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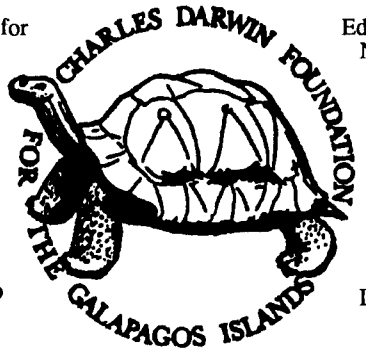

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Front Cover Design and Map of Isla San Cristobal by Heidi Snell

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NEWS FROM ACADEMY BAY

Donación Japonesa.—En 1987, con motivo de la visita del embajador Japonés, Señor Hajine Nishimiya, a las Islas Galápagos, la Fundación Charles Darwin con respaldo de la Dirección Nacional Forestal presentó el proyecto "Donación Cultural" al gobierno japonés. Los objetivos que persigue son fortalecer los programas de educación, entrenamiento y divulgación de la investigación científica que se realizan en las Islas Galápagos.

En junio de 1988 mediante un intercambio de notas entre el Gobierno Japonés y el Gobierno Ecuatoriano, se formaliza el ofrecimiento de la donación de equipos al SPNG y a la ECCD a través del Ministerio de Agricultura y Ganadería del Ecuador.

En mayo de 1989, el Embajador del Japón, Sr. Nakira Nakayama, entregó en la ciudad de Guayaquil a las autoridades de la MAG, oficiales de la FCD, de la ECCD y del SPNG los equipos donados, que entre otras cosas consta de: un jeep Toyota equipado para trabajos de filmación, equipo profesional de video, microscopios, binoculares, balanzas analíticas, y equipos de VHS. Sin lugar a dudas esta importante donación, cuyo monto es de US $300.000 dolares permite cubrir un importantes renglon de las actividades educativas y de difusión que en conjunto realizan la ECCD y el SPNG.

Japanese Donation.—In 1987 the Charles Darwin Foundation (CDF) and the Ecuadorian National Forest Service submitted the proposal "Donación Cultural" to the Japanese government. The submission corresponded with the Galápagos visit of the Japanese Ambassador to Ecuador, Mr. Hajine Nishimiya. The proposal's objectives were to strengthen the education and research programs carried out in Galápagos.

In June of 1988 the governments of Ecuador and Japan formalized the offer of equipment to the Charles Darwin Research Station (CDRS) and the Galápagos National Park Service (GNPS) via the Ministry of Agriculture of Ecuador (MA).

In May of 1989, the current Japanese ambassador, Mr. Nakira Nakayama, delivered the donated equipment to officials of the MA, CDF, CDRS, and GNPS in the city of Guayaquil. The donation consisted of a Toyota Landcruiser, professional video equipment, microscopes, binoculars, analytical balances, and camera gear. Without any doubt this important donation will improve both the education programs and the dissemination of research results of the CDRS and the GNPS.

Nuevo Gerente en la ECCD.—EL Ing. Oscar Aguirre fue nombrado Gerente Administrativo de la Estación a partir del 1 de julio del presente año. Oscar tiene una amplia experiencia en Galápagos; desempeñó las funciones de Planificador Pesquero en INGALA además fue Delegado Cantonal encargado de esa entidad. Reemplaza en las funciones al Sr. Patricio Jervis, quién por razones personales se retiró de la institución. Damos la bienvenida a Oscar a sus nuevas funciones y le deseamos éxito.

Agradecemos a Patricio por su aporte a la Estación, y le auguramos éxitos en sus labores futuras.

New Manager for the CDRS.—Ing. Oscar Aguirre was named Administrative Manager of the Station on 1 July 1989. Oscar has considerable experience in Galápagos as INGALA's fisheries planner. He was also the Santa Cruz delegate to INGALA. Oscar replaces Patricio Jervis, who recently left the CDRS for the continent. We welcome Oscar, thank Patricio, and wish them both the best of luck and success in their new jobs.

Un "Rose-breasted Grosbeak" en Galápagos.- El ornitólogo Dr. Joseph Boyles y el Sr. John Findey reportaron que durante su visita a la Isla Genovesa el 22 de junio, observaron un pájaro al que finalmente identificaron como el "Rose-breasted grosbeak" (*Pheucticus ludovicianus*). Es primero reporte de este especie en Galápagos.

A Rose-breasted Grosbeak in Galápagos.— The ornithologists Dr. Joseph Boyles and John Findey reported that during their visit to Genovesa on 22 June 1989 they observed a bird that they finally identified as a Rose-breasted Grosbeak (*Pheucticus ludovicianus*). This is the first record of this species in Galápagos.

MORPHOLOGICAL VARIATION IN *WALTHERIA OVATA* CAV. FROM THE GALAPAGOS ISLANDS AND SOUTH AMERICA

By: Eileen K. Schofield

INTRODUCTION

All plants vary somewhat in morphological features such as leaf size, leaf shape, and amount of hairiness. However, some populations show greater degrees of variation. Botanists must decide if the extremes of variation can be described as separate species or if the whole range of variation can be expressed in one species. In the latter case, the cause of the variations may be genetic, related to environmental factors, or both.

For over 100 years, botanists have noticed the variability of *Waltheria* (Sterculiaceae) from the Galápagos Islands (Fig. 1). *Waltheria* are common shrubs of the dry forests on most of the major Islands. Hooker in 1847, when studying specimens collected by Darwin and others, described a new species, *W. reticulata* (Hooker 1847). Robinson (1902) recognized this species but divided it into four forms, based on leaf shape, size, and pubescence. In 1911, Stewart likewise maintained Hooker's species, but described two forms (Stewart 1911). Not until Svenson's study of Galápagos plants (Svenson 1935) was Hooker's name placed in synonomy under the older epithet, *W. ovata* Cav. However, Svenson also tried to deal with the leaf variation by delineating four forms. In a later study, Svenson (1946) noted the similar variations in leaves of *Waltheria* growing near the coasts of Ecuador and Perú. In the *Flora of the Galápagos Islands*, Wiggins and Porter (1971) took a conservative approach by treating *W. ovata* as a variable species and placing all the previously described forms in synonomy.

This study was prompted by observations of two types of pollen, which were seen during the preparation of reference slides for a study of fossil pollen in the Galápagos (Colinvaux and Schofield 1976). Most plants have distinctive pollen grains, which can be preserved in soil for thousands of years. They are used to reconstruct the vegetation of previous times; and by comparing the past and present vegetation, changes in climate can be identified.

Some time later, herbarium specimens were obtained of *Waltheria* from Galápagos and South America. These, plus some field observations, were

Figure 1. *Waltheria ovata* in Galápagos; left, typical habitat under *Bursera* trees; right, close view of leaves. Waltheria ovata *en Galápagos; izquierda, habitat típico bajo árboles de Bursera; derecha, vista cercana de las hojas.*

used to further investigate the dimorphic pollen, to document the variations in leaf size and shape, and to look for correlations that might clarify the taxonomic interpretation of *W. ovata*.

METHODS

Pollen samples were removed from 81 herbarium specimens (51 Galápagos and 30 South America, Ecuador and Perú) and processed by the acetolysis method (Faegri and Iversen 1975). Permanent slides were made with glycerin jelly and examined under a light microscope at 400X. Polar and equatorial diameters of several grains per slide were measured with a micrometer and averaged. Fossil pollen samples were processed and measured in the same way, but were mounted in liquid glycerine so they could be moved for better observations.

Flowers were removed from 24 herbarium specimens (9 Galápagos, 15 South America) and softened in water. Petals and sepals were removed, and the gynoecium and androecium (male and female organs) were observed with a dissecting microscope and measured with a millimeter ruler.

Leaf variations were recorded for 167 specimens (73 Galápagos, 94 South America). For each specimen, the largest and the smallest leaves were measured with a millimeter ruler. The length of blade along the midrib and width of blade at the widest point were noted. Averages were calculated for all specimens and for Galápagos and South American specimens separately. The texture of dry leaves, shape of leaf bases, and dentation of leaf margins also were described for each specimen.

RESULTS

Pollen.—Among specimens from South America, 18 samples had reticulate pollen (netlike surface) and 12 had echinate pollen (spiny surface). Among Galápagos specimens, 31 samples were reticulate and 20 were echinate.

Within the Galápagos, both kinds of pollen occurred on the eastern Islands (Santa Cruz and east); only echinate occurred on two Islands (Pinta and Santiago); and only reticulate on three Islands (Rábida, Isabela, and Fernandina).

Echinate pollen grains were consistently larger, with an average polar diameter of 68.1μ and an average equatorial diameter of 67.9μ. Size of the reticulate grains averaged 51.2μ for polar diameter and 50.8μ for equatorial diameter.

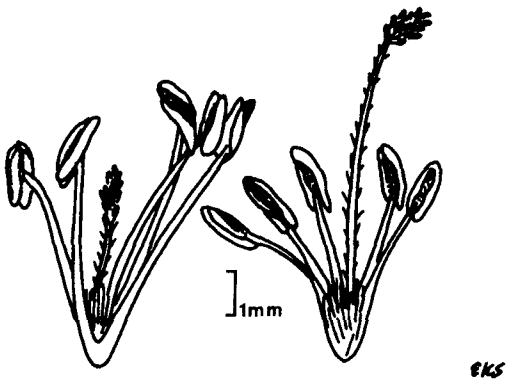

Figure 2. Stamen and pistil of *Waltheria ovata*; left, short style; right, long style. *El estambre y el pistilo de* Waltheria ovata; *izquierda, estilo corto; derecha, estilo largo.*

Only two collections from South America showed a clear difference in flower color. Reticulate pollen was found in the orange flowers and echinate in the yellow flowers.

In the fossil material from the Galápagos, there were few *Waltheria* grains in any sample. However, both kinds of pollen were present at three sites: lagoons on Santiago, a crater lake on Genovesa, and Beagle crater on Isabela. Echinate pollen was found in 16 samples and reticulate pollen in 9 samples of these postglacial deposits.

Flowers.—Two types of flowers were observed, one with styles exserted (pin) and one with styles inserted (thrum) (Fig. 2). Long styles averaged 4.5 mm, and stamens associated with them averaged 3.6 mm. Short styles averaged 1.1 mm, with associated stamens averaging 5.5 mm. In short-style forms, the stigma was longer in proportion to the style.

There were 5 long styles versus 4 short styles in Galápagos specimens and 10 long versus 5 short styles in South American material. All long styles correlated with reticulate pollen, and all short styles correlated with echinate pollen.

Leaves.—A "typical" leaf of *Waltheria ovata* and the range of variations are shown in Fig. 3. The average leaf size for 167 specimens was 3.0 cm long x 2.5 cm wide. Overall, the largest leaf was 10.0 x 7.5 cm, and the smallest leaf measured 0.5 x 0.2 cm. The average size for leaves from South America was 4.0 x 3.0 cm, whereas that for leaves from Galápagos was 2.9 x 2.0 cm.

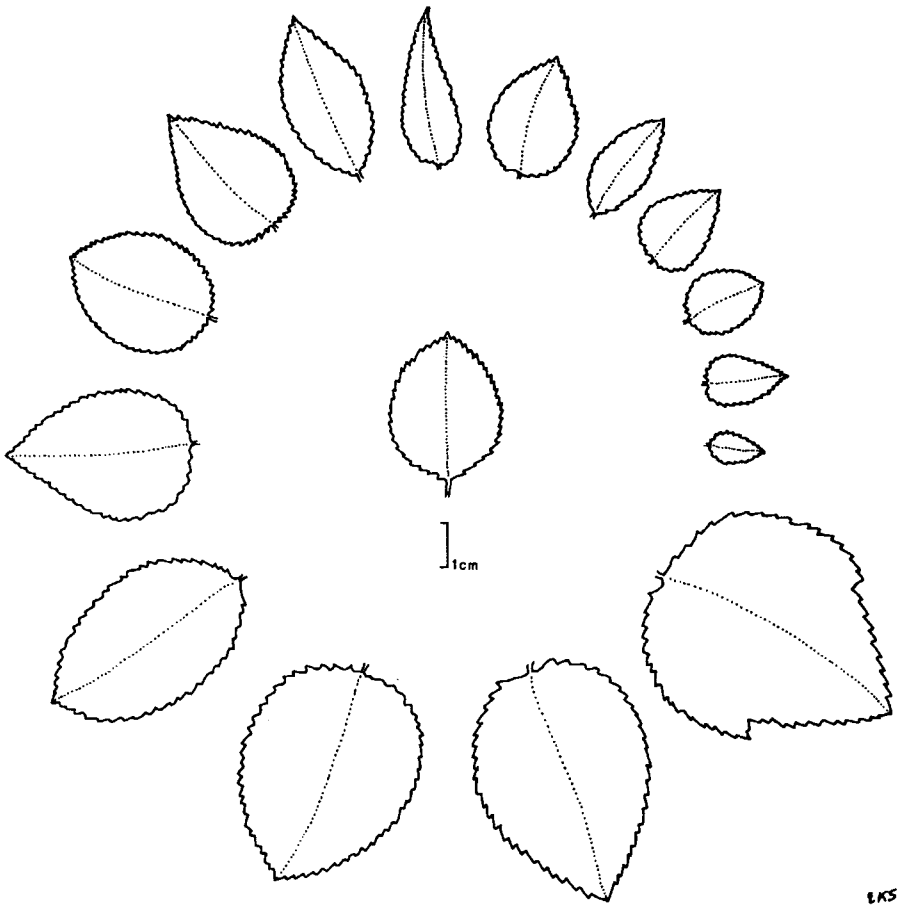

Figure 3. Representative leaves of *Waltheria ovata*, showing variation in size, shape, and marginal dentation (all to relative size); "typical" leaf in center derived by averaging all measurements. *Hojas representativas de* Waltheria ovata, *mostrando variación en tamaño, forma, y margen de la hoja. Hoja típica en el centro dibujada con medidas promedias.*

Comparisons were made of several duplicates of individual collections from Perú and Galápagos. For Hutchinson and Wright 5419 (Perú), leaf size ranged from 8.0 x 7.2 cm to 0.5 x 0.4 cm, averaging 3.7 x 3.1 cm. For Schimpff 165 (Galápagos), the size varied from 3.7 x 2.4 cm to 0.6 x 0.3 cm, averaging 2.1 x 1.2 cm.

A separate analysis of 69 specimens from the Galápagos showed a size distribution from the largest leaf on Genovesa to the smallest average on Isabela. The largest individual leaf (6.5 x 7.0 cm) and the smallest individual leaf (0.5 x 0.2) also occurred on these respective Islands.

Leaf shape varied from nearly lanceolate, through ovate, to oval or cordate (occasionally three-lobed). The most common shape for both geographical areas was ovate, hence the specific epithet "*ovata*."

Leaves from Galápagos specimens tended to be more rugose (wrinkled) in texture, regardless of size. In South American specimens, only the smaller leaves appeared rugose.

In South American collections, there were 24 specimens with cordate bases and 70 without. Galápagos specimens included 27 with cordate bases and 46 with noncordate. The latter ranged from slightly rounded to nearly acute.

Among South American specimens, there were 69 with leaf margins having pointed teeth, 23 with intermediate, and 2 with rounded teeth. Galápagos specimens included 24 with pointed, 38 with

intermediate, and 11 with rounded teeth. Two shallow, basal lobes were apparent only on leaves of three specimens from South America.

DISCUSSION

Pollen.—Dimorphic pollen was not reported previously in *Waltheria* from the Galápagos Islands. Pollen of *M. ovata* from Chile was described by Heusser (1971) as having a reticulate surface. However, Köhler (1976) did describe two types of pollen in several specimens of *W. ovata* from Ecuador, Perú, and Brazil. Surface textures and dimensions were similar to those mentioned here.

The distribution of two types of extant pollen among the Islands does not clarify the taxonomic status of the species. A majority of the Islands have both types. Also, the fossil pollen samples indicated that both types were present in the past on Isabela (now only reticulate) and Santiago (now only echinate). Another consideration is the random nature of pollen preservation—not all pollen present in an area will be preserved.

Among the limited number of fossil pollen samples, the echinate type was more common. This does not agree with Köhler's (1976) opinion that the reticulate type has more primitive characteristics.

Flowers.—Distyly (two types of styles) in flowers of Galápagos *Waltheria* was overlooked by previous collectors. The detailed description of *W. ovata* in Wiggins and Porter (1971) did not give any measurements of styles and noted that stamens were "about equal" to the petals in length. However, distyly was known from the Sterculiaceae and several species of *Waltheria* (Köhler 1976). As in this study, his results showed that long styles were consistently associated with reticulate pollen and short styles with echinate pollen.

The occurrence of more than one style type is a system of self-incompatibility that favors outbreeding. Pollen dimorphism frequently is associated with the different flower types (Davis and Heywood 1963). In a survey of angiosperms, Vuilleumier (1967) found that heterostyly occurs sporadically and independently in different families. She further stated that morphological dimorphism of floral parts and diallelic incompatibility are independent breeding systems. When they occur together, they produce increased efficiency of cross-pollination and cross-fertilization.

Carlquist (1974) observed *Limonium*, a heterostylous genus distributed both on islands and continents, and concluded that outbreeding would be an advantage for the small island populations. The same conclusion could be drawn for *Waltheria* in the Galápagos, but insect pollinators are scarce. Further study is needed to determine if the genetics of *Waltheria* require some outbreeding, even with a limited supply of insects to facilitate cross-pollination.

Leaves.—The variations in leaf shapes of *W. ovata* have been noticed since the earliest collections were studied. Attempts to organize these variations into forms or subspecies were based on limited numbers of specimens. This study of a larger number of plants from a wider geographical range showed that the leaves vary even more than previously described.

For example, the "typical" leaf derived from my analysis was 3.0 x 2.5 cm and oval, with a noncordate base and small, pointed teeth (Fig. 3). A "typical" leaf described by Robinson (1902) was 2.5 x 1.5 cm with dentate margin and rounded (not cordate) base. Svenson (1935) described a "typical" leaf as 4 x 3 cm, broad, and cordate. Even the ranges for length, width, base, and margin published by Wiggins and Porter (1971) did not include all of the variations noted in this study.

Size varied widely in both geographic areas, but leaves of Galápagos specimens were generally smaller than those from South America. Svenson (1946) also observed that the small leaf sizes seen on Galápagos plants did not occur on the mainland. This difference might be due to climatic or ecological conditions, but no data have been compiled.

Not enough Galápagos collections are available to make any significant correlations between leaf variations and location. *Waltheria* grows from near the shore to mid-elevations on small and larger Islands but is most common in the Transition Zone forming a shrub layer under *Bursera* trees (Fig. 1). Further study is necessary to determine if there are sufficient differences in ecological factors to account for the morphological variability.

CONCLUSIONS

My preliminary study of leaves, flowers, and pollen of *Waltheria ovata* from the Galápagos Islands

and South America documented the presence of distyly, dimorphic pollen, and considerable diversity in leaf morphology. A detailed examination and comparison of these variations, an evaluation of environmental differences, and a study of genetics and pollination within populations of *Waltheria* in both areas are needed. Such analyses of a much larger data base might indicate useful taxonomic subdivisions of this variable species. Until such data are compiled, the plants in Galápagos and South America must be considered as belonging to a single species.

ACKNOWLEDGMENTS

I am grateful to the curators of the following herbaria for allowing study or loaning specimens of *Waltheria*: California Academy of Sciences, Dudley Herbarium of Stanford University, Field Museum, Harvard University Herbaria, Missouri Botanical Garden, New York Botanical Garden, Swedish Museum of Natural History, and United States National Herbarium.

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THE NESTING OF THE DARK-BILLED CUCKOO IN THE GALAPAGOS

By: Stephen Ervin

Dark-billed Cuckoo (*Aguatero*).

The Dark-billed Cuckoo (*Coccyzus melacoryphus*), like other members of the genus, has the reputation of being secretive in its daily activities and in its breeding habits. Harris (1982) noted that in the Galápagos the species is "More often heard than seen." Gifford (1919) reported the birds to be "shy" and, although they have been reported on most of the Islands in the Archipelago, there was "seldom more than one individual being seen at a time." Consequently, there have been few reports of nesting behavior. Gifford (1919) reported that nests were "not infrequent," but he described only one active nest. Swarth (1931) compared the morphology of mainland and Galápagos forms and did not comment on reproductive behavior. Many longtime Galápagos residents and visiting scientists have never seen the nest of the cuckoo.

Related species in the genus, the Yellow-billed Cuckoo (*C. americanus*) and the Black-billed Cuckoo (*C. erythropthalmus*), have long breeding seasons, abbreviated incubation periods, staggered incubation, asynchronous hatching, and very early nest departure of the young (Spencer 1943, Hamilton and Hamilton 1965). Hamilton and Hamilton (1965) suggested that these adaptations are correlated with seasonally abundant food supplies and insure survival of at least a part of the brood. Early maturity is also suggested to be a mechanism to permit rapid independence of young in food gathering. Such adaptations occur in widely fluctuating environments where food supplies vary considerably from year to year. Rainfall in the Galápagos fluctuates greatly from year to year. In the Galápagos, the Dark-billed Cuckoo is commonly reported to be abundant in and following El Niño-Southern Oscillation (ENSO) years with high rainfall. Jackson (1985) reported that the cuckoo became much more abundant during the 1982-83 ENSO. Workers at the Charles Darwin Research Station and local residents of Isla Santa Cruz also indicated that the cuckoo population increased in other wet years including the year of my visit, 1987. The local name for the cuckoo, "Aguatero," reflects this association. Cuckoos are known to breed on dry islands following an ENSO (Curry and Stoleson 1988).

During the spring of 1987, I was able to locate four nests of the Dark-billed Cuckoo in the dry zone vegetation in the vicinity of the Darwin Station east of the town of Puerto Ayora on Academy Bay, Isla Santa Cruz. The vegetation was dominated by a variety of small trees and shrubs and the cacti *Jasminocereus thouarsii* and *Opuntia echios*.

The first evidence of breeding of the cuckoo in 1987 came on 2 February with the discovery of a pair of adults feeding a single young in the scrub vegetation at the Darwin Station. The young bird was barely capable of flight and was not fully feathered. It could not be captured because of the ease with which it fled through the scrub of salt bush (*Cryptocarpus pyriformis*) and espino (*Scutia pauciflora*). Considering my experience at later nests, I would estimate the fledgling's age at approximately 10 to 12 days. Subtracting this and a minimum incubation period of approximately 11 days would establish a date for the first egg of 10-12 January. December 1986 had a total rainfall of 12.4 mm while January

1987 had a total of 124.7 mm. The onset of breeding corresponds to the onset of the rainy season.

Nest #1 was located on 6 February in an acacia (*Acacia* sp.) approximately 3 m from the ground. The nest was not readily accessible for measurements of eggs or chicks. The nest was similar to that described for the Black-billed Cuckoo by Spencer (1943) with the exception of the absence of pine needles. The nest was composed of small sticks and twigs with an outside diameter of approximately 8-10 cm and a cup diameter of 5-6 cm. The nest contained four bluish white, chalky eggs. The adult flushed from the nest at my approach and returned immediately after I moved a short distance away from the nest. By 0815 on 8 February two eggs had hatched and a third had pipped. The brooding adult left at my approach. The young closely resembled those of the Yellow-billed and Black-billed Cuckoos in appearance and behavior (Spencer 1943, Hamilton and Hamilton 1965), but no buzzing sound was given by the chicks as reported in those two species. The young could be induced to beg by shaking the nest branch. By 9 February at 1230, three young were present and one egg remained unhatched. The young birds could no longer be induced to beg. By 1100 on 14 February the nest contained a large chick, and a smaller chick was perched bittern-like on a branch near the nest. There was no sign of the third chick or the unhatched egg. The pose of the chick out of the nest was identical to the pose described by Bent (1940) for the Black-billed Cuckoo.

Nest #2 was located on 26 February in an acacia next to a pad of opuntia (*Opuntia echios*) that intruded into the canopy. The nest was 2.5 m above the ground. The adult was incubating five eggs. Measurements of the eggs were: 2.85 by 2.30 cm, 8.5 g; 2.80 by 2.25 cm, 8.0 g; 2.80 by 2.30 cm, 8.0 g; 3.10 by 2.45 cm, 10.5 g; and 3.00 by 2.50, 10.5 g. Incubation continued until 6 March when one egg had hatched by 0845. By 1050, three eggs had hatched and surprisingly a sixth egg was present. Two of the chicks weighed 8.5 and 9.0 g. Since the nest was checked only by touch in the interval between 26 February and 6 March, I cannot be sure of the date of the laying of the sixth egg, but it was after 27 February. By 0720 on 7 March there were four young and two unhatched eggs. I assumed the fourth egg hatched in the afternoon of the previous day. The fifth egg hatched by 1250 (the chick was eventually marked as #006). On 8 March the eyes had opened on the third-day chicks (#s 002 through 005) and I noted a wide discrepancy in the size of the chicks. The chicks were weighed and marked with colored leg bands as well as the numbered bands noted above. The chicks' legs were already sufficiently developed and adult size (#2) leg bands were attached without risk of loss. Weights on this and subsequent dates are noted in Table 1.

Table 1. Dark-billed Cuckoo nestling weights in grams for Nest #2, Isla Santa Cruz.

	Dates:			
Chick #	03/08	03/09	03/10	03/11
002	23.5	25.5	32.0	27.5
003	20.5	24.0	27.0	-
004	16.5	21.0	26.0	29.0
005	21.0	23.5	27.5	32.5
006	13.0	16.5	-	-

On 10 March the smallest chick (#006) was missing from the nest and on 11 March a second chick (#003) had disappeared. When handled, the chicks defecated a sticky brown liquid of digested hawkmoth larvae. By 11 March, Chick #002 was sitting on a branch adjacent to the nest and was more active, possibly accounting for the small weight loss. The same bittern-like posture seen at Nest #1 was again observed. On 12 March, Chick #005 was found dead beneath the nest and was preserved for the Station's collection. One chick (#004) remained in the nest. On 13 March the sixth egg hatched by 1415. None of the older chicks were present. The new chick was begging, but apparently was not fed or brooded as it was found dead in the nest by the morning of 14 March. This chick was never banded. It is also preserved at the Station. Unfortunately none of the marked chicks were observed during the remainder of my stay; they apparently dispersed rapidly from the nest site into the scrub.

Nest #3 was located on 10 March in a lantana (*Lantana peduncularis*) overlain by climbing passion flower vines (*Passiflora foetida*). The height was approximately 2.5 m. This nest was not covered by

a canopy of vegetation as were the previous two nests. The nest contained four eggs and by 1115 on 12 March a fifth was present. I was not able to return to this nest until 24 March when one approximately 4-5 day old chick and two eggs remained. If one egg per day was laid as usual and the chick was from the first egg laid (8 March) the incubation time was 11-12 days. The chick was banded and weighed (25.0 g) on 26 March. There was no sign of broken eggs beneath the nest. The chick and remaining eggs had disappeared by the end of March.

Nest #4 was located in a white mangrove (*Laguncularia racemosa*) on 24 March. The adult present was incubating two eggs; the other adult was bringing small sticks and lichen to the nest. The nest was 3.5 m from the ground. By 0830 on 2 April the nest contained three eggs. Between 6 and 9 April no incubation was observed, and no birds were present near the nest. Following heavy rains (22.8 mm) on 9 April the nest was found tilted and abandoned with one cracked egg present.

In its breeding biology, the Dark-billed Cuckoo of the Galápagos acts like the other members of the genus. It has a short incubation period and asynchronous hatching with considerable variability in chick size. Chicks grow rapidily and are able to move about in the vegetation before they are capable of flight. The capability of feeding themselves at an early age is conjectural although ample supplies of larvae of the hawkmoth were evident in the area. The existence of second nestings in the same season is not known. It is quite likely that populations of this cuckoo fluctuate greatly in number, and the apparent paucity of birds in dry years does not necessarily reflect movement to other habitats.

ACKNOWLEDGMENTS

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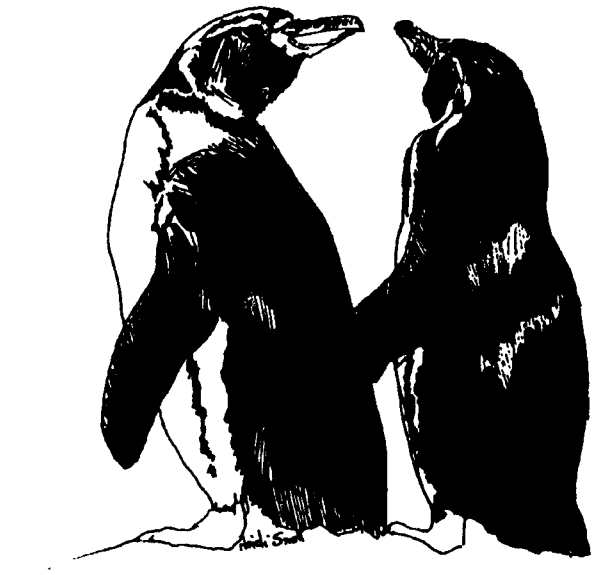

VEGETATION REGROWTH ON ISLA PINTA: A SUCCESS STORY

By: P. M. Whelan and O. Hamann

Isla Pinta—one of the most northerly Islands of the Galápagos Archipelago—appeared and disappeared out of a cloud bank on the morning of 30 October 1988. The 2-day trip from Puerto Ayora had been uneventful—no whales, no dolphins, nothing, except the continuous sound of the boat engines. We were accompanied by Andy Schmidt, Raúl Salazar, and Fionnuala Walsh (all Darwin Station personnel). The purpose of the visit was to resurvey the vegetation plots established by Tjitte de Vries in 1970 when the level of destruction of vegetation by introduced goats was at its highest. Since then joint campaigns by the National Park and Darwin Station have systematically and drastically reduced goat numbers. In theory, some improvement in the regrowth of vegetation should have been visible since the last time the plots were surveyed 6 years ago.

There are only two safe anchorages in Pinta and, while on our first night the western anchorage proved to be very calm, the distance from the vegetation plots and the dense growth of scrub made reasonable access to the plots impossible. The only signs of goats to be seen were dried-up bones. The vegetation showed no signs of grazing. The southeastern anchorage was much more exposed and the boat had to be anchored fore and aft. Embarking and disembarking were difficult, with the dinghy being pitched high up and down in the rough sea (rough enough to have one member of the team jump into the dinghy and be thrown out over the opposite side!), but the anchorage proved to be more convenient to the vegetation plots.

Even the first impressions of landing at the southeastern shore confirmed the idea that the vegetation was rapidly reestablishing itself in the absence of goat grazing. One vegetation plot near the beach, which 6 years ago contained a tall *Opuntia* cactus and little else, was now a mass of saltbush (*Cryptocarpus*) and mesquite (*Prosopis*). The cactus had fallen over.

Another vegetation plot was situated higher up the slopes of the extinct volcano that forms Isla Pinta. The lower reaches of the trail to this plot were marked in the typical Galápagos way—stones in the forks of trees. Further along the trail, the markers were no longer present and landmarks, compass bearings, and careful search for the marker stakes eventually allowed us to locate the vegetation study plot. Here again the regrowth was considerable and no evidence of goats was seen. Many of the trees marked with tags 6 years ago had died (probably during the abnormally wet El Niño year 1982-83) but new, young trees were replacing them. These new and the surviving old trees were tagged and measured to monitor their survival and growth over the next few years.

The most arduous part of the work was the trek to the third study plot near the summit of the Island. Again the trail of stones in the forks of trees (established in the 1970s by Camilo Calapucha, field assistant at the Darwin Station) was followed and stones were replaced where they had fallen down or were missing. Eventually the trail faded and the heat, humidity, weight of equipment, the steep incline, and, most of all, the spiny *Zanthoxylum* (cat's claw) forest made the trek exhausting. From the maps, we knew the summit to be 690 m high, and regular check of the altimeter confirmed that we were painfully, but very slowly, hacking our way to the summit. Arms and clothing kept getting caught in the low cat's claw trees and branches and we agreed that the local name —"uña de gato" (cat's claw)—was very appropriate. The floor of this forest was a dense wet carpet of ferns, and using a machete to cut a path in an area such as this felt almost as wrong as doing so in a botanical garden. Ferns and orchids, species only occurring here and nowhere else in the world, all appeared to be thriving in the absence of goat grazing. On reaching the summit we found that the height according to our altimeter was 645 m (and not 690 m as on our map or 775 m as on other maps). After a 6-hour trek from beach to summit, the team had a well-earned lunch break in the cool breeze.

The study plot at the summit was startling in the amount of regrowth that had occurred in the last 6 years. A formerly bare, rocky patch with one cat's

Figure 1. Permanent Quadrat No. 3, close to the summit of Isla Pinta, approximately 630 m, as photographed by Tjitte de Vries when he established the plot in November 1970. The vegetation was severely destroyed by feral goats. *Quadrante No. 3 cerca la cumbre de Isla Pinta, aproximadamente 630 msnm fotografiado pot Tjitte de Vries al establecer el quadrante noviembre de 1970. La vegetación fue destruida por chivos.*

Figure. 2. The same plot in October 1988 as photographed by O. Hamann. A rapid regeneration of vegetation has occurred since 1977, following the successful goat eradication campaign during the 1970s. Now, 18 years after the establishment of the plot, it contains a very dense vegetation, dominated by *Zanthoxylum* and *Pteridium*, as well as many fern species. In the photo from left to right are: Fionnuala Walsh, Raúl Salazar, Andy Schmidt, and in the shade of the *Zanthoxylum*, Pat Whelan. Note that the corner post in front of Salazar is the left corner post in Fig. 1. *El mismo quadrante en octubre de 1988 fotografiado por O. Hamann. La regeneración de la vegetación ha ocurido desde 1977, despues una campaña contra los chivos desde los 1970s. Actualmente despues 18 años, el quadrante tiene vegetación densa, con* Zanthoxylum *y* Pteridium *dominantes y muchos elechos. Desde la izquierda a la derecha estan: Fionnuala Walsh, Raúl Salazar, Andy Schmidt, y en la sombra del arbusto, Pat Whelan. Se nota que la estaca cerca Salazar representa el mismo en la fotografia anterior (esquina izquerda).*

claw tree had grown into an impenetrable thicket of small trees, shrubs, and ground level plants. The number of species had also considerably increased. Only photographs of its former state could show us how startling the regrowth of vegetation had actually been (Figs. 1 and 2). One new quadrat was established in the bracken fern (*Pteridium*) zone at the very summit where it adjoined the *Zanthoxylum* zone, to permit determination in the future whether this bracken zone was a permanent feature or whether it would be encroached upon or colonized by elements from the *Zanthoxylum* forest zone.

The final day's work consisted in rechecking the growth, death, and replacement of trees in another vegetation plot in the palo santo (*Bursera*) zone (125 m above sea level) on the lower southeastern slopes. Again as at other plots, it was obvious that rapid regrowth of all species was taking place in the absence of goats. Here the study was extended to include measurements of *Scalesia*, *Bursera*, and *Opuntia* cactus outside the vegetation plot so as to be able to monitor the changes in the population structure in the years ahead. Similar measurements were taken of these species at a lower elevation (45 m above sea level). It was obvious that the plant populations consisted of either very old, large trees or lots of very young trees (which had grown in the absence of goat grazing). Obviously, the trees that should have been intermediate in size had all been eliminated earlier by goats. While doing the work, the team was closely watched by a family of Galápagos hawks, which sat in the low trees above us—almost at arm's reach.

The goat extermination campaign by the Park and Station, though expensive, has been a spectacular success with rapid vegetation regeneration and reestablishment on the west and southern slopes of Pinta (the other parts of the Island are mainly lava fields without vegetation). The team saw no visible signs of goats, but a few goats still remain (a crew member from our boat may have heard one near the western anchorage). Eradication of these few remaining individuals will be difficult and expensive, but it must be done to prevent the population from recovering the high population levels that were so deleterious for the Island. At middle elevations, we encountered several characteristic areas, where dense, forestlike vegetation was interspersed with open, grassy meadows. We considered these areas to be the prime tortoise habitat on Pinta, but sadly we did not find traces of the Pinta tortoise. It appears that Lonesome George will still be lonesome; no mate is available for this sole survivor of the Pinta tortoise population.

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THE SLOW RECOVERY OF *OPUNTIA MEGASPERMA* ON ESPAÑOLA

By: P.R. Grant and B.R. Grant

The mature *Opuntia* cacti of Española have sturdy trunks that support numerous pads from lateral branches. Conspicuous as individuals, they are also conspicuously rare. The best guess as to why they are so scarce is that goats have damaged many old trees and eaten, trampled, or pushed over many of the younger ones. This was the view of Stewart (1911, 1915) who warned that the cactus was in danger of becoming extinct. For example, the density of mature cactus is much higher on the neighboring Island of Gardner which has never had goats. There is no obvious climatic or edaphic difference between the Islands that would account for the difference in cactus density. A parallel situation exists on Floreana (goats common, cactus very rare) and its two satellite Islands, Champion and Gardner (no goats, cactus dense).

Goats were introduced to Española some time in the last century. By the time the California Academy of Sciences expedition visited the Island in 1905-06 the goats were already well established and *Opuntia* were scarce (Stewart 1911, 1915; Slevin 1931). Goats

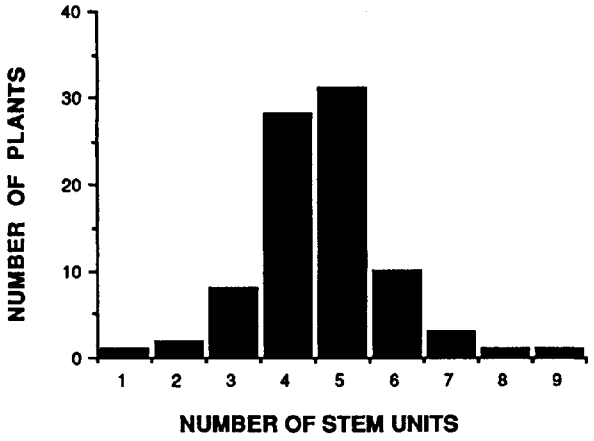

Figure 1. The number of plants observed in each size class as measured by counting stem units on Española in 1979. *El número de plantas en catagorias de tamaño determinado por el número de segmentos en sus truncos, Isla Española, 1979.*

were removed by hunting by 1978 (Hoeck 1984). This should have resulted in good survival of young plants if goats had previously been destroying them. We visited the Island in August 1979, and our observations suggested that indeed *Opuntia* recruitment was well underway.

We attempted to count all young individuals on the top of Red Hill, in an area of approximately 10,000 m^2. The hill is between 0.5 and 1.0 km inland behind Gardner Bay. To characterize the size of the young plants, we counted the number of units in the stem which are demarcated by constrictions.

Altogether we found 85 unbranched saplings, ranging from 1 to 9 stem units, with a mean of 4.6 ± 1.24 (SD) and a mode of 5 units (Fig. 1). If 1 stem is added each year, and growth starts in the year after the seeds are formed, the years of greatest production would have been 1973 and 1974. Heavy rains fell in 1972 and 1973, but not in 1974. According to our observations on Genovesa, Daphne Major, and Champion, seed germination is promoted by wet conditions, so we are inclined to think that the modal class of 5 stem units was 7 years old in 1979. Regardless of the exact ages, a strong production of young *Opuntia* saplings coincided with both heavy rains in the early 1970s and the removal of the last goats.

In addition to the 85 unbranched saplings, one was found with three lateral pads on the top of a 9-unit stem. Seven more branched ones were found further inland. They ranged from 6 to 10 stem units high, and had from 2 to 10 lateral pads. The most complex form was an 8-stem unit trunk supporting two lateral branches of four pads each, with two more pads at the end of one of them. Unless they had matured more rapidly, these were older by a few years than the unbranched ones on Red Hill. Nevertheless, young saplings made up the vast majority of the recruits, on Red Hill and elsewhere.

We returned to Española in early February 1988, and made the same survey on Red Hill. If goats had been the sole agent inhibiting recruitment prior to the 1970s, the large number of young plants seen in 1979 should have survived well and should have been augmented by many new ones produced in the next few years. Far from being augmented, however, the population of young *Opuntia* was drastically reduced. Despite intensive searching we could find only eight unbranched individuals; 1 had 4 stem units, 1 had 5, 2 had 7, and 4 had 9. In 1979 there had been only one branched sapling, but in 1988 there were 10. The number of stem units ranged from 6 to 9 (mean 8.0 ± 1.33 SD), and the most complex in growth form was about as complex as the most elaborate one found on the Island in 1979.

Clearly recruitment had been poor in the intervening years, and mortality among the saplings had been high. Given the age estimation in 1979 of 7 years for an unbranched plant with 5 stem units, the 10 branched plants in 1988 would have been the remnants of the 85 unbranched ones in 1979. We do not know if this is a normal rate of attrition for *Opuntia* plants elsewhere, but the absence of replacement cohorts was not expected.

The key to understanding the poor performance of *Opuntia* may lie in the extraordinary El Niño event of 1982-83. Probably more rain fell on Española then, as it did on other Islands, than at any other time this century (Grant 1984). Prolific rains did not inhibit flowering on the other Islands we visited in 1983 (Genovesa, Daphne Major, and Champion), and they facilitated germination. But they did contribute to the death of several cactus bushes. Roots rotted in waterlogged soil and the bushes, made heavier by extensive uptake of water, were blown over by strong winds (Grant and Grant 1989). The heavy rains also promoted extensive growth of vines which smothered

whole *Opuntia* bushes on Genovesa and Daphne Major, as a result of which several died (Grant 1986). A second El Niño event in 1987, while not as severe or as long, had similar effects on vines and *Opuntia* bushes (Grant and Grant 1989). On Española, we suspect, the rampant growth of vines and other plants in these 2 years (together with the direct effects of rain) caused the demise of all but the tallest and sturdiest of the saplings that germinated prior to 1979, and smothered almost all those that germinated afterwards. In February 1988 the ground cover of Red Hill was a rich, dense tangle of dead herbs.

These observations show that the goat removal "experiment" has still not produced the expected effect on the cactus population. Either the two recent El Niño events, especially the first, have delayed the expected effect, or other factors not yet identified have been responsible for the weak recruitment and low adult density of *Opuntia megasperma* on Española. Time, and further study, will tell. The observations also highlight our ignorance of population processes in *Opuntia* in general. This could be rectified by a well-designed, long-term investigation at the Charles Darwin Research Station, as well as by continued monitoring on Española and Islands similarly affected by goats such as Santa Fé and Pinta (Hamann 1975).

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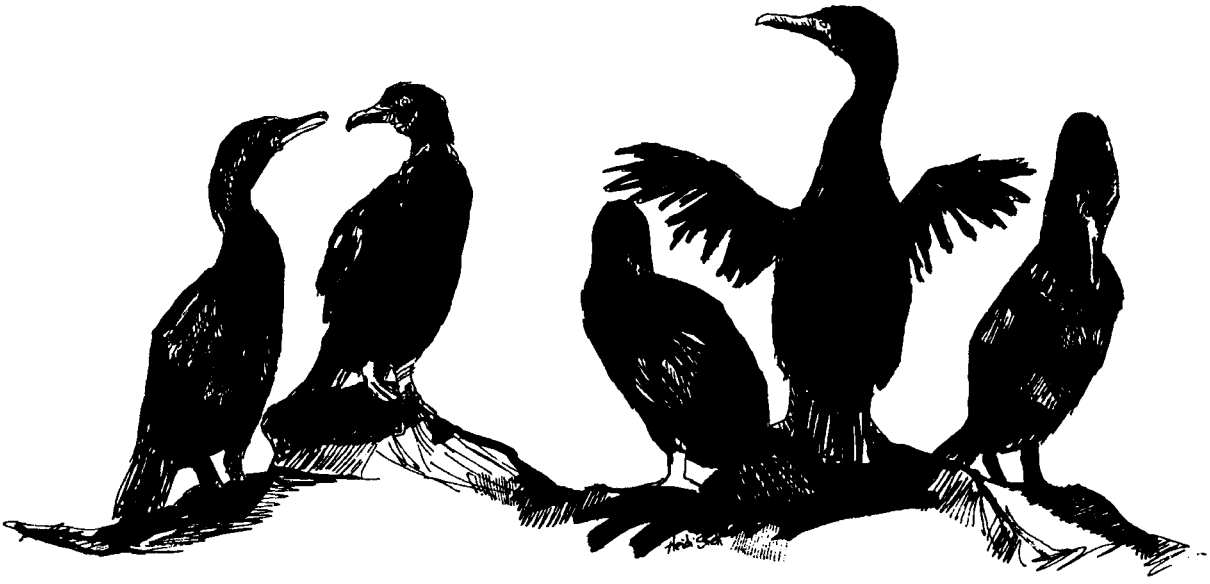

THE GALAPAGOS CARPENTER BEE, JUST HOW IMPORTANT IS IT?

By: Conley K. McMullen

The presence of the endemic Galápagos carpenter bee (later to be called *Xylocopa darwini* Cockerell) was first reported by Fredrick Smith in 1887 (Linsley et al. 1966). By the early 1900s, this bee was known to be well represented among the Islands of the Archipelago, especially in what would now be considered the littoral and arid vegetation zones. Williams (1926) noted that it used the wood of *Hibiscus tiliaceus* (Malvaceae), *Croton scouleri* (Euphorbiaceae), *Bursera graveolens* (Burseraceae), and *Erythrina velutina* (Fabaceae) for nesting purposes. Because of this habit of nesting in wood, it was hypothesized that the carpenter bee may have initially reached the Archipelago in a drifting log (Cockerell 1935).

A Galápagos carpenter bee visiting a hibiscus (*Hibiscus tiliaceus*) flower. *Una abeja carpentera visitando el flor de peregrina* (Hibiscus tiliaceus).

Since these early reports, only a few studies have been conducted to determine the carpenter bee's distribution and role in the Galápagos. However, by 1981 it had been recorded on the Islands of Baltra, Daphne, Española, Floreana, Gardner (near Española), Isabela, Pinzón, San Cristóbal, Santa Cruz, Santa Fé, and Santiago (Linsley 1966, Linsley et al. 1966, Grant and Grant 1981). It was found to nest in *Scalesia affinis* (Asteraceae), *Maytenus octogona* (recorded as *M. obovata*; Celastraceae), and *Castela galapageia* (Simaroubaceae) (Linsley et al. 1966) as well as those species already mentioned by Williams. Studies by Linsley (1966), Linsley et al. (1966), Rick (1966), and McMullen (1985, 1986, 1987) have also suggested that this bee is undoubtedly responsible for the vast majority of insect pollination that takes place in the Archipelago.

Additional support for the role of *X. darwini* as primary pollinator was obtained during a trip to Galápagos in August of 1988. I observed the carpenter bee visiting the flowers of several plants on Santa Cruz, but few other insect pollinators were seen. In fact, only *Phoebis sennae* (Pieridae), the Galápagos sulfur butterfly, and *Leptotes parrhasioides* (Lycaenidae), the Galápagos blue butterfly, were observed, and these only rarely. The list of plants visited by the Galápagos carpenter bee, along with the resident status of each, is in Table 1. The majority of these observations took place along the road from the Darwin Station to Bella Vista in the arid and transition vegetation zones. However, the *Hibiscus tiliaceus* was located in the littoral zone at the Darwin Station; and the members of *Acacia insulae-iacobi* (Mimosaceae), *Cassia picta* (Caesalpiniaceae), and *Lycopersicon cheesmanii* var. *cheesmanii* (Solanaceae) that were seen being visited by this bee were located along the road in the arid zone on the north side of Santa Cruz. The carpenter bee was seen pollinating flowers of *Parkinsonia aculeata* (Caesalpiniaceae) and *Waltheria ovata* (Sterculiaceae) in the arid zones on both the south and north sides of Santa Cruz.

Since most of these were casual observations, a comment on the usual level of visitation activity would be difficult to make. However, there were two species that *X. darwini* appeared especially attracted to and visited daily. These were *Parkinsonia aculeata* and *Hibiscus tiliaceus*. Pollen from these plants was clearly visible on the abdomen of bees that visited them. When visiting *H. tiliaceus*, each bee would enter a flower and work its way around the staminal

Table 1. Summary of flowers visited by the Galápagos carpenter bee (*Xylocopa darwini*) on Isla Santa Cruz, 11-28 August 1988.

Family	Species	Status[1]
Asteraceae	*Sonchus oleraceus*	IW
Boraginaceae	*Cordia lutea*	N
Caesalpiniaceae	*Cassia picta*	N
Caesalpiniaceae	*Parkinsonia aculeata*	N
Convolvulaceae	*Ipomoea linearifolia*	E
Malvaceae	*Bastardia viscosa*	N
Malvaceae	*Hibiscus tiliaceus*	N
Mimosaceae	*Acacia insulae-iacobi*	N
Nyctaginaceae	*Commicarpus tuberosus*	N
Passifloraceae	*Passiflora foetida* var. *galapagensis*	E
Solanaceae	*Lycopersicon cheesmanii* var. *cheesmanii*	E
Solanaceae	*Solanum americanum*	N
Sterculiaceae	*Waltheria ovata*	N
Verbenaceae	*Clerodendrum molle* var. *glabrescens*	E
Verbenaceae	*Clerodendrum molle* var. *molle*	N
Verbenaceae	*Lantana peduncularis* var. *peduncularis*	E

[1] Status is coded as follows: IW = Introduced Weed, N = Native, and E = Endemic.

column, dusting itself thoroughly with pollen before moving on to the next flower (see photograph).

Most of the species listed in Table 1 have previously been reported as visited by *X. darwini* (Linsley et al. 1966, Rick 1966, McMullen 1985). However, four species represent new records for the Archipelago. These are *Cassia picta*, *Ipomoea linearifolia* (Convolvulaceae), *Solanum americanum* (Solanaceae), and *Sonchus oleraceus* (Asteraceae).

All of the bees observed were female, except for one male seen visiting *Acacia insulae-iacobi* and another visiting *Waltheria ovata*. Both of these sightings occurred on the north side of Santa Cruz.

The adult carpenter bee was thought not to have any natural enemies in Galápagos (Linsley 1966). While observing the male at *W. ovata*, an event took place that was quite unexpected. A mockingbird, perched on a nearby tree, flew down and without stopping snatched the bee from the inflorescence. It then landed, and began to shake the bee and beat it on the ground. The bee escaped twice but both times was recaptured before being killed, and I assume it was eaten although I did not actually see it being swallowed. It would be interesting to know if the carpenter bee is important to the mockingbird as a regular food source. Linsley et al. (1966) mentioned that attempts to establish honeybees in Galápagos failed, probably as a result of predation by mockingbirds. Perhaps this might also help explain the absence of the carpenter bee on some of the Islands in the Archipelago.

As mentioned earlier, the Galápagos carpenter bee is thought to be the major pollinator in the Archipelago. However, it has been hypothesized that many of the endemic members of the Galápagos flora were present before the carpenter bee arrived; and because of this lack of insect pollen vectors, these plants are primarily automatic self-pollinators and have nonshowy flowers (Linsley et al. 1966, Rick 1966, McMullen 1987).

I hope to test this hypothesized relationship between pollinator presence and plant reproductive biology by comparing the results of my earlier work on Santa Cruz angiosperm breeding systems (McMullen 1987) with future studies of the same plant species on another island where the carpenter bee is not present. These studies will indicate whether or not the carpenter bee has influenced the breeding systems and flower characteristics of endemic plants on the islands that it inhabits and will add to our understanding of its overall importance in the Galápagos.

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ISLA SAN CRISTOBAL

Por: Jacinto Gordillo G. and Amrit Work Kendrick

Superficie.—Tiene de superficie 558 km^2, aproximadamente la mitad del area de la Isla Santa Cruz. Solamente tres de las islas del Archipiélago son mayores en superficie.

Altura.—Su mayor altura es de 735 m.s.n.m. en la cumbre de Cerro San Joaquín, pero la área alrededor de este cerro consiste de un volcán grande de 660 m.s.n.m. promedio por arriba. Para la mitad de la Isla al Este, las alturas no pasan 160 m.s.n.m.

Características de Geografía y Geología.—La Isla San Cristóbal (previamente conocido como Isla Chatham), como las demás, es de orígen volcánico y una de las más viejas de Galápagos. Es la Isla mas al Este del Archipiélago. Su constitución externa, revestida en partes de lava fluente de carácter extrusivo y en partes de material intrusivo, nos hace pensar en varias etapas de formación. De Cerro Brujo hacía el Noreste es más nueva que la del Suroeste, donde justamente tiene su asiento la población humana.

Ecología.—Como otras islas, San Cristóbal tiene áreas altas con vegetación densa y climas húmidas y áreas bajas muy secas. Por influencia de los vientos y la forma de la Isla, el Noreste es la más seca; además es aislado de las zonas colonizadas.

Población Humana.—La Isla San Cristóbal, a pesar de contrarse en el extremo Este del Archipiélago, por tanto más cercana al Ecuador continental, no fue la primera en ser colonizada por el hombre, pese a que es una Isla más grande y de mayores recursos naturales. Fue ocupada con prioridad la Isla Floreana en 1832; pero al fallar los reiterados intentos de ocupación agrícola en la mencionada Isla, San Cristóbal empezó a servir de refugio a ciertos hombres que abandonaban Floreana.

Muy poco se sabe sobre fechas y nombres de los primeros immigrantes; solamente a partir de 1866, conocemos con certeza el ingreso del señor Manuel Julián Cobos que vinó con José Monroy, con el propósito de explotar el orchilla (*Rochella abintonii*). Ver folleto "Manuel J. Cobos - Historia de un Pionero," por Jacinto Gordillo en Galápagos (1987). Además desarrollaron una industria de azúcar con su propia refinería.

Al terminarse el intento de colonización en la Isla Floreana y comenzar la ocupación permanente de la Isla San Cristóbal, pasaron también a esta sus derechos

políticos. Así fue cómo en 1861, al erigir en Provincia a la Región Insular, determinó que San Cristóbal fuera la capital y aunque en 1885 fue nuevamente anexada a la Provincia de Guayas, siempre se ha considerado capital del Archipiélago a la Isla San Cristóbal. El 18 de febrero de 1973, fue Galápagos, por segunda, vez elevado a la categoría de Provincia, con su capital San Cristóbal.

La población actual de la Isla sobrepasa los 3,000 habitantes. Hay un alto porcentaje de nativos; pero también hay residentes del continente. Las fuentes de trabajo desde muy antiguo son la agricultura y la pesca, las que actualmente están siendo suplantadas por los empleos públicos, la industria turística, y el avance tecnológico.

Desde 1979 y muy particularmente a partir de 1980 con el establecimiento del Instituto Naciónal Galápagos (INGALA) y los jugosos presupuestos dados por el Gobierno, tanto los municipios como el Instituto empezaron a proveerse de todo el equipo caminero: volquetes, tractores, motoniveladoras, tractocarros, etc. Por punta de vista de un galapaqueño, hoy en San Cristóbal cruzan diariamente centenares de aparatos rodantes arrojando día y noche bocanadas de Dióxido de Carbono, levantando grandes cantidades de polvo e interrumpiendo el tranquilo descanso de los ciudadanos que existía durante el siglo anterior. Pero por los ojos de un visitante la Isla todavía puede representar un paraíso con un mínimo de los problemas, ruidos, y contaminaciones que representan progreso al mundo moderno. Puerto Baquerizo Moreno se ha convertido en Nucleo Receptor de Turismo con el servicio del aeropuerto desde el 12 de febrero de 1986. Como consequencia se está experimentando cambios rápidos en los campos sociales, económicos, y culturales. Existen hoteles, tiendas turísticas, y restaurantes donde habian pocos antes.

Problemas Actuales.—Cerca el aeropuerto, se encuentra playas aprovechadas en sacar arena para construcciones necesarias en el desarrollo de la Isla. Inundaciones de Pto. Baquerizo y el ingreso de aguas servidas al puerto durante lluvias fuertes son preocupaciones frecuentes por consequencia de caminos y alcantarillas construidos con pocol consideración en los drenajes y las mareas. Con el tráfico del mundo externo, viene peligros de las introducciones de plantas y animales. El control de "exóticos" ya establecidos continua, y la protección de las cuencas de agua potable para la población constituyan trabajos de importancia para todo la Isla. La población de galápagos que viven en el lado Este de la Isla es una de las más seguras del Archipiélago por la vigilancia del Servico Parque Naciónal Galápagos hace más que 10 años.

Lugares de Interés.—*Laguna El Junco* - Una hora por carro, y una caminata corta subiendo la cumbre del crater permite una vista de la laguna y el campo alrededor. Frecuentamente se ve patillos (*Anas bahamensis*) nadando en el agua y fragatas (*Fregata spp.*) volando en los vientos frescos de la zona. Arbustos de Miconia y helechos se cubren las paredes del crater hasta la orilla de la laguna.

Cerro de las Tijeretas - Nombrado para las fragatas (tijeretas) que anidaban aquí hasta años recientes, esta loma es acesible (1.3 km) a pie del puerto. En medio camino, es una playa arenosa (Playa Mann) y las ruinas de una procesadora de pescado ya abandonada.

Puerto Grande y Sappho Cove - Este cabo pequeño, cerca León Dormiente, tiene una playa donde se ve tunas grandes (*Opuntia*) y otras plantas de la orilla.

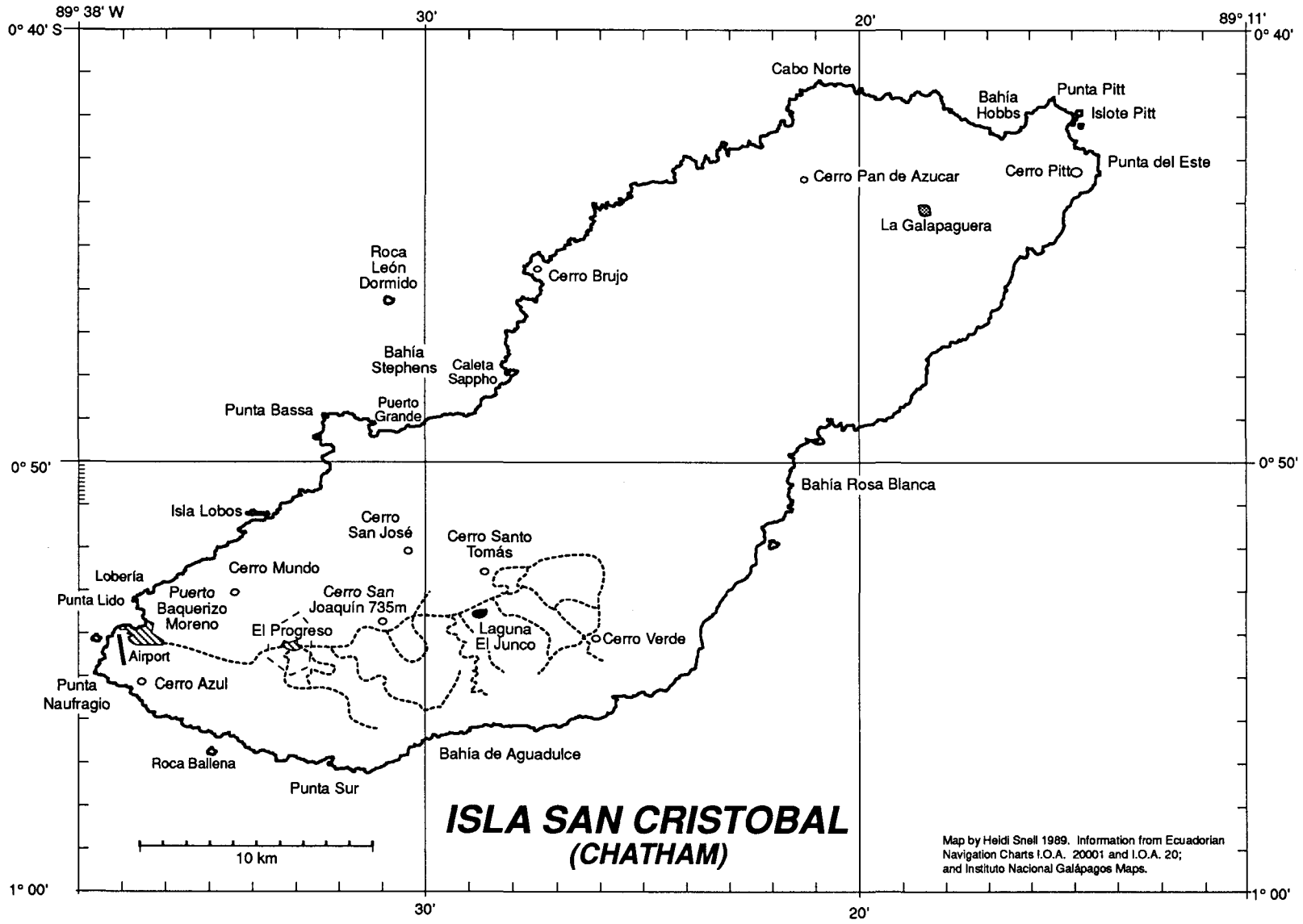
La Lobería - Un lugar favorito para mirar a los lobos del mar cerca el pueblo.

Isla Lobos - Un viaje de una hora por bote de Pto. Baquerizo Moreno es una roca nombrada para los lobos que descansan en su orilla y juegan en los aguas anexos. Durante la estación de anidación, las Patas Azules estón abundantes aquí.

La Galapaguera - La población de galápagos vive en una zona seca lejos de la costa en el Este de la Isla. Aquí se reproduzcan sin peligros de animales exóticos y el hombre. No es un sitio de visita del SPNG.

Islote Pitt - Esta Isla pequeña es lugar de anidación de muchas especies de aves marinas.

Jacinto Gordillo G., Delegado Cantonal INGALA-Isabela, Puerto Villamil, Isla Isabela, Galápagos, Ecuador; and Amrit Work Kendrick, Perth, Western Australia.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Punta Pitt
Islote Pitt
Punta del Este
Cerro Pitt
Cerro Pan de Azucar
La Galapaguera
Roca León Dormido
Cerro Brujo
Bahía Stephens
Caleta Sappho
Punta Bassa
Puerto Grande
Bahía Rosa Blanca
Isla Lobos
Cerro San José
Cerro Santo Tomás
Lobería
Cerro Mundo
Punta Lido
Puerto Baquerizo Moreno
Cerro San Joaquín 735m
El Progreso
Laguna El Junco
Cerro Verde
Airport
Punta Naufragio
Cerro Azul
Roca Ballena
Bahía de Aguadulce
Punta Sur
10 km
ISLA SAN CRISTOBAL
(CHATHAM)
Map by Heidi Snell 1989. Information from Ecuadorian Navigation Charts I.O.A. 20001 and I.O.A. 20; and Instituto Nacional Galápagos Maps.

ISLA SAN CRISTOBAL

By: Jacinto Gordillo G. and Amrit Work Kendrick

Size.—With a size of 558 km^2, the Island is about half the size of Isla Santa Cruz and the fourth largest of the Galápagos Islands.

Elevation.—The highest elevation is Cerro San Joaquín (735 m), a parasitic cone and part of a large volcanic area reaching 660 m in the middle of the western half of the Island. Elevations in the eastern half of the Island are less than 160 m.

Geography and Geology.—Like the other Islands in Galápagos, San Cristóbal (previously known as Isla Chatham) is volcanic, comprised of both extrusive and intrusive lavas originating from various volcanic stages. It is the easternmost part of the Archipelago and probably the oldest island. The northeastern half of the Island is younger than the more mountainous western half where the human population is located.

Ecology.—Similar to the other large Islands of the Galápagos, San Cristóbal has moist, thickly vegetated highlands and arid lowlands. Due to prevailing winds and the Island's topography, the northeastern half is the most arid part of the Island; it is also most isolated from the colonized areas.

Human Population.—Despite being the easternmost of the Islands, closest to the South American Continent, and a large island with abundant natural resources, San Cristóbal was not the first island colonized by man. Only after the colonization of Floreana began to fail did people begin to appear in San Cristóbal. Little is known about the earliest settlers, but in 1866 Manuel J. Cobos and José Monroy arrived with the intent of harvesting the "orchilla" (*Rochella abintonii*), a moss used in making a then-important dye. The colony also worked with sugar cane and built its own sugar refinery.

The abandonment of Floreana and subsequent colonization of San Cristóbal resulted in political status for the latter. It was designated the capital of the province in 1861, only to have Islands grouped under the Province of Guayas from 1885 until 1973 when San Cristóbal was once again recognized as a provincial capital representing the entire Archipelago.

At present, the human population exceeds 3,000 people. Many are natives of Galápagos, but other residents are recent arrivals from elsewhere in Ecuador. The historical occupations of farming and fishing still predominate, but increasing opportunities exist for employment in government, tourism, and technical fields.

Since 1979, and especially after 1980 with the establishment of the Instituto Naciónal Galápagos (INGALA) and increased governmental grants, vehicles have arrived in greater numbers to the Island, and roads have improved. The opening of the airport in 1986 provided another leap forward for the Island, bringing tourists and rapid economic, social, and cultural changes. Hotels, tourists shops, and restaurants have multiplied to meet the needs of the Island's visitors.

Current Problems.—Near the airport are sandy beaches that have been mined for sand needed in the accelerated construction on San Cristóbal. Flooding in the town and sewage outfall into the harbor are frequent concerns because roads and culverts were constructed without planning for variations in rainfall and tides. As on all the populated Islands, the danger of introducing more exotic species is increased with additional traffic of people and cargo. The struggle against exotics already resident is ongoing with feral cats and dogs at various visitor sites. The tortoise population on the eastern side of the Island is considered to be one of the least threatened in Galápagos because of diligent efforts by the Galápagos National Park Service over a period of more than 10 years.

Sites of Interest.—*Laguna El Junco* - One hour drive inland from the port, and then a short walk up the steep slope of the crater. Often pintails (*Anas bahamensis*) are found swimming on the lake and frigate birds are sighted flying high above the lake. Shrubs of Miconia and ferns extend down to the water's edge.

Cerro de las Tijeretas - Named for the frigates that nested here until recently, this hill can be reached on foot from the port (1.3 km). Midway is a sandy beach, Playa Mann, and an abandoned fish processing plant.

Puerto Grande y Sappho Cove - This tiny cove near Roca León Dormido has a beach and provides an opportunity to see large cactus (*Opuntia*) and other coastal plants.

La Lobería - A favorite site to view the sea lions near the port.

Isla Lobos - One hour by boat from Pto. Baquerizo Moreno is a rock named for the sea lions that congregate here. During the nesting season Blue-footed Boobies are conspicuous here.

La Galapaguera - The population of tortoises that lives in a xeric area of eastern San Cristóbal is one of the most secure in the Archipelago, in part due to diligent research and management activities conducted by Park personnel for more than a decade. This is not a visitor site.

Islote Pitt - Many sea birds nest on this small Island.

Jacinto Gordillo G., Delegado Cantonal INGALA-Isabela, Puerto Villamil, Isla Isabela, Galápagos, Ecuador; and Amrit Work Kendrick, Perth, Western Australia.

GALAPAGOS ISLAND NAMES

By: John M. Woram

In any attempt to sort out all the names that have been applied to this or that island in the Galápagos Archipelago, one usually begins with William Ambrosia Cowley, who visited the Islands in 1684. According to no less an authority than himself, he ". . .being the first that came to an Anchor there, did give them all distinct Names." Or so he claims in the much-edited printed edition (Cowley 1699) of his handwritten journal (Cowley ca. 1690). In the journal itself, Cowley is more restrained: ". . .there being in Number 15 Ilands that I have Seen: I have Named 8 of them."

Of the first of these eight, Cowley writes that "This island maketh high Land, the which I called King Charles's Island." Tradition has it that this is the Island now known officially as Santa María and popularly as Floreana. According to the journal, the other seven were: "Duke of Yorks Iland but now by the Grace of God King James the Seconds Iland, Duke of Norfolks, Duke of Albemarles, Lord Norris's, Lord Wainmans, Ld Culpeppers, and Cowlys [sic]." The change from Yorks to James reminds us that the Galápagos segment of Cowley's journal was written after the fact, for it was not until the death of Charles II in February 1685 that the Duke of York became King James II. Cowley did not hear of Charles' death until late in December of the same year, according to his printed edition. Therefore, unless Ambrosia was the Jeanne Dixon of his era, the "by the Grace of God" remark could not have been written much before 1686, even though it appears as a June 1684 entry (p. 14).

In fact, Cowley lost his onsite Galápagos notes in August 1684, when he left Captain Edward Davis and the *Batchelors Delight* to join Captain John Eaton aboard the *Nicholas*. In an entry for that month he writes ". . .I got neither my Journall which I had kept from Virginia, nor more than my quadrant." All else was left behind. So at some point after this date he rewrote the lost journal from memory, and then began making more-or-less daily entries in a new journal. At first glance, these might appear to begin on page 28, where for the first time the day is noted (December 22, 1684), a practice which continues throughout the rest of the journal. However, it is not until page 71 that the journal reaches the time when Cowley learned of James' accession to the throne (although this point is not actually mentioned). Since the journal is only 116 pages in its entirety, it's a safe bet that the entire manuscript now preserved at the British Library was written after October 1686, when its author finally returned to England; rummaged through his various notes, shipboard journals, and earlier recollections; put things in chronological order; and changed Yorks to James.

To return now to the details of Island names, Cowley writes of King Charles Island that "we having the Wind at South, and being on the Northside thereof, . . . we could not sail to get to it, to discover what was upon it." Yet in the journal of Cowley's more-famous shipmate, William Dampier (ca. 1690) describes anchoring "at the Easter Side of the

Eastermost Iland in 16 Fathom water, hard Sand a mile from the Shoare. Capt. Eaton came to a mile to Leward of us and one of the Prizes gott to anchor at the north End of the Iland, but the other two could not fetch in. There wee went a Shoare . . . ."

The "prizes" were ships captured a few weeks earlier, and—assuming both journals are reasonably accurate—the contradiction would be resolved if Cowley had earlier been placed in temporary command of one of those vessels that "could not fetch in." Indeed, *someone* must have been placed in charge of each prize, since we can hardly expect the captives would have followed the *Batchelors Delight* and *Nicholas* of their own free will. As master of the *Batchelors Delight*, Cowley would have been a logical choice for the job. And if so, this answers the question of how Dampier did, and Cowley didn't, land at that first Island.

A casual glance at a modern map (see back cover of *Noticias*) suggests that Santa María could not possibly be the first Island observed (and named) under the conditions described by both writers. Although the shipmates of Cowley and Dampier were noted for their prowess at the rum keg, they would have had to be blind drunk or asleep (perhaps both) to sail between the present Española and San Cristóbal without seeing either one of them. As a further consideration, Dampier's description of the anchorage does not fit the rocky eastern coast of Santa María, where the modern visitor finds not hard sand a mile from shore, but rather, Champion, Enderby, Caldwell, Gardner, and Watson protruding from the water. Surely, Dampier and/or Cowley would have noticed them too.

At this point, it seems clear (to me, at least) that Cowley's Charles is none other than the present San Cristóbal, and that it could not possibly be Santa María. To support this contention, Dampier's description of the anchorage does fit this general area, as does Cowley's "it makeing high Land and low Land" (or just "high Land" in the printed work). In either case, Cowley's remark rules out Española, which is low land only.

Dampier further reinforces the case for being nowhere near Santa María, by mentioning a later voyage of Captain Edward Davis, who "went to other Islands on the West-side of these. There he found also plenty of Brooks of good Fresh-water" (Dampier 1703). In 1712, Captain Woodes Rogers also writes in his *A Cruising Voyage Round The World* of Captain Davis, and of "the Island S. María de l'Aquada, reported to be one of the Gallapagos, where [according to Davis] there is Plenty of good Water" (Rogers 1712). Although Rogers doesn't have much confidence in Davis, the description does fit the present Santa María, which is indeed west of San Cristóbal. West of Santa María is the barren southern end of Isabela, an Island known to Cowley and Dampier although they did not reach this end of it.

Rogers' opinion of Captain Davis eventually found its way to a Galápagos chart published by Harris (1744). At the bottom of the chart we read that Captain Rogers "was deceived by one Capt. Davis's account of these Islands." The chart still turns up every now and then, often with coloring added. It is almost identical to a 1699 H. Moll chart which appears in Cowley's book, except the Moll chart credits the discovery of the Islands to Captain John Eaton, even though Cowley was still aboard the *Batchelors Delight* (or as noted, in charge of one of the prizes) when the Islands were first seen and named. At that time, the captain of the *Batchelors Delight* was John Cook. When he died shortly thereafter, Edward Davis was elected by the crew to fill the vacancy. Was Cowley peeved at losing an election? He says nothing of this, but perhaps such an event had something to do with his decision to try his luck with Eaton, and led to giving Eaton the credit on the 1699 chart. In any case, the Harris chart restores credit to Cowley, who is now identified as *Capt.* Cowley.

A map of South America from the same period, again by Moll (ca. 1700), shows two distinct and separate Islands labeled St. María de l'Aquada and K. Charles I., respectively. The former is significantly displaced westward of its true position, perhaps in reaction to Dampier's retelling of Davis's visit there. The map suggests that the separate identities of these Islands were known in the years immediately following the visits by Cowley, Dampier, Davis, and Eaton.

The subsequent mix-up came about as an inadvertent error introduced by Captain James Colnett, who visited the area in the merchant ship

Rattler in June 1793. Carrying on the literary tradition of his forbears, Colnett wrote his *Voyage to the South Atlantic and Round Cape Horn into the Pacific Ocean* (1798). In his Chapter VI, "The Gallipagoe Isles," Colnett clearly describes and positions the Islands known today as San Cristóbal and Española. However, he does not realize that San Cristóbal is in fact Cowley's Charles: "As I could not trace these isles, by any accounts or maps in my possession, I named one Chatham Isle, and the other Hoods Island" and for those who have trouble following things, he helpfully adds "after the Lords Chatham and Hood." A 1798 Galápagos chart by A. Arrowsmith is found in Colnett's book, and this may mark the first place in which Cowley's Charles is applied by mistake to the present Santa María.

The mix-up did not escape the attention of James Burney. In Volume IV of his 1816 *A Chronological History of Voyages and Discoveries in the South Seas* (Burney 1816), he writes of an Island (Santa María) that Colnett "appears to have mistaken for the King Charles's Island of Cowley's chart. On comparing Captain Colnet's [sic] chart with Cowley's, it is evident that Captain Colnet has given the name of Lord Chatham's Isle to Cowley's King Charles Island." To reinforce the point, Burney inserts an Island to the lower center of Cowley's chart. A note below the chart states that "The Island Santa María de l'Aquada, according to the situation from Albemarle [Isabela] Island, is added from the Chart published by Mr. Arrowsmith." The general outline is identical to the Charles Island group seen in the Arrowsmith chart. To summarize, Burney has correctly placed the Island of Santa María, and restored Charles to its rightful place.

Colnett's survey came just a few months after a visit by Don Alonso Torres y Guerra, Captain of the Spanish frigate *Santa Gertrudis*. Don Alonso prepared a very rough sketch during a visit that lasted from 18 to 21 March 1793 (Torres y Guerra 1793). An enhanced copy of his chart was drawn in Lima in 1794 by Tomás de la Cruz Doblado and names 13 of the Islands (Cruz Doblado 1794). However it is difficult if not impossible to recognize any of them. What might be the largest Island, now Isabela, is labeled Cordillera de Islas (note plural) de Santa Getrudia. Is this actually Isabela, which Torres thought to be several islands or, several islands including Isabela, Santa María, and others? Perhaps we shall never know, but in any case the orientation of the group—and perhaps of the entire chart—is skewed sufficiently to make any definitive statement a risky business.

Torres and Colnett were followed in 1813 by David Porter in the American frigate *Essex*. Not to be outdone by his British predecessors, Porter contributed his *Journal of a Cruise Made to the Pacific Ocean* (Porter 1815) to the literature, and the name of Porter's to the Island now known as Santa Cruz. Actually the ship's chaplain, the Reverend Adams, did the honors, on not recognizing it as Cowley's Duke of Norfolks Island. Porter had Colnett's chart with him, on which is seen but a fragment of Norfolk; no doubt not enough to help him recognize Adams' error. Or perhaps he did recognize it but rather liked the idea of seeing his own name on a chart. In any case, Porter's name didn't stick, and it is not seen on any map but his very own, which appears in the second American edition (1822) of his work, and again in a much-abridged edition published in England as *A Voyage to the South Seas* (1823). In this edition, a previously unnamed island (probably Rábida) is labeled "Phillips's I.," with no explanation given. Perhaps none is needed; the edition was published by Sir Richard Phillips & Co. (See the previous issue of *Noticias* for comment about the actual location of Porter's Bainbridge's Rocks.)

Twenty-two years later (1835) the most famous visitor of them all arrived, sailing in the company of Captain Robert FitzRoy. While Charles Darwin busied himself with other matters, Captain FitzRoy worked on a superb chart of the Islands, which surpasses all the others in detail and accuracy. However, and although FitzRoy also thought that Charles was in reality San Cristóbal (Grant 1975), his chart did carry on the Colnett error, and in so doing perhaps legitimized it for posterity.

Another writer of some note, Herman Melville, visited the Islands in 1841 and later wrote *The Encantadas, or Enchanted Isles* (Melville 1854). Melville mentions a few of the British (i.e., Cowley and Colnett) names and invents two of his own; McCain's Beclouded Isle and Wood's Isle.

Fortunately for posterity, Herman did not draw a map.

With the possible exception of William Beebe, who reproduced Burney's adaptation of Cowley's chart in his 1924 *Galápagos: World's End* (Beebe 1924) but did not identify the source, it would seem that the world of cartography has followed the path from Cowley to FitzRoy, via Colnett. In travel literature Cowley is now all but forgotten, while Dampier is still widely admired as one of the world's finest travel writers. As for who named what, this information has also faded with the passage of the centuries. Although many of the old names remain, their origins are almost forgotten.

In 1892, Ecuador—having formally claimed the Islands in 1832—now formally renamed 13 of them in honor of various aspects in the history of—of all people—Christopher Columbus. The old Santa María de l'Aquada, honoring a drink of water, became the new Santa María, now honoring one of the great admiral's vessels. As already noted, the locals prefer to call it Floreana, although on just about every map in existence the British name of Charles still appears as well. I suppose it doesn't matter any more, what with all those other names, but it would be rather nice to see Charles again restored to his proper place, if only to honor our old friend Ambrosia Cowley, who started all the confusion so very long ago.

Since 1684, it seems that just about every visitor has brought along a new set of names, and at least one Island has collected some 11 of them (one or two of dubious origin): Carenero, Dukes, Gil, James, Olmedo, San Bernardo, San Marcos, San Salvador, Santiago, Tabac, and Yorks. And then there's the one with no name at all—Sin Nombre.

A final note: to add still more confusion to the matter of who named what, some recent accounts have attributed the journal of Dampier to Cowley, and Cowley's own journal to Davis. But in fact, Davis was probably illiterate; when captured some years later in Virginia, he signed various court depositions (Public Record Office 1688) with a sometimes-inverted letter "E."

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Galápagos Island Names

Island Name A name given to one of the islands. **Boldface;** the official name of an island. *Italic;* the popular (local usage) name, only when this differs from the official name or there is no official name. [in brackets]; the name is either misspelled, or has been applied to the wrong island. The nature of the error is briefly stated in the next column.

Named after The person or place honored by the name. "quotes;" the English translation of an island name. 'single quotes;' the Spanish translation or transliteration of an English name.

Named by The person who gave the island the name listed in the 'Island Name' column. Name; the person who named the island. Name, date; an author-date citation for the book in which the name appears. Cowley xx/yy; the pages in his journal/book. (Name); the island *may* have been named by this person. **Ecuador (x);** the official name is taken from the 1892 decree, where **(x)** is the order in which the name is listed in the decree. *Ecuador;* the name has assumed official status through long usage, but the person who first used the name is unknown.

Chart/Attribution The authority for the information in the previous columns. Name, date; an author-date citation for the book which gives the information. *Name date;* engraver and date of the chart/map on which the name appears. *IOA xx;* Instituto Oceanográfico (Ecuador) chart. *DMA* or *5xx;* Defense Mapping Agency (U.S.A.) chart. For *5xx,* the full number is *22XCO 225xx.* If (*5xx*), the island appears without a name, or with some variation in name.

Undocumented data ?; uncertain, but thought to be as given here. ??; the missing information is unknown.

Island	Named after	Named by	Chart, or attribution	Official name, other name(s)
A Rock	(in Elizabeth Bay)	Cowley (Hack?)	*William Hack 1687*	*Marielas?*
A. Rock (another)	(east of Dassigney)	Cowley (Moll?)	*Herman Moll 1699*	Privateer's Rock
Abingdon, Abington	Earl of Abington	Cowley, /10	*William Hack 1685*	**Pinta**
[Albania Isle]	[misspelled Albanie-y]		*Fleming 1894*	**Albany**
Albany	Duke of Albany	Cowley (Hack?)	*William Hack 1685*	Albanie
Albanie	Duke of Albany	Cowley (Hack?)	*Herman Moll 1699*	**Albany**
Albemarle	Duke of Albemarle	Cowley, 16/10	*William Hack 1685*	**Isabela**
Anónima, Isla	"anonymous"	??	Bur.Amer.Rep., 1894	**Sin Nombre**
Avachumbi	"outer island"	Inca legend	Sarmiento, 1572	**Isabela?**
Bainbridge's Rocks	Comm. Wm. Bainbridge	David Porter, 1822	*Hooker 1822*	**Rocas Gordon**
[Bainbridge, Rocas]	[now misplaced east of **San Salvador**]		*545, 547*	Roches Pamfreys?
	[misplaced at Daphne]		*Fleming 1894*	
Baltra	(an acronym?)	USAF, WWII?	*U. S. Army, Corps of Engineers 1943*	Base Beta, Beta, South Seymour, "The Rock"
[Bambridge] Rocks	[misspelled Bainbridge]		*Neele & Son 1823*	**Rocas Gordon**
Barrington Isle	Adm. S. Barrington	James Colnett, 1798	*A. Arrowsmith 1798*	**Santa Fe**
Barrington Islet	(just off **Santa Fe**)	B. Lanza	B. Lanza, 1974	Islote de Santa Fe
Bartholomew	Lt. David Bartholomew	??	??	**Bartolomé**
Bartolomé, Bartholomé	Lt. David Bartholomew	*Ecuador*	*545, 547*	Bartholomew
Bartolomé, Escolle de	Lt. David Bartholomew	B. Lanza	B. Lanza, 1974	**Gran Felipe**
Beagle	ship, Robert FitzRoy	*Ecuador*	*545*	Tiburón
Beta, Base	code name, WWII	U.S. Army,WWII	*none*	**Baltra**
Bewel Rock	??	??	Joseph Slevin, 1959	**Sin Nombre**
Big Penguin	after the penguins there	Wm. Robinson,1957	*none*	one of *Marielas*
Bindlos's	Capt. John Bindlos	Cowley, /9	*Herman Moll 1699*	**Marchena**
[Bindloe]	[misspelled Bindlos's]		*William Hack 1685*	
[Bindolese]	[misspelled Bindlos's]		Bur.Amer.Rep., 1894	
Blanca, Roca	"white rock"	*Ecuador*	*545*	none
Bolivia	Simon Bolívar	José Villamil	*none?*	**Santa Cruz**
Botella, La	"bottle" nr. Black Beach	??	*none*	none
Bowditch, Escollo de P.	Nathaniel Bowditch	B. Lanza	B. Lanza, 1974	none
Brattle's, Bruttle	Lord Nicholas Brattle	Cowley, /9	*William Hack 1685*	**Tortuga**
[Bundlaw]	[misspelled Bindlos's]		*L. Duperrey 1822*	**Marchena**
[Bura], Roca	[misspelled Burra]		*IOA 20 1983*	
Burra, Roca	"Donkey Rock"	*Ecuador*	*531*	none
Caamaño, [Coamaño]	Pres. Placedo Caamaño	*Ecuador*	*528*	Jensen
Caldwell	Admiral Caldwell	James Colnett, 1798	*A. Arrowsmith 1798*	none
Campéon	Andrew Champion	James Colnett, 1798	*(526)*	Champion
Carenero	"careening place"?	??	*Fuente F. 1748*	**San Salvador?**
[Carlos]	[incomplete San Carlos]		Bur.Amer.Rep., 1894	
Carlos IV, Tierra de	Carlos IV	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Champion	Andrew Champion	James Colnett, 1798	*A. Arrowsmith 1798*	**Campéon**
Charles's, King	King Charles II	Cowley, 13/9	*William Hack 1685*	**San Cristóbal**

Island	Named after	Named by	Chart, or attribution	Official name, other name(s)
[Charles]	[misplaced @ **St. María**]	James Colnett, 1798	*A. Arrowsmith 1798*	
Chatham Isle	John Pitt, Earl of C.	James Colnett, 1798	*A. Arrowsmith 1798*	**San Cristóbal**
Chaves	??	??	*Richard Mayer 1914*	**Santa Cruz**
Chavez	??	??	*Nat. Geographic 1921*	**Santa Cruz**
Colón, Archipiélago de	"Archipelago of Columbus"	**Ecuador**	(designated as a province in 1973)	Provincia de Ecuador, **Prov. de Galápagos,** Las Encantadas, Islas de la Floreana, *Galápagos,* Las Huerfanas
Corona del Diablo	"Devil's Crown"	*Ecuador*	(*from* Devil's Rock)	**Onslow**
Cousins	??	*Ecuador*	??	Mares
Cowan Rocks	Midshp. John S. Cowan? [or misspelled McGowen?]	L. Duperrey?	*L. Duperrey 1822*	**Arrecife Macgowen**
Cowley	William Cowley	*Ecuador*	*545*	Cowley's Enchanted
Cowley's Enchanted	William Cowley	himself, /10	*Herman Moll 1699*	**Cowley**
[Cowlys]	[misspelled by Cowley!]	himself, 16/	*none*	**Cowley**
Crossman	Richard Crossman [misplaced at **Pinzón?**]	Cowley, /9	*William Hack 1685* *Vandermaelen 1827*	Erasmus?, Los Hermanos, Tabaco?
Culpepper, Cullpeper	Lord Culpepper	Cowley, 16/10	*William Hack 1685*	**Darwin**
[Culpepper]	[mislinked to **Rábida**]		V.W.von Hagen, 1949	
Dalrimple, Rocas	Alexander Dalrymple	J. Colnett?, 1798	*A. Arrowsmith 1798*	Dalrymple Rock, [Privateer's Rock], Remarkable Rock, Rendevous Rock
Dalrymple Rock	Alexander Dalrymple	J. Colnett?, 1798	*A. Arrowsmith 1798*	**Rocas Dalrimple**
Daphne	HMS Daphne	??	*547, 548*	**Daphne Major, Daphne Minor**
Daphne Chica, Minor	HMS Daphne	Wm. Beebe, 1924	*547, 548*	Daphne
Daphne Major	HMS Daphne	Wm. Beebe, 1924	*547, 548*	Daphne
Darwin	Charles Darwin	*Ecuador*	*DMA 22ACO 22000*	Culpepper, Guerra, one of Los Hermanos
Dassigney's	Phillip Dassigney	Cowley, /9	*William Hack 1685*	**San Cristóbal?**
Dean's	Sir Anthony Dean	Cowley, /9	*William Hack 1685*	**Pinzón**
Devil's Rock	*now* 'Corona del Diablo'	David Porter, 1822	*none*	**Onslow**
Diable	"devil"	old French	*Delisle 1722*	uncertain
Diablo	"devil"	old Spanish	??	**Marchena**
Diamond Rock		David Porter?, 1822	*Hooker 1822*	**Onslow?**
Dismal, Rock		David Porter, 1822	*none*	**Onslow**
Douwes	(misspelled Downes?)	Robert FitzRoy?	*J. Arrowsmith 1839*	**Genovesa**
Dower	(misspelled Downes?)		du Petit-Thouars,1841	**Genovesa**
Dowers	(misspelled Downes?)		*Vandermaelen 1827*	**Genevosa**
Downes	Lt. John Downes	David Porter?, 1822 or Downes himself?	*Hooker 1822* *none?*	**Pinzón?** **Genovesa**
Dukes	ship, Woodes Rogers	Edw. Cooke, 1712	(sketch in his book)	**San Salvador?**
Duncan	Admiral Duncan	James Colnett, 1798	*A. Arrowsmith 1798*	**Pinzón**
Dutchess	ship, Stephen Courtney	Edw. Cooke, 1712	(sketch in his book)	**Santa Cruz?**
Ecuador, Archipiélago de	"Archipelago of Ecuador"	Ignacio Hernández	Larrea, 1973	**Archipiélago de Colón**
Eden	Admiral Henry Eden?	*Ecuador*	*545, 547*	none
Elefante, Islote	"Elephant Islet"	??	*none?*	**Watson**
Elizabeth	(in Elizabeth bay)	Dagmar Werner?	Peter R. Grant, 1975	one of *Marielas*?
Encantadas, Las	"The Enchanteds"	old Spanish	*Ortelius 1589*	**Archi. de Colón**
[Enchanted Island]	*see* Cowley's Enchanted		*William Hack 1685*	
Enderby	Samuel Enderby	James Colnett, 1798	*A. Arrowsmith 1798*	none
Erasmus	??	??	*Vandermaelen 1827*	**Crossman?**
[España]	[misspelled **Española**]	R. Enock, 1914	*Richard Mayer 1914*	**Española**
Española	"Spanish"	**Ecuador** (11)	*524*	Hood, Mascarin, McCains, de Tabac?
Esperanza, N.S. de la	"Our Lady of Hope"	Fuente F.?	*Fuente F. 1748*	uncertain
Este, Roca	"east rock"	*Ecuador*	*521*	none
Eures's, Ewres	William Eure	Cowley, /9	*William Hack 1685*	**Genovesa,** [Wolf]
Fernandina	Fernando II of Spain;	**Ecuador** (4)	*533, 541, 542*	Fernando, Narborough, Ninachumbi?, de Plata Turtle
Fernando	Fernando II of Spain			**Fernandina**
Floreana	Pres. Juan José Flores ["floriferous"]	Ignacio Hernández M. Jackson, 1985	Larrea, 1973	**Santa María**
Floreana, Islas de la	Pres. Juan José Flores	Decreto Legislativo, 12 April, 1839		**Archi. de Colón**
Floriana	variant of *Floreana*	Ecuadorian Constitution, 1835 & 1843		**Santa María**
Floriana, La	(local usage, ca. 1832)		J. N. Reynolds, 1835	**Santa María**

Island	Named after	Named by	Chart, or attribution	Official name, other name(s)
Foche	??	??	*Brit. Admiralty 1899*	**Lobos**
Galápagos	"tortoise"	Old Spanish	*Mercator 1569*	**Archi. de Colón**
Galápagos, Prov. de	"Province of Galápagos"	*Ecuador*	since 1973	**Archi. de Colón**
Gallego	Juan de Gallego	old Spanish	*Bellin 1695*	**Santa María?**
Gardner-by-Charles	Adm. Sir Alan Gardner	James Colnett, 1798	*A. Arrowsmith 1798*	**Jardinero**
Gardner-by-Hood	Adm. Sir Alan Gardner?	??	*524*	**Jardinero**
[Gasna]	[misspelled, incomplete Nuñez Gaona]		various	uncertain, **Wolf?**
Genovesa	"of Genoa" (birthplace of Columbus)	**Ecuador** (12)	*541*	Douwes, Dower, Eure's, Hawk, Nightmare, Quita Sueño, Salud, Sante, [Tover], Tower, [Wenman, Wolf]
Geraldino, Isla de	??	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Gil, Tierra de	F. Gil, Viceroy of Peru	Torres (Cruz?)	*Cruz Doblado 1794*	**San Salvador?**
Gordon, Rocas	G. Wold (Norwegian)?	himself?	*547*	Bainbridge Rocks
Grande	"grand"	??	V.W.von Hagen,1949	**San Cristóbal**
Gran Felipe, Islote	Felipe Degel (a guide)	himself	*IOA 20211*	Bartolomé, Escollo de
Guerra	Alonso Torres y Guerra	himself (Cruz?)	*Cruz Doblado 1794*	**Darwin?**
[Guerra]	[mislinked to **Rábida**]		V.W.von Hagen, 1949	
Guy Fawkes	Guy Fawkes	*Ecuador*	*545, 547*	none
Hancock Bank	Allan Hancock	himself	*none*	**Banco Hancock**
Hancock, Banco	Allan Hancock	himself	*526*	Hancock Bank
Hawk	man-of-war hawk (frigate)		*L. Duperrey 1822*	**Genovesa**
Herdars, Roches	?? (rocks, nr. Campéon)	Vandermaelen?	*Vandermaelen 1827*	(charting error?)
Hermanas, Las dos	"the two sisters"	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Hermanos, Los	"the brothers"	old Spanish	various	**Crossman** (& **Tortuga**?)
Hermanos, Los dos	"the two brothers"	Fuente F.? *after* Fuente F.?	*Fuente F. 1748, Robert Sayer 1775*	**Darwin & Wolf?**
Hobbs, Arrecife	??	*Ecuador*	*521*	none
Hood	Lord Hood	James Colnett, 1798	*A. Arrowsmith 1798*	**Española**
Huerfanas, Las	"the orphans"	Cabello Balboa?	*Cabello Balboa 1584*	**Archi. de Colón**
Iguana Tree	(after an iguana in tree)	W. Robinson, 1936	*none*	one of *Marielas*
Indefatigable	HMS Indefatigable	??	??	**Santa Cruz**
Isabela	Isabela I of Spain; 1451-1504	**Ecuador** (3)	*532, 533, 542, 543, 544, 545*	Albermarle,Avachumbi?, S. Gertrudis, S. Margarita, Ysabel
James	King James II	Cowley, 14/25	*William Hack 1685*	**San Salvador**
Jardinero	Sir Alan Gardner	*Ecuador*	*(526)*	Gardner-by-Charles
Jardinero	Sir Alan Gardner?	*Ecuador*	*(524)*	Gardner-by-Hood, Rodger's
Jarvis, Jervis	Admiral John Jarvis	James Colnett, 1798	*A. Arrowsmith 1798*	**Rábida**
Jensen	? Jensen (Norwegian)?	himself?	Alan White, 1972	**Caamaño**
[Jenson]	[misspelled Jensen]		Lévêque, 1964	Caamaño
[Johnson]	[misspelled Jensen]		Brosset, 1963	Caamaño
Kicker Rock	??	James Colnett, 1798	*A. Arrowsmith 1798*	**Leon Dormido**
Leon Dormido	"sleeping lion"	*Ecuador*	*(521)*	Kicker Rock, Leon Dormiente, Remarkable Rock
Leon Dormiente	*see* **Leon Dormido**		*521*	
Little Seymour		USAF, WWII	*none*	**North Seymour**
Loberia, [Loveria]	(near Post Office Bay)	*Ecuador*	Margret Wittmer, 1961	none
Lobos, Isla	"Wolves (sea lions) Isle"	*Ecuador*	*521*	Foche
Macgowen, Arrecife	*from* McGowen's Reef	J. Colnett?, 1798	*524*	Cowan Rocks?
Magicienne Rocks	HMS Magicienne	??	*Brit. Admiralty 1841*	
Marchena	Fr. A. de Marchena	**Ecuador** (9)	*551*	Bindloe, Bindlos, Diablo, Torres?
Mares	Lodovico Mares	B. Lanza	B. Lanza, 1974	*Cousins*
Marielas	"Mariela"	??	*none*	A Rock?, Elizabeth?, Big Penguin, Iguana Tree
Marqueses	ship, Edward Cooke	Edw. Cooke, 1712	*none*	**San Cristóbal**
Mascarenas	??	de Villefort?	James Burney, 1816	**Santa María**
Mascarin	??		*Delisle 1720*	**Española**
Mazarredo	??	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
McCain's Beclouded I.	??	H. Melville, 1854	"The Encantadas"	**Española**
McGowen's Reef	*now* **Macgowen,Arrecife**	J. Colnett?, 1798	*A. Arrowsmith 1798*	**Arrecife Macgowen**
Mercedes	Pres. José Flores' wife	José Villamil	de Gueydon, 1846	**San Cristóbal**

Island	Named after	Named by	Chart, or attribution	Official name, other name(s)
Mosquera	Pres. A. Mosquera?	*Ecuador*	*547, 548*	Seal Island
Nameless	'Sin Nombre'	??	*528, 547*	**Sin Nombre**
Narborough	Sir John Narborough	Cowley, /10	*William Hack 1685*	**Fernandina**
Nerus, Rocas	(transliterated Nories?)	*Ecuador*	*551*	Nories, North Rocks, Wainman's Little Island
Nightmare	*see* Quita Sueño	old Spanish	Irving Johnson, 1936	**Genovesa**
Ninachumbi	"island of fire"	Inca legend	Sarmiento, 1572	**Fernandina?**
Norfolk	Duke of Norfolk	Cowley, 16/10	*William Hack 1685*	**Santa Cruz**
Norris's, Lord	Lord Noris	Cowley, 16/		**Pinta**
Nories Rocks	Lord Noris	Cowley (Moll?)	*Herman Moll 1699*	**Rocas Nerus**
North Rocks		Cowley (Hack?)	*William Hack 1687*	**Rocas Nerus**
[Nuñez]	[incomplete Nuñez Gaona]		various	
Nuñez Gaona	??	Torres (Cruz?)	*Cruz Doblado 1794*	**Wolf**
Olmedo	José Joaquin Olmedo	Ignacio Hernández	Larrea, 1973	**San Salvador**
Onslow	??	*Ecuador*	*Brit. Admiralty 1899*	*Corona del Diablo,* Devil's Rock, Diamond Rock, Rock Dismal
Osborn	Henry Fairfield Osborn	Wm. Beebe, 1926	*524*	none
Pamfreys, Roches	??	Vandermaelen?	*Vandermaelen 1827*	**Rocas Bainbridge?**
Pan de Azucar	"sugar loaf"	B. Lanza?	B. Lanza, 1974	**Sin Nombre**
Phillip's	Sir Richard Phillips	himself?	*Neele & Son 1823*	**Rábida**
Pinnacle Rock	(near Black Beach,)	??	*526*	none
Pinta	ship, Martin Pinzón; (Columbus' caravel)	**Ecuador** (8)	*551*	Abingdon, Carlos IV? Geraldino, Norris's
Pinzón	Brothers Pinzón; Nina, Pinta captains	**Ecuador** (10)	*545*	Deans, Douwes?, Downes?, Duncan
Pitt, Isla	William Pitt?	??	*W. Collins Sons 1974*	none
Plata, de	"plate" (silver)	old Spanish	*Robert Sayer 1775*	**Fernandina**
Plaza (North, South)	Pres. Leonidas Plaza	*Ecuador*	*547*	none
Porter's	Captain David Porter	David Adams	David Porter, 1822 *Hooker 1822*	**Santa Cruz**
Privateer's Rock	the buccaneers	Cowley (Hack?)	*William Hack 1685*	A. Rock
[Privateer's Rock]	[mislinked with **Dalrimple**]		V.W.von Hagen,1949	
Quita Sueño	"without sleep"	Fuente F.?	*Fuente F. 1748*	**Genovesa**
Rábida	Convent of la Rábida	**Ecuador** (13)	*545*	[Culpepper, Guerra], Jarvis, Jervis, Phillips
Redonda, Roca	"round rock"	Cowley (Hack?)	*543*	Redondo Rock
[Redondo] Rock	[misspelled **Redonda**]	Cowley (Hack?)	*William Hack 1685*	
Remarkable Rock		Edw. Cooke, 1712 & W. Rogers, 1712	*none*	**Leon Dormido**
Rendevous Rock		W. Rogers, 1712	*none*	**Rocas Dalrimple**
Roca(s), Rock(s)	*see* Burra, Redonda, Rycot, Union, etc.			
"Rock, The"	popular usage in WWII	U. S. Army, WWII	*none*	**Baltra**
Rodgers', [Rogers]	Commodore J. Rodgers	David Porter, 1822	*none*	**Jardinero**
Rycot, Rycaut Rock	??	Cowley (Hack?)	*William Hack 1685*	none
Salud	"health"	old Spanish	Bur.Amer.Rep., 1894	uncertain
St. Charles		??	Bur.Amer.Rep., 1894	**Santa María**
St. Barnabe	"St. Barnaby"	??	*Desisle 1722*	uncertain
San Bernardo	"St. Bernard"	old Spanish	Bur.Amer.Rep., 1894	**San Salvador**
San Carlos	"St. Charles"	??	??	**Santa María**
San Clemente	"St. Clement"	Fuente F.?	*Fuente F. 1748*	**San Cristóbal**
San Cristóbal	"St. Christopher" (to honor Columbus)	**Ecuador** (1)	*521*	Charles, Chatham, Dassigney's?, Grande, Marqueses, Mercedes, San Clemente
San Marcos	"St. Mark"	Fuente F.?	*Fuente F. 1748*	uncertain
		after Fuente F.?	*Robert Sayer 1775*	**San Salvador**
San Salvador	Columbus's first landfall, in Caribbean	**Ecuador** (5)	*545, 547*	Carenero?, Dukes?, Gil?, James, Olmedo, San Bernardo, San Marcos, *Santiago*, Tabac, Yorks
Santa Cruz	"holy cross"	**Ecuador** (6)	*528, 547*	Bolivia, Chaves, Chavez, Dutchess?, Indefatigable, Norfolk, Porter's, [*Santiago*], Valdez, [Vera Cruz]
Santa Fe	Spanish city	**Ecuador** (7)	*523, 528*	Barrington
Santa Fe, Islote de	(just off Santa Fe)	B. Lanza	B. Lanza, 1974	Barrington Islet

Island	Named after	Named by	Chart, or attribution	Official name, other name(s)
Santa Gertrudix	ship, Alonso Torres	Torres (Cruz?)	*Cruz Doblado 1794*	**Isabela**
Santa Gertrudiz	ship, Alonso Torres	Torres (Cruz?)	*Cruz Doblado n.d.*	**Isabela**
Santa Isabel	patron saint of Isabela?	Fuente F.?	*Fuente F. 1748*	**Isabela**
Santa Margarita	"St. Margaret"	old Spanish	James Burney, 1816	**Isabela?**
Santa María	Columbus' flagship	**Ecuador** (2)	*526, 529*	[Charles], Floreana, Gallego?, Mascarin, St. Charles, San Carlos, Sta. María de l'Aquada, Saute
St. María de l'Aguada	"S. Mary of the Water"	old Spanish	*Herman Moll ca. 1700*	**Santa María**
St. María, Islas de	"St. Mary, Isles of"	old Spanish	*Robert Sayer 1775*	Brattle & Crossman
Santa Rosalia	(poetic license)	K. Vonnegut, 1985	"Galapagos"	none
Santé	"health"	Le Sieur de Villefort?, 1700	*Delisle 1720* James Burney, 1816	uncertain
Santiago	"St. Iago"	old Spanish	??	**San Salvador**
[*Santiago*]	[misplaced @ **Sta. Cruz**]	Bur.Amer.Rep., 1894		
[Saute]	[misspelled Santé]	de Villefort, 1700	Joseph Slevin, 1959	**Santa María**
Schiavoni, Arrecife	??	*Ecuador*	*521, 523*	Schiavoni Reef
Schiavoni Reef	??	??	*Brit. Admiralty 1899*	**Arrecife Schiavoni**
Seal Island	(due to sea lions there)	U. S. Army, WWII	*U. S. Army 1943*	**Mosquera**
Seymour	Lord Hugh Seymour	*Ecuador*	*547, 548*	Little Seymour, North Seymour
Seymour, North	Lord Hugh Seymour	??	*(547, 548)*	**Seymour**
Seymour, South	Lord Hugh Seymour	??	??	**Baltra**
Sin Nombre	"without name"	*Ecuador*	*(528, 547)*	Anónima, Bewel Rock, Pan de Azucar
Solano	??	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Sombrero Chino	"Chinese hat"	*Ecuador*	*(545, 547)*	none
Tabac, (de, à)	"tobacco"	Le Sieur de Villefort?, 1700	*Delisle 1722* James Burney, 1816	**Española?**
[Tabaco]	[misplaced at Crossman]	old Spanish	Bur. Amer. Rep., 1894	
Tejada	??	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Terrapin Rock	turtle	??	*Bur. Amer. Rep. 1894*	??
Tiburón, Islotes	"shark" (near Villamil) (also used by Lanza for **Beagle**)	B. Lanza?	B. Lanza, 1974	none?
Torres	Alonso Torres y Guerra	himself (Cruz?)	*Cruz Doblado 1794*	uncertain
Tortuga	"turtle"	*Ecuador*	*529*	Brattle, one of Los Hermanos?
Tortuga, Islote	(another, off Española)	local usage	*none?*	none
[Tover]	[misspelled Tower]		*Nat. Geographic 1921*	
Tower	var. on "Dower?"	??	*Brit. Admiralty 1375*	**Genovesa**
Turtle		A. Gerbault, 1929	*none*	**Fernandina**
Union, Roca	"union rock"	*Ecuador*	*532*	none
Valdès, Tierra de	??	Torres (Cruz?)	*Cruz Doblado 1794*	uncertain
Valdez, Tierra de	??	Torres (Cruz?)	*Cruz Doblado n.d.*	uncertain
Venecia	Venice (canals of)	C&F Angermeyer?	??	none
[Vera Cruz]	[used in error]	U. S. Army, WWII	*none*	**Santa Cruz**
Wainman	Lord Wainman	Cowley, 16/	*William Hack 1685*	**Wolf**
Wainman's Little Island	Lord Wainman	Cowley (Hack?)	*William Hack 1685*	**Rocas Nerus**
Watson	??	*Ecuador*	*526*	Elefante
[Wenam]	[misspelled Wainman]	David Porter, 1822	*Hooker 1822*	
[Wenman]	[misspelled Wainman]	Cowley, /10		
[Weriman]	[misspelled Wainman]		*Blondeau ca. 1780*	
Whale, Roca	"whale rock"	*Ecuador*	*521*	none
Wolf	geologist Teodoro Wolf	*Ecuador*	*DMA 22ACO 22000*	one of Los Hermanos, Nuñez Gaona?, Wainman
	[mislinked to Ewres & **Genovesa**]		Joseph Slevin, 1959	[Wenman], [Weriman]
[Wood's Isle]	[typographical error?]	H. Melville, 1854	"The Encantadas"	Hood's?
York's	James, Duke of York	Cowley, 14/10	*none*	**San Salvador**
Ysabel	"Isabela"	old Spanish	various	**Isabela**