# 9. Giants of the Sea: Diversity and Taxonomy of Marine Mammals in India

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## Introduction

Marine mammals are warm-blooded aquatic vertebrates belonging to the class *Mammalia*. They are a diverse group of mammals with unique physical adaptations that allow them to thrive in the marine environment with extreme temperatures, depths, pressure, and darkness. They rely on lungs for breathing, use fins and flippers for movement, and nurse their young with milk. These animals are categorized into four distinct taxonomic groups: **cetaceans** (whales, dolphins, and porpoises), **sirenians** (manatees and dugongs), **pinnipeds** (seals, sea lions, and walruses), and **marine fissipeds** (sea otters and polar bears). While cetaceans and sirenians are fully aquatic, the other groups spend part of their lives on land for specific biological needs<sup>1</sup>.

Cetaceans are categorized into two main groups: baleen whales (mysticetes) and toothed whales (odontocetes). They spend their lives in water, and have many adaptations to their entirely aquatic lifestyle. There are over 70 different species of cetacean. Pinnipeds are in the suborder pinnipedia, which means "fin-footed." These carnivores use flippers to move both on land and in the water. Pinnipeds spend the majority of their lives swimming and eating in water and come onto land or ice floes to bear their young, rest, and molt. Like cetaceans, sirenians also spend their whole lives in water. They are the only entirely herbivorous group of marine mammals. Sirenians are named for sirens, the legendary Greek sea beauties that lured sailors into the sea. Some think historic mermaid sightings were actually sirenians, not the mythical half women, half fish. The marine fissipeds are considered marine mammals, but spend most of their time on land and only part of the time in the water, mainly to hunt for their food.

As keystone species, marine mammals play a crucial role in ocean ecosystems. Their population dynamics can trigger cascading effects in the food web, ultimately impacting human communities. Their wide distribution, large body size, and predatory nature make them significant influencers of marine food webs, affecting both the structure and functionality of aquatic ecosystems. They inhabit a variety of environments, including tropical, subtropical, temperate, and polar regions, as well as estuaries and coastal areas connected to major river systems. These species contribute to prey-predator interactions, nutrient cycling, and habitat modifications, shaping the marine environment in multiple ways<sup>2</sup>.

In recent years, marine mammals have faced numerous threats, including accidental entanglement in fishing gear, vessel collisions, and entrapment in water regulation structures, pollution, ocean acidification, disease outbreaks, harmful algal blooms, seismic disturbances, and rising ocean temperatures. These challenges highlight the urgent need for conservation and sustainable management to maintain their population levels, distribution, and

biodiversity, ensuring a balanced ocean ecosystem. Taxonomy plays a fundamental role in conservation efforts by helping to define population structures and species classification, which are essential for determining conservation priorities.

Globally, marine mammals are represented by 21 families (including 8 monotypic families) and 135 recognized species, distributed among the four major taxonomic groups. According to the IUCN (2009), 25% of marine mammal species are classified as threatened, with several species at risk of extinction if conservation measures are not effectively implemented. Without urgent intervention, many of these species could disappear, disrupting marine biodiversity and ecological balance<sup>11</sup>.

Order	Infraorder	Parvorder	Family	No. of Species
			· · · · · · · · · · · · · · · · · · ·	•
Carnivora (38)	Arctoidea (3)	Ursida	Ursidae	1
		Mustelida	Mustelidae	2
	Pinnipedia (35)		Otariidae	15
			Odobenidae	1
			Phocidae	19
Artiodactyla (92)	Cetacea (92)	Mysticeti (15)	Balaenidae	4
			Neobalaenidae	1
			Eschrichtiidae	1
			Balaenopteridae	9
		Odontoceti (77)	Physeteridae	1
			Kogiidae	2
			Ziphiidae	23
			Platanistidae	2
			Iniidae	1
			Lipotidae	1
			Pontoporiidae	1
			Monodontidae	2
			Delphinidae	37
			Phocoenidae	7
Sirenia (5)			Trichechidae	3
			Dugongidae	2
Total				135

## Marine Mammal Diversity Of The World<sup>10</sup>

## Marine Mammals Diversity Of India

In the Indian seas, the marine mammals are represented by cetaceans and sirenians, and they together contribute 28 species<sup>12, 4</sup>, comprising almost 25 percent of the world's marine mammals, and almost 8% of all mammalian fauna recorded in India<sup>13</sup>. The sirenian group in India is represented by a single species, *Dugong dugon*. The Wildlife (Protection) Act 1972 of India listed all the marine mammal species under Schedule I.

## **Taxonomy Of Marine Mammals**

The identification of marine mammals employs a variety of techniques, ranging from traditional morphology-based taxonomy to advanced molecular tools. Classical taxonomy relies on physical characteristics, while acoustic detection distinguishes species by analyzing sound frequencies. Molecular methods such as DNA barcoding (COI, 16S rRNA), mass spectrometry (collagen peptide mass fingerprinting), and environmental DNA (eDNA) analysis (droplet digital PCR) have become increasingly valuable in species identification.

Next-Generation Sequencing (NGS) is frequently used for studying cetacean populations by reconstructing mitogenomes, genomic single nucleotide polymorphisms (SNPs), and complete nuclear genomes, providing deeper insights into their evolutionary relationships and population histories. Current molecular research on cetaceans includes DNA barcoding<sup>5</sup>, eDNA analysis<sup>6</sup>, whole genome sequencing<sup>7</sup>, mitogenomics<sup>8</sup>, and market sample identification<sup>9</sup>. However, despite the precision of molecular approaches, their high costs and the difficulty of obtaining fresh tissue samples make morphological identification the more commonly used method.

Marine mammals can be identified based on morphological traits, such as flipper-to-body ratio, coloration patterns, tooth count, body shape, head structure, throat grooves, dorsal fin position, fluke shape, body color, and blowhole placement. In visual surveys, blow patterns are key indicators of species identity. Photo-identification, which involves capturing images of dorsal fins and flukes, helps distinguish individual cetaceans and is useful for studying group size, population structure, and species composition. Repeated photo sessions from the same location over time allow researchers to monitor resident and migratory populations and assess reproductive success.

Identifying marine mammals in the wild differs significantly from identifying stranded or deceased individuals. Even under optimal conditions, observers often catch only fleeting glimpses of splashes, blows, dorsal fins, flippers, or backs, making accurate identification challenging, especially at great distances<sup>1</sup>.

## Classification

### **Order:** Artiodactyla

### Infraorder: Cetacea<sup>14</sup>

- All cetaceans share a similar streamlined body structure
- Nostril(s) on the top of the head make up the blow hole, with one in odontoceti and two in mysticeti
- Propulsion by up and down movement of tail ends with a flattened paddle like cartilaginous fluke
- Telescoping in skull- restructuring process that pushed the nasal passages posteriorly in the cetacean skull<sup>15</sup>

- Body is enfolded in well-developed blubber layer
- Newly derived boneless structures in the form of tail flukes and a dorsal fin or ridge

## Parvorder: Mysticeti (Baleen Whales)<sup>16</sup>

- This group has the largest animal on the planet. Antarctic blue whale, weighing up to 181 tonnes (approximately 33 elephants) and reaching up to 98 feet in length
- Paired nostrils or blowholes are longitudinal slits situated at the top of the cranium causing a V-shaped blow
- Wing like flipper movement helps in the propulsion of the body
- Presence of baleen (keratinaceous baleen plates (or "whalebone")) instead of teeth in their mouths to sieve planktonic creatures from the water
- Indian baleen whales are represented by the family Balaenopteridae

## Key Characteristics For Whale Identification

- Shape of head
- Shape and location of dorsal fin
- Body color and pattern
- Baleen plates colour
- Number of ventral (throat) grooves
- Flipper length and shape
- Girth to length ratio
- Head length to body length ratio

## Family: Balaenopteridae

- Members of this family also known as rorquals, contains the gigantic animals ever to live
- In India Balaenopteridae comprises 6 species belonging to 2 genera: Balaenoptera and Megaptera
- Except the humpback whale other members shares a streamlined body with a series of long pleats from the snout tip to as far back as the navel on the ventral surface
- Lunge feeding is an extreme, fast and active feeding method, their morphology allows them to accelerates to a high velocity and then open their jaws wide and distend their throats to take in huge mouthful of water during feeding
- The baleen plates are of moderate length and fringe fineness. Density and fringe diameter- vary among species, and along with plate number and width to length ratio, are diagnostic characters
- Dorsal fins situated behind the midpoint of the back at  $2/3^{rd to} 3/4^{th}$  of total length.
- Pleated throat grooves distinguish balaenopterids from other whales.



Blue whales have a very small dorsal fin, measuring about 1% of its total body length, positioned at approximately threequarters of its body length. It possesses 260 to 400 black baleen plates per side, each with black bristles, and all three sides of each plate are roughly equal in length. The body is bluish or light grey with grey patches on the dorsal surface. It has 60 to 80 ventral grooves that extend near the navel. The maximum recorded body length is 33 meters, though most adults typically measure between 23 to 27 meters, while newborns are about 7 to 8 meters long. According to the IUCN, this species is classified as Endangered.

Balaenoptera borealis Lesson, 1828 -Sei whale<sup>17</sup>



Sei whales have a pointed rostrum, with a slightly downward-turned snout at the tip. Its pectoral fins are relatively short, making up only 9%–10% of the total body length, and are pointed at the tips. It possesses 32 to 60 ventral pleats, with the longest extending past the flippers but stopping well short of the navel. The 300 to 380 pairs of baleen plates are black with numerous whitish bristles and measure less than 80 cm in length. The flippers are entirely dark, and the species features a single median ridge. The maximum recorded body length is 19.5 meters.



Fin whales have a V-shaped head when viewed from above, with a pointed tip. It features a ridge on the upper side of the mouth and another prominent ridge between the dorsal fin and fluke. The baleen plates, numbering 260 to 480, are grey with white streaks on the sides. Its coloration is asymmetrical, with the left side of the head appearing grey, while much of the right side is white. The back is dark with light streaks, and the belly is white. The tall, falcate dorsal fin is positioned farther forward on the caudal peduncle. The species has 50 to 100 ventral grooves, extending up to the navel. Adults can reach a maximum length of 27 meters in the Southern Hemisphere and 24 meters in the Northern Hemisphere. According to the IUCN, this species is classified as Vulnerable.



Bryde's whales have a pointed head with three prominent ridges on the dorsal side of the rostrum. It features 40 to 70 ventral pleats that extend to the umbilicus. The baleen plates, numbering 250 to 370 per side, are slate-grey with white to light grey head coloration fringes. The is symmetrical, and the dorsal fin is tall and well falcate. Its dorsal profile is dark grey, while the ventral side is lighter. The tip of the lower jaw is dark, adding to its distinctive appearance. The maximum recorded body length is 14 meters. According to the IUCN, this species is classified as Least Concern.

Balaenoptera acutorostrata Lacepede, 1804 -Common Minke whale

Minke whales have a sharply pointed, Vshaped head with a prominent ridge on the upper rostrum. Its tall, falcate dorsal fin is positioned at about two-thirds of the body length. The body is dark grey with shaded lateral sides. It has 50 to 70 throat grooves that extend just past the flippers. The 231 to 360 baleen plates per side are cream-colored with coarse bristles, measuring less than 21 cm in length. These plates are predominantly yellowish-white, white or sometimes featuring a dark margin along the outer edge. The species often has conspicuous white bands on the upper surface of the flippers. The head appears sharply pointed when viewed from above, and the maximum body length is 9 meters. According to the IUCN, this species is classified as Least Concern.

Megaptera novaeangliae (Browski, 1781) -Humpback Whale



Humpback whales have a robust and stocky body, with the top of its head covered in knobs, including a prominent cluster at the tip of the lower jaw. It features distinct tubercles near the lips and chin. The elongated flippers make up onefourth to one-third of the total body length and have knobs along the leading edge. The small dorsal fin is typically positioned on top of an obvious hump. The body is primarily black and dark grey in coloration. It has 14 to 35 ventral grooves that extend beyond the navel. The baleen plates, numbering 270 to 400 per side, range from black to olive brown with grey bristles and are less than 80 cm long.

#### Parvorder: Odontoceti (Toothed Whales)<sup>18</sup>

- Represented by 6 families (India)
- These are small to medium sized cetaceans except sperm whales (male of which can grow at least 18 m)
- Presence of teeth throughout life
- Single blow hole
- An asymmetrical skull with
  - $\Box$  Concave profile
  - $\Box$  Sternum with 3 or more parts
  - $\Box$  Complex system of nasal sacs
  - $\Box$  Fatty organ in the forehead area called the melon
- Capable of echolocation to
  - □ Navigate
  - $\Box$  Find food
  - □ Avoid predators

#### Family: Physeteridae (Sperm Whales)<sup>19</sup>

- The sperm whales are the largest toothed cetacean
- There is a low dorsal hump, followed by a series of crenulations
- Has a large head with a squarish profile, narrow underslung lower jaw, and functional teeth only in the lower jaw (these fit into socket in the upper jaw)

- Caudal flukes are triangular and very thick
- Blowhole located at the left front of the head
- Head is divided into sections called the "junk" and the spermaceti organ or "case"
- The spermaceti: is large oil filled reservoir
- Capable of very deep and long dives



### Family: Kogiidae<sup>20</sup>

- Blunt squarish heads not more than 15% of the body length with very short rostrum
- Blowhole is not located at the front of the head
- Dorsal fin is larger than the sperm whale
- 8 to 16 long thin and sharply pointed homodont teeth in each side of lower jaw, fitting into upper jaw sockets
- Similar to that of sperm whales, Kogiidae also possess spermaceti in their head
- Body size less than 4 m



Pygmy sperm whales has a small, squarish head with a tiny underslung lower jaw. A hump is present on the dorsal side between the blowhole and dorsal fin. The wellcurved dorsal fin is positioned behind the midpoint of the body, while the flippers are set close to the head. Throat creases are generally absent, and the dorsal fin is short, measuring less than 5% of the total body length. The distance from the tip of the snout to the blowhole is greater than 10.3% of the total body length. It has 12 to 16 sharp, fang-like teeth in each half of the lower jaw, though occasionally, individuals may have 10 to 11 teeth. The maximum recorded body length is 3.5 meters. According to the IUCN, this species is classified as Least Concern.

*Kogia sima* Owen, 1866 - Dwarf Sperm Whale



#### FAO

Dwarf sperm whales has a tiny underslung lower jaw and a triangular or squarish head. Unlike some related species, it lacks a hump on the dorsal side between the blowhole and dorsal fin. The dorsal fin is tall and slightly falcate, while the small, blunt-tipped flippers are positioned near the head. It has a pair of short throat grooves and 7 to 12 pairs of sharp, fanglike teeth in the lower jaw. The distance from the tip of the snout to the blowhole is greater than 10.2% of the total body length. The maximum recorded size is 2.7 meters. According to the IUCN, this species is classified as Least Concern.

### Family: Ziphiidae

- Beaked whales are medium size cetaceans (4 to 13 m long)
- Have a pronounced beak in general
- Relatively small dorsal fin set far back on the body
- Small flippers that fit into depressions on the sides
- A pair of converging grooves under the throat, and the notch is absent in the tail fluke.
- Not more than 1 or 2 pairs of exposed teeth in the lower jaw of males only
- The blubber of these whales is predominantly composed of wax ester, a unique characteristic of this family<sup>21</sup>



### **Key Characteristics For Identification Of Dolphins**

- Shape and location of dorsal fin
- Shape of flipper
- Shape of head
- Colour and pattern of body
- Teeth count

### Family: Delphinidae<sup>22</sup>

- Many small to medium sized odontecetes of various forms have been lumped together in this group, and so the family has been referred to as "taxonomic trash basket" range in size from the 1 to 10 m
- Most delphinids share the following characteristics
  - □ Marine habitat
  - $\Box$  A noticeable beak
  - $\Box$  Conical teeth
  - $\Box$  A large falcate dorsal fin set near the middle of the back.











## Family: Platanistidae<sup>24</sup>

- Includes the extant susu and the bhulan of the Ganges and Indus rivers, respectively
- Long forceps like beak, with front teeth that extend outside the closed mouth
- Blowhole is a longitudinal slit
- Instead of a true dorsal fin a short dorsal ridge is present



# Family: Phocoenidae<sup>18</sup>

- They are small cetaceans generally coastal in distribution with no prominent beak
- Streamlined body and two limbs that are modified into flippers
- Spade-shaped teeth distinguished from the conical teeth of dolphins
- Short triangular shaped or no dorsal fin
- Exhibit sexual dimorphism in which females are larger than males



rises steeply from the snout tip and lacks a beak. Instead of a true dorsal fin, it has a narrow dorsal ridge covered in thick skin, featuring several lines of tiny tubercles. Small bumps are present on the dorsal side behind the forehead. Its body color is grey or black, with a lighter belly. It has 15 to 22 teeth in each jaw. The flippers have large, rounded tips, while the fluke has a concave trailing edge. The maximum recorded size is 1.7 meters. According to the IUCN, this species is classified as Vulnerable.

## **Order: Sirenia**<sup>25</sup>

- These are herbivorous group of marine mammals
- Robust fusiform body with tough and thick skin bearing short hair
- They have heavy bones that act as ballast to counteract the buoyancy of their blubber
- 2 nostrils present on top or at the front of a thick muzzle
- External ear pinnae and hind limbs are absent
- Forelimbs modified as flippers
- Horizontally flattened tail; and dense and swollen bones

#### Family: Dugongidae

- There is only one extant species in the family
- Flattened tail is broadened into flukes similar to cetaceans
- Rostrum is deflected downwards, presence of erupted tusks in males
- Absence of nails on the flippers



#### Conclusion

Marine mammals, encompassing cetaceans, sirenians, pinnipeds, and fissipeds, are essential components of marine ecosystems, influencing food webs, nutrient recycling, and habitat dynamics. India's marine mammal diversity is notable, representing a significant portion of global marine mammal species, with unique species such as the Dugong and various dolphins and whales. However, these species face numerous threats, including habitat degradation, accidental entanglement, pollution, and climate change. These challenges underscore the urgent need for effective conservation strategies to protect these keystone species.

Taxonomic studies, whether through classical morphological methods or modern molecular techniques like DNA barcoding and next-generation sequencing, are crucial for understanding the population structure, evolutionary history, and conservation needs of marine mammals. While molecular techniques offer high precision, traditional identification methods like photo-identification remain vital for monitoring populations in the wild.

Conservation efforts in India, such as listing marine mammals under the Wildlife (Protection) Act of 1972, are vital steps toward safeguarding these species. Continued research, monitoring, and collaboration among government agencies, research institutions, and local communities will be key to ensuring the survival of India's diverse marine mammal species. Ultimately, protecting these creatures not only preserves biodiversity but also ensures the health and resilience of marine ecosystems, which are critical to the well-being of both marine life and human populations.

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