Global diversity of mammals (Mammalia) in freshwater

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Abstract Species that are dependant on, or adapted to, freshwater environments are found in almost all mammalian orders, and two orders, the Cetacea and the Sirenia, are strictly aquatic and include some freshwater-dependant species. Overall, the aquatic and freshwater-dependant species represent around 70 of the more than 1,200 living or recent genera of mammals, and occur in all continents except Antarctica. They include some of the most endangered species of mammals, and several have gone extinct or become critically endangered in recent decades. One of the main threats is habitat loss or degradation. This chapter provides an overview of the freshwater species within each order of mammals, their evolutionary history, their relations to humans and their conservation status.

Keywords Mammalia · Freshwater · Diversity · Conservation

Introduction

The mammals are tetrapod vertebrates characterized by their jaw articulation (between the dentary and the squamosal), presence of three bones in the middle ear (malleus, incus, and stapes), mammary glands that produce milk, and presence of hair. Living forms are divided into three clades, the monotremes (Monotremata), the marsupials (Metatheria), and the placentals (Eutheria). Mammals have adapted to most kinds of habitat and have assumed various modes of existence—terrestrial, arboreal, aerial, fossorial, and aquatic, and inhabit all regions of the world. At least some forms in most of the orders depend on water for habitat and food, many also for protection from predators. Two orders, the Cetacea and the Sirenia, are strictly aquatic. For most partially or semi-aquatic mammals, at least giving birth or rearing of the young takes place outside the water.
Species diversity and geographical distribution

Freshwater mammals occur on all continents except Antarctica, some species widely distributed but many with very restricted ranges (Fig. 1). Many are threatened and these are listed in Table 1 with information on their distribution.

Order Monotremata (2 families; Groves, 2005)

Among the five species of living monotremes, the duck-billed platypus (Ornithorhynchus anatinus) lives in streams, lakes and lagoons in eastern Australia and Tasmania, but it has been extirpated from much of its range due to hunting and habitat degradation, river fragmentation from dams, and entrapment or entanglement in fishing gear (Nowak, 1999).

Metatheria (or Marsupialia) (7 Orders, 22 families; Wilson & Reeder, 2005)

Among the 331 species of metatherians, the only truly semi-aquatic species is the South American water opossum (Chironectes minimus). It possesses webbed feet and differs from other marsupials in having its rear-facing pouch equipped with a sphincter muscle to make it watertight for the attached young (Marshall, 1978). The thick-tailed opossum (Lutreolina crassicaudata) is an excellent swimmer that exploits wetlands for food and nesting habitat (Nowak, 1999).

Eutheria (placental mammals)

Order Chiroptera (1116 species in 18 families; Simmons, 2005): Many bats are associated with fresh water but one group, the fishing bats (Noctilio albiventris and Noctilio leporinus), belonging to the family Noctilionidae, feed on aquatic insects, and N. leporinus also eats fish, frogs, and crustaceans. Like other bats, they use echolocation to locate prey, detecting the ripples on the water surface (Schnitzler et al., 1994). They can swim and take flight from the water (Revenga & Kura, 2003). Several species of vesper bats (Vespertilionidae) share the enlarged hind legs and claws of noctilionids, including Myotis (Pizonyx) vivesi of Mexico, Myotis adversus of

Fig. 1 Species and genus number of freshwater (aquatic and water dependent) mammals by zoogeographic region: species number/genus number. PA: Palearctic Region; NA: Nearctic Region; AT: Afrotropical Region; NT: Neotropical Region; OL: Oriental Region; AU: Australasian Region; PAC: Pacific Region and oceanic islands, ANT: Antarctic Region