Executive Summary

EARTH, THE BLUE PLANET. A full three-quarters of its area lies under water yet we continue to regard it in terms of landmass and territory. Throughout the globe, humans represent the greatest threat to the marine environment, degrading marine ecosystems, and reducing the capacity of estuaries and oceans to thrive.

As a result, approximately three-quarters of marine fisheries are in drastic decline due to fleet modernization, over-subsidization and ineffective management regimes. Mangroves, coastal wetlands and estuaries around the world are being cleared for croplands and urban development. Coral reef bleaching is a worldwide crisis that may be a result of increased water temperatures due to global warming. And, many marine species are now considered threatened or endangered due to overfishing, overhunting, habitat destruction and other factors.

Due to the transboundary nature of the marine realm, solutions to these problems cannot be implemented only at single sites. On the contrary, it is increasingly recognized that ecosystem-based approaches are needed to improve the management of water systems that suffer from the problems mentioned above. Yet, while it is widely believed that ecosystem-based approaches are essential for effective marine conservation, all such approaches must depend first on efforts to define and better understand marine ecosystems.

By classifying marine environments, developing methods for establishing geographic priorities and finally, identifying high-priority conservation areas, this report hopes to serve as an initial step in the direction of greater understanding of the marine realm in the LAC region. It is the third and final component of a larger effort undertaken by the Biodiversity Support Program (BSP), a USAID-funded consortium of World Wildlife Fund, The Nature Conservancy and World Resources Institute. The goal of this effort has been to identify high-priority conservation areas in Latin America and the Caribbean. The first priority-setting workshop took place in 1994 and focused on terrestrial ecoregions (*A regional analysis of geographic priorities for biodiversity conservation in Latin America and the Caribbean*, BSP et al., 1995). Participants at that workshop recognized the urgent need to adapt the priority-setting framework they used to aquatic freshwater and marine systems. Responding to this need, USAID provided BSP with funding to carry out priority-setting exercises for freshwater and

marine habitats. The results of the freshwater analysis, undertaken by World Wildlife Fund and Wetlands International, were published in 1998 (*Freshwater biodiversity of Latin America and the Caribbean: A conservation assessment*, Olson et al., 1998).

Methods

This study comprises two parts. The primary study (detailed in chapters I and II), was supported by BSP and USAID and consisted of the following steps:

1) delineating coastal biogeographic provinces
2) delineating coastal biogeographic regions (also called here as marine ecoregions)
3) ranking ecoregions within provinces.

Delineation of Coastal Biogeographic Provinces

To distinguish provinces a number of biological, physical, and geographic characteristics had to be considered, including the features of the continental shelf and ocean currents, the water temperature regime, and the occurrence of upwellings.

Nine provinces were thus delineated along the Atlantic and Pacific coasts of Latin America and the wider Caribbean, including south Florida, the Gulf of Mexico, and the Bahamas (see Figure 1 and Appendix A-2). The provinces and ecoregions are described in detail in Chapter 1.

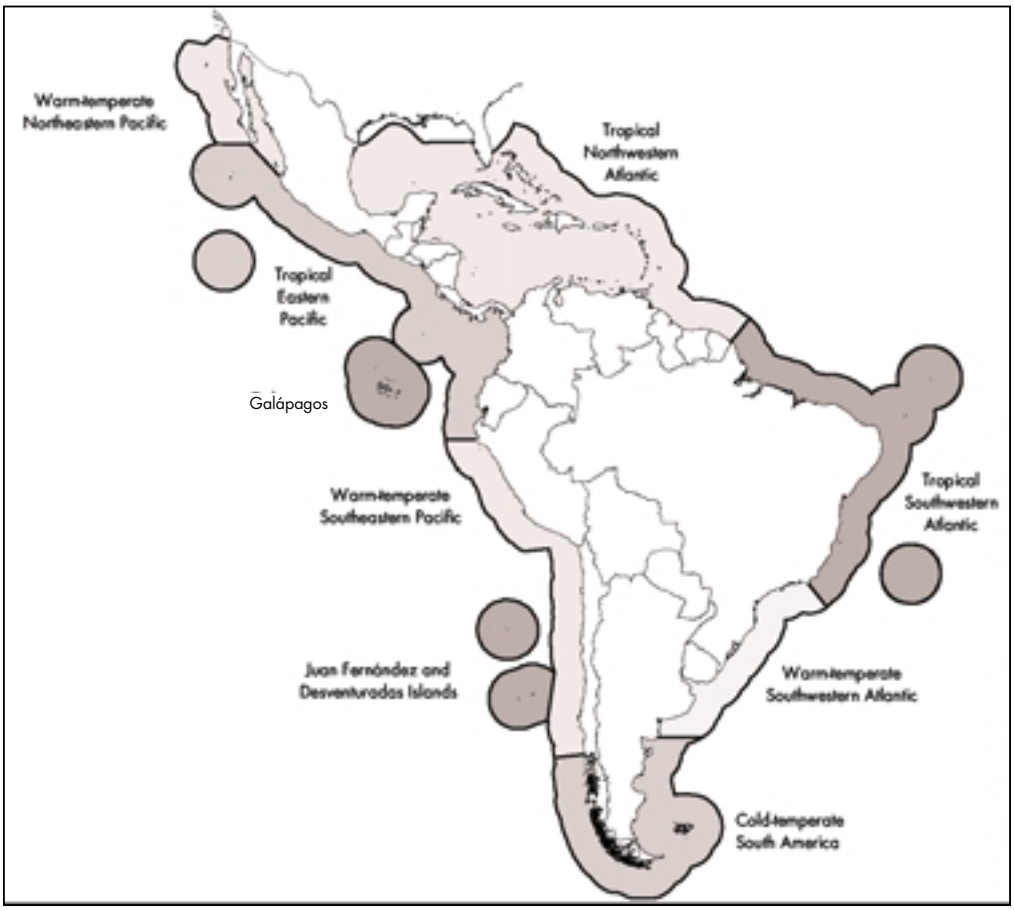

Figure 1 - Coastal Biogeographic Provinces of Latin America and the wider Caribbean

Figure 2 - Coastal Biogeographic Regions (or Marine Ecoregions)

Delineation of Marine Ecoregions

Each large province consists of smaller geographic units called Coastal Biogeographic Regions, or simply Marine Ecoregions. These were defined and delineated according to patterns of ocean circulation, coastal geomorphology, and distribution of major faunal populations (see Figure 2 and Appendix A-3).

Ranking Ecoregions Within Provinces

The study involved ranking ecoregions within each province according to biological value and conservation status. There is no basis for the comparison of ecoregions across provinces as these are very distinct from one another. For example, there is little basis for comparison between an ecoregion in the Warm-temperate Southeastern Pacific and one in the Tropical Northwestern Atlantic.

To establish priorities, four main tasks were carried out.

- Project Design: Indicators were selected as direct and indirect measures of biological value and conservation status. Reviews of the credibility of these parameters as measures of biodiversity, resource abundance, or changes in natural systems were performed.

- Information Compilation: Information specific to ecoregions was compiled from library research, scientists, local naturalists, and technical data sources.

- Expert Assessment: The collected information was evaluated and ecoregions were ranked for biological value

and conservation status. The institutional capacity and political commitment to marine resource conservation of each country within the project area were examined, but not used in the ranking of ecoregions.

- Review and Ranking: A workshop was held in Miami from September 11 to 15, 1996. Regional experts and project personnel reviewed the compiled information and decided on which indicators should be used for ranking within each province. The ranking process and criteria were examined to determine the scientific validity of establishing geographic priorities. Indicators of biological value and conservation status were ranked as low (L), medium (M) and high (H), with assigned numerical values (1, 2, and 3 points respectively). Ranks for each indicator in each ecoregion were generated after examining the range of scores across all ecoregions within the province. When quantitative data of important indicators were not available, ranks were produced after a qualitative assessment based on the experts' best knowledge. Overall ranking for biological value/conservation status was obtained by a simple sum of all ranked values. Experts held that this method provided reasonable and scientifically supported results, therefore no attempt was made to use discriminated weighting or grouped indicators. A matrix created by cross-referencing biological value and conservation status made it possible to develop a list of priorities.

Results

No attempt was made to rank ecoregions within the Galápagos, and Juan Fernán-

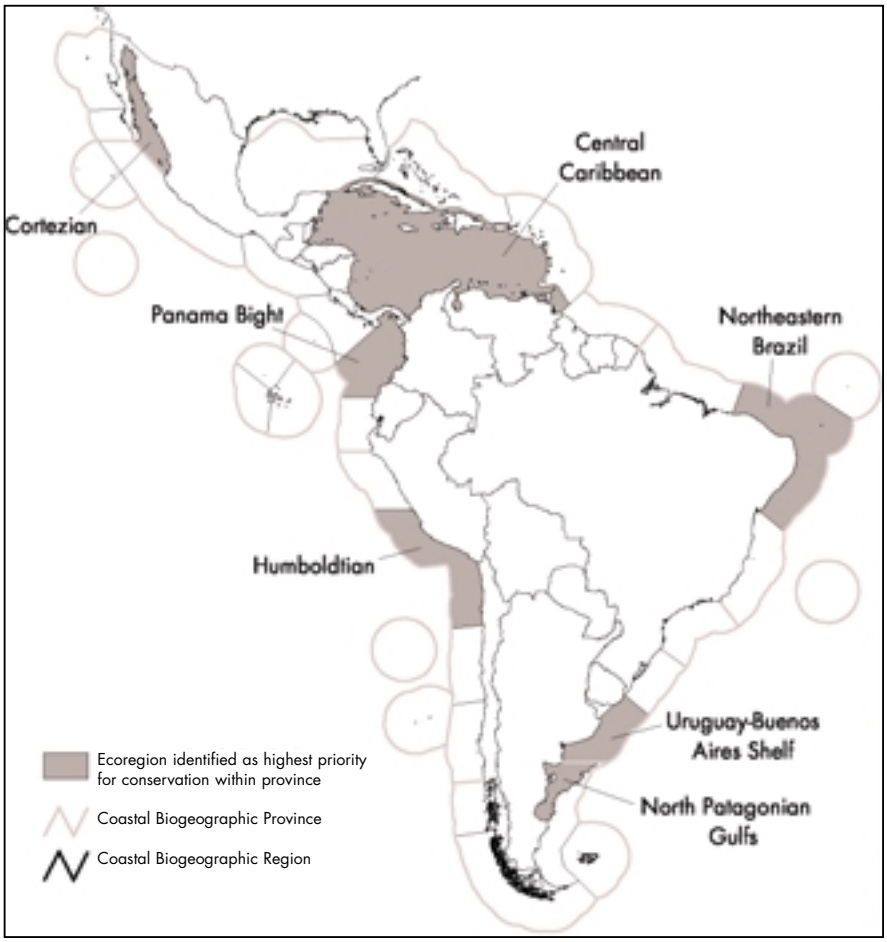

Figure 3 - Coastal Biogeographic Regions (or Marine Ecoregions) designated as highest priority for conservation within each Coastal Biogeographic Province

dez and Desventuradas provinces, due both to lack of information and the small size of the provinces. For the other seven provinces, the priority ecoregions are as shown (see Figure 3 and Appendix A-4).

- **Warm-temperate Northeastern Pacific province**: The Cortezian ecoregion. The ranking indicates the unusual setting of the Gulf of California and its vulnerability, as an enclosed sea, to over-exploitation and land-based sources of pollution.

- **Tropical Eastern Pacific province**: The Panama Bight ecoregion. This ecoregion includes unique coastal communities such as mangroves and coral reefs, several highly productive rivers and estuaries, breeding sites for marine mammals, and an abundance of commercially important fish and crustaceans.

- **Warm-temperate Southeastern Pacific province**: The Humboldtian ecoregion. This ecoregion includes abundant populations of fish, seabirds, and marine mammals. It also has numerous conservation problems, including coastal pollution and over-fishing. Marine pollution from fish processing plants is a real threat to both the Peruvian and Chilean portions of the ecoregion.

- **Cold-temperate South America province**: The North Patagonian Gulfs ecoregion. Numerous seabird colonies and abundant fishery resources give the ecoregion a high value for biodiversity and production. The high conservation status score is due mostly to threats such as over-harvesting of mollusk and crustacean populations, numerous ports and oil facilities, and high tourist visitation.

- **Warm-temperate Southwestern Atlantic province:** The Uruguay-Buenos Aires Shelf ecoregion. The Uruguay-Buenos Aires Shelf is a wide platform with high biological productivity, abundant populations of finfish, and numerous colonies of marine mammals and seabirds that feed upon those fish. However, pollution generated from industries and oil facilities, together with the exploitation of coastal mollusks, coastal development, and intensive tourism, have combined to assign this ecoregion the highest rank with regard to conservation concerns.

- **Tropical Southwestern Atlantic province:** The Northeastern Brazil ecoregion. This ecoregion has large numbers of nesting sites and nursery grounds for sea turtles, along with abundant fish and seabird populations. The presence of coral reefs also adds to the ecoregion's conservation value.

- **Tropical Northwestern Atlantic province**: The Central Caribbean ecoregion. The coastlines of this ecoregion are diverse, including large river deltas and estuaries, mangrove forests, complex bays and coastal lagoons, and upwelling areas. A series of coral atolls is located along the western extent of the ecoregion. The ecoregion also has high coastal population densities, a long history of human use of marine resources, and significant land-based sources of pollution associated with oil extraction, port development, and agriculture.

These high-priority ecoregions are discussed in more detail in Chapter 2.

Central Caribbean Marine Ecoregion Case Study

High-priority ecoregions are still generally too large to provide useful guidance to donors and policymakers about investing in specific areas. Consequently, the authors conducted a separate case study to delineate, assess and rank the "coastal systems" that comprise the Central Caribbean ecoregion of the Tropical Northwestern Atlantic province. This

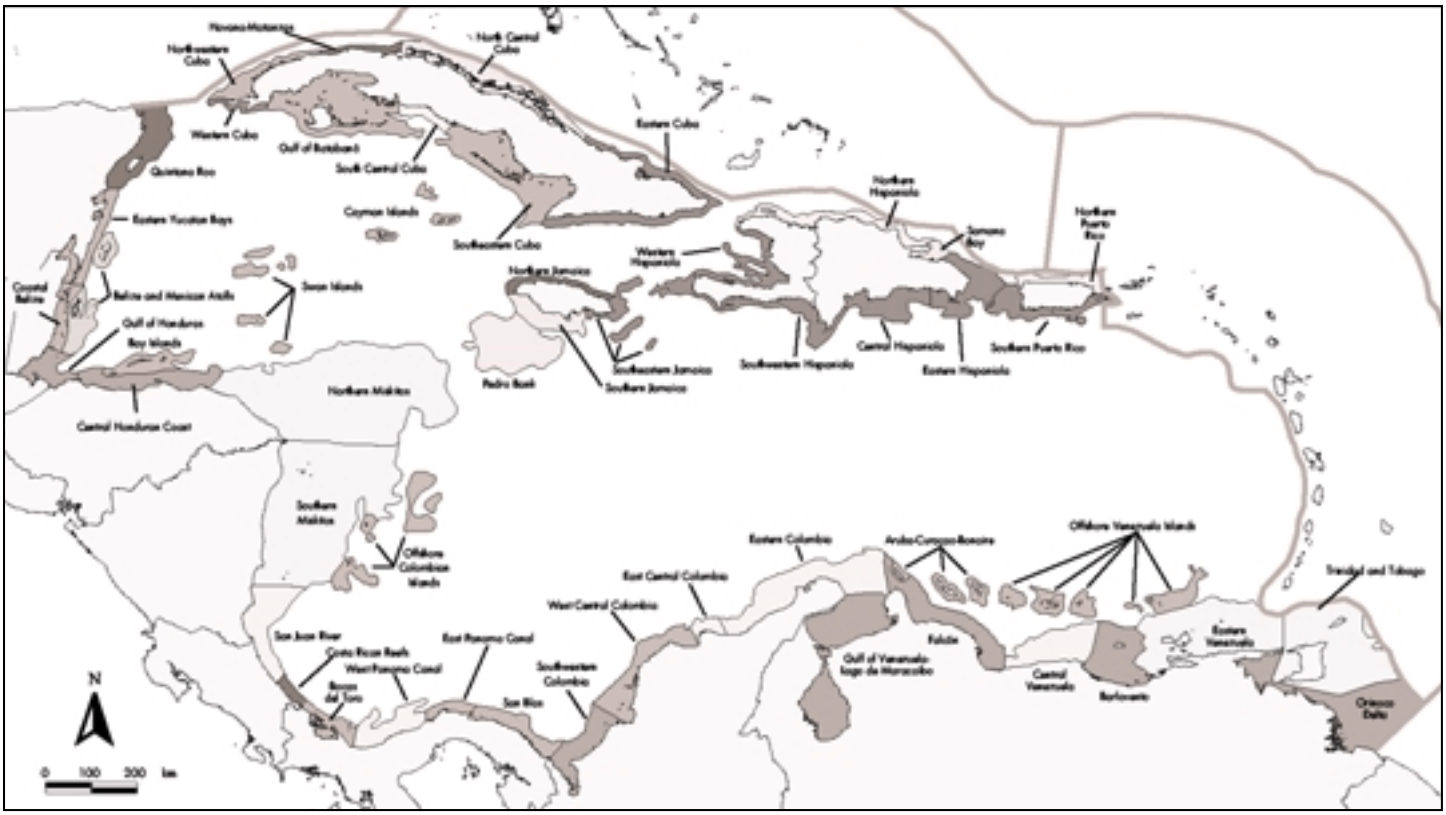

Figure 4 - Coastal Systems of the Central Caribbean Coastal Biogeographic Region (or Marine Ecoregion)

case study was supported by The Nature Conservancy and the University of Miami but due to lack of additional funds, it was not possible to apply this level of analysis to other ecoregions.

This case study (detailed in Chapter 3) created a framework to identify and rank smaller "Coastal Systems" (see Figures 4 and 5 and Appendices A-13 and A-14) based on conservation targets such as natural communities and their geographic location relative to ocean currents. This more detailed process is intended to identify specific sites for marine conservation action and coastal stewardship programs.

The process of setting priorities within ecoregions was carried out in three steps. First, a further classification delineated smaller segments of the coastal shelf. These units, called coastal systems, were defined in terms of coastal morphology, hydrology, geology, and dominant biological features, on a scale that was practical for the collection of information.

The Central Caribbean ecoregion was segmented into 51 coastal systems that extend from coastal wetlands (mangroves) outward to the 1,000-m depth contour (see Figure 4 and Appendices A-13 and A-14). Coastal systems varied in size from a few thousand square kilometers in the Samana Bay to more than 28,000 km^2 in the Orinoco River Delta. The coastal systems are described in Appendix B.

The 51 coastal systems can be grouped into seven types:
- reef-dominated
- seagrass-dominated
- mangrove-dominated
- mixed seagrass-mangrove-reef dominated
- rocky platform dominated
- beach/sand-bottom dominated
- upwelling dominated.

After this process of classification, the second step in the priority setting exercise was to use "scorecard" criteria to evaluate biological value and conservation status of the coastal systems. The process drew less on quantitative data (which did not exist for the scale of coastal systems), and more on expert opinion regarding the diversity and status of the smaller coastal systems. The objective was to identify and locate the "best" reef systems or mangrove forest systems.

The final portfolio of priority coastal systems targeted for conservation action should include the best (or least disturbed) examples of each type of coastal system with some geographic distribution in upstream to downstream positions in the ecoregion. The third step—a review of the feasibility of investing in a particular site—was added to select 25 of the 51 coastal systems as priority sites (see Figure 5 and Appendix A-14).

In each of these 25 coastal systems, conservation of the region's coastal biological diversity should be a critical priority. Some part of the coastal system needs to be in a marine protected area or marine reserve. The hydrological processes linking land and sea need to be intact and coastal habitats and shorelines need to be protected.

Unfortunately, there are many coastal systems of spectacular natural beauty and biological diversity that are already severely impacted by land-based sources of pollution, loss of coastal habitats, and over-harvesting. Based on this method of priority setting, these are not good candidate sites for conservation action.

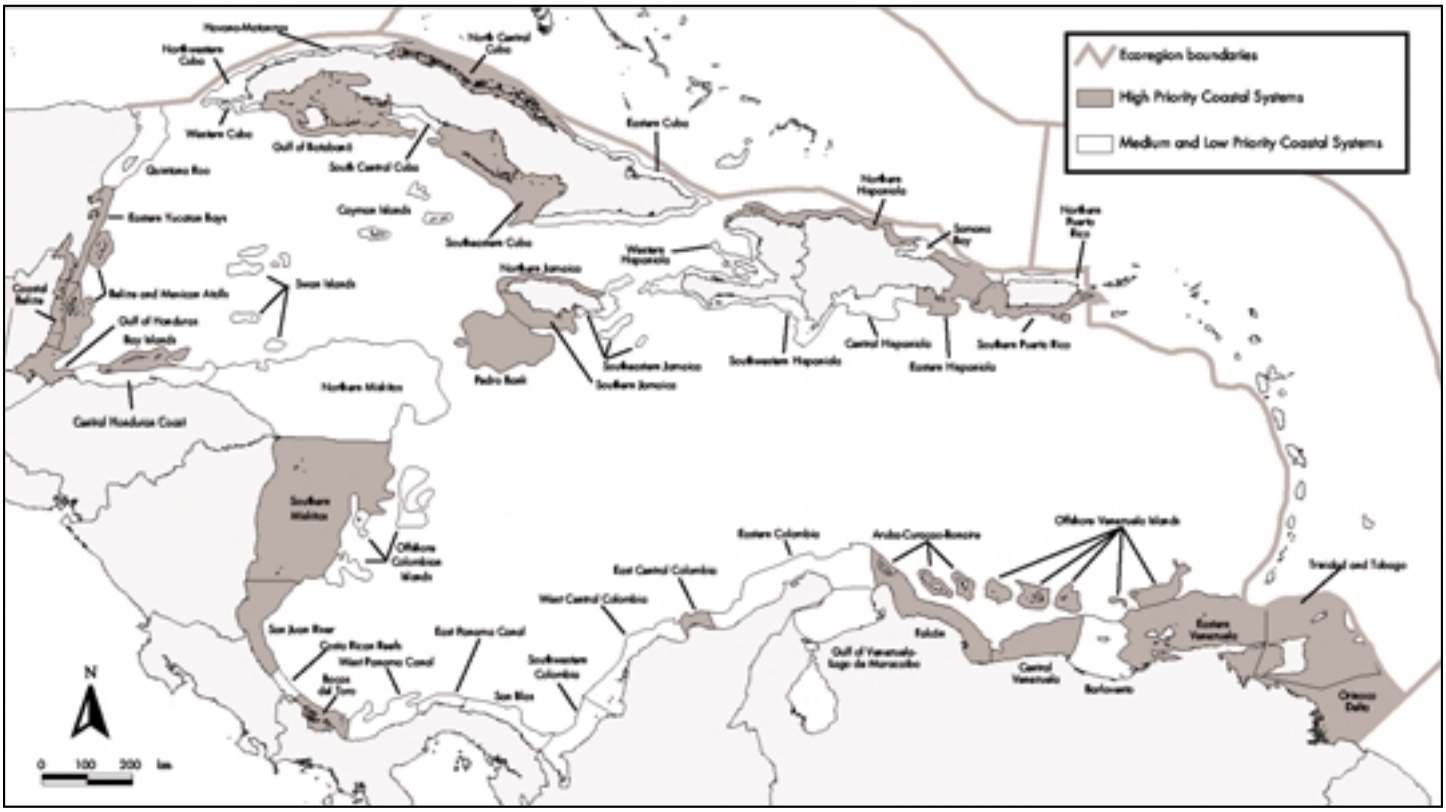

Figure 5 - High Priority Coastal Systems of the Central Caribbean Marine Ecoregion

Conclusions and Recommendations

Once geographic priorities have been established, practitioners and policy makers can develop strategies for marine conservation that aim to keep coastal environments intact and functioning. These may include

- The preservation of natural hydrological and hydrochemical linkages between rivers, streams, and terrestrial run-off to the coastal environment.
- The protection of natural links between land and sea (such as coastal wetlands) to help preserve coastal ecology and productivity.
- The selection and design of "cornerstone sites" (parks, protected areas, or sanctuaries) that are important for productivity, ecological processes, or natural community composition.
- The promotion of grass-roots programs in coastal communities to assume stewardship and protection of sustainable marine resource use.
- The development of methods needed to transfer information to local communities for coastal development, sustainable harvesting, and preservation of the quality of life associated with living at the ocean's edge.

The preservation or restoration of linkages, the selection of special conservation sites, and effective stewardship action all depend on sound scientific information. We hope that this report serves as an initial step in the provision of this information. Conservation donors can then use such analyses to strategically target their investments so that the greatest conservation good is achieved.

List of marine provinces and ecoregions in Latin America and the wider Caribbean

Warm-temperate Northeastern Pacific Province
Mexican Temperate Pacific
Magdalena Transition
Cortezian*

Tropical Eastern Pacific Province
Clipperton & Revillagigedo Islands
Mexican Tropical Pacific
Chiapas-Nicaragua
Cocos Islands
Panama Bight*
Nicoya
Guayaquil

Galápagos Islands Province
Northern Galápagos Islands
Eastern Galápagos Islands
Western Galápagos Islands

Warm-temperate Southeastern Pacific Province
Central Peru
Humboldtian*
Central Chile
Araucanian

Cold-temperate South America Province
Chiloense
Channels & Fjords of Southern Chile
Malvinas/Falklands
Patagonian Shelf
North Patagonian Gulfs*

Warm-temperate Southwestern Atlantic Province
Uruguay-Buenos Aires Shelf*
Río de la Plata
Rio Grande
Southeastern Brazil

Tropical Southwestern Atlantic Province
Eastern Brazil
Trindade and Martin Vaz Islands
Northeastern Brazil*
São Pedro and São Pablo Islands
Amazonian

Juan Fernández and Desventuradas Province
Juan Fernández & Desventuradas Islands

Tropical Northwestern Atlantic Province
Guianan
Lesser Antilles
Bahamian
Central Caribbean*
South Florida
Gulf of Mexico

* denotes high priority ecoregions