

DID GALÁPAGOS EXPERIENCE AN EL NIÑO IN 1878?

By: Matthew J. James

The biological consequences of the warm water produced by the El Niño phenomenon in the eastern Pacific Ocean are felt early in the Galápagos Islands, and the impacts can be severe, both on the islands themselves and in the near shore waters surrounding the islands. Recent experience by Galápagos scientists has shown that sea surface temperatures near the Charles Darwin Research Station exceeded 28°C (83°F) during both the 1982-83 and 1997-98 El Niño events (Snell & Rea 2002, data for March 1983 and March 1998). Documenting the frequency and magnitude of even earlier El Niño events in this area could assist in better understanding the impact of the phenomenon on Galápagos organisms.

In the summer of 2000, I visited the National Archives in Washington, DC, to find information about a United States Coast Survey vessel that would ultimately figure prominently in Galápagos history. Serendipitously, air and sea temperature information from this ship's log eventually led me to believe that an El Niño occurred in 1878 when the ship passed 200 miles to the west of the Galápagos Islands. Kiladis and Diaz (1986) recognized evidence for an El Niño event in 1877-1878. My research confirms both the existence and severity of that event.

In the year 1875, the 89-foot composite-hulled gaff-rigged schooner *Earnest* was launched in Baltimore by the William E. Woodall Company, a well-known shipbuilder (Figure 1). Following some brief coastal surveying work in Florida, the *Earnest* sailed north on assignment to Maine where she was badly damaged and sank in shallow water off Isle Au Haut in an October 1876 storm. The schooner was re-floated, returned to Baltimore for repairs, and was then dispatched to Puget Sound on the opposite coast, by way of Cape Horn.

Under the command of Sailing Master P. G. Letournau, the *Earnest* departed Baltimore in the fall of 1877. While rounding the Horn, the vessel's most southerly position was 59° 8' 24" S and 65° 7' 12" W before turning north towards the equator.

My specific interest in this voyage of the *Earnest* was to learn if the ship had stopped at the Galápagos Islands en route to Puget Sound. I examined several of the 35 logbooks covering the period from 1875 to 1898 housed in the National Archives. If the *Earnest* had visited Galápagos, it would have presaged another, more famous, trip by the same vessel some 28 years later. The logbooks revealed that the *Earnest's* sailing track carried her nearly 200 miles to the west of the Galápagos. But as I tracked the vessel's northward progress on page after page of the logbook, I



Figure 1. The schooner *Earnest* (later renamed *Academy*) when she was on the rocks on Yerba Buena Island in San Francisco Bay in March 1904. (U.S. Naval Historic Center, Wash., D.C.).

Table 1. – Geographic and ocean temperature data obtained by the U.S. Coast Survey schooner *Earnest* in 1878, approx. 200 miles west of the Galápagos Islands (Source: National Archives 1878).

1878 April	Sea Surface Temp.	Latitude	Longitude	Rainfall Weather
10	82-83°F (27.8-28.3°C)	8°41'24''S.	104°4'48''W.	Light squalls & rain
11	83°F (28.3°C)	7°9'00''S.	105°9'36''W.	Light squalls
12	83°F (28.3°C)	4°32'24''S.	106°25'12''W.	Fine & clear
13	83°F (28.3°C)	2°25' 2''S.	107°4'48''W.	Fine clear weather
14	82-83°F (27.8-28.3°C)	0°33'00''S.	109°1'12''W.	Fine clear weather
15	83-84°F (28.3-28.9°C)	On Equator	109°19'12''W.	Fine clear weather
16	83-84°F (28.3-28.9°C)	1°28'48''N.	109°24'00''W.	N/A
17	84° F(28.9°C)	3°7'12''N.	109°7'12''W.	Much rain
18	83-84°F (28.3-28.9°C)	4°6'00''N.	110°21'00''W.	Much rain
19	84°F (28.9°C)	5°6'36''N.	112°15'00''W.	Fine weather

stumbled onto what is perhaps an equally interesting historical observation.

On a nearly daily basis while en route from Baltimore to Puget Sound, Letournau and his crew took the air and sea surface temperature readings mentioned previously. These data, along with daily general weather observations and latitude and longitude readings, were consistently recorded in one of the *Earnest's* logs. Data for ten days as the *Earnest* approached and departed the equator (Table 1) indicate a mass of extremely warm water in the eastern Pacific.

The maximum sea surface temperature recorded between April 15 and 19, 1878, was 28.9°C (84°F) from the time when the schooner had just crossed the equator and continuing at least until 5° north of the equator. Since these readings fall in the upper range of temperatures for an El Niño event and are higher than those of non-El Niño years, it appears that the *Earnest* sailed right through an El Niño on its way from Cape Horn to Puget Sound.

How strong was the El Niño event that the schooner *Earnest* sailed through in 1878? Quinn and Neal (1995) analyzed the intensities of 115 separate El Niño events between 1525 and 1987. On an intensity scale of 1 to 5, they assigned a value of 5 to both the 1877-78 and 1982-83 events. Their highest ranking of "Very Strong" was also given to both the 1877-78 and 1982-83 events, a ranking that was only given to nine out of the 115 events documented since 1525. According to Kiladis and Diaz (1986), the 1877-1878 El Niño was an extreme event comparable to the 1982-83 event, and these two events are most likely the strongest such occurrences that can be documented with reliable data. Many of the same extreme worldwide weather anomalies observed in 1982-83 were also observed in 1877-78.

After reaching San Francisco in May 1878, and spending two weeks there, the schooner continued north to spend the next 20 years in Coast Survey work in Puget Sound, the San Juan Islands, and on several trips to Alaska. By the end of the 19th century, the now-tired and well-used schooner was "of no further use" to the U.S. Coast and Geodetic Survey. In February 1898, the *Earnest* was "condemned as a hulk" and turned over to the U.S. Navy at the Puget Sound Naval Station in Bremerton, Washington "to be used as a target or for any other purpose." Despite two offers to purchase the schooner in 1898, the Chief of the Navy's Bureau of Navigation informed the Secretary of the Navy that: "The schooner "Earnest" is worth far more than three hundred dollars to this Bureau for target practice, and was turned over to the Navy Department for that purpose – not to be sold." (National Archives 1898).

Ships, like people, sometimes get a second (or third or fourth) chance. In September 1898, a reprieve of the scuttling sentence came when the Commandant of the Puget Sound Naval Station wrote to the Secretary of the Navy in Washington, D.C., requesting that the *Earnest* be con-

verted for use as a lighter at the Naval Station. Permission was granted.

On March 9th, 1904, the *Earnest* was anchored near Yerba Buena Island in central San Francisco Bay, now playing a new role as a naval training vessel. During the night, a violent southeast gale parted both a heavy wire rope and a sturdy hawser causing the *Earnest* to be tossed above the high tide mark on the island. Her advanced age, intense Coast Survey use in the 1880's and 1890's, and newly acquired storm damage resulted in the Navy putting the schooner up for public sale (the documents authorizing the sale were signed by President Theodore Roosevelt; National Archives 1898).

In May 1905, the California Academy of Sciences purchased the schooner from the Navy in a sealed-bid auction for \$1000. As the West Coast's largest and oldest museum, the Academy was eager to purchase a suitable vessel for a scientific expedition. They changed her name to the *Academy* and again made her seaworthy. Her eager new owners soon dispatched her on a yearlong voyage of scientific collecting and exploration to the Galápagos Islands. The expedition departed San Francisco on June 28, 1905.

In late September 1905, almost 70 years to the day after Charles Darwin first approached the Galápagos archipelago aboard HMS *Beagle*, and approximately 28 years after having rounded Cape Horn and passing westward of the archipelago, this sturdy schooner would approach Hood Island from the north, 89 days out of San Francisco. While following in Darwin's footsteps, the *Academy* and her crew of eight young men who served as sailor-scientists assembled an unrivaled collection of scientific specimens, including tortoises, birds, plants, insects, mollusks, fossils, and other organisms. Notable scientific events during the 17-month expedition included the documentation of tool-use by the woodpecker finch, and the collection of the only known tortoise specimen from Isla Fernandina. The schooner herself was honored in perpetuity when the bay on southern Santa Cruz Island was named Academy Bay on November 5, 1905. The schooner and her expedition members remained in Galápagos waters for a year and a day before returning to San Francisco in late November 1906.

Joseph R. Slevin's 1931 *Log of the Schooner "Academy"* and other works published after the voyage provide much useful information for Galápagos researchers. In this short article, I have added another link between this special boat and science in the islands by highlighting the careful and useful records by the crew of the U.S. Coast Survey vessel *Earnest* in 1878.

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Matthew J. James, Department of Geology, Sonoma State University, Rohnert Park, California 94928 USA E-mail: matt.james@sonoma.edu.

THE CHARLES DARWIN RESEARCH STATION HERBARIUM: IMPROVEMENTS OF THE LAST SIX YEARS

By: Patricia Jaramillo and Alan Tye

INTRODUCTION

An herbarium is an indispensable tool for all botanical research since plant studies depend on reliable identifications. For many difficult taxonomic groups, well-prepared specimens are essential for identification. Herbarium collections also provide material for traditional (morphological) and modern (genetic) research in plant systematics, evolution, and ecology.

Until 1963, all plant collections made in Galápagos had been sent to herbaria located outside the Galápagos Islands (Mauchamp and Aldaz 1997). Large or important collections from Galápagos are deposited at: the Royal Botanic Garden, Kew, UK; Cambridge University, UK (including most of Darwin's collections); and the California Academy of Sciences, San Francisco, USA (Wiggins and Porter 1971, Mauchamp and Aldaz 1997). In 1964, the Charles Darwin Research Station (CDRS) created its own herbarium to preserve important collections locally and to facilitate botanical investigation in the islands. The majority of the first collections were made in 1963-64 by David Snow, Director of the CDRS at that time. An important contribution was made by I. L. Wiggins in 1966, who left duplicates of the specimens collected for the preparation of the modern flora of the islands (Wiggins and Porter 1971). The herbarium received international recognition in 1975 with its inclusion on the World Index Herbariorum with the institutional identifier acronym of CDS.

Until 1994, herbarium maintenance was sporadic and often not up to international standards, resulting in many specimens still being deposited in other institutions (Mauchamp and Aldaz 1997). In March 1994, the collections were moved to a new dehumidified, and since 1995, air-conditioned room with custom-built storage cabinets (Mauchamp and Aldaz 1997). The collection data were entered into a computerized database which now forms the core of the CDRS Database of the Galápagos Flora. In 1995, an agreement was signed with the National Herbarium in Quito, Ecuador, (QCNE), providing for identification assistance from mainland researchers (especially for introduced species) and for the deposit of duplicate specimens in Quito. The present paper reports activities since 1996.

THE COLLECTIONS

The botanical collections have increased greatly in recent years, growing from 7,000 specimens in 1996 (Mauchamp and Aldaz 1997) to more than 14,000 in 2003, a growth of nearly 1,000 specimens per year (Figure 1). This near doubling of the collection in six years has necessitated continued expansion of the herbarium facilities. The collections currently represent approximately 85% of vascular plant taxa known from the islands, 70% of algal taxa, 40% of lichens, and a collection of bryophytes which is not yet fully catalogued. The collections include