

Historical review of ichthyological research in Indonesia

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Abstract—The history of ichthyological research in Indonesian waters falls into four major periods: pre-colonial (from earliest recorded history until the end of the 16th century), colonial (from the beginning of the 17th century to Indonesian independence in 1945), post-independence (from 1945 to 2000) and the 21st century. Scientific fish collections began with French expeditions conducted in the early 19th century, including *La Physicienne* (1817–1820), *L’Uranie* (1818–1819), *La Coquille* (1823), *L’Astrolabe* (1826–1829) and *La Bonite* (1836–1837). British and Dutch expeditions included those of H. M. S. *Curacoa* (1873) and H. M. S. *Challenger* (1872–1876), the *Siboga* (1899–1900), and the *Snellius I* (1929–1930) respectively. These expeditions did not involve Indonesian scientists; nor were collected materials deposited in Indonesian Institutions. More recent expeditions and with the participation of the Indonesian Government included the *Baruna Expedition* (1964), the *Te Vega* (1963, 1965) and the *Alpha Helix* cruises (1979), the *Rumphius Expedition I–IV* (1972–1980), the *Corindon Expedition II–III* (1982–1984), the *Snellius II* (1984–1985), the *Karubar* (1991) and the *Anambas* (2002).

Key words: Indonesia, ichthyology, history, research, fish specimen, expedition

Introduction

Indonesia, situated in the tropical Indo-Pacific, comprises about 17,500 islands with an overall coastline of more than 81,000 km. The area, rich in natural marine resources occupying a range of ecosystems, has long been considered to have extremely high marine biodiversity (Bellwood and Wainwright 2002). The fish fauna is extremely rich and no other region ranks with the Indonesian archipelago in the number of fishes, their diversification and habitats. In particular, Halas and Winterbottom (2009) who provided information on coral reef biota in the East Indies, defined the East Indies Triangle (islands between Sumatra in the west, New Guinea in the east, and Luzon, Philippines in the north) as having the highest marine biodiversity, including fishes, in the world. Munro (1967) showed that the territory of eastern Indonesia shared many of the elements of the Indian Ocean, the western part of Oceania and tropical Australia.

In historical times, the Indonesian archipelago was an important trade region, Srivijaya and Majapahit trading with China and India (Palomares and Heymans 2006). Some of the world’s most valuable commodities, including nutmeg, cloves and pepper were found abundantly in Indonesia, attracting initially Portuguese traders, who attempted to monopolize such sources in Maluku, in addition to spreading Roman Catholicism, followed by Dutch and British traders.

Portuguese cultural elements still remain throughout Indonesia, but particularly in eastern parts.

Arriving in Indonesia in 1602, Dutch traders established the Dutch East India Company (*Vereenigde Oost-Indische Compagnie*, VOC), and the Netherlands became the dominant European power in the region as the demand for spices increased in Europe. Agencies were established, interacting mostly with Indian, Chinese and Arab merchants, which encouraged active trade and the growth of ‘middlemen’ transporting these goods between the East Indies and Europe (Palomares and Heymans 2006).

I examined the history of ichthyological research in Indonesia, emphasizing in particular, those individuals primarily responsible for the present-day level of knowledge of Indonesian fishes.

History of Ichthyological Research in Indonesia

In early days, most studies of Indonesian waters were made for navigational purposes, although the economic importance of the region’s marine resources became more and more recognized, resulting in a growing emphasis on research. Although some natural history accounts were published earlier (see below), ichthyological research on fishes collected in Indonesian waters really began in earnest with the visits of European explorers and naturalists in the early 19th century (Allen and Adrim 2003).

Ichthyological research in Indonesian waters can be di-

vided into four major periods: pre-colonial (from earliest recorded history until the end of the 16th century), colonial (from the beginning of the 17th century to Indonesian independence in 1945), post-independence (from 1945 to 2000) and the 21st century.

Pre-colonial period

The first European accounts of the East Indies can probably be attributed to Marco Polo, who stayed in Sumatra in 1292 (Palomares and Heymans 2006).

However, the earliest biological investigations in Indonesian waters were made by German-born Georg Everhard Rumpf (1627–1702), who was stationed on the spice island Ambon (eastern part of Indonesian archipelago) as an agent for VOC (Pariwono et al. 2005, Van Aken 2005). His scientific work, *D'Amboinsche Rariteitkamer*, published in 1741, included biological studies of marine invertebrates and plants (Nontji 2009).

Colonial period

Although this period was dominated by Dutch exploration, fish collections for the purposes of scientific studies began with the visits of French explorers in the Raja Ampat Islands and Waigeo Island in the early 19th century, including expeditions by *La Physicienne* (1817–1820), *L'Uranie* (1818–1819), *La Coquille* (1823), *L'Astrolabe* (1826–1829). Fishes originally described from Waigeo (West Papua Province) by early French researchers such as Quoy and Gaimard (1824, 1834), Lesson (1828–1830), and Cuvier and Valenciennes (1828–1849), include such well-known species, Black-tipped Shark (*Carcharhinus melanopterus*), Bluefin Trevally (*Caranx melampygus*), Bigeye Trevally (*Caranx sexfasciatus*), Semicircular Angelfish (*Pomacanthus semicirculatus*), and Sergeant Major (*Abudefduf vaigiensis*) (Allen and Erdmann 2009). Albert Günther, who visited the neighboring island, Misool, during the cruise of H. M. S. Curacao in 1865, recorded 28 species (Allen and Erdmann 2009).

Other important surveys included *La Bonite* (1836–1837), H. M. S. Curacao (1873) and H. M. S. Challenger (1872–1876), and finally the Dutch expedition by Siboga (1899–1900). Subsequent scientific surveys were made by the U.S. Fish Commission steamer *Albatross* (1909), the Danish Expedition (1922) and the Mortensen Java-South Africa expedition (1929) and followed by the Dutch vessel *Snellius I* (1929–1930) (Nontji 2009). Organized and financed by Western Governments or Scientific Organizations, the above expeditions did not involve Indonesian scientists; nor were collected materials deposited in Indonesian Institutions.

The predominant researcher of Indonesian fishes in this period was Pieter Bleeker (1819–1878), who arrived in Java in 1842 and was employed as a medical officer in the Dutch East Indian Army from 1842 to 1860. Besides his army du-

ties, he also worked in ichthyology, conducting much independent research on fishes from various localities throughout Indonesia. During his life, he realized the aim of studying both intensively and extensively the fish fauna of the Indo-Australian archipelago. His work provided the basic framework of present-day knowledge of East Indian fishes. Many of his specimens were received from local fishermen or collected from fish markets, and although his travels around the Archipelago were limited, he built up a network of contacts whose regularly sent specimens from various government outposts throughout the islands.

After Bleeker's death in 1878, both unique specimens (including type specimens) and duplicates were sent to the British Museum, although the greater part of Bleeker's collection was eventually bought to the Rijksmuseum van Natuurlijke Historie in Leiden (Carpenter 2007) and a smaller part to the Natural History Museum in Paris (Palomares and Heymans 2006). After returning to the Netherlands in 1860, he started publishing his work in *Atlas Ichthyologique*, with over 1500 illustrations in 36 volumes. This remains an important resource for present-day ichthyologists.

During his life, Bleeker acquired about 18,000 fish specimens from the Indo-Pacific, Europe and Africa, and described 1,925 species and 520 fish genera. The majority of these were from Indonesia (Carpenter 2007).

After Bleeker's death, studies of Indonesian fishes were continued by M. Weber, who made collections in the Archipelago from 1888 to 1900. He also headed the Siboga Expedition in 1909 and 1910, exploring the marine fauna in deep basins in the Indonesian archipelago. With his co-worker L. F. de Beaufort, who also collected fishes in the Indonesian archipelago, particularly the eastern region, Weber published a monumental work, *Fishes of the Indo-Australian Archipelago*, published in 11 volumes between 1911 and 1962. After Weber's death in 1937, his work was continued by L. F. de Beaufort, W. M. Chapman, F. P. Koumans and J. C. Briggs.

In addition to a number of Dutch zoologists, including H. C. Delsman and J. D. F. Hardenberg, who worked on fishes at the Fisheries Station in the periods after 1920, at the Laboratory for the Investigation of the Sea in Batavia, W. Volz, from Bern, Switzerland, spent two and a half years in southeast Sumatra, and published *Fische von Sumatra* in 1903. A year later he published a second paper under that title, dealing with fishes collected by G. Schneider. These two papers made great contribution to present knowledge of freshwater fishes of Sumatra (Palomares and Heymans 2006).

Post-Independence

After the Independence of Indonesia, the collection and study of fishes continued, with the participation of the Indonesian Government. *RV Te Vega* of the Hopkins Marine Station (Stanford University) explored Borneo and Sumatra

in 1963 and 1965. The Baruna Expedition explored the eastern part of Indonesian archipelago in 1964, and expeditions mounted by V.G. Springer and M. Gomon in 1973 and 1974 resulted in extensive collections from the Molucca Islands (Ambon, Haruku, Ceram, Nusa Laut and Saparua), the Banda Sea (Kabaena Island, Banda Islands and southern Buton) and the Java Sea (Bawean, Karimundjawa, and Seribu Islands) (Allen and Adrim 2003). In addition, more recent expeditions included the Scripps Institution of Oceanography RV Alpha Helix in Papua in 1979, the Rumphius Expedition I–IV (1972–1980), the Corindon Expedition II–III (1982–1984), the Snellius Expedition II (1984–1985), the Karubar (1993) and the Anambas (2003).

Other important foreign ichthyologists and fish photographers who visited and collected specimens from Indonesia during this period included G. R. Allen, P. Cakrabarty, S. Kimura, R. Kuitert, M. Kottelat, J. M. Leis, K. Matsuura, H. Motomura, L. R. Parenti, J. Paxton, J. E. Randall, B. C. Russell, J. P. Whitehead, and T. Yoshino.

After P. Bleeker, M. Weber and L.F. de Beaufort, the most influential ichthyologist with regard to Indonesian marine fishes, especially the reef fish fauna, is J.E. Randall of the Bishop Museum, Honolulu (Allen and Adrim 2003). Specimens obtained during 15 separate visits between 1975 and 2000 in localities including Ambon (Fig. 1), the Java Sea, Bali, Sulawesi, Lombok, Komodo, the Banda Sea Islands, Flores, the Lucipara Islands, Halmahera and other islands in western Papua, Timor and nearby islands, Sumatra and the Mentawai Islands, and Bintan Island. His collections reached over 3000 lots.

The necessity of further studies of Indonesian fishes was summed up by Randall as follows: The number of fishes for

Indonesia will certainly increase with additional collecting and continuing investigation of existing museum fish collection, in particular the deep-water and pelagic species. That much remains to be done even with reef and shore fishes might be surmised from our finding seven new records and nine new species of reef fishes in five days of diving in Sumatra off Padang and Siberut Island (Randall and Kunzmann 1998). To date, a total of 607 new species have been described by J. Randall including about 50 new species from Indonesia (counted from Carpenter and Pyle 2010).

21st Century

The Indonesian Government has recently emphasized applied research rather than basic research. In addition, limitations of present research facilities in Indonesia are unfavorable for fish taxonomy. Nevertheless, both fresh water and marine fish taxonomic studies are presently being undertaken at the Research Center for Biology and Research Center for Oceanography, Indonesian Institute of Sciences.

The Bogor Museum is the only institution in Indonesia that has a professionally curated fish collection. Other reference collections of the Research Center for Oceanography, Indonesian Institute of Sciences, in Ambon, Maluku Province and Bitung, North Sulawesi, are poorly curated, with the scientific value of the specimens unappreciated. Although many universities in Indonesia maintain fish specimens for use in student research, such specimens are generally poorly curated and are sometimes scattered or disposed of. The world's largest museum collection of Indonesian fishes is kept at the United States National Museum of Natural History (USNM) in Washington, D.C. (Allen and Adrim 2003).

Since 2000 some collaborative work has been undertaken between the Indonesian Institute of Sciences with other museums world-wide, including the Natural History Museum (NHM), London; the Raffles Museum and Biodiversity Research (RMBR), National University of Singapore, Singapore; Zoologische Museum Staatssammlung (ZSM), München; Zoologisches Forschungsinstitut und Museum Alexander Koenig (ZFMK), Bonn; the Florida Museum of Natural History (FLMNH), Florida; the American Museum of Natural History (AMNH), New York; and the National Museum of Nature and Science (NSMT), Tokyo. A recent collaborative effort with Conservation International, under the auspice of the Monaco–Asia Society, resulted in a charity auction conducted by Christie's International in Monaco, whereby funds raised will be used for several young scientists working with specialists and continuing their studies in master and doctoral courses on taxonomy of various groups of organisms.

The most important collaboration over the last ten years has been the Core University Program of the Japan Society for the Promotion of Science (Biodiversity Studies in the

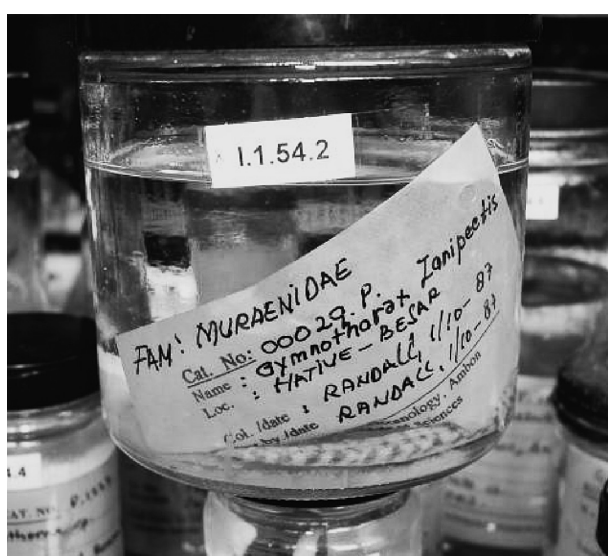


Fig. 1. Specimen collected by J. E. Randall when he visited the Technical Implementation Unit for Marine Biota Conservation, Research Centre for Oceanography, Indonesian Institute of Sciences (formerly Ambon Research Station) in 1987.

coastal areas of South East Asia) and the Multilateral Cooperative Research Program of the Japan Society for the Promotion of Science (Coastal Oceanography) under the leadership of the Atmosphere and Ocean Research Institute (AORI), Japan. A number of Indonesian scientists, including graduate students, have been involved in the programs, receiving curatorial and other professional training. During this collaboration a number of new species have been reported, including *Leiognathus kupanensis* and *Stolephorus teguhi* (Kimura et al. 2003, 2005, 2009). New records of various fishes to Indonesian waters included *Epinephelus octofasciatus* Griffin, 1926 (Peristiwady 2009a), *Thamnaconus modestoides* (Barnard, 1927) (Peristiwady 2009b), *Cephalopholis igarashiensis* Katayama, 1957 (Peristiwady et al. (2009)), *Bodianus izuensis* Araga and Yoshino, 1975 and *B. masudai* Araga and Yoshino, 1975 (Peristiwady et al. 2010), and *Scorpaena onaria* Jordan and Snyder, 1900 (Motomura and Peristiwady 2010). In addition, collaborative efforts resulted in publication of the field guides: Field Guide to Lombok Island, Identification Guide to Marine Organisms in Seagrass Beds of Lombok Island, Indonesia (Matsuura et al. 2000), Fishes of Bitung, Northern Tip of Sulawesi, Indonesia (Kimura and Matsuura 2003) and Economical Important fish of Indonesia: Fish Identification Guidebook (Peristiwady 2006).

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