its borders, and accompanied by appropriate illustrations.* Additionally, a list of mammals, birds, reptiles, and amphibia, drafted by DeKay prior his death in 1851, were published in the *Catalogue of the Cabinet of Natural History of the State of New York and of the Historical and Antiquarian Collection Annexed Thereto.*

DeKay left us with the first scientific description of a cavefish for the Western Hemisphere, a voluminous zoological work, and a sense of science as a romantic endeavor. All three legacies show the worth of this man's life dedication to the pursuit of knowledge.

South Carolina fishes were examined and written about by **John Edwards Holbrook (1796-1871)**. Born in Beaufort, he was an 1815 graduate of Brown University and in 1818

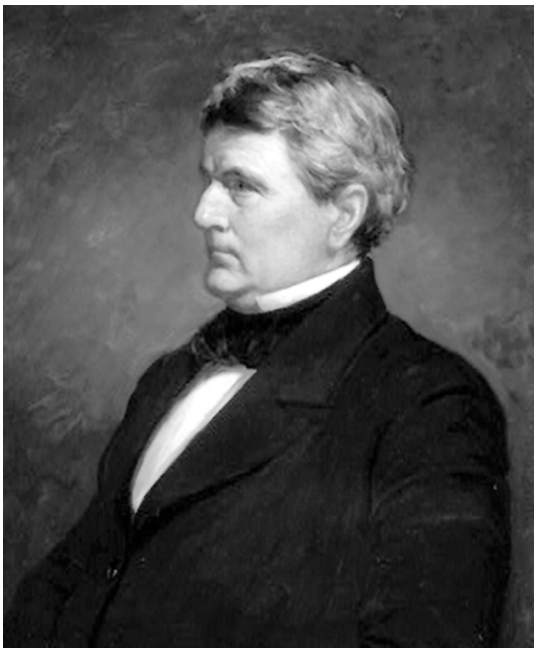


John Edwards Holbrook, *Ichthyology of South Carolina,* Charleston, 1860.

took his M.D. degree from the University of Pennsylvania. After he had received his medical degree, Holbrook traveled to Europe where the intensity of natural science studies affected him profoundly. In his 1819 European travel memoir, Holbrook found political sentiments towards Americans more acceptable in Scotland than England. **"The Scots are more favorable to our Institutions than the English," Holbrook wrote, "...but I believe as much in pique to their own good government as in a love of justice or affection towards us. There has been a great ferment about Jackson whom they 'hate as they do hell pains'** (Note: the reference is to Andrew Jackson who became a national hero when he defeated the British at New Orleans). **These Britons are altogether jealous of us & this feeling they cannot hide. You well know that I came to this country a federalist but the abuse that every paper teems with upon our institutions & the general hostility of the British to them, have abated much of my complacence to these islanders as political friends."**

In the decades before the Civil War, Charleston, South Carolina, enjoyed recognition as the center of scientific activity in the South. By 1850, only three cities in the United States - Philadelphia, Boston, and New York - exceeded Charleston in natural history studies, and the city boasted an excellent museum of natural history. Soon after his return to medical practice in Charleston, South Carolina (he was a was a founder of the Medical College of South Carolina), Holbrook undertook the writing of a systematic study of reptiles in the United States. By 1842, he had published *Herpetology of the United States* and started a companion volume on fishes. Holbrook concentrated on fishes of the South, and the volume on South Carolina, *Ichthyology of South Carolina* (1860; Charles Girard, by the way, spent the summer of 1851 in Charleston helping Holbrook in his preparations for this book), represents the first part of a larger work that was interrupted by the Civil War. As a result of the war, the Medical College closed its doors and all except three faculty members found themselves among the ranks of the Confederate States' members. One of its oldest members, Holbrook found himself at age 69 having to sleep under wagons with the troops even though his official title was "Director of Examining Board of Surgeons."

A contributor to the literature on marine fishes of both the Pacific and Atlantic coasts was **William O. Ayers (1817-1891)**. With no other vehicle for scientific publication, William O.



John Edwards Holbrook (1796-1871).

The Stoplight Loosejaw described by William O. Ayers in 1851.

Ayres, first Curator of Ichthyology at the California Academy of Sciences (1854) published descriptions of California fishes in San Francisco's *Pacific*, *Placer Times,* and *Transcript* newspapers. Ayers was the author of eight new genera, *Anarrhichthys* (wolf eel), Anoplopoma (sablefish), *Cebidichthys* (monkey-faced eel), *Malacosteus* (Stoplight Loosejaw), *Mylopharodon* (hardhead), *Notorynchus* (sevengilll shark), *Seriphus* (queenfish), and *Stereolepis* (giant black sea bass). In his paper, *On a very curious fish*, Boston Soc. Nat. Hist. (1848-1851), Ayers described the Stoplight Loosejaw, an elongate, compressed fish whose jaws are much longer than its skull. Ayres is also noted for his early weather observations of San Francisco during the Gold Rush, from 1856 until 1868.

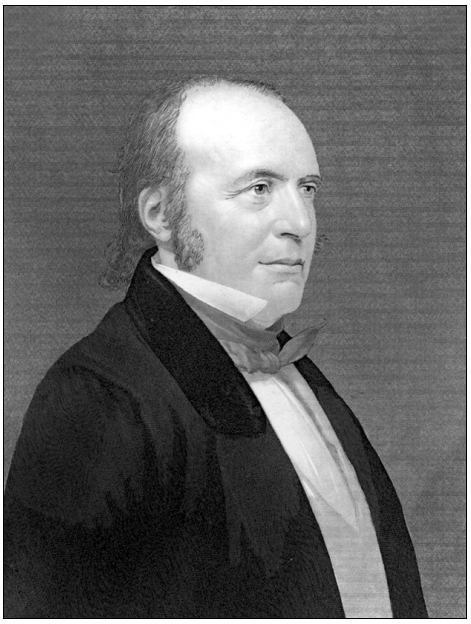
Jean Louis Rodolphe Agassiz (1807-1873) was born in Friborg Switzerland. Like many of the 19th century naturalists, Agassiz was educated in the medical tradition and qualified as a physician. He was, by the way, an accomplished swordsman, the saber being his weapon of choice.

In 1827, following the death of Spix in 1826, Martius gave his collection of Amazonian fishes to Agassiz for study, encouraging him to complete his studies. He received his medical degree in April 1830, nine months after the publication of the *Fishes of Brazil*, which attracted the attention of Cuvier.

Agassiz arrived in Paris in 1831 to study comparative anatomy under Cuvier, who provided space in his lab for Agassiz and his assistants. Agassiz made such an impression on Cuvier that he abandoned, in favor of Agassiz, plans for a major work on fossil fishes, releasing his materials, drawings, and notes. Agassiz quickly developed a reputation throughout Europe. Humboldt, for example, contributed 1000 francs toward publication of his *Recherches sur les poissons fossiles* (*Research on Fossil Fishes*), five volumes of which appeared at intervals from 1833 to 1843.

Agassiz left Paris in 1832 following the death of Cuvier, accepting a modest position as Professor of Natural History at the Lyceum of Neuchâtel in Switzerland, where he developed his ideas on continental glaciation and earth history. It was during these years in Switzerland that Agassiz developed his strong reputation as a scientist and lecturer, and developed the personal associations with colleagues and assistants that would persist throughout his career.

This period in his life was notable for the number of projects and publications that Agassiz embarked upon, not all of which were completed, and for the large entourage that he assembled, all of which were under his personal financial support. Expenses began to greatly exceed his modest salary and the philanthropy of friends and family. Realizing that his present position could not afford him the means of achieving his professional ambitions, he decided to seek a change by embarking on a tour first of Europe, then the United States.



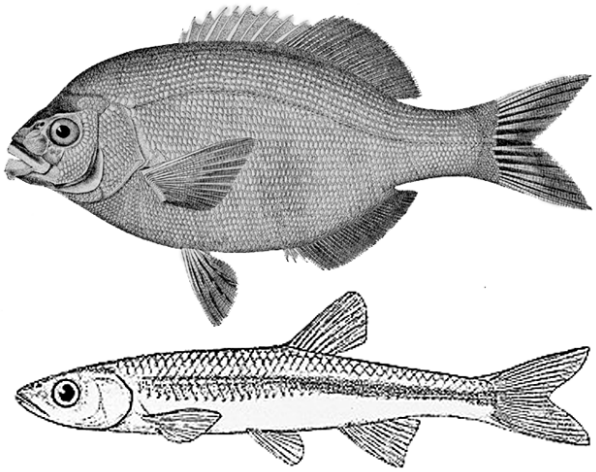
Jean Louis Rodolphe Agassiz (1807-1873).

In January 1848, John A. Lowell approached Agassiz about accepting a professorship at Harvard College, a position in zoology and geology created for him and which he accepted. In May 1860, the first phase of construction on the Museum of Comparative Zoology (MCZ) was completed and the Museum was inaugurated on November 13, 1860. Soon after, due in part to mounting financial pressures, discontent among his students and assistants, Agassiz's health slowly began to fade.

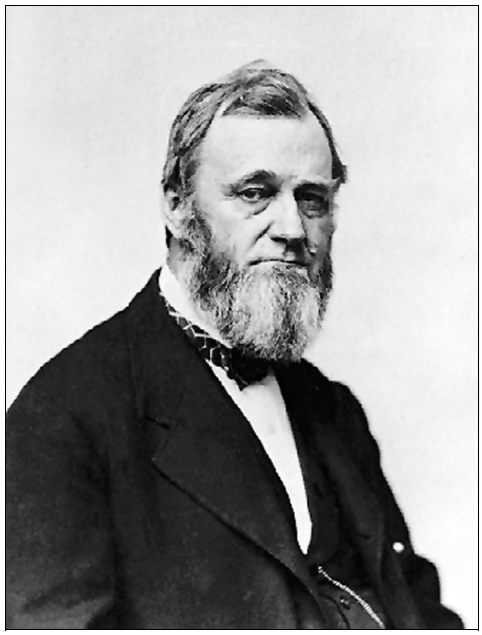
Agassiz tried in vain to stop the sweep of Darwinism, and was most distressed by the fact that most proponents of Darwinian thinking in the U.S. at that time were not naturalists. (A parallel can be drawn here between Agassiz's opposition to Darwinism and Cuvier's debate with Geoffroy-St. Hillaire.) The American Civil War was yet another obstacle in the building of the museum and Agassiz lost several students to military service. In part, as an escape from the mounting pressures, and because of declining health, Agassiz sought with much relish an opportunity to visit Brazil and to rekindle his long-standing interest in Amazonian ichthyology begun during work on the collections of Spix & Martius. Agassiz, his wife, six assistants and several volunteers embarked on the Thayer Expedition to Brazil between April 1865 and July 1866.

After the Thayer Expedition, Agassiz participated in the deep-sea dredging project of the U.S. Coast Survey during the spring of 1869 and, accompanied by Franz Steindachner, took part in the Hassler Expedition to conduct deep-sea dredging along the coast from New England to San Francisco during 1871-72. Some 30,000 specimens were collected during the latter expedition, which used 3,500 gallons of alcohol in packing!

From this time on his scientific studies dropped off, but he was a profound influence on the American branches of his two fields, zoology and geology, teaching decades worth of future prominent scientists, including David Starr Jordan. In return his name appears attached to several species, as well as here and there throughout the American landscape, notably Lake Agassiz, the Pleistocene precursor to Lake Winnipeg and the Red River. During



Top: The Alfione, *Rachochilus toxotes*, Agassiz (1854).
Bottom: The Rosyface Shiner, *Notropis rubellus*, Agassizi (1850).



Spencer Fullerton Baird (1823-1887).

this time he grew in fame even in the public consciousness, becoming one of the best-known scientists in the world. By 1857 he was so well loved that Longfellow wrote *The fiftieth birthday of Agassiz* in his honor. His own writing continued with four volumes of the *Natural History of the United States* that were published from 1857 to 1862. During this time he also published a catalog of papers in his field, *Bibliographia Zoologiae et Geologiae*, in four volumes between 1848 and 1854.

Spencer Fullerton Baird (1823-1887) was born in Reading, Pennsylvania but the family relocated to Carlisle, Pennsylvania following the death of Baird's father from cholera in 1833. Baird entered the local Dickinson College as a freshman in 1837, receiving his B.A. degree in 1840. Following graduation Baird attended the College of Physicians and Surgeons in New York for one year, but found that he had a dislike for the medical practice and returned to Carlisle to continue with his scientific studies. In 1845 he was appointed professor of natural history at Dickinson College and as professor of natural history, and became popular among the students for his practice of taking the young men out into the field to study the natural world.

In 1848 he received a grant from the Smithsonian Institution to explore the bone caves of Pennsylvania, the very first grant made by the Institution for scientific exploration and field research. This same year he became chair of both the departments of natural history and chemistry and, throughout his time as professor, Baird continued to write on subjects of natural history, quickly becoming a respected ornithologist, zoologist, and naturalist.

In July 1850 he was appointed assistant secretary of the Smithsonian, then, starting with his own personal collection which he gave to the Institution (it reportedly took two freight cars to transport his collection of birds, lizards, fish, skins, and skeletons, weighing 89,000 pounds, from Carlisle to Washington), he developed the United States National Museum, and was in charge of explorations and collections made by the government in the expanding West. Also in this year he became permanent secretary of the American Association for the Advancement of Science. In 1863 he helped organize the National Academy of Sciences.

When the new United States Commission of Fish and Fisheries was created in 1871 he was appointed by President Ulysses S. Grant its first commissioner, to serve without additional salary, which he did until his death. Upon the death of Joseph Henry in 1878, Baird succeeded him as Secretary of the Smithsonian Institution. Baird established the first marine laboratory in the United States, at Woods Hole, Massachusetts, and started a federal fisheries program to rehabilitate the nation's fisheries resources. A prolific editor and writer, he was head of the science department of Harper's Magazine and was editor of *The Annual Record of Science and Industry*. His list of titles exceeds one thousand, covering such

diverse fields as mammals, birds, reptiles, fish, geology, and travel. He held honorary memberships in 15 foreign academies and scientific societies, and received decorations from Norway, Australia, France, and Germany. All through this, Baird attained not only the respect of the world outside, but also the warm and affectionate loyalty of all the men personally associated with him.

William Peters Gibbons (1812-1897) was a medical doctor, an able amateur botanist, and early member of the California Academy of Sciences. In 1855 he was elected Curator of Geology & Mineralogy at the Academy. Gibbons described numerous species of marine and fresh-water fishes from the California area. He described four new genera: *Cymatogaster* (Shiner perch), *Hyperprosopon* (Spotfin surfperch), *Hysterocarpus* (Tule perch), and *Micrometrus* (Dwarf perch). A California surf fish, *Holconotus gibbonsii*, was named after him.

George Suckley (1830-1869) was born in New York City, and studied medicine at the College of Physicians and Surgeons (now a part of Columbia University). After receiving his M.D. in 1851, he served as resident surgeon in the New York Hospital. In 1853, he was appointed assistant surgeon and naturalist to the Pacific Railroad Survey of the 47th and 49th parallels between St. Paul, Minnesota, and the Puget Sound. He accompanied General Isaac I. Stevens to the west coast, and later explored the Washington and Oregon territories. He resigned from the United States Army in 1856 to pursue his interests in natural history. Suckley's reports on the mammals, water birds, and fishes collected during the Pacific Railroad Surveys appeared in the official publication issued by Isaac I. Stevens, *Supplementary Report of Explorations for a Route for a Pacific Railroad*, volume 12 of *Pacific Railroad Surveys* (1859). In addition, he wrote on the new species of Salmonidae collected by C. B.R. Kennerly during the Northwest Boundary Survey (1857). His monograph on *Natural History of Washington Territory* (1859), co-authored by James G. Cooper, was based on their survey of the northern Pacific Railroad route. George Suckley rejoined the Army at the outbreak of the Civil War and served as brigade surgeon in 1861, and staff surgeon to United States Volunteers from 1862 to 1865. The shark, *Squalus suckleyi* (Girard, 1855) and the sucker, *Catostomus suckleyi* (Girard, 1856), are named after him.

Charles Frederic Girard (1822-1895) was the Smithsonian's first ichthyologist as well as its first herpetologist. He led a remarkably versatile and productive life, spanning 73 years and two continents. Girard was born in Mulhouse, in the Alsatian region of France. He studied at the College of Neuchâtel, Switzerland, where he was a student of Louis Agassiz. When Agassiz moved to the United States in 1847, Girard accompanied him and worked as his assistant at Harvard College. There he published his first scientific paper, on cottid fishes (sculpins), in 1849. He worked in Cambridge with Agassiz until 1850 when Spencer Baird brought him to the Smithsonian in 1850 to assist in identifying and describing the north American reptiles and other natural history

George Suckley (1830-1869).

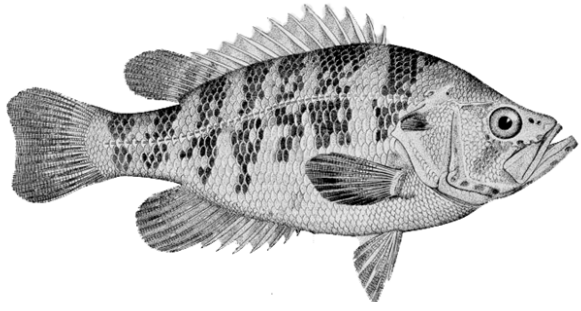
Charles Frederic Girard (1822-1895).

collections that were accumulating at the Smithsonian.

Eventually, Girard was assigned the fishes and amphibians, and these became the main subjects of his studies. His interests were not confined to these groups, however, and he also published on such varied organisms as spiders, insects, and worms, and on theoretical issues. Girard was largely a museum scientist; although he studied material collected from far-flung corners of the world, he did little collecting himself. He was a prolific worker who turned out many publications during his 10 years at the Smithsonian, some of them in collaboration with Baird. Among his more important ichthyological papers were a monograph of the cottoids, (*Smithsonian Contributions to Knowledge,* 1852), a review of the cyprinoid fishes (minnows and suckers) of the western United States (*Proceedings of the Academy of Natural Sciences of Philadelphia,* 1856), and the reports on fishes of the United States and Mexican Boundary Survey and the Pacific Railroad Surveys. During all this activity, he somehow found time to earn his medical degree from Georgetown University (Washington, DC) in 1856.

In 1859, Girard returned to Europe for an extended visit, and there in 1861 he was awarded the Cuvier Prize by the Institute of France for his work on western regions of the New World and for his work on fishes and reptiles. Although he had become an American citizen in 1854, Girard never returned to the Smithsonian. While he was in Europe, the Civil War broke out in America, and his sympathies were firmly on the side of the South. He joined the Confederate war effort by promoting the Confederate cause in Europe and accepting a commission to supply the Southern armies with medical equipment and arms. In 1863, he slipped through the blockade into the Confederacy and traveled through Virginia and the Carolinas. He published an account of this trip in Paris the following year.

When the war ended, Girard chose to remain in Europe and embark on a career in medicine. During the Franco-Prussian War in 1870, he served as a military physician during the siege of Paris. Based on his experiences there, he wrote an important treatise on the etiology of typhoid fever. Following that war, which his side also lost, Girard continued in his medical practice until about 1888, when he renewed his interest in natural history. Over the next three years, he wrote eight more papers, seven on fishes, and one on flatworms. He spent the remaining years of his life in quiet seclusion near Paris, where he died on 29 January 1895.



The Sacramento Perch,
***Archoplites interruptus*, Girard (1854).**

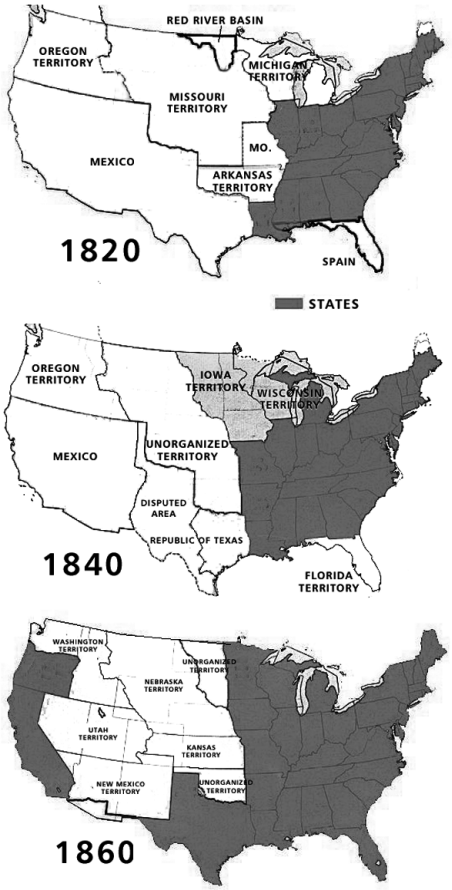
***Gillichthys mirabilis*, Cooper 1864. The genus was named by Cooper for Theodore Nicholas Gill.**

Girard usually receives little notice in the history of ichthyology, and his reputation is that of a minor player in the initial description of the North American fish fauna, and one whose work appears to have been flawed or even careless when compared to his contemporaries. However, a review of both contemporary and modern taxonomic works reveals that Girard's productivity far exceeded that of either Agassiz or Baird. Furthermore, an examination of the tendency of Girard and his contemporaries to introduce synonymous names into the literature, which might reflect careless or uncritical work, suggests that Girard was among the more accomplished workers of his era, including Agassiz and Baird. Girard's low ranking in the folklore of North American ichthyology, therefore, can not be attributed to discernible shortcomings in his scientific work, but rather to a public and private campaign of criticism waged by Agassiz after Girard's departure from Harvard. While Agassiz's dispute with Girard stemmed from their personal interactions, he expressed them as criticisms of Girard's work, and thus helped shape Girard's scientific reputation as it has been transmitted through the lore of ichthyology. Thus, scientific reputation may not always rest on accomplishment, but can be influenced by personal interactions obscured by time but nonetheless important to history.

James Graham Cooper (1830-1902), a protégé of Spencer Fullerton Baird, was the son of William Cooper (ornithologist, friend of Audubon, Nuttall, Torrey, and Lucien Bonaparte, and one of the founders of the Lyceum of Natural History of New York). He graduated in 1851 from the college of Physicians and Surgeons, New York and in 1853 he contracted with Governor Isaac I. Stevens, of Washington Territory as physician of the northwestern division of the Pacific Railroad Survey. In addition to his medical duties he made botanical and zoological collections and meteorological observations. He continued to engage in similar work up to the time of his connection with the California Survey.

One of the first to collect specimens in the Pacific Coast regions, he became an expert on the geological, biological, and zoological aspects of that area. He published material on the natural history of California and Oregon and wrote a chapter on zoology for *Natural Wealth of California*, edited by T. F. Cronise. After traveling extensively, he practiced medicine and lived in California until his death in 1902. He is the author of two Pacific coast marine genera, *Gibbonsia* (the Pacific coast kelpfish), named for William Peters Gibbons, and *Gillichthys* (one of the gobies), named for Theodore Nicholas Gill.

In the period 1820-1865 in America, the Monroe Doctrine was declared, the Erie Canal opened, the Oregon Trail came into use, the Black Hawk and Seminole Wars were fought, Texas fought for Independence, Samuel Colt invented the revolver, Samuel Morse sent the first telegraph message, the U.S. fought the Mexican-American War, Gold was discovered at Sutter's Mill in California, the Gadsden Purchase was executed, the economic Panic of 1857 occurred, the Transatlantic cable was laid, the first Oil well was drilled, the Pony Express began, and the United States Civil War was fought. In 1820, the States covered the area shown in the map, less than a third of the present continental United States; in 1840 this area had only grown to about 40%, and



The States, 1820, 1840, and 1860.

even in 1860 it was only about 60%. Many of the ichthyologists of this time (and, unlike previous area where many ichthyologists were originally educated for the clergy, most of these men were trained as physicians of one sort of another) were exposed to all sorts of dangers and difficulties. They traveled across some of the country's most punishing terrain by horseback and with wagons laden with specimen jars and other equipment, all the time being exposed to greatest possible imaginable dangers and physical difficulties. They deserve our deepest admiration.

Added to this is fact that natural history was the worst paid and least appreciated of all the professions, and was not even part of any university degree course. Some universities in the United States were willing to appoint natural history professors only if they could teach a range of other subjects as well. At the University of Transylvania, Rafinesque had the title of "Professor of Natural History and Modern Languages," and Spencer Fullerton Baird at Dickinson, was expected to teach "Animal Physiology, Natural Theology and Mathematics," all for the equivalent in today's currency to a measly $8000.

In any case, whether or not natural history appeared on a university's course catalog, there was no way that a student could major in it. The only degree course remotely applicable to the naturalist's needs was medicine, where one could obtain knowledge of comparative anatomy and physiology. However, one needed a strong stomach to study medicine in the days when operations were performed without anesthetics and frequently stolen from the grave. Such bodies positively reeked when upon the dissection table. This why many of the principles discussed here abandoned medicine as a profession after obtaining their degrees.

When studying the lives of famous ichthyologists I sometimes come across an unexpected or fascinating fact and this period is no exception. It appears that one of these men became embroiled the abortion controversy just short of 150 years ago!

The story begins on November 7, 1855, when Dr. David Humphreys Storer gave the Introductory Lecture that commenced the term of Harvard's Massachusetts Medical College where Storer was the Professor of Obstetrics and Medical Jurisprudence. The lecture was titled, *Duties, Trials and Rewards of the Student of Midwifery*, but the last portion of the lecture also dealt with the sharp increase in induced abortion (it may come as a surprise to some that induced abortions were common among married Protestant women at that time) and with what David Humphreys Storer argued was a direct result, the increase in women's diseases. Although David Hum-

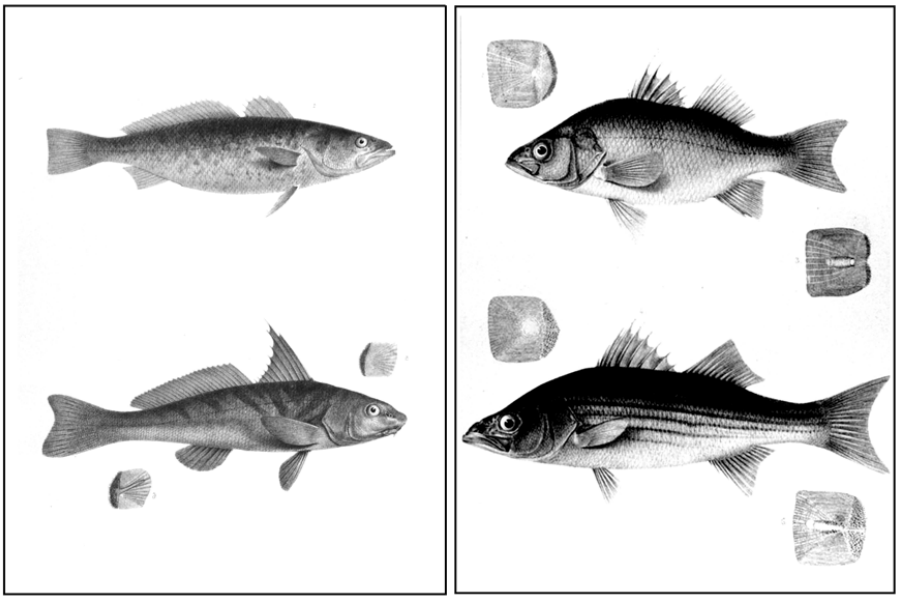
phreys Storer's son, Dr. Horatio Robinson Storer, is credited as the founder of the "physicians' crusade against abortion," he repeatedly credited this lecture of his father as the stimulus for his crusade.

The Introductory Lecture was traditionally published as a pamphlet, and this was true for David Humphreys Storer's Lecture, as well. However, at the request of Dr. Henry J. Bigelow, Professor of Surgery at the Medical College, the abortion portion of the lecture was omitted from the pamphlet. Unnecessary abortion was a taboo and controversial topic in 1855, and one reason for suppression was that publication would lead to the condemnation of New England because induced abortion was prevalent. It also was believed that publication would reflect badly on the Medical College and cause fewer students to enroll, reducing the fees students paid directly to their professors.

Although the Boston Medical and Surgical Journal was typically controlled by the Medical College, its editors, William W. Morland and Francis Minot, bravely criticized the medical school faculty for suppressing the anti-abortion segment of the Introductory Address. One passage from their December 1855 editorial on the Introductory Lecture read:

"We referred to the fact that the fair proportions of this Address have been essentially diminished by an omission of certain portions. While we confess the truth of the adage that 'half a loaf is better than no bread,' we particularly dislike all processes which abstract the leaven from any compound. Deferring to the judgment of others, whose opinions we all delight to honor, Professor Storer has omitted the very paragraphs, which, in our judgment, should have been allowed to go forth as freely as they were spoken. To whom shall the community look for a verdict upon practices which disgrace our land and prevail to an extent that would hardly be credited, if not to physicians - and, chiefest among them, to medical teachers?"

The suppressed portion of the Lecture was finally published seventeen years later and was a landmark event in the successful "physicians' campaign against abortion." Within a few decades this campaign led to the passage of laws in almost every state and territory protecting the unborn from conception, the effect being to reduce abortion among married Protestant women.



Plates from *History of the Fishes of Massachusetts* by David Humphreys Storer, 1853.

The History of Ichthyology: Part IV - The End of the 19th Century in America

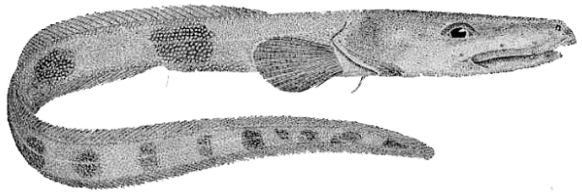
George Brown Goode (1851-1896) is best remembered today as a museum administrator, historian of science, and ichthyologist. After meeting Spencer Baird in 1872, he quickly won Baird's confidence, becoming his trusted assistant and colleague. In that capacity, Goode supervised the summer research activities sponsored by the U.S. Fish Commission; took charge of the Smithsonian displays at the Philadelphia Centennial Exhibition (1876), and the Fisheries Exhibitions in Berlin (1880) and London (1883); and served as the Curator of the U.S. National Museum. Despite his remarkable effectiveness in administration, he saw himself as a scientist and admitted that he knew more about "fish and fishing in America" than about anything else.

Goode was born in New Albany, Indiana, on 13 February 1851. After his mother died only a year and a half later, his father remarried and in 1857 moved his family to Amenia, New York. Young George did not attend schools but was educated by private tutors until he entered Wesleyan University in Middletown, Connecticut, in 1866. After graduating in 1870, he briefly attended Harvard University, where he studied under Louis Agassiz. The following year, he left Harvard to return to Wesleyan to take charge of its new natural history museum.

During the summer of 1872, Goode worked as a volunteer for the U. S. Fish Commission in Eastport, Maine, and there he met Spencer Baird. The meeting turned out fortuitously for both men. Baird found his greatest protégé and closest assistant, and Goode was set on the path of his life's work. For the next five years, Goode spent his summers doing fieldwork with the Fish Commission and divided his winters between Wesleyan and the Smithsonian. In 1877, he left Wesleyan and joined the Smithsonian full time, first as an assistant curator and later, curator. After the United States National Museum was formally established in 1879, Goode became its Assistant Director. In 1887 he was appointed Assistant Secretary of the Smithsonian, and assumed full responsibility for the National Museum following Baird's death.

Like Baird, Goode was a man of many and varied talents. Much of his career was spent as an administrator, a task at which he excelled. Goode was a fervent advocate of science, which he believed had the potential to improve the life of all citizens. For Goode, there was no

George Brown Goode (1851-1896)



***Lycodes verrilliix*, from *Oceanic Ichthyology, a Treatise on the Deep-sea and Pelagic Fishes of the World, Based Chiefly upon the Collections Made by the Steamers Blake, Albatross, and Fish Hawk in the Northwestern Atlantic*, G. Brown Goode and Tarleton H. Bean, 1896.**

distinction between pure and applied science; the increase of knowledge and the application of its benefits were inseparable. He was also a great believer in the diffusion of scientific knowledge to the general public, for which the museum was a primary vehicle. He wrote extensively on the theory and practice of building and running museums and became probably the foremost museologist of his time. He organized many special, off-site exhibits, including the Centennial Exposition in Philadelphia in 1876, and the great Fisheries Expositions in Berlin in 1880, and London in 1883.

Considering his many administrative responsibilities, it is remarkable that he was able to do any research at all, but he was a consistent and productive scientist. Goode maintained an interest in all manner of animals and plants and published on reptiles, birds, mammals, and crustaceans. Fishes were always his first and greatest love, however. His first substantial scientific publication was his *Catalog of the Fishes of the Bermudas* (1876), written after a visit to that island. He retained an interest in Bermuda and continually added to the record of fishes known from there. His work on Bermuda fishes later formed the basis for a Ph.D. degree, granted by Indiana University, Bloomington, in 1886. This early work may also have stimulated his life-long interest in the geographic distribution of fishes.

Goode wrote both long and short papers on fishes. Many of his systematic papers were written in collaboration with his Smithsonian colleague, Tarleton H. Bean. It was a most productive partnership; the ichthyological team of Goode and Bean turned out nearly 40 papers, climaxing in the monumental *Oceanic Ichthyology*, published only shortly before Goode's death. His solitary publications tended toward monographic works, in which he covered nearly all aspects of particular fishes or groups of fishes. His 1879 publication, *The Natural and Economical History of the American Menhaden*, is a prime example. In connection with the 1880 Census, Goode directed a complete survey of the state of American fisheries. The results were published in seven large volumes, *The Fisheries and Fishery Industries of the United States* (1884-87).

Goode summarized his vast knowledge of fishes in *American Fishes* (1888), a popular treatise on game and food fishes of North America. It is evident here that Goode was not only an outstanding scientist, but a fine writer as well. Goode never slowed down. At the time of his death, he was working on a treatise on the geographic distribution of deep-sea fishes. In addition, he and Theodore Gill were planning a book on the fishes of America, for which they had already assembled extensive material.

Goode was also profoundly interested in history, especially in the history and development of science in America. He produced bibliographies of a number of American naturalists, and at the time of his death was preparing a complete bibliography of ichthyology, including a list of all the named genera and species.

His marriage was a happy one and produced four children. Goode was never a man of vigorous health. As early as 1876 he suffered a physical collapse following his efforts on be-

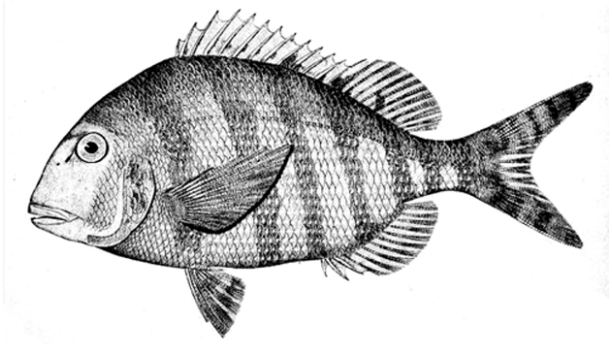
half of the Centennial events. He compounded his problems by being a heavy smoker. In the summer of 1896, Goode contracted pneumonia. In an age before antibiotics or any of the now-standard treatments, and weakened by years of cigarette smoking, he could not fight off the infection. He died in his home in Washington on 6 September 1896, at the age of 45.

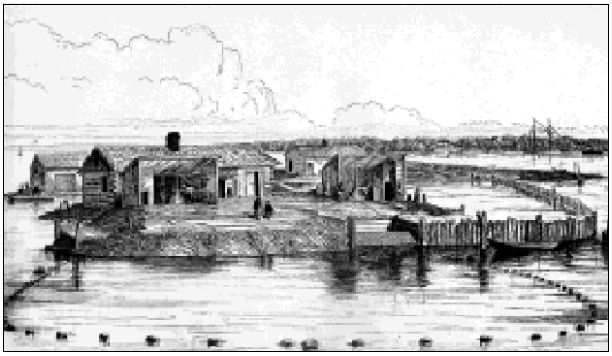
G. Brown Goode, like Spencer Baird, was a man for whom no one ever had a harsh word. He was universally liked and respected. His personal character, the care he took in his work, and his professional ethics were of the highest order. His legacy was immense, and we can only wonder what else he might have achieved had he lived a normal life span. His death left a void at the Smithsonian, and with the departure of Tarleton Bean the year before, research in ichthyology came to a standstill. There was simply no one who could take Goode's place. It would be forty years before ichthyology at the Smithsonian would begin to regain the level of production it had enjoyed during the tenure of George Brown Goode. David Starr Jordan acknowledged the influence of Goode's (coauthored with Tarleton H. Bean) *Oceanic Ichthyology* on his own monumental work on American fishes. "*The Fishes of North and Middle America* (3,000 pages published in a series of four volumes): **"[It] would never have been written except for my friend's [Goode's] repeated insistence and help."**

Also engaged in early explorations was **James Wood Milner (1841-1879)**. In 1874 Milner was an Assistant Fish Commissioner of the United States and described new species of Salmonoid fishes from Montana, Wisconsin, and Ontario. During his last year of life (he died at the very early age of 38) he also collected fishes for the Smithsonian on the west coast of Florida.

David Starr Jordan (1851-1931) was the most influential of all American ichthyologists. He and his students dominated the field in the late 19th and early 20-century. It has been said that all ichthyologists today can trace their professional ancestry back to Jordan. Born in Gainesville, New York, Jordan received bachelor and master's degrees from Cornell University in 1872. He was a science teacher at Indianapolis High School during 1874-75, received the Doctor of Medicine degree from Indiana Medical College in 1875, and a Ph.D. from Northwestern Christian University (now Butler University) in 1878.

Most of Jordan's scientific career was spent at Indiana University, starting in 1879 where he was Chairman of the Department of Natural Sciences and sixth President (1885-1891), and also at Stanford University (1891-1931), but he was closely associated with the Smithsonian for much of his career. He was even of-





Top: Pagellus milneri, Goode & Bean (1879).
Bottom: Line drawing of a lake whitefish fishery from "The fisheries of the Great Lakes and the species of *Coregonus* (or white fish)," Milner, J.W. 1874.

David Starr Jordan (1851 - 1931)

fered, at different times, the positions of National Museum director and Smithsonian Secretary, but he declined both. Like so many naturalists of his generation, Jordan owed much to Spencer Baird. Reminiscing in later years, he said that the three figures who contributed most to his own development were Andrew Dickson White (president of Cornell University, where Jordan studied), Louis Agassiz, and Spencer Baird.

Jordan visited Baird's summer laboratory of the U.S. Fish Commission at Noank, Connecticut, in 1874. Although Baird himself was absent, Jordan met several of Baird's group, including George Brown Goode. Here, as Jordan tells it, is where he first came under Baird's influence. Baird by this time was certainly aware of Jordan and recognized his talents. From the mid-1870s into the 1880s, Jordan and his students made summer collecting trips into the southern states, whose fishes were poorly known at the time. Baird provided financial support and collecting equipment, and most of the fishes collected were deposited at the Smithsonian. Jordan, in effect, became part of Baird's vast network of collectors and greatly contributed to the growth of the Smithsonian's fish collection. The relationship was mutually beneficial and created a synergy that produced much more than either could have accomplished on their own. In Jordan, Baird found not just an individual collector, but also a fellow scientist who had his own network of student assistants. Jordan not only collected the fishes, but also studied and published on them as well. Baird, in turn, gave Jordan access to resources he would not otherwise have had. In those days, the Smithsonian and the U.S. Fish Commission were closely intertwined, as Baird headed both organizations. Jordan worked in association with both agencies and published much of his work in their journals.

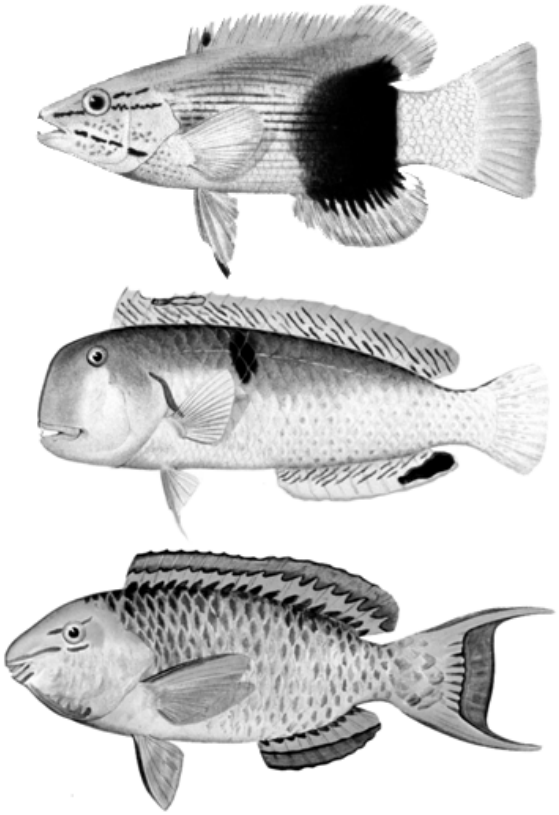
Jordan's collecting trips began in 1875 in Indiana and Wisconsin. His most important fieldwork was done in the southern states, where he spent several summers, beginning in 1876. In 1880, as part of the Tenth Census, Baird organized a survey of the fisheries in the United States, and in connection with this he asked Jordan to explore the Pacific coast. Jordan and

A very young David Starr Jordan when, in 1885, he became the sixth President of Indiana University at the age of 34.

his assistants collected fishes along the entire west coast, from the Mexican border to Canada. Jordan's student and assistant, Charles Henry Gilbert, extended the collecting to Mexico and Central America. In 1884, at the request of Goode, Jordan undertook an extensive survey of the fresh-water fishes of southern United States. Assisted by Gilbert, J. Swain, and Seth Eugene Meek, he explored various rivers in Missouri, Arkansas, Texas, Alabama, and Tennessee. It was, to date, the most detailed exploration of fresh-water fishes in the U.S. (See: *Record of Collections of Fishes*, 1885). Jordan's various expeditions constituted, in effect, a survey of North American fishes, complementing the railroad and boundary surveys of the 1850s. These collections formed much of the basis for the classic Fishes of North and Middle America by Jordan and Evermann, published between 1896 and 1900. In the years that followed Baird's death in 1887, Jordan maintained his association with the Smithsonian and the Fish Commission by undertaking expeditions to Hawaii, Alaska, Samoa, and Japan.

When Goode died in 1896, Jordan was offered the directorship of the National Museum. He was then early in his tenure as president of Stanford University and did not feel he could leave during its critical formative years. In 1906, he was offered the post of Smithsonian Secretary. This time he was strongly tempted to accept, but then the great earthquake struck the San Francisco area, and Jordan again felt it was his duty to stay. The history of ichthyology might have been quite different if Jordan had decided to accept either of these offers. In 1921, on the occasion of Jordan's 70th birthday, the Smithsonian Secretary Charles D. Walcott sent him a letter of congratulations, acknowledging his close ties to the Institution. **"Your early associations were with Baird, Gill, Brown Goode, and Tarleton Bean,"** he said, **"and your name will go down in the Museum's history linked with theirs. No wonder we have always regarded you as one of us, and we know that this sentiment is being reciprocated by you."**

Jordan served as an expert witness on the validity of the theory of evolution at the Scopes trial in Tennessee where he ardently defended the theory of evolution. In addition, he was known for his work in education and philosophy, publishing many works on those subjects. He was best known, however, for his work as a peace activist and was a proficient author in this field. He often approached the subject of peace from a biological angle, arguing that war was detrimental to the health of the species be-



From top to bottom: *Lepidaplois strophodes, Hemipteronotus baldwini Scarus lauia.* From: *The Shore Fishes of the Hawaiian Islands, with a General Account of the Fish Fauna*, by David Starr Jordan and Barton Warren Evermann, *Bulletin of the United States Fish Commission*, Vol. XXIII, 1903.

Samuel Garman (1843-1927)

cause it removed the strongest individuals from the gene pool. He served as president of the World Peace Foundation from 1910 to 1914 and as president of the World Peace Conference in 1915. He was also vice president of the American Peace Society. Although he campaigned vigorously against U.S. involvement in World War I, once war was declared, he advocated aggressive measures to end the conflict quickly.

Jordan was the dominant figure of his day in the study of fish. He was a large man best remembered for his intellect, drive, and keen memory and for the sheer force of his personality. He also possessed an uncanny knack for distinguishing similar looking species of fish. He was a prolific researcher, generating well over 600 publications - single scientific papers to weighty texts - about fish over the span of half a century. Scientific folklore has it that Jordan dictated from memory most of his two-volume *Guide to the Study of Fishes* – all the while serving as president of Stanford University.

Samuel Garman (1843-1927) was born in 1843 to a Quaker family living in a part of Pennsylvania dominated by the Society of Friends. As a young man he took part in surveying the routes for the Union Pacific Railroad and, having left home very early, he fought Indians and shot meat for the working crews while hardly more than a boy. After graduating from college in 1869, Garman became the principal of the Mississippi Normal School (now the University of Southern Mississippi), and in 1871 taught natural science at the Ferry Hall Seminary (now part of Lake Forest University.

Garman traveled west to San Francisco and there on board the survey vessel *Hassler* he met an ailing Louis Agassiz. Garman accompanied Agassiz back to Harvard's Museum of Comparative Zoology (MCZ) and, after becoming one of Agassiz's favorite pupils, settled into the scientific community of the Boston area, participating in several scientific societies and publishing papers in their journals.

On the death of his father in 1874, Alexander Agassiz was made curator of the MCZ. Garman's affection for Louis Agassiz and his lifelong friendship with his son amounted almost to hero worship, indicating a worthy spirit of loyalty.

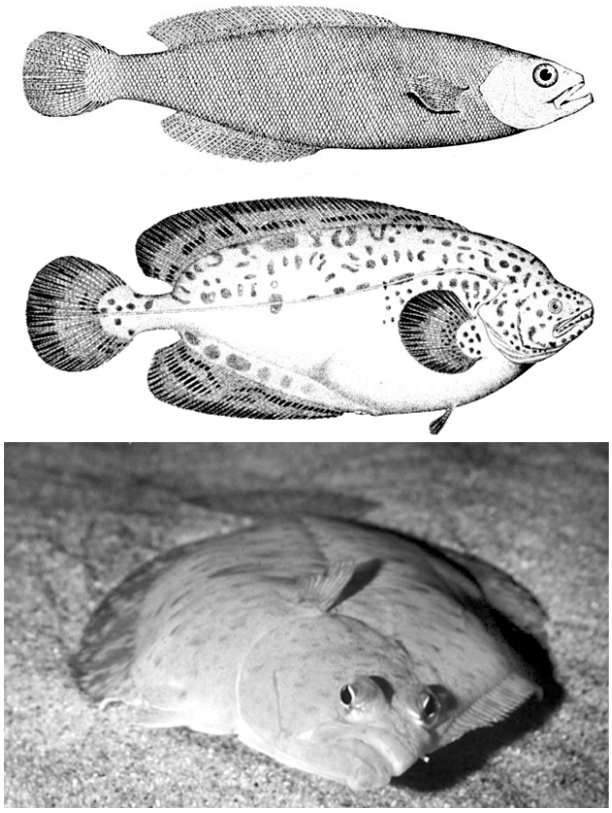
All his life long Garman maintained a singular reticence and it was only after years of intimate friendship that he would discuss any scientific work that he had in hand. Indeed he habitually put away his manuscript and the specimens that he was dissecting when a visitor rang the bell to his room. This was not by any means all from a fear that others might anticipate his results, although he did at times have this fear, as was so commonly the case with the zoologists of those times, but rather because he disliked discussing any of his work until his studies were completed.

Alexander Agassiz' departure from the museum in 1898 was marked by a serious downturn of Garman's productivity. Though his production of scientific papers all but ceased, Garman did not retire but continued to rule the fish department from his office in the basement of the museum where his reclusive ways, odd dress, and curmudgeonly attitude made him a figure of fun in his declining years. There is ample evidence that Garman was not an easy man to get along with, and certainly in his later years he was quite eccentric. There is also no doubt, however, that he produced a multitude of important ichthyological works. His skill with a dissecting knife, his perceptive eye for species, and his tireless devotion to descriptive taxonomy earn him a place among significant ichthyologists and, as a result, he has been honored by having a total of 23 new fish species after him plus one genus, *Garmanella*. He was the author of 36 ichthyological papers, the most noted of which was *The cyprinodonts*, 1895.

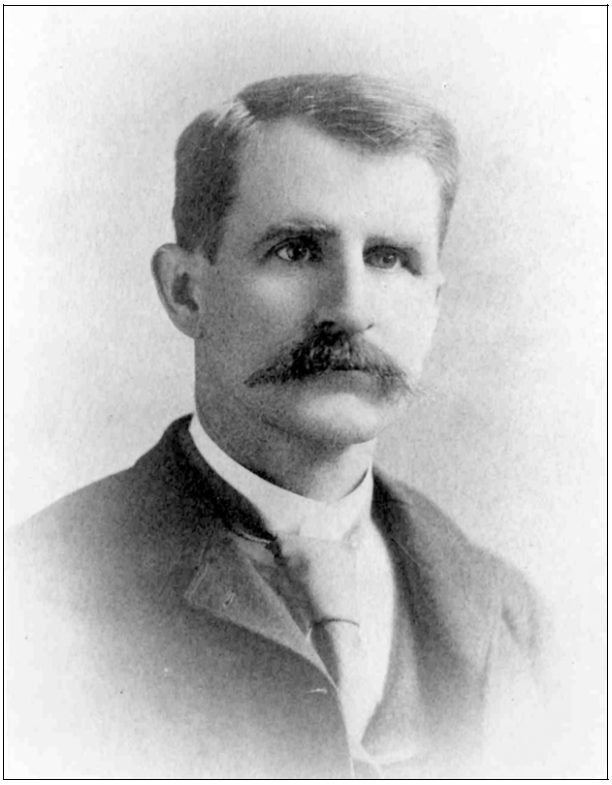
William Neale Lockington (18??-1902) was curator of fishes, reptiles, crustaceans and "radiates" (plantlike hydroids, the flowerlike sea anemones, the jellyfishes, and the horny and hard corals) at the California Academy of Sciences between 1875-81. He is the author of 50 papers on fishes, mostly describing California marine species. In 1879, when David Starr Jordan was appointed special agent of the U.S. Census Bureau, in charge of the enumeration of the fisheries and other marine interests of the Pacific coast of the United States, he was given special assistance in the San Francisco area by Lockington. Lockington named the flounder, *Eopsetta jordani,* after him, the first of many such honors.

Tarleton H. Bean (1846-1916) has the distinction of being the first Curator of Fishes at the Smithsonian Institution. As an effective manager of collections, a field collector, a researcher, and a prolific writer, he contributed greatly to the development of American ichthyology. He was also an internationally known authority on fish culture, the artificial propagation of game and food fishes.

Bean was a native Pennsylvanian, born and raised in the small town of Bainbridge, on the lower Susquehanna River. He attended college at the state normal school at nearby Millersville, where he specialized in botany. After graduating in 1866, he taught for several years and served as the principal of Wilkes-Barre high school from 1871 to 1874. Bean's interest clearly lay in science rather than teaching, and in 1874 he made two important moves. That



Fishes named by and for William N. Lockington:
Top: The Medusafish (the young hide among jellyfish tentacles), *Icichthys lockingtoni*, Jordan & Gilbert (1880).
Middle: *Icosteus enigmaticus*, Lockington (1880).
Bottom: Petrale sole, Eopsetta jordani, Lockington (1879).



Tarleton Hoffman Bean (1846-1916)

summer he began his association with the U. S. Fish Commission, working at the Commission's summer station at Noank, Connecticut. Then he moved to Washington and began medical studies at Columbian College (now George Washington University). He was granted an M.D. degree in 1876 but never became a practicing physician. Instead, he turned his full attention to the Smithsonian and the Fish Commission, which in those days were closely intertwined.

Over the next two decades, Tarleton Bean assumed a variety of duties in both organizations. In 1877, he became a full-time staff member of the U.S. National Museum, first as Assistant in Ichthyology and then as Curator of Fishes in 1879. Throughout this period, he continued to work for the Fish Commission. Most summers found him in the field at one of the Commission's shore stations or aboard one of its vessels. In 1880, he spent a good part of the year in Alaska, exploring the fishes of the region under the auspices of the Census Bureau and the Fish Commission. The work resulted in the description of many new species, and eventually led to his long-time interest in Alaskan fishes.

Following the 1880 census, the Museum received larger collections of fishes than ever before, and Bean increasingly spent time managing collections, supervising the day-to-day functions of preserving and cataloging fishes, and displaying them in the Museum's exhibit halls. By 1882, for example, the Department of Fishes had 20,000 'reserve' specimens, 20,000 specimens on exhibit, and 10,000 duplicates. Bean's detailed instructions found in the "Directions for Collecting and Preserving Fish" reveal the extent of the work that went into managing the ichthyological collections. In addition, he supervised the work of artists who were engaged in preparing illustrations of fishes for the department.

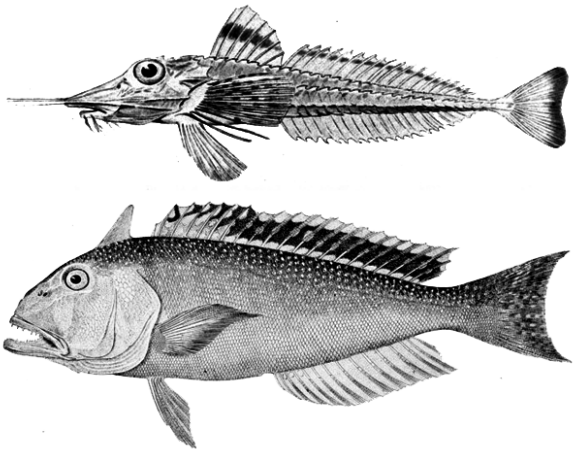
In 1883, the Fish Commission and the Smithsonian participated in the Fisheries Exhibition in London. Bean assisted George Brown Goode, who was in charge of the American exhibits, and published a catalog of 450 fish specimens that were displayed in London. While in Europe, he visited natural history museums in Berlin, Paris, and Genoa, studying the American fishes held in their collections. From 1878-1886, he was the editor of the *Proceedings of the U.S. National Museum* and supervised the printing of the *Bulletin.* By 1888, his duties with the Fish Commission had become so demanding that he reduced his Smithsonian title to Honorary Curator and took his pay entirely from the Fish Commission. About the time of this administrative change, Tarleton Bean's younger brother, Barton Appler Bean (1860-1947), who had been working as assistant since 1882, became Assistant Curator of Fishes, a position he held until 1932. However, the latter's reign seemed to be, quoting from Carl L. Hubbs, **"less productive and less illustrious."**

Dasycottus setiger, Bean (1890).

In 1889, Bean was appointed the editor of the Commission's publications, while continuing to hold the title of Ichthyologist. Most of his work at the Commission related to fish culture. In 1893, he represented the Commission at the World's Columbian Exposition in Chicago. By this time, Bean's reputation as a fish culturist was such that the New York Aquarium asked him to be its director and to oversee its reorganization and rebuilding. He served there with notable distinction from 1895-1898, when political changes led to his resignation. For the next eight years, he occupied a series of temporary positions. He served as the director of the forestry and fisheries exhibit for the United States at the Paris Exposition in 1900 and as chief of the departments of fish, game, and forestry at the World's Fair in St. Louis from 1902-l905. In 1905, he approached the Field Museum in Chicago about collecting fishes in Bermuda. His request was approved, and he spent that summer and fall collecting and preserving fishes in Bermuda. The resulting catalog of Bermuda fishes was published by the Field Museum in 1906. In that year, Bean was appointed head fish culturist for the State of New York, a position he held until his death in 1916.

Bean's name will always be linked with that of his colleague, G. Brown Goode, with whom he wrote some 39 papers, culminating in the classic *Oceanic Ichthyology* (1896), published the year Goode died and the year after Bean left Washington. Their first joint paper was published in 1877, a description of two deep-water fishes collected while they were both aboard the Fish Commission steamer *Speedwell.* Bean published more than 300 papers over the course of his career, about eighty percent of them dating from the time when he was at the Smithsonian and the Fish Commission. Most of his shorter systematic papers appeared in the *Proceedings* of the U. S. National Museum. Among his larger works, besides *Oceanic Ichthyology,* are *The Fishes of Pennsylvania* (1893), *Catalogue of the Fishes of Long Island* (1901), *Food and Game Fishes of New York* (1902), and *Catalogue of the Fishes of New York* (1903). Most of his later papers dealt with fish culture, and he published numerous popular articles in *Forest and Stream* magazine. Although the great majority of his work was on fishes, Bean also had considerable expertise in forestry and conservation. By the end of his life, he was generally considered to be the premier fish culturist in the world. His accomplishments were widely recognized in his time, and he received numerous awards from the United States and other countries.

According to one of the greatest American ichthyologists of the 20th Century, Carl L. Hubbs, **"Rosa Smith was indeed the first woman ichthyologist of any accomplishments."** Who then



Top: *Peristedion gracile*, Goode & Bean (1896).
Bottom: The Tile-Fish, *Lopholatilus chameleonticeps*, Goode & Bean (1879).

Rosa Smith Eigenmann (1858-1947)

was Rosa Smith? **Rosa Smith (1858-1947)**, born in Monmouth, Illinois, was the last of nine children. Her parents had come from California to Illinois to launch a newspaper, but they returned when their frail, tubercular youngest was advised to seek a warmer climate. Rosa finished her secondary schooling at Point Loma Seminary, taking a lively interest in the natural history of the region. From the beginning she showed a great deal of interest in natural history and joined the San Diego Society of Natural History and began, as an amateur, to collect, observe, and identify local species of animals and plants. In the dark, rocky caves beneath San Diego's Point Loma Peninsula live schools of little, pink, blind fish, six or seven inches long. They were discovered and later described in 1881 by Smith who named it the blind goby, *Typhologobius californiensis* (*now Othonops eos*), an action that inaugurated her scientific career.

In 1879 in San Diego she met David Starr Jordan (1851-1931) who was impressed by her abilities. (One of Smith's daughters wrote that Jordan met Smith while renting a horse and buggy from her father, but another daughter believed they met at the Society of Natural History. There, the story went, Jordan heard Smith read a paper on a new species of fish (very likely the blind goby), was deeply impressed, and urged her to study with him at Indiana University.) Jordan urged her to go on with her education at Indiana university where he had just joined the faculty. Before moving to Indiana, Smith spent the summer of 1880 in Europe, with Jordan and his students in a natural history tour. She spent the two years at Indiana University in Bloomington, but never graduated because she had to return to California due health problems in her family. However, while in Bloomington she met a Jordan protégée, Carl H. Eigenmann, who was in the process of obtaining a doctorate in ichthyology.

While in San Diego she published many papers, while keeping an intense correspondence (scientific and personal) with Eigenmann. Before they married on August 20, 1887, she had published nearly 20 papers on her own. They married on 20 August 1887 and from then on they worked closely together. The Eigenmanns traveled to Harvard University, where they studied the Thayer Expedition collections of Louis Agassiz and Hassler Expedition collections of Franz Steindachner. As a result of that collaboration they published a series of seminal works that included *Preliminary Notes on South American Nematognathi* (1888), *A revision of The South American Nematognathi* (1890), and *Catalogue of the Fresh-water Fishes of South America* (1891).

In 1891, Jordan became chancellor of Stanford University, and Carl Eigenmann was left to head the zoology department at Indiana University. He ultimately became department chair and, later, Dean of the Graduate School. The five Eigenmann children included a dis-

abled daughter and a son who was eventually institutionalized, and the burden of childcare fell heavily on Rosa Eigenmann. Nevertheless, she managed to collaborate with her husband on 20 more papers. Eigenmann and Eigenmann were first to describe some 150 species of fish.

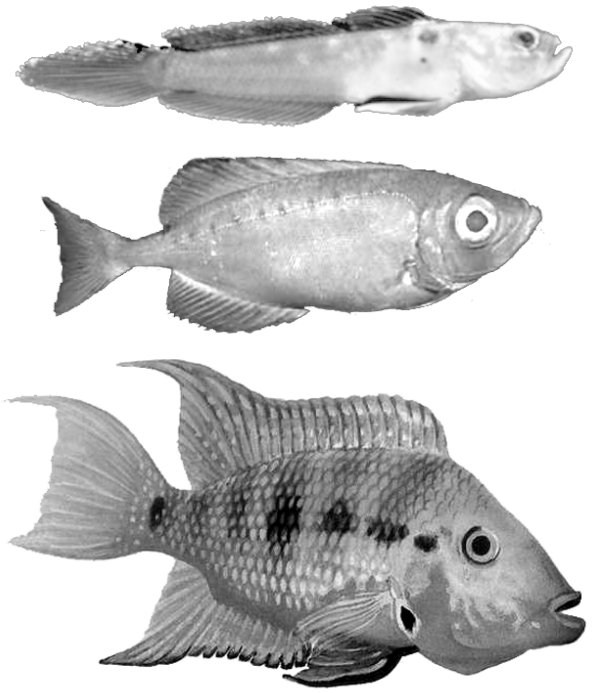
When Carl Eigenmann had a stroke in 1927, Rosa returned with him to San Diego, where he died on April 24. She stayed in San Diego with her children but was not scientifically active. Her brief but productive career had been pursued in spite of all obstacles, and she once wrote, **"in science as everywhere else in the domain of thought woman should be judged by the same standard as her brother. Her work must not simply be well done for a woman."** Eigenmann did not let her gender prevent her from accomplishing anything she set out to do. Some sources indicate she was the first woman allowed to attend graduate-level classes at Harvard; the first woman to be the president of the Indiana University chapter of Sigma XI, an honorary science society; and the first woman to determine a new species of fish. A remarkable woman, indeed, was Rosa Smith Eigenmann.

Seth Eugene Meek (1859-1914) seemed destined to spend his life peering into the waters of one river or another. He was born in 1859 in Hicksville, a small town in far northwest Ohio. He was brought up on a farm and attended district schools until he was ready for high school. He entered Valparaiso University, graduating in 1881 with the degree of Bachelor of Science. That same year he entered Indiana University where he received a Bachelor of Science degree (for the second time) in 1884, and a Master of Arts in 1886. He was a Fellow at Cornell University in 1885-1886, and in 1891 he received the degree of Doctor of Philosophy at Indiana University.

The first position occupied by Meek was that of Professor of Natural Science at Eureka College, Illinois, which he held from 1886 to 1887. He next became Professor of Natural Science at Coe College, Iowa, remaining there from 1887 to 1892. In 1892 he transferred to the University of Arkansas as Assistant Professor of Biology and Curator of the Museum. He remained there until 1896 when he went to Naples, Italy under a scholarship granted by the Smithsonian Institution. Upon his return to the United States in 1897 he became Assistant Curator of Zoology in the Field Colombian Museum, which later was renamed the Field Museum of Natural History (now the Chicago Museum of Natural History). He held this position until the time of his death in 1914.

He wasn't far into his studies at Indiana University when he became fascinated with ichthyology. It was here at Indiana University where the lives of three important ichthyologists converged. Meek and Charles Gilbert were students there when David Starr Jordan served as head of the department of natural

Seth Eugene Meek (1859-1914).



Fishes named for Seth E. Meek:
Microgobius meeki,
Evermann & Marsh (1899).
***Priacanthus meeki*, Jenkins (1903).**
***Thorichthy meeki*, Brind (1918).**

science. Meek, Gilbert and Jordan often would spend their summer breaks from the academic world engaged in field research for the United States Fish Commission or the U.S. National Museum. Gilbert and Meek, both then just in their mid 20s, ventured across southwest Missouri in the summer of 1884. During this trip they discovered the bluestripe darter and Niangua darter.

That same summer Meek and Jordan traveled north to study the 102 and Missouri rivers, Tabo Creek near Lexington, and tributaries of the Lamine River. They netted a small minnow that was then abundant in the Missouri near St. Joseph. It was slender, with small eyes and sickle-shaped pectoral fins. Jordan and Barton Warren Evermann, another of his colleagues, eventually determined it to be a new species. Their scientific name for it was *Macrhybopsis meeki* in honor of Meek, but the fish's anatomy inspired its common name, the sicklefin chub. Today, it is rare in the state and is a candidate for protection under the federal Endangered Species Act.

Meek returned with two students in July and August of 1889 to survey streams in Missouri and Arkansas. Meek's records provide a glimpse into their work and travels. In just 16 days on the Missouri leg of the trip, they collected fish in 18 streams across the basins of the Meramec, Gasconade, Osage, Neosho, and White rivers. Their zigzag route took them from St. Louis through or near St. James, Rolla, Dixon, Marshfield, Neosho, and Springfield before their final stops on the Big Piney and North Fork rivers near Cabool. It was on this trip that they discovered the yoke darter in the James River and the Ozark shiner in the North Fork. Meek generously named the yoke darter *Etheostoma juliae* for Julia Gilbert, his colleague's wife.

Meek's records also provide a number of personal observations. He found the Niangua **"quite remarkable for the bright colors of its minnows and darters."** By contrast, he seemed disappointed after visiting the Big Piney near Cabool. **"Fish are apparently scarce in this stream,"** he wrote in an account published in the Bulletin of the United States Fish Commission. **"The scarcity is in some measure due to the presence of gristmills and sawmills, which discharge refuse into the stream, and to the use of dynamite (to kill fish)."** He also reported that it was common near Newburg and Neosho for dynamite to be used in a similar fashion. Meek called attention to the rugged terrain and bluffs along the North Fork of the White River south of Cabool: **"The country is also heavily timbered and as yet sparsely settled,"** his account reads. **"These men were out seining in the White River basin before any dams were built so you can imagine the conditions,"** explains Henry Robison of Southern Arkansas University.

Charles Henry Gilbert (1859-1928)

The accounts of Meek, Gilbert, and Jordan of their explorations of Missouri and Arkansas are in a sober and methodical scientific language. They convey little sense of the excitement and awe they must have felt. After all, these were accomplished scientists who lived to discover and push out the bounds of our knowledge of the watery world of darters and shiners. And here was a place where every flash of color darting through a riffle held out the prospect of discovery and acclaim. That prospect drew Seth Meek to Missouri no less than three times and into Arkansas many more than that. And he must have been more than a little amazed at what he saw when he gazed into the water here. Why else would he have returned again and again?

Like Eigenmann, Meek revised many early group and regional papers. Besides focusing his attention on freshwater fishes of Middle America, Meek's collections of Mexican and Central American Fishes at the Field Museum in Chicago made ichthyology a world-renowned resource. His work in Mexico resulted in his largest and most comprehensive publication, "The Fresh-water Fishes of Mexico north of the Isthmus of Tehumtepeo." While Gilbert and Jordan were far bigger names in scientific circles, Meek's work here stands out. He was **"the single biggest contributor to knowledge of Missouri fishes before 1900,"** according to William L. Pflieger, retired Conservation Department ichthyologist and author of *The Fishes of Missouri*.

Charles Henry Gilbert (1859-1928) was a pioneer ichthyologist and fishery biologist of particular significance to natural history of the western United States. He collected and studied fishes from Central America north to Alaska and described many new species. Later he became "the" expert on Pacific salmon and was a noted conservationist of the Northwest.

Born in Rockford, Illinois, Gilbert spent his early years in Indianapolis, Indiana, where he came under the influence of his high school teacher, David Starr Jordan. When Jordan became a Professor of Natural History at Butler University in Indianapolis, Gilbert followed and received his B.A. degree in 1879. Jordan moved to Indiana University, in Bloomington in the fall of 1879 and Gilbert again followed, receiving his M.S. degree in 1882 and his Ph. D. in 1883. His doctorate was the first ever awarded by Indiana University.

Jordan and Gilbert explored the streams and rivers of Indiana and the southeastern United States in the late 1870s and described a number of new fishes. In 1879, Jordan was asked by Spencer Fullerton Baird, then Commissioner of the U.S. Fish Commission, to undertake a survey of the fisheries of the Pacific Coast of the United States. Jordan took leave of absence from Indiana University, chose Gilbert as his assistant, and headed west to San Francisco, California, in December 1879. Their pioneering one-year survey of fishes of the West laid the foundation for nearly 50 years of study of Pacific fishes and fisheries by

the team of Jordan and Gilbert.

By the time Gilbert received his Ph.D. degree at the age of 24, he was the author or co-author of over 80 scientific publications, most of them as junior co-author with Jordan. Gilbert served at Indiana University from 1880-1884, first as instructor, then as Assistant Professor in Natural Sciences and Modern Languages. In 1884, he accepted the Professorship of Natural History at the University of Cincinnati, in Ohio, remaining there until December 1888. In 1889, Gilbert returned to Indiana University as Professor of Natural History.

Jordan became President of Indiana University in 1885. However, in 1890, Senator and Mrs. Leland Stanford chose Jordan to be the founding president of a new university to be established in Palo Alto, California, in memory of their deceased son, Leland Stanford, Jr. Among Jordan's first appointments to the new faculty was Charles Henry Gilbert to serve as the Chairman of the Zoology Department.

Gilbert then began a career at Stanford University that spanned nearly 37 years. He concentrated on Pacific fishes, mostly marine, and participated in numerous expeditions aboard the U.S. Fish Commission Steamer *Albatross*. These cruises included three to Alaska, two off California, and one each to the Hawaiian Islands and the Japanese Archipelago. As a pioneer descriptive ichthyologist, Gilbert described, either alone or with others, about 117 new genera and 620 species of fishes.

Around 1909, Gilbert turned his attention to the study of Pacific salmon and soon became the foremost expert on these economically important fishes. He studied salmon from California to Alaska, but concentrated his efforts on British Columbia (from about 1912 to 1921) and Alaska (from 1918-1927). He was the first scientist to correctly apply the scale method to the aging of Pacific salmon, he pioneered racial studies using scales, and he was instrumental in establishing tagging programs on salmon in Alaska. He was the first to confirm the "home stream" theory to spawning salmon. Additionally, he was also one of the very first scientists to consider the population dynamics of northwest stocks of salmon. In his later years, Gilbert became an outspoken champion of the need for conservation of Pacific salmon, warning all who would listen that this resource was in dire jeopardy unless overfishing was curtailed. His worldview was far ahead of his time and he urged the U.S. Bureau of Fisheries to instigate data collection programs for Alaska salmon. This earned him the title of **"the father of modern fisheries biological research in America."**

Always formal and proper and a man of high moral standards, Gilbert nevertheless was a demanding person with a sharp eye and an even sharper temper. He supervised the graduate studies of several ichthyologists and fishery biologists who became notable in their field, among them William Francis Thompson and Carl Levitt Hubbs.

Gilbert died in 1928 at the age of 68, but he has been remembered and honored by ichthyologists and fishery biologists for his many contributions. In addition to the "*Gilbert Ichthyological Society,*" a United States Bureau of Commercial Fisheries research vessel was commissioned in 1952 as the *Charles H. Gilbert*. In 1991 a building at Stanford University was named the "Charles Gilbert Biological Sciences Building."

Carl H. Eigenmann (1863-1927) was one of the most talented and well respected men in the ichthyological world, the man whom many would call, **"The Father of Characid Studies."** He was born in a small town in Germany, Flehingen, in 1863 and at fourteen moved to Rockport, Indiana. Within two years of his arrival in the United States he was capable

Carl H. Eigenmann (1863-1927)

enough with the English language to enroll in the University of Indiana, where he studied under David Starr Jordan. Under the tutelage of Jordan, Eigenmann would develop his interest in biology into a love for ichthyology and began publishing with works on darters, eleotrids, and diodontids.

In 1886 he received his Bachelors degree from Indiana University and traveled to California where he met and later married Rosa Smith on August 20, 1887. The newlyweds then traveled to Harvard University, where they were able to study the Thayer Expedition collections of Louis Agassiz and Hassler Expedition collections of Franz Steindachner, thus beginning the "Eigenmann and Eigenmann" publication series, including *Preliminary Notes on South American Nematognathi* (1888)*, A revision of The South American Nematognathi* (1890)*,* and *Catalogue of the Fresh-water Fishes of South America* (1891) and an overwhelming interest in neotropical fishes.
In 1888 the Eigenmanns moved back to San Diego where he became the curator of a local natural history society and helped establish the San Diego Biological Laboratory. Eigenmann received the Ph.D. from Indiana University in 1889 and in 1891 was offered a position at the University of Indiana as Professor of Zoology. In 1892 Dr. Günther of the British Museum financed his first expedition. The trip was to explore fishes of the Pacific and Atlantic slope. The trip took him through the Northwestern United States and throughout western Canada. After the expedition Eigenmann showed an interest in the blind fishes that live in the freshwater caves of Indiana. This interest brought him to fresh water caves in Indiana, Texas, and Missouri throughout the 1890's. All of these expeditions brought Eigenmann national attention due to discovery of new blind cave salamanders (*Typhomolge*, *Typhlotrition*). Then in 1902 through a grant from the American Association for the Advancement of Science, Eigenmann was able to travel to the blind fish caves of Cuba. The Carnegie Institution made it possible for him to go back to the island several more times between 1902 and 1904.

In 1906 Eigenmann left for Europe to attend lectures by Weismann and Wiedersheim at the University of Freiburg. While in Europe Eigenmann studied type specimens among the collections of South American fresh water fishes in the museums of London, Paris, and Vienna; he then returned to the United States in 1907 and was named the Dean of the graduate school at his alma mater in 1908. In working on the Brazilian Characidae and monograph based on the Thayer collection, Eigenmann realized that material assembled in the major museums by the early explorers was not adequate for a thorough understanding of the neotropical fauna, thus providing the motivation for eventual fieldwork in South America. Although he did not participate in the fieldwork, Eigenmann was influential in urging Congress to undertake a survey of the Panama region done before the completion of the ca-

The Indiana University Colombian Expedition of 1911-1912 was the second of Eigenmann's three to South America in the early 1900's. In Colombia Eigenmann collected freshwater fishes in the Magdalena, Viejo, Cauca, Cali, San Juan, Atrato, Sucio, Gualandai, Pepita and Dagua rivers.

nal. He stated that **"the Panama Canal when completed, would destroy natural barriers and cause the faunas of two slopes to migrate to a great extent".**

In 1907, one of Eigenmann's former students, John D. Haseman, made a collecting trip for the Carnegie Museum to Central South America. The Haseman collections rival in quality and importance to those of the Thayer Expedition and represent regions of central South America not covered by the latter. It is interesting to note that the Carnegie Expedition took place apparently after the falling-out between Haseman and Eigenmann. There is little available published information on the basis of the problem between the two, however, it is generally known that Haseman was strong-minded and critical of several of Eigenmann's projects, principally his biogeographic hypotheses. Haseman never completed studies for his degree and became a pseudo-professional collector.

In 1908 Eigenmann got the financial support of the Carnegie Museum in Pittsburgh that made his first expedition to South America possible. In September of 1908 Eigenmann departed for Georgetown for The Carnegie British Guiana Expedition with his assistants and volunteers. They returned back to New York with a collection of 25,000 specimens. The trip was a huge success by yielding 28 new genera and 128 new species. The expedition made his relationship with the Carnegie Museum closer, and he was named honorary curator of fishes. In 1912 Eigenmann undertook the Indiana University Colombian Expedition. This trip took him through western Colombia, and most of Panama. The collections taken on the trip were brought to the Carnegie Museum in Pittsburgh for study. Eigenmann would travel on one more expedition, the 1918 Indiana University Irwin Expedition. This trip would take Eigenmann and his daughter (Adele) to the high Andes of Peru, La Paz in Bolivia, and Chile to study the fishes of high elevations on the Pacific slope. The expedition returned home in 1919. Unfortunately, Eigenmann had become ill on the trip, and would never make another one.

Carl H. Eigenmann's influence on modern ichthyology can be seen in both his laboratory and fieldwork, along with the success of his students and fellow ichthyologists whom he influenced in one way or another. Eigenmann's students and associates John D. Haseman (Carnegie Museum Expedition to Central South America) and Arthur Henn and Charles E. Wilson (Indiana University Landon- Fisher Expedition to Columbia) all made huge contributions to the advancement of ichthyology. Eigenmann also influenced William R. Allen (Centennial Expedition), Nathan R. Pearson (Mulford Expedition), and Dr. Carl Ternetz (Indiana University Northern South America Expedition) by assisting them in the setting up of their expeditions.

The following years were spent writing and

Marshall McDonald (1835-1895)

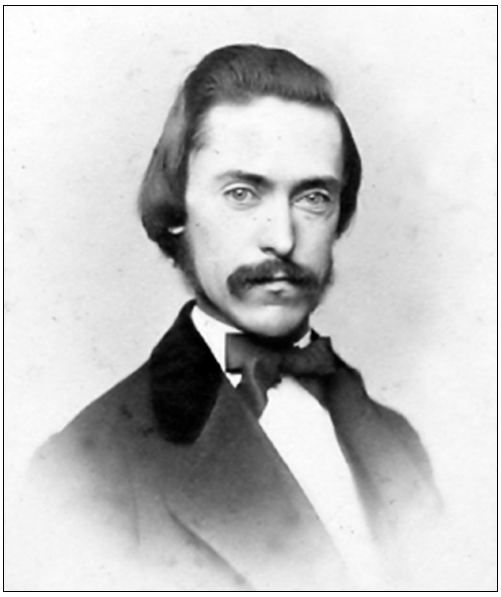
finishing reports from previous expeditions and studies. In 1922 Eigenmann completed a summary of his South American work, entitled *The Fishes of the Pacific Slope of South America and the Bearing of their Distribution on the History and Development of the Topography of Peru, Ecuador, and Western Colombia*. He was elected to the National Academy of Sciences in 1923. On April 24, 1927 Carl H. Eigenmann died in a small, private hospital in San Diego. Upon his death his successor (Fernandus Payne) praised Eigenmann's researches by placing him **"in the first rank of ichthyologists of all time."** Jordan praised Eigenmann by describing him as **"one of the most eminent workers in the field of systematic zoology and one of the ablest of natural history teachers, withal the most tireless of explorers."**

Marshall McDonald (1835-1895) was born at Romney, Hampshire County, West Virginia on June 26, 1835. He was the fourth of six sons of Col. Angus William McDonald and was graduated from Virginia Military Institute in 1860, standing 2nd in a class of 41. During the 1860-1861 academic years, he remained at Virginia Military Institute where he was an assistant professor of tactics. In April 1861, McDonald was appointed a Lieutenant in the Engineer Corps of the Confederate Army. He served throughout the war as an engineer officer, and was acting Chief Engineer, Department of North Carolina, when the war ended in April 1865.

Following the war, McDonald returned to VMI, where he taught chemistry, geology and mineralogy until 1879. He was subsequently appointed the first Fish Commissioner of Virginia and in 1888 he was appointed the third (after Baird and Goode) U.S. Commissioner of Fish and Fisheries by President Grover Cleveland, remaining in the post until his death. His assistant was Hugh M. Smith. The deep-sea fish *Conocara macdonaldi* (Goode and Bean, 1895) is "In honor of Col. Marshall McDonald, United States Commissioner of Fisheries since 1888." (The "mac," instead of "mc," prefix of the *Conocara* species, *Lampanyctus macdonaldi* (Goode & Bean, 1896), and *Callionymus macdonaldi* (Ogilby, 1911), and perhaps *Notobrancaea macdonaldi* (Pelseneer, 1886), is a nod to Latinization, rather than placed there just to confuse historians!)

Theodore Nicholas Gill (1837-1914), the eminent ichthyologist and professor of zoology at George Washington University, was associated with the Smithsonian Institution for over fifty years. Although he maintained an office at the Smithsonian and spent countless hours studying the museum specimens, for most of that time he was not a part of the paid scientific staff. Nevertheless, his name is indelibly linked to the Smithsonian, and he contributed greatly to the Smithsonian's reputation for scientific excellence.

Theodore Gill was born in New York City. His father wanted young Theodore to become a clergyman and made sure that his son received a good education soundly based in the classics.



Theodore Nicholas Gill (1837-1914)

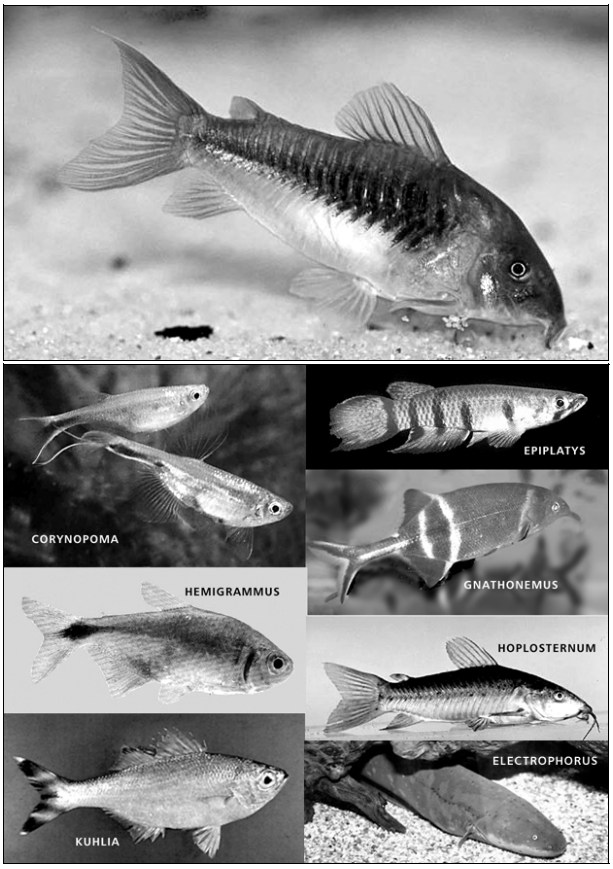
Theology held no attraction for Gill, and he decided to study law instead, eventually joining an uncle's law firm. His true interests, however, lay in science and nature. His visits to the great Fulton Fish Market and his proximity to the maritime traffic of the port of New York led him toward the study of fishes. Science offered few opportunities for employment in those days, but Gill managed to obtain a scholarship from the Wagner Free Institute of Science in Philadelphia, which enabled him to pursue his studies.

He began to extend his network of acquaintances, and in 1856 he met the invertebrate zoologist William Stimpson, who had recently returned from the North Pacific Exploring Expedition and was working at the Smithsonian. Stimpson returned to Washington and told Spencer Baird about the young naturalist he had met in New York. Baird and Gill became acquainted through correspondence, and Baird arranged to publish Gill's report on the fishes of New York in the Smithsonian Annual Report for 1856. In December 1857, Gill visited Washington in preparation for an expedition he was about to make to the West Indies. There he met in person both Baird and Smithsonian Secretary Joseph Henry. It was the beginning of a lifelong association with the Smithsonian.

Gill returned from the West Indies with an important collection, particularly of freshwater fishes from Trinidad. In August 1858, he went to Washington to begin working up his collection, which he deposited at the Smithsonian. In 1859, he made another trip, this time to Newfoundland to help settle the estate of his grandfather. These two voyages, to the West Indies and Newfoundland, were the only extensive fieldwork Gill ever did. He spent the remainder of his career in the museum studying the ever-growing collections.

After returning from Newfoundland, Gill was appointed by Baird to the team that was working up the results of the Northwest Boundary Survey. In 1862, Gill was put in charge of the Smithsonian's library. When the library was transferred to the Library of Congress in 1866, Gill went with it and became the Assistant and later Senior Assistant Librarian of Congress, a post he held until 1874. Aside from the Smithsonian, his longest professional association was with Columbian College in Washington, now The George Washington University. Gill began there as an adjunct professor in 1860 and progressed to lecturer (1864), professor (1884), and finally professor emeritus (1910). During that time, the University granted him four degrees: Master of Arts (1865), honorary Doctor of Medicine (1866), Doctor of Philosophy (1870), and Doctor of Laws (1895).

From all accounts, Gill was an uninspiring lecturer, and he showed no interest in administrative matters or in the day-to-day drudgery of managing the collections. Indeed at one point early in his career, after having moved the entire Smithsonian fish collection three times, he told Baird that he would have nothing more to do with it. Research was his passion, and in

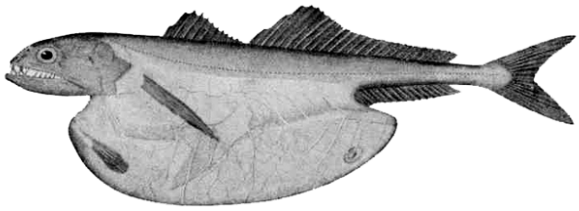


Gill described many well-known aquarium fishes such as *Corydoras aeneus.* He also described many well-known aquarium genera such as *Corynopoma, Epiplatys, Gnathonemus, Hoplosternum, Electrophorus*, *Kuhlia, and Hemigrammus,*

this he excelled. His temperament was perfectly suited to the careful, time-consuming, painstaking observations necessary for successful research in systematic biology.

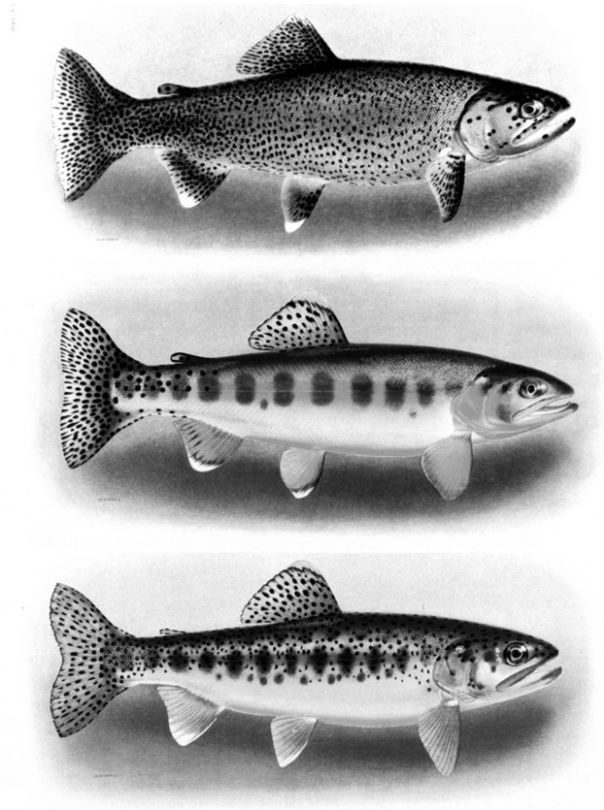
Gill was a prolific worker, producing more than 500 papers over his long career. The majority of these, 388, dealt with fishes, but he also published on birds, mammals, and mollusks, as well as theoretical and general biology. For a time, he edited an ornithological magazine, *The Osprey.* Gill was mainly interested in relationships among animals and in constructing classifications. He used osteology and other internal characters in his studies. As a result, Gill's work has a decidedly modern ring to it, in contrast to the bare-bones taxonomic descriptions common in that era. His work was always based on careful observation, but he went beyond mere description and tried to determine the meaning and higher significance of what he saw.

Gill's papers were all relatively short. He preferred to work on small groups and publish his results as he completed them. Many of his early papers were published in the *Annals of the New York Lyceum of Natural History*, of which he became a member in 1858, and the Proceedings of the Academy of Natural Sciences of Philadelphia, of which he was elected a correspondent in 1860. After the *Proceedings of the United States National Museum* were begun in 1878, most of Gill's papers appeared there. Among his most influential works was his classification of fishes, *Arrangement of the families of fishes, or classes pisces, Marsipobranchii, and Leptocardii* (Gill, 1872), which formed the basis for the arrangement of the Smithsonian's fish collec-



Chiasmodon niger Johnson (1864).

From an interview with Theodore Gill conducted by a *Washington Post* reporter in August 1889: "There are strange-looking creatures at the bottom of the sea," said Prof. Theodore Gill, of the Smithsonian Institution, to a Post reporter a few days ago. Professor Gill is one of the highest authorities on fishes in the United States, and in his little den up in the tower of the gothic pile built with Mr. Smithson's money he has lots of books and pictures relating to all manner of creatures which inhabit the deep."



Although Evermann's name is intimately associated with that of Jordan, Evermann did publish on his own. The following illustrations are taken from Evermann's "The Golden Trout of the Southern High Sierras," written in 1905.
From top to bottom:
Salmo gairdneri gilberti (Kern River trout).
Salmo roosevelti (Golden Trout of Soda Creek).
Salmo whitei (Golden Trout of Volcano Creek).

tion and which was followed by ichthyologists for many years after.

Although Gill never married and spent much of his time holed up in his Smithsonian quarters, he was by no means a recluse. He participated fully and actively in the scientific and social life of Washington. He was a member of many scientific societies, including the American Association for the Advancement of Science, of which he was elected president in 1897. He was elected to the National Academy of Sciences in 1873. His colleagues held him in great affection and esteem. David Starr Jordan viewed him with a respect that bordered on hero-worship, calling him the **"master of taxonomy"** and the **"keenest interpreter of taxonomic facts yet known in the history of ichthyology."** Gill gave freely of his time and his knowledge, both to his scientific colleagues and to the public. He contributed to encyclopedias and other sources of public information, including an interview in the Washington Post on the subject of deep-sea fishes, which is reproduced here. Weakened by a stroke, Gill spent his last years quietly in Washington, where he died on 25 September 1914, the last link to the founding era of ichthyology at the Smithsonian.

Barton Warren Evermann (1853-1932) was born in Iowa and received his higher education at Indiana University, receiving the degrees of B.S (1886), A.M. (1888) and Ph.D. (1891). For ten years he was a teacher and superintendent of schools in Indiana and California. Between the years 1888 and 1914 he held successively the following positions in the United States Bureau of Fisheries: Assistant Ichthyologist, Ichthyologist, Chief of Division of Statistics and Methods of Fisheries, Assistant in Charge of Scientific Inquiry, and Chief of Alaska Fisheries Service.

In addition to these positions he had also been the United States Fur Seal Commissioner, a lecturer on fish and game protection at both Cornell and Yale, Chairman of the Fur Seal Body, and Vice-President of the Board of Education, Washington, D.C. At the time of his death he was employed as a special lecturer at Stanford University, as the Director of the Steinhardt Aquarium, and as the Director of the California Academy of Sciences.

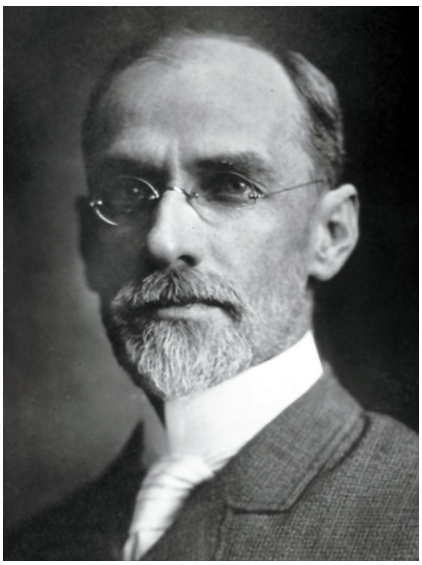
Evermann described many fish in the western

Barton Warren Evermann (1853-1932).

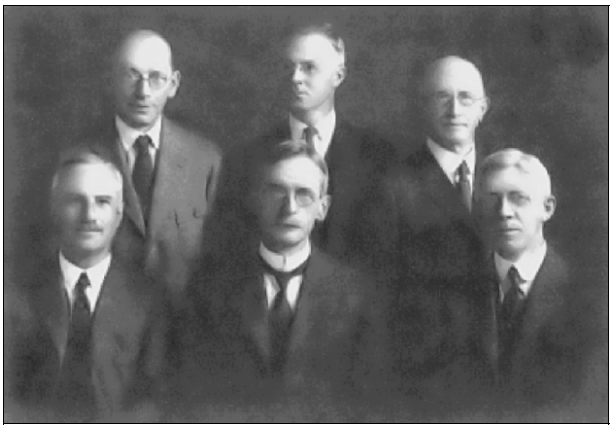
U.S. With Jordan he wrote the *Fishes of North and Middle America* (4 volumes, 1896-1900). He helped complete the first survey of Hawaiian fishes in 1903 and described several new species. With Ignatz Steinhart, Evermann began planning a new aquarium "as fine and complete as any in the world." (Arriving in California in 1873, Ignatz Steinhart worked successfully in the banking industry and enjoyed an active civic life, making many contributions to San Francisco and California culture. Steinhart's most well known contribution is his gift of the Steinhart Aquarium to the California Academy of Sciences in honor of his brother, Sigmund.) The aquarium opened on September 29, 1923.

He wrote 387 papers - 196 on fishes, 59 on birds and 30 on mammals. Four genera of fishes were name after him: *Evermannia* (Jordan,1895); *Evermanella* (Fowler, 1901), *Evermanolus* (Eigenmann, 1907), and *Evermanichthys* (Metzelar, 1919). Mt. Evermann, the highest peak on Socorro island, Mexico, was also named in his honor. He began to decline in 1923, when on a trip down the Lower Colorado River, he contracted a bronchial disturbance from which he never fully recovered.

A native of Washington, D.C., **Hugh McCormick Smith** (1865-1941) joined the U.S. Fish Commission in 1886 and spent over forty years in government service. During the time of the Expedition, he was the Deputy Commissioner of the U.S. Bureau of Fisheries (formerly U.S. Fish Commission.) While the marine sciences and natural history remained his main interest throughout his life, he received an M.D. degree in 1888 and taught on the medical faculty of Georgetown University until 1905. Smith visited 22 countries to study their marine resources and fisheries, and the extensive collections obtained during these expeditions are now deposited in various museums, including the Smithsonian. Among his numerous publications, *The Fresh Water Fishes of Siam, or Thailand* (1945), a classic work in ichthyology, was the result of his decade-long study of native fishes in Thailand, where he lived from 1923 to 1935. In honor of Smith's contributions to natural history, 25 species of fishes, birds, reptiles, amphibians,



Hugh McCormick Smith (1865-1941)



Top: John O. Snyder, George C. Price, and Harold Heath.
Bottom: Edwin C. Starks, Walter K. Fisher, and Charles H. Gilbert.

invertebrates, and plants were named for him.

Edwin Chapin Starks (1867-1932) was a professor from Leland Stanford Junior University in Palo Alto, California. In 1891, Jordan took Gilbert with him to Stanford, with Gilbert as Professor, and subsequently Chairman, of the Zoology Department. One of their early students was Starks, who, starting in 1895, became prominent as a collector of and publisher on the fishes of the Pacific Coast, Alaska, Mexico and South America, California, and the West. Starks was a frequent co-author with Jordan but some of his other publications include *The fourth major survey of the fishes of southern California*, made from 1902 to 1905 by Starks and Earl Leonard Morris, *On a collection of fishes made by P. O. Simons in Ecuador and Peru* (1906), and *The Fishes of the Stanford Expedition to Brazil* (1913).

By virtue of his first ichthyological publication in 1897 (*On a new species of Edestus, E. lecontei, from Nevada*), **Bashford Dean (1876-1928)** barely makes it into this history of 18th and 19th Century American ichthyology. (To be included in this history, the subject's earliest ichthyological paper had to appear before 1900.) Dean had an illustrious and curious dual career. As a young man, he assisted J. S. Newberry with studies of Devonian fishes, particularly giant armored placoderms and primitive sharks from Ohio. At the same time, Dean's interests in arms and armor led him to accumulate a magnificent collection that was eventually acquired by the Metropolitan Museum of Art. Dean published profusely on the evolution of fishes and on medieval armor, and was widely considered an authority in both subjects. He was associated with both the American Museum of Natural History and the Metropolitan Museum of Art from 1903 until his death, and at times he served as a curator in both institutions. As an authority on medieval arms and armor he became curator (1903) of the collection at the Metropolitan Museum of Art and made it one of the greatest collections of its kind in the world. His important works on ichthyology include *Bibliography of Fishes* (1916–23).

Even more of a "squeaker" in this history by virtue of his 1899 publication, *Notes on a small collection of Chinese fishes*, is **Henry Weed Fowler (1878-1965)**. Fowler was born in Holmesburg, Pennsylvania. His post-high

Bashford Dean (1876-1928)

school academic career was limited to two years (ca. 1900) spent at Stanford University as a special student under David Starr Jordan. His entire professional life was spent in association with the Academy of Natural Sciences of Philadelphia where he was employed as a museum assistant (1903-1922), a museum fellow (1922-1923), associate curator of vertebrate zoology (1925-1934), curator of fishes and reptiles (1934-1940) and curator of fishes (1940-1965). While Fowler published papers on crustaceans, birds, reptiles and amphibians during his lifetime, ichthyology was his main interest and the area in which he did most of his work. He was a founder of the American Society of Ichthyologists and Herpetologists and its treasurer for seven years. He was also President of the Society in 1927.

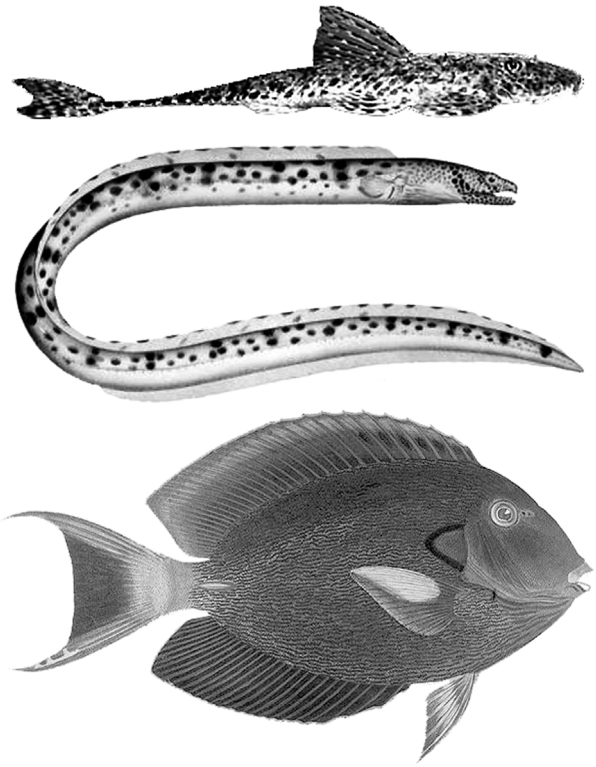
When Fowler became responsible for the fish collection at the Academy of Natural Sciences of Philadelphia, he commented at the time as follows: **"My first acquaintance with the Academy's collection of fishes began in 1894 when I entered the institution, like many of my predecessors, as a Jessup student. At that time most of the fishes, as well as the amphibians and reptiles, were staked in wall cases in the original Race Street building. Unfortunately, many had been marked with outside labels, written in ink, and tied about the neck of the jar by a strong cord. As the cases were often damp and poorly illuminated, many of the labels became infected with mould and became illegible. A hundred or more dried specimens were placed in flat cases, often before the windows."**

Fowler's connection with the Smithsonian centered on two main projects. Around 1918, Barton A. Bean, assistant curator of fishes at the United States National Museum, recommended that the fishes of the Wilkes Exploring Expedition be sent to Fowler since they had never been properly identified. Fowler returned a manuscript of approximately 750 pages in 1920. This manuscript was never published although Fowler did publish a summary of the paper in 1940 in the *Proceedings of the American Philosophical Society*. Bean and Fowler also published a report on eighteen new species of fish in the Wilkes collection in the *Proceedings of the United States National Museum* (1923).

In 1925, Fowler and Bean began a collaborative work on the fishes collected by the Bureau of Fisheries steamer *Albatross* in the Philippines from 1907-1910. Six volumes were published from 1928 to 1941 as parts of *Bulletin 100 of the United States National Museum*. The first three were jointly authored by Bean and Fowler, and the latter three by Fowler alone. In addition, Fowler submitted six additional manuscripts that were never published.

Unfortunately, as the years went by Fowler often adopted poor cataloging and curatorial procedures. As the years passed, he received more and ever larger collections, and resorted to cataloging and labeling only the types. Remaining specimens were accorded only penciled labels, often on flimsy paper, wrapped in small bundles of cheesecloth, tied with string and closely packed in large brown crocks filled to capacity, never to been seen again or studied by Fowler. Nevertheless, Fowler stud-

Henry Weed Fowler (1878-1965).

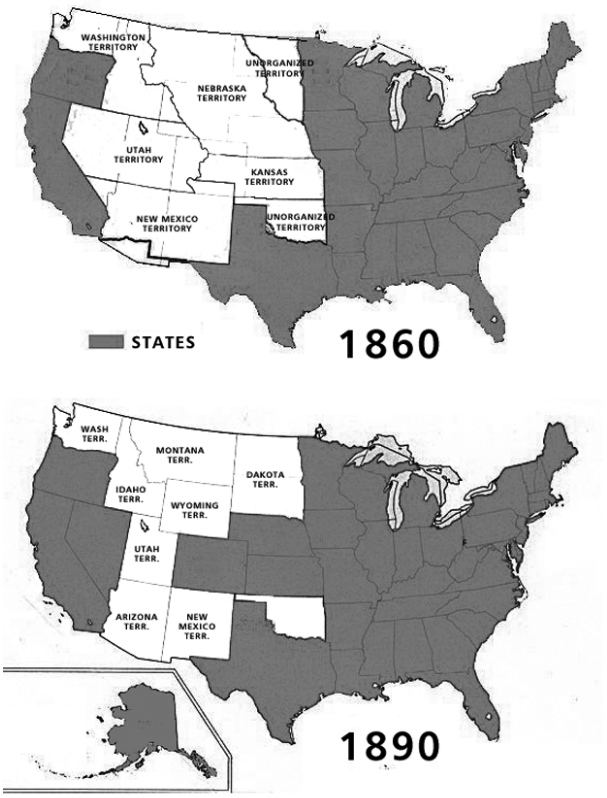


Fishes named for Henry W. Fowler:
***Cteniloricaria fowleri*, Pellegrin (1908).**
***Microdonophis fowleri*, Jordan & Evermann (1903).**
***Acanthurus fowleri*, de Beaufort (1951).**

ied and published on a remarkable number of new collections in addition to most of the older material. Over a span of 80 years of research activity, Fowler described some 1,449 nominal species of fishes and 442 genera in 674 publications.

Although by the last quarter of this Century settlers had spread over a large portion of the United States where biologists did most of their research, much of the region's wild quality remained intact. The map shows that even by 1890 the States covered only about 75% of the present continental United States. Travel, therefore, was still difficult and collecting even more so. During this time Thomas Edison invented the light bulb, Jessie James' carried out his first train robbery, the massacre at Wounded Knee took place, gold was discovered in Klondike, the USS Maine exploded in Havana precipitating the Spanish-American War, and Billy the Kid was shot by Sheriff Pat Garrett.

Also consider that, in 1884, Charles Darwin's *The Origin of Species* had been in print just 25 years and was clearly reshaping views of the natural world. Much of America's flora and fauna remained uncataloged, even though naturalists and scientists had toiled for decades naming and classifying everything from fish to finches. This is one reason why the 25 years leading up to 1900 have been called the **"Golden Age of Descriptive Ichthyology in the United States."** Scientists knew that multitudes of fish lived in rivers like the Gasconade and Niangua in the Ozarks, for example, but many of the individual species were yet to be discovered, named, and classified. Jordan and his many followers dedicated themselves to closing that gap.



The States, 1860, and 1890.

"SUCCESS RATE" of ICHYOLOGISTS

Author	Refs	Names	Valid	Rate
Linnaeus	5	504	386	77%
Gilbert	112	845	629	74%
Eigenmann	90	753	535	71%
Boulenger	234	1139	784	69%
Steindachner	185	1041	581	56%
Guenther	147	1690	916	54%
Jordan	273	1380	692	50%
Bleeker	328	1994	825	41%
Fowler	225	1449	572	39%
Cuvier	34	1098	413	38%
Girard	30	437	168	38%
Bloch	20	751	278	37%
Evermann	51	332	122	37%
Valenciennes	36	1883	669	36%
Poey	20	413	110	27%
Lacepede	9	632	138	22%
Rafinesque	28	444	65	15%

Refs = Number of publications with at least one new species;
Names = Total new names described by the author;
Valid= Total Valid names (per Eschmeyer), valid subspecies not included;
Rate = Percent of names still regarded as valid.

In 1880, Jordan and Gilbert collected specimens from British Columbia to San Diego, chiefly from fish markets that then, especially in California, contained a wide variety of inshore fishes. These were quickly returned to their hotel room where they prepared the fishes for shipment in preservative. Many quick descriptions were done this way with prompt publication following their discovery. Expediency for correct descriptions was the norm and this would later create problems for ichthyologists to follow. In one situation on a trip to Matzatlán and on two trips to Panamá, in 1881 and 1882, for example, Gilbert made large fish collections that were destroyed by fire. As a result, his monograph on *The Fishes of the Pacific Coast of Tropical America* was never written.

That this expediency took its toll is evident by an examination of what might be called the "success rate" of ichthyologists, i.e., the percent of fish names they described that are still regarded as valid (see table). Jordan's rate was only 50% whereas other noted ichthyologists of the period such as Gilbert and Eigenmann had much higher rates (lesser lights, such as Fowler and Evermann had much lower rates). Of the American ichthyologists, Jordan holds the record for the greatest number of valid new species, followed by Gilbert and Fowler (the latter coming perhaps as a surprise who have denigrated his ichthyological work, Fowler having even more valid species than Eigenmann).

In passing note that Linnaeus has the highest success rate, but this is due to the fact that, being first, there were fewer opportunities for making errors in describing new species. Sadly, our old friend Rafinesque is at the bottom of the list, a casualty of "leaping before looking" to name new species. Guenther, Bleeker, and Boulenger – in that order - have the highest number of valid species attributed to them.

Since I like to tell little-known stories about well-known ichthyologists, I'll end this history with some stories about Barton W. Evermann and Seth Eugene Meek. Evermann, then director of the California Academy of Sciences, first applied to the Secretary of the Interior in 1915 for permission to collect four grizzly specimens for a museum exhibit. The secretary demurred, writing that gathering specimens for museum display or collections was against park policy, but permits were issued to institutions needing bears for live exposition in public zoological gardens. Four years later Evermann wrote to Stephen T. Mather, the first Director of the National Park Service, regretting the extirpation of the California Grizzly, the most appropriate bear for museum display because of its large place in California history. The next best thing would be to exhibit a group of Yellowstone grizzlies. Evermann was under the impression that the grizzly was so abundant in Yellowstone that **"it is desirable to reduce their number somewhat from time to time." The academy would need "an adult male (the biggest we can get) plus a female and two cubs."** Although such a display would have an educational and scientific value, Evermann used one more argument to kindle Mather's interest, suggesting that a group of Yellowstone grizzlies on display in San Francisco **"would prove a very fine advertisement of the Park."**

Relations between the California Academy and the National Park Service started out on a friendly basis. In February 1920 Mather granted a permit for Evermann to collect a representative group of four bears - one male, one female, and two cubs. Evermann selected the team that would actually carry out the work, which included Dr. Saxton Pope, a San Francisco surgeon, principal agent for the Academy, and (unfortunately, as it turned out, one of the forefathers of modern archery. By mid-June, shortly after the Museum's expedition arrival in Yellowstone, embarrassing news accounts and criticism of the park appeared. In total Pope killed and skinned seven grizzly bears in the **"interests of science,"** exceeding his permit by three specimens.

Once the news that someone was killing Yellowstone's bears hit the press, the fact completely overshadowed any information about the intentions of the expedition, and the scientific and educational benefits that had motivated granting a permit. These words proved hollow when the October issue of *Forest and Stream/Rod and Gun* hit the newsstands. It contained an article by Pope titled, *Hunting Grizzly with the bow: that the age-old implement of the chase still holds its place among modern weapons is conclusively proved by two California sportsmen*." Pope described how his team had lured the bears with bait; tracked wounded bears through the forest, finding pools of blood along the way; the sudden **"roar**

like dinner-time in a menagerie"; maddened beasts milling about in pain and surprise; the surprise charge of an enraged sow; and the kills by bow and arrow. Pope reported a most gratifying feeling, having killed the bears **"fair and clean with the bow and arrow."** In other words, it was a lurid account aimed at hunters pining away the closed season and dreaming of bigger adventures.

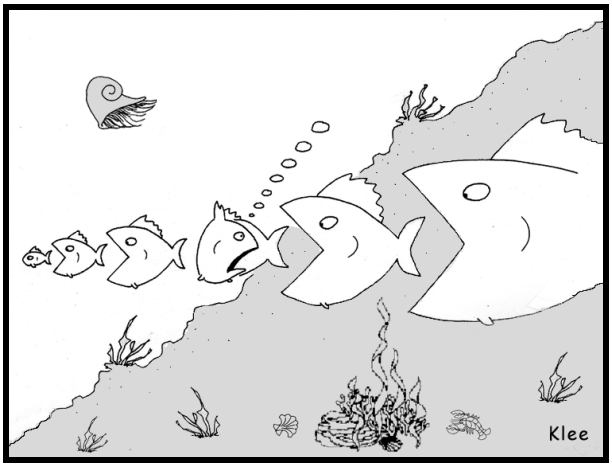
Notwithstanding Pope's pretensions about being a connoisseur of hunting technique, this article sealed the fate of museum collecting missions in Yellowstone for quite some time. The Interior Department received many public complaints about the deaths of the bears. Director Mather was demonstrably livid, promising that he would confront Evermann personally if presented with an opportunity. The scientists from California had abused the trust extended by Mather, never to regain it. Mather believed that for Barton Evermann, the only issue was skins, ostensibly for scientific study and practically for display. But for Mather, ethical questions as well were involved. To him, the special nature of the national parks had been violated, their unique purpose of protection and preservation cheapened.

In 1921 the NPS suggested to Evermann that he delete any reference whatsoever to Yellowstone National Park from the display in San Francisco. The NPS regretted issuing the permit in the first place and wished they had detailed park rangers to collect the specimens rather than allowing any outside party to conduct the work. This feeling that no one could be trusted with a gun in Yellowstone set a lasting precedent.

Samuel F. Hildebrand, who was Meek's assistant in the Field Museum and who accompanied him to Panama during Meek's field investigations there, provides a number of interesting anecdotes about his boss. Hildebrand liked Meek and noted that, although a big man (Meek was six feet two inches tall and weighed about 250 pounds), the name, Meek, suited him and indeed was descriptive of him, for he appeared a very meek and modest man. He was, however, careless of dress and somewhat untidy in his work habits. The

"The condition of Meek's desk in his office in the Field Museum upon my arrival gave me my first insight into his lack of order, system, and neatness. He had no letter files, no secretary, and no typewriter. As letters arrived he answered them in long hand, except for important ones, which were typed in another office. When a letter had been answered it simply was pushed back (not stacked) on the roll top desk. When I arrived in August to take up my duties as a sort of laboratory aide, there still was some clear working space left on the middle of the desk. However, this gradually became cluttered up too. I kept watching the desk, wondering what he would do when no more working space was left. He was not to be outdone by a mere trifle like this. He simply pulled out the board at the side above the drawers. It so happened that while there still was a little vacant space on this board, he left for Key West, Florida to collect fish for an exhibit.

"During Meek's absence I consulted my good friend, William Gerhard, the Museum's entomologist, relative to placing the office in or-



**"Hey, wait a minute!
I haven't been described yet!"**

Samuel F. Hildebrand (1833-1949)

Important ichthyological contributions authored or co-authored by Hildebrand include: *Collection of fishes from Talara, Peru*, *Fishes of Chesapeake Bay*, *Study of the top minnow,* Gambusia holbrooki *in its relation to mosquito control*, *Fishes of the fresh waters of Panama*, *New species of fishes from Panama*, and *Synoptic list of the fishes known to occur within fifty miles of Chicago*.

der. He approved the idea, and even came in later to lend a hand. I do not recall just how we handled the numerous letters on Meek's desk; however, I do recall that Gerhard worked out a system for filing the separates, which we followed closely. If Meek, upon his return noticed that his office had been put in order he failed to say so. However, I retain a mental picture, as vivid as if it had happened yesterday that upon the day of his return from Florida he had occasion to consult one or more publications, stepped up to the closet containing the separates, and without saying a word he grabbed an armful of publications here and there and threw them on the table until he found the ones he wanted, and of course left the rest in a helter-skelter way on the table. Later that day, when Meek had stepped out of his office, I asked Gerhard to come in and take a look. Gerhard shook his head, and uttered several emphatic words, which commonly are not seen in writing. We both vowed that we never again would voluntarily straighten up Meek's office.

"He is the only man I have known who dressed fully of mornings with shirt and tie on before shaving. He, in fact, carried out this entire routine without ever lifting himself clear of the bed. He also is the only man I have known who did not wash the soap out of his brush after shaving. Indeed, he argued that it was a waste of time and energy to do so. My mention of unsightliness, of course, was mere nonsense to him.

"One day we were collecting near an inland Canal Commission town. We had no difficulty getting a room for the night in bachelor quarters in the camp where we were stranded. However, linens were not furnished. I was not too much concerned about the absence of sheets and pillowcases, but I did feel the need of a towel. As the commissary remained open I purchased one. When I returned to the room Meek wanted to know why I spent my money that way. I replied that I intended to wash before going to supper and therefore needed the towel. To which Meek replied, "Why don't you use your shirt tail?" and that is precisely what he did.

"On another occasion we had gone to eastern Panama to collect in the Rio Tuyra basin. We had worked our way upstream gradually and finally reached Cana, not very far from the Colombian border. We arrived about noon and the call for dinner came very soon after our arrival. We were visiting with Mr. E.A. Goldman, who also was a member of the Smithsonian Biological Survey of the Panama Canal Zone. Goldman was already well established, having reached Cana several days ahead of us. When the dinner call came Meek hurriedly wet his hands and face (which he termed "washing"), and as no towel was in sight immediately he reached for the corner of an immaculately white sheet that was hanging from Mr. Goldman's cot. Goldman was not in his room at the moment, but returned very shortly, and immediately saw the wet black smudge of ample

proportion. In the meantime Meek had gone. Accordingly, Goldman asked me what had happened to his sheet. Believing that Meek was well able to defend himself against Goldman, who was not a big man, I answered his question as truthfully as if I had been under oath. So far as I can remember this was the only time I heard Goldman use a bit of profanity.

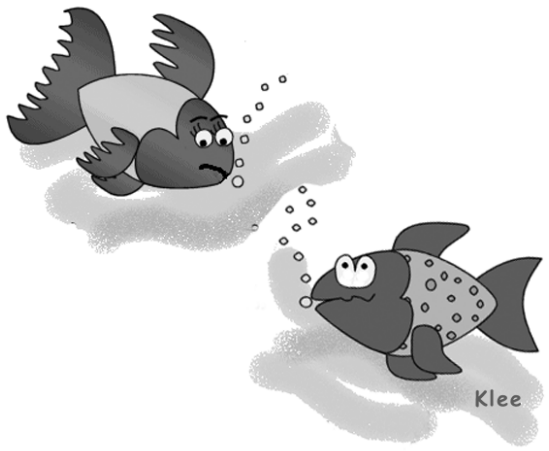
"Meek was frugal, though I would not say he was stingy or miserly with his own money. While he spent little on himself he was generous with his wife and in the home. He was scrupulously clean morally. He did not indulge in liquor; he did not use tobacco, and spent comparatively little on entertainment and amusement. He did like a game of cards occasionally, and often entertained friends in his home. He was generous with his time and money in helping those in need. To the contrary, he was miserly with the funds given us for conducting the survey in Panama.

"How carefully Meek guarded the Field Museum's fund is evident from the fact that when we went to Taboga Island where the Canal Commission maintained a convalescent home, we were given the choice of registering as patients or as guests. If we registered as guests we were obliged to pay a small fee for board. However, if we registered as patients, room and meals were free. (That is, the Canal Commission absorbed the cost). Nevertheless, there was a drawback to being a patient, namely, the patient was obliged to observe the rules of the hospital, i.e., he had to be in his room at certain hours and had to appear before the house physician at least once a day for a check. Meek registered as a patient while I registered as a guest.

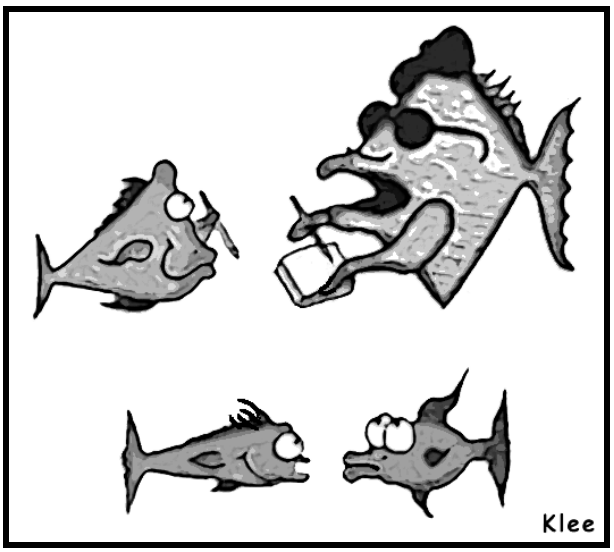
"One of the most amusing incidents of Meek's effort to save a penny occurred on one of several occasions when we returned to Panama City by sea from a collecting trip to some distant stream. Because of the extremely high tides, Panama City has no piers for the accommodation of the somewhat larger vessels. Therefore the ships anchor in the bay well off shore, and the nearby water literally swarms with rowboats, generally manned by a single person, to take the passengers and their possessions ashore. While I assisted our boatman in unloading our equipment, specimens, and baggage on the beach, Meek without telling me where he was going, disappeared carrying with him a rifle. I waited a long time, wondering what had become of him, when finally a small boy succeeded in conveying the information to me in Spanish that my comrade had been arrested. I quickly rushed into the nearest street, hailed a hack, and asked to be driven to police headquarters. By the time I got there, Meek had succeeded in getting in touch with some officer of the Canal Commission, who had assured the native police that Meek was all right, and he was about to be released. Meek looked meeker than ever.

"It developed that Meek had rushed into the street with his rifle, and when asked for authority to carry firearms he had none, and accordingly was taken to police headquarters. Whether he had to pay a fine I shall never know. Now why had Meek left me so suddenly to go into the street? Once more he was "saving money." Although many draymen had driven their carts down on the beach and were crying for business, Meek had conceived the idea that he could negotiate for a cart in the street, and perhaps save a dime."

Along the way I have described the close friendship between Linnaeus and Artedi, the

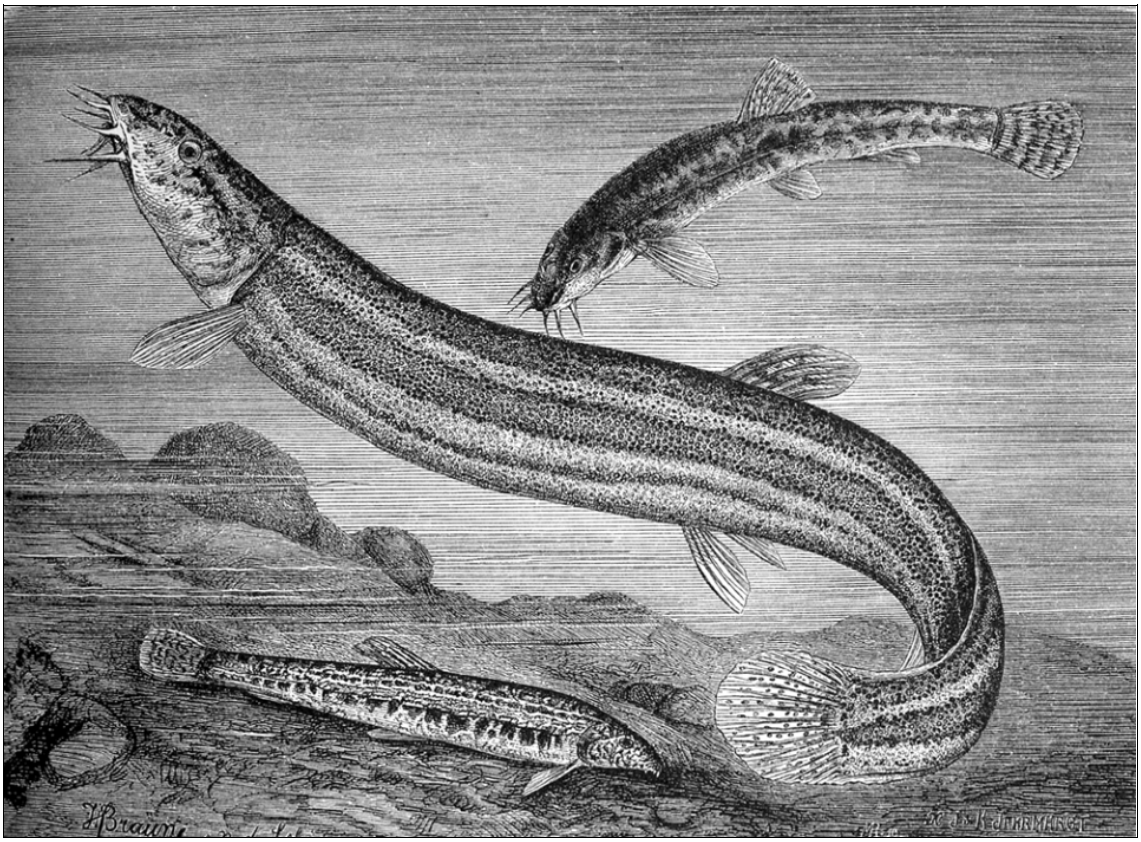


"My psychiatrist diagnosed it as acute schizophrenia – those damned ichthyologists keep changing my name!"



"He's been signing autographs ever since David Starr Jordan declared him a type species!"

heated controversy between Cuvier and Geoffroy Saint-Hilaire, the former's insensitive treatment of Saartje (Sara) Baartman, Samuel Garman's reclusive behavior, David Humphreys Storer's involvement with the abortion movement over 150 years ago, Rafinesque's flaky behavior, and the hot water Barton W. Evermann got into over the Yellowstone grizzly bear incident. In short, we have seen that these great ichthyologists were men with strengths and frailties, and with personalities that varied from eccentric to respected. Whatever category they fall into, however, their contributions laid down the foundations of the science of ichthyology.



ADDENDUM
Edward Drinker Cope, The Master Naturalist

Edward Drinker Cope's name is familiar to knowledgeable aquarists if for no other reason than the foremost scientific journal in the field of ichthyology and herpetology, *Copeia*, is named in his honor. Cope is the author of over 125 papers on fishes, and aquarists who do pay attention to the authors of the scientific names of their fishes will recognize genera such as *Brochis* (Cope, 1872) and *Metynnis* (Cope, 1878). There are, in addition, 15 species of fishes named after him. Cope's name is even more famous, however, because he was a participant in the greatest scientific feud this country has ever seen.

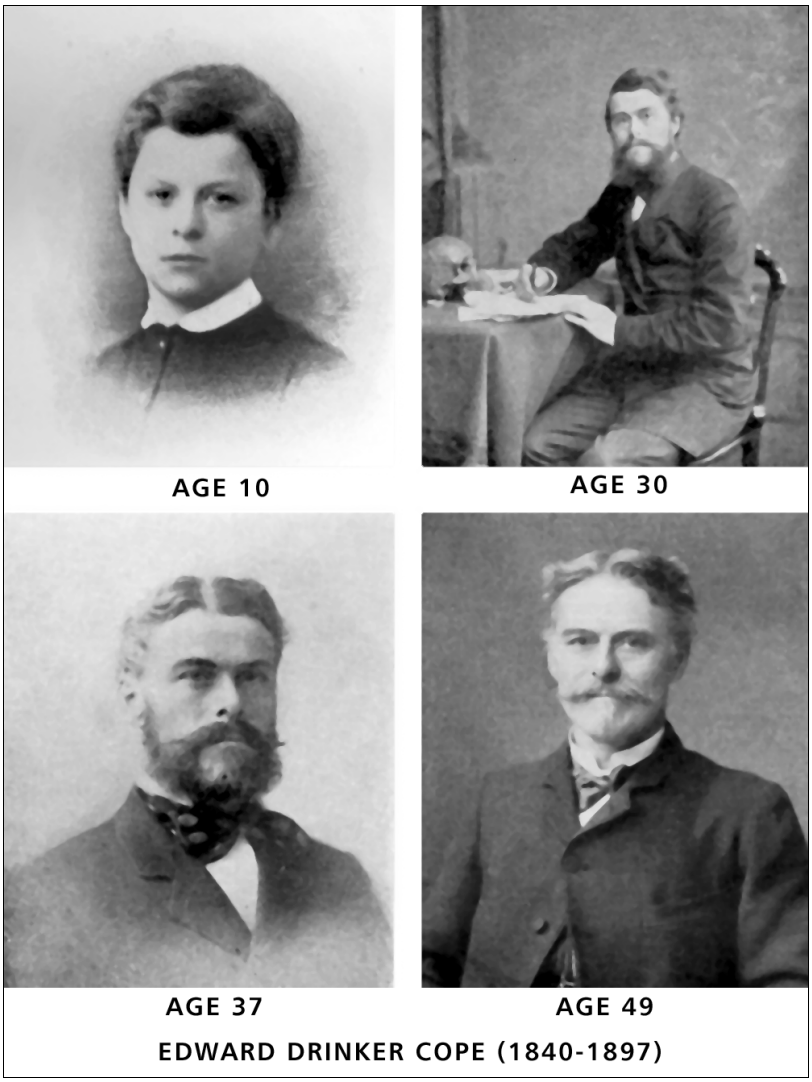
Cope or Cop in the Saxon tongue denotes a head or prominence, hence the summit of a hill, and so a man, whose house stood high upon a hill, came in the centuries before family names were cut and dried in England, to be pointed out among his neighbors by this peculiarity of domicile. A man who chose such a perch for his house was probably possessed of some means of fortification or some urgent desire to be aloof from his fellows; the first Copes to be so designated were, therefore, probably Saxon thanes, but their individual histories have been lost in the mists of unrecorded events, prior to the battle of Hastings. William the Norman, having won that combat, proceeded to catalogue his new domain for purposes of revenue, and from that time on the name of Cope appears frequently, and often with great distinction, in the archives of English county and national history.

Copes were esquires, members of the landed gentry ruling small villages from ancient manor houses. Always they were high-spirited, gallant, and adventurous. There were frequent instances in the family history of an eldest son flinging away his birthright and, disinherited, establishing a new and flourishing branch of Copes. There were other instances of younger sons, impoverished by the entail laws, yet rising to distinction. In one such vicissitude of family fortune, Oliver Cope emigrated to the United States in 1686. Copes at this time had been persecuted for attendance at Quaker meetings and Oliver Cope's American descendents became staunch members of the Society of Friends.

Edward Drinker Cope (Edward Drinker was a philanthropist of great local renown and a friend of the family) was born in 1840 to this wealthy Philadelphia Quaker family (to keep him out of the Civil War, Cope's father sent him to study in Europe). Even as a boy he had been a keen observer of nature. On a voyage to Boston, the seven-year-old Cope noted the citing of whales in his journal: **"They are large black fish and they blow water out of a hole in their heads. Some of them have white spots on their sides. One came along side the vessel."**

His father, however, wanted him to become a farmer and the young man's formal schooling stopped at the age of sixteen. Cope would not be deterred. He took the famous anatomy class at the University of Pennsylvania Medical School of Joseph Leidy, and reorganized the reptile collections at the Philadelphia Academy of Sciences. At the age of eighteen, Cope delivered his first scientific paper before the Academy on the reclassification of salamanders. It was the beginning of a distinguished career.

Cope was perhaps the brashest, most creative, and quixotic paleontologist of the 19th Century. The author of "Cope's Law" - stating that over time species tend to become larger - and of the Triassic class, Archosauria, he was



AGE 10 AGE 30

AGE 37 AGE 49

EDWARD DRINKER COPE (1840-1897)

a brilliant taxonomist and evolutionary theoretician. But he did not simply inhabit the ivory tower. In expeditions across the sprawling and sometimes violent American West, Cope discovered the dinosaurs *Camarasaurus* and *Coelophysis*, and proved himself a consummate fossil hunter. Between his theoretical writing and fieldwork, Cope was one of the most prolific researchers ever. Even today he holds the record for scientific publication with 1,395 published papers.

One of the concepts followed by the International Commission on Zoological Nomenclature (ICZN) is that of priority, although the Commission occasionally makes departures from that rule. Readers are all familiar with the dinosaur, *Tyrannosaurus rex* (remember *Jurassic Park?*), but *T. rex* had an earlier christening and in actuality, *Manospondylus gigas* was its first name. The reason? Edward Drinker Cope proposed and published that name in 1892, about a dozen years before Henry Fairfield Osborn described *Tyrannosaurus rex*. Since it was based on a single bone, Osborn could not have known that Cope's *Manospondylus gigas* was the same species as his. On January 1, 2000, a ruling by ICZN upheld the common sense solution to the dilemma of *Tyrannosaurus* vs. *Manospondylus* and so *Tyrannosaurus rex* it is.

Herpetology was Cope's first love and remained an active field of active research throughout his productive life. Cope's first paper on fishes, (March 31, 1862), written when he was twenty-two years of age, had already been preceded by thirty-one papers on the classification of the snakes, lizards and batrachians. Consequently when he approached the subject of ichthyology he was already experienced in the classification of the other vertebrate classes. Moreover, in this paper, dealing with certain carp-like fishes of Pennsylvania, Cope had the advantage of following the excellent systematic work of Bleeker and of Theodore Gill. (An eminent ichthyologist and professor of zoology at George Washington University, Theodore N. Gill (1837-1914), was associated with the Smithsonian for over fifty years and contributed greatly to the Smithsonian's

reputation for scientific excellence.)
Cope left a legacy of descriptions of some two hundred and twenty-odd new species, including many strange forms. He was primarily a faunal naturalist, who studied fishes as they came to him along with other vertebrates. Cope was a veritable titan of the natural sciences. His labors in ichthyology alone, as recorded in one hundred and twenty-five titles, would suffice to establish the reputation of an ordinarily industrious ichthyologist, and yet we find that collectively they were but a tenth of his writings!

Although ichthyology was neither his first nor his chief field, his contributions to the major classification of the fishes were remarkable both for their boldness and originality and for their wide influence, especially in American ichthyology. In many respects, however, Cope's views on fish classification were inferior to those of Gill. Cope was primarily a systematist but had the old erroneous habit of naturalists of seizing upon one or a few conspicuous characters for his major criteria, while Gill taught that classification should eventually rest upon examination and comparison of the entire structure, a procedure which required far more time and greater effort, but which was certain to lead to more lasting results.

Cope's greatest contributions to the ichthyology of living fishes may be summarized as follows:

1) His major classification of the fishes that, while erroneous in many important points, followed Gill's great principle that **"Analysis must precede synthesis"**;
2) His breaking up of the unnatural orders of Ganoids (gars, bowfins, bichirs, sturgeons, and paddlefishes) and Apodes (eels);
3) His recognition and naming of many new orders, which have been accepted by the leading ichthyologists of the world.

Two recent events of some note to aquarists interested in native fishes involve Cope. The first occurred in 1991 when State fishery biologists in Georgia made a startling discovery. They collected five unknown fish from the Oconee River and, to everyone's surprise, they turned out to be robust redhorses (*Moxostoma robustum*), the mystery fish of the Carolinas and one that vanished from the eyes of Science for 121 years. This strangely named fish, the largest species of redhorse sucker, was first described in 1870 from a fish taken in the Yadkin River east of Charlotte. The original reference was Cope, E.D., *Partial synopsis of the fishes of the fresh waters of North Carolina*, PROC. AM. PHILOS. SOC. v. 11 (no. 84): 448-495, 1870.

Now the robust redhorse is not a tiny minnow living in an obscure pool. It is a river fish, a member of the sucker family that grows as large as 17 pounds. Sometime after its original description it disappeared, largely through scientific confusion and misidentification, and for years the fish was believed to be extinct. After its rediscovery in the Oconee River (it was estimated that this population remnant, surviving along a 70-mile stretch of river, numbered as few as 2,000), biologists then began looking elsewhere in earnest. They checked haunts in the Piedmont and upper Coastal Plain. Within nine years, they had captured robust redhorses in two other Georgia rivers, the Savannah and the Great Pee Dee.

Robust Redhorse (*Moxostoma robustum*), the mystery fish lost to Science for 121 years.

Cope at his study table, 1895.

Since this time, more than 30,000 artificially reared fish have been introduced into Georgia Atlantic slope rivers.

The second event had to do with Cope's interest in catfishes. In 1864 he described a blind catfish from Pennsylvania (Cope, E.D., *On a blind silurid, from Pennsylvania*, *PROC. ACAD. NAT. SCI. PHILA*. v. 16, no. 4, 231-233, 1864). This fish had rudimentary (vestigial) eyes and was believed to have issued from one of the subterranean streams of the limestone cave region into Conestoga creek, a tributary of the Susquehanna. Cope's comments on this discovery are of interest since they illustrate his leaning toward the Lamarckian theory of evolution (i.e., that acquired characters are inherited):

"Here we have an interesting transitional condition in one and the same animal, with regard to a peculiarity which has at the same time physiological and systematic significance, and is one of the comparatively few cases where the physiological appropriateness of a generic modification can be demonstrated. It is therefore not subject to the difficulty under which the advocates of natural selection labor, when necessitated to explain a structure as being a step in the advance towards, or in the recession from, any unknown modification needful to the existence of the species. In the present case observation on the species in a state of nature may furnish interesting results. In no specimen has a trace of anything representing the lens been found."

However, Dr. Aldemaro Romero (an expert on cave fishes, Romero has studied blind cavefishes extensively, including *Brachyrhaphis rhabdophora,* the eyeless catfish of Trinidad, *Rhamdia quelen, Astyanax fasciatus, Trichomycterus conradi*, and many others) presented a paper in 2000 by, "Disproving a Negative: The Alleged Blind Cave Fish from Pennsylvania Never Existed." In his paper Romero demonstrated that the species described by Cope in 1864, *Gronias nigrilabris*, was, in reality, based on deformed specimens of the brown bullhead (*Ictalurus nebulosus*). Such specimens have been used in both the technical and popular literature to infer that there are troglobitic fishes (a term meaning species living obligatory in caves) in

Pennsylvania, and Romero showed that this was an assertion without scientific validity.
And now to what can be called, "Science Friction." What truly assured Cope's place in the history of paleontology and even eclipsed his science was his bitter feud with Yale University paleontologist, Othniel C. Marsh (1831-1899). What began as a friendly rivalry in the late 1860s, broke into all out war in 1872 and then raged on until Cope's death in 1897.

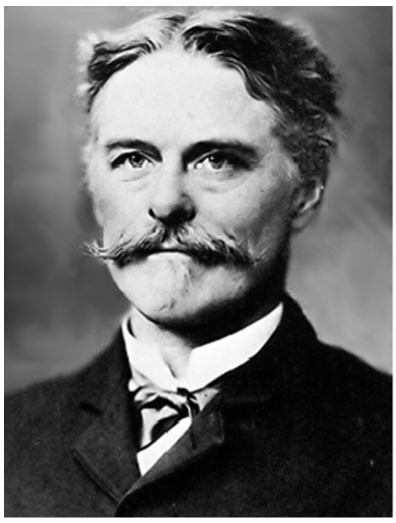
Marsh came from a modest farming background but was saved from a life as a country schoolteacher or carpenter by the intervention of a rich uncle - the mercantile millionaire George Peabody - who paid Marsh's expenses at Philips Exeter Academy and Yale University. Marsh also studied, with his uncle's support, at the great German universities in Berlin and Breslau before returning to Yale to become the nation's first professor of paleontology.

Cope and Marsh started out as friends, meeting in Europe and hunting fossils together in the eastern United States. But when he visited one of Cope's digs in New Jersey, Marsh covertly paid Cope's crew to send future finds to him (Marsh). The already strained relationship turned truly ugly when the first great fight between Cope and Marsh occurred in 1869. Cope had just finished piecing together the skeleton of a plesiosaur, *Elasmosaurus platyurus*. *Elasmosaurus* (whose name means "plated reptile") was a long-necked, long-tailed marine reptile that lived at the same time as the dinosaurs.

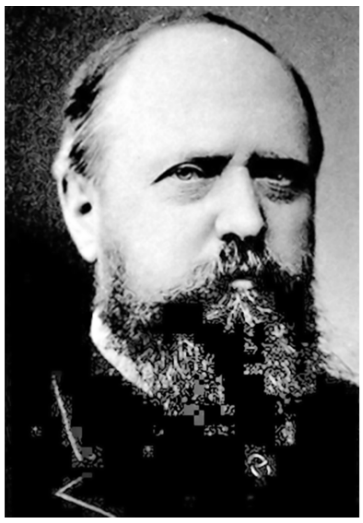
Marsh examined Cope's work and realized Cope had made the mistake of mounting the head on the end of the tail. Marsh jokingly suggested in an article he wrote that Cope should have named the creature *Steptosaurus*, which means, "twisted reptile." Cope was mortified and attempted to buy up all the pictures of his mistaken reconstruction and have them replaced with corrected versions. Marsh, however, wouldn't let the mistake die. In that same year Marsh described a new dinosaur, *Mosasaurus copeanus* (Marsh, 1869). Although "anus" is a Latin word root for "ring," it does have another obvious implication. One clause of the International Commission of Zoological Nomenclature says, **"No zoologist should propose a name that, to his knowledge, gives offense on any grounds."** It seems that Marsh was not a great advocate of this rule, at least not in Cope's case! What followed were 20 years of what became known as the **"Great Bone Wars"** (or, as the Germans refer to it, "der knochenkrieg"!).

Despite making a career of highlighting Cope's mistakes, it was Marsh who produced perhaps the biggest blunder in the history of paleontology - the *Brontosaurus*. Marsh's Wyoming collectors had produced for him a near perfect specimen of a sauropod dinosaur except for a skull. To complete the restoration Marsh used a skull from a quarry about three miles away. What Marsh did was put a *Camarasaurus* skull on an *Apatosaurus* body. (Ironically, the *Apatosaurus* was also one of Marsh's dinosaurs.) This resulted in one creature receiving two names - *Brontosaurus* and *Apatosaurus*. In 1903, Elmer Riggs of the Field Museum in Chicago was studying Marsh's work when he found the mistake: **"... the writer is convinced that the Apatosaur specimen is merely a young animal of the form represented in the adult by the Brontosaur specimen."** Riggs, following the naming rules for animals that applied at the time added: **"In view of these facts the two genera may be regarded as synonymous. As the term '*Apatosaurus*' has priority, '*Brontosaurus*' will be regarded as a synonym."** In recent years, museums all over the world had to scramble to change nametags from *Brontosaurus* to *Apatosaurus*.

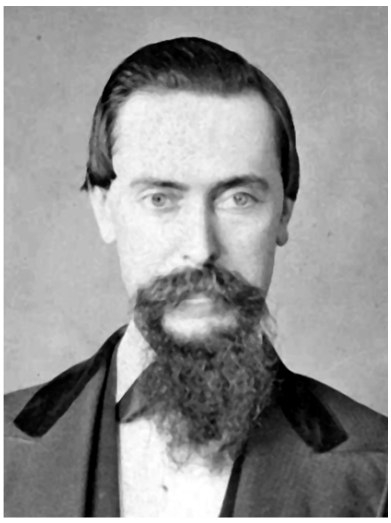
Why did Cope and Marsh fight so? In part it



Edward Drinker Cope
(1840-1897)



Othniel C. Marsh
(1831-1899)



Theodore N. Gill
(1837-1914)

was a question of ego. Each man was brilliant in his own way and each craved the limelight. In part, it was because they disagreed intellectually on several key concepts. Marsh was a Darwinian and much of his work was focused on proving the thesis of Charles Darwin's *The Origin of Species*, which had been published in 1859. Marsh's reconstruction of the evolution of the horse over sixty million years, for example, is widely credited as the first substantial fossil proof of evolution.

Cope - who was raised as a devout Quaker - could not accept the absence of divine design in nature. He became a leading exponent of the "Neo-Lamarckian" school of evolution that tried to show order and design in the growing fossil record. In the late 1800s, Neo-Lamarckian evolution was more popular in America than Darwin's ideas. But perhaps most of all, Cope and Marsh fought, feuded and fumed at one another because their backgrounds and personalities just seemed to go together like nitro and glycerin, and in the small world of the "Gilded Age of American science," the mixing was unavoidable.

Cold, calculating and methodical, Marsh was one of the new breeds of university-trained scientists that were supplanting the gentleman scientist of an earlier epoch. Marsh was interested not only in science, but also in building scientific institutions. He was curator of the Peabody Museum of Natural History at Yale (built with a grant from Uncle George) and he served as president of the National Academy of Sciences. Marsh traveled in the most rarified society, conferring with President Ulysses Grant and lunching with the Rothschilds.

Marsh was not as intellectually gifted as Cope, but he was a ruthless and masterful organizer and politician. He worked (successfully), for example, to cut off federal funding to Cope. The following comparison shows some of the differences between the two men. On one expedition Marsh came across an Indian funeral platform upon which rested the bodies of a man and woman, and beneath lay the skeleton of a pony. It was the custom of some tribes of American Indians to place the bodies of the deceased on platforms with tokens of respect such a food. Additionally, a horse might be sacrificed as a token of honor. After a period of time, the tribe would return and gather the bones of the deceased. Marsh's attitude was indicated by his admonition to the students: **"Well, boys, perhaps they died of small-pox; but we can't study the origin of the**

Indian race unless we have those skulls!"

Cope had a different way of dealing with the Indians. When visiting Indian camps, he would amuse them by taking out his false teeth. The Indians were fascinated by an individual who could remove and then replace his teeth!

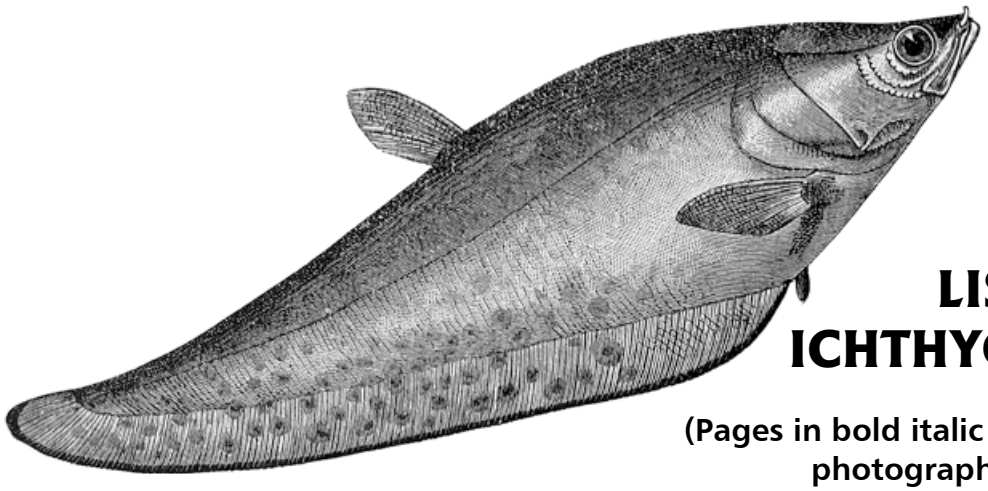
When Cope and Marsh began their research in paleontology, only 18 dinosaur species were known to North America. Between the two of them, Cope and Marsh named more than 130 new dinosaur species. Unfortunately, among the valid identifications were plenty of misinterpretations and multiple naming of the same species. While the battle raged on over the fossil record and the Western dinosaur discoveries, Cope also spent much time studying and writing on the natural history of reptiles and amphibians. In two monumental works, *Bactrachia of North America* and *The Crocodilians and Snakes of North America*, Cope established the foundation for the study of these animals in America.

Marsh still retains a reputation as an "armchair paleontologist," too busy to work in the field, who owed his high standing not to genius, but to luck and to his family's money. Whereas Cope went into the field throughout his career, Marsh himself spent only four seasons in the field, between 1870 and 1873. On the other hand, Cope was an extremely abrasive and combative individual who managed to alienate most people he met. Beyond his consuming feud with Marsh, Cope had trouble with others as well including conflicts with administrators at Haverford College (where he was professor of comparative zoology and botany from 1864 to 1867), and arguments with council members of the Philadelphia Academy of Natural Sciences (where he was curator of herpetology from 1865 to 1873) from which he eventually resigned or was possibly forced to leave. Financially ruined in his later years, he had to sell his house and move in with his museum collections. Cope spent his final days on a cot surrounded by piles of bones. It may come as a surprise to readers, however, that as of 1993 Edward Drinker Cope is the type specimen for *Homo sapiens* Linnaeus, 1758, Robert Bakker having formally described his skull and the type approved by the ICZN.

Gardeners are familiar with the plant *Wisteria,* was named for Caspar Wistar (the describer - Thomas Nutall - misspelled it with an "e," and this name of the plant is now stuck forever). Readers might rightly wonder why I mention a mistake in a plant name when the discussion is about zoological nomenclature.

When Cope died in 1897 - just a few weeks shy of his 57th birthday - he showed himself a true scientist by willing his body and brain to the Anthropometric Society so that his skeleton and brain could be preserved for further study. When his bones were finally delivered, however, they were badly decalcified and so they were shelved. His skeleton eventually wound up in the Wistar Institute in Philadelphia where it was retrieved by Louie Psihoyos (a *National Geographic* photographer researching a dinosaur book) and eventually relayed to paleontologist Bob Bakker. The Wistar Institute (Philadelphia), the nation's first independent medical research facility, was founded in 1892, and is named for no other than Caspar Wistar!

Finally, there is a story that Cope offered a final challenge to Marsh. Cope directed that after his death the volume of his skull was to be measured. If Marsh did the same thing, then history would know who was the smarter man! Marsh didn't take up Cope's challenge, and today of course we know such a measurement is not a very good indicator of intelligence. In any event, history has decided that Cope was the more brilliant of the two.



LIST OF ICHTHYOLOGISTS

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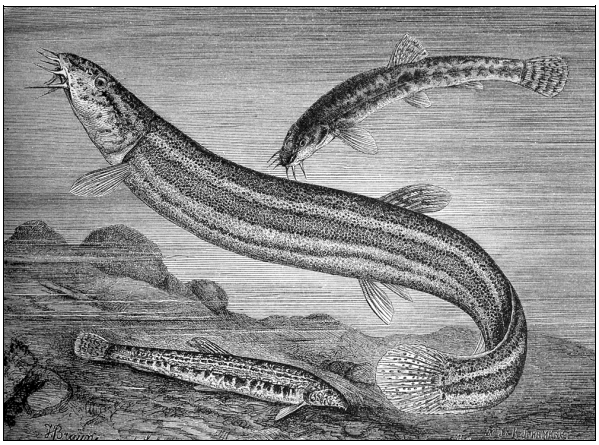

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