

fear. Chandroo *et al.* (2004a, p. 225) found that teleost fish, such as those of the family salmonidae, 'simultaneously demonstrate functional similarities and a level of cognitive development suggestive of sentience'. Their research on anatomical, pharmacological and behavioural states in fish signified that pain and the conscious experience of fear and psychological stress are likely to be experienced by fish in ways similar to those other animals, including mammals – and that 'fish have the capacity to suffer'.

Research has shown that marine invertebrates are also highly intelligent (Bekoff, 2007). Octopuses are considered the most intelligent of these, and have been equated to the domestic cat in this respect. They are able to open jars by learning from observation; they have exhibited behaviours described as play, and are known to escape from their **aquaria** either to socialize or eat other aquarium animals. Fear and stress in fish may be characterized through aversive behavioural responses, branchial responses, alarm pheromone-initiated responses and stereotyped behaviour (Chandroo *et al.*, 2004a). Highly publicized welfare concerns have been raised regarding great white sharks in captivity because of serious self-inflicted wounds associated with their bumping into the sides of the enclosure, as well as fatal attacks on shark tank-mates (in addition to unusually high mortality).

As Yue *et al.* (2004, p. 352) have stated: 'Taken together with the recent evidence that fish can suffer in other ways, e.g. by experiencing pain ... the results suggest that fish may be worthy of more moral consideration than they have had in the past'. Much of the research on welfare in fish has concluded that such implications should be taken into account for captive farmed fish, and recommendations have been made to include the welfare of fish used in **aquaculture**, many of which are relevant to fish captured for, and displayed in, oceanaria.

A US government-sponsored document (see web site below) noted that fish need to be maintained in a controlled environment, with limitations on stress and that: 'Traumatized animals (including fish) may show signs of abnormal physiological, behavioural, and ecological responses'. Similarly, in 2005, The Canadian Council on Animal Care published

guidelines on the care and use of fish in research, teaching and testing. This document included recommendations for the design of captive environments to meet the physical and behavioural requirements of fish in terms of social groupings and other factors. This document acknowledged that the sociable behaviour of fish can be quite complex, and noted physiological signs of acute stress. However, none of these guidelines or recommendations are legally required or enforceable.

Despite the many scientific recommendations and guidelines, legislation protecting non-mammalian marine wildlife is virtually absent in most countries. In fact, the US Animal Welfare Act, and legislation in some other countries, specifically excludes captive birds, fish and other cold-blooded animals from protection.

See also: Advocacy, Aquaculture, Aquaria, Fishing, Fish Watching, Marine Park (Oceanarium), Ray Tourism, Shark.

Related internet sources

AWIC/USDA Information Resources on Fish Welfare: <http://www.nal.usda.gov/awic/pubs/Fishwelfare/fishwelfare.htm>

Canadian Council on Animal Care Guidelines on the Use of Fish: <http://www.ccac.ca>

Toni Frohoff

West Indies The term West Indies originated with **Christopher Columbus**, who thought that he had discovered the 'Indias' when sailing west. Today's definition of West Indies is that of the **archipelago** of about 7000 **islands** found between North and South America. These islands form an arch from Florida to Venezuela, and stretch for over 2400 km. They establish the border between the **Caribbean Sea** and the **North Atlantic Ocean**. The West Indies are also known as the Antilles, with the Greater Antilles made up by the four larger islands: Cuba, **Hispaniola** (today's Haiti and Dominican Republic), Jamaica and Puerto Rico; and the Lesser Antilles by the rest of the islands. The Lesser Antilles are further divided into the **Leeward Islands** and **Windward Islands**. In some cases, Trinidad and Tobago, Barbados and the islands off the northern coast of Venezuela are considered separate from the rest.

Originally these islands were occupied by three major ethnic groups: the Ciboneys, the Arawaks and the Caribs. Beginning with the conquest and colonization of the islands by Columbus and those who followed in his footsteps, many of the **indigenous peoples** were displaced, died from disease or were killed, thereby reducing the original population of these islands (believed to be in the hundreds of thousands) to just a few thousand in only a few decades. The Spaniards were followed by the British, the French, the Dutch and the Danes.

Each controlling country left behind part of its culture, and therefore the nations of the West Indies have inherited a variety of cultural **heritages**. Europeans thought of the West Indies as the ideal place for cultivating sugarcane and tobacco, among other crops, and brought thousands of Africans to the islands to work on the plantations, which further changed the ethnicity of the island people. Today these islands are inhabited by about 34 million people, mostly of mixed race and/or African descent. After WWII many islands in the region became independent countries, but many others remained politically dependent on European nations.

There is a great diversity of geology among the West Indies islands: some are volcanic, others sedimentary while others are former **coral reefs**. This has generated a great deal of environmental diversity, ranging from rain-forests to xeritic (very dry) habitats. This diversity of **environments**, in turn, hosts a great diversity of fauna and flora.

Because most of these islands lack major rivers or streams their waters tend to be very clear, and many of the **beaches** in the region are considered as being among the best in the world. Boating, **scuba-diving**, **whale and dolphin watching** and **fishing** are major tourist attractions in the area all year-round. Although there are a great variety of vacation **destinations**, the **hurricane** season (1 June–20 November) causes some **seasonal** variation in visitor numbers.

The significance of **tourism** in this area is enormous, not only because of the variety of destinations but also for attractions in terms of activities, from **sailing**, to relaxation, to sporting events, to meetings and conventions.

There is an added value for the region because of the diversity of cultural heritage, including Hispanic, British, French, Dutch and Creole.

The proximity to North America and direct flights from Western Europe also make these destinations ideal for tourists from the developed countries, particularly in the winter time, helping infuse capital into the local economies. Over the last two decades the **cruise industry** has increased the number of **ports** visited, mostly under the 'sun, sand and sea' theme, which is also commonly utilized by many resorts in the region.

Related internet source

West Indies Tourism: <http://travelchannel.igougo.com/planning/destinationHome.asp?LocationID=997>

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Western Indian Ocean Marine Science Association (WIOMSA)

The Western Indian Ocean Marine Science Association, a regional, **non-governmental organization**, promotes educational, scientific and technological development in marine sciences, particularly in the nine member countries (Kenya, Tanzania, Mozambique, South Africa, Comoros, **Madagascar**, Mauritius, **Seychelles** and Réunion (French)). Registered in 1994 and based in Zanzibar, it has a Board of Trustees (President, Treasurer, four members and two co-opted members), as well as Country Coordinators from each of the nine countries (Tanzania has two coordinators, with one each from the mainland and Zanzibar). Through a **Memorandum of Understanding** with the Nairobi Convention, WIOMSA provides support to the UN Regional Seas activity, and it hosts the regional Group of Experts on Marine Protected Areas for the Eastern African region (GEMPA), as well as the Forum of Heads of Academic and Research Institutions (FARI).

Every two years WIOMSA, in collaboration with its partners, organizes regional scientific symposia for the exchange of ideas and realistic examinations of the current state of knowledge of coastal and marine **resources** and their management. From 2000 to 2005, WIOMSA organized and ran ten regional workshops on topics as diverse as **marine protected area** management, application of