Charles Darwin, Galapagos and Evolution

When Darwin arrived in the Galapagos Islands almost a hundred and eighty years ago, little did he realise that he would stumble upon life forms that would ultimately lead him to propound his theory of natural selection in evolution.

The Galapagos Islands are an archipelago volcanic islands distributed around the equator in the Pacific Ocean, about 600 miles West Coast of South America. The islands have given birth to and seen the death of many species of flora and fauna.

The islands became famous around the world after the survey ship HMS Beagle, arrived in Galapagos in 1835 with the naturalist Charles Darwin. These islands were declared a National Park in 1959. It is a UNESCO World Heritage site. Galapagos in Spanish means tortoise. There are giant tortoises on these islands.

The islands consist of a vast number of endemic and endangered flora and fauna. Fur seal, Rice rat, Sea lion like mammals, land and marine Iguanas, Tortoise, Lava lizard, Flat-tailed lizard-like reptiles, Blue-footed boobies, Albatross, Penguin-like birds, Hammerhead shark, Bat fish, Galapagos damsel-like fishes, Scorpion spider and Carpenter bee-like arthropods are worth mentioning. These islands are considered a “Living Museum”.

The islands are thought to have formed about 19 million years ago by the creation of volcanoes due to the melting of Earth’s crust from below by the mantle of the plume. The islands are named in Spanish and English languages.

Baltra is considered as the land of the Iguana, Bartolome is one of the younger islands where the smallest species of Penguin are found. Fernandina

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is the youngest island where hundreds of marine Iguanas gather on the black lava rocks, besides flightless Cormorants. In Floreana, Galapagos petrel, the seabird, is found which spends most of its life away from land. Green turtles and flamingos are also seen.

Genovesa is nick-named as the bird island or bird watchers’ paradise. The only nocturnal species of gull in the world, the swallow-tailed gulls and frigate birds, are present on this island. Isabela is the largest island where marine Iguana, Sally lightfoot-crabs, penguins and cormorants are present. Marchena is the home for the Lava lizard, an endemic species, besides hawks and sea-lions.

North Seymour is the home for blue-footed boobies and swallow-tailed gulls. Pinta is the land of Pinta tortoise. Rabida is a bird watchers’ delight. Nine of the fifteen species of finches have been reported in this island. South Plaza Island is where the largest sea-lion colonies are seen. San Cristobal has the largest fresh water lake. Giant tortoises, blue and red-footed boobies are common in this island.

In Santa Cruz are located the Charles Darwin Research Station and the headquarters of the Galapagos National Park. San Fe is a forest of Opuntia cactus. Land-Iguana, sea-gulls and tropic birds are common here. Santiago is the home for large varieties of invertebrate animals. Darwin finches and fur-seal are common here. Vampire finch is the famous resident of the island.

However, the Galapagos archipelago is characterized by a paucity of animal life. Amphibians are completely absent. In the animal kingdom there is only one marine lizard, the marine Iguana, and it is living here only. There are about 80 species of birds. The bulk of land birds are finches. The mammals are represented by only seven species of rodents and two species of bats. There are about 700 species of insects.

These islands are also of interest because of the high percentage of endemic forms. Besides, the terrestrial vertebrates show a striking lack of fear of land predators and man. Though the islands are situated on the equator, species of Antarctic origin such as Penguins and Fur seals also live on these islands.

The most celebrated visitor to the Galapagos Islands was undoubtedly the young Charles Darwin in 1835 on board HMS Beagle. The ship was homeward bound after spending three years charting the coast of South America from Rio Plata to Chiloe in Southern Chile. In his travels ashore on the Pampas of Argentina and in Cordilleras of the Andes, Darwin collected animals and fossils and studied the geology.

In September 1835, the Beagle arrived in the Galapagos Islands. Darwin landed on the San Cristobal Island. He was not much impressed by the island’s appearance at first sight. On 24th September, when the Beagle moved on to Floreana, he met the giant tortoise. The next day he visited Isabela and Pinta where Darwin first saw the land Iguana. On 8th October, he visited Santiago where he saw many tortoises and collected varieties of birds. HMS Beagle had spent just five weeks in Galapagos waters, but Darwin’s presence on board ensured that Galapagos would occupy a special place in the history of science.

Darwin’s innate qualities of enquiring critically with an open mind into every one of his observations had given rise to doubts in his mind about
the correctness of the view of creation held at that time by most scientists as well as the church. In Galapagos, Darwin found a remarkable population of plants, birds and reptiles that had developed in isolation from the mainland, but often differed on almost identical islands and whose characteristics he could explain by a gradual transformation of the various species.

Back home, Darwin handed over his fossil collections to his mentor John Stevens Henslow at Cambridge. Richard Owen also helped Darwin in identifying the fossils and most of them represented species not yet familiar to experts.

During his second voyage to Galapagos, a group of fifteen species of passerine birds were collected by Darwin. These birds are found only in Galapagos Islands. These birds are named by Percy Lowe as Darwin finches. The largest is the vegetarian finch and the smallest are warbler finches. They show differences in the size and shape of their beaks which are adapted to different food sources. They are grouped into Ground finches, Cactus ground finches, Vegetarian tree finches, Insectivoros finches, Wood pecker finches and Warbler finches.

Darwin finches of Galapagos Islands more resemble the birds of the neighbouring continent, North America, than the birds of distant islands or continents. Hence, it is believed that North American finches were ancestors of Darwin finches. The ancestral birds migrated to Galapagos Islands in the past.

The Galapagos archipelago was an oceanic island; it was free from enemies with a variety of ecological niches. All these islands are separated from one another by the ocean water. Hence the ancestral population on each island was sufficiently isolated from other such populations.

The ancestors of finches reaching there made themselves comfortable in the different islands. The islands differ from each other in many features of the environment and in the food plants available. As a result each island population developed its own adaptation in its particular island condition. These adaptations included genetical, morphological, and behavioural changes. As these adaptations were different from one island to the other, the different populations did not interbreed when they came into contact with each other. In the absence of interbreeding, each population would be considered as a separate species. Another remarkable feature of Darwin finches is the existence of a number of subspecies.

These finches laid the seed in the minds of Darwin for the germination of the Natural Selection theory in evolution. These finches show adaptive radiation and form clear evidences for evolution. They also show that isolation brings about evolution and the origin of species.

During his second voyage, Darwin observed the differences in tortoises of San Cristobal and Santiago islands. In Floreana he did not observe any tortoise as the tortoise subspecies was nearly extinct. On islands with humid highlands, the tortoises are larger with domed shells and short necks; on islands with dry lowlands, the tortoises are smaller with saddle-back shells and long necks. Darwin’s views on the mutability of species were rested in his notebooks: “Animals on separate islands ought to become different if kept long enough apart with slightly differing circumstances”.

During Darwin’s time it was believed that God created species independently and had chosen to place them, almost arbitrarily, in their particular locales – kangaroos in Australia, giraffes and Zebras in Africa, Rheas, Sloths and Armadillos in South America – extinct and living forms clustered closely in space and time. The clustering in time and space thus hinted that each group had descended with modifications from common ancestors.

The data Darwin collected in Galapagos was important in shaking faith in the orthodox view persuading him that evolution was a reality. Alluding to the Galapagos species differing island by island, he said that species gradually become modified by transmutation. How did this transmutation occur?

In 1838, in England, the Industrial Revolution had made rich the owners of production, not the workers. In increasingly crowded cities, ordinary
people struggled for their daily existence. It was under such circumstances that Darwin, coming back from his voyage on the Beagle and trying to understand the forces that drove the origin of new species, read the works of Thomas Malthus, a social economist.

Malthus believed that unless people expressed restraint in the number of children they had, the inevitable shortfall of food in the face of spiralling population growth would doom mankind to a ceaseless struggle for existence. Out of that battle some would survive and many would not, as famine, disease and war put a ceiling on the growth in population.

This idea galvanized Darwin’s thinking about the struggle for survival in the wild where restraint is unknown. Darwin could apply these ideas to populations of all species and came up with the idea of “survival of the fittest”. Malthus’s idea seemed to support all observations Darwin had done on Galapagos finches and their beak adaptation. Only individual species that had favorable adaptations would survive long enough to pass those traits to their offspring. This is the cornerstone of “natural selection”.

These clues from Galapagos Islands led Darwin to conclude that Earth’s living diversity had arisen by an organic process of descent with modification – evolution as it is now known and that natural selection is the mechanism.

In 1858, Darwin received a draft of an essay from a British Naturalist named Alfred Wallace. He was collecting biological specimens in Southeast Asia for sale to museums and private collectors. Darwin was surprised to read that Wallace had come upon the same explanation for evolution. Darwin gave due credit to Wallace for the natural selection theory during the debates over its validity at a meeting of the British Association for the Advancement of Science in Oxford.

In 1859, Darwin finally published his theory of evolution for the public in a 490-page book entitled *On the Origin of Species*. It was this book that convinced most scientists and other educated people in the late 19th century that life forms do change through time.

The endemic fauna of Galapagos are of the greatest conservation interest because their future depends entirely on their continued existence in the islands. Galapagos fauna like giant tortoise, land Iguana, penguins, flightless cormorant and many others are considered jewels of the archipelago.

The Galapagos National Park and the Charles Darwin Foundation provide an up-to-date assessment of the status of each species for use by conservationists. Habitat loss, invasive species, predators and vectors, global weather, ocean pollution and human activities are considered the principal reasons for extinction of the island species. While the GNP does most of the field work, the CDF provides research information and scientific advice.

The Galapagos Islands are unique in the incredible variety of creatures that live there. The interactions between each other are very evident in the biological interrelationships that have been going on without interruption for centuries. By studying how these species interact on the Galapagos Islands, one can better understand how other species all over the world evolved.

Dr. K. Venkataraman is retired Reader and Head, Madura College (Autonomous), A–T–2 Porkudam Apartments, Bypass Road, Madurai-625016; Email: durai1941@hotmail.com