

NOTICIAS DE GALAPAGOS

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NEWS FROM ACADEMY BAY

THE NEW DIRECTOR

Dr. Hendrik Hoeck arrived in January to take over from Dr. Craig MacFarland as Director of the Charles Darwin Research Station. He was joined by his wife and daughter in March.

VISITORS TO THE STATION DURING THE FIRST QUARTER OF 1978

- 6 January – 23 February : Fritz Harschberger; filming woodpecker finches.
6 January – 24 February : Dr. William G. Reeder, University of Wisconsin; research on arachnids.
28 January – 3 February : HRH Prince Bernhardt; cruise on BEAGLE III.
3 February – 28 February : Dr. Kurt Rehn, Universidad Catolica, Quito; research on grasshoppers.
3 February – 24 February : Drs. James Norris, Mark Littler and W. Duane Hope; cruise on BEAGLE III for research on algae and marine invertebrates (continuation of the Smithsonian algal program in the Galapagos).
17 February – 21 March : Dr. James Mears, Academy of Natural Sciences, Philadelphia; research on *Altenanthera*.
26 February – 21 March : BBC TV team, filming "The Voyage of the BEAGLE", a dramatised version of Charles Darwin's account of his cruise.
13 March : Captain Napoleon Fernandez, the new Governor of the Province of Galapagos.
21 March – 25 March : Dr. Raul Icaza, Director of the Instituto Nacional de Pesca.
23 March : Dr. Duncan Porter arrived.
25 March : Brigadier General Luis Leoro Franco; Commander-in-chief, Ecuadorean Air Force; Member of the Supreme Council of Government.
30 March : Mr. John Hickman, British Ambassador, Quito, began visit.

SAVING THE LAND IGUANAS

Since the holocaust, when feral dogs invaded their colonies, the outlook for the land iguana populations of Santa Cruz and Cartago Bay (Isabela) has been none too encouraging but after two years of hard work, research and improvisation, the prospect now seems brighter. The survivors which are kept in pens at the Station and also those in semi-captivity on the tiny satellite island of Venecia are all in good shape and more is constantly being learned about their care and maintenance. There have been no breeding successes so far. A few clutches of fertile eggs have been laid but experiments in artificial incubation have not yet been successful. * The Station had comparable problems in the early years of captive breeding of giant tortoises and solutions were eventually found. Experiments are continuing and natural nests of other unthreatened populations are being investigated to discover the correct humidity and temperature for incubation. Howard Snell, the principal advisor for the land iguana programme has had 90 tons of earth unloaded on Venecia, at the cost of much time, effort and money. Luckily, unusually heavy rains have greened and consolidated this soil and the iguanas have already begun to dig their burrows in it. So there is now hope of successful nesting. At the same time funds are being solicited to construct large (100m x 100m) breeding enclosures at the Station to replace the present small holding pens. Sir Peter Scott has proposed that

consideration should be given to the possibility of building dog-proof fences round endangered breeding sites, despite the inevitably high expense.

THE CONTROL OF INTRODUCED MAMMALS

Only modest success has rewarded the strenuous efforts of the National Park Service to reduce the menace of feral dogs and cats by hunting, and it becomes increasingly clear that studies in depth, even if they take years, are needed to find new methods of control.

On the other hand good results have again been reported in the goat control campaign, in spite of the reduction, for lack of funds, in the planned number of hunters. Checks conducted on Rabida and Santa Fe confirm the eradication of goats and the recovery of the vegetation. For lack of hunters the final liquidation of the goats on Espanola was delayed; the handful remaining can do little damage to the vegetation but until they are completely eliminated they will continue to breed and to impose a drain on the Park Service's manpower. Similarly it would be economical to remove with all speed the remaining three or four dozen goats on Marchena. Of course, the fewer that are left the harder they are to hunt. On Pinta (Abingdon) the wardens report having killed 627 goats last year, bringing their grand total to over 40,000 in the last seven years but still leaving 1,500 – 2,000 goats at large. However, the botanist, Dr. Ole Hamann, confirms that already the sadly degraded vegetation is recovering in every part of the island – slowly in the arid lowlands but dramatically in the moist uplands.

Pinta is a small island; Santiago (James) is relatively large and has an immense goat population – upwards of 100,000 – and with present resources and methods it is not possible to bring them under control: hence the continuing ecological and behavioural studies to find some more effective method than shooting. Meanwhile, the wardens have concentrated their efforts on the feral pigs, which, in the particular circumstances of Santiago, are even more destructive than the goats – at least on a *per capita* basis. Last year the hunters accounted for 1425, thus reducing the pressure on the endangered tortoises and Hawaiian Petrels.

PROTECTION OF ENDEMIC PLANTS

Until a solution is found to the goat problem, it will continue to be necessary to give temporary protection to prevent the extinction of various endemic species of plants on Santiago. Critical areas have been enclosed within goat-proof fences. These "quadrats", measuring between 100 and 600 square metres, have proved effective in encouraging regeneration of the vegetation but they are not really large enough. The present programme is to fence in ten quadrats of 100 x 100 metres. Funds have been generously offered to make a start with the first two of these.

COLLABORATION IN MARINE RESEARCH

During March 1978 a number of important, interlocking agreements were concluded between the National Institute of Fisheries, the University of Guayaquil and the Charles Darwin Research Station. The object is to co-ordinate the research work of the three institutions in the Galapagos and, wherever appropriate, to pool their resources, equipment and manpower. Joint projects will be developed and incorporated in annual programmes. Scholarships will be offered to enable students proposed by the University to do research for one or two years and prepare for future employment in this field. The results of all investigations will be common property.

The three institutions are agreed that the prime purpose of their joint programme is to ensure the conservation and rational exploitation of the marine resources of the Galapagos. To this end it is clearly necessary to enlarge and deepen knowledge of the surrounding seas. In the last few years interest in underwater investigation has quickened and, while information is still scanty, it is already suspected that the marine ecosystems of the Galapagos are as important to science as the terrestrial. The new agreements should greatly help to overcome the lack of men and resources, which has hitherto limited research.

THE FUTURE GALAPAGOS MARINE PARK

A Seminar will be held on Isla San Cristobal (Chatham Island) from 3 – 5 July 1978 to discuss plans for the inclusion of a marine zone within the Galapagos National Park and the effects that this might have on the fishing interests in the Islands. The Conference is being organised jointly by the Galapagos National Park Service, the Charles Darwin Research Station and the San Cristobal Fishermen's Co-operative. Among the participants will be representatives of the Ministry of Natural Resources, the Ministry of External Relations, the Ecuadorean Navy, the National Institute of Fisheries and the provincial and local authorities.

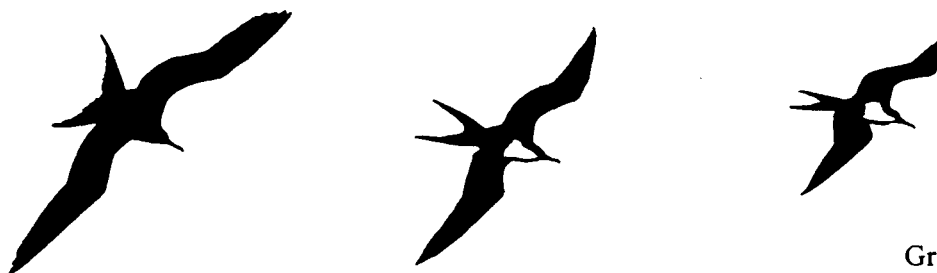
FRIGATE BIRDS ON SAN CRISTOBAL

A study of the Great Frigate (*Fregata minor*) and Magnificent Frigate Bird (*F. Magnificens*) was undertaken in 1976 by Senor Jacinto Gordillo, the CDRS representative in Isla San Cristobal. Since that date he has monitored the colonies at regular intervals. There has been a sharp decline in the numbers of breeding pairs of the Great Frigate at Manglar Punta Pitt (Pitt Point Mangroves) compared with a slight increase at Islote Pitt.

	March 1976	March 1977	March 1978
Manglar Punta Pitt	181	118	18
Islote Pitt	41	66	71

Heavy predation of chicks by feral cats occurs at Manglar Punta Pitt, but not at Islote Pitt (an off-shore islet where cats do not occur). This may have resulted in Great Frigates seeking to nest elsewhere. The increase of breeding pairs at Islote Pitt may be due to immigration of such birds. Other factors are involved however. At Manglar Punta Pitt, interspecific competition occurs with the Magnificent Frigate Bird occupying the high nesting sites in the trees, thus forcing the Great Frigate to nest in the low bushes, where it is more vulnerable to cats. Islote Pitt has a pure Great Frigate colony.

Direct evidence of cat predation abounds, not only among the Frigates, but in all three species of Boobies nesting on San Cristobal. Dr. Tindle, resident scientist at the Darwin Station, considers it very necessary that systematic studies be made and appropriate conservation measures taken.



Great Frigate Birds.

Drawing by Peter Scott

SURGERY AT THE STATION

Giant tortoises are extremely tough creatures, on the rugged Galapagos lava they need to be. Their biggest danger, once they have survived infancy, is if they crack their thick shell. Early this year, one unfortunate tortoise suffered a major rupture of its plastron (the lower or ventral part of the shell). As it was otherwise doomed, the National Park wardens decided to operate and succeeded in closing the fissure. Nursed by Heidi Snell, the giant made a good recovery.



Heidi and the Beast – photo by H. Hoeck.

*SINCE THE ABOVE WAS WRITTEN, THE FIRST LAND IGUANA EGG HAS BEEN SUCCESSFULLY HATCHED IN THE CDRS INCUBATORS.

FORTY YEARS AFTER

by S. Dillon Ripley

Mr. S. Dillon Ripley, now the Secretary of the Smithsonian Institution, first visited the Galapagos as a young ornithologist in 1937 and again as recently as October 1977. He gives his impressions in this article, reprinted from the Smithsonian Magazine. Sir Peter Scott, Chairman of the World Wildlife Fund, has illustrated the article with a drawing of the Swallow-tailed Gull. Both contributors were founding fathers of the CDF and are still members of its Executive Council.

"I have not as yet noticed by far the most remarkable feature in the natural history of this archipelago; it is, that the different islands to a considerable extent are inhabited by a different set of beings. [There are] tortoise, mocking-thrush, finches and numerous plants One is astonished by the amount of creative force displayed on these small barren, and rocky islands."

(from THE VOYAGE OF THE BEAGLE)

So wrote Charles Darwin about his visit to the Galapagos Islands off the west coast of South America in September 1835. Years later the thoughts based on these observations – along with many others – were to be crystallized into his great theory of evolution.

My own first visit was in 1937, in a schooner on the way out to a year of studying birds in New Guinea. Now, 40 years later, I have recently returned with my wife to Galapagos in an effort to help underscore the importance of these islands to world conservation.

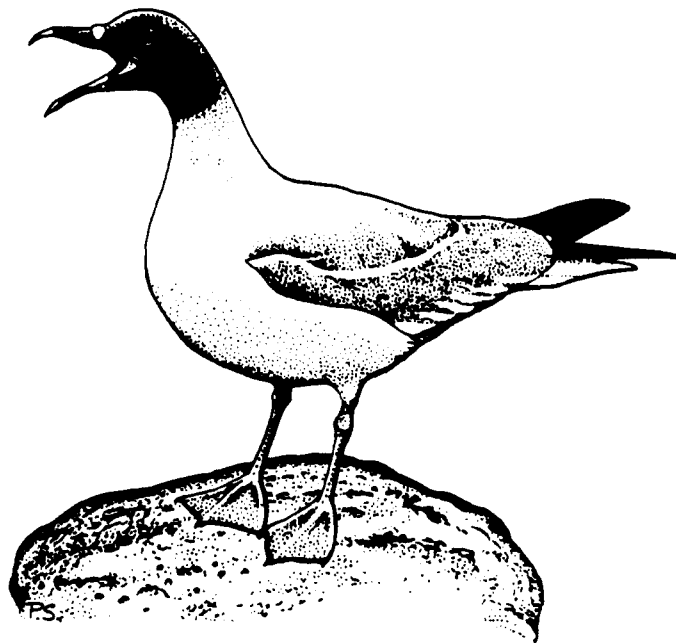
In 1937 the government of Ecuador had limited interest in its isolated possessions; now our trip was made notable by the presence of the Foreign Minister of Ecuador, Dr. José Ayala Lasso, accompanied by Ambassador Alfredo Luna and Dr. Franklin Bahamonde of his department, and by Ing. Teodoro Suarez, Director General of Forestry and head of the Department of National Parks and Wildlife. The Galapagos Islands now form an Ecuadorian province, with an airport, administrative offices, defense installations and a small tourist industry. Alongside this growing governmental involvement has been the development of the Charles Darwin Foundation for the Galapagos Isles, established in Brussels in 1959 as a consortium of societies and government-supported institutions – with UNESCO backing – in Belgium, West Germany, France, Great Britain and the United States.

Eighteen years after the founding of the Charles Darwin Foundation, and 145 years after the voyage of the *Beagle* on which Darwin journeyed, what did we find? We clambered up and down over lava seeking out fur seals and sea lions, birds of some 43 species, land and marine iguanas, lizards, tortoises, turtles.

The effect was overwhelming. In spite of the ravages of time and civilization, the Ecuadorian national parks system, collaborating with the Darwin Foundation, has persevered in protecting the environment and in training its park "wardens", or rangers, and guides for the tourists. Dedication is at a high level, for Galapaguinos are proud of their natural habitat. On the little island of South Plaza, my favourite of our brief visit, swallow-tail gulls beat along the windy, black lava cliffs, alternating with rows of stiff-winged, red-billed tropic birds, noddy terns, boobies and flying Audubon's shearwaters. Inland, other gulls perched, necks vibrating, out-stretched heads and bills emitting their greeting, an un-gull-like rattling sound.

I had remarked on this soft, warbling rattle in my diary for February 1937, and the fact that these gulls circled curiously over our schooner at night. Only years later, when Jack P. Hailman, the animal behaviour specialist, studied these seabirds did we learn that the lustrous-eyed creatures catch fish and squid at night, the only nocturnal-feeding gulls in the world!

What hope for Man's future, to live in harmony with such a laboratory of nature's creation. The world is better for this unity of purpose in an essential cause.



Swallow-tailed Gull

Drawing by Peter Scott

STORM PETRELS IN GALAPAGOS

by M. P. Harris

Storm petrels include the smallest seabirds and are well known to ocean travellers because they are widespread, sometimes very numerous and usually unafraid of ships, which they often follow to feed on plankton churned to the surface in the wake. Unfortunately the various species are often difficult to identify. Three of them nest in Galapagos and each is of great interest in its own very special way.

The Band-rumped (or Madeiran) Storm Petrel (*Oceanodroma castro*) is the most widespread of the three, breeding among boulders or in cracks in cliffs on many of the smaller islands. Apart from its complete white rump patch, it is an all black species with a slightly forked tail. It is rarely identified, presumably because it feeds well away from the islands and is completely nocturnal in its visits to land. In Galapagos the species has two distinct breeding seasons a year with eggs being laid in the nest-sites either from November to February or from late-April to June. It came as quite a shock when the ringing of these birds showed that there were two entirely separate breeding populations, each nesting annually. Although about a thousand adults have been ringed on Plaza and checks of the population have been made over a ten year period, there is not a single record of a bird moving from one population and season to the other. Two birds ringed by Raymond Lévêque in 1960 were still breeding in the same season 12 years later. It is normally believed that the evolution of new species can only occur when the new emergent forms are separated geographically, e.g. the mockingbirds on Hood, Floreana and San Cristobal. In the case of this storm petrel, speciation could be brought about through the separation of populations by time. The critical question is: in which of the two seasons do the young birds first breed? If they always come back and breed in the same season as their parents did, then the scene is set for two separate species to evolve. Only three birds ringed as young have so far been caught back at the colony; all were ringed in January and were retrapped in January several years later. Suggestive indeed but, as always, more work is needed.

The Wedge-rumped Storm Petrel (*Oceanodroma tethys*) is similarly coloured to, but slimmer than the previous species; the rump patch is much larger and wedge-shaped with the apex almost reaching the notch in the slightly forked tail. This latter point might seem a bit academic but it is certainly noticeable in the field. Its habits are the complete opposite to the Band-rumped. It breeds only around the edge of Tower, Isla Pitt (off San Cristobal) and Roca Redonda (off Isabela). It is very common at sea especially in the northern parts of the archipelago, and it only visits land by day. In this latter respect it is unique among storm petrels. It has been suggested that it does this so that it can feed at night, thus avoiding competition with the previous species which feeds by day. A visit to the colony on Tower, when the half a million or more birds are all flying around in the morning, is an unforgettable experience. Like so many other things about this group of birds, the significance of this mass flying is unknown.

The White-vented Storm Petrel (*Oceanites gracilis*) is noticeably smaller than the other two species, has more rounded wings, a square tail and such long legs that in flight the feet project behind the tail. As well as having a white rump, it has a white stripe down the centre of the belly, though this is sometimes difficult to see. The flight is fluttery and it regularly 'walks on the water'.

Although it is probably the commonest storm petrel seen in Galapagos especially close to land,

and although the Galapagos subspecies is endemic and resident, no nest has ever been found. This is remarkable as the older scientific expeditions (especially the one led by the redoubtable Roland Beck), and more recently Raymond Lévêque and myself have actively searched for a colony. I have landed on virtually every rock that seemed a possible breeding site – but all in vain. Similarly no nest of the other subspecies, resident in Peru, has ever been found. However, it must breed as an egg has been taken from inside a dead bird! The search continues and a prize awaits the solver of this puzzle.

At least five other storm petrels have been recorded as migrants to Galapagos waters but all are very rare and difficult to identify, so are of little concern to any but the most ardent bird watcher. For all other people the resident species are interesting enough.



White-vented Storm Petrel

Photo: Fritz Pölking.

THE EAST PACIFIC GREEN SEA TURTLE IN GALAPAGOS

INTRODUCTION

Sea turtles the world over are in a precarious position. Due mainly to man's greed, but also in part to this need for survival, numbers are decreasing at an alarming rate. Even the remote Galapagos have not escaped. Two visits by a large refrigerator ship, the "Chikuzen Marou", in 1971 and 1972 accounted for the loss of large numbers of subadults, juveniles and males as well as the more commonly taken females. Reports as to the actual numbers vary from fisherman to fisherman – as low as 1,000 and as high as 10,000. Between 2 and 3 thousand seems realistic.

Based on reports and recommendations by Dr. Peter Pritchard, the then director of the Charles Darwin Research Station, Dr. Peter Kramer, was successful in obtaining a temporary government ban on their commercial exploitation while a long-term, full-time study was carried out. This is partly why I, armed with a grant from the National Geographic Society and receiving logistical support from the Charles Darwin Foundation, returned to the Galapagos in 1975.

SPECIES PRESENT

Of the seven contemporary species of sea turtle, only three have ever been reported from Galapagos, and only one of these, the east Pacific green, or "tortuga negra" as it is known locally, *Chelonia mydas agassizi*, nests here. It ranges from California to southern Chile and as far west as Hawaii and Micronesia. The Indo-Pacific Hawks-bill, *Eretmochelys imbricata bissa*, is occasionally found here, but the pelagic Leatherback or Luth, *Dermochelys coriacea schlegeli*, is included only from one sighting by David and Johanna Fox from the yacht "Delfin" in open water between Hood and Floreana in April 1977.

THE WORK

In the five years prior to 1975, the work was concentrated on the nesting beaches and so basically only mature females were tagged. Peter Pritchard and his assistants, Miguel Cifuentes and Judy Webb, did a really fine job in a) initiating a turtle study in Galapagos and b) laying the foundations and ground-work for my more intensive full-time research.

Briefly, the current work consists of two major parts. During the breeding season (December to June), several beaches are monitored and nesting females are tagged, measured and weighed. The nests are marked and just prior to hatching (incubation takes 7-9 weeks) a cylindrical wire cage is inserted above the nest to trap the emerging young. Before their release at the water's edge, they are counted, measured, weighed and marked by notching the margin. The old nests are then excavated so that % hatch and % emergence can be determined.

The second part of the work deals with the feeding areas. This entails catching males, subadults and juveniles as well as females with nets or by hand. After tagging, measuring, and weighing they are released. Recapturing these turtles, especially in the case of the juveniles, helps to determine growth rates in the wild. Underwater observations (using quadrants and transects), together with stomach analyses, give us a good idea of their feeding habits. The feeding grounds are also patrolled during the nesting season in order to determine the relationships between these areas.

Since 1975 almost 3,000 turtles have been tagged. These, together with the 1,000 tagged by Pritchard, *et al.*, make an impressive total. Excluding this current nesting season, some 12,000 hatchlings have been notched for future identification.

MIGRATION

It is well known that green turtles are capable of long-distance migrations between their nesting and feeding grounds. In order to determine the case with the Galapagos population, the metal tags, which are inserted into the trailing edge of the right foreflipper, bear the following inscription:

PREMIO REMITE	(REWARD RETURN
ESTACION DARWIN	DARWIN STATION
GALAPAGOS ECUADOR	GALAPAGOS ECUADOR)

Unfortunately, as is usual, tag returns are few and far between. When the two following letters arrived you can imagine the exultation they caused:

Letter No. 1 (by a fisherman from Esmeraldas, Ecuador)

Esmeraldas – Galera 1 Agosto 1977.

Soy agricultor y tambien me dedico a la pesca, faena que realizo desde la punta Galera hacia abajo asi en motor mercury pesco langosta, langostino, sierra con redes de arrastre de tierra en una de mis especie capturada sobre la punta Galeria me alle dicha placa que me sentiria feliz al allar o resivir contestacion de su prestigiosa Gerencia. Me llamo Cesar Cabezas.

Mi direccion en la ciudad de Esmeraldas, calle Mejia v 7 Avenida # 725. En Caleta sitio Finca la (Malpelo) Alegria Km. 10 del carretero, Esmeraldas, Muisne.

Letter No. 2 (from two prisoners in Panama)

Centro de rehabilitacion Coiba 11/11/78

Estacion Darwin.

Tengo el honor de dirigirme a ustedes con la finalidad de informarle que en las costa de este centro penal fue capturada una tortuga con placa de identificacion de ese pais y una plastica con el distintive Numero 322. Segun la placa de metal tiene una eleyenda donde dice premio remite Estacion Darwin, Galapagos Ecuador me he tomado la finalidad de remitirsela porque espero ese premio, no se en que se vase ese premio, nosotros aqui en la penal acostumbramos a casar tortugas para aprovechar su casar tortugas para aprovechar su carne, muy rica y nutritiva la tortuga en mencion tenia un peso en la bacula de 180 libras completa y deven ustedes de imaginar el tamano que tenia dicho animal. Se ve que estos animalee navegan muy lejos de Ecuador ha Panama tengo entendido que hay muchas millas maritima.

Para mejor informacion, yo soy un recluso purgando una larga condena en este centro penal, esperio que el premio sea mayor de lo que yo quiero pedir, pido un radio transistor de 4 bandas, en este penal se hoyee muchas emisoras de ese pais Ecuador como radio Mil de Guayaquil y sin mas me despido de usted con el mayor respeto y deseandole que hayan pasado unas Felices Pascuas y un venturoso ano, 78.

de Usted atte.

Victor Samuel Sanchez
Cedula de identidad
8-110-317 Panama

OJO. Tambien se capturo por un companero otra tortuga con una placa de plastico que no tenia la de metal parece que la placa de metal se le salio el numero de la placa es 145 fue capturada por el Sr:

Valerio Santos Gonzales

The turtle mentioned in letter No. 1, a female, was tagged on the nesting beach of Quinta Playa, Isabela on 10 February 1977. It laid 5 clutches with 80-85 eggs in each clutch and was last seen on the night of April 24th, prior to its recapture on mainland Ecuador some 3 months after. Both turtles referred to in letter No. 2 were also tagged on Quinta Playa – No. 145 on 20 February 1976 and No. 322 on 5 February 1977. Unfortunately in the latter case the turtles were eaten. In addition, two turtles tagged on Isabela by Pritchard prior to 1975 were recaptured near Costa Rica (pers. comm.). It seems that 8 years of hard work is bearing fruit at last.

These 5 tag returns represent 8 years work and over 3,000 turtles – but minimal as they are, they at least show that some of the local population are migrating – probably first to Ecuador and then following the coast north to Costa Rica and perhaps further. This means that, although they are enjoying protection here in the Galapagos, they may well be exploited elsewhere. There is, however, a “resident” population which stays here all year round. Although this mainly consists of subadults and juveniles, there are mature males and females (late departures of the previous season or early arrivals of next season?). It is quite possible that this “resident” population is continually changing.

PROBLEMS

Apart from the ever-present lack of funds, one of the biggest problems is to find enough assistants to cover the nesting beaches. A tight budget determines that assistants have to pay their own way to and from Galapagos but once here they receive free room and board. This mainly consists of living in a tent for periods of 3 months or more and eating rice and tuna fish. Anyone interested should contact me here at the Station.

The turtles themselves have their problems, both natural and otherwise. Apart from the well-known predation by frigatebirds, ghost crabs, hermit crabs, night herons, *etc.*, feral cats and especially feral pigs, both introduced by man, are causing extensive damage to eggs and hatchlings alike. However, one more predator, hitherto unknown as such, has entered the turtle world. My work has uncovered another, as yet little known, introduced species – a scarab beetle, *Trox suberosus*. Formerly known only for its association with carcasses, it has now been found to be parasitic on turtle eggs on beaches of southern Isabela. It has probably been introduced via the cattle in nearby Villamil. This beetle is the main contributor in causing the normal healthy 65% hatching success – found elsewhere in Galapagos – to be reduced to a dangerous 35% for Quinta Playa, the most important nesting beach in the archipelago.

FUTURE PLANS

There are plans this year (1978) to extend the study to include mainland Ecuador, where, unfortunately, turtles, mainly the Pacific Ridley, *Lepidochelys olivacea*, are still being exploited commercially. The Instituto Nacional de Pesca has agreed to supply funds for this work. Meanwhile, the project here will, I hope, continue for at least another 5 years.

IN CONCLUSION

Any research of this type depends to a large extent on good will. Local fishermen, the Ecuadorian military, students, guides, assistants from 11 different countries, and even prisoners have co-operated magnificently. My personal thanks go out to each and every one of them.

Yes, eight years of hard work does seem to be bearing fruit at last!

DEREK GREEN
Principal Investigator
Galapagos Green Sea Turtle Ecology Study

April 1, 1978.

POSTSCRIPT:

Just after this article was written, we received a letter from a fisherman working on a shrimp trawler. He enclosed a metal tag removed from a female turtle caught in March off the Ecuadorian coast. This turtle was originally tagged in Galapagos in 1976. After removal of the tag she was released, perhaps to end up in Galapagos once again?

Arrangements have been made with the authorities in Panama to meet the request of the two prisoners to be rewarded with transistor radios instead of the usual cash awards.

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EL TERO REAL (HIMANTOPUS HIMANTOPUS) EN LAS ISLAS GALAPAGOS

Por Arnaldo Tupiza, representante de la Estacion Biologica Charles Darwin en Isabela y Jacinto Gordillo, representante de la Estacion Biologica Charles Darwin en San Cristobal.

Entre los lugares protegidos con especial atención por los miembros del Servicio del Parque Nacional Galápagos están las lagunas de agua salobre, que a raíz de la organización de esta Entidad, en 1969, fueron declaradas como *santuarios inviolables de aves*.

Esta declaracion se hizo en base a informaciones venidas de la Isla Isabela sobre la inmoderada posesión de ciertos colonos en las pozas y sus orillas, con fines de cultivo de pasto para animales y aprovechamiento de lena, con lo que se ponía en peligro el habitat de los flamings y demás aves que viven en ellas.

La declaración fue oportuna y cortó el peligro, pudiendo contar ahora con hermosos lugares, variados nichos ecológicos donde se desarrollan abigarradas comunidades de animales residentes, a más de 20 especies identificadas de aves migrantes (Harris 1974).

Este es uno de los aspectos más atractivos y ricos del Sur de la Isla Isabela, donde por fortuna la presencia de los turistas no es un peligro. El puerto es de difícil acceso y guarda con celo las riquezas de este sector del Archipiélago.

En Galápagos se puede ver los Tero-real en cualquier isla y en cualquier parte de la isla donde existen lagunas de agua dulce o de agua salobre, ciénagas o charcas de agua eventuales.

METODO

Este trabajo es fruto de parciales observaciones de ciertos actos de comportamiento de los Tero-real, a partir del año 1974.

En el mes de Marzo de 1977, gracias a una acuciosa y diligente preocupación, se descubrio 9 nidos y recopiló datos acerca de la postura y eclosión de los huevos.

Para determinar el ciclo reproductivo, hemos recorrido los lugares posibles de nuevas anidaciones. Con el propósito de obtener datos acerca de los periodos incubatorios, hemos hecho observaciones permanentes desde las 6 de la manana hasta las 6 de la tarde durante cuatro días.

EPOCA Y COSTUMBRES REPRODUCTIVAS

La epoca reproductiva de los Tero-real, tiene lugar entre los meses de Noviembre a Marzo. Durante estos cinco meses estas aves realizan las distintas etapas que garantizan la prolongación de la especie, de las que tan solamente anotaremos las siguientes: poses de cortejo, postura y eclosión de los huevos, periodos incubatorios y éxito reproductivo 1976-1977.

POSES DE CORTEJO

1. El macho y la hembra pican animadamente como buscando su alimento.
2. La hembra golpea fuertemente con su cabeza sobre el agua.
3. Al acercarse el macho, la hembra adopta la postura horizontal.

4. El macho tambien golpea el agua como la hembra, primero en un lado y luego en el otro, cortejando a su companera.
5. El macho muy erguido y ceremonioso busca colocacion.
6. Con un ligero salto sube sobre la hembra y copulan.
7. Terminada la copula, los dos juntos, con elegancia marcial, caminan unos cincuenta centimetros, con lo que terminan este cortejo amoroso, se dedican luego a la diaria faena alimenticia.

POSTURA Y ECLOSION DE LOS HUEVOS

Una vez construido el nido, que lo hacen acumulando palitos sobre las oquedades naturales de las rocas a orillas de las pozas o en las hierbas de los grameros, ponen de tres a cuatro huevos con intervalos no mayores de veinticuatro horas entre uno y otro.

La eclosion tiene los mismos intervalos, correspondiendo a cada uno 21 dias de incubacion.

PERIODOS INCUBATORIOS

El macho y la hembra cobijan los huevos turnandose en periodos cortos, varias veces al dia. Al hacer los cambios no ejecutan ceremonia alguna; en cuanto llega el companero (a), se levanta del nido el (la) ocupante y el otro (a), toma posesion del nido. Lo unico que hace el que sale, es un intento de picar en el suelo y el que entra se sacude una tras otra las patas.

En el siguiente cuadro podremos apreciar el numero de cambios y horas diarias de cuidado de la pareja y las horas que queda abandonado el nido.

CUADRO DE LOS PERIODOS INCUBATORIOS

FECHA	CAMBIOS			TIEMPO EN HORAS			TOTALES
	M.	H.	A.	M.	H.	A.	
14-III-77	7	5	2	5.26	2.06	1.38	9.10 hours
15-III-77	8	14	6	3.05	7.34	1.21	12.00 hours
16-III-77	9	10	6	3.34	6.11	2.15	12.00 hours
17-III-77	7	11	8	2.33	7.12	1.37	11.22 hours
DIAS	31	40	22	14.38	23.03	6.51	44.32 hours

SIGNIFICADO: M. = macho
H. = hembra
A. = abandonado

El peso de los huevos recién puestos es de 19 gramos y próximos a eclosionar pesan diez gramos. Los huevos son de color verde oliva con manchas café oscuras.

Los pichones recién nacidos pesan también diez gramos en promedio y el color de la parte superior del ave es del mismo color del huevo, lo que les sirve para camuflarse en caso de peligro.

CUIDADOS POST-INCUBATORIOS

VIGILANCIA. – Los hadres estan juntos a los nichones. No permiten que aves de su misma especie u otras de la poza se acerquen y, mas que nunca, estan siempre alerta a cualquier peligro que los anuncian con agudos chillidos para que se camuflen en las rocas.

PROVISION DE ALIMENTO. – Posiblemente por razones de escasez de alimento en la poza, los padres buscan lagunas que tengan mas comida o que sean propia para sus pequenos.

TRANSPORTE. – Les transportan o conducen uno a uno a pozas con mejor comida.

EXITO REPRODUCTIVO EN EL CICLO 1976-1977

Nro. del Nido	FECHA DE HALLAZGO	Nro. de Huevos	Eclosionados.	No eclosionados	Lugar	Area
1	21-XII-76	4	3	1	Poza Cocal	Rural
2	14- I-77	4	-	4	Poza Cocal	P.N.
3	14- I-77	4	4		Poza Cocal	P.N.
4	15- I-77	4	4		Poza Cocal	P.N.
5.	17- I-77	4	4		Poza Cocal	P.N.
6.	24- I-77	4	3	1	Poza Cocal	P.N.
7.	24- I-77	4	3	1	Poza Cocal	P.N.
8.	29- I-77	0			Salinas Aquiles	P.N.
9.	29- I-77	0			Salinas Aquiles	P.N.
10.	14- II-77	3	3		Poza Datil	Urbana
		31	24	7		

De los diez nidos hallados dos no fueron ocupados por causas desconocidas. En los ocho nidos restantes pusieron 31 huevos, de los cuales eclosionaron 24, y se perdieron 7.

El nido Nro. 2 estaba construido en medio de un gramero frecuentado por animales (caballos y asnos) y gente. Sospechamos que esta fue la causa de la no eclosion de los huevos.

La timidez y nerviosismo que les caracteriza ha sido uno de los aspectos dificiles para sue observacion; pero, se han tomado notas suficientes para darnos una idea de su vida y se espera puedan servir de base para futuros estudios.

Son muy importantes, la conducta alimenticia, medios de comunicacion, las diferencias entre macho y hembra, la agresividad, poses de cortejos sexual, periodos incubatorios y exito reproductivo.

SUMMARY

Among the places specially protected by the Galapagos National Park Service are the salt water lagoons, which were declared "Inviolable Bird Sanctuaries" in 1969.

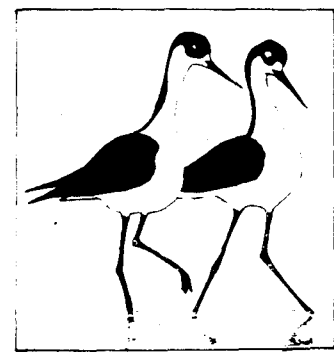
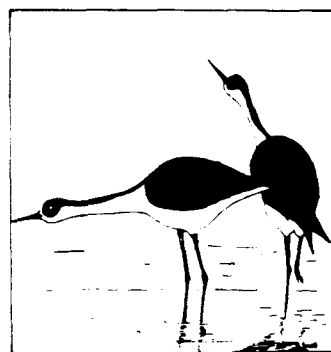
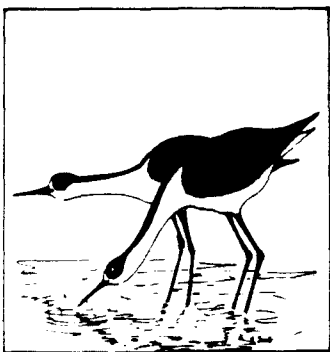
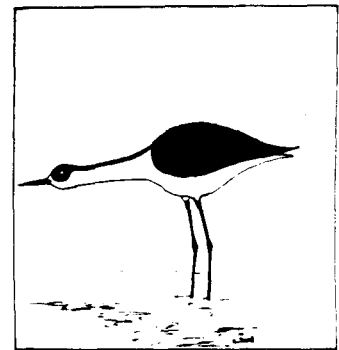
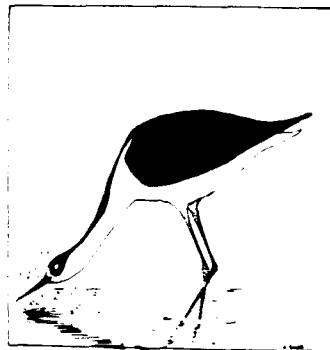
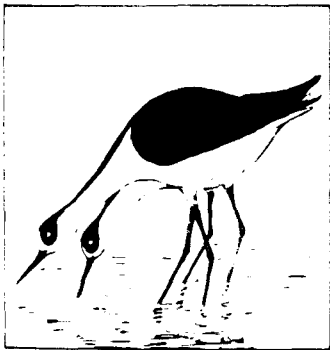
This declaration was made on the basis of information from the island of Isabela, concerning the possession and use of springs and shorelines by certain colonists. By using these areas for pasture or the collection of firewood, the habitat of flamingoes and other birds was endangered.

The timely declaration put an end to the danger, and today we have biotops of great capacity and beauty, an animal community of much variety, including more than twenty identified species of migrant birds. (Harris 1974).

This is one of the most attractive aspects of Southern Isabela, where, fortunately, tourists present no danger. The port, which is of difficult access, jealously guards the beloved treasure of this part of the archipelago.

It is in these places that the Black Necked Stilts live and breed between November and March.

From 1974 to 1977 we have been gradually accumulating ethological data on these birds, with special reference to their reproduction. The characteristic timidity of the Black Necked Stilt made its observation difficult; but we have taken sufficient notes to give us an idea of its life and habits and, we hope, to serve as a basis for future studies. The following aspects of behaviour are important: feeding habits, means of communication, sexual differences, aggressiveness, courtship patterns, incubation periods and breeding success.



Courtship of the Black-necked Stilt (*Tero Real*). Drawings by Heidi Snell, after J. Gordillo.

ESPANOLA TORTOISE RETURNS TO GALAPAGOS

by Thomas H. Fritts

On 8 August 1977 the number of male Española (Hood) tortoises available for propagation programs by the Darwin Research Station and the Galapagos National Park Service was increased 50% by the arrival of a large male from the San Diego Zoo in California. Previously only two adult males and 12 females were known to be living. The third male tortoise from Espanola (Hood Island) had been in San Diego for several decades and was of unknown origin prior to detailed statistical comparisons of giant tortoises which suggested that the tortoise was indeed an Española tortoise (*Geochelone elephantopus hoodensis*). Ultimately Craig MacFarland and I had a chance to confer on more subjective characteristics distinguishing tortoises from Espanola and the identification was confirmed.

Suddenly a tortoise previously known only as "No. 21" was recognized as being of critical importance to conservation efforts, and the San Diego Zoological Society generously offered to repatriate their magnificent specimen to Galapagos.

No. 21 was flown to Ecuador and it was **proposed** that he should then be taken by the tourist ship, *Iguana*, from Guayaquil to Galapagos. Considering that this would lengthen the trip by several days, I was at first resistant to shipment by the *Iguana*. However, when I recalled that during the last century thousands of tortoises (perhaps including the ancestors of No. 21) had lived for months in the holds of whaling vessels during their tragic journeys from the islands, my fears were dispelled. Tortoises are hardy animals, and No. 21 was no exception.

Though somewhat dazed on arrival, the tortoise was in good condition and began to eat as soon as he was removed from the shipping container. Within a few days the former zoo inmate, that had eaten the fleshy leaves of Galapagos prickly pear from the hand of the station director, had acclimated to his new surroundings sufficiently to begin actively avoiding human visitors to the isolation corral where he was temporarily housed.

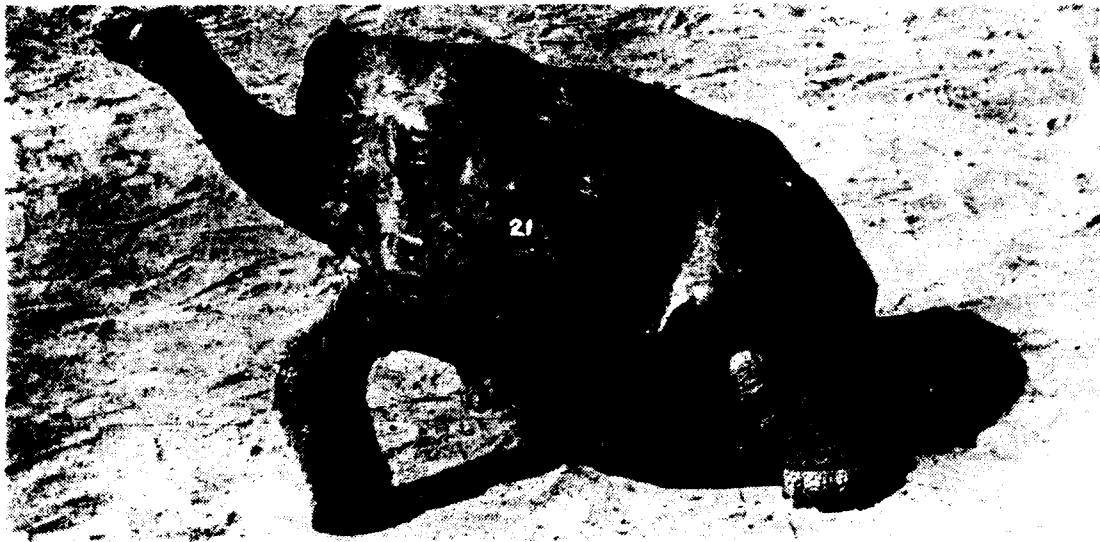
In October the new tortoise was released from quarantine and completed his journey when he was moved a few hundred yards and reunited with the other Española tortoises (twelve females and two males) for propagation purposes. Prior to captive breeding efforts by the Darwin Station and the National Park, these 14 adults composed the entire known population of tortoises of the Española sub-species. By 1977, as a result of conservation efforts, over a hundred young had been hatched; 37 individuals over 5 years old had been returned to Espanola and a further 37 were due for repatriation in 1978. Goats have been virtually eliminated from the island, the vegetation essential for survival of the Española tortoises is recovering, and the youngsters are thriving. During 1977, 24 new Española tortoises were hatched at the Station.

The incorporation of a third Española male will provide additional propagation stock and potentially contribute to the genetic diversity of the recovering population. Such genetic diversity is important in order to avoid reproductive failure due to inbreeding and small population sizes. Although the survival of the Española tortoise was once in grave doubt, a much brighter future for the population can be projected today.

Thanks to co-operative efforts by many organizations, individuals, and government agencies, an extremely rare tortoise has been incorporated into a critical propagation program. Funds from the National Science Foundation and the San Diego Zoological Society allowed com-

parative studies of giant tortoises, leading to the discovery and identification of the third Espanola male.

The effort is now being continued and a search is being promoted for survivors of the Pinta race of giant tortoises, which is currently represented by a single living male.



'No 21' – now identified as *Geochelone elephantopus hoodensis* and returned to Galapagos with the compliments of the San Diego Zoo.

Photo: by T. H. Fritts.

THE LAKE OF THE CEMETERY

by Elizabeth Tindle

"How eerie it is and yet how beautiful", I think to myself as I paddle across the moonlit lagoon, alone. It is very quiet. All I can hear is the swish of my roughly made oar, and the lapping of the water against the side of my balsa-wood raft as I make my way to our camping site on the other side of the lake, known as the Lake of the Cemetery. This name is derived from the rather macabre looking cemetery nearby. The night is quite still. The full moon in a near-cloudless sky provides sufficient light for me to pick my way around the tiny islands of mangrove and dead wood protruding above the level of the lagoon. The reflections of these same obstacles are quite clearly seen in the water. How beautiful is all appears!

I am returning to camp from a night observation at the flamingo colony. My husband and I have been here on the Island of Isabela for almost a month and in that time we have been able to watch the progress of a group of 36 nesting flamingos.

Very little accurate detail is known about the breeding behaviour of these birds in the Galapagos Islands where there is a population of between 500-700. In other parts of the world where they occur, they are so timid that it has been difficult to get close enough to them in the wild to observe their every move. Flamingos select secluded inaccessible spots for nesting. We have been fortunate in discovering this small colony set on one of a myriad of tiny islets in the middle of a salt water and mud lagoon.

I am now nearing our landing spot at the side of the lake. As the water becomes progressively shallower here, I must take care in piloting the raft through the submerged mangrove roots. Should the raft catch onto one, it could mean my having to delve into the thick mud and slime in order to release it. The mud in parts of the lake reaches chest height and holds one immobile by its powerful suction. This time the raft passes smoothly across the water and halts abruptly in the thicker mud on land. I clamber off. This time my rubber boots have not filled with water as frequently happens. I pull the raft as far on land as I am able. Without this precaution, the balsa would become quickly waterlogged. I pick my way blindly through the pitch black mangrove fringing the lagoon. Squelch, squelch, squelch, I hear as I plod across the soggy earth. Soon I can see the dim light issuing from the kerosene lamp hanging high from a branch at our camp site. Bob has supper ready. It smells good. It's a diablo (Chanos chanos), meaning devil, a fish caught by Bob this afternoon in the lake.

To catch these enormous fish one has to walk slowly in the deep mud and water, holding open the neck of a sack. Diablo nudge one's legs and body all the while, their visibility being reduced by the churned-up mud. With a quick jerk of the wrist a fish is in the bag. I have watched groups of local men rounding up the diablo with a long net. As the circumference of the net is reduced, the lake begins to 'boil' with the thrashing movement of fish. Fins appear travelling in all directions at the surface like a hundred sharks. A little later the diablo start leaping high. They smack into the bodies of the men. Surely it must hurt! (The fish as well as the men). Many fish miss the lake completely and land on shore. Finally, the net is dragged on to land. The men need the helping hands of others to release themselves from the unyielding mud. The fish are beheaded and gutted on the rocky sea coast, while frigate birds soar overhead, swooping at intervals to scoop up a delectable morsal of entrails. The pelicans, meanwhile, stand by for the larger fish heads.

During our meal, we can hear in the darkness surrounding us the scurrying of rats over the

thick carpet of leaves. They also climb to considerable heights in the mangrove. Each night before turning in we must ensure that all edibles, including those in plastic containers, are stored away in large tins. Our enormous stem of bananas created a problem. Since we suspended it from a high branch some distance from our kitchen, it seems that it has been sustaining all the creatures of the forest. The finches, yellow warblers and mocking birds feast themselves during the day. The rats seem to have a wonderful time during the night, taking flying leaps from the nearest branch, onto the banana stem. Sometimes they miss and land with a crunch and rustle of leaves on the ground below. In addition we have a wild burro, nick-named Neddy, who spends much of his day and night travelling on a circuitous route which passes right through the middle of our camp. Each time he passes he helps himself to a few bananas. We had the impression that his visits were becoming more frequent. I later discovered that, in fact, there are four Neddies; all enticed by our bananas, I'll warrant!

Now it's day shift observation at the colony. I sit on my log, hidden by a clump of mangrove. I am clad in bikini bottoms, sun hat, rubber boots and binoculars.

In the colony at present, there are seven bickering chicks and one sleeping adult. The other parents will return this evening to feed their offspring. We have followed the daily activities of this colony of birds, some of whom deserted their eggs while others accidentally broke their eggs and had to abandon their nests. Seven chicks have survived which is average breeding success for flamingos. Both parents incubated their single egg in turn and when the chick hatched, after 28 days, both male and female fed it. This was accomplished by the parent holding the chick under its wing, lowering its long curved beak and dribbling a bright red liquid into the chick's mouth. Later the feed was given with both parent and chick standing. The long neck of the adult reached down to the white, fluffy chick. Now that the chicks are almost a month old, they look like ugly ducklings and spend much of their time together in one small part of the colony. Their incessant squabbling resembles the yapping of a litter of young pups. They consume great quantities of solid mud, gulping it down in huge chunks. They really are strange little creatures but quite fascinating to watch.

During our studies here, we have discovered much about flamingos in general and the Caribbean flamingo of the Galapagos Islands in particular. We are happy to think that our work may prove to be a valuable contribution to the conservation of the flamingos in their natural habitat.



Flamingo on nest with chick.

Drawing by Peter Scott.

**INFORME ANUAL SOBRE EL PROGRAMA DE BECAS PARA
ESTUDIANTES UNIVERSITARIOS ECUATORIANOS**

1977

Durante el año 1977 fue posible continuar con un número elevado de becarios el Programa de Becas iniciado en el año 1971. Este programa, que permite a estudiantes y profesores de las universidades ecuatorianas trabajar en la Estación Charles Darwin por un tiempo, realizando investigaciones científicas, fue posible continuarlo en 1977 debido al generoso apoyo de la Sociedad Zoológica de Frankfurt, Alemania Federal; el Fondo Mundial para la Naturaleza (WWF); y, las empresas turísticas nacionales, Metropolitan Touring, Veleros de Galapagos, Machiavello Tours y Galápagos Tourist Corporation. El Servicio del Parque Nacional Galápagos, la Fundación Charles Darwin, a través de la Estación Darwin, las universidades involucradas en el intercambio y los becarios mismos colaboraron también en hacer posible este Programa de Becas.

Durante el año pasado, un profesor y quince estudiantes de cuatro de las universidades más representativas del país realizaron investigaciones científicas bajo los auspicios de este programa de colaboración. Las investigaciones abarcaron un total de 58 meses/becario por periodos de un mes hasta seis meses por individuo. En la mayoría de los casos, servirán estos estudios para la preparación de Tesis de Grado o monografías requeridas por los estudiantes para la obtención de su título académico.

La Estación Científica Charles Darwin, además de dirigir y coordinar el programa, provee el asesoramiento científico en el campo a los becarios por intermedio de su propio personal científico o por medio de científicos invitados que realizan investigaciones en las Islas al amparo de la Estación, garantizándose en todos los casos un alto nivel en los campos respectivos de asesoría, en beneficio del estudiante becario.

Craig MacFarland
Director
Estación Científica Charles Darwin

Isla Santa Cruz, Iro de Enero de 1978.

LISTA DE INVESTIGACIONES E INVESTIGADORES

Nombre	Universidad	Investigación	Duración (meses)	Asesor de campo
Sres. Jorge Ayala y Bernardo Beate	Escuela Politécnica Nacional	Terminación del estudio de Petrología y mapa geológico de Isla Española	2 (Nov. Dic).	Dr. M. Hall

Nombre	Universidad	Investigacion	Duracion (meses)	Asesor de campo
Lcdo. Jaime Cilio	Universidad Central	Co-relacion entre parametros del habitat y distribucion del lobo marino (<i>Zalophus californianus</i>) en Islas Floreana y San Salvador y Censo de la poblacion del lobo marino en Isla Floreana.	4 (Abr.Ago.)	Dr. F. Trillmich
Lcda. Rosa Gallo	Universidad Central	Estudio sobre el comportamiento del cormoran no volador (<i>Nannopterum harrisi</i>) en colonias visitadas por turistas y colonias no visitadas, Isla Fernandina.	6 (Abr.Oct.)	Dr. R. W. Tindle
Lcdo. Hugo Loza	Universidad Central	El impacto turistico en la biologia de la crianza de los piqueros enmascarados (<i>sula dactylatra</i>) en Islas Genovesa y Espanola.	5 (Oct.-Feb.)	Dr. R. W. Tindle
Lcda. Nela Martinez	Universidad Central	Estudio sobre la efec- tividad y eficiencia de varios venenos en matar a la hormiga colorada introducida (<i>Wasmannia auropunctata</i>)	5 (Mar.-Ago.)	Dr. F. Trillmich
Sr. Jose Mino	Universidad de Guayaquil	Estudio sobre la ve- getacion de los charcos de Isla Santa Cruz.	2 (Ago.Sep.)	Dr. H. Adersen
Lcda. Aurora Pazmino	Universidad Central	Estudio sobre el comportamiento del cormoran no volador (<i>nannopterum harrisi</i>) en colonias visitadas por turistas y colonias no visitadas, Isla Fernandina.	6 (Abr.Oct.)	Dr. R. W. Tindle

Nombre	Universidad	Investigacion	Duracion (meses)	Asesor de campo
Sr. Patricio Ramón	Escuela Politécnica Nacional	Aspectos de Pedagogía de la Geología de Galápagos.	1 (Oct.Nov.)	Dr. M. Hall
Dr. Kurt Rehn	Universidad Católica Quito	Taxonomía del saltamonte (<i>Schistocerca</i> spp) mediante electroforesis.	1 (Oct.Nov.)	—
Dr. Pedro Ortiz	Instituto Nacional de Pesca	Dinámica Poblacional de las langostas.	12 (Ene./Dic.)	Dr. G. Rock
Lcda. Fanny Rodríguez	Universidad Central	El impacto turístico en la biología de la crianza de los piqueros enmascarados (<i>sula dactylatra</i>) en Isla Genovesa y Española.	5 (Oct.-Feb.)	Dr. R. W. Tindle
Lcda. Ximena Sacoto	Universidad Central	Estudio sobre la efectividad y eficiencia de varios venenos en matar a la hormiga colorada introducida (<i>Wasmannia auropunctata</i>).	5 (Mar./Ago.)	Dr. F. Trillmich
Srtas. Yadira Saldaña Teresa Ventimilla	Universidad de Guayaquil	Estudio sobre algunos aspectos de la biología de la crianza del cormorán no volador (<i>Nannopterum harrisi</i>) en Isla Fernandina.	6 (Abr.Oct.)	Dr. R. W. Tindle
Biólogo Iván Zambrano	Instituto Oceanográfico de la Armada	Estudios sobre las algas marinas microscópicas.	1 (Agosto)	Dr. I. Manton

CDF NUMBERED CONTRIBUTIONS SINCE 1970

Whenever the Charles Darwin Research Station has been of significant assistance in the research project of a visiting scientist, we ask that this be acknowledged by giving the resulting publication a number in the CDF Contribution Series, and mentioning this on the title page or in the "Acknowledgements" section. This request has not always been complied with, but a considerable number of papers in specialist journals of many disciplines have carried the phrase: "Contribution No. XXX of the Charles Darwin Foundation". The following list, compiled by Tom Simkin, the Foundation's Secretary for the Americas (Science), illustrates the wide scope of the investigations conducted by international scientists associated with the Darwin Research Station.

CDF No.		Year
070	KELSEY, L.P. <i>A new Scenopinus from the 1964 Galapagos International Scientific Project (Diptera: Scenopinidae)</i> . Pan-Pacific Entomologist, V. 46, p. 96-97.	1970
080	PORTER, D.M. <i>The Genus Dodonaea (Sapindaceae) in the Galapagos Islands</i> . Occas. Papers Calif. Acad. Sci., V. 81, p. 1-4.	1970
081	CHILD, C.A., HEDGPETH, J.W. <i>Pycnogonida of the Galapagos Islands</i> . J. Nat. Hist., V. 5, p. 609-634.	1971
093	EIBL-EIBESFELDT, I. <i>Fregata Spec. (Fregatidae) Balz</i> . Encyclopedia Cinematographica, E 594, p. 3-7.	1970
094	EIBL-EIBESFELDT, I. <i>Fregata Spec. (Fregatidae) Fütterung Der Jungen</i> . Encyclopedia Cinematographica, E 595/80, p. 3-5.	1970
097	HARRIS, M.P. <i>The Biology of an Endangered Species, the Dark-Rumped Petrel, (Pterodroma Phaeopygia), in the Galapagos Islands</i> . Condor, V. 72, p.76-84.	1970
107	WIGGINS, I.L. <i>Studies on Plants of the Galapagos Islands I. New Species and Combinations</i> . Madrono, V. 20, p.250-253.	1970
108	STOOPS, G. <i>Micromorphology of Some Important Soils of Isla Santa Cruz (Galapagos)</i> . Trans. Third Intntl. Working Meeting on Soil Micromorphology, Wroclav 1969, p.471-483.	1974
111	HARRIS, M.P. <i>Breeding Ecology of the Swallow-Tailed Gull (Creagrus Eurcatus)</i> . Auk, V. 87, p.215-243.	1970
112	ROTH, B. COAN, E.V. <i>Marginellidae (Mollusca: Neogastropoda) from the Galapagos Islands and Cocos Island</i> . Proc. Calif. Acad. Sci., V. 37, p.575-584.	1971
113	SIMKIN, T. HOWARD, K.A. <i>Caldera Collapse in the Galapagos Islands, 1968</i> . Science, V. 169, p.429-437.	1970
114	DUNSON, W.A. <i>Excessive Drinking (Polydipsia) in a Galapagos Mockingbird (Nesomimus)</i> . Comp. Biochem. Physiol., Vol. 36, p.143-151.	1970
117	FORD, H.A. PARKIN, D.T. EWING, A.W. <i>Divergence and Evolution in Darwin's Finches</i> . Biol. Jour. Linn. Soc., V. 5, p.289-295.	1973
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Courtship of Waved Albatross. Photo by Fritz Pölking.

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