The Amazing Galapagos

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VW122014

The Galapagos Islands

Known as the "Enchanted Islands", the Galapagos is noted for its amazing geological history , animal & plant life. The place was made famous by Charles Darwin's visit in 1835 which inspired him to later published "On the origin of Species" explaining to the world his principle on Evolution by natural selection. The Galapagos has been a UNESCO World Heritage Site since 1978 & a World Biosphere Reserve in 1985. In 2007 the organization declared the islands environment endangered due to increased tourism & the introduction of invasive species like dogs, cats, rats, pigs & *goats. Fortunately this status was removed on Feb 2012 after implementing stringent regulations to manage the environment

* Goat Eradication Project cull over 500,000animal in 2000

Galapagos Tourism & population

215,691 tourists including us visited the island in 2014 (+6%)

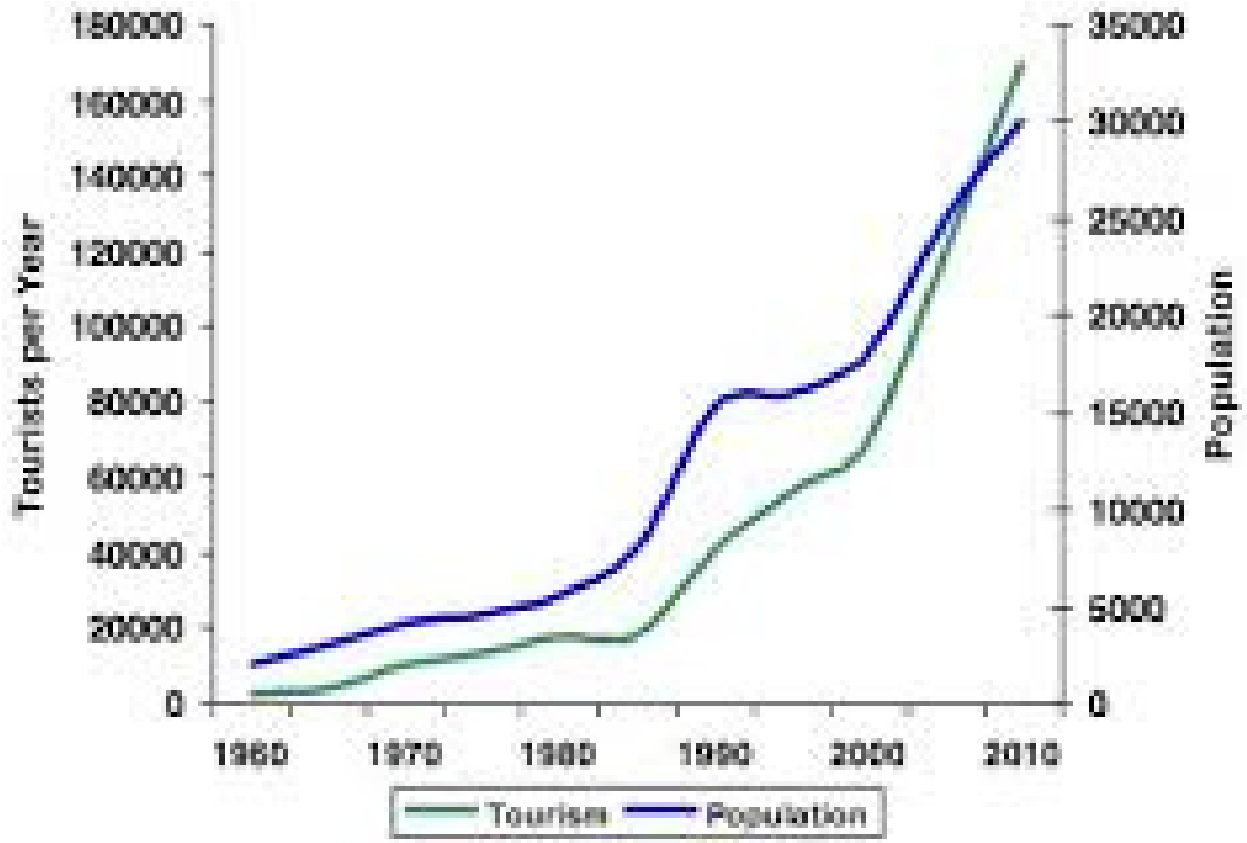
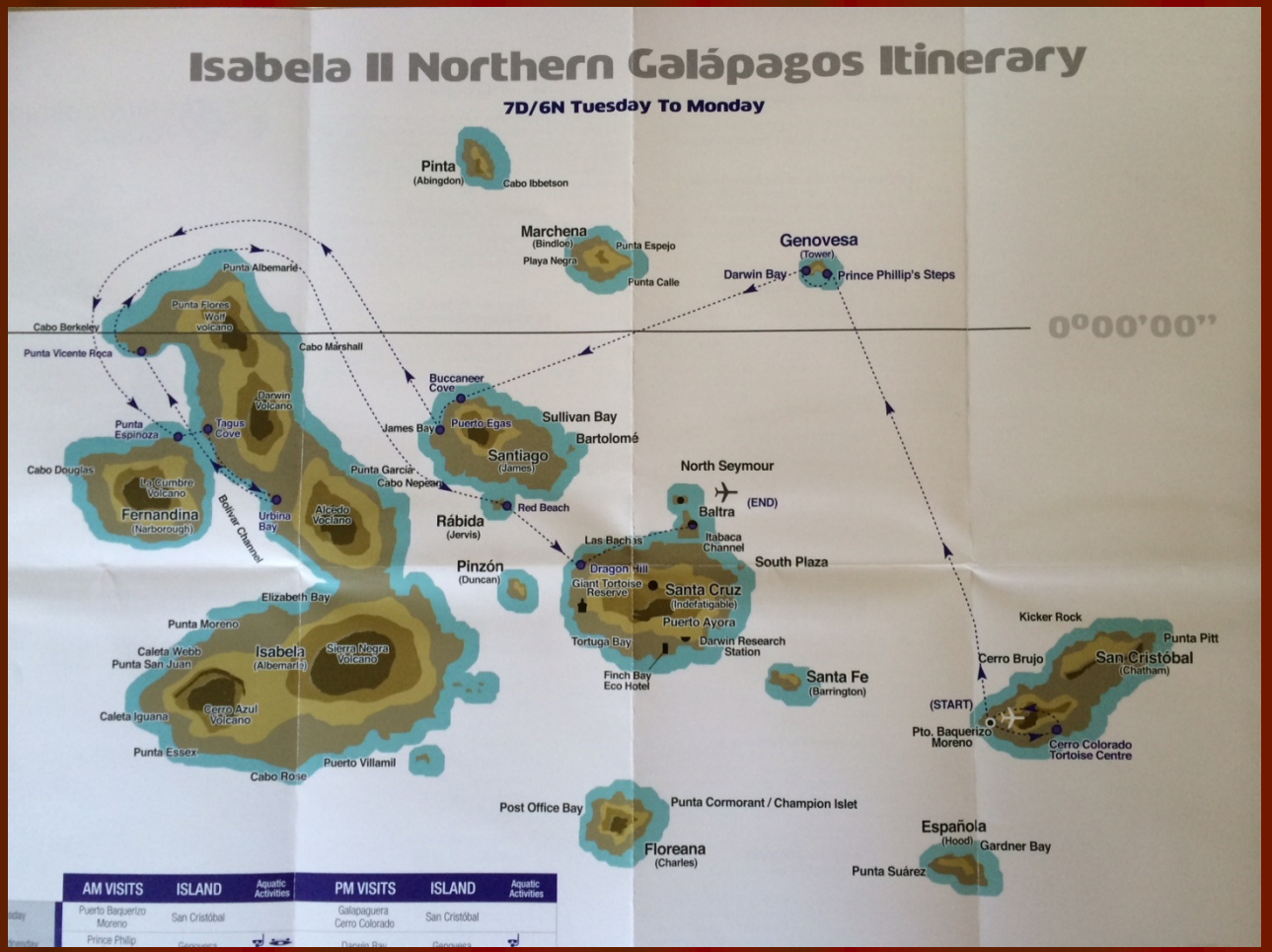


Fig. 1 Galapagos Tourism and Population Trends

Our voyage onboard Isabela II in December 2014



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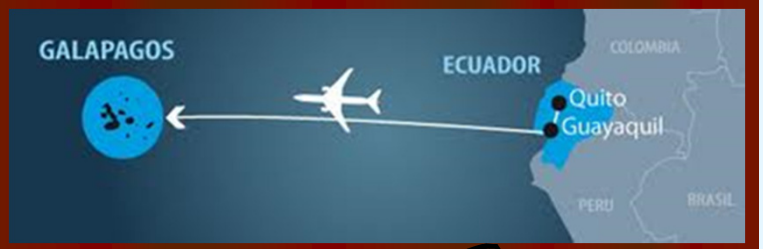
Geography

The Galapagos is a volcanic archipelago totaling 8,000 sq km composing of 13 major islands, 6 small islands & 100 islets located in the Pacific Ocean on both sides of the equator some 1,000 kms west of the Republic of Ecuador



Brief History

- First discovered in 1535 by Fray Tomas de Berlanga, the 4th Bishop of Panama which he described as "Las Encantadas" meaning the "Bewitched Ones"
- Occupied by English buccaneers in the 16th century
- Replaced by whalers & sealers in the 1790s
- First settler Irish seaman Patrick Watkins in 1807
- Annexed by the Ecuador government in 1831
- Islands made famous after Charles Darwin's Voyage of the Beagle in 1835
- 1892 : officially named Archipelago de Colon in honor of Christopher Columbus

- 2nd World War US built runway in Baltra for the defense of the Panama Canal
- 1959 : 97.5% of the total land area is designated a National Park & managed by the Galapagos National Park Service & the Charles Darwin Research Station
- 1978 : became a UNESCO World Heritage Site
- 1985 : became a World Biosphere Reserve
- 1994 : 133,000 km2 of ocean around the archipelago was declared a Marine Reserve

Parque Nacional
GALÁPAGOS
Ecuador

PARQUE NACIONAL
RESERVA MARINA
GALAPAGOS

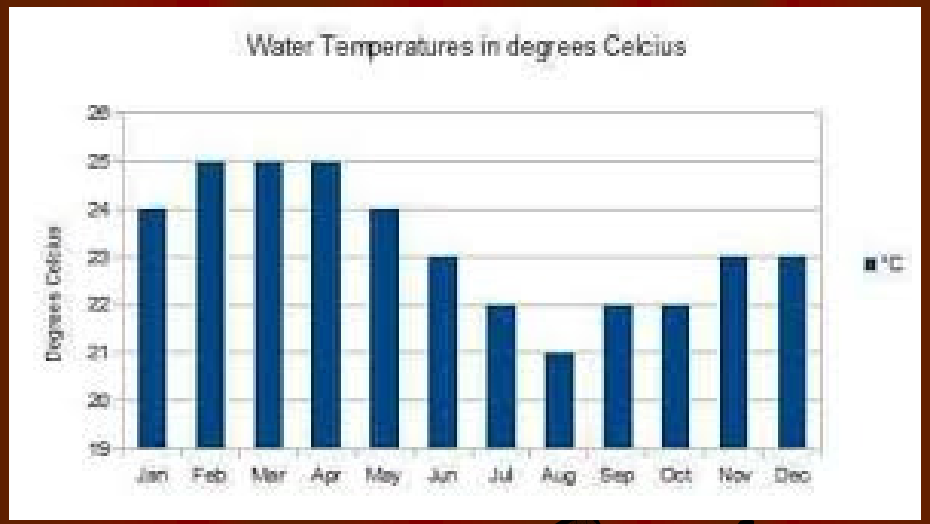
Current Status

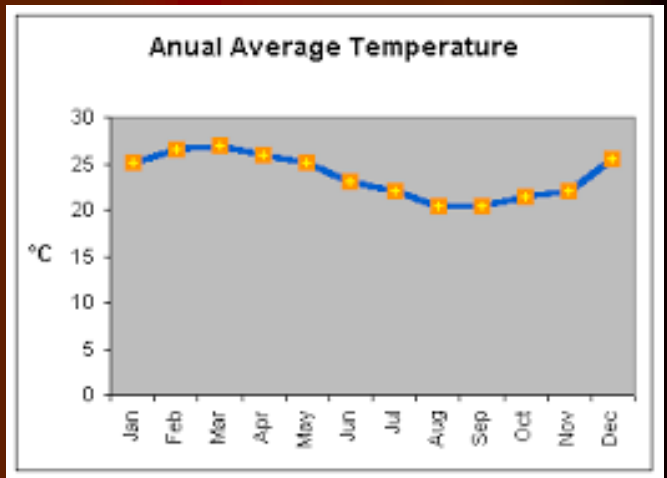
- Political Status : an administrative division of the Republic of Ecuador
- Capital : Puerto Baquerizo Moreno on San Cristobal Island
- Official Language : Spanish
- Population : 30,000 living in 5 islands (Baltra, Floreana, Isabella, San Cristobel, Santa Cruz)
- Economy : mainly supported by tourism
- Currency : national currency abolished now using US Dollar

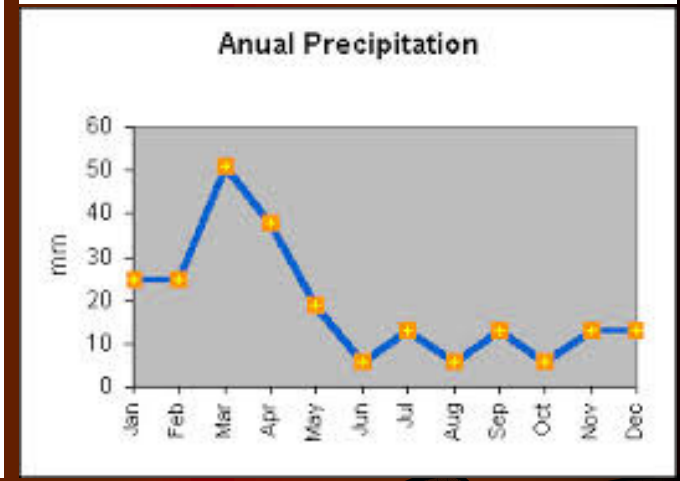
Climate

Subtropical with 2 primary seasons, Rainy (January to May) & Dry or Garua (June to December)

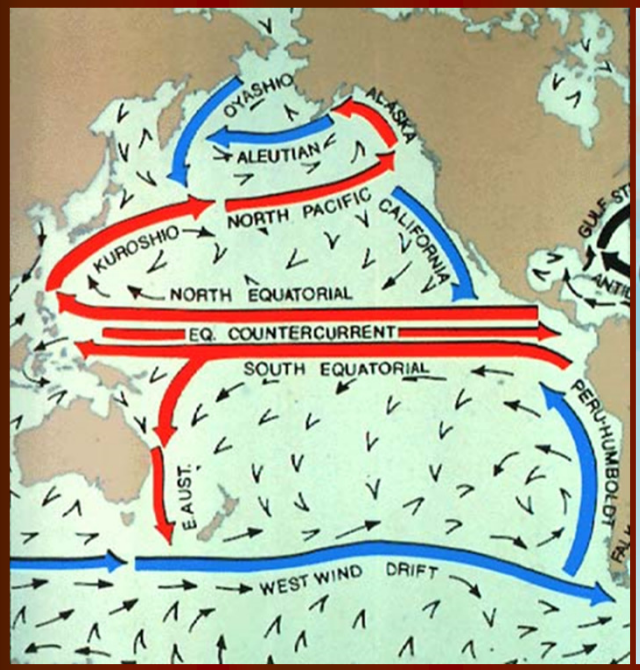
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ave. max	30	30	31	31	26	26	26	26	26	27	28	29
ave. min	22	24	24	24	22	21	19	19	19	20	21	22
ave. rain mm	20	40	30	20	-	-	-	-	-	-	-	-

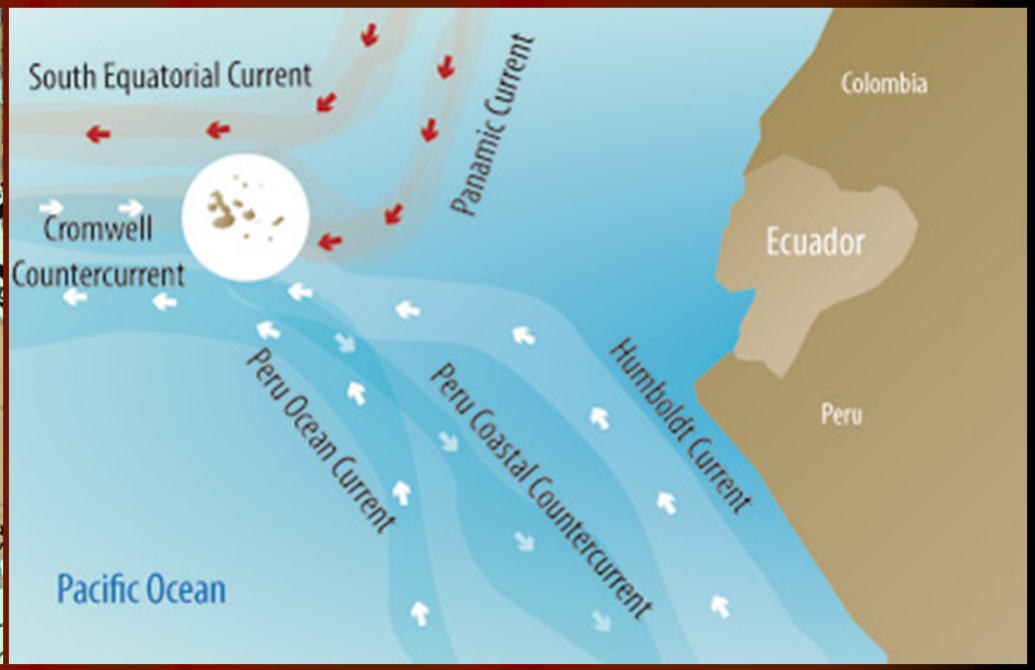




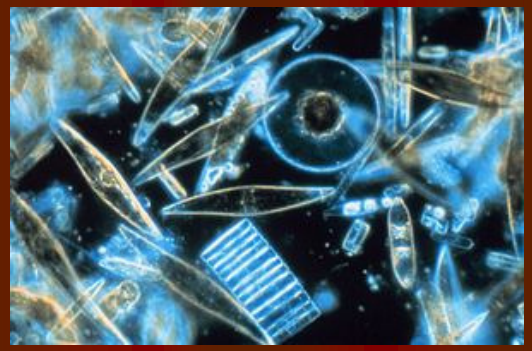


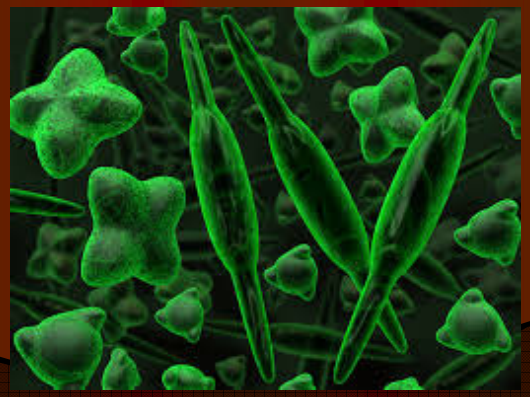
- Although located on the Equator, the temperature rarely rises above 26C due to the influence of the cold Humboldt Current (Peru Current) travelling north from Antarctica. However there is quite a difference in local weather condition with changes in elevation - hot & dry on the low lying parts & cold & humid in the hilly parts. Also the surface temperature of black lava can sometimes reach as high as 50C !



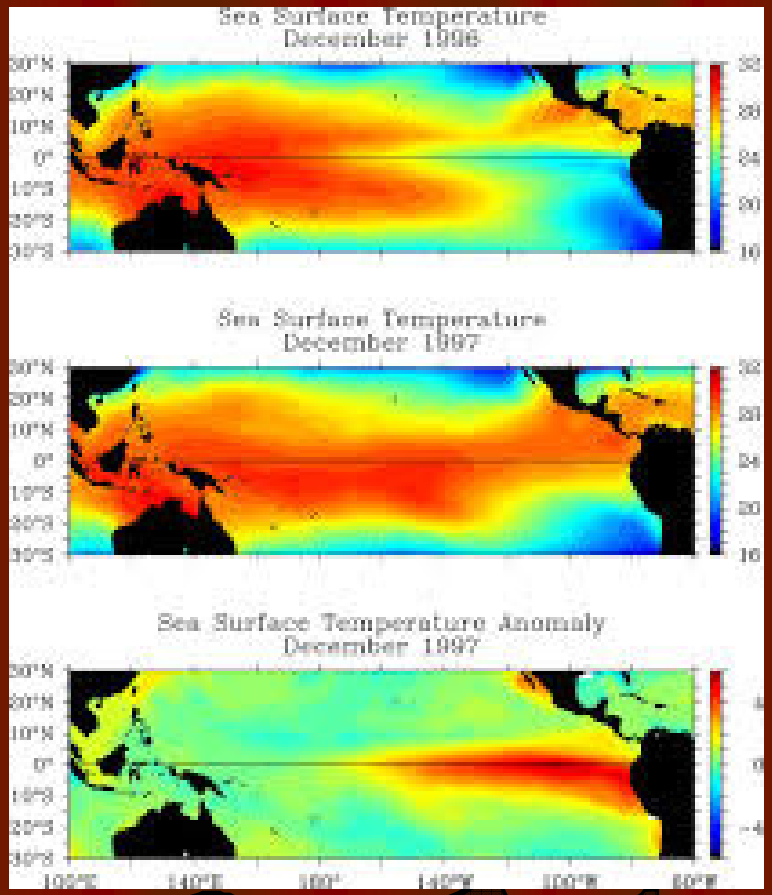


The Humboldt Current is the largest upwelling system and the most productive Marine Eco System in the world. It occurs year round but is most pronounced between July & November. This cold low salinity upwelling ocean current carries plenty of nutrient in the form of nitrate, phosphate & silicate which support the growth of phytoplankton (Diatom), bacterioplankton & zooplankton (Foraminifera & Radiolarian) 浮游生物 .These in turn create a rich habitat for all sorts of marine life. A cool submarine current called the Cromwell current which runs from west to east also creates the same effect to the western islands



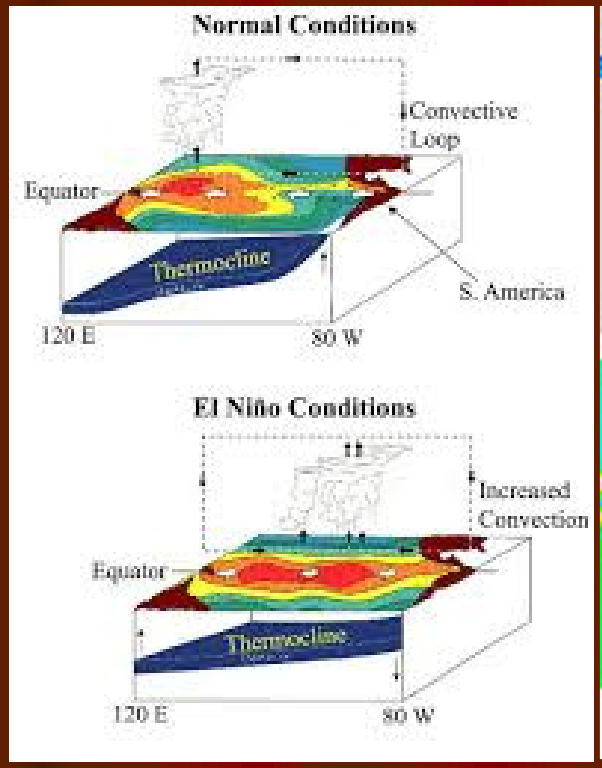
- In the past about every 4 to 5 years the Humboldt Current is interrupted by a phenomenon called *El Nino 厄尔尼諾/聖嬰現象 bringing heavy rain, flooding & land slide to the islands. This is now occurring much more frequently & experts believe by 2050 it will be increased to once every 2/3 years. A real bad one occurred in 1997/98. The last strong event took place in 2009/2010. One has started this year which will likely continue to 2016

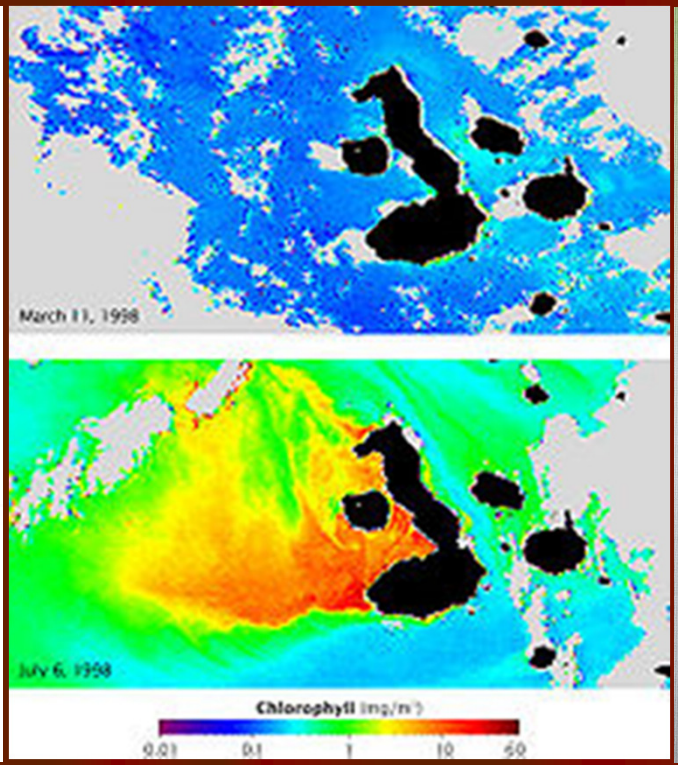


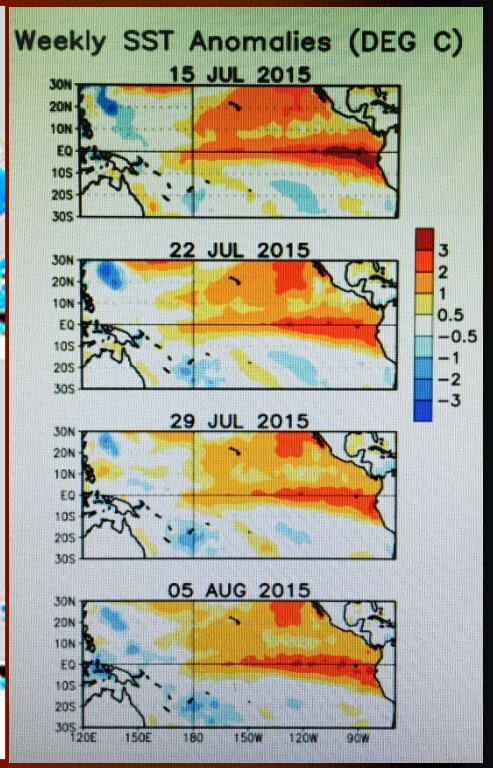
* El Nino means "Boy Child" as it usually occurs around Christmas

El Nino Southern Oscillation (ENSO)

El Nino is a band of warm ocean water temperature that occasionally develops off the west coast of South America which causes climatic changes across the Pacific Ocean resulted in decrease of Trade wind, reduction in rainfall in Indonesia & Australia & reduced fish stock account absence of upwelling cold nutrient rich water. During the 1997/98 El Nino water temperature was 5C warmer than usual. Many animal including 70% of the marine iguana as well as many seals & sea birds were starved to death due to the lack of food supply in the sea







Impact of the 1997/1998 El Nino on Galapagos fauna is devastating



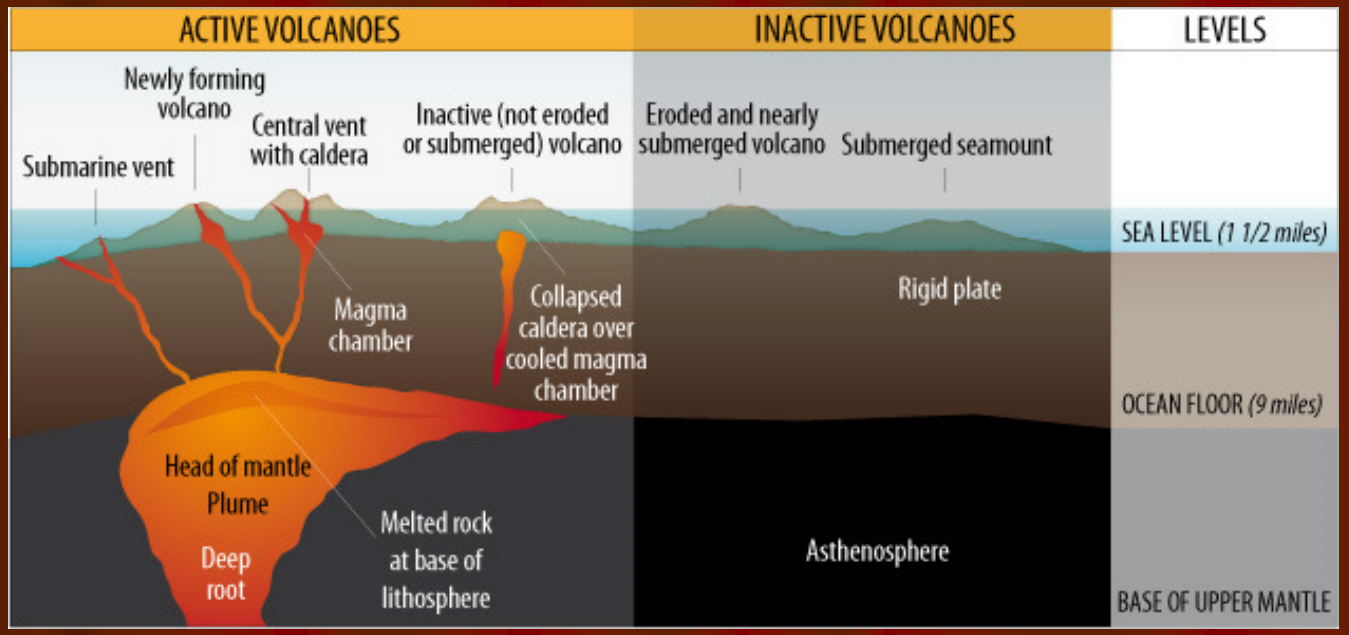


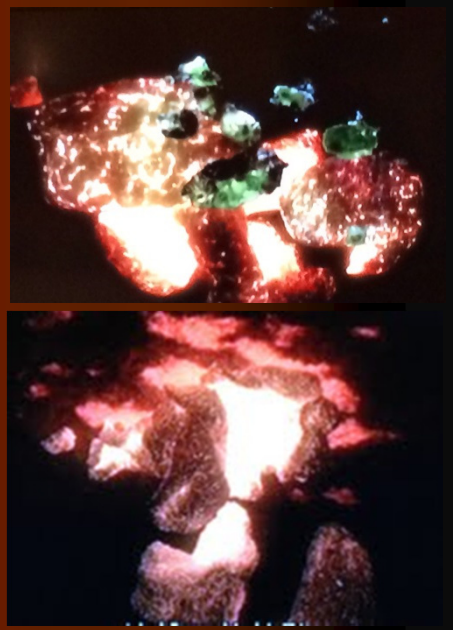




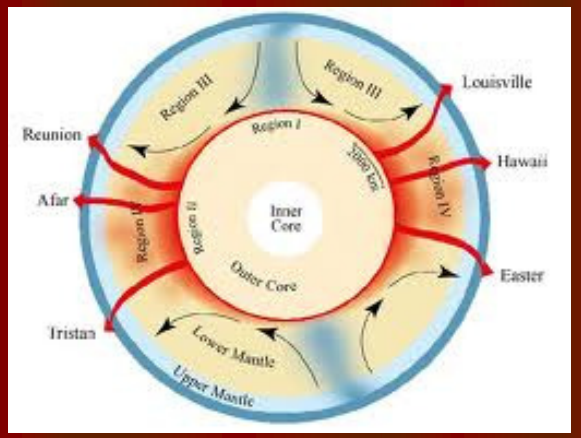
Geology

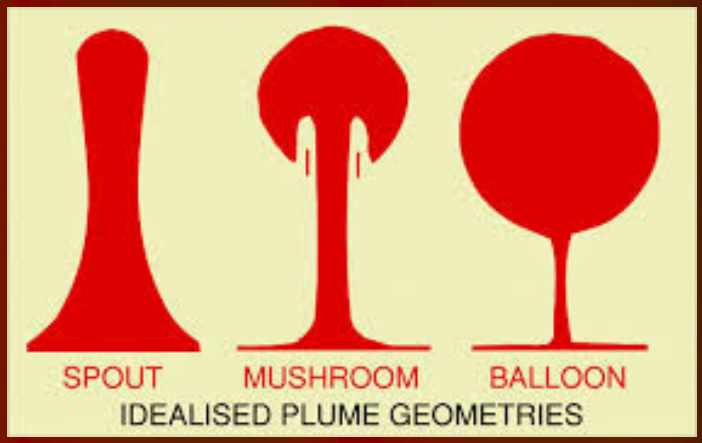
Lying right on top of the Nazca Plate, Galapagos is an archipelago of Volcanic Islands formed probably during the Pliocene Epoch 上新世 (5.3-2.5Ma) above a geological hot spot called a Mantle Plume 地函柱. Espanola, the oldest island was formed about 4 million years ago whereas the youngest island Fernandina is only 500,000 years old. Volcanos on some islands are still active whilst others are dead as they are being moved south east ward at 7 cm per year further and further away from the hot spot by the force of plate tectonic 板塊運動

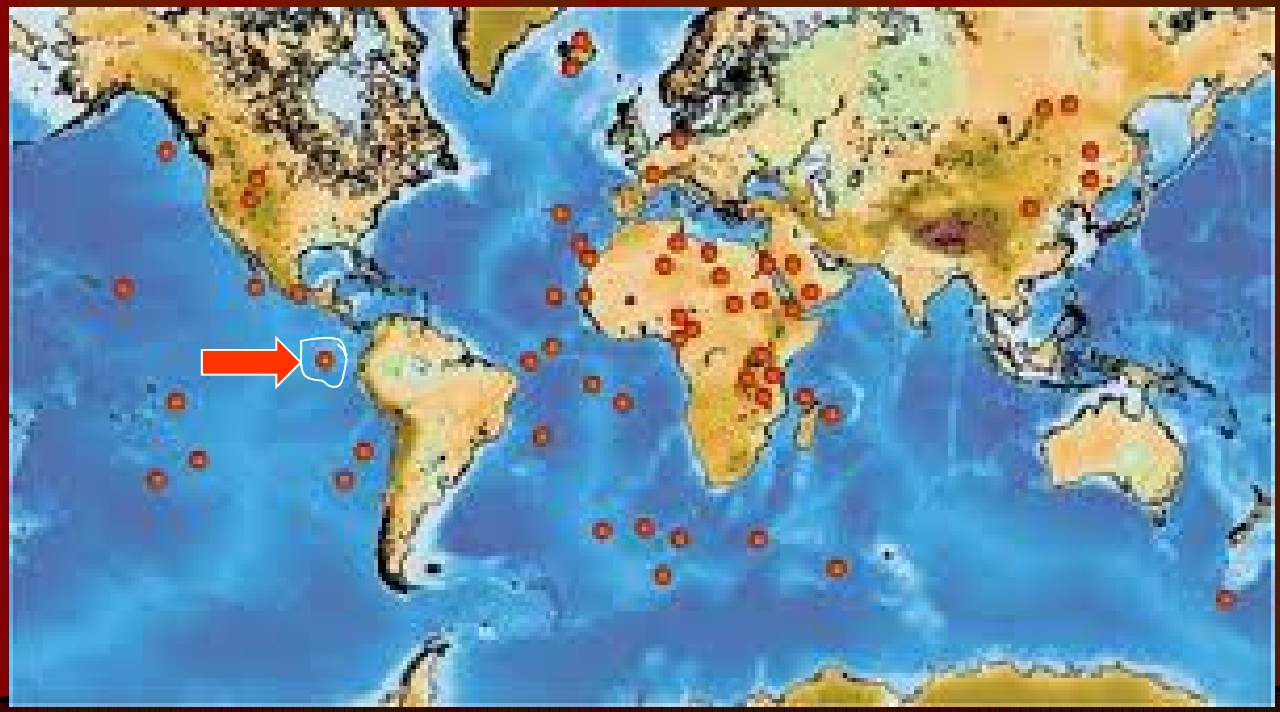




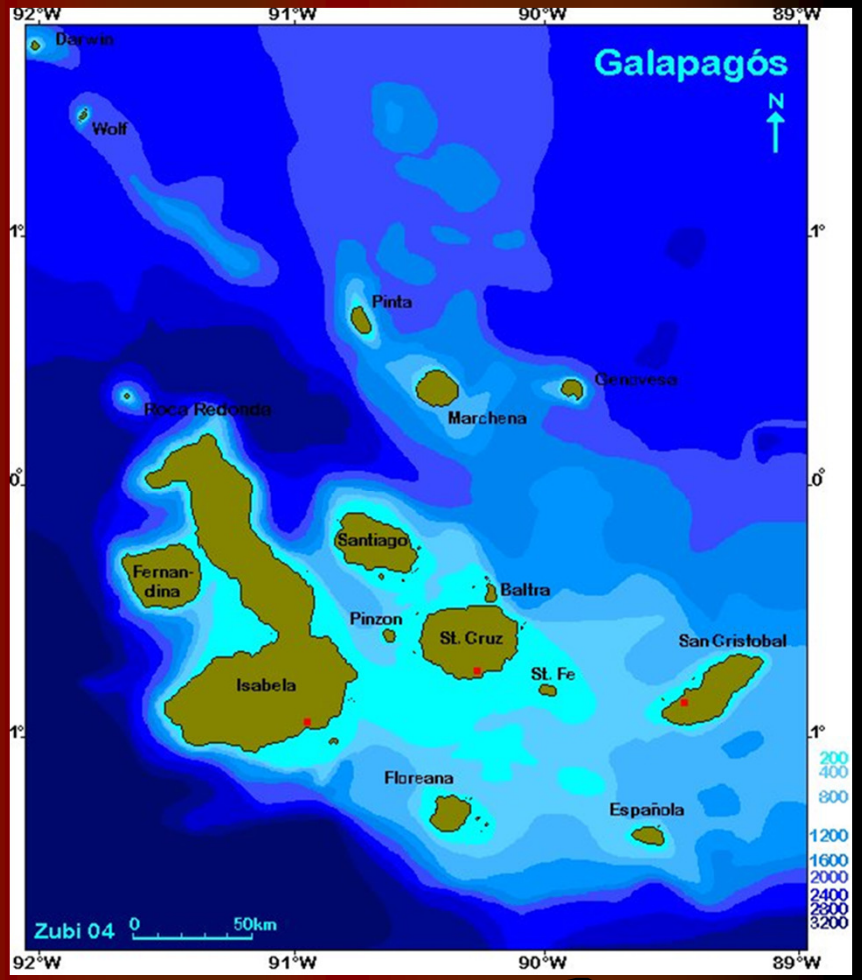
Mantle plumes 地函柱



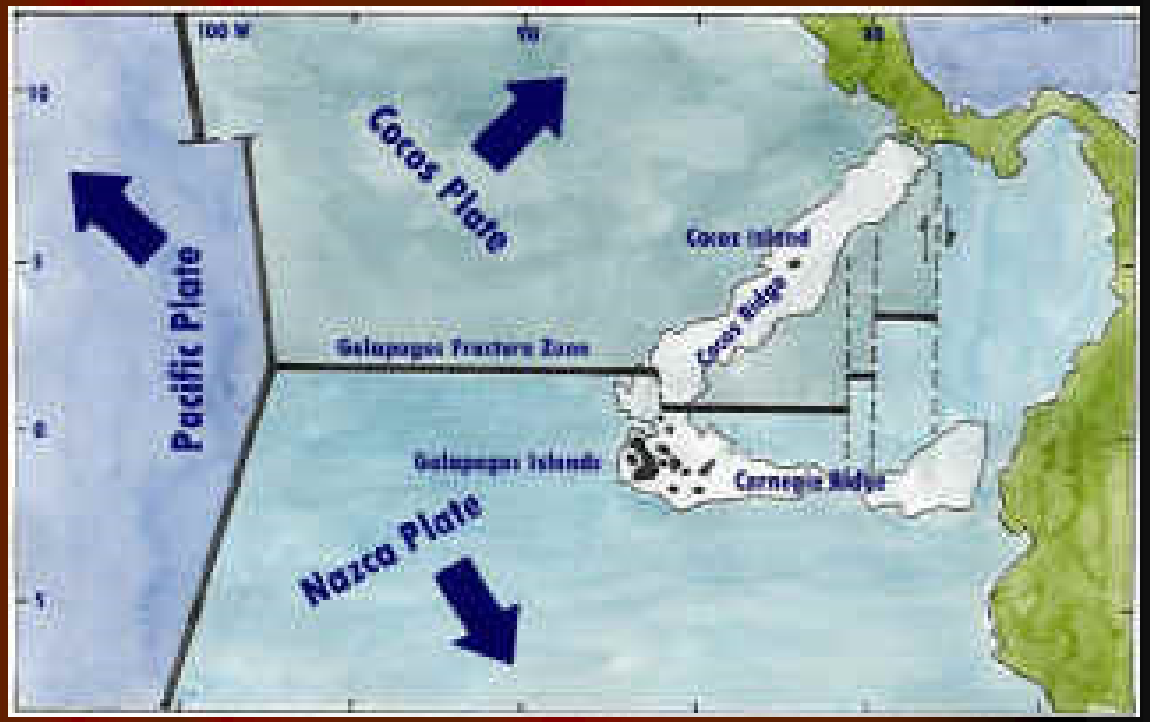




The islands are actually summits of volcanoes located on the Galapagos Submarine Platform comprising entirely of basalt which rises over 3,000 m from the Pacific floor & causes the upwelling of the Humboldt & the Cromwell Current

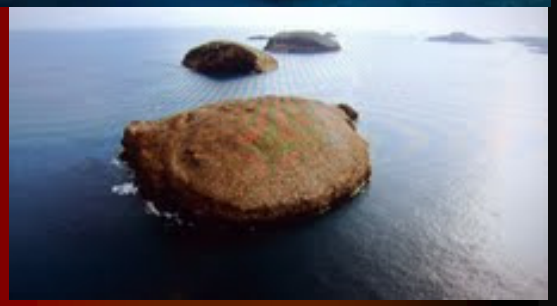


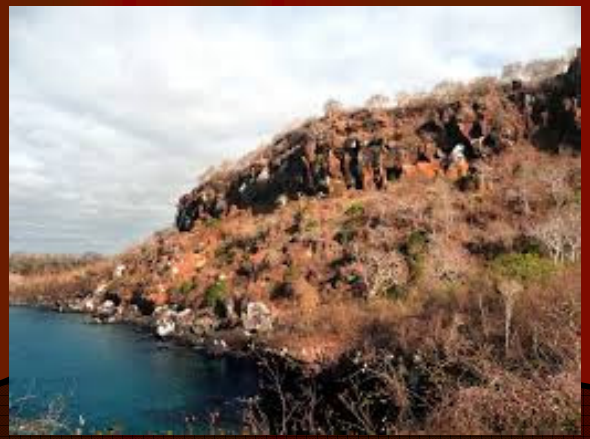
Geologists recently claimed to have found some 9 million year old island remnants to the East of the existing islands !



The volcanic islands once moved away from the hotspot will eventually be worn down by the elements, became flat & reduced in size & ultimately collapsed under the sea & "die"

(Yellow : young, Blue : middle age, Red : old age)

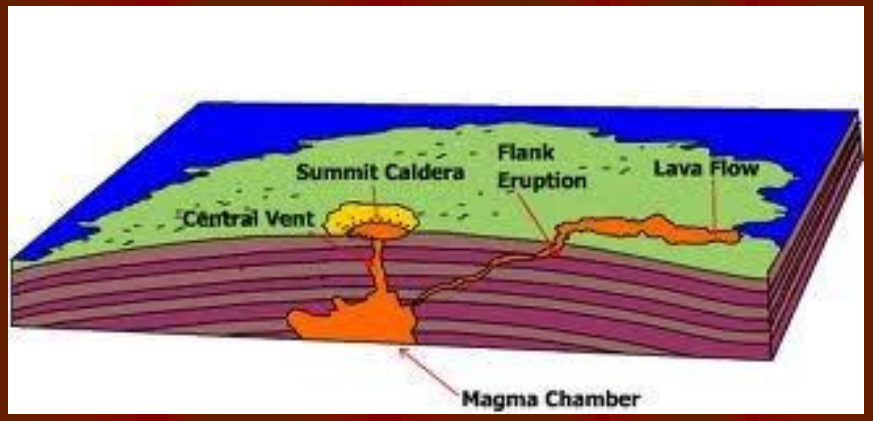




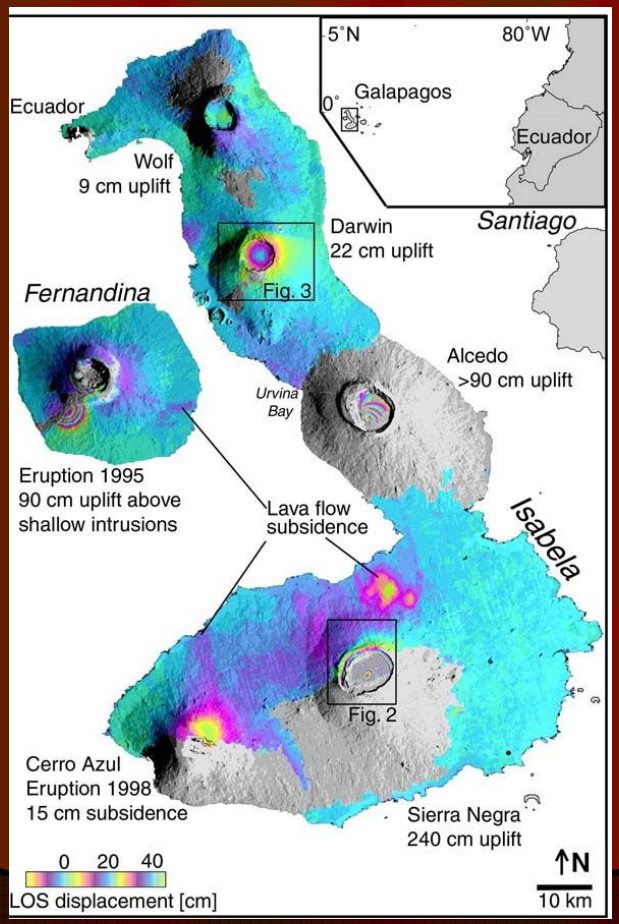
Volcanoes

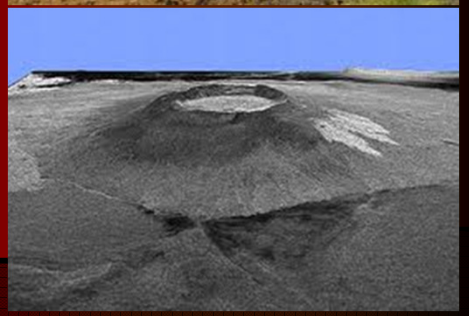
With 9 active volcanos, the Galapagos is among the world's most active volcanic areas today. Activity is intense with over 50 eruptions in the last 200 years. Each of the large islands except Isabela is consist of a single large Shield Volcano 盾型火山 in the shape of an "Inverted Soup Bowl" with some containing huge calderas

Shield Volcanos are giants of the volcano world formed by repeated eruption of fluid lava

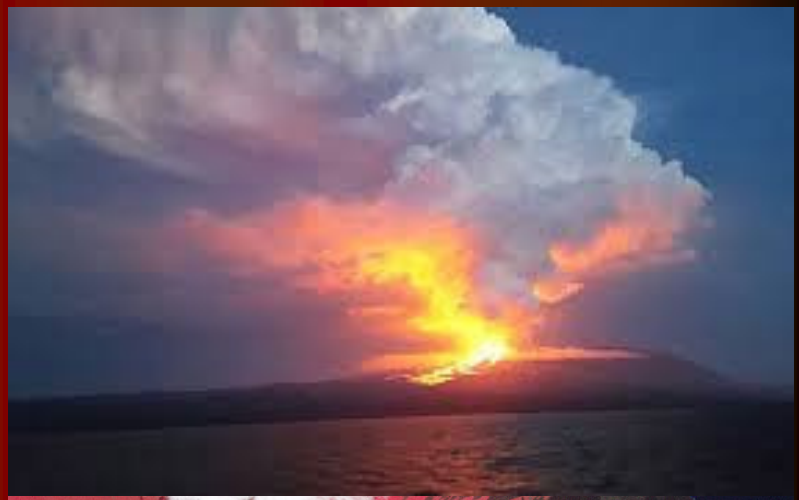


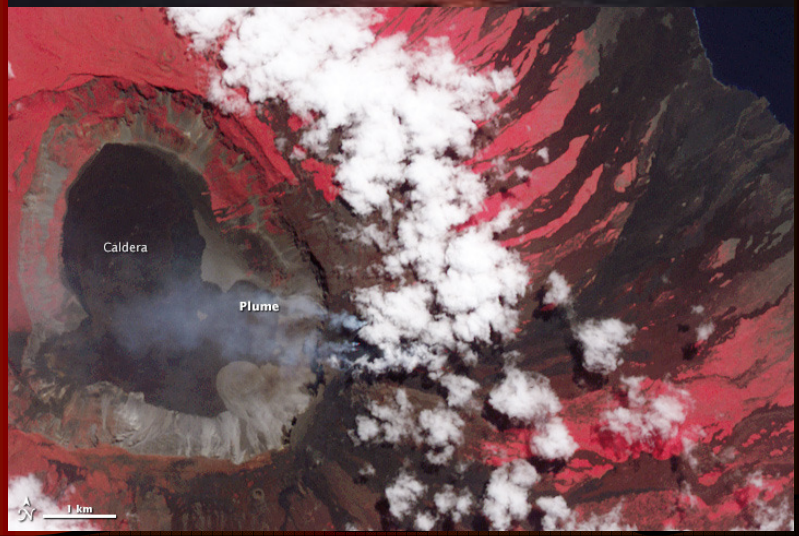
Isabela the largest island is formed by the merger of five volcanic islands as they moved towards the south east. Its volcanos are still active with the Sierra Negro last erupted in 2005 as they are close to the mantle plume. Some geologists predict Fernandina Island now lying on its left will also eventually merged with it





Latest news the Wolf Volcano at 1,710 m being the highest volcano in the Galapagos erupted for the first time on 25th May 2015 after 33 years spewing fire, smoke and lava flowing in the east & south east direction. Prior to that the last eruption occurred at La Cumbre Fernandina in April 2009





Volcanic landscape abound : lava fields, lava tubes/tunnels, sulphur fields, palagonite (lava cooled under water), fissures, parasitic cones, spatter cones, crater lakes 火口湖 & calderas 破火山口






Lava

Lava is molten rock expelled by a volcano during an eruption & the resultant rock after solidification and cooling. When first erupted from a volcanic vent, lava is a liquid at temperature from 700 to 1200 C and can be up to 100,000 times as viscos than water. Lava can be subdivided into 3 chemical types :

- Felsic 長英質 : extremely viscous silicic lava such as Rhyolite & Dacite which can erupt at temperature as low as 650-750 C
- Intermediate : Andesitic lava lower in aluminum & silica commonly hotter between 750-950 C & less viscous
- Mafic 鐵鎂質 : basaltic lava high in iron & magnesium generally erupt at 950 C. Relatively low viscosity allows it to flow very long distance

Lava types in the Galapagos

- A'a : Hawaiian word meaning "hurt", basaltic lava with a rough or rubbly surface like twisted black toffee, temp 982-1093C, high viscosity, slow moving 5 -100 m/hour, found at Fernandina

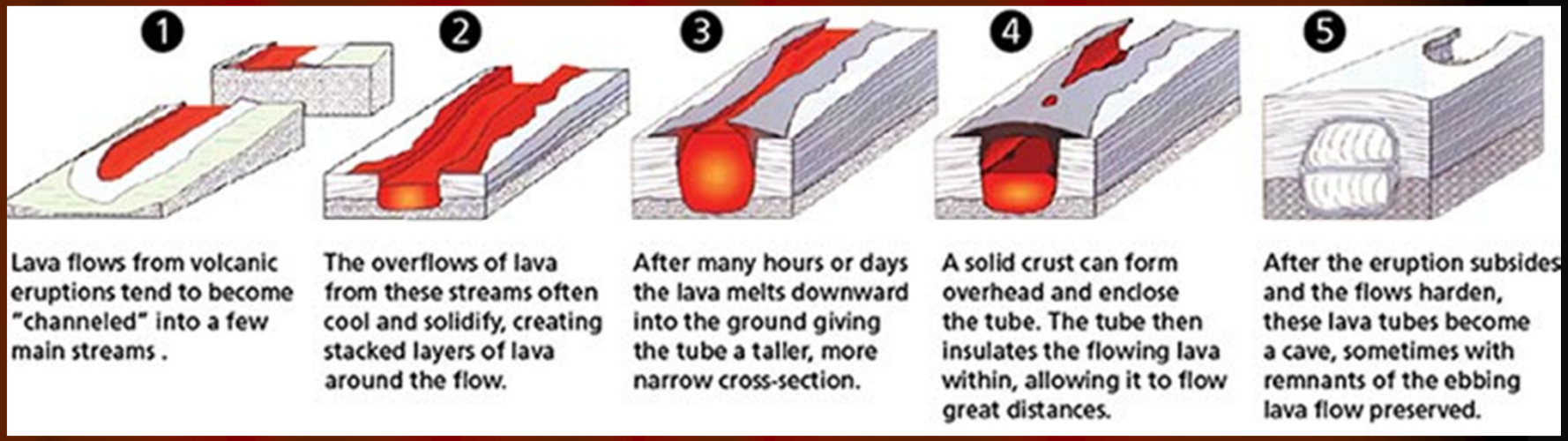


- Pahoehoe : Hawaiian word meaning "ropy", basaltic lava with a smooth unbroken ropey surface, temp 1093-1204 C, low viscosity, fast moving - up to 10 kph, found at Sandiago



Lava tunnels/tubes 溶岩管

Many lava tunnels big & small have been located in the islands including kilometer long lava tunnels found in Santa Cruz. They provide a special environment for new species of arthropods which are mostly blind



- We visited the Bellavista Cave or Gallardo's Cave which is also known as the Love cave. At 2,250 m in length, it is an immense lava tube being South America's second longest. Note the "Doorman owl" resting at the entrance to the Cave !






- Note the longitudinal stretch marks made by lava on the cave walls

Flooded volcano craters & Crater Lakes at Tagus Cove, Isabela 堰塞湖

- The "Los Gemelos" Sink holes (The Twins) at Santa Cruz is a gigantic depression formed when subterranean magma chamber or gas containing area was emptied and the roof collapsed

- Basalt*, Obsidian*, Pele's hair, Pele's tear & Pumice* from Isabela; Olivine crystals on the olivine beach at Floreana Island which are eroded out of basalt. No sample collection is allowed in the Park !

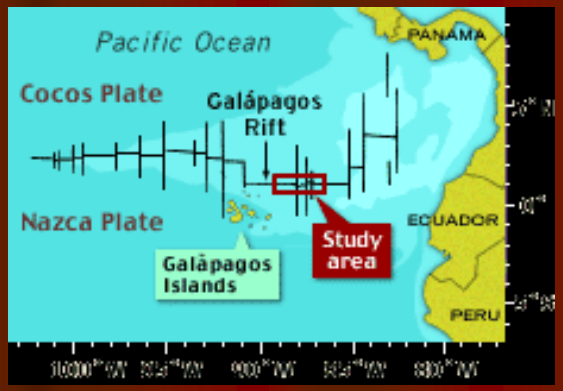


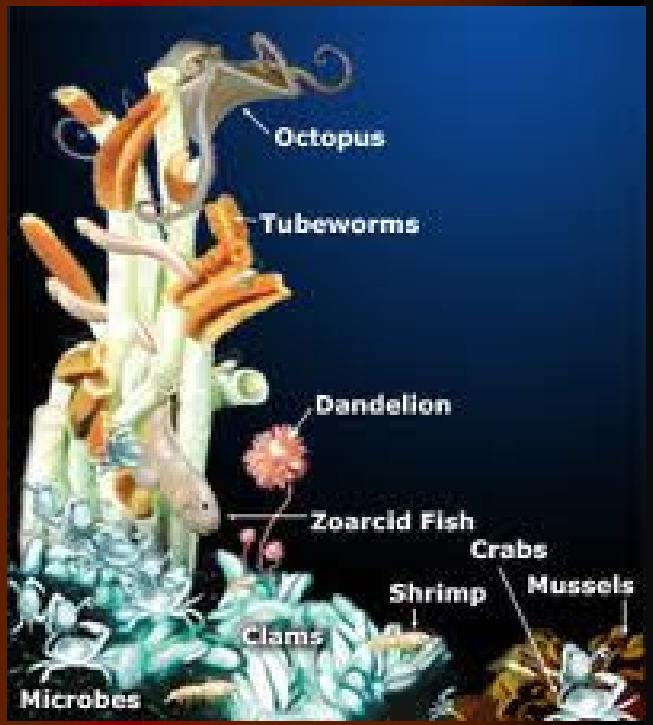


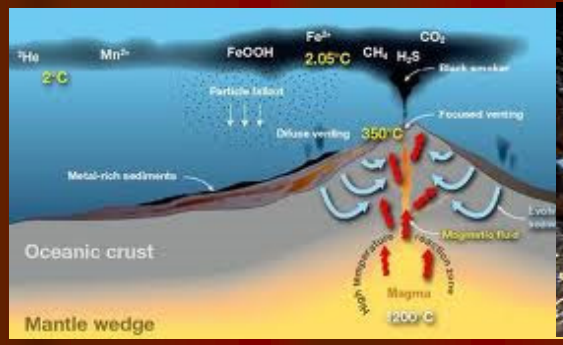


Hydrothermal vent 深海熱泉

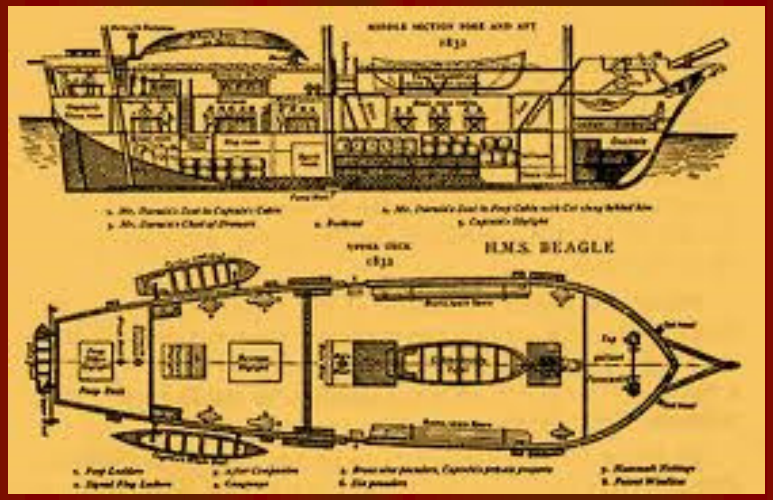
The world's first hydrothermal vent was discovered at the Galapagos Rift in 1977. The "Black Smokers" contain sulphide; the "white smokers" contain barium, calcium & silicate. No light, poisonous & as hot as 400 C unusual fauna from tubeworms to mussels, blind shrimp & crabs not only survive but promulgate basis on chemosynthesis 化學合成





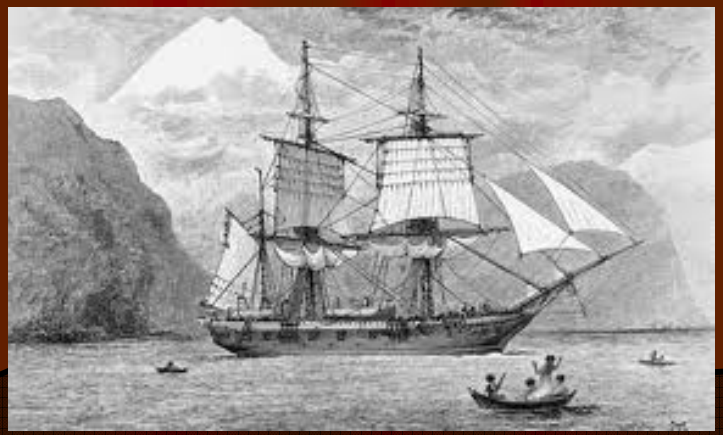


Voyage of the Beagle & Evolution

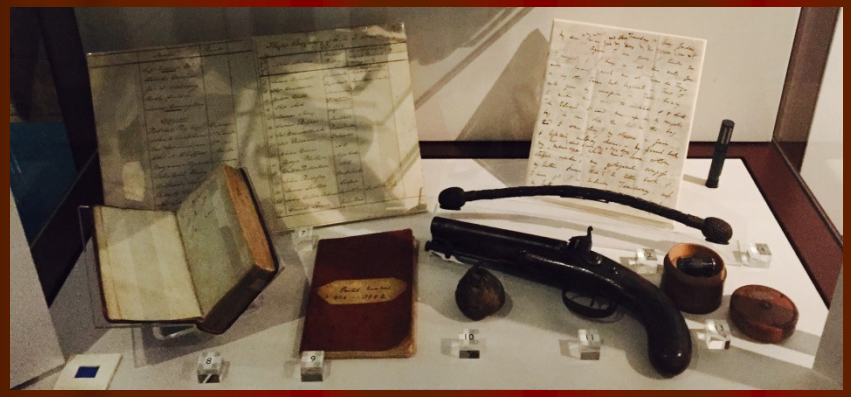


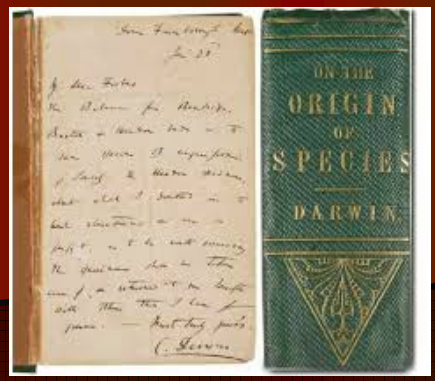
Voyage of the Beagle 1831-1836

Oct 1835 Charles Darwin visited Galapagos at the age of 22 & spent 5 weeks investigating the islands. In 1859 he published "On the Origin of Species" on the concept of Evolution which was partly inspired by this trip



Darwin’s residence : Down House, Downe, Kent, London





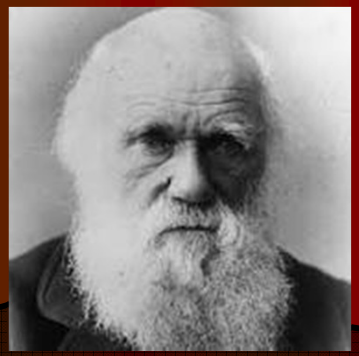
Darwin Theory of Evolution

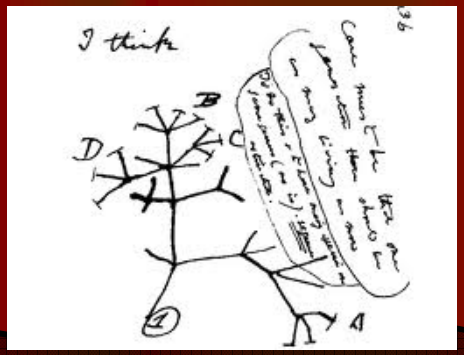
The diversity & complexity of life on Earth can be explained by Darwin's theory of Evolution 演化

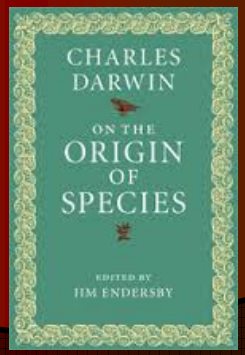
Evolution of living organism is changes through time by mutation 變異 with natural selection 天擇 /自然選擇 eliminating the harmful ones whilst favorable ones are preserved & passed down by heredity – "Survival of the fittest" 適者生存;

Mutation is to a large extend triggered by the changes in the living environment (noticeably climate, food & chance to mate) ;

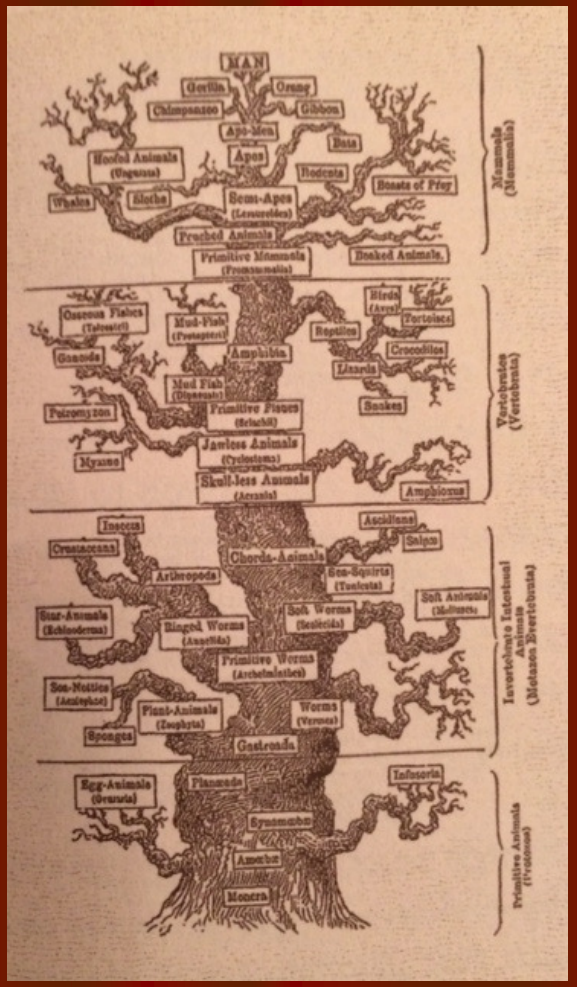
All living things descend from a common ancestor LUCA 萬物共祖 that lived at 3.8 -3.5 billion years ago







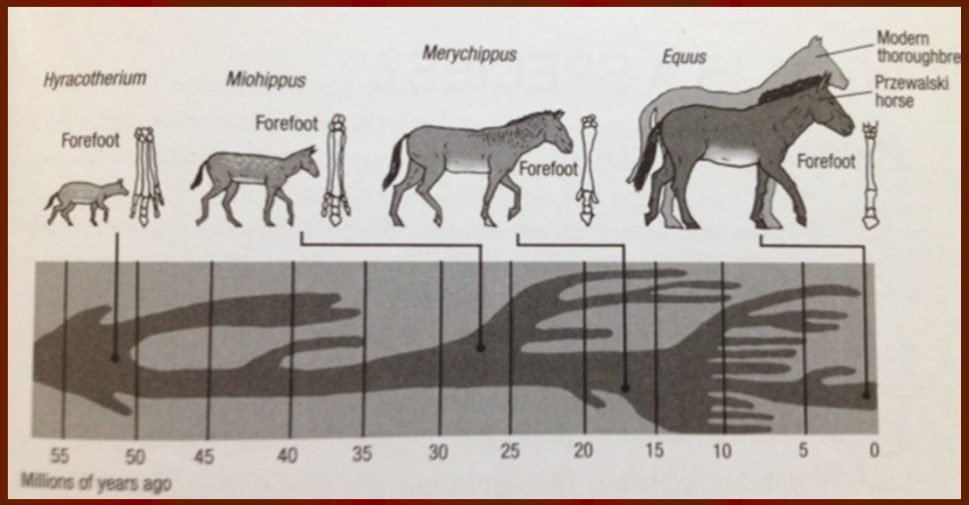
- Concept came as a bomb shell as common view at the time all living creatures were individually created by God & Early Linnaean tree of life shows mammals at the top & man at the summit

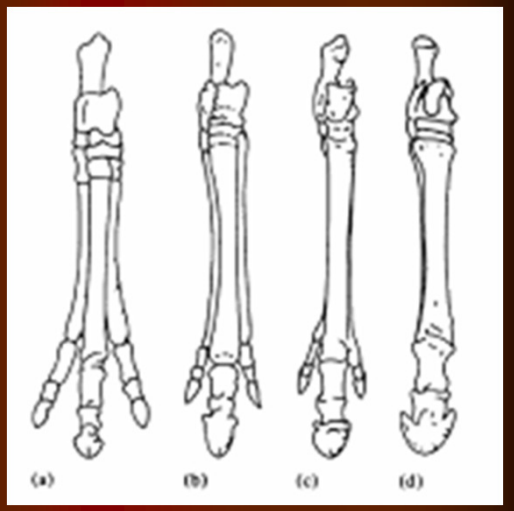


Where are the Evidence ?

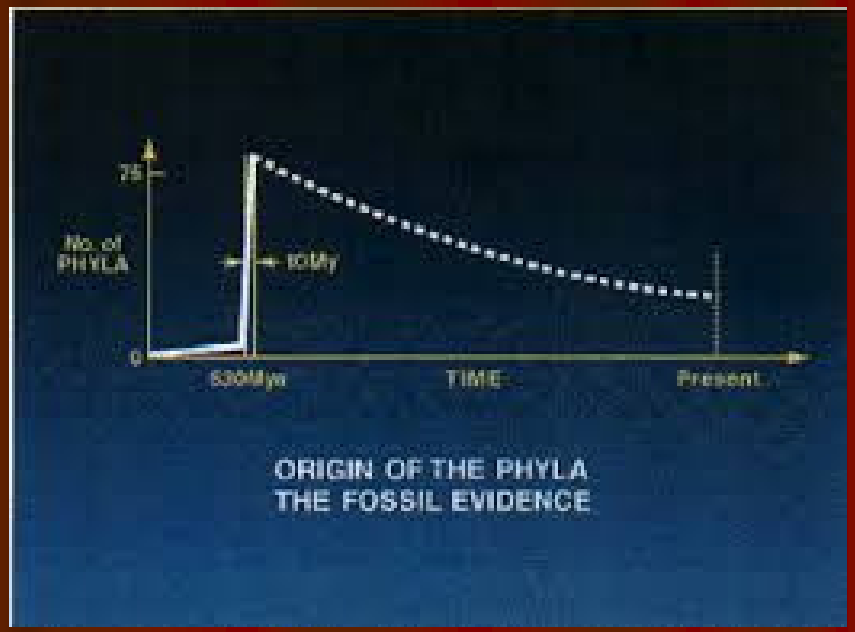
- 1. By Comparative Anatomy
- 2. By studying products of domestication of wild animals & plants through artificial selection e.g. Fancy Pigeons hundred of subspecies all come from one species *Columbia livia*

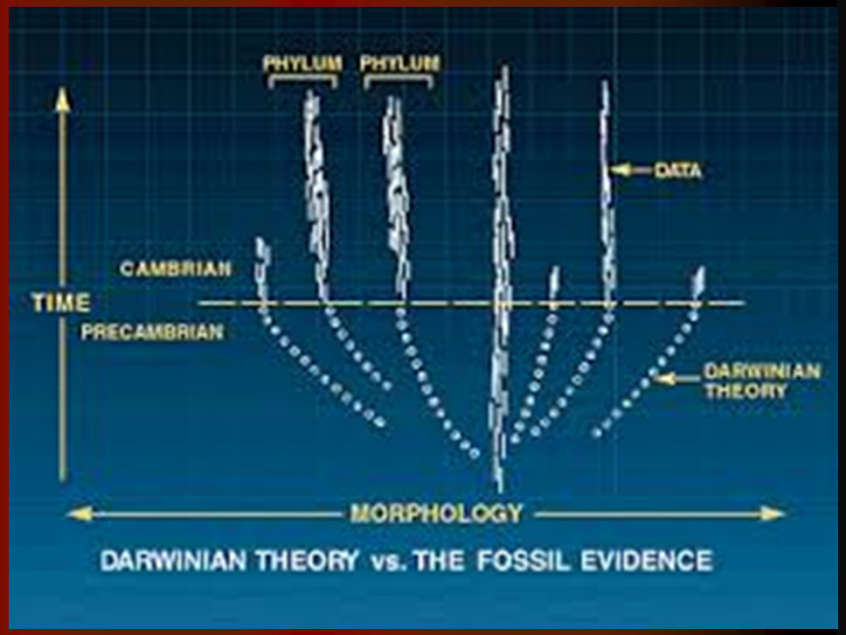
- 3. By studying fossils : horses & archaeopteryx with the latter discovered just 2 years after "On the origin of species" was published





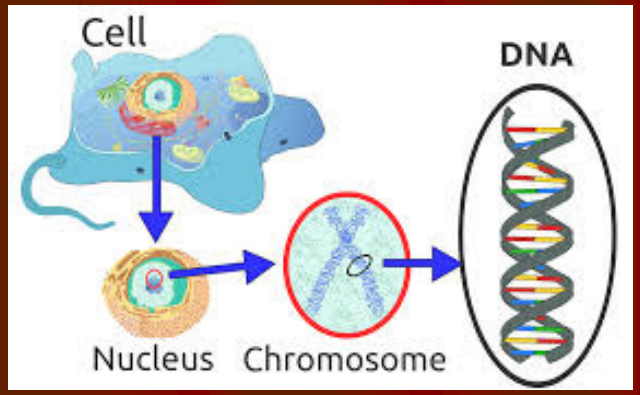
No fossil support for the Cambrian Explosion ?



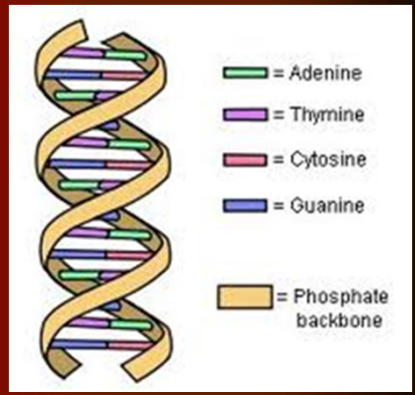


Molecular Biology & DNA Sequencing

All living organisms are composed of cells formed by different types of protein which in turn are made up of the same 20 amino acid (C, H, N). The recipe for producing the right type of protein is recorded in DNA (Deoxyribonucleic acid) 脫氧核糖核酸 which is a molecule 分子 encoding the genetic instructions used in the development and functioning of all living organisms. Its chemical structure is a double helixes 雙股縲旋 make up of two complementary strands of sugar phosphate linked up by 4 types of bases called nucleotides 鹼基對 which pair in specific ways. For simplification scientist use the first letter of the bases A,T, C & G to record the different types of DNA



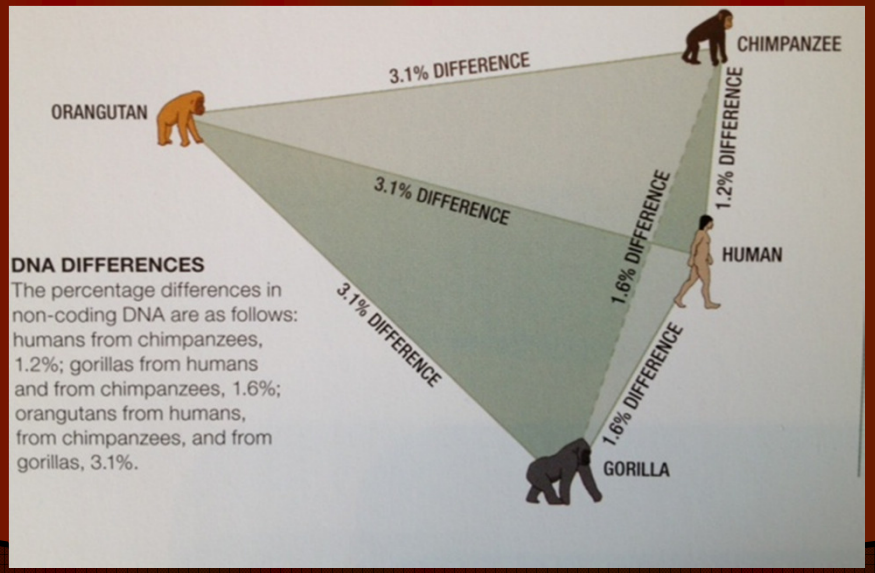
(A) Adenine 腺嘌呤
(T) Thymine 胸腺嘧啶
(C) Cytosine 胞嘧啶
(G) Guanine 鳥嘌呤



DNA in turn is packed into tiny rods called Chromosomes 染色體

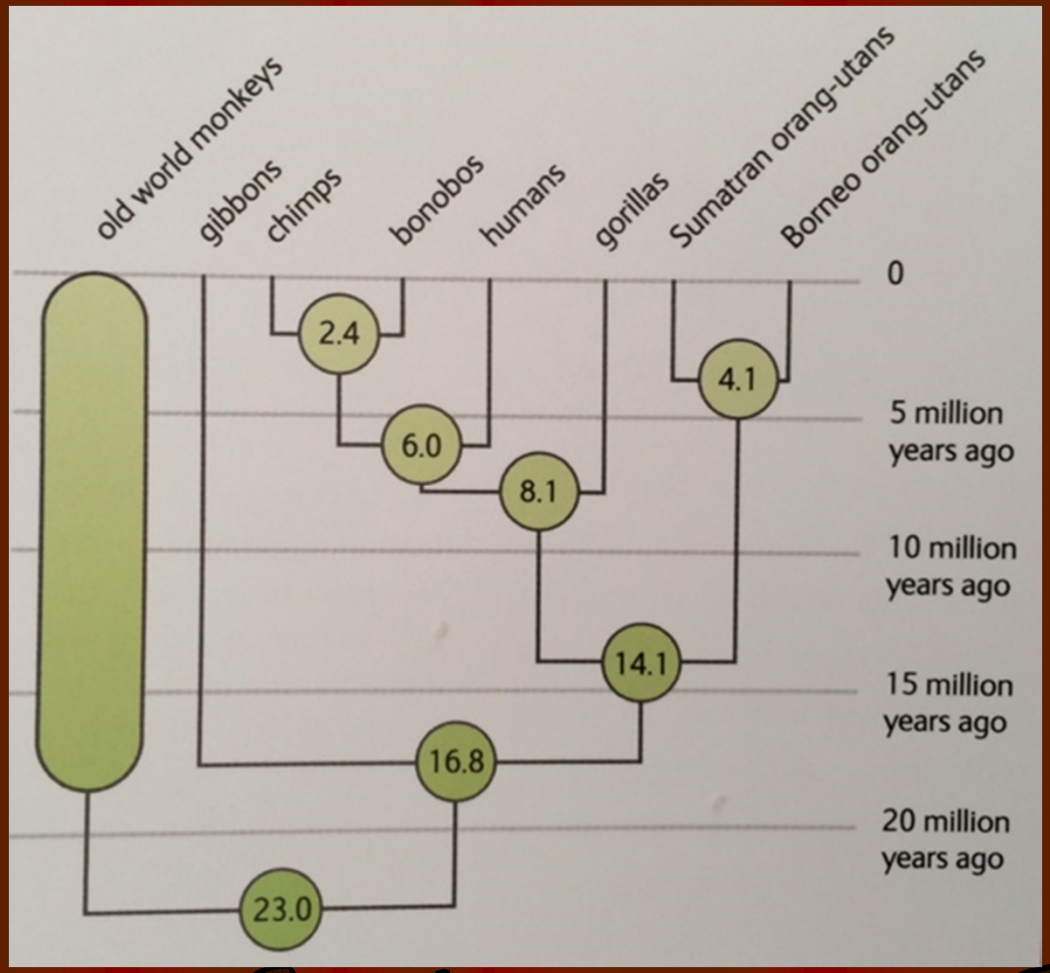
Human Chromosomes difference with Chimpanzee identified in 1, 2, 4, 5, 9, 12,15, 16, 17 & 18

DNA Differences between Human & Great Apes

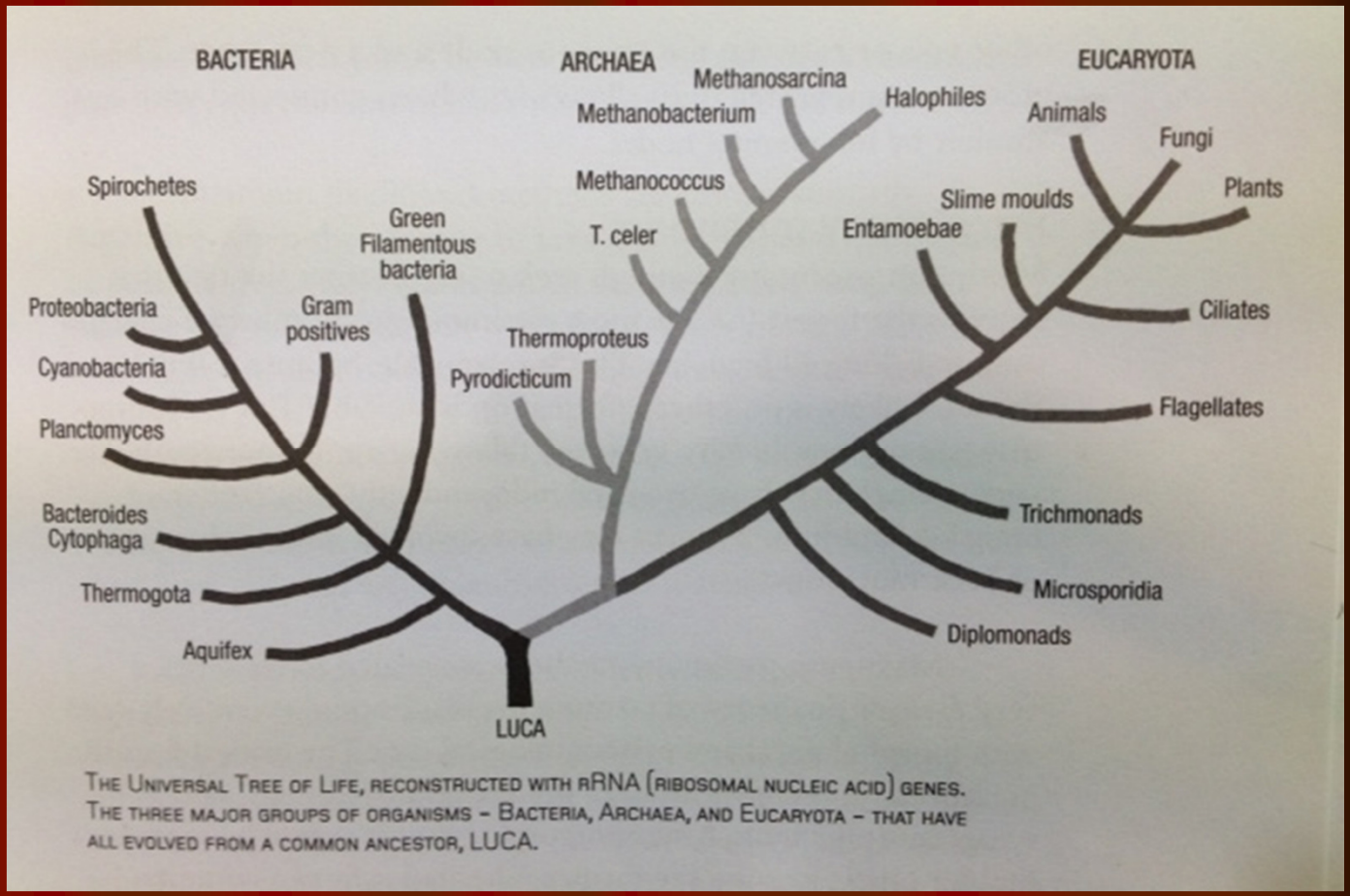


Mitochondrial DNA (mtDNA 線粒体) & Y chromosome allow biologists to elucidate the evolutionary relationship among species

Evolution of Primates



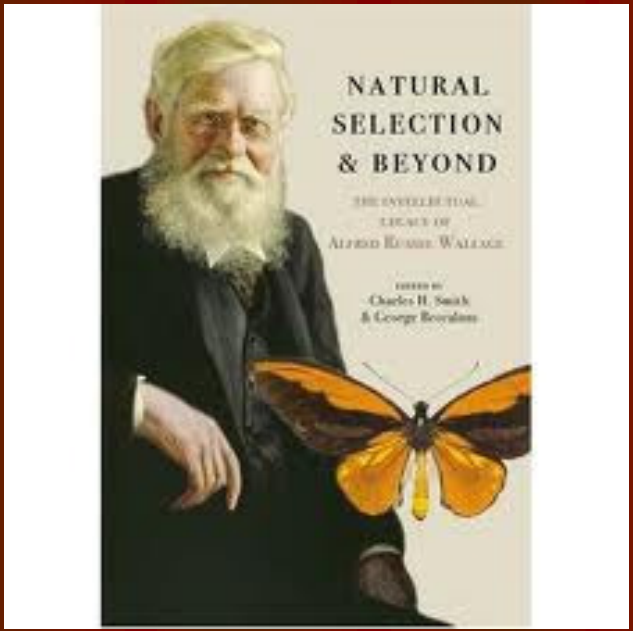
The new universal tree of life reconstructed with RRNA Gene

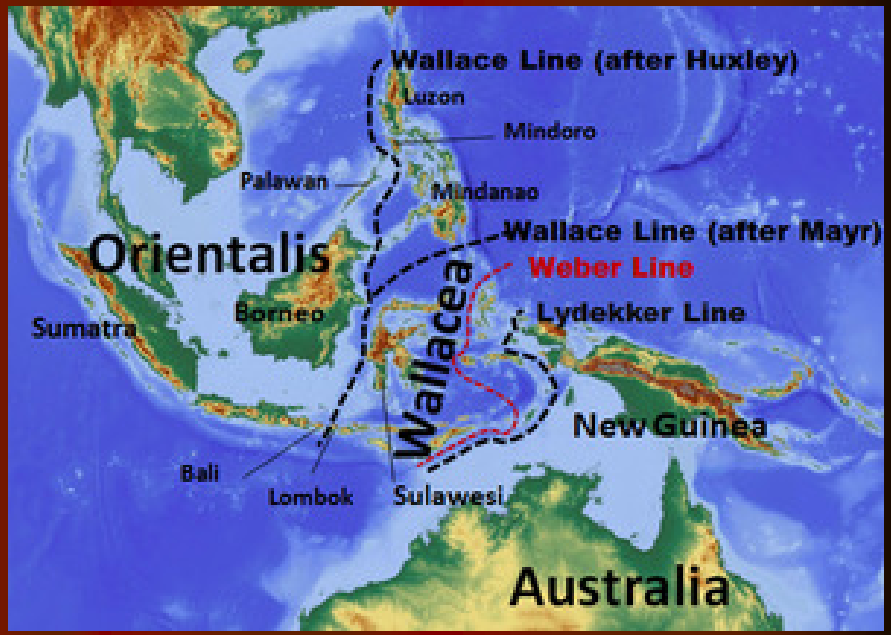


THE UNIVERSAL TREE OF LIFE, RECONSTRUCTED WITH RRNA (RIBOSOMAL NUCLEIC ACID) GENES. THE THREE MAJOR GROUPS OF ORGANISMS – BACTERIA, ARCHAEA, AND EUCARYOTA – THAT HAVE ALL EVOLVED FROM A COMMON ANCESTOR, LUCA.

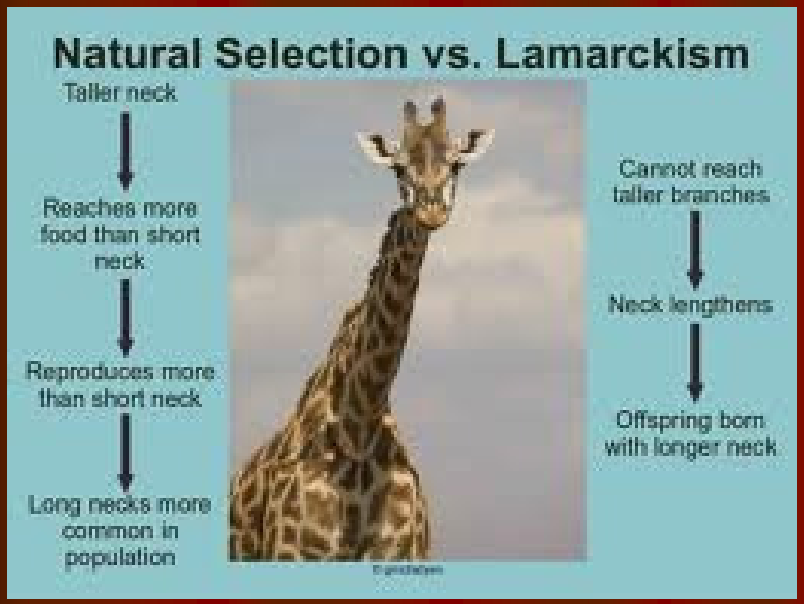
- Tribute to Alfred Russel Wallace 1823 -1913

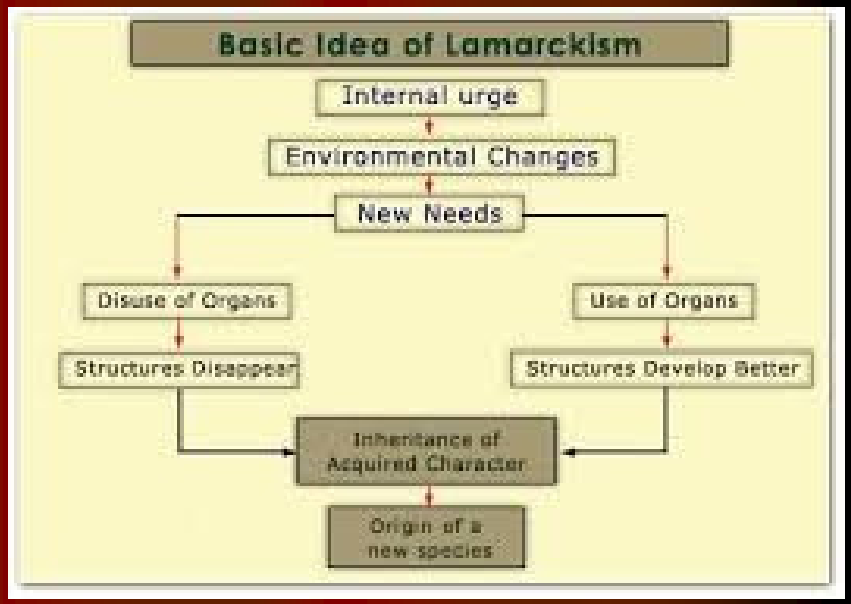
  He independently conceived the theory of evolution through natural selection. His paper was jointly published with some of Darwin's writing in 1858 & prompted Darwin to publish "On the origin of species". His other important contribution is the discovery of the "Wallace Line"



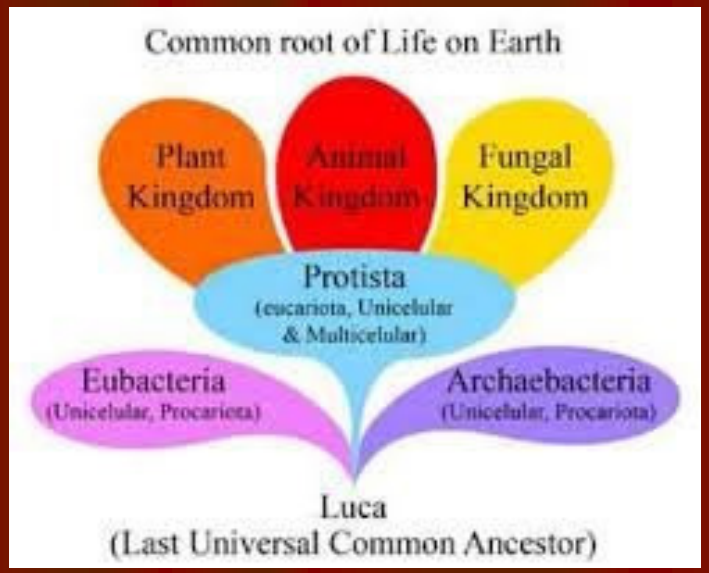


- Lamarkism inheritance：also known as "soft inheritance" is the idea proposed by Jean-Baptiste Lamarck (1744-1829) basis on the rule of "Use & Disuse" 用進廢退說 (e.g. giraffe, snakes, blind fish & flightless birds) & that organism can pass on characteristics it acquired during its lifetime to its off springs 獲得性遺传．He believed evolution is directional from lower to higher form and extinction did not exist





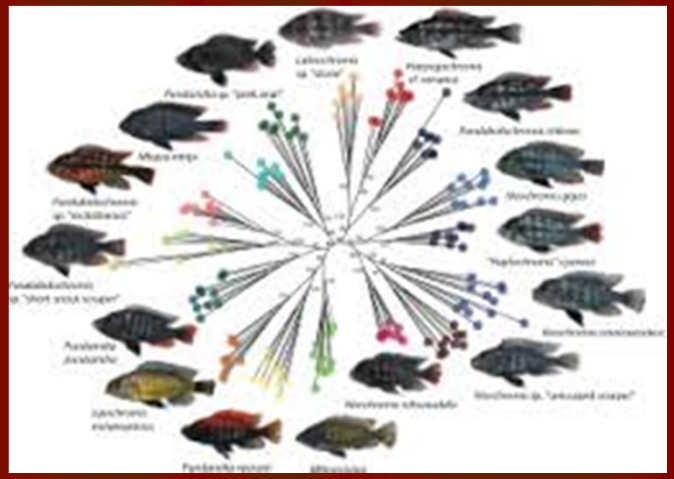
- Mega Evolution 大演化 : from LUCA to all living things – the new universal tree of life



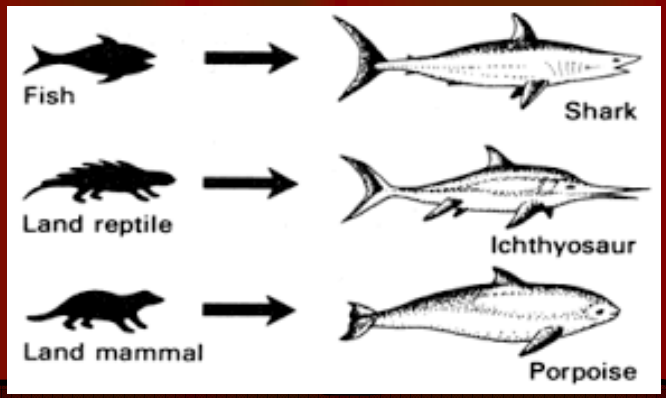
- Microevolution 微演化 : change within a species over a short period of time e.g. size & weigh of house sparrows in North America/black & white moth in England for camouflage

- Macroevolution 物種演化 : evolution on a scale of separated gene pool resulting in the splitting of species at least into two

- Divergent Evolution 趨異演化 : it is the accumulation of differences which can lead to the formation of new species e.g. Cichlids in Lake Victoria – 1 to 800 about 113 million years ago!

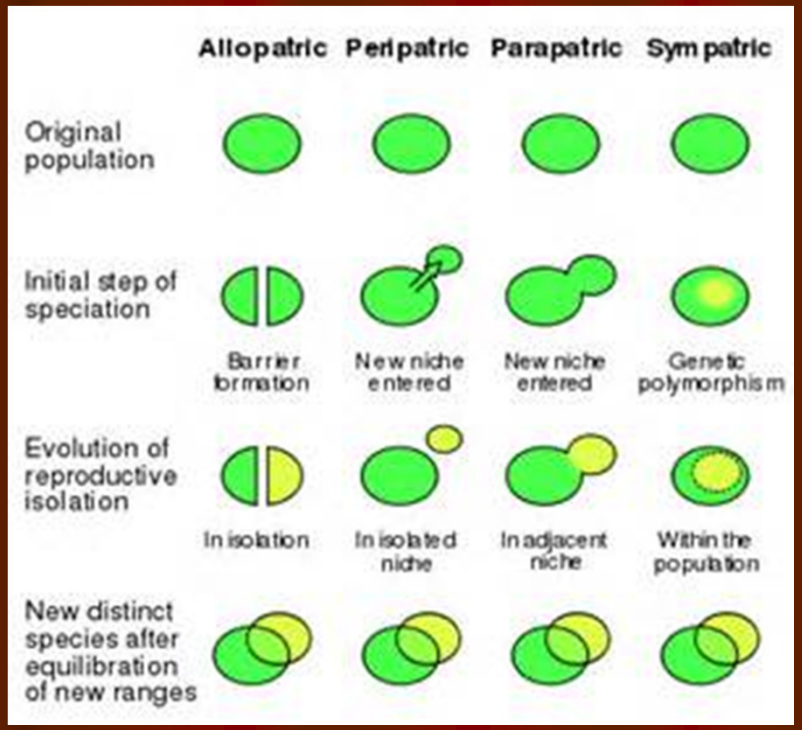


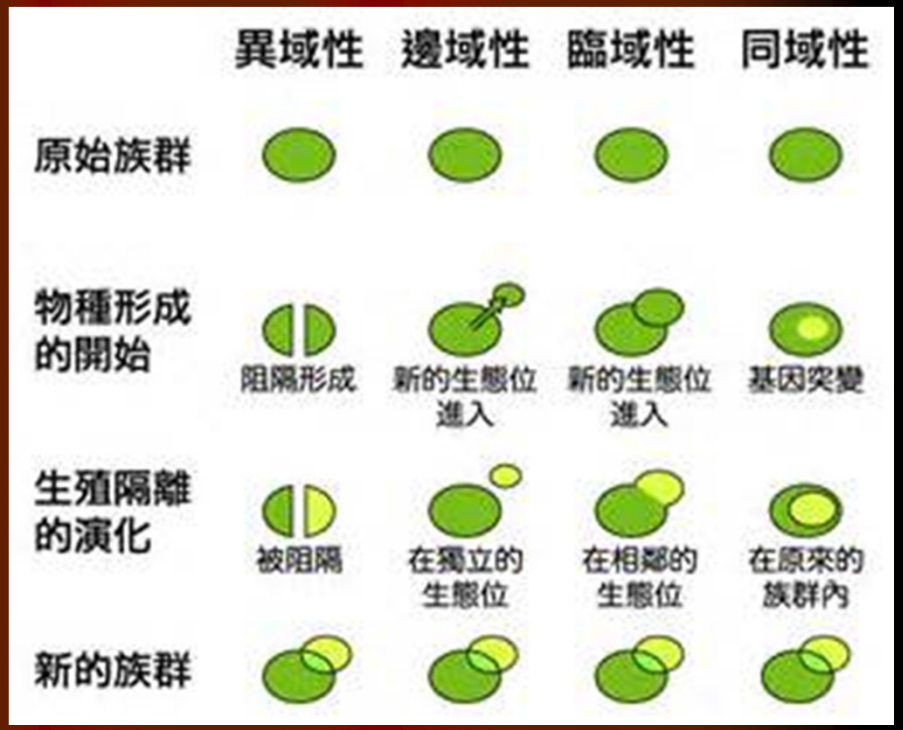
- Convergent Evolution 趨同演化: arises when there are some ecological or physical drivers towards a similar solution e.g. wings in birds and bats to fly & body designs in fish, marine reptile & marine mammal to swim



- Co-evolution 協同演化 : interaction between organisms can produce conflict (e.g. garter snake & newt) & cooperation (e.g. Comet orchard & hawk moth with a 35 cm long tongue to reach the nectar spur)

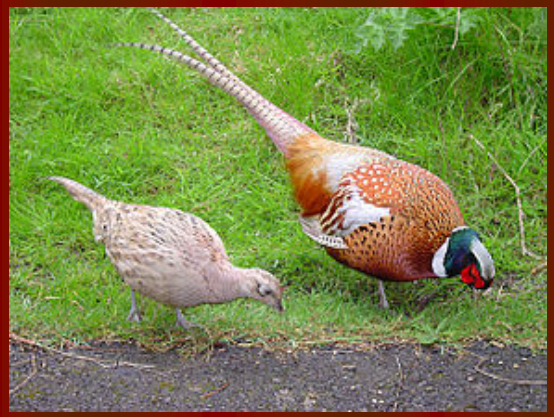
- Speciation 種化：is the evolution process by which new biological species arise. Geographical **ISOLATION** 隔離 is the key & there are four geographic modes of speciation – Allopatic 異域性, Peripatric 邊域性, Parapatric 臨域性, Sympatric 同域性



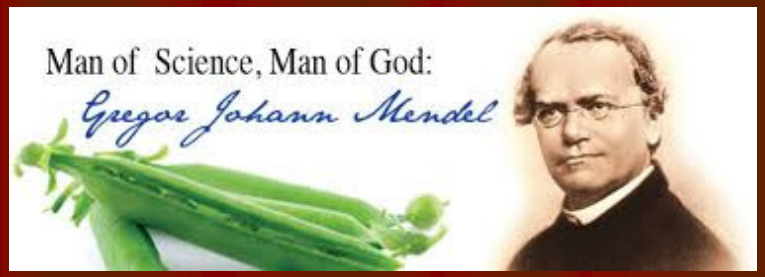


- Island Evolution : Effect of isolation including "Insular Dwarfism" resulting in small size e.g. pigmy hippo in West Africa & "Insular Gigantism" resulting in large size e.g. moa in New Zealand


- Sexual Selection & Sexual Dimorphism : size & color matters, the 130 Eyes in peacock's tail feathers serve only one purpose

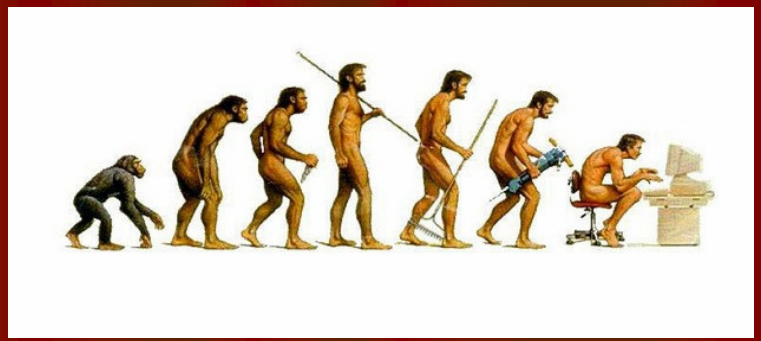



- Heredity – Mendelism : Dominant & Recessive traits in Genes : Gregor Johann Mendel (1865) 隔代遺存



- Social Darwinism & Eugenic 優生学（ artificial selection)

- Dysevolution 不良演化 : Cultural changes in the past centuries have propagated non-infectious diseases like diabetes, heart diseases, back pain that our ancestors didn't face



- Survival of the fittest in Capitalistic Society

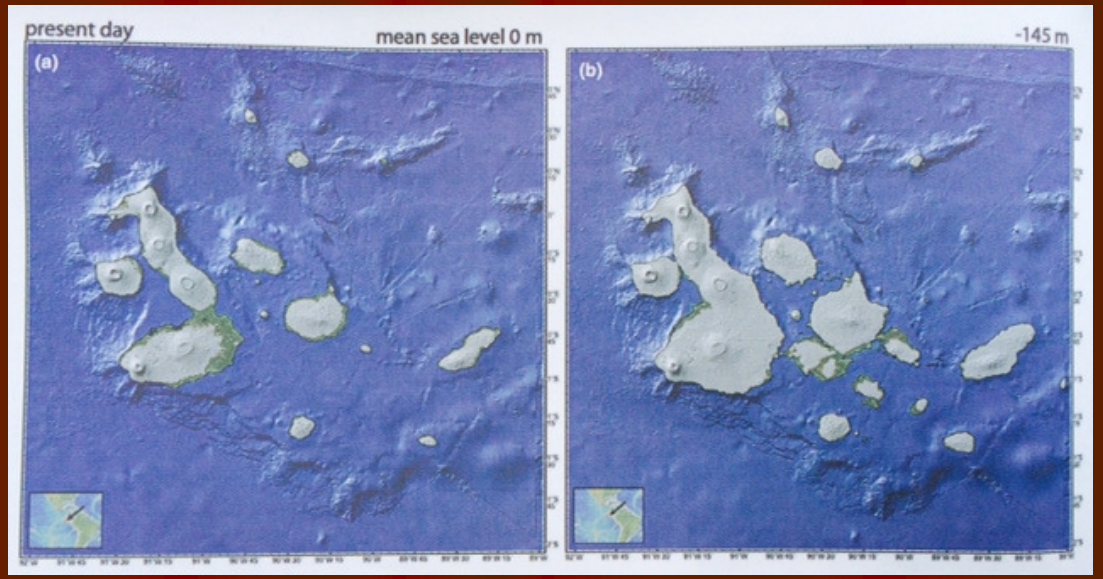
Arrival of the Species

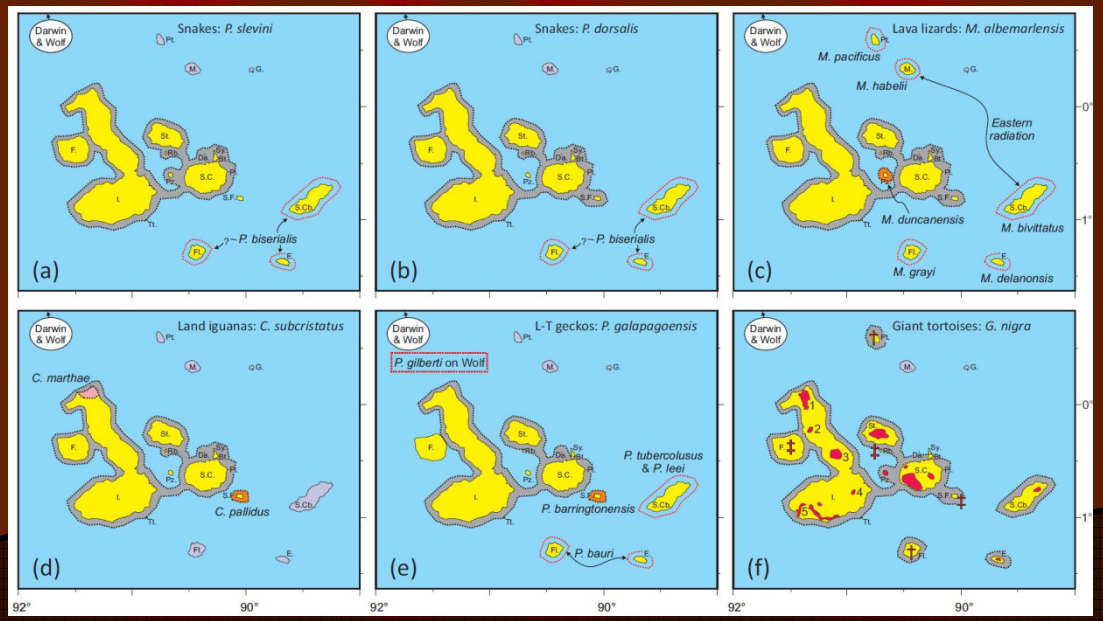
Originally these volcanic islands were completely devoid of plants & animal. Then life forms arrived from the mainland mainly accidentally by :

- Rafting on vegetation eg. reptiles & small mammals like rats
- Floating eg. mangroves
- Swimming eg. tortoise, seas lions, penguins
- Wind – by both the NE & SE Trade eg. spores & seeds of plants as well as small insects, snails & birds
- Flying eg. Sea birds
- Island hopping on islands/land bridge which now already submerged
- Hitching a ride on human, birds & other animals e.g. *Tribulus cistoides* 大花蒺藜



Effect to the topography with a 145 m drop in sea level between 20k to 342k years might have assisted the distribution of species (HKU Prof. Jason Ali 2014)





That so many endemic species can be developed in these islands is due to :

1. Geographical isolation from the main land which is 1,000 km away

2. The unusual geology, oceanography & climate within the archipelago

3. The lack of large predators, only small snakes, hawks & millipede. As a result the wildlife in Galapagos is extremely tame & not afraid of people – its like the "Garden of Eden"




- Friendly finches next move in Santa Cruz – they shared my ice cream !




- Swimming & snorkeling with sea lions, turtles, iguanas, rays & lots of fish are absolutely fun & enjoyable !

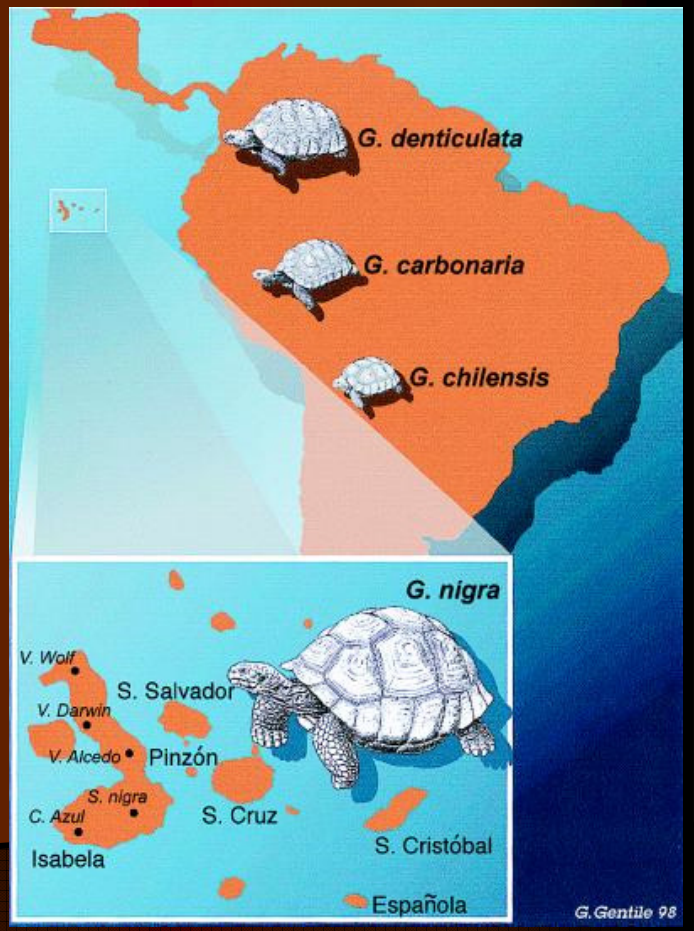


Darwin's theory was partly inspired by the animal he investigated in the Galapagos including the Giant Tortoises, Mocking Birds, Finches, Flightless Cormorants & Marine Iguana

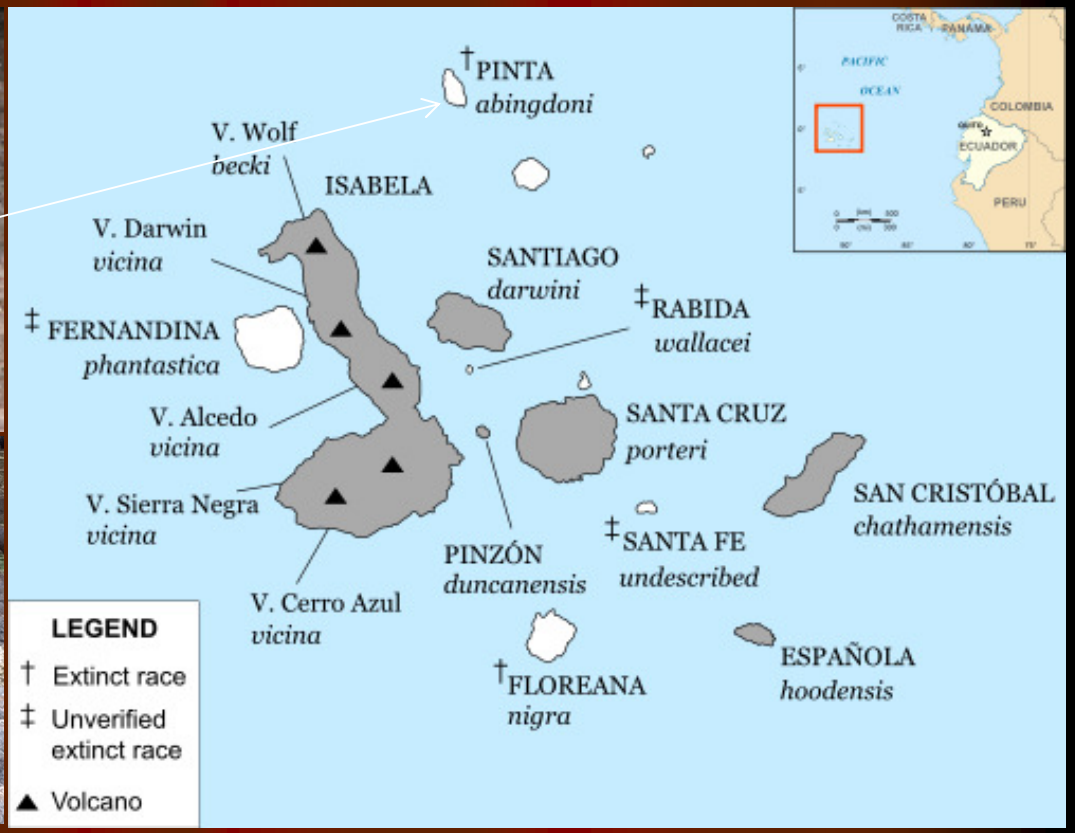
- Giant Tortoise 巨陸龜 /象龜 (*Geochelone nigra*)

Galapagos tortoise is the largest species of tortoise in the world. Galapagos is a Spanish word for saddle which early explorers used to describe the animal because of the shape of their shell/ carapace

Scientist believed the first tortoise arrived Galapagos from South America 2 to 3 million years ago either by vegetation raft or on their own - Giant tortoise can survive without food or water for up to an astonishing 1 year ! Then Divergent Evolution kicked in



When Charles Darwin arrived there were 15 subspecies now ony 10 survived. Lonesome George, the last survivor of the 11th subspecies (*Cryptodiva nigra abingdoni*) from Pinta Island died on 24th June 2012 aged 100 (the oldest captive Giant tortoise recorded was 170 !)

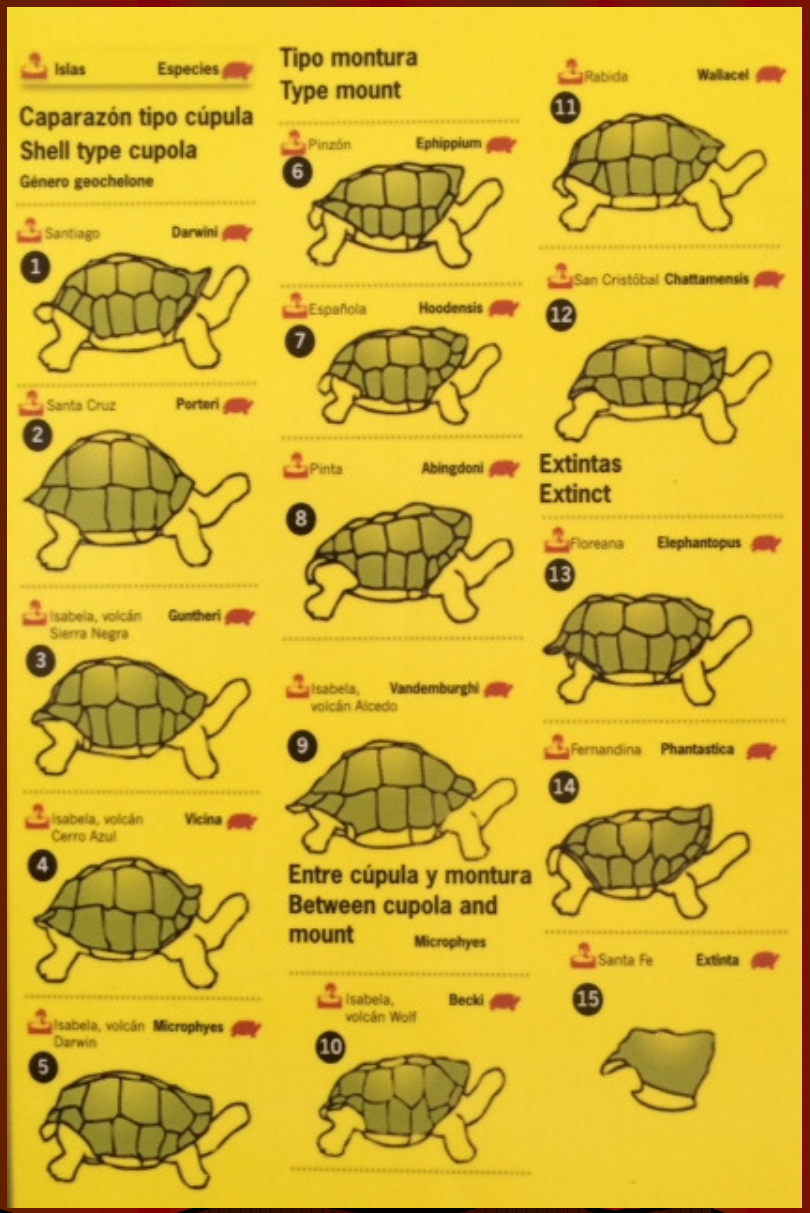


All giant tortoise are cold blooded terrestrial herbivores. Can weight over 400 kilos with length close to 1.8 m – insular gigantism !

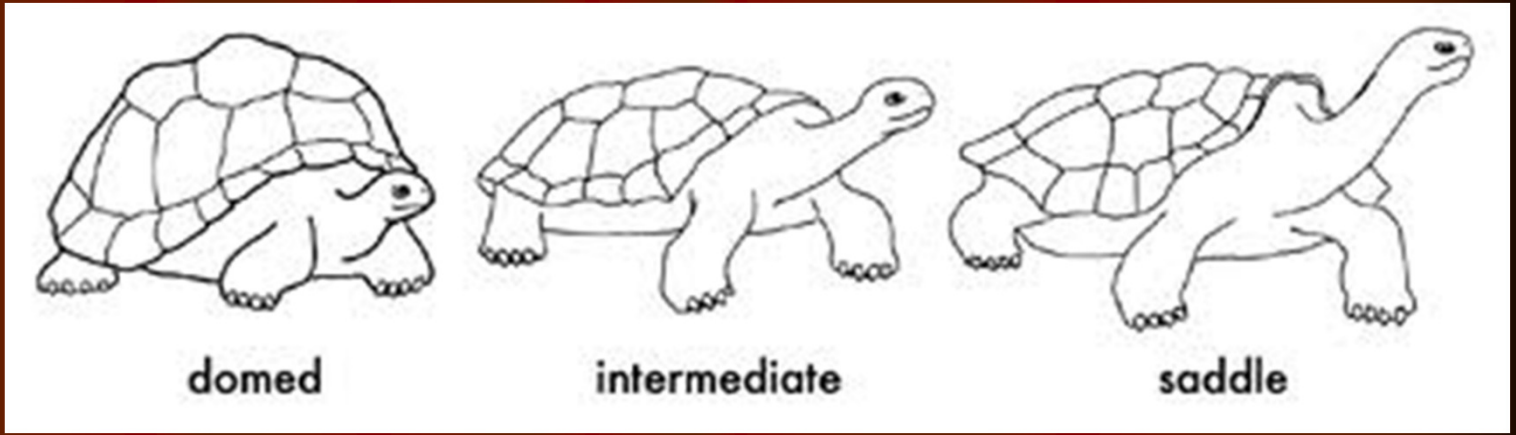


Total number have dwindled from 250,000 in the 16C to only 3,000 in the 1970s. An estimated 200,000 animals were hunted as food by pirates, whalers, sealers & merchantman. Rats bought by ships also ate their eggs. Now recovering close to 20,000 thanks to conservation but still classified as "vulnerable". There is increasing evidence that they act as "ecosystem engineers" exposing soil for plants to take root, opening up dense vegetation, dispersing seeds & help them to germinate.

Captive breeding at the Charles Darwin's Research Centre Santa Cruz


Islas
Especies
Caparazón tipo cúpula
Shell type cupola
Género geochelone
Santiago
Darwini
1
Santa Cruz
Porteri
2
Isabela, volcán Sierra Negra
Guntheri
3
Isabela, volcán Cerro Azul
Vicina
4
Isabela, volcán Darwin
Microphyes
5
Tipo montura
Type mount
Pinzón
Ephippium
6
Española
Hoodensis
7
Pinta
Abingdoni
8
Isabela, volcán Alcedo
Vandemburghi
9
Entre cúpula y montura
Between cupola and mount
Microphyes
Isabela, volcán Wolf
Becki
10
Rabida
Wallacei
11
San Cristóbal
Chattamensis
12
Extintas
Extinct
Floreana
Elephantopus
13
Fernandina
Phantastica
14
Santa Fe
Extinta
15

Three main types of shell shapes



- Dome shell Giant Tortoise* (*porteri*)

  on islands with humid highland such as Santa Cruz which has a lot of ground vegetation, the tortoise are larger with dome shaped carapace & relatively short necks






- Intermediate shell Giant Tortoise*:(*chathamensis*)

- Saddleback Giant Tortoise* (*abingdoni i*)

  on smaller islands with dry lowlands such as Espanola & Pinzon, the tortoise are smaller & have arched shaped carapace & long necks to allow them to reach for tall vegetation above especially the prickly pear cactus, an example of coevolution & the Red Queen hypothesis. Some scientists also think the special shape may have sexual appeal like the peacock feathers






- Giant Tortoise mating; tortoise egg & hatchling. Note the smaller size of the female, an example of sexual dimorphism

- Galapagos Mockingbird * 嘲東 /模仿鳥 An aggressive bird but unlike its North America cousins they cannot mimic the sounds of other birds & insects. Darwin's attention to the islands great diversity was first aroused by comparing the 4 different mockingbird species living on the islands (*Mimus parvulus, M. macdonaldi, M. trifasciatus, M. melanotis*) rather than finches.

  Another example of divergent evolution & adaptive radiation

All four species were originated from the mainland's Long-tailed Mockingbird

Only 200 Charles Mockingbird left in Floreana !

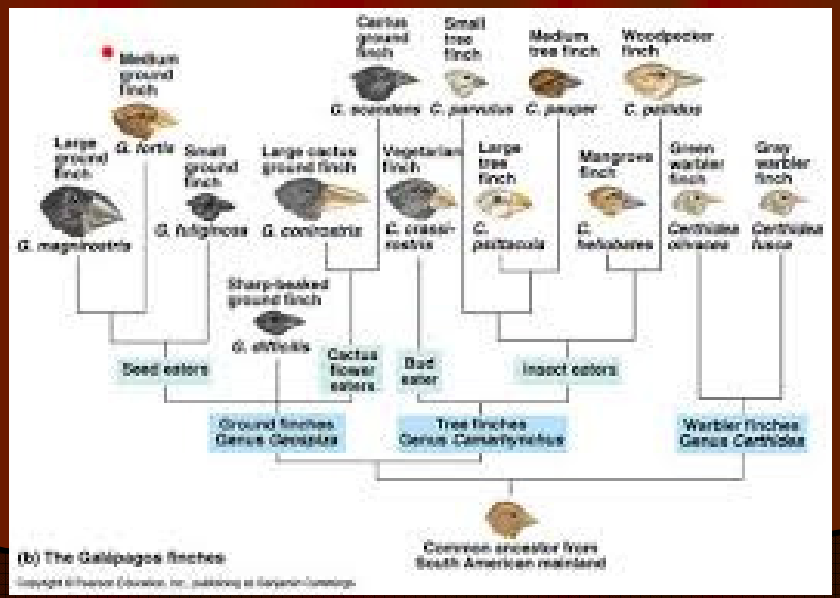
Mocking bird is very territorial & inquisitive. Hood Mocking bird is particularly aggressive



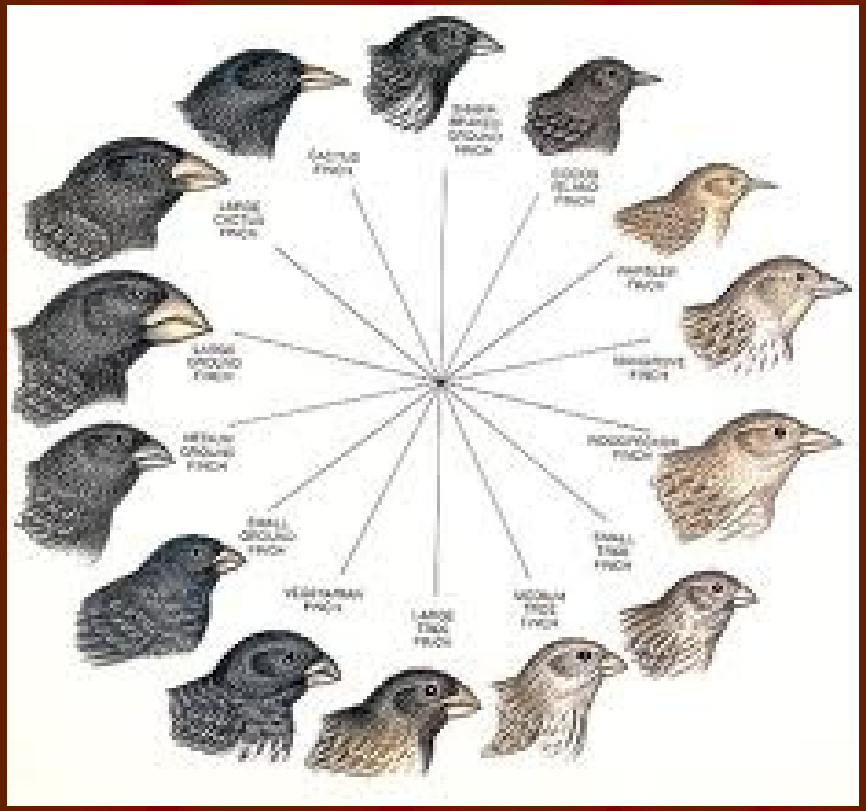



- Darwin's Finches* (*Passeriforms thraupidae*) 地雀/芬雀/鷽鳥
  15 species* evolved from a common ancestor which arrived the island 2-3 Ma each with different beak adapted to their different feeding habits varying from seeds, buds, leaves, fruits, insects to tool using & blood sucking (* 1 already extinct, 1 in Coco Island)

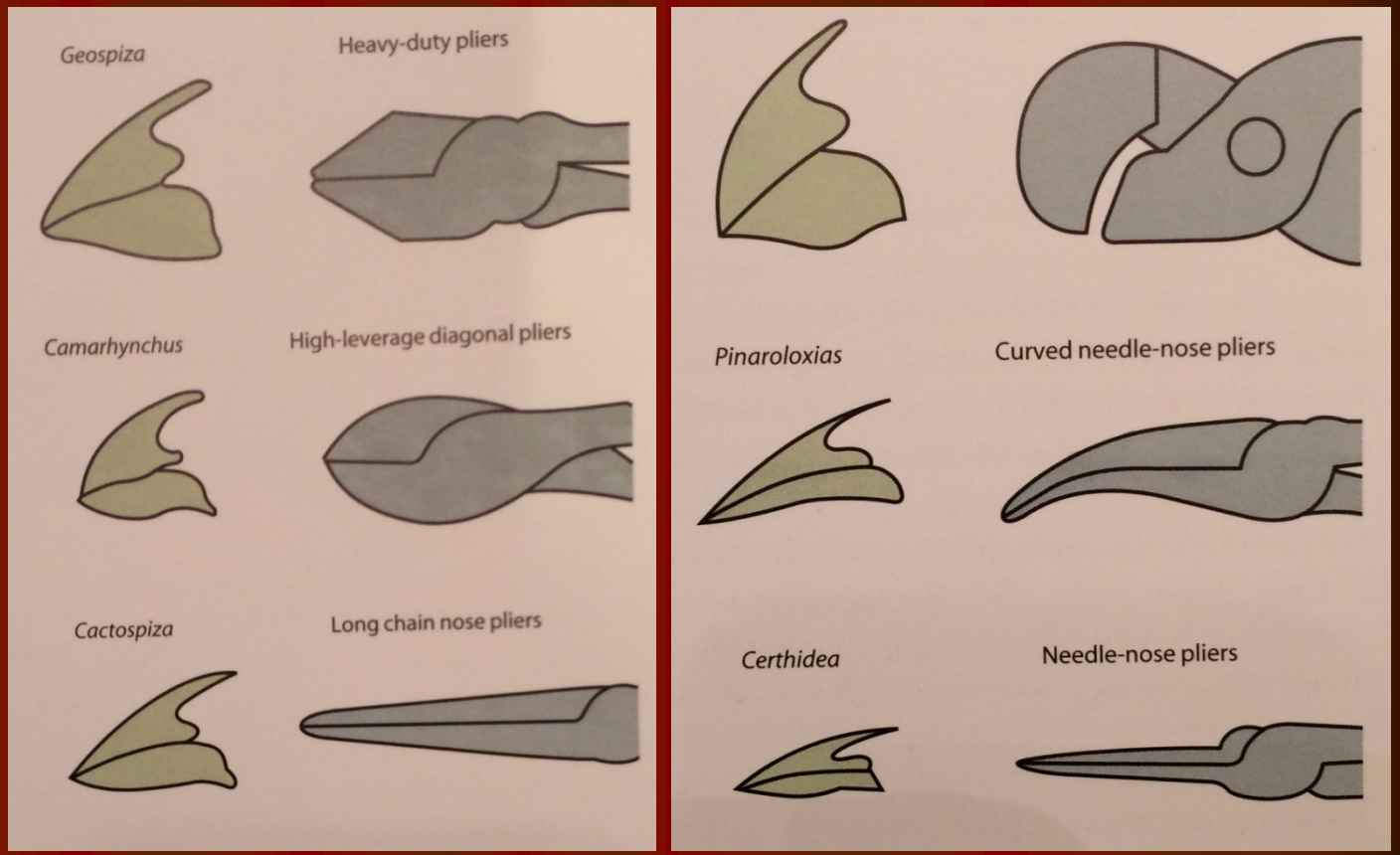


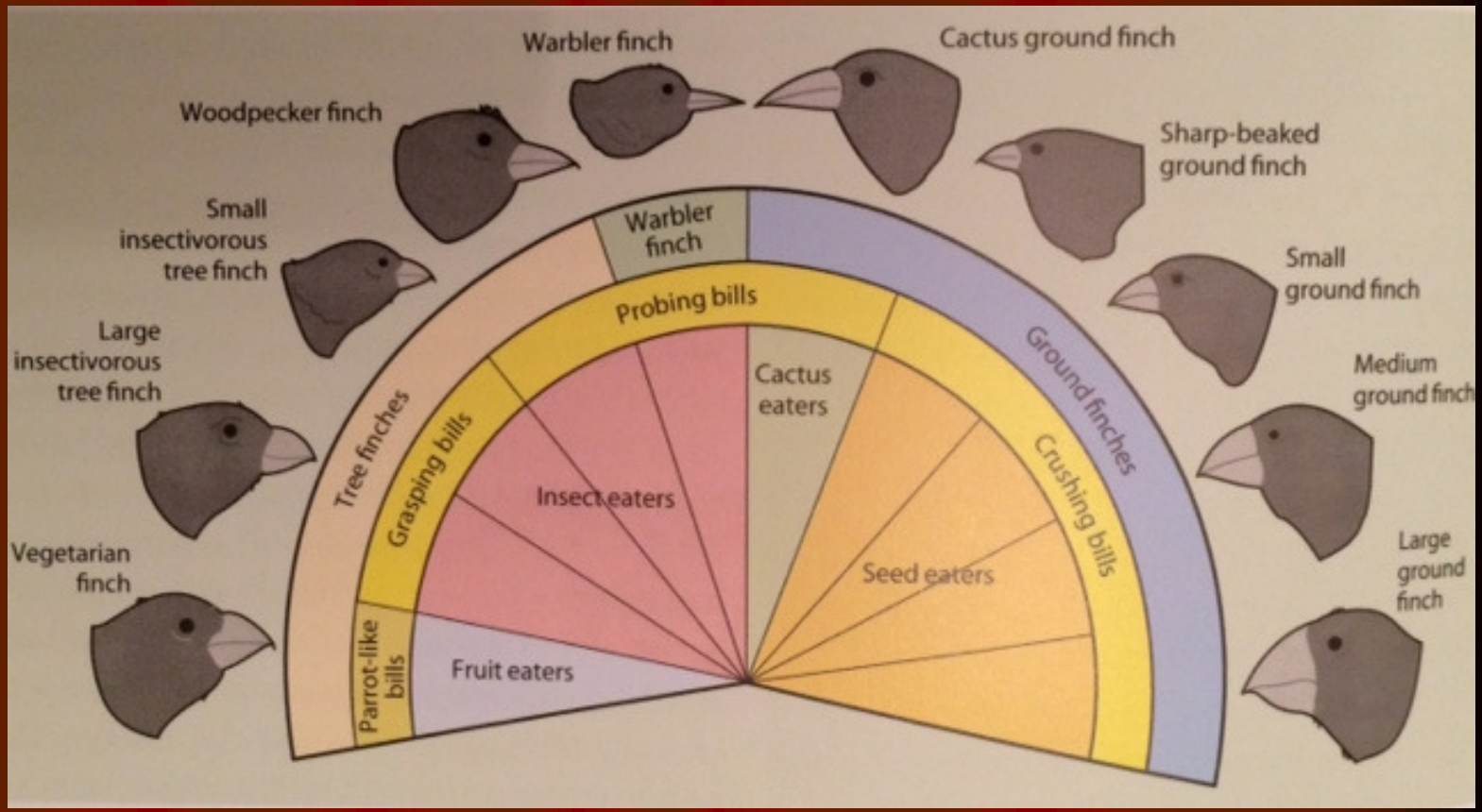
Darwin's finches vary in size from 10 to 20 cm and weigh between 8 to 38 grams. The 14 species include Ground finches 地芬雀 (6), Tree finches 樹芬雀 (4), Vegetarian Finches 素食芬雀 (1), Wabler finches 鶯芬雀 (1), Coco finches 可可芬雀 (1) & 离草芬雀 (1). Vegetarian finches is the largest & Warbler finches the smallest



The beaks of finches are tools for gathering & dealing with different types of food, a classic case of Adaptive Radiation 適應性副射 meaning an organism diversify rapidly into a multitude of new forms due to fragmented landscape and in this case living on isolated islands

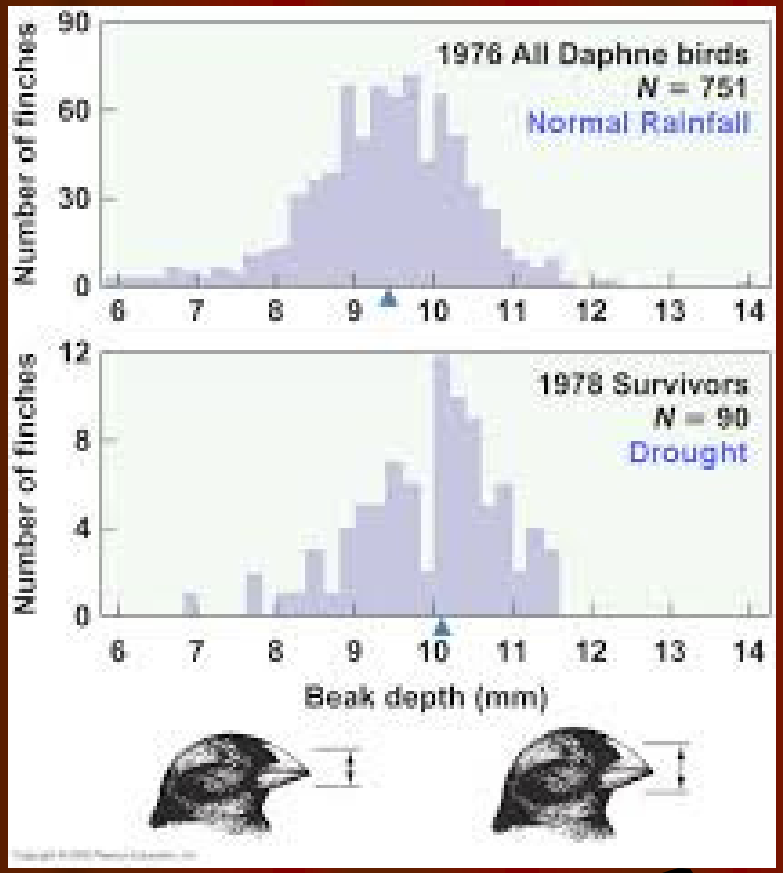


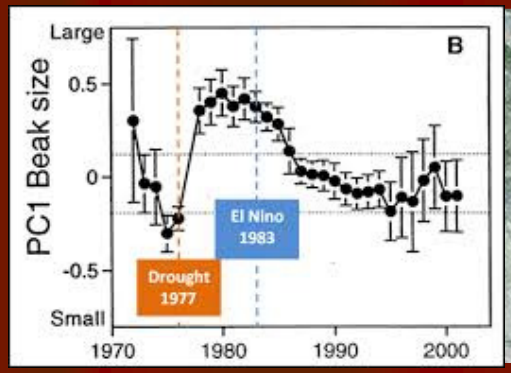
Different kinds of finches flourish under different type of climatic condition. During dry periods seeds are hard so birds with large beak have an advantage & increase in flock size. Reverse is true in wet period when more soft seeds are produced which favors birds with small beak



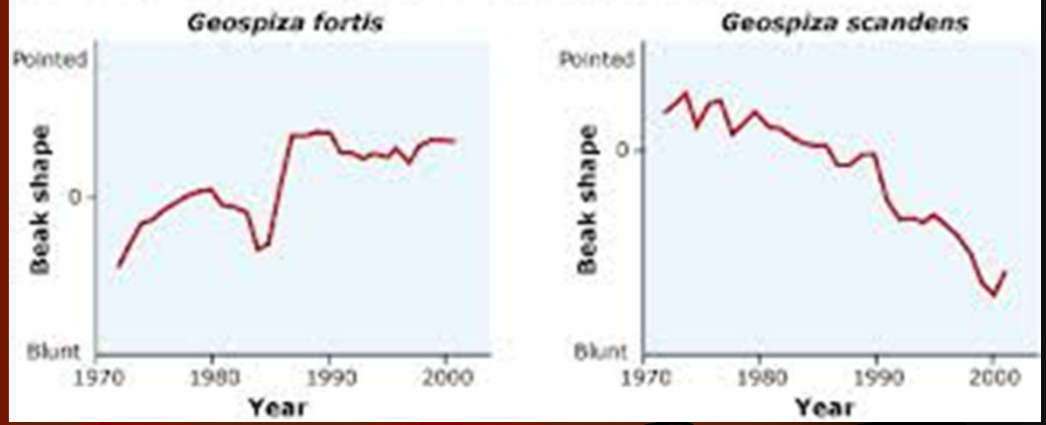
Peter & Rosemary Grants study on Dalphne Island 1976-1993

Different kinds of finches flourish under different type of climatic condition. During dry periods seeds are hard so birds with large beak have an advantage & increase in flock size. Reverse is true in wet period when more soft seeds are produced which favors birds with small beak = evolution in action over a relatively short period





These graphs of beak shape over time for two species of Galapagos finch show that a lot can change over a relatively short period.



The woodpecker finch or carpenter finch (*Camarhynchus pallidus*) is unique in using a twig or a cactus spine as a tool to extract hidden insect larvae

The rarest is the mangrove finch found in the islands of Fernandina & Isabela. Total population only 60-140. As one of the tree finches it feeds on insects, larvae, spiders & vegetarian matters found in mangroves. Now classified as critically endangered

- Flightless Cormorant* 鸕慈 (*Phalacrocorax harrisi*)

Endemic with only 800 pairs living along the coast of Fernandina & Isabela. Due to the lack of predator they have completely lost their flying skill with wings being degenerated & also grow in size. However with their streamlined body & strong pedal like feet these flightless birds can fly under water. An example "Use & Disused" & Insular gigantism. This bird do not mate for life !






- Galapagos Penguins * (*Spheniscus mendiculus*)

  Closely related to the Humboldt Penguin but smaller in size at 0.5m, it is the only wild penguin species living on the Equator. They live in the cooler water on the west coast and use the cool lava tubes as nursery. Population only 1,200 – now endangered !







At 0.5m, it is the smallest of the banded penguins. An example of Island dwarfism

1. Humboldt
2. Magellanic
3. African
4. Galapagos








Iguana 鬣蜥

There are three species of iguana in the Galapagos all sharing a common ancestor from the South America mainland which arrived the islands by rafting some 50,000 years ago :

- Black Marine Iguana (*Amblyrhynchus cristatus*)
- Yellow Land Iguana (*Conolophus subcristatus*)
- Pink Land Iguana (*Conolophus marthae*)

- Black Marine Iguana 海鬣蜥 (*Amblyrhynchus cristatus*)

  Unique in the world, marine iguana divergence happened when land iguana arrived the islands by rafting. Due to insufficient vegetation on land, they have to eat sea weed & algae & developed the skill to swim & dive to 20 m & stay there for up to an hour. Note the mouth is no longer protruding for easier feeding on algae. Also the development of a nasal gland allows the animal to filter its blood for excess salt ingested whilst eating & then expelled through the nostril. During lean El Nino years marine iguana can reduce their body size by absorbing the muscle & bones but still many died of starvation



Marine Iguana have 6 subspecies. They are all cold blooded. Most are black in color for camouflage against the black lava intertidal area where they live. However their color is not always black. Some adults are grey & adult males vary in color with the season. Adult males are up to 1.7 m long, female 0.6 to 1 m, males weigh up to 1.5 kilos. They can dive for 10 minutes & up to 12 m. Life span 30 years

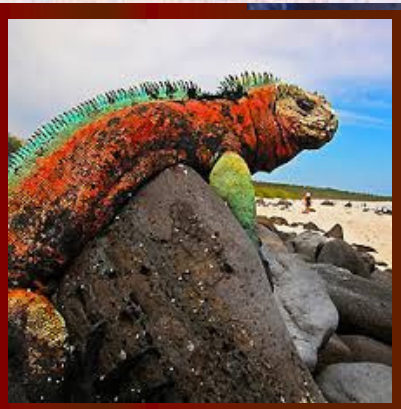





Some marine iguana are multicolored instead of black all over &
some possess complicated head & body decor









- A baby marine Iguana with its distinct lighter color dorsal stripes is hiding in a bush for protection against predators like herons




- Yellow Land Iguana* 陸鬣蜥: (*Conolophus subcristatus*)
  1 of 3 sub species*, over 1 m long weighing over 13.5 kilos, territorial but harmless vegetarians, love cactus (* the other two are *c. rosada* & *c. pallidus*). Land iguana can live up to 60 years









A Land iguana coming out of its underground burrow to eat a cactus fruit by first rubbing it on the ground in order to remove the spines

- Pink Land Iguana 粉紅陸鬣蜥 (*Conolophus marthae*)

  Native only to the northern side of Isabella Island around the Wolf Volcano & potentially moving closer into extinction by the eruption which is now taking place





Pink Land Iguana

- Hybrid Iguana 混種鬣蜥

  A cross between marine iguana & land iguana has been discovered in the last few years which is evolution in action !




Other interesting faunas

- Lava lizard* 熔岩蜥蜴 (*Tropidurus / Microlophus*)

  Seven different species all evolved from one single species. Each communicate differently by moving the body up & down like doing "push ups" but in distinct ways. Some of them catches flies on the bodies of seals & iguanas. Color patterns varies with the male larger than the female & very territorial. Unlike geckos they are active during the day



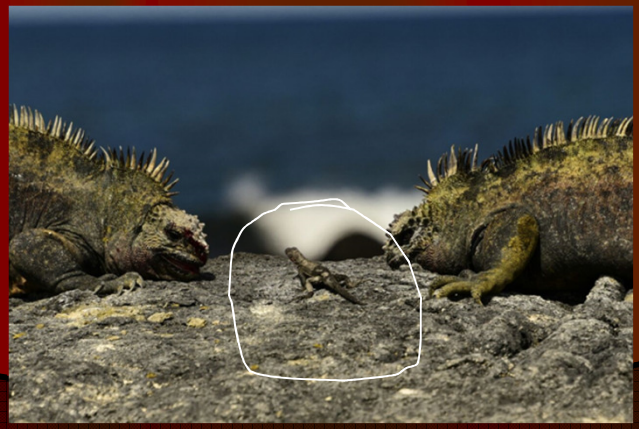
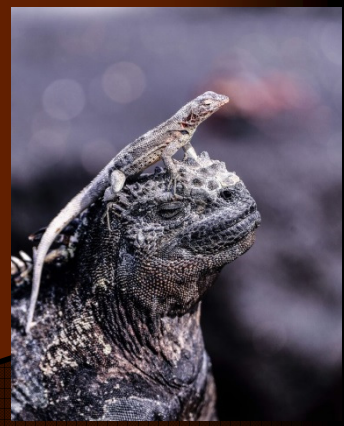


More Lava lizards 熔岩蜥蜴 (*Tropidurus*)







- Blue Footed Booby* 鯷鳥/笨鳥（*Sula nebouxii* ）

  A large sea bird skill in plunge diving from 30 m at 60 mph to a depth of 25 m catching sardine, anchovies, mackerel & squid. Their necks are protected by special air bags to cushion the impact. Blue foot is a sexually selected trait & the bird is also famous for its comical mating dance. The name Booby derives from the word "Bobo" which is Spanish for "Clown". 3/4 of the world's Blue Footed Booby are living in the Galapagos

Blue Footed Booby diving in motion

Blue Footed Booby's habitat; the comical mating dance & chicks

Blue Footed Boobys in their cliff side habitat

- Red Footed Booby*(*Sula sula*) smallest member of the booby family but very powerful & agile flyer despite clumsy in takeoffs & landings







Only Red Footed Booby is able to built its nest on trees due to the special design of their webbed feet






- Masked Booby or Nazca Booby (*Sula granti*)

  Largest of the three species, usually lays 2 eggs with an age gap of 2 to 7 days. The elder of the two will evict the younger chick which will die very quickly due to starvation. This is known as the "Kane & Abel Effect" (Genesis 4)







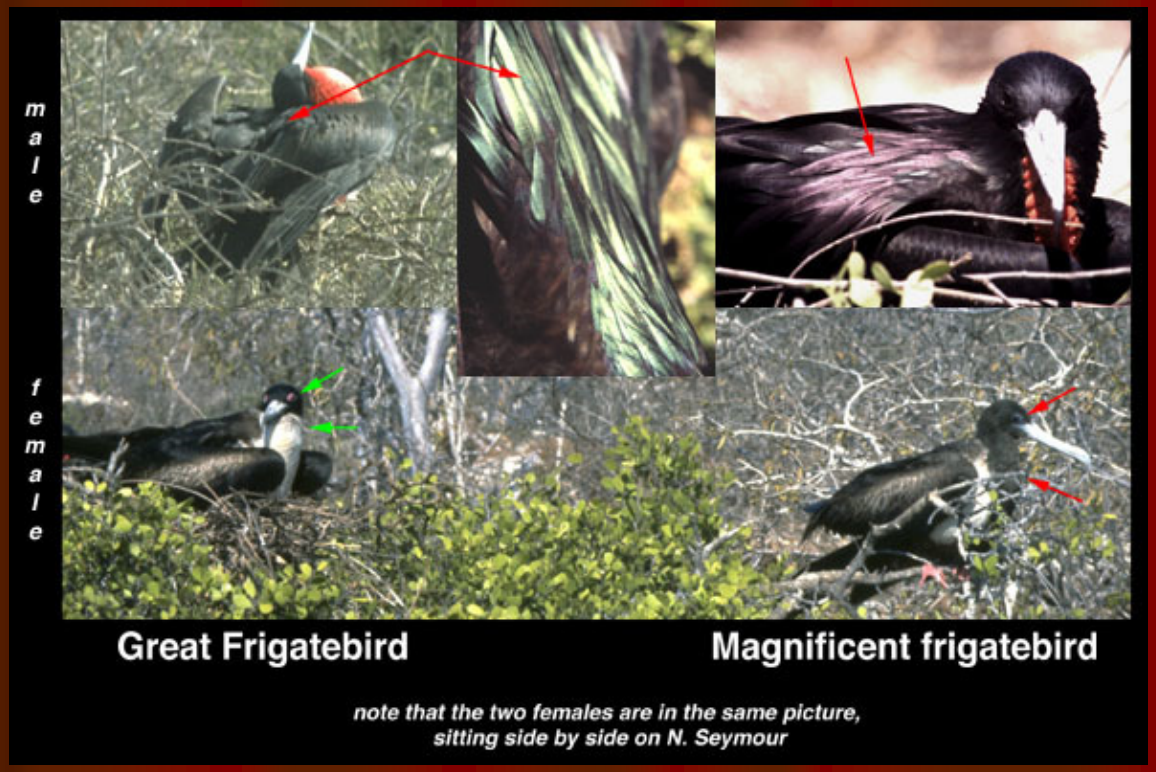
Nazca Booby is extremely territorial & protective of their chicks

- Frigate Bird 軍艦鳥

Previously known as Man-O'-War bird, it spends day and night on the wing covering 200 km before landing on land because it's body produces very little oil & cannot dive. Feeds mainly on fish but often attack other sea birds & force them to dislodge their meals. Only male has the red gular sacks which they inflate during courtship. Two species namely the Great Frigate (*Fregata minor*) & the Magnificent Frigate (*Frigata magnificens*) totaling 2,000 lives in the Galapagos



When reflecting the sun, the scapular feathers of the Great frigate has a green sheen where as the Magnificent frigate has a purple iridescence



Frigates resting on our boat

- Waved Albatross*信天翁（*Diomedea irrorata*）

  The name "waved" refers to the wave pattern in its feather. With a wing span of 2.4 m & weighing about 3-5 kilos, it is the largest bird in the islands & the only albatross species living entirely in the tropics. Feeding on squids, fish & crustaceans, Albatross can fly very long distance but cannot take off without the aid of strong wind

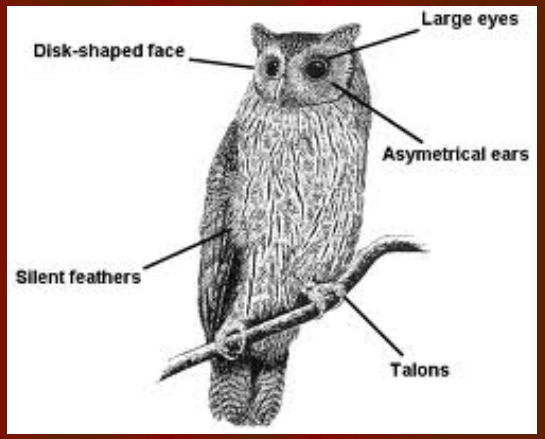
The world's entire population of 12,000 pairs of Waved Albatross nest on Espanola. They can live up to 50 years & are mated for life. They select their partners through a lengthy & noisy courtship "Dance" by clicking their beaks together at a great rate. They lay only one egg

- Galapagos Hawk* 加拉巴哥鷹：A large hawk endemic to the islands preys on insects, marine iguana and small goats. Representing the top of the food chain. For this one the female is larger than the male & mates with up to 7 males per season !






- Short-Eared Owl* 短耳貓頭鷹 (*Asio flammeus*) : This bird hunts during the day & also at night with petrel being its favorite food



- Galapagos doves* 加拉巴哥鴿 (*Zenaida galapagoensis*)

  Endemic to the Galapagos living in the arid lowland. With a curved beak to feed on seeds, it is a very tame bird which can only fly for a short time






- Galapagos Brown Pelican* 加拉巴哥鵜鶘 /塘鵝 (*Pelecanus occidentalis*)

  They are the smallest of all pelicans species living on a fish diet





- Galapagos Greater Flamingo* 加拉巴哥火烈鳥

  There are about 500 greater flamingo living in the many hypersalinic lagoons in the Galapagos. Galapagos flamingo are considered to be the most brightly colored flamingo in the world. Their pink color is obtained by eating a pink brine shrimp called artemia. Their necks are longer than the feet which can only bend backward. Flamingo usually live in pairs but we only saw two singles during the trip !






- Galapagos Petrels* (*Pterodroma phaeopygica*) 海燕：

  Locally called patapegada meaning "web-footed one" they are endemic sea bird nesting in areas of high humidity in the larger islands. Population seriously reduced to only 10,000 individuals due to introduced mammals like dogs, cats & rats. They are also the favorite meal for the Short-eared Owls. Now under protection






- Lava Heron* : Their black feathers provide excellent camouflage for hunting among lava rocks. Endemic to the islands catching fish, crabs & lizards



- Yellow Crowned Night Heron*: A common resident water bird

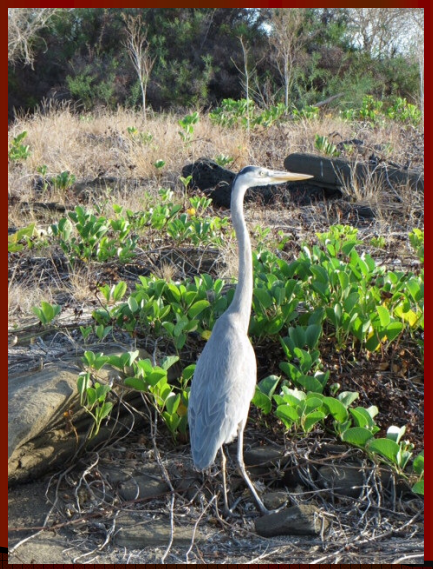


- Great Blue Heron* (*Ardea herodias*)

  It is a resident wading bird of the heron family found along the coastal areas. Weighing 2 kilos 130 cm high with a 2 m wing spread








- Cattle Egret* (*Garca de ganado*)




- Lava Gulls* 熔岩海鷗（*Gaviota de lava*）: It is the rarest gull on earth with only 400 pairs still alive as omnivores/scavengers






- Swallow Tailed Gulls* (*Creagrus furcatus*): a near endemic bird of the Galapagos Islands and the only nocturnal gull & sea bird in the world with total population only around 35,000 pairs preying on squids & small fish which rise to the surface at night to feed on planktons. The bird has very low melatonin level compared to other non nocturnal sea gulls






- American Oystercatchers*(*Ostrero*) they are shore birds feeding on marine invertebrates and built their nests on rocky beaches for breeding




- Ruddy turnstone* (*Vuevle piedras*)



- White cheeked pintail*(*Patillo*) : they shared our swimming pool in Santa Cruz !



- Galapagos flycatchers* *(Myiarchus magnirostris)*：also known as large-billed flycatcher or Papamoscas locally, endemic & present on all the main islands



- Yellow warblers*(*Canario maria*) 黃柳鶯：They can be found frequently in the Galapagos



- Galapagos Red bats

- Rice Rats (*Aegiatomys galapagoensis*): 7 endemic species including Santiago Galapagos mouse & Fernandina Galapagos Mouse. It is tamed & unafraid of human

- Galapagos snakes : 3 endemic species - Floreana, Galapagos & Slevins, all only slightly venomous






- Galapagos insects : both poor in varieties and in number. Nevertheless there are still about 1,000 species including beetles, ants*, wasps, bees*, butterflies*, moths, locust*, scorpions, spiders* & centipedes. Many insects living inside the lava tubes are blind – a case of "use & disuse"

Galapagos Carpenter Bees* (*Xylocopa darwini cockerell*)

Flowers on the Galapagos islands are mostly either white or yellow in color because carpenter bees which is the only endemic species & therefore the major pollinator love these two colors ! Males are golden brown females are black in color – Coevolution in action



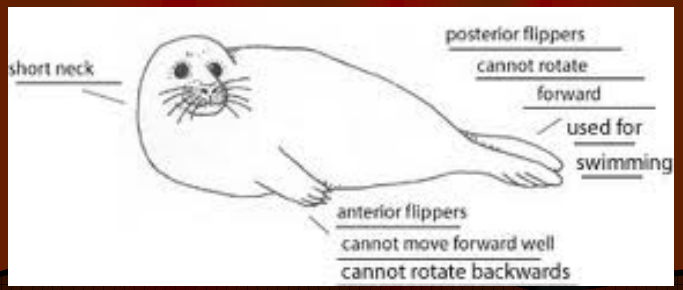


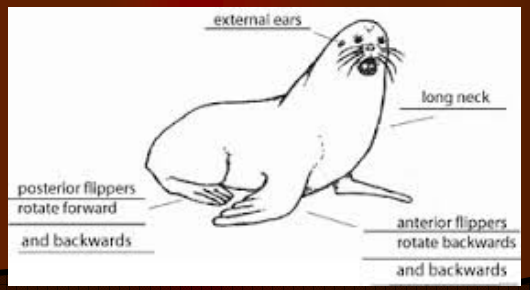

- Galapagos land snails : Many tiny endemic species. One species Bulimulidae snail is endemic & only reach 25 mm

Galapagos Marine lives

Differences between Seal & Sea Lion

	Seal	Sea Lion
Ears	No external ear flap (just a hole)	External ear flap
Fore Flippers	Short and fur covered Long claws	Long and skin covered Short claws
Hind Flippers	Point out or away from their bodies and cannot rotate under their bodies	Rotate under their bodies Most useful for 'walking' on land
Insulation	Primary source: a thick layer of blubber Fur is not thick enough trap air for insulation	Primary source: both blubber and a dense layer of fur to trap air for insulation





- Galapagos Fur Seals*加拉巴哥海狗 (*Arctocephalus galapagoensis*)
  Smallest fur seal in the world totaling 30,000 endemic to the Islands living in large colonies on rocky shores of Santiago & Genovesa






- Galapagos Sea Lions*(*Zalophus wollebaeki*) 加拉巴哥海獅

  Relative of the California sea lion they are found everywhere with population fluctuating between 20,000 to 50,000. Length 1.5 to 2.5 m. Their thinly webbed flippers, external flapped ears, agility on land with stronger forearm & no fur differ them from seal






- A great show performed by a young sea lion !

Sea lions on the red beaches of Rabida Island, totally relaxed









- Whales : Humpback, Blue, Southern Minkes, Brydes, Pilot & Orcas

Examples of Convergent evolution








- Dolphines 海豚

There are five species of dolphins living in the Galapagos. They include Bottle noised dolphin*, common dolphin, Risso's dolphin, Spinner dolphin & Spotted dolphin. The Bottle noised is the most commonly sighted cetacean living in pods of 20 to 30








- Pacific Green Sea Turtles*(*Chelonia agassizii*)

  Galapagos has the richest concentration of Green Sea Turtles in the Pacific which is a darker subspecies of *Chelonia mydas*. Male has a larger tail & narrower carapace than female & they can rest or sleep underwater for several hours. We observed two or more males courting a female and actually saw several of them mating in turns. The female lays from 40 to 100 eggs every 3 to 5 years but only 3 to 5% can reach maturity not having eaten by frigate birds, pelicans & big fishes. Note the nests located above high tide mark





- Hawksbill Turtles* (*Eretmochelys imbricata*) The hawk bills are endangered & under protection




Photos of Green Sea Turtle & possibly hawk bills taken under water

Fishes

400 different species of which 50 are endemic. We encountered many whilst snorkeling. This page Razor Surgeonfish* (Yellow tail), Moorish Idols*, Grunts*, King Angels*, Panamic Sergeant Major* & Parrot fish*





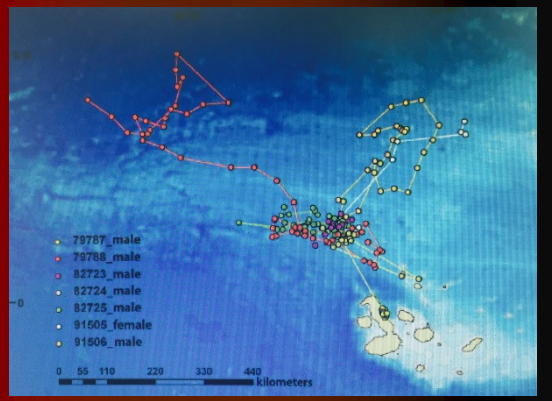

This page Mexican Hogfish*, Eye stripe Surgeon fish*, Wrasse* & Red Grouper* with one being consumed by a sea lion right in front of us





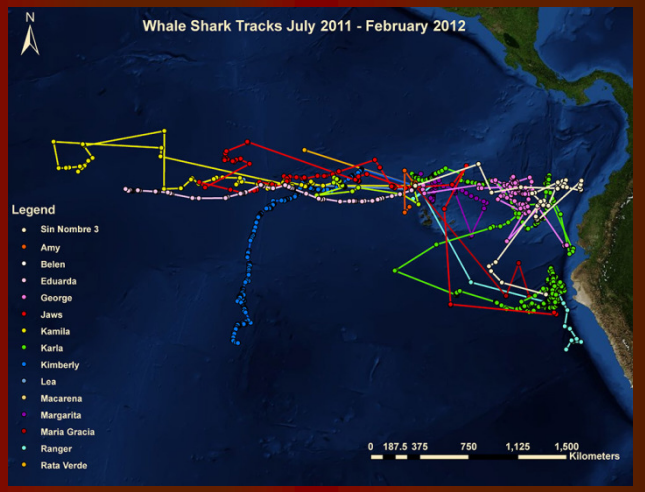

- Scalloped Hammerhead Sharks* (*sphyrna lewini*)

圓齒雙髻槌頭鯊 up to 1.8 m in length they swam in large numbers in the surrounding sea but are relatively unaggressive. Groups particularly likes to congregate around Wolf Island & Darwin Island which have become a major destination for divers. We only saw one baby swimming close to our boat



- Whale Sharks (*Rhincodon typus*) 鯨鯊

  It is the world's largest fish which can grow up to 12-18 m long weighing 12 tons. Whale sharks are filter eaters. They pass through the Islands typically Wolf & Darwin from June through November each year to feed on planktons then move west towards the Pacific



- Rays : Some 15 species including Spotted Eagle Rays, Golden Rays* & Manta Rays* with the latter stretching 9 m across the "wings"









- Ocean Sun fish*：翻車魚 also called “Mola Mola” is the heaviest bony fish in the world weighing 1,000 kilos & reaching 3 m across. Its favorite food is jelly fish. Although the body contains toxin it is considered a delicacy by man especially in Taiwan (萬波魚) & Japan. Saw one swimming past the boat

- Red-lipped batfish (*ogcocophalus darwini*)

  Endemic, lower fins modified to walk on the floor at a depth of 30m



- Galapagos sea robin (*Prionotus*) can also "walk" on the sea floor

- Red Rock Crabs* 紅岩蟹 (*Grapsus grapsus*)

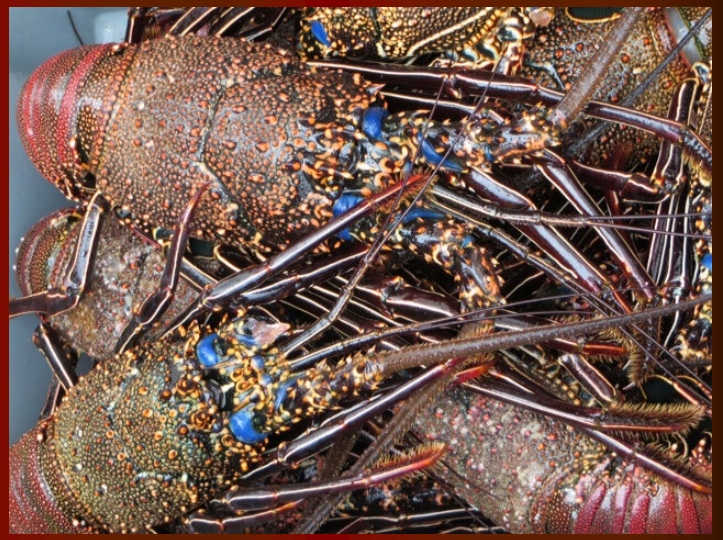
  Salt water crabs living on rocks along the coast just above the limit of the sea spray. Feeds on algae. Very agile, walks on tiptoes does the name "Sally lightfoots"






Baby crabs are lava herons favorite so they are in black color which makes them less conspicuous against the lava rocks than the bright red adults

- Galapagos lobsters*: beautiful to look at but not very tasty



- Sea urchins : saw large colonies of endemic Green Sea Urchin*(*Lytechinus semituberculatus*), Pencil Spined Sea Urchin* (*Eucidaris thouarsii*) as well as big black Hatpin Sea Urchin*






- Star fish : Panamic Cushion* ,Chocolate Chip*, Blue sea star, Sun star

Galapagos flora

Galapagos flora

Over 560 species all "Pioneer Plants" of which 180 are endemic. About 59% were transported as seeds by birds, 32% by wind & 9% by ocean








There are 7 main vegetation zones on mature islands such as Santa Cruz

1. Coastal Zone 2. Arid Zone 3. Transition Zone 4. Scalesia Zone
5. Brown Zone 6. Miconia Zone 7. Pampa Zone

1. Coastal zone : mainly evergreen, 4 species of mangrove, saltbush, creeping vines & succulent shrubs




2. Arid zone : lying in the rain shadow, a semi desert forest mainly cactus particularly opuntia, cereus & Palo Santos, all drought resistant



3. Transition zone : intermediate in character between the arid & the humid scalesia zone dominated by shrubs. Forest still mainly deciduous, endemic plants include guayabillo (guava) & Galapagos tomato




4. Scalesia Zone : Humid area with evergreen lust cloud forest dominated by *scalesia pedunculata* trees, ferns & orchid


5. Brown Zone : intermediate between the dense scalesia forest & the miconia shrubs, an open forest dominated by cat's law, *tournefortia pubescens* & *anunistus ellip*ticus. Trees heavily draped with mosses, liverworts & ferns


6. Miconia zone : 300-600m, treeless with endemic miconia shrubs, liverwort & ferns. This area is also used for cultivation and pasture



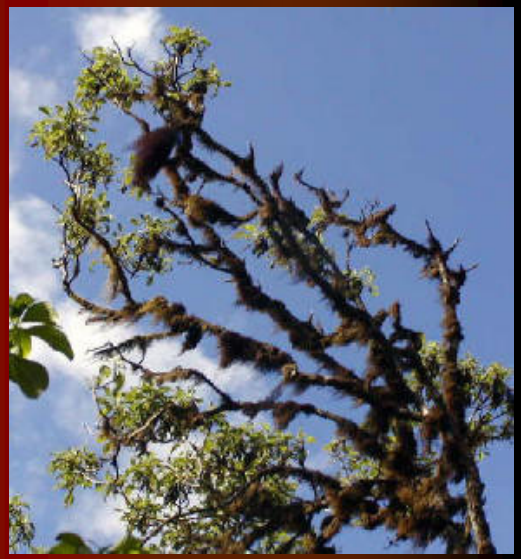
7. Pampa zone : over 600m, no trees or shrubs, largely grasses & sedges


- Scalesia or "Daisy Tree"* 樹菊屬

  A genus belonging to the family *Asteraceae* (Daisy family) is endemic to the Galapagos . There are 15 species growing as shrubs and trees. Scalesia is called "Darwin's finches of the plant world" because they show a similarly dramatic pattern of adaptation radiation. The plant can grow on hardened lava because of its ability to absorb water directly from the air

Of the 15 species 3 are trees with *Scalesias pedunculata* being the tallest growing up to 20 m. Their trunks and branches are often covered in epiphytes: dripping mosses, ferns & orchids. They flourish best in the humid wind ward sides of Santa Cruz, San Cristobal, Santiago & Floreana

Scalesia trees are often covered with mosses*, fern* & orchids*



- Galapagos carpet weed* (*Sesuvium edmonstonei*) 氈草
  A plant from the Aizoaceae family which is endemic. Its leaves turn reddish in color in dry weather




Palo Santo (Holy Wood/Incense Tree/Torch wood)*

帕羅奧聖樹

Found in the arid zone, this ghostly looking tree produces a mystical wood related to Frankincense

- Darwin's cotton plant* (*Gossypium darwinii*)

  Closely related to the native American species, it's flower is the largest among Galapagos endemic species. Note the color , its yellow again !

Galapagos Cactus*

One of the principal source of good for the animal living in the low land. Key species : *Brachycereus nesioticus*, *Opuntia echios, O. galapageia, O. litorallis, O. hellen, O. insularis, O. megasperma & O. saxi cola*






Lava cactus* (*Brachycereus nesioticus*)

Endemic & smallest of the Galapagos cactus colonizing the lava fields






Prickly pear cactus (*Opuntia echios*)

Endemic. A case of "Co evolution" with the giant tortoise

Note the internal structure of the pear cactus stem for storing water

Giant cactus

(*Opuntia megasperma*)

Can grow up to 12 m high with trunks like trees

Prickly pear cactus (*Opuntia litorallis*)

has yellow flower & green fruits and grow between 1 to 3 m tall







Prickly pear cactus

(*Opuntia saxicola*)

Endemic & critically endangered, restricted to Isabela

Prickly pear cactus

(*Opuntia insularis*)

Endemic & endangered, restricted to Fernandina & Isabela

Candelabra cactus* (*Jasminocereus*)

Endemic, can grow up to 7 m high







Poison apple* (*Manchineal*)

The tree is actually a Euphorb which is very toxic even when simply touched.
However it does no harm to giant tortoise & land iguana

Galapagos Moonflowers *曼陀蘿

A romantic plant with flowers opening in the evening & stay open until sun rise.
It is however also poisonous !






Galapagos Passionflower (*Passiflora foetida*) 西番蓮

It is the flower of an endemic vine covering shrubs, rocks & trees. Its fruit is a food source for birds & other animal. Locals believes it has a seductive property & use it for pain relief; treating heart condition, anxiety and even epilepsy

Galapagos Passionflower (*Passiflora foetida*)

The Tour

- Travel Agent : Jacada Travel London, 144 Liverpool Road, London N1 1LA (open 2008 with 40 staff handling 1,000 clients per year, AIT insured) in cooperation with Metropolitan Touring Ecuador. Staff in charge Ms Ciara Owen (44- 020-7619 1380 or 44-020-7619 1397 email : ciara@jacadatravel.com) Metropolitan Touring (593) 99-972-2941/2, Andria 0983501077 email operaciones@metropolitan-touring.com

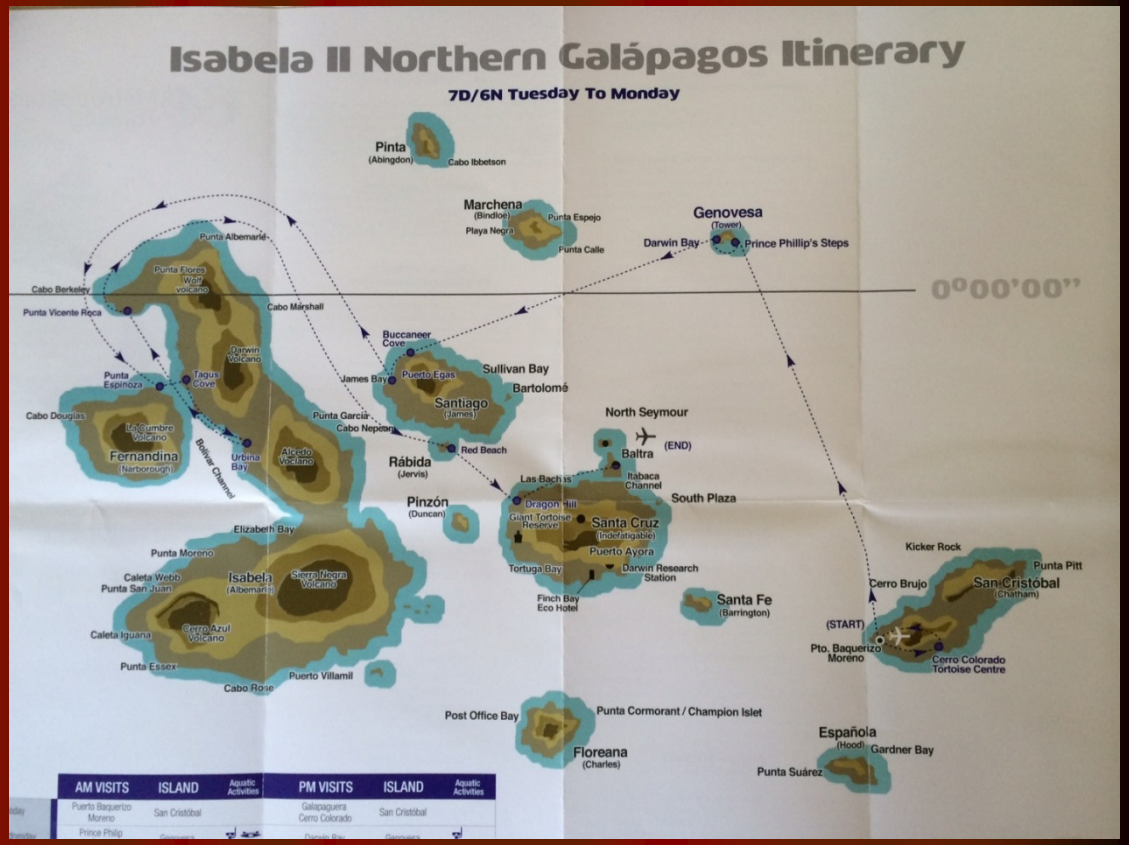
- 15 day trip from Sunday the 7th to Sunday the 21st December including : 6 nights island cruise living on a boat, 2 nights on Santa Cruz Island & 6 nights land tour in Ecuador mainland

- Island Cruise : by Isabella II

- Price : US$6,500

8 Island Cruise itinerary

- San Cristobal
- Genovesa
- Santiago
- Fernandina
- Isabela
- Rabida
- Santa Cruz
- Baltra



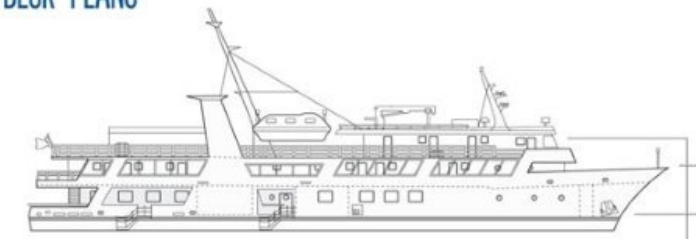
We passed the Equator six times at sea

Group Photo – 33 strong

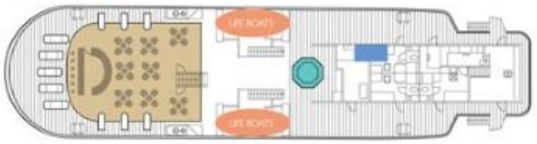
Isabela II

- 1,025 tons expedition yacht built 1979 refurbished 2000 speed 10 knots maximum 12 knots
- 16 classic rooms, 2 standard singles, 2 double plus one child total capacity 40 all air conditioned with bath/toilet & hair dryer
- Dining room, bar-lounge, reading room/library, exercise room, Jacuzzi, sun deck, gift shop,
- Owner Metropolitan Travel, Ecuador
- Equipped with 3 zodiac inflatables, 1 glass bottom boats, kayaks, wet suits, snorkeling (not diving) equipment
- E-mail, Internet, phone/fax
- Electricity 110 volt US style outlets
- 3 onboard naturalists
- 1 medical officer

DECK PLANS

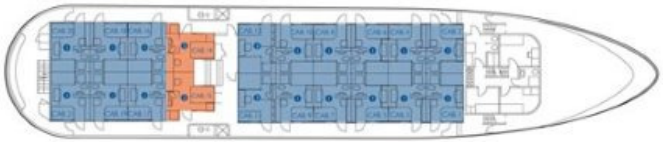


Boat Deck



Bar
Exercise Room
Jacuzzi

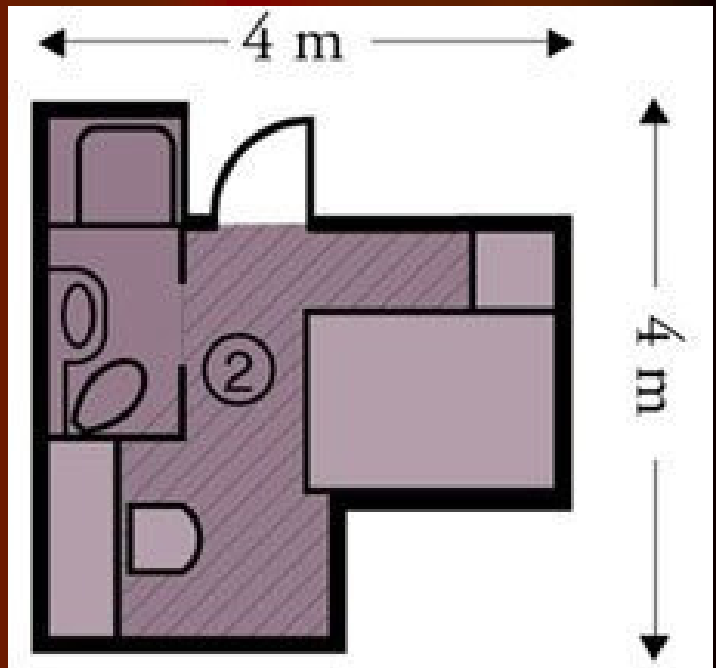
Cabin Deck



classic cabin
standard cabin

Main Deck

natural history library
master cabin











GALAPAGOS
EXPERIENCE



OCEAN KAYAK
MALIBU TWO

Isabela Fried Rice, an “introduced” recipe

Park Rules

- Stay on the trails
- Visit sites only accompanied by official guides
- Do not feed or touch the animals – keep 3 m away
- Do not remove any object living or not from the islands
- Do not bring food to the visitor's sites
- Do not litter
- Do not buy objects made from plants or animals
- Smoking is not allowed

Parque Nacional
GALÁPAGOS
Ecuador

SAN CRISTOBAL (Chatham)

- The Eastern most island & geologically oldest. See frigate birds, blue & red footed boobies, tortoises, marine iguana, sea lions, swallow tailed seagull, rays, sharks, lobsters. Visited Puerto Baquerizo Moreno & Galapaguera Cerro Colorado

- Puerto Baquerizo Moreno, the main port of the Archipelago



- Galapaguera Cerro Colorado : visited the Cocoa plantation. The exhibits of the Interpretation Center is quite disappointing



GENOVESA (Tower)

- Genovesa Island is a shield volcano with a collapsed caldera & relatively young lava flows on the flanks. Called the "Bird Island" there are large colonies of frigates, boobies, gulls, petrels, mocking birds as well as Darwin's finches

- Up the Prince Philip's Steps & down to the Darwin Bay



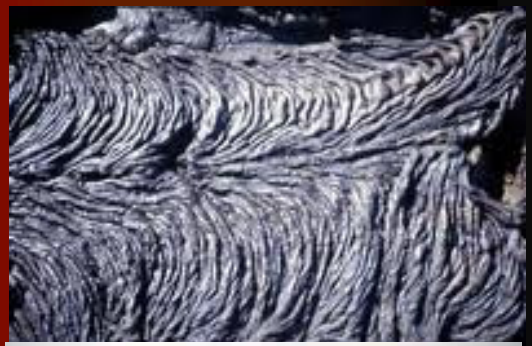






SANTIAGO (James)

- Also known as San Salvador the island is consisted of two overlapping volcanos. The oldest lava flow is dated at 750,000 Ya. Marine iguana, sea lions, seals, sea turtles & crabs are found here.

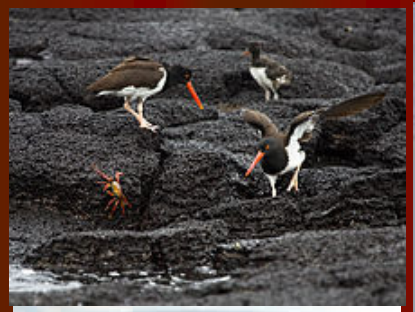


- The Buccaneer Cove

- Puerto Egas

FERNANDINA (Narborough)

- It is the youngest of the Galapagos Island formed by the hotspot with La Cumbre Volcano located right at the center. Last eruption took place in April 2009. Marine iguanas, land iguanas, flightless cormorants & penguins inhabit the island



- Punta Espinoza : iguana, whale bones, lava tubes & lava cactus

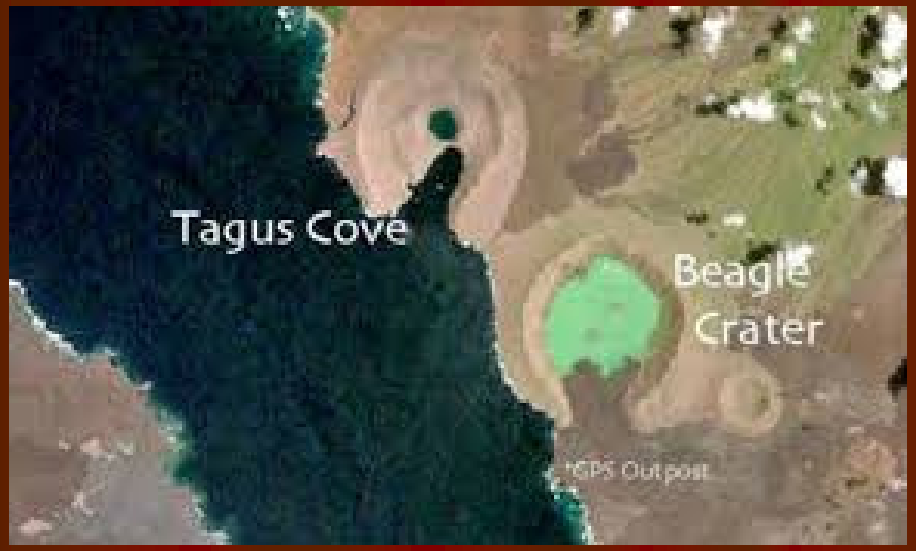





ISABELA (Albermarle)

- It is the largest island of the Galapagos & at 1 million years old, one of the youngest. The island is formed by merger of 6 shield volcanos. Isabela is rich in animal, bird & marine life : frigate birds, blue & red footed boobies, cormorant, tortoises, marine iguana, sea lions, penguins, swallow tailed seagull, rays, sharks & lobsters

- Tagus Cove : a crater lake created by lava flow



- Road to Tagus Cove surrounded by Palo santo trees

- Urbina Bay : land iguanas, giant tortoises & penguins





- Punta Vicente Roca : a large sea cave



Recent lava flow

RABIDA (Jervis)

- At 4.9 km2, the island is famous for its red sand beaches resulted from oxidation of iron rich volcanic material and a salt water lagoon inhabited by flamingos

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Santa Cruz

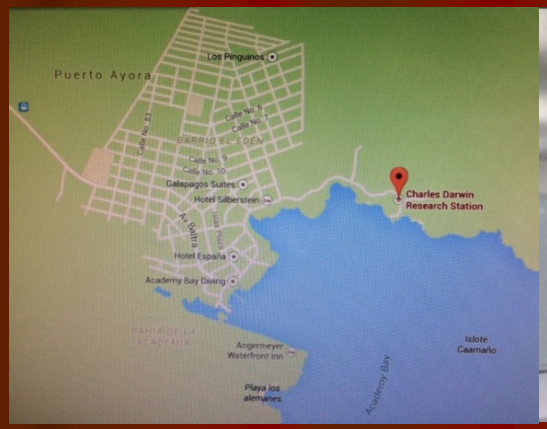
- It is the second largest island with the largest population and all the seven vegetation zones. Stayed in the Finch Eco hotel. Saw giant tortoise, scalesia trees, volcanic caves & visited the Charles Darwin Research Center

- The tortoise farm






- Charles Darwin Research Center (CDRS):
  Established in 1959 Puerto Ayora dedicated in 1964 breeding captive land tortoise for reintroduction to the various islands



- The lobster dinner at Puerto Ayora in Santa Cruz

Baltra

- Also called South Seymour. Located at the center of the Galapagos it is small & flat formed by geological uplift. Its famous landmark is the Pinnacle Rock which is a tuff cone. The island is very arid with salt bushes, prickly pear cactus & Palo Santo trees. During World War II it was used as a U S Army Air force base to provide protection for the Panama Canal & now continue as an Ecuadorian military base






- Farewell to Baltra & the Galapagos !

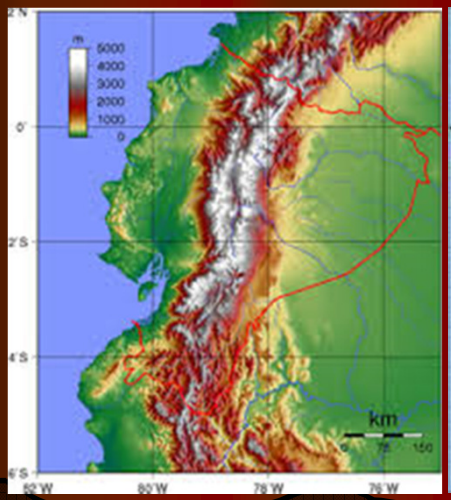
THE END

REPUBLIC OF EUCADOR

REPUBLIC OF ECUADOR - GEOGRAPHY

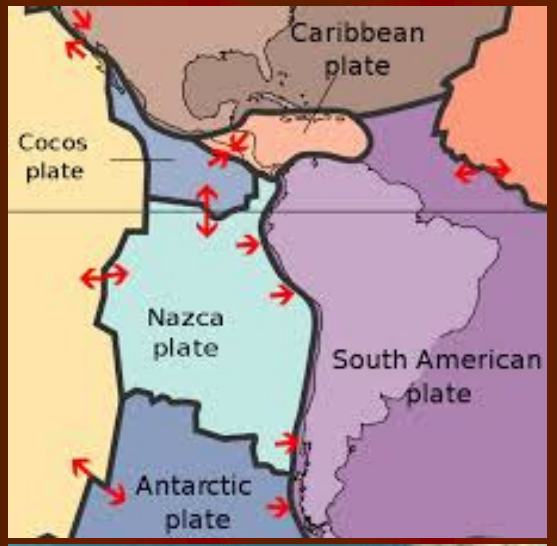
<u>Four main geographical zones</u>

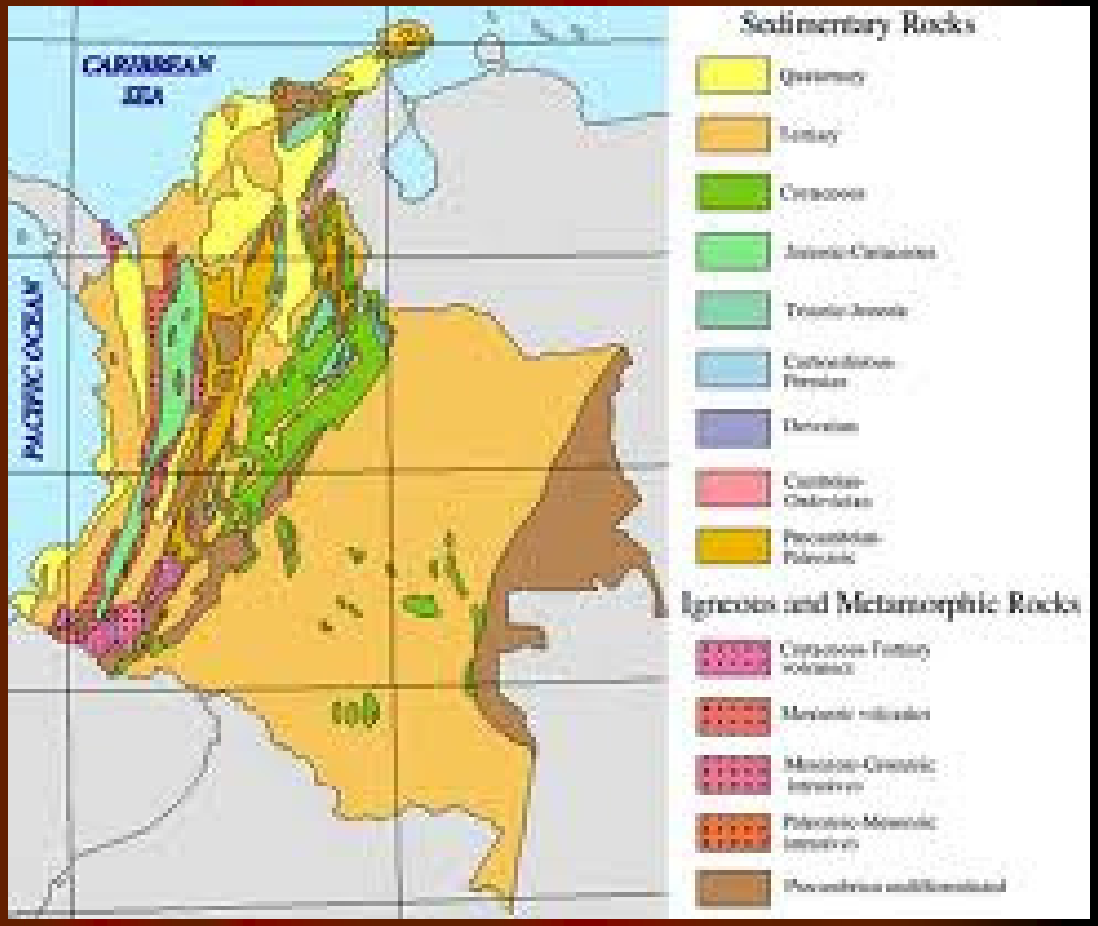
- La Costa – the coast
- La Sierra – the Andes
- El Oriente – the Amazon
- Region Insular – the Galapagos



REPUBLIC OF ECUADOR - GEOLOGY

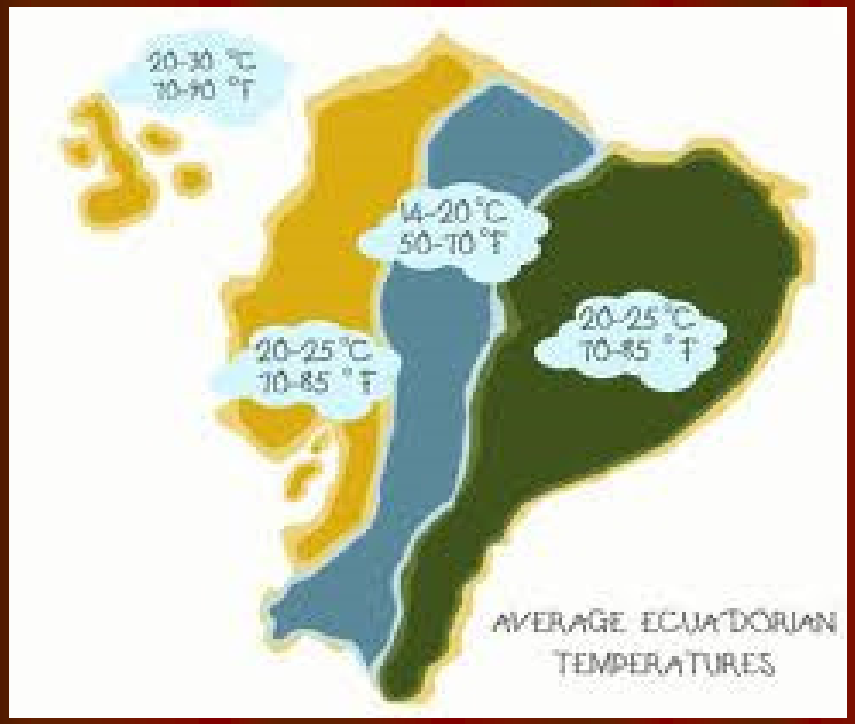
- A dynamic landscape shaped by plate tectonic, uplift & volcanism with 12 major active volcanos

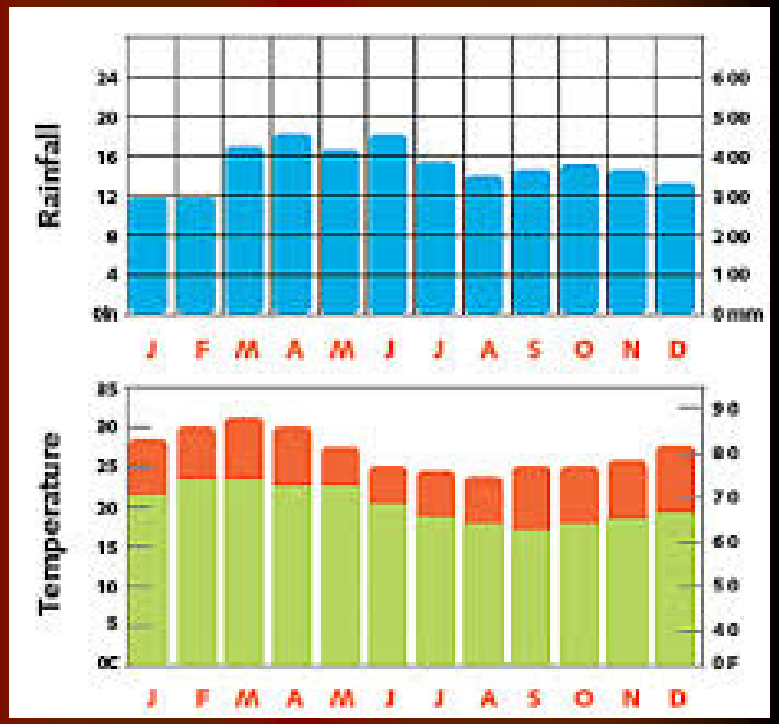




REPUBLIC OF ECUADOR - CLIMATE

- Being right on the equator it is tropical along the coast , cooler inland at higher elevation, tropical again in Amazonia jungle lowland





REPUBLIC OF ECUADOR - HISTORY

30,000 BC : Hunter gatherers

3,500 BC : first permanent settlements

15 Century : Incas Empire

1532 : Francisco Pizaro invaded Ecuador started 300 years of Spanish colonization

1822 : Colonist revolted & became part of Grand Columbia which also included present day Columbia, Panama & Venezuela

1830 : independent Republic, revolts & dictators followed

1895 : Radical liberal rule

1941 : Peru invaded

1944 : Glorious May Revolution

1972 – 1979 : Military government

1979 : returned to democracy

1981 – 1995 : War again with Peru & Ecuador lost control over much of the Amazon territory

1999 : Peace Treaty signed with Peru

Over 80 changes of government since independent in 1830. Current President Rafael Correa is popular but taken by rebellious police & only release after a gun fight

REPUBLIC OF ECUADOR – CURRENT STATUS

- Size : 256,370 sq.km similar to the size to England
- Capital : Quito which is a UNESCO World Heritage Site
- Other major cities :
  Guayaquil : largest, a port city
  Cuenca : Spanish style colony city,
  another UESCO World Heritage
  Site

- Population : 13.9 million 25% composed of 12 indigenous groups ; 65% Spanish colonial decedents (Mestizos) balance includes Afro-Edcuadorians (descent from Africa slaves), immigrants from Columbia , China & Lebanon
- Official language Spanish, Indians speak the Inca Empire language called Kichwa, 95% Roman Catholic
- Currency : National currency replaced by US Dollar, tipping is at discretion

REPUBLIC OF ECUADOR - ECONOMY

- Essentially rural economy. Main export oil plus shrimp, tuna, roses & banana



- Minimum salary US$340 per month professionals like doctor US$2/3,000 but 18% live only on US$1 per day
- U S Dollar being used as national currency
- Ecuador has the first constitution to recognize & protect the right of nature with 11 national parks, 10 wild life refuge & eight ecological reserves

POPULAR LOCAL CUSINE

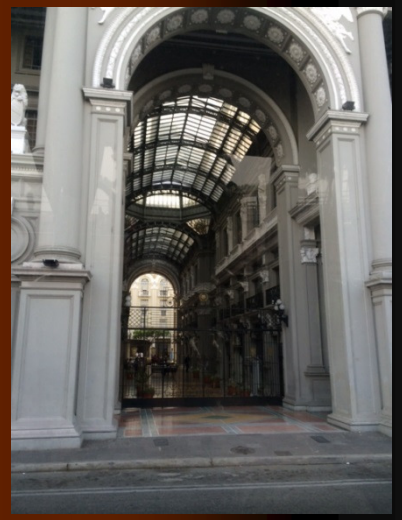
- Humita & tamales : corn wrapped in leaves
- Llapingachos : fried meshed potato
- Ceviche : saucy shrimp cocktail
- Locro : potato soap
- Barbecued Pig skin, pig's head & beetles

- Visited a cocoa plantation : Ecuador claims to produce the best cocoa in the world in terms of quality. Majority exported to Europe & USA for making chocolate






- Guayaquil : a sea port & commercial center of Ecuador



- Guayaquil : a sea port & commercial center of Ecuador. Our hotel is the venue for the Miss Ecuador pageant !

- Guayaquil – ghost festival offerings to be burnt as offerings

- Otavalo : we stayed at an old Spanish farm called Hacienda Cusin












- Lunch at another Hacienda where we tried the Guinea Pig

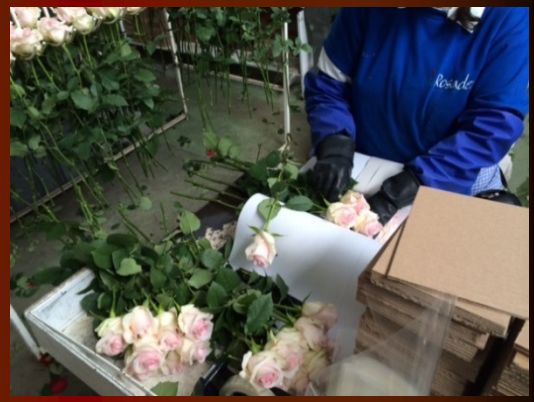




- Rosadex is a very successful roses plantation













- Quito* the Capital of Ecuador, 2,800 m above sea level. Note the old city square – crime scene for the two missing I phones

- Quito city center with Cathedrals, Monuments & City Hall

- Quito : the Old City with narrow cobble stone streets






- Quito : the Franciscan Monastery & National History Museum

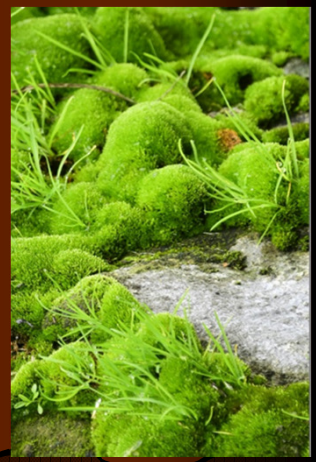




- Cotacachi Lake* : at 3,068 m it is an active crater lake formed 3,100 Ya in which one can observe gas emission. Our launch broke down !







- Quito : city scene 4 days before Christmas 2014

- Quito : old market with very colorful stores









- The people




- The people








- An evening at the La Chola with folk dance shows

- Panama hat : came from Ecuador not Panama ! It is handwoven from the leaves of a palm like plant called toguilla (*Carludovica palmata*). Now an UNESCO intangible cultural heritage it is very expensive !





- TAGVA : the art of palm nut carving




- Trilobite fossil from the high Andes


The Ecuador Andes

- Reached 4,000 m at Quito by cable car, quite exhausting






The Ecuador Amazon

The Incas Empire

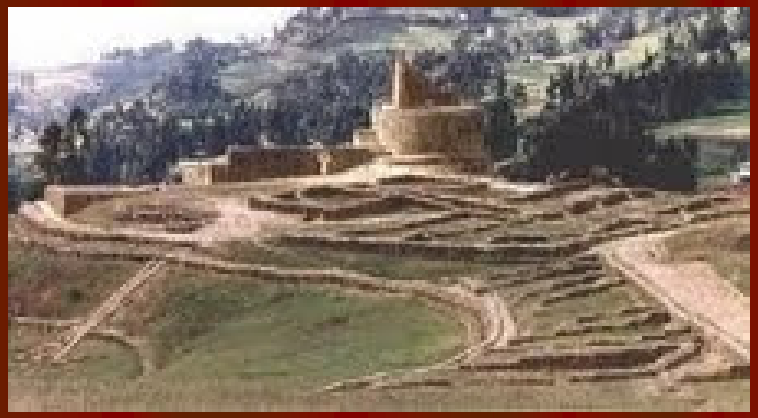
- The Incas civilization arose from the highland of Peru sometime in the 13th century

- Developed between 1438 & 1532, it is the largest empire in pre Columbian America covering present day Peru, Ecuador, Bolivia & northern Argentina

- The political & military center was located in Cusco Peru

- It is a federalist system with 4 quarters or Suyu (see map below)
- 1532 Francisco Pizarro the Spanish conquistador killed the Emperor in Cusco & conquered the empire

The Incas Empire





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