

Marine turtles are classic flagship species. Their remarkable natural history—large body size, dependence on both terrestrial and oceanic environments, delayed maturity requiring decades to reach adulthood, regular migrations that crisscross ocean basins, massive reproductive output, mammal-like physiology, and other features—make them attractive to researchers and the general public alike.

This attraction is further enhanced by the fact that these reptiles are widely recognized as endangered species. They are “biomagnets” for people around the world, from various sectors of society; incredible amounts of time, energy, and resources go into diverse types of investigation, public education, conservation, and international policy directed specifically at these “lowly reptiles.” Oceanographers, ecologists, geneticists, marine biologists, and specialists from other related disciplines frequently begin basic research projects on marine turtles. These activities quickly evolve into large multifaceted programs including conservation activities, community-based approaches, and public education together with other forms of development and social projects, and even policy initiatives for promoting regional and global cooperation in the conservation of these shared resources and the habitats on which they depend. Besides enhancing better understanding of the biology and ecology of these animals and nurturing more active and diverse conservation and education initiatives, work on marine turtles also promotes much-needed initiatives in interdisciplinary and international cooperation, which are fundamental challenges to marine work in general. This paper provides a summary of the flagship species concept and gives examples of how work focused on marine turtles has promoted diverse initiatives in marine research, education, and conservation at multiple scholarly, social, and political levels; it argues that this approach serves as a critical integrating force to nurture a

wider comprehension and appreciation of the scientific endeavor and its role in society. John G. Frazier, Conservation and Research Center, National Zoological Park, Smithsonian Institution, 1500 Remount Road, Front Royal, Virginia 22630, USA (frazierja@si.edu).

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FLAGSHIP SPECIES AND THE INCREASE AND DIFFUSION OF KNOWLEDGE Scientists, educators, and conservationists who specialize on marine organisms and marine environments may all be convinced of the fundamental importance of such things as larval nectophores, pedunculate siphonophores, disappearing zooxanthellae, discharged nematocysts, mitochondrial cytochrome oxidase 1, maximum parsimony, and other indicators of “good science,” but what of the rest of society? Marine biodiversity is unique yet poorly understood or appreciated by the general public or decision makers; 242 • SMITHSONIAN CONTRIBUTIONS TO THE MARINE SCIENCES and

a central question with which we all must contend is “How can we promote it?” Many marine organisms have complex, intriguing life histories, and marine turtles, comprising just seven living species, are classic examples. These air-breathing reptiles are typified by highly complex life cycles: they live with fish but nest on land, relying on terrestrial, coastal, benthic, and pelagic environments during different parts of their life cycle; they can occur in extremely dense concentrations both on land and in the sea; they are “highly migratory,” crossing ocean

basins; they take a decade or more to reach sexual maturity and can live for half a century or more; and they have highly specialized morphological and dietary adaptations, including mammal-like physiology. A single female often lays more than 100 eggs in a nest and can lay several nests in a season. Their large body size (up to 1 ton), striking coloration, and primeval appearance all add to the attractiveness of these marine reptiles. The fact that marine turtles are globally recognized as endangered species adds a further level of importance. Hence, these reptiles are flagship species: ambassadors of the oceans. The attraction has led to not only enormous interest on the part of the general public but also disproportionate attention in academic circles (Frazier, 2003a, 2005a, 2005b): nearly as much research is conducted on just seven species of marine turtles as is carried out for the remaining 300 some species of chelonians. In addition, marine turtles are widely valued as sources of meat, eggs, oil, skin, and shell, which have been utilized, crafted, and traded for millennia. A global trading network that supplied elite urbanites of the Mediterranean with raw materials from the shores of the Indian Ocean and beyond was well established before the time of Christ, and the most frequently mentioned commodity was tortoise shell (the external keratinous scutes of the hawksbill turtle, *Eretmochelys imbricata* Linn.). Intricately fashioned toilet articles, particularly ornamental combs, some of which were 85 cm wide, as well as a special style of French furniture luxuriously inlaid with tortoise shell and metal ("Bouille"), and religious accoutrements have all been made famous by the tortoise shell used in their creation. In addition to the tremendous diversity of objects crafted from turtle parts, these animals have been portrayed for millennia on a wide variety of media, from cave walls to carved rocks to delicate ceramics to the cylindrical seals of ancient Arabia (Frazier, 2003b, 2004a, 2005c). Hence, they have had very important cultural, social, and spiritual values in many societies. During contemporary times marine turtles have been celebrated in many and diverse forms, ranging from symbols of sacred nature and "pristine" environments to evidence of the evils committed by modern society on the environment (Campbell, 2003). All this conveys upon these animals a wide variety of values, from cultural and historic to economic and spiritual.

ACTIVITIES FOCUSED ON MARINE TURTLE RESEARCH AND CONSERVATION

The national marine turtle program in Brazil, which began as a dedicated study of reproductive biology and natural history, has evolved into one of the best known long-term programs in South America and the world in general, and the attraction of the turtle flagship over the years has resulted in the incorporation of massive efforts in public education and community development, including alternate livelihoods for community residents, training, and facilitated interactions between different sectors of government and society, not to mention national counsel for regional and international policy actions (Marcovaldi et al., 2005). Similarly, multiyear programs in Uruguay (Laporta and Miller, 2005), northwestern Mexico (Delgado and Nichols, 2005), the Caribbean (Eckert and Hemphill, 2005), and Nova Scotia (Martin and James, 2005) conduct research on diverse topics such as feeding ecology, reproductive biology, genetics, migration, and fisheries interactions. All this research, as well as the associated educational and conservation activities, has been greatly facilitated—if indeed not made possible—by the attractiveness of marine turtles and the ease

with which researchers have been able to make use of these flagship species to promote interest in collaborating with different research activities. It is not uncommon for fishermen to go out of their way not only to inform researchers about sightings and captures of marine turtles but also to take on extra work, requiring time, effort, and materials to deliver information and specimens to researchers. Frequently this means allowing, or even inviting, researchers to come onboard and make free use of the fishermen's vessels and materials. Swordfish fishermen in Nova Scotia provide their vessels as research platforms for the complicated process of capturing, boarding, measuring, instrumenting, and releasing turtles of half a ton in body weight or more; researchers are very much aware that the success of their work depends on the altruistic behavior of fishermen (Martin and James, 2005). Uruguayan fishermen, many of whom live at a subsistence level, not only invite researchers to make use of their boats but are active collaborators in the research, attending meetings and participating in presentations (Laporta and Miller, 2005).

THE TURTLES' TALE: FLAGSHIPS AND INSTRUMENTS FOR MARINE RESEARCH, EDUCATION, AND CONSERVATION

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