

NOTICIAS DE GALAPAGOS

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## NEWS FROM ACADEMY BAY

### ENVIRONMENTAL EDUCATION

The Charles Darwin Foundation has always been aware that, in the long run, the success of its efforts in the Galapagos would depend on the degree of public understanding of the need for protection of the environment. Within its limited resources, the Research Station began in the 1960's to give natural history lessons in the local schools and organised well-attended environmental courses for local teachers and officials. The year 1981 has seen a major expansion in educational possibilities.

For its part the Foundation appointed Señora Olga Herrera de MacBryde, formerly Director of the Department of Biology in the Catholic University of Quito, as staff member of the Research Station to take charge of all its educational activities, including the supervision of the Ecuadorean scholarship students. This coincided with a radical new initiative on the part of Dr. Galo García F., Minister of Education and Culture, who proposed sending groups of selected teachers from mainland Ecuador to take part in short scientific and environmental courses in the archipelago.

The first two courses were held during the school holidays in March with 50-60 teachers participating in each. It was decided that the courses should be held on board the Navy's cruise ship, *Calicuchima*, as this would permit visits to five islands as well as the National Park H.Q. and the Darwin Station. The teachers were flown one way by the Ecuadorean Airforce. Lectures and discussions were held during the sea passages, led by staff members of the CDRS, GNPS, and local teachers.

This programme, which is to be continued with other groups, could produce a variety of benefits. It makes an obvious if small contribution to science teaching in the colleges. It spreads throughout the mainland provinces a knowledge of the realities of the Galapagos in contrast to some curious but widespread notions arising from their other name of "The Enchanted Isles". The archipelago is a thousand kilometres from the continent and, until recently, few Ecuadoreans have been able to visit their island possession. Above all it should strengthen the growing realization of the need to protect the unique Galapagos environment on which UNESCO has now conferred the status of World Heritage. Moreover, having seen both the problems arising from the misuse of natural resources in the past, and the more recent successes of conservation in the National Park, the programme of teachers' visits should stimulate the national determination to protect the still enormously valuable natural areas in other parts of the Republic. At one further remove, the success achieved by Ecuador in the field of wildlife protection could provide encouragement for conservation movements in other Latin American countries.

### HAWAIIAN PETREL ON THE DANGER LIST

The International Union for Conservation of Nature has now entered the Dark-rumped (or Hawaiian) Petrel in its Red Book of endangered species. There are still thousands of adults but the rate of reproduction has fallen so low that, if protective action is not taken, the final extinction of the species may not be long postponed. This magnificent pelagic bird, with a three foot wingspan, breeds only in Hawaii and Galapagos, and in both archipelagos it is under severe pressure: every one of its known breeding colonies in Galapagos is threatened. For once man is not the main culprit — at least, not directly. The trouble arises from the pigs, dogs, cats and rats that man introduced and against which the petrel has little defense. At sea it is safe but on land, where it nests in burrows dug in the moist soil of the uplands, its chances of successfully raising young are now dismally small. Unfortunately it does not breed on any of the islands that are free from introduced predators.

Much research by Darwin Station scientists under trying conditions — the petrels nest in the highlands during the cold *garua* (drizzly mist) season — has given a general idea of the problems of survival. Now it is a question of action which, as so often before, depends on the resources that can be made available

Research suggests that the pigs and dogs might be eradicated, at least in some areas. Rats and cats would prove more difficult but it should be possible to secure a considerable measure of control in selected breeding colonies. Experiments are continuing with artificial burrows to provide safe nesting places and Dr. David Duffy makes other proposals elsewhere in this issue.

The one thing that is quite obvious is that there is no time to lose if *Pterodroma phaeopygia* is not to be the first bird to become extinct in the Galapagos. Given the restricted resources in men and money, efforts in 1982 will be centred on a relatively concentrated colony at the summit of Cerro Pajas on Floreana (Charles Island), where breeding success has been less appallingly low than elsewhere.

#### THE DOG CONTROL CAMPAIGN

At the request of the Foundation and the National Park Service, Dr. Hans Kruuk, an expert on canines, and Howard Snell, the herpetologist who had spent three years studying Galapagos iguanas, investigated the rapidly growing menace of feral dogs to the survival of Marine Iguana populations. In their report, published in the *Journal of Applied Ecology* (1981) 18:197-204, they concluded that "the species was not adapted to cope with dog predation". They mentioned specific cases such as: "predation at Caleta Webb, Isabela, was much greater than the iguana population could sustain" and "at least one other population (at Tortuga Bay, Santa Cruz) had been virtually eliminated by dogs during our study period and the year preceding it". This same fate had already befallen important colonies of Land Iguanas, which the dogs had wiped out, apart from the few taken to the Research Station for protection and captive breeding. There are dog-free islands where both kinds of iguanas can survive but it is clearly important that all the various species or races of these unique reptiles should be protected, not to mention the endemic Tortoises, Fur Seals, Sea Lions, Penguins, Flightless Cormorants and the other nesting seabirds, which likewise fall victim to the fierce dogs.

From this thorough study by experts on both canines and iguanas, it became clear that the only practical policy for the protection of the native animals was the elimination of the introduced dogs. A campaign has been mounted on Isabela Island, south of the Perry Isthmus, (see Noticias 33) with the support of the Frankfurt Zoological Society. The first three expeditions, composed of four park wardens under the leadership of Alan and Tui De Roy Moore, made commendable progress in devising and executing control methods. In spite of this early success, there is little prospect of the task being completed before the end of 1982, because it now appears that there are several hundred, (perhaps 1,000) wild dogs in Southern Isabela, their packs scattered over many square miles of fierce lava, including the great volcano, Cerro Azul. The hunting teams operate there for 20 days each month in conditions of great hardship and it is estimated that 24 such expeditions may be necessary before a final solution can be achieved.

#### VISITORS AND EVENTS AT THE CHARLES DARWIN RESEARCH STATION: JANUARY—JUNE 1981

##### JANUARY

Seminar on Ecodevelopment in Galapagos, organized by INGALA.

Friedemann Koester, the new Director of the CDRS, took up his duties.

Hugo Loza began as staff member for CDRS for human ecology.

Alfred Thorwarth, West German Television, and team arrived to film subtidal marine life.

Caldwell Hahn, WWF-USA, visited CDRS.

Sylvia Earl, California Academy of Sciences, arrived to co-ordinate plans for a diving expedition next year.

Roger Perry, former Director of CDRS, visited the Station.

Walter S. Wingo, U.S. News and World Report, visited CDRS.

Mary Margaret Curran de Espinoza began as librarian.

## FEBRUARY

- Grady and Elizabeth Walker arrived to study *Opuntia* cacti.  
Carmen Rohrbach, Max Planck/Seewiesen, returned to Germany after a one year study of breeding biology of marine iguanas on Caamaño Island.  
Warwick Reed, Director's Aide, returned to New Zealand.  
Olga Herrera de MacBryde began as staff member of CDRS for education.  
Malcolm Coulter began his project on breeding biology of Hawaiian Petrels on Floreana.  
Bruce Coblenz, Oregon State Univ., and assistant arrived to study feral pigs on Santa Cruz and Santiago.  
Horst Weylandt, Bremerhaven, visited CDRS to prepare a research project on marine microbiology.  
Ulla and Ake Norberg, Univ. of Goteborg, returned to Sweden.  
Uno Eliasson, Univ. of Goteborg, and his family returned to Sweden.  
Friedemann Koester and José Villa, Director and Subdirector of CDRS, travelled to Quito to attend the CDF Council meeting.  
Peter Kramer, President of CDF; Marinus Hoogmoed, Museum of Natural History, Leiden; Robert Dressler, STRI, Panama; Paul Paredes, CONADE, Quito; Friedemann Koester and José Villa, CDRS; began work on the Station's operational plan for 1981-1989.  
Ole Hamann, Univ. of Copenhagen, his family and assistant, arrived to continue their botanical studies.  
Richard Tracy, Colorado State Univ., left after a month on Plaza Island studying land iguana behaviour and ecology with Heidi and Howard Snell.  
Marinus Hoogmoed had to leave Galapagos in emergency and was operated on in Quito for appendicitis.  
Bruce Coblenz gave a seminar on methods of eradicating feral pigs.

## MARCH

- Gunther Reck, Undersecretariat for Fisheries, Guayaquil, arrived to assist in the formulation of the operational plan for 1981-89.  
Formal inauguration of the Station's vessel *Beagle IV* by the playwright, Tom Stoppard, and Ivan Hattingh, WWF-Great Britain.  
Tom Stoppard and Ivan Hattingh, accompanied by Humberto Ochoa, GNPS (Galapagos National Park Service) and Friedemann Koester and David Duffy, CDRS, left on *Beagle IV* to visit various islands.  
Heide Koester, wife of the Station Director, arrived with their children.  
Alan Moore gave a seminar on tourism statistics in Galapagos.  
Alan Moore, Tui de Roy Moore and four park wardens left for Isabela Island for the first stage of the joint GNPS/CDRS dog eradication programme.  
Steven Shemeld, librarian of CDRS and Ulrike Eberhardt, formerly in charge of the botanical collection and editing the "Galapagos Reader", returned to Europe.  
Arno Wuenschmann, Director of Munich Zoo, visited the Station.  
Joseph A. Sawe, Toman Hutagalung and George Thullen, Joint Inspection Unit, United Nations, Geneva, visited CDRS and GNPS.  
Walter Arnold, Max-Planck/Seewiesen, and assistant arrived to study fur seals on Fernandina Island.  
First two courses on environmental education and conservation for teachers from mainland Ecuador, given on board vessel *M/N Calicuchima*, during a tour of the islands.

## APRIL

- Yael Lubin began as staff member of CDRS for entomology.  
Eliana M. Beluzzo D., Univ. de São Paulo, visited CDRS.  
Second stage of dog programme on Isabela Island.

Catherine Rechten, Max-Planck/Seewiesen, arrived to study courtship and breeding behaviour of albatrosses on Hood Island.  
Bruce Barnett, Univ. of California, arrived to study the feral dog populations on Santa Cruz and Isabela Islands.  
H.R.H. Princess Juliana of the Netherlands, and H.R.H. Prince Bernhard visited CDRS and GNPS accompanied by José Jijón, Ministerio de Relaciones Exteriores, and Tjitte de Vries, Universidad Católica, Quito.  
Gary Robinson and his wife, Gayle, arrived as staff member of CDRS for marine biology.  
Nelly Ruiz began as executive secretary at CDRS.

#### MAY

Environmental courses started in all schools on Santa Cruz and San Cristóbal Islands.  
Hugo Luza, CDRS, attended Seminar on Management and Development of Coastal Zones, held in Guayaquil.  
Adriano Pastrone, Agence Coopération et Aménagement, France, visited CDRS.  
Bruce Barnett gave a seminar on Indian wild dogs.  
Third stage of dog programme on Isabela Island.  
French Navy vessel "Comandant Bory" visited Puerto Ayora: staff members of CDRS were invited on board.  
David Duffy returned from a one month vacation.  
Robert Reynolds, Cruz Márquez, Linda Cayot and José Villa began survey of populations and breeding areas of tortoises on Santiago (James) Island.  
Park Nobel, Univ. of California, arrived to study eco-physiological aspects of Opuntia cacti and gave a seminar on his research on Sonoran desert cacti.

#### JUNE

Celebration of Earth Day in Puerto Ayora.  
George J. Vanalek arrived to study the Galapagos bats.  
Meeting of CDRS and INGALA ecodevelopment group to discuss future activities of both institutions.  
José Villa left for International Conference on National Parks in Lima, Peru.  
Charles J. Hedlund, The Nature Conservancy, visited the Station.  
Norbert Rauch and his family, Max-Planck/Seewiesen, returned to Germany on home-leave.  
Yael Lubin left for a four-month lecturing period at Univ. of Florida, Gainesville.  
Nelly Ruiz, executive secretary at CDRS, returned to Quito.

### THE WWF IN THE GALAPAGOS

The World Wildlife Fund celebrated its 20th Anniversary in May 1981. This makes it slightly younger than the CDF, so it was the WWF's scientific partner, the International Union for Conservation of Nature, that sponsored the establishment of the Darwin Foundation in 1959. But from its very earliest days the WWF has been a consistently enthusiastic supporter of the CDF. Both its new International President, H.R.H. The Duke of Edinburgh, and its Founder-Chairman, Sir Peter Scott, have personally championed the cause of Galapagos conservation for many years.

WWF support for the Foundation has taken so many forms that it would be wearisome to catalogue them. One recent example was essential finance for the purchase of the new research vessel, *Beagle IV*, which was formally handed over to the Research Station by Tom Stoppard, the distinguished playwright and author, and Ivan Hattinoh of WWF/UK. On his return to England, Mr. Stoppard wrote a 5,000 word article giving his impressions of the Galapagos. An extract is printed in this issue of Noticias under the heading: "This Other Eden".



On behalf of the World Wildlife Fund, Tom Stoppard (right), formally handed over the new research vessel, Beagle IV, to Friedemann Köster, Director of the Darwin Station.



## THIS OTHER EDEN

by

*Tom Stoppard*

*At the World Wildlife Fund's 20th Anniversary celebrations when H.R.H. The Duke of Edinburgh, Honorary Life Member of The Charles Darwin Foundation, was installed as International President, the actress Janet Suzman gave a most eloquent reading of this extract from a long article by Tom Stoppard, the playwright and author, about his recent visit to the Galapagos on behalf of WWF.*

We stood one morning on the broken cliffs of southernmost Espanola, known to Darwin as Hood and indiscriminately so called to this day by the descendants of those Ecuadoreans who claimed the archipelago, without disputants, a hundred and fifty years ago. The surf destroyed itself thunderously against a shambles of black lava, washing over sunset-coloured crabs and leaving mists of spray over blowholes where the sea forced a booming passage through the rocks. Marine iguanas from the bestiary of Hieronymus Bosch, baleful little dragons with sagging throats and jaws like mean old men, waited out the millenium while gulls and dive-bombing boobies whistled a neurotic high register into the groaning, hawking din of a colony of sealions; whose other appeal to the senses was the stench of rotten fish.

It was a spectacle which bore out a phrase noted in his journal by Captain Robert Fitzroy of H.M.S. Beagle on making his landfall on September 15, 1835: "A shore fit for pandemonium."

But the Galapagos has different styles of accommodation for different classes of sinner. (Darwin and Fitzroy actually found a settlement of political prisoners here, conveniently disposed of in the eastern Pacific some six hundred miles from the South American mainland). On Isla Santiago, called James for the Stuart king, we burned our soles on a black petrified lake that once flowed hugely around two ochre cones of clinker, molehills as big as the Ritz. The surface of this lake was not smooth but disturbed on two scales, being broken into tilted slabs, each slab preserving the forms of an ancient viscosity, waved, plaited and combed like women's hair. On this waterless joke against landscape a cactus hardly bigger than a shaving brush seemed as miraculous as the palm house at Kew Gardens.

What, then, puts one in mind of paradise? Simply this, and nothing in countryside or garden, safari park or rain forest, prepares one for it: the animals are in a state of innocence. They have no idea that you and I are, as the biologists put it, the most successful of the species, and that we could choose to wipe them out if we did not choose to cherish them; and so they are not afraid.

This is more strange than words can make it. One walks among iguanas, herons, doves, mocking-birds and finches as Adam and Eve in medieval paintings walk among antelopes and cranes.

The sealion lies down with the snorkler. Boobies nest on the trail. The swallow-tailed gull (the prettiest gull in the world, it has large, perfectly round, luminous black eyes set in a bright red ring, and looks as if it comes from Hamley's toy shop) and the Galapagos dove (the prettiest dove in the world, it has a plump rosy breast, blue button eyes and speckled wings, and looks, as it has sometimes found to its cost, good enough to eat) pose for photographs.

Evidently they have learned nothing since Darwin captured specimens with his hat, using his gun on one occasion to knock a hawk off a branch with the muzzle.

Moreover, such is the persuasiveness of this disadvantaged Eden that the traveller who has seen penguins in Antarctica and flamingoes in the Caribbean, and has thereby found Nature to be in good working order, has no difficulty in accepting the presence of both birds on one small island at latitude nought.

What is Eden for the poetically minded is sheer heaven for the research biologist. It's nature on a platter. How about a study of the flightless cormorant, which dives like a seal to catch its food? Simple — get in the water with it. The flightless cormorant doesn't mind a bit.

There is that; and there is the fact that the flightless cormorant, like the Galapagos penguin, the Galapagos dove, the iguanas (land and marine), the swallow-tailed gull, the four kinds of mocking-birds, the thirteen kinds of finches and a dozen other birds and reptiles, not to mention those giant tortoises and two hundred and twenty eight species of plant, exists nowhere else.

And above all that, there is Darwin.

"It's like studying art in the Louvre," said one of the scientist-Crusoes who are often the sole inhabitants of one or other of the forty-eight islets scattered through the archipelago. "It's hammered into you — Darwin, Galapagos — Galapagos, Darwin."

Charles Darwin spent five weeks here, one week under canvas on James Island. He had set sail from a world which orthodox scholarship had ascertained to have been created at nine o'clock in the morning on Sunday, October 23, 4004 B.C. Whatever Darwin made of this calculation, he had no reason to doubt that all species of beings had been created simultaneously and immutably by God. The Galapagos pages of his narrative of the Beagle's voyage give the reader a spooky view of the penny dropping...

"The natural history of these islands is eminently curious and well deserves attention. Most of the organic productions are aboriginal creations, found nowhere else; there is even a difference between the inhabitants of the different islands ... Considering the small size of these islands we feel the more astonished at the number of their aboriginal beings and their confined range ... Both in space and time, we seem to be brought somewhat near to that great fact — that mystery of mysteries — the first appearance of new beings on this earth."



Galapagos Dove *Photograph by Fritz Pölking*



## TWENTY YEARS OF CONSERVATION IN THE GALAPAGOS. ASSESSMENT, LESSONS AND FUTURE PRIORITIES

Results of a Seminar on Conservation and Research in the Galapagos, held in Quito, 18-27 February 1980. Published by the Charles Darwin Foundation for the Galapagos Isles, 1980.

*reviewed by*

*Kai Curry-Lindahl*

*Professor Curry-Lindahl was active in promoting Galapagos conservation through the Charles Darwin Foundation even before the society's actual organization in 1959. He spent several years with UNESCO and, more recently, served as Senior Adviser in Ecology and Conservation with UNEP, the United Nations Environmental Programme. Today he is a Special Adviser to the Swedish Ministry for Foreign Affairs. Over the years, he has never faltered in his devotion to the environment in general and the Galapagos in particular.*

This seminar was organized by the Charles Darwin Foundation for the Galápagos Isles (CDF) under the auspices of the Ministry of Agriculture and Livestock of Ecuador and with the support of the Ministry of Foreign Relations and UNESCO.

Nearly two centuries of human activities and land use in Galapagos have convincingly demonstrated the extreme vulnerability of the islands' renewable natural resources. The environmental degradation and irreparable destruction in the form of extinctions and eradication of habitats are tragic man-made consequences, because the scientific resources of Galápagos are of universal significance. Moreover, two decades of conservation activities in the Galápagos Archipelago have in the reviewer's opinion clearly shown that the only human land use that is not destructive to the fragile environment on these islands is field research, controlled tourism and cautious marine fishery.

It was indeed high time when in 1959 the Charles Darwin Foundation for the Galápagos Isles became established and the Galápagos National Park was declared. The Foundation, UNESCO, WWF and other international and national organizations have ever since shown to Ecuador and the world how important it is to conserve the natural environment of the Galápagos for research, education, tourism and "intellectual outdoor recreation". The financial efforts of these organizations during 20 years have served as seed-money, because the persistent conservation work by CDF and UNESCO in Galápagos have convinced the Government of Ecuador and the country's academic institutions of the archipelago's importance as a scientific and cultural asset. This is made manifest by the financial and administrative measures recently taken by the government in support of the Galápagos National Park. This recognition was one of the primary goals of CDF 20 years ago.

Two decades after the legal establishment of the CDF and the Galápagos National Park, many problems regarding the conservation of the resources of the archipelago can be seen more clearly. Scientific priorities need to be re-formulated on the basis of the present conservation situation and administrative requirements need to be re-defined with eyes on the year 1989, when the agreement between the Government of Ecuador and the Charles Darwin Foundation lapses. International collaboration in the Galápagos needs guidelines for the next decade. Ecuadorean governmental bodies, also the experts and international organizations involved in this collaboration, require a carefully considered official directive. In addition they await well thought-out proposals for the development of the Galápagos project after the termination of the present agreement between the Ecuadorean Government and the Darwin Foundation.

In consequence, the Executive Council of CDF decided to organize a seminar in Quito in order to undertake a critical examination of activities so far, with a view to deducing any positive or negative lessons as a basis for considering and defining priorities for further action. The method of work was to circulate before the seminar a list of queries about lessons to be learned from the Galápagos experience and about future needs and perspectives to some 150 experts, who were invited to submit their views in

writing. International and national specialists in conservation, resource management, development and research met in Quito in 1980 to thrash out these problems. Their report is the result of the seminar. It provides a constructive and realistic background for work in Galápagos during the next decade.

The experts recognize that there is no other archipelago which is at the same time so extensive, so isolated, so simple in terms of its ecosystems and, despite centuries of destruction, so little disturbed by man. Therefore, the most careful management is needed to protect these exceptional but fragile ecosystems.

It was felt by the seminar that conservation policy in the Galápagos Archipelago has on the whole been fruitful but there are certain gaps which still demand attention. On the positive side there is the creation, planning and management of the National Park covering 88% of the land area of archipelago; but this is offset by the failure to include any marine zone whatsoever. This is still the case despite a statement by the government at a joint meeting with CDF's Executive Council in Galápagos in 1979 that all marine waters between the islands would be included in the National Park. Another gap is that there has hitherto been no overall plan for the integral management of the ecosystems, including as an essential element the interests of all those who use the islands — local population and visitors — and this has impeded the proper co-ordination of the various institutions involved.

The problems of the human population on Galápagos (at present about 5,000 residents) are of extreme importance. None of the educational programmes has focused attention on the ultimate consequences of man's settlement in the islands. Nor has any dialogue been established between the local people on one side and the National Park Service and the Charles Darwin Research Station on the other. This is a weakness, though it may have been politically wise to wait before tackling this sensitive problem until understanding of the national park concept had been anchored among the local inhabitants of Galápagos. On this point the seminar concluded that man's sustained use of the resources of the islands must in the long term depend on their conservation and on seeking a balance between their protection and the necessity for human development. In other words, conservation of the natural resources should be the basis for development.

Therefore, in my opinion, it is vital for the future of Galápagos to acknowledge the facts that the islands are ill-adapted to human settlement, unsuitable for agriculture and that livestock has disastrous environmental effects. It is desirable to undertake a socio-economic study on subsistence possibilities for the present human population based on the only viable human activities which can be reconciled with the Galápagos Archipelago without destroying its resources, namely those already mentioned: scientific research, tourism and fishing. The first can give work to scientists, field and laboratory assistants and other staff necessary for the manifold activities of the Charles Darwin Research Station. Tourism under strict control can develop into a local industry. This has already been demonstrated. Marine fisheries are a third potential for subsistence. The ultimate responsibility for all these activities lies with the Galápagos National Park Service itself, with its growing staff of administrators, rangers and guards.

The CDF model to induce conservation measures and conservation oriented research in a critical geographical area of international significance has proved successful. It has resulted in a gradually increasing participation and, finally, full responsibility by the Government for the management of the national park, while retaining close ties with the CDF, which continues to give advice and scientific leadership. This is an interesting and unusual experiment in co-operation between a government and an international non-governmental organization which has now been going on for 21 years. I have been closely involved in similar attempts in several tropical countries but none has been so durably successful as that of the CDF. Yet this organization is operating on a minute budget and its office is located in the home of its Honorary Secretary-General. Certainly there is no other international conservation organization of similar character running its operations virtually without overhead costs. This humble approach may have contributed to the CDF's success and the respect it has acquired in Ecuador.

Therefore, the results of the Quito seminar 1980 include not only an important 10-year plan for conservation in Galápagos but also an interesting document for those who wish to try the CDF model and approach in other parts of the world.

## A MASTER PLAN FOR ORNITHOLOGY IN THE GALAPAGOS ISLANDS

by

*David Cameron Duffy*

*Dr. Duffy, staff ornithologist at the Charles Darwin Research Station, also served for much of 1980 as Acting Director. He has now taken up a new post in Africa but, before leaving in July, he set out his personal views on future ornithological activities in the Galapagos.*

### INTRODUCTION

In February 1980 a group sponsored by the Darwin Foundation met in Quito to assess the performance of the Darwin Station in the past and to suggest priorities for the future. These priorities, published in *Twenty Years of Conservation in Galapagos*, were necessarily rather general, given both the scope of the project and the near absence at the meeting of biologists active in Galapagos research. The present document attempts to provide a more detailed planning for conservation-related research in ornithology.

Any such plan must be open to change: new concerns arise or individual scientists have different strengths and interests. My hope is to set a basic programme, the importance of which would be obvious and indisputable. In addition to this I have listed some more or less urgent projects and finally some programmes that should be undertaken when possible. These last items are not urgent but may become so in another decade or more.

I hope the basic programme will remain intact subject to our increasing knowledge. Equally I hope that future workers will attempt the other projects but I am sure that they will make their own additions or deletions, and this is as it should be. For example this document has addressed only conservation-related research. It is obvious that much 'pure' research will have abundant conservation spin-offs and benefits. A 'pure' science list of priorities is a complex task beyond the scope of this paper but I should like to suggest that such 'pure' work makes a substantial contribution to the reputation and fund-raising ability of the Station. One need look no further than Charles Darwin as an example.



Waved Albatross *Photograph by Fritz Pölking*

## SPECIES OF CONCERN

While all Galapagos species are of concern, limited funds and skilled personnel force us to shorten the list. Our concerns should centre on: 1) research and conservation efforts for endangered species; and 2) monitoring rare or restricted-range endemics in the islands. These include:

- Waved Albatross *Diomedea irrorata*: breeding only on Española and La Plata.
- Dark-rumped Petrel *Pterodroma phaeopygia*: endangered by introduced mammals.
- Galapagos Penguin *Spheniscus mendiculus*: restricted breeding range, vulnerable to oil spills and human fishing.
- Flightless Cormorant *Nannopterum harrisi*: very restricted range, low numbers.
- Galapagos Greater Flamingo *Phoenicopterus ruber*: low numbers.
- Charles Island Mockingbird *Nesomimus trifasciatus*: only 150 left, extinct on main island of range.
- Charles Island Large Ground Finch *Geospiza m. magnirostris*: extinct?
- Santa Cruz Sharp-Beaked Ground Finch *G. difficilis*: extinct on Santa Cruz?
- Mangrove Finch *Camarhynchus heliobates*: restricted range.
- Galapagos Hawk *Buteo galapagoensis*: extinct or very rare on human-inhabited islands, apparently flourishing on other islands.

## THREATS TO BIRDS IN GALAPAGOS

A. Direct human disturbance, through hunting, vandalism, and tourism. Hunting at present seems to be confined to the Galapagos Hawk, Short-eared Owl, and Barn Owl, presumably only on inhabited islands and then only in areas outside the National Park. Defense of poultry is the usual reason given. Vandalism seems to be very rare, possibly limited to nests of the three raptors and of the Dark-rumped Petrel in the farm zone. Despite studies by several scientists and numerous students, no clear-cut harmful effects of tourism have ever been found, at least since the creation of trails.

B. Introduced predators and diseases. Feral pigs and rats are the main predators on nesting Dark-rumped Petrels and their offspring. Domestic and feral dogs are also a problem for petrels and other seabirds. Rats seem to be a problem for nesting attempts of Galapagos Mockingbirds (*Vargas pers. comm.*) A devil's advocate might claim that we have no bird problems, only problems with introduced mammals. The solution therefore would come from the study of and removal of these mammals.

Not all feral problems are so obvious. Vargas (ms) found that the avian pox, introduced by domestic fowls, is the major cause of nesting failure in mockingbirds. Avian pox, avian malaria and other pathogens may play or have played an important role in determining present day distributions and past extinctions. For example, the Galapagos Rail retreated to higher elevations on Santa Cruz following human colonization with its attendant domestic birds. The Santa Cruz Sharp-billed Finch apparently went extinct during the same period. The Charles Island Mockingbird and Charles Island Large Ground Finch also disappeared from Charles Island (Floreana).

We still know almost nothing about which diseases are present, either in poultry or wild birds.

C. Oil. Chronic, small spills are the rule in Galapagos ports and at many tourist-boat anchorages. Low-level oiling is harmful to birds but at present the extent and effect of oil on Galapagos birds is unknown.

D. Human fishing. Currently, human fishing is divided into traditional fishing for benthic species and highly mechanised fishing for pelagic tuna. Neither fishery has been thoroughly studied. The tuna fishery apparently includes a large illegal component making quantification difficult. Many tropical seabirds feed over mixed schools of tuna and porpoise. These schools are often set on by tuna boats. Penguins and other species may be killed by entanglement in nets. In the longer term, overfishing of porpoise - tuna may reduce the food sources for the seabirds dependent on them. Finally, within the range of the Flightless Cormorant there is a very real danger that increased fishing by humans, especially lobster netting or trapping, could lead to major mortality of these inshore-feeding seabirds.

E. Natural Agents. It is probably not the responsibility of either the Galapagos Park Service or the Darwin Station to intervene with species suffering from natural threats. However, these need to be studied to distinguish them from other, artificial agents. For example we already know that the El Niño oceanographic phenomenon in Galapagos leads to widespread nesting failure but does not lead to increased adult mortality such as occurs elsewhere. On the other hand, a prolonged drought may explain the recent decline of flamingoes. Longer-term climatic changes in precipitation may influence vegetation zones, nesting success and, eventually, which species are present. Finally, volcanic activity on Isabela and Fernandina may eventually endanger their three endemic birds (Galapagos Penguin, Flightless Cormorant, and Mangrove Finch).

F. Habitat Destruction. The increase in the human population and its attendant ranching and farming may have extirpated several middle-elevation finches on the inhabited islands (Bowman 1961. Morphological Differentiation and Adaptation in the Galapagos Finches. Contr. 1, Charles Darwin Foundation). Clearing does not seem to have had a directly negative effect on the Dark-rumped Petrel (Baker 1980. Report to CDRS). On the other hand there has been no attempt to assess avian faunal changes over the years. An analysis of mist netting records might be of use.



Woodpecker Finch probing for food with twig. *Photograph by Roger Perry*

#### THINGS TO DO

A. Life History Studies. It is a truism, but one which evidently needs frequent repetition, that any conservation effort must be based on a knowledge of the species involved if it is to be successful. Life history studies are a necessary preliminary. We are fortunate that such studies are available for most of the species of concern. The major omission, the Charles Island Mockingbird, is being studied by P. Grant and R. Curry. This research should be supported.

For species such as Lava Gulls, other finches, flycatchers, Galapagos Martin, etc., the Station should encourage outside investigators but should not invest its own resources. This disagrees with the recommendations of the Foundation's document *Twenty Years of Conservation in the Galapagos* (1980) which calls for studies of Galapagos Rails and the two endemic gulls on the basis of their being endangered. After the work by Snow, Snow, Hailman, Bailey, Harris, Clark and Clark on these species, we have at least a first level knowledge of their biology. While rare and endemic, they do not seem to merit the status of "endangered" or the diversion of funds from more serious problems.

B. Studies of Potential Threats. The important thing is to identify the serious threats for each species. Exact or repeated quantification of damage is of little value. For example we already know that rats are a very serious source of nest failure for Dark-rumped Petrels. Research that informs us that there was a 97% nest failure this year compared to a 90% failure the year before is not of great use — unless it is linked to a rat control programme. We can safely assume that a problem will remain a problem until something is done about it. Money and time should be spent on the solution, not on documenting the problem.

In the case of feral mammals we have in most cases abundant, if unquantified, evidence of their impact. Dogs eat penguins, pelicans and boobies. Cats are a major problem in booby colonies at Vicente Roca and Punta Pitt. Pigs and rats have almost eliminated Dark-rumped Petrel reproduction.

Unfortunately we lack any more than anecdotal evidence of the seriousness of predation by rats and cats on smaller landbirds and their nests. This should be investigated. Other threats of unknown potential include chronic and acute oil pollution, avian pathogens, collision with cars, land clearing and fishing.

We do know that at present visitor-levels, with competent guides and the present path system, tourism is not having much — if any — effect on Galapagos seabirds.

Specific steps recommended to determine the importance of various threats include:

1. A study of rat predation on nesting landbirds (student or outside investigator).
2. An analysis of cat scats for frequency of avian prey in different areas (The Konecny dissertation may provide sufficient information for this project).
3. The apparent introduction of anis should be investigated; their potential for spreading, population size, and diet should be investigated for future use and the population eliminated by the Park Service.
4. Poxvirus survey and effect on nesting success. A survey has been underway these last two years to determine pox frequency but administrative duties have consistently hampered the project and an outside investigator may be necessary. Investigation of the effect of pox on nestlings could easily be combined with the study of rat predation.
5. Habitat use and bird diversity. Partially combined with the pox survey, this study should use brief periods of netting to determine the effect of grazing, farming and high density housing on landbird numbers and diversity.

C. Dealing with the Threats. It is the task of the National Park Service to reduce or eliminate threats to Galapagos wildlife. It is the responsibility of the Darwin Station to advise on methods and the species of concern. At times however these distinct tasks blend, as for instance when the Station tries several methods in field tests before recommending one, or when highly skilled personnel are necessary for a programme.

The Park has ongoing dog and goat control programmes. An attempt to control pigs on Santiago is in the fund-raising stage. The Park Service has indicated its willingness to attempt to control rats in defense of nests of Dark-rumped Petrels on Santa Cruz. This is in the fund-raising stage.

In the absence of anyone studying control of rats in Galapagos and given such a programme's importance to conservation of the Dark-rumped Petrel, the staff ornithologist should continue to monitor the pest control literature since several promising anticoagulant rodenticides are appearing. The potential for secondary poisoning should also be considered in a pragmatic way, taking into account the differing raptorial species on the various islands.

Specific programmes recommended to deal with threats include:

1. Continued monitoring of literature on rodenticides and their side effects.
2. A field trial of selected rodenticides while monitoring effect on nest success of petrels.
3. A long term, intensive effort at rat control on Cerro Pajas, Floreana, the highest density petrel nesting area. For continuity, this programme should employ a resident of Floreana as its leader.
4. Helping the Park Service establish a long term rat control programme on Santa Cruz using methods determined in project no. 2 above.
5. Monitoring success of anti-pig and anti-dog artificial burrows for petrels to see if more should be constructed.
6. Contingency plans to deal with oiled birds (in preparation with Bird Rescue Center, Berkeley, CA, and New York Zoological Society).

D. Monitoring of Species. Apart from the endangered Dark-rumped Petrel, the rare and vulnerable Charles (Floreana) Island Mockingbird, and two possibly extinct taxa, bird conservation in Galapagos is at least holding its own — at present. However, if we are to be effective in the future we need timely information on problems. Since seabirds and flamingoes are long-lived and often have low reproductive success, effective monitoring is best done for adult birds. Because interisland or intersite movement may occur, censuses or indices of entire populations are more useful than partial counts.

The recommended monitoring programme should include:

1. Annual December count of all flamingoes throughout the archipelago using simultaneous counts.
2. Annual counts of penguins and cormorants in August or September.
3. A May count of nests, deserted eggs, non-breeding adults and breeding pairs (active nests) for the Waved Albatross (this would best be done by the Park Service and would replace their present banding programme).
4. Annual census of the Charles Island Mockingbirds on Gardner and Champion. Presently this is being done by P. Grant and students but it should be continued if they cease.
5. Annual or more frequent visits to tourist sites for "check-ups" on their condition. Accompanying a tourist boat as a lecturer is the least expensive way.

Some important factors should be kept in mind. First we have no idea of annual variations in populations. Until this is established, regular and annual counts are essential. We are not interested in one year counts but in trends. We must be able to distinguish the two. Second, the time of year for censuses should not fluctuate. Counts made before and after a breeding season can be quite different. Censuses made at different times of year cannot be compared, especially for such species as flamingoes which are strongly affected by seasonal forces.

Third, the methods should remain the same. We are less interested in accuracy than in replicability. The counts should of course be accurate enough to reflect trends but not so detailed that year-to-year differences in observer competence becomes the key factor.

E. Short-term Urgent Needs in Research. A number of other important efforts should be made as soon as possible:

1. To see if the Floreana (Charles) Large Ground Finch still exists. It was reported and collected in 1957.
2. To see if the Sharp-billed Finch still occurs on Santa Cruz.
3. Another survey should be done for the Mangrove Finch.
4. The Charles Island (Floreana) Mockingbird should be reintroduced onto Floreana. This should be done only after initial research on the species has been completed on Champion and a trial conducted using Santa Cruz Mockingbirds on Santa Cruz. There must be strict co-operation with the scientists studying this mockingbird (Grant and Curry). Slap-happy introductions would be likely both to fail and to endanger the Champion population of only 150 birds. The Station should consider supporting the scientific research involved.
5. The conditions limiting the range, nesting season, and population of the Flightless Cormorant should be investigated. In view of plans to open a fishing port at Elizabeth Bay in the heart of the Cormorant's range, we need to identify key prey species and necessary conditions before the fishery is established.

F. Longer Term Needs in Research. In addition to the above, there are a number of other programmes of perhaps less urgency but of equal long-term importance not only for avian conservation but also for marine conservation and human medical entomology.

1. Booby growth and survival as indicators of marine conditions. Blue-footed Boobies, inshore feeders, may reflect local oceanographic conditions in their growth and nesting success. If present studies confirm this, an effort should be made to use it as a long term monitor of the Galapagos marine environment. This study should also help explain the periodic mass desertions which are at present all too often blamed on tourists and park mismanagement.
2. Efforts should be made to investigate the various avian diseases and their vectors present in the islands. Seabirds elsewhere harbour diseases dangerous to humans.
3. A study of the habitat needs of the tree finches should be undertaken to identify critical tree species, vegetation structures, fruit sizes, or whatever might be endangered by human clearing of land for agriculture and housing.
4. During voyages, information should be collected on seabird species feeding over tuna-porpoise groups or whales.

From a scientific point of view, but unfortunately not from a conservation one, it would be useful to continue the long term banding projects of the Flightless Cormorant and Waved Albatross. Analyses of these data have already been published by Harris. Unless additional objectives are clearly defined and someone found both competent and eager to analyze additional data, there is a danger of data "narcosis", where collecting data becomes an end to itself. On the other hand, populations that have been banded for over a decade are rare and valuable. I believe the answer is to strongly encourage either students in the CDRS scholarship programme or outside investigators to work on these species and do the banding. Should unlimited funds become available then of course the above argument does not apply.

G. Education and the Transition to Ecuadorian Scientists. Implicit in the Station's existence is the training of competent Ecuadorian scientists to take over the responsibility for conserving the Galapagos Islands.

There are a number of excellent students who have worked on avian subjects in Galapagos and have the talent to fill the post of CDRS ornithologist. None of them however has received the advanced training that would be essential to the position. Such training is still of limited availability in Ecuador.

I would strongly recommend that the Darwin Foundation support Ecuadorian students in obtaining advanced degrees at foreign universities. Given the prestige of the Foundation's Executive Council, connections might be found with universities and funding sources for this purpose. The Grupo Ecuatoriano of the Foundation might profitably investigate the O.A.S. and U.N. funds in addition.



For the present, the Station's ornithologist can perhaps make his or her most substantial contribution through helping with the education of the CDRS scholarship students and teaching in the courses for tourist guides. The scholarship programme is a unique opportunity for a student to work closely with a scientist and learn field methods. The success and worth of the programme are attested to by the presence of so many ex-scholars in the conservation and natural resource sections of the Ecuadorian government and the national universities.

Well-trained and conscientious guides are the first line of defense in protecting the Park from any evil effects of tourism. The guides' course is the best place to inform them of the uniqueness and fragility of the islands and their key role in preserving Galapagos.

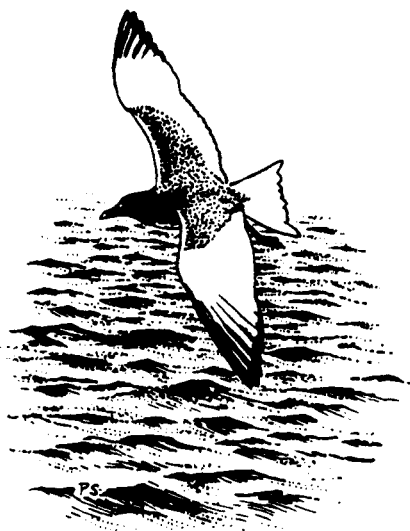
### CONCLUSION

Today there are only a few *critical* avian problems in Galapagos. For this the past programmes of the Park Service and Station deserve great credit. However, there is a danger that the present situation will lead to complacency. The inhabited islands of Floreana, San Cristobal, Santa Cruz and Isabela are not at all stable. The human populations are increasing, leading to more pressure for more land and increasing the frequency of introductions of exotic organisms. If present trends continue, we can unfortunately expect a rash of extinctions on the inhabited islands of the small, inconspicuous plant species, arthropods, and other invertebrates that are the heart of any ecosystem. What effect this will have on birds is hard to say. At best it will be neutral. We can at least monitor and try to understand changes on the inhabited islands in the hope that we can improve things as, for example, we propose to do on Floreana by controlling rats and by reintroducing the mockingbird.

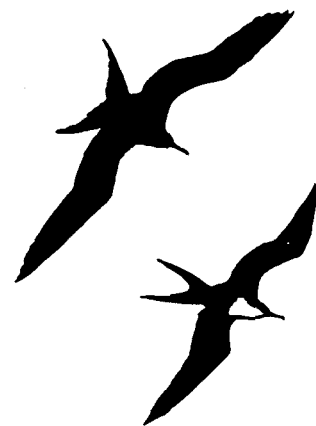
On the uninhabited islands, if Park Service patrols can be maintained or increased and if the naturalist and auxiliary guides remain both competent and concerned, the future is bright.

Galapagos birds are among the most studied in the world but, in writing this, I am struck both by the enormous amount of information and effort that went into these background studies and by the enormous amount of information still needed.

I hope we will come to realize that information is by and large the key to the survival of the islands. Scientists are trained to both *gather* and *interpret* information. It will be a very dark day for the islands and their animals if the importance of science is ever lost to the Darwin Station or the National Park Service.



Swallow-tailed Gull *Drawing by Peter Scott*



Great Frigate Bird *Drawing by Peter Scott*

## LAND IGUANAS (*Conolophus Subcristatus*) ON NORTH SEYMOUR ISLAND

by

*Robert P. Reynolds, Staff Herpetologist, CDRS*

A sight that truly impressed William Beebe during his visit to the Galápagos in 1923 was the great abundance of land iguanas on Isla Baltra (South Seymour). So numerous were they that according to Beebe (1924): "Every cactus, every small isolated bush of *Cordia* or *Acacia* or *Bursera* sheltered a lizard, and all big ones." There was no reason for Beebe to suspect that land iguanas on Baltra would ever be any less abundant than at the time of his visit.

In the early 1930's a fortuitous event occurred, the significance of which would not be appreciated until many years later. Along on one of Hopkins' expeditions was a scientist named Perkins who found it puzzling that literally hundreds of land iguanas thrived on South Seymour while none lived on North Seymour, a small islet approximately one kilometre away. Perkins apparently decided it would be interesting to see if land iguanas could survive on North Seymour so he transported between 20 and 30 animals from Baltra to the smaller island.

Presumably land iguanas continued to fare well on both Baltra and North Seymour for the next decade or so. The situation changed drastically, however, with the advent of the Second World War. At that time, the United States was permitted to build a military base on Baltra for the purpose of monitoring enemy approaches to the Panama Canal. By the time the United States flag was taken down in 1946, land iguanas were extinct on Baltra. The combined effects of constructing the military base and airfield, and the senseless killing of iguanas by U.S. military personnel had taken a grave toll. Today, the land iguanas remaining on North Seymour represent the only surviving members of the original Baltra population, having themselves survived heavy use of North Seymour as a practice bombing target during U.S. occupation. Indeed, when my wife Donna and I visited North Seymour in February 1981 we observed spent bomb fragments littering the entire eastern plateau and found active iguana burrows within metres of old bomb craters.

In 1979, Howard and Heidi Snell, herpetologists working at the Darwin Station, surveyed the land iguana population on North Seymour and found no more than 20 surviving adults (Snell and Snell, 1979). By comparing measurements of existing animals with a collection of Baltra specimens preserved at the California Academy of Sciences, they determined that the animals remaining on North Seymour were from the original introduction by Perkins. While they found evidence of nesting, no young animals were encountered, indicating a complete lack of hatchling survivorship on North Seymour. The reason for this may be two-fold: Galápagos snakes and frigatebirds may predate the young, and the dry nature of North Seymour may not allow for sufficient production of those plant foods needed by young iguanas.

In co-operation with Miguel Cifuentes, Superintendent of the Galápagos National Park, the Snells brought a pair of adult iguanas to the Darwin Station in January 1980. These animals became part of the joint Station/Park captive breeding programme for land iguanas, which also includes animals from the islands of Isabela and Santa Cruz. On 14 January 1981, the female laid 11 eggs which then hatched on 11 May 1981 after artificial incubation. The young are presently being maintained at the Station until they are large enough to be returned to the wild.

This first successful breeding in captivity for these Baltra animals makes prospects for the population's survival very strong. In the near future additional male and female land iguanas will be brought from North Seymour for inclusion into the captive rearing programme at the Station.

Ledo. Fausto Cepeda, the present Superintendent of the National Park, is currently working on an agreement with the Ecuadorian military to allow for repopulation of Baltra with offspring raised at the Station.



Land Iguana (*Conolophus Subcristatus*): Drawing by Heidi Snell

It appears that measures taken to save this population were none too soon, as in November 1980 a dead land iguana was found by Dave Duffy while he was working with Blue-footed Boobies on North Seymour, and I found another dead in February 1981 while surveying the iguana population. Both animals apparently died of natural causes, possibly old age.

#### **ACKNOWLEDGEMENT**

Howard Snell provided information on the Hopkins expedition from field notes he found at the California Academy of Sciences.

#### **LITERATURE CITED**

- Beebe, W. 1924. Galápagos, World's End. Putnams, New York. 433 pp.  
Snell, H. and Snell, H. 1979. Land iguana conservation program. Annual Report of the CDRS. pp. 36-51.

## WATER WATER ANYWHERE: THE SEARCH FOR THE POTABLE IN GALAPAGOS

by

*David Cameron Duffy*

*Thirst has been an ever-recurring threat since the Galapagos were accidentally discovered by Fray Tomas de Berlanga. The Spanish bishop, 17th century buccaneers, naval vessels such as the U.S.S. Essex and H.M.S. Beagle, ship-wrecked mariners and settlers have all lamented the scarcity and uncertainty of the fresh water supply. Dr. David Duffy, the staff ornithologist at the Darwin Station, discusses new methods for coping with this old problem.*

For the scientist working in the arid Galapagos, water is an almost constant preoccupation. All too often it has to be carried from the Darwin Station to the camp site in six-gallon plastic containers known as "chimbuzos". One gallon weighs 10 pounds, so at one gallon per day per person there is a considerable amount of portering for larger or longer trips. However, there are some ways to avoid lugging chimbuzos around the islands. At certain times or in certain places, water is available or can be made available.

The rainy season (roughly January to April) produces a series of heavy rains that can be captured by rooftops or tarps and stored in cisterns or chimbuzos. The Darwin Station obtains enough water in this way to supply all its own *drinking* water and to provide for scientists in the field. Also, a well set-up camp in the field in this season may have water to waste, or at least to shower with.

Ironically, in the "dry" season, roughly from July to November, while the lowlands may be parched, the highlands are soggy from the driving mist called "garua". Small pools collect in collapsed lava tubes or depressions. Even waterfalls occur from time to time after especially heavy garua.

Both rain and garua accumulate in certain deep fissures or lava tubes as permanent pools. Such sites may be pumped out to supply water for a farm or a village, others are known only to a few residents who may stop to drink or even to swim in the chilly waters during a goat hunt.

Garua can also be collected by using screen condensers, a method exploited by Lynn Fowler and used successfully on Volcan Alcedo during her study of feral burros. The device is simply a patch of wire screening ("malla" in Spanish). A rubber or plastic hose split lengthwise or some other form of catchment is placed at the bottom of the screen. The tube leads to a chimbuco. The wind blows the garua against the screen where it condenses and trickles down to the tube and along to the chimbuco. The dimensions of the screen, wind speed, and heaviness of the mist all influence the amount collected. This device might also be useful in places such as the west coast deserts of South America, where garua occurs but it rarely if ever rains. Tui and Alan Moore report that such a device is already used in Lachay, Peru, to water newly planted trees.

Solar distillation of seawater is also possible at sites near the shore. June and Bryan Nelson, during their pioneering studies of boobies in Galapagos, lived partly on water distilled from seawater in a plastic solar still. This may not always work, especially on islands with heavy sealion traffic or continuous cloud cover during the garua season.

After isolation, water has been the most important force in moulding Galapagos life. There are dew drinking species, highland plants that rely on garua for their moisture, plants that wait for the heavy rains and a few species like the giant tortoise and *Opuntia* cactus that have their own, internal chimbuzos. Scientists, as they have learned to live and work in Galapagos, have come to many of the same solutions. Perhaps there are other lessons to be learnt from wildlife here on how to survive in the arid environment of Galapagos.

## GALAPAGOS EXHIBITIONS AT THE SMITHSONIAN

From June to August the Smithsonian's Natural History Museum displayed an impressive collection of 80 enlarged colour photographs entitled "Galapagos: born of the sea". These pictures, the work of environmentalist-photographer Feodor U. Pitcairn, vividly demonstrate the riches of Galapagos marine life: not only the strange fish and the turtles but also the sea-dependant Flightless Cormorants, Pelicans, Penguins, Fur Seals and Iguanas. "Friends of the Galapagos" and guests of the artist were invited to the opening night by the Secretary of the Smithsonian Institution, the Secretaries for the Americas of the Charles Darwin Foundation and the Director of the National Museum of Natural History.



Opening Night

A new, and permanent, exhibit at the same museum also owes its origin to the Galapagos area. "Deep-Sea Dives to Biological Frontiers" reveals the extraordinary and previously unknown creatures — giant crabs, clams and enormous "science fiction" tube worms — discovered by the U.S. Navy's research submarine, Alvin, living an incredible two miles below the ocean surface in the Galapagos Rift.

## SOME RECENT BOOKS

*Galapagos: Islands Lost in Time*, by Tui de Roy Moore. Viking 144pp. \$25.

*The Origin: A Biographical Novel of Charles Darwin*, by Irving Stone. 743pp. Macmillan (New York) and Cassell (London). £6.95.

*Life on Earth*, by David Attenborough.

- 1) Collins/British Broadcasting Corp., 319pp. £8.95.
- 2) Reader's Digest augmented edition. 368pp. £14.95.
- 3) Fontana/Collins paperback. 319pp. £3.95.